SCIENTIFIC AMERICAN

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A Peruvian Infernal Machine.

On the 3d of July the Chilian transport steamer Loa was destroyed in Callao Bay by an ingenious and effective torpedo boat. A Peruvian officer took an ordinary fruit boat, put a torpedo in the bottom, and over this he placed a false bottom, resting on springs kept down by the weight of the cargo. He then loaded it with a very choice assortment of camotes, yucas, chirimoyos, grandillas, fowls, turkeys, green vegetables, etc., and, towing it toward the blockading squadron before daylight, set it adrift.

After floating about for some hours the torpedo boat was seized by the Chilians and brought alongside the Loa. As the weight on the false bottom was diminished by the transference of the cargo, the machinery in connection with the torpedo was set free, and in a moment 300 pounds of dynamite were exploded and the Loa was almost lifted out of the water. The effect, as described by those who were watching the operation from the shore, was awful in the extreme. Every house in Callao was shaken to its foundations, and every ship in the bay shivered as though a fearful earthquake had spent its fury beneath them. The fated ship appeared as enveloped in one mass of flame, which resolved itself into dense clouds of black smoke. When this cleared away she seemed not to have suffered, but suddenly she was seen to sink at the stern, while her bows went high in the air, and the Loa disappeared forever.

Boats from neutral vessels picked up about 40 of the Loa's crew; the rest, to the number of 150 or more, perished.

The Loa was an English built iron steamer. She was armed with one long range seventy-pounder and four smaller pieces, and at the time of foundering had on board two long range seventies, which were to have been mounted on the iron clad Blanco Encalada, 140 tons of shot and shell, and a miscellaneous cargo for the fleet.

ELECTRIC LIGHT FOR MARINE USE.

The unprecedented number of disastrous and terrible accidents that have occurred from collisions of steam vessels in fogs, during the last six months, have created a great deal of speculation and provoked much discussion in mechanical and scientific circles as to the best means of averting such disasters. It is generally conceded that among all the devices and appliances proposed for this purpose there is nothing that promises so well as the electric light. It is not only the strongest artificial light, but the smallness of the point from which the light emanates renders it singularly well calculated for projecting a concentrated or parallel beam, and makes it possible to get one hundred times more light exactly in the focus of a reflector than by any other means.

Fog is simply a supersaturated atmosphere, an atmosphere whose transparency is affected by a surcharge of vapor. A slight rise in the temperature dissipates it. The sun raises the temperature of the air, and the air absorbs the water and becomes transparent. The quantity of solid or liquid matter required to give a foggy appearance to the air is surprisingly small, and the heat required to dissipate it is not very great. The electric beam, owing to its great heat, warms up all opaque bodies in its path, and, as it might be said, cuts out a way for itself through the fog; thus giving it an unobstructed path for a considerable distance. To produce this result, however, the beam of light

[*Continued on page* 130.]

Fig. 2.

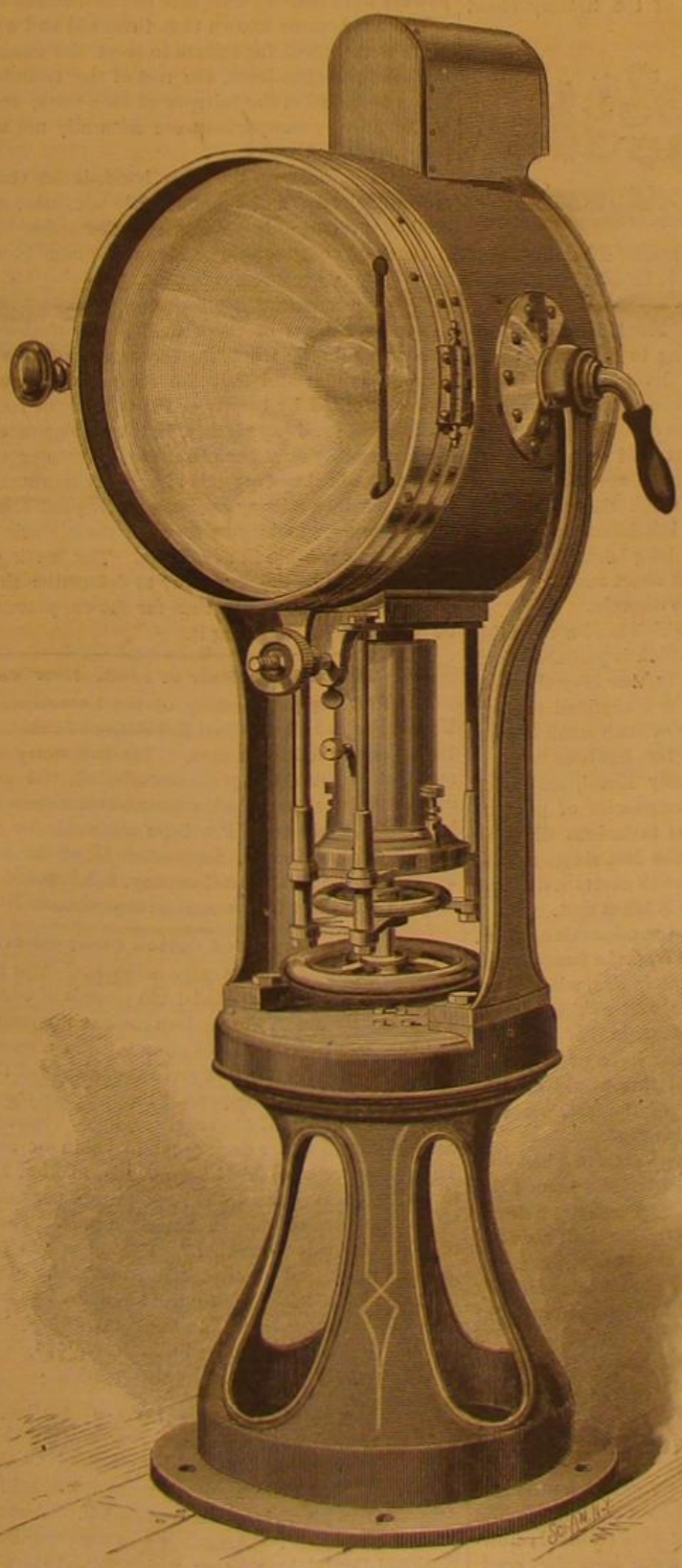
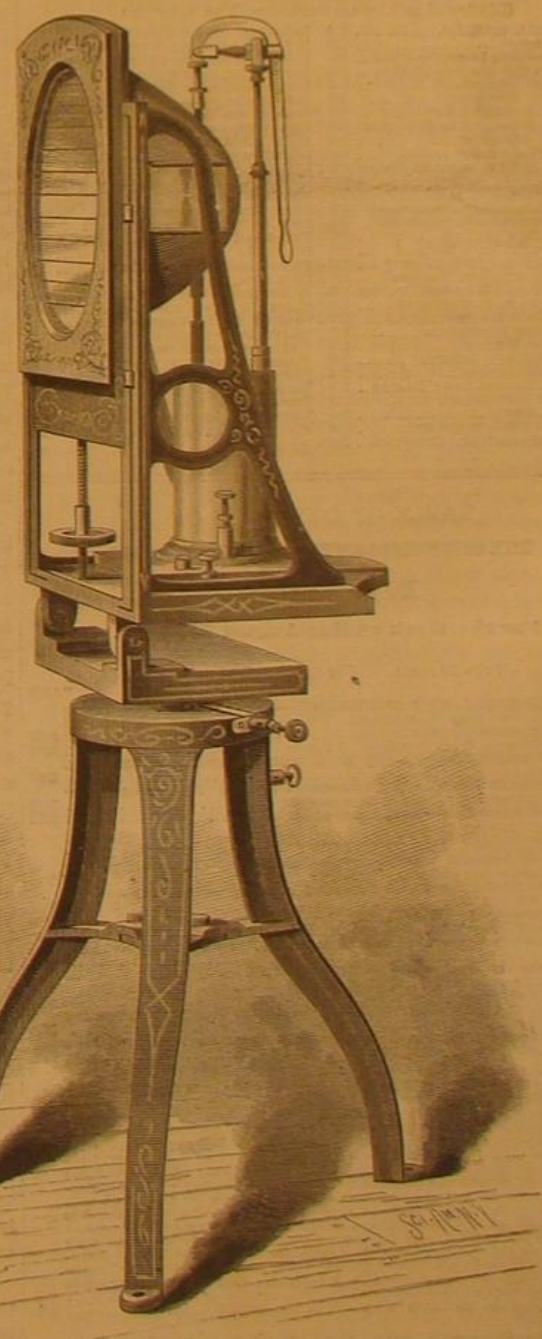


Fig. 3.



MAXIM'S ELECTRIC LIGHT PROJECTORS FOR LAND AND MARINE PURPOSES.

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NEW YORK, SATURDAY, AUGUST 28, 1880.

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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 248,

For the Week ending August 28, 1880.

Price 10 cents. For sale by all newsdealers.

EFFECT OF STARVATION ON THE BLOOD.

During the last hour of Dr. Tanner's forty days' fast, some of his blood was withdrawn from the hand and subjected to a careful microscopic examination by Dr. P. H. Vander Weyde. It was found to be entirely different from healthy blood. The corpuscles, which are otherwise smooth and round flat disks, with a depression in the center, and of an average diameter of 1-3600th part of an inch, were found to be ragged, irregular, and shrunk to the average of about 1-5000th part of an inch in diameter.

When blood is given time to dry on the microscope slide, the corpuscles may lose their smooth appearance and become smaller by shrinkage, but in this case there was no chance to be misled into error by such a cause, as the blood was examined while perfectly fresh and the corpuscles still moving freely in the plasma.

This ragged appearance was so common in all of them that there was scarcely a smooth corpuscle among them, except the white ones, which had very nearly the normal size and were smooth. Their number, which ordinarily bears to the red corpuscles the proportion of 1 in 400, was apparently increased, as in a field covering a diameter of 8000th of an inch, and containing 40 corpuscles in its diameter, nearly touching one another, a dozen white corpuscles were seen. As this field contained 20 x 20 x 3·14 or 1,256 corpuscles, it gives an average of nearly 1 white corpuscle in 100. Occasionally the white corpuscles were seen clotted together in a way never observed in normal blood.

A further study of these abnormal red corpuscles showed that their rough appearance was generally caused by points projecting from their surface, and looking like a fungoid growth which covered them, while in many this growth appeared to be taking place at the expense of the corpuscle itself and living on its substance, as the corpuscles most densely covered were the smallest and the most irregular in shape; in fact some of them appeared disintegrating and breaking up.

We represent here some of the corpuscles as they appeared in the blood of Dr. Tanner, as seen and drawn by Dr. Vander Weyde, and at the side of the healthy blood the contrast is striking.

Appearance of the Corpuscles of Normal Human Blood.

Appearance of the Corpuscles of Dr. Tanner's Blood after Forty Days of Starvation.

It is a common law observed in organic substances that when a breaking up of the structure is impending, foreign living organisms spring up, and are sustained at the expense of the decaying organic body. Mould, and all kinds of fungoid growth, originate according to this law, while in infusorial life it reaches its highest development. In the latter case it appears intended to economize the organic materials of the structure, and in place of allowing them to decompose into their primary elements, and to be built up again by the slow and laborious process of vegetation under the influence of light, these organic materials are directly transformed into food for the larger inhabitants of water, and finally for fishes. In this way a long laborious course of natural successive operations is cut short and the decaying organic material made useful more directly.

If the formation of fungoid spores, which is of a vegetable nature, also serves a useful purpose (which is probable), is as yet a question to be determined by further investigation; but certain it is that such a growth is not confined to large masses, but even found on the surface of such small objects as the corpuscles of the blood; this in fact has been recently investigated by microscopists, especially Korel, and such growth was found upon the blood corpuscles of patients when seriously suffering from various malarious diseases, such as typhus fever, etc., also in the last stages of consumption; and they agree that this growth exerts a destructive influence upon the body in which it takes root.

The appearance of Dr. Tanner's blood verifies this opinion. Very few, if any, corpuscles were free from the fungus, and all appeared to have suffered and shrunk in size, while many of them had become irregular in shape, and evidently were breaking up. As it appears to be the function of the liver to secrete the effete blood corpuscles, the liver of Dr. Tanner must have been taxed greatly, and this would explain his biliousness during the latter stages of the fast, when he often vomited bile with the mucus of his stomach.

In regard to the latter its digestive powers are phenomenal. Immediately after breaking the fast at the exact hour that the forty days were ended, by eating a peach, he drank successively two large glasses of milk, ate half a watermelon, two beafsteaks, five apples, drank Hungarian wine, and had a good time generally, and was the next day already in good condition, gaining at the rate of five pounds weight every twenty-four hours.

The effect on the blood was already very perceptible twenty-four hours after breaking the fast. The fungoid spores had disappeared from a great many of the blood corpuscles, or, rather, perhaps, fresh ones had been evolved in the system, which is the most probable, as they looked as smooth and fresh as if they were entirely new. At the second day about half of the blood had become normal, while on the third day most all the corpuscles were restored; however, there were here and there still some imperfect ones, irregular in shape, as if they were remnants, and even some of these were not yet entirely free from the fungoid growth.

Powers of endurance have been exhibited by various individuals, but we believe that none have ever gone through such severe and well authenticated test of physical endurance as Dr. Tanner, to whom at least the credit should be given to have practically demonstrated what man can endure when he, to use Dr. Tanner's own words, "once understands his own machinery and knows how to run it."

COLOR BLINDNESS IN CONNECTICUT.

A recent act of the Connecticut legislature provides that on or before October 1 next, the railway companies of the State shall cause every person in their employ, as locomotive engineers, firemen, conductors, brakemen, station agents, switchmen, flagmen, gate tenders, or signalmen, to be examined at the expense of the railroad company in regard to color blindness and visual power, and under such rules as the Board of Health shall prescribe; and any corporation employing a person not possessing a certificate showing that he has passed a successful examination shall be liable to a fine of from $200 to $1,000.

Two grades of certificates have been adopted by the Board of Health, the first grade being issued to engineers, firemen, and brakemen, the second grade to all other railway employes. The tests adopted are very severe, and the results have led to the circulation of a petition, signed by most of the railway officers in the State, asking the Board of Health to change the methods of examination. On the first day of the examinations first-class certificates were refused to engineer Charles Bullard, of the Shore Line Road, and engineer William Fisher, of the New York and New Haven Road, both of whom had been many years in the service. Mr. Bullard had run an engine for twenty-eight years, giving daily proof in all sorts of weather that his eyes were equal to the requirements of his calling; and when subjected to practical tests on the road by the president of the company Mr. Bullard gave ample evidence of strong and clear vision. In the same way Mr. Fisher satisfied the officers of his road that his visual powers were entirely adequate to the needs of the service.

When it became known that these old and well tried engineers were barred for failure to meet the exacting requirements of the examiners, the rest of the trainmen naturally began to question the fairness of such tests; and the officers of the railway companies were naturally not without sympathy with their men.

The examiners, on the other hand, insist that their tests are simple, fair, and unmistakably accurate; and that any method of correctly testing eyes for color blindness and strength of vision would condemn the men to whom certificates had been refused.

From an impartial point of view it really looks as though the over-niceness of theoretical hobby-riders might bring into disrepute the whole matter of visual tests for railway men and pilots; and that the evidence of practical visual power afforded by twenty or thirty years of recognition and obedience to railway signals, in the management of locomotives, certainly ought to count for as much as that obtained with a lot of colored crewels in as many minutes. The question is whether railway men can distinguish the red, green, and white flags and lights used on their roads under such conditions as obtain in actual life. The sorting of colored worsteds may be the best way to determine this question; but, in view of the results thus far shown, practical men may be pardoned for doubting it.

The World's Fair of 1883.—New York.

The first regular meeting of the Commissioners of the United States International Exhibition of 1883 began August 10 and continued three days. The temporary organization required by act of Congress was effected, and an executive committee was appointed, with sub-committees on finance, legislation, and sites. Provision was made for the opening of subscription books, September 15, at the office of the Farmers' Loan and Trust Company, fiscal agents. The commission will meet for permanent organization November 14.

An Improved Cotton Compressor.

Three years ago the average cargoes of ships sailing from New Orleans did not exceed 1,425 pounds of cotton per ton register. By use of the modern cotton compressors the average has been raised to 1,725 pounds. In a recent issue the New Orleans *Price Current* gives as evidence of the efficiency of the Morse cotton compressor the fact that the British ship Ben Lomond, of 887 tons register, lately cleared with 4,363 bales of cotton under deck (none in cabin or crew spaces). The cotton weighed 2,054,848 pounds, making 2,316 pounds to the ton measurement, the largest cargo per ton ever taken by a sailing vessel from an American port. The larger part of this cargo was "doubled." The cargo was tied by hand (colored men), and consequently without the 20 per cent advantage claimed for steam "band pullers." The cargo was thus 35 per cent greater than the average obtained with average compression, and the gain in freightage at the current rate was nearly $4,000 for the single voyage.

The National Dental Association.

A mass meeting of dentists, representing the American Dental Convention, the American Dental Association, and two Southern societies similarly named, was held in this city, August 11, with a view to consolidation. About 150 delegates were present. The result was the organization of the National Dental Association, which hopes to absorb the other organizations.

INFLUX THE SOURCE OF INVENTION.

Your correspondent, G. G., in a very learned and able article on "The Evolution of Ideas," on page 97, has, I think, laid himself open to attack in some of the views advanced. He says, "Science declares that ideas are the results of the same natural forces which act in organic nature; and mental phenomena are not different from other natural phenomena in kind, but only in greater complexity," and upon this unsubstantial foundation builds up the theory that "evolution in nature on our globe has reached its highest stage in man, and with him terrestrial development has arrived at a remarkable turning point." "Instead of producing higher organisms, nature has given to the human species the faculty of invention." In other words, having created a being in all respects equal to itself, it has transferred to him all its powers, and has retired from the scene of action for ever, leaving to him and his mysterious mistress Evolution the government of the world on which he dwells.

G. G. quotes Herbert Spencer to prove "that no idea or feeling arises save as a result of some physical force expended in producing it;" but a greater than Spencer has said: "Man's mind is his spirit, and the spirit is a man, because the mind means the whole will and understanding, which exist in first principles in the brain, and in derivatives in the body, and they therefore include in their forms the whole man. Therefore the mind rules the body in all its particulars at will. Does not the body execute whatever the mind determines? It directs the ear to hear, the eye to see, the tongue and lips to speak; it impels the hands and fingers to do what it pleases, and the feet to go where it wills. Is not the body, therefore, mere obedience to the mind, and could it be such unless the mind were in its derivatives in the body? Is it conformable to reason that the body should obediently act because the mind so wills? They would thus be two, one above, the other beneath—one commanding, the other obeying. This no reason will admit; therefore it follows that man's life is in first principles in the brain, and in derivatives in the body. All the constituents of the mind relate to the will and understanding, and the will and the understanding are receptacles of love and wisdom from the Lord and constitute man's life."

"That the first principles or primary forms of life are in the brain is obvious: First, from sense itself; for when man exerts his mind and thinks he feels that he thinks in the brain; he introverts his sight, contracts his brow, and feels a speculative process going on within, especially in the upper part of the forehead. Secondly, from man's formation in the womb; for the brain or head is first formed, and for some time continues larger than the body. All the external senses, sight, hearing, taste, feeling, and language, are located in the fore part of the head, and by means of fibers communicate immediately with the brain and draw from it their sensitive and active life. The affections, which are derivatives of love, portray themselves in the face; and the thoughts, which are derivatives of wisdom, portray themselves in the light of the eyes. Anatomy teaches that all the fibers descend from the brain through the neck into the body, and that none ascend from the body through the neck into the brain.

"Where the fibers are in their first principles and primary forms, there life is in its first principles and primary forms."

Will Herbert Spencer or G. G. maintain that the origin of life is not at the origin of the fibers? What, then, becomes of the proposition that "all ideas are the result of some physical force expended in producing them"?

If I interpret correctly the teachings of the great Swedish philosopher, we must look higher for the source of life and inspiration than to the wonderful organization of flesh and blood known as the natural man, which the scientists say is "the highest stage yet reached by evolution."

Within the smallest particulars, as well as in the larger members, organs, and viscera of the human body—the grand microcosm of the universe—there is a conscious, breathing, pulsative soul in constant communication with the author of life. So in and above the world of matter there is a world of spirit, through which life from the Divine is constantly flowing into all forms and organizations of matter fitted for its reception. If this was for a moment suspended, all animal and vegetable life would immediately end, the revolving earths and the mighty suns be consumed like meteors, and chaos would come again.

But as the heavens are eternal, and material worlds and systems of worlds are but representatives of the grander glories of the spiritual and celestial degrees of life, so will the physical universe endure for ever. Here, then, is the source of all inspiration. The poet, the artist, the inventor, or the divine may drink from this inexhaustible fountain.

As the blazing center of our solar system is daily seeking in the crevices of the rocks for seed to germinate, or in the fathomless oceans for leviathans to bring forth; so the great Sun of the spiritual universe is sending forth his light and heat to bless with new inventions for the comfort, new delights for the eye, new harmonies for the ear, and new joys for the hearts of his children. Not a step do we take but by his permission, not a mouthful of food that he does not provide, not an hour of sleep that he does not send.

Man, the crowning glory of the universe, comes into the world more helpless than the vilest worm. Without assistance he would soon die for lack of nourishment, whereas all other forms of animal life are born into full knowledge and ability where to seek their food, to know their companions, which are friends and which are enemies; construct houses, form marriages, bring forth young, love them tenderly, provide for them until able to care for themselves, and to perform the same offices, and by procreation perpetuate their kind.

Man is born without any knowledge whatever, and yet he has the capacity to attain the wisdom of the highest angels, and light is given in proportion to his power to receive and appropriate. All inventions are given by influx from the world of spirits. When the printing press, the steam engine, the sewing machine, and the telephone were needed suitable mediums were found for transmitting the knowledge of them to mankind. No amount of "physical force" could have produced one of them.

Within the past one hundred years a greater flood of light has been poured upon the earth than has fallen during any ten centuries since its creation. What tongue can tell the progress of the next golden cycle? When higher altitudes are attained by the spiritual man on the earth and in the heavens, the natural will rise to higher stages of development than have yet been reached. When the new schools of philosophy, instead of attributing all things to *nature*, and *evolution*, and *force*, will "render unto Cæsar the things that are Cæsar's, and unto God the things that are God's," when science and religion, hand in hand, drink together from the fountain of divine revelation, and reason and rationality prevail over skepticism and pride of opinion, then will come the golden age of the world.

CHARLES REESE.

Baltimore, August 9, 1880.

ARTIFICIAL CITRIC ACID.

Among the latest triumphs of the synthetical chemist we have to record the preparation of citric acid by Messrs. Grimaux and Adam, of France. All the principal acids found in the vegetable kingdom had already been prepared, and for several years citric acid, the acid of the lemon, the currant, and gooseberry, has been the only one of which it could be said, "this acid has not yet been made artificially." Tartaric acid had been made several years ago from dibromsuccinic acid, and malic acid, the acid of unripe apples, from monobromsuccinic acid, an acid obtained from amber; but succinic acid itself was made from ethylene cyanide.

It would be hard to tell why the synthesis of citric acid had never before been attempted, since the process involves no unusual operations or unexpected reactions. As early as 1872, C. Bischoff, in Berlin, began the study of the dichloracetone, from which citric acid has recently been made, in the hope, as he said, of making artificial citric acid. Having learned that Glutz and Fischer were also studying the compounds of this dichloracetone, he withdrew from that field. As these gentlemen had not published anything further on that subject for several years, one of our own chemists in this city again began the synthesis of citric acid, but stopped on learning that Grimaux and Adam had preceded him, and secured the field by a communication made to the Paris Chemical Society in May last.

The details of the preparation of citric acid, as published in *Comptes Rendus* (xc., 1,052), are nearly as follows: Glycerine is subjected to the action of hydrochloric acid gas, whereby two atoms of hydrogen are replaced by chlorine, forming a liquid called dichlorhydrine, $CH_2Cl,CHOH,CH_2Cl$. This substance when oxidized by a mixture of potassic chromate and sulphuric acid yields dichloracetone, CH_2Cl,CO,CH_2Cl. This product was next treated with concentrated prussic acid, which formed with it a cyanide readily convertible by hydrochloric acid into dichloracetonic acid. This acid had not previously been prepared, although Bischoff long since made an acid isomeric with this one from another form of dichloracetone. The graphic formula of Grimaux's acid is:

$$\begin{array}{l} CH_2Cl \\ | \\ C(OH)COOH \\ | \\ CH_2Cl. \end{array}$$

This acid was distilled in vacuo and then extracted with ether, which left on evaporation a sirup that gradually became solid, forming transparent tabular crystals, soluble in water, alcohol, and ether, and fusing at 90° to 92°, and sublimable at a gentle heat, but cannot be distilled.

The concentrated solution of the soda salt of this acid was heated with two molecules of potassic cyanide, when the chlorine exchanged places with the cyanogen, producing potassic chloride and dicyanacetonic acid:

$$\begin{array}{l} CH_2CN \\ | \\ C(OH)COOH \\ | \\ CH_2CN. \end{array}$$

This substance, as expected, proved to be a *nitrile, i. e.*, a substance which by saponification with potash yields an acid, or rather its potash salt. The acid thus obtained is identical in every respect with that obtained from lemons; in fact, is really citric acid, thus establishing the formula of this acid as:

$$\begin{array}{l} CH_2COOH \\ | \\ C(OH)COOH \\ | \\ CH_2COOH. \end{array}$$

The synthesis of citric acid is looked upon at present as a triumph of more theoretical than practical interest, because citric acid can be made more cheaply from natural sources than by this new process. Since citric acid, too, is much employed in flavoring and in medicine, the use of cyanides in its manufacture is highly objectionable, lest in its manufacture a trace of this deadly poison remain in the finished product.

Now that the constitutional formula has been fully established by this synthesis, there is more probability of citric being made by other methods, and although the preparation of an acid from a cyanide is the easiest and best known, other processes may yet be devised which shall remove this objectionable feature. For use in dyeing citric acid made from cyanhydrine would be as good as any other, if the process can be improved so as to render it profitable on a large scale.

Some encouragement can be derived from this synthesis as showing that in some departments, at least, chemistry has reached the point where it is possible to predict what will be the result in certain cases. Like an engineer planning a series of works, these chemists started out with a definite object in view, planned each step, and followed the plans which lead to the expected point. In this sense, at least, it is a victory.

E. J. H.

A GOOD YEAR FOR STATISTICS.

Besides being a "census year," 1880 has the distinction of showing the largest foreign commerce, both in exports and imports, ever known in the history of the country. The grand total for the fiscal year ended June 30 amounts to $1,503,679,489, an increase of 30 per cent on the foreign trade of 1879, and about 81 per cent on that of ten years ago. The "balance of trade" in our favor, or the excess of exports over imports, amounts to $167,908,359, although we have imported, as partial payment of this balance, $75,891,391 in gold and silver coin and bullion, more than our coin and bullion exports; it is probable, however, that no inconsiderable proportion of the remainder has been taken up as the profits of carriers, a service in which American ships find comparatively little employment.

There is hardly an intelligent American but would feel greater pride than is now possible were the large exports we are making to a more considerable extent of manufactured articles. The enormous increase in shipments has been made up almost exclusively of breadstuffs, cotton, and provisions, while in manufactured articles our foreign trade for the past year has been almost at a standstill. The principal explanation of this is probably to be found in the great and sudden advance in prices which took place last fall, with the general revival of trade here, but values have again dropped, in most articles, nearly to where they were a year ago, and those who are endeavoring to enlarge the foreign market for American manufactured goods are now working under more favorable conditions than they have been at any previous time within the past twelvemonth. It may be interesting, however, to note that in some important specialties of American manufacture the exports show an increase. The complete figures have not yet been collected from all the custom houses for the year, but, taking the last statement of the Treasury Department, which brings down the returns to May 31, we find that there has been a small increase in our shipments of all the following articles: Plows and cultivators; railroad, passenger, and freight cars; car wheels; stationary steam engines; firearms, cannon, and gunpowder; clocks and parts of; mathematical, philosophical, and optical instruments; organs and melodeons; paper and stationery; printing presses and type; scales and balances; wines; tin and manufactures of; and watches and parts of. That we have been able not only to hold our own, but actually to increase our exports in all these specialties during a year when the home market has been so disturbed, presents an outlook for the future which contains much of promise.

When, however, we turn to our imports, and find that they exceed those of 1879 by 50 per cent, and that many of the articles which help to make up the increase are such as we excel in the manufacture of, and on which have to pay a high duty, we then are presented with a practical demonstration of the cheapness of labor and capital in Europe and the far more favorable situation of all classes here. These increased imports are of every description of staple and fancy articles, but the larger trade is principally conspicuous in manufactures of cotton, flax, iron and steel, silk, and wool. Our own manufacturers in all these lines have had a full business, but, besides what they have produced, we have been taking liberal supplies from abroad in exchange for our bountiful agricultural products. The circumstances under which this trade has been done, showing no accumulation of foreign indebtedness, and a liberal balance to our credit abroad, to be covered by gold shipments to this country, are more favorable to our continued prosperity than they have ever been in any former period of excessive imports.

The St. Lawrence River Tunnel.

Surveys were begun August 9 for the long-talked of tunnel under the St. Lawrence River at Montreal. The line contemplated is from the Liverpool wharf, Montreal, to the Hudson Cotton Factory, at Hochelaga. The river has a depth of 42 feet, and the tunnel will be 40 feet below the bottom. The work has been undertaken by the South Shore Railway and Tunnel Company. Mr. Walter Shanly, well known through his connection with the Hoosac Tunnel, is chief engineer.

FIRE IN A PENNSYLVANIA COAL MINE.

A fire which threatens to be one of the most disastrous in the history of American coal mining, broke out August 9, in the Keely Run Colliery, at Shenandoah, Pa. No lives were lost, and all the mules and portable machinery had been safely brought to the surface before the fire became fully developed. Mine Inspector Parton and Ex-Mine Inspector Edmunds attribute the fire to spontaneous combustion in a quantity of coal waste which had been dumped into a break leading into the mine. A breast had been worked up to the surface not far from the breaker, and the opening had been used as an economical receptacle for dirt, slate, and other mining refuse. The natural oxidation of this stuff caused an outflow of "white damp" into the mine, and the efforts made to ventilate the mine only served to force more air through the heated and inflammable matter, resulting in its general combustion and the threatened destruction of the entire mine.

The Keely Colliery is in the mammoth vein, and its workings connect with those of the Kohinoor Colliery and with those of Colliery No. 8. The situation is a critical one, as the Keely Run Colliery cannot be flooded without drowning others; while if it is not flooded the fire must spread to and ruin a number of very valuable properties.

ELECTRIC LIGHT FOR MARINE USE.

[*Continued from first page.*]

must be a very strong one, and concentrated to its smallest possible dimensions, in order that the volume of air operated upon may be very small.

We give herewith engravings of electric light apparatus designed by Hiram S. Maxim, M.E., the electrician of the United States Electric Lighting Company, for projecting a strong parallel beam for marine and other uses.

Fig. 1 (on this page) represents the dynamo-electric machine for producing the electric current This machine has an armature of soft iron rings, with the wire wound parallel to the axis, both plates and wires being so arranged that a free circulation of air through the armature prevents any dangerous heating, even if the machine is run on a short closed circuit—a test that would soon destroy many of the best foreign machines. The armature is so built up in sections that no current is induced in anything except the wires which generate the current for use. The magnets are of soft iron bars with spaces between.

The commutator is large and heavy, with the sections curved in a right and left hand spiral, so that no break in the current is possible.

The whole forms a neat and compact piece of machinery, admirably built and well calculated for the purpose intended. It may be driven with a belt from any source of power, or a small high speed engine which has been especially designed by the same inventor may be applied directly to the spindle, thus completely obviating the annoyance and vexations accompanying the use of belts in a damp atmosphere.

Fig. 2 represents the projector for throwing the light. It consists of a strong brass cylindrical case mounted on trunnions, so that it moves freely in any direction. The lamp used in this projector is the same as described in these columns some months ago (Maxim's patent). It is a focusing lamp, that is, one that feeds both carbons in proportion to their consumption, thus keeping the luminous points always in the same place. To enable the operator to bring the carbon points exactly in the focus of the reflector, regulating screws are provided. The lamp may be raised or lowered at will, or moved forward or backward with equal facility. A small lens placed in the side of the reflector throws an inverted image of the carbon points on a ground glass screen, so that their action and position may be observed without any danger or inconvenience to the eyes of the operator. The silvered reflector is eighteen inches in diameter, and in form is a perfect parabola. The apparatus is highly finished and presents a fine appearance on the deck of a ship. It is inclosed so that a heavy sea cannot interfere with its perfect working. When it is desired to cut off all light in the foreground, and illuminate only distant objects, a long funnel-shaped bonnet is fastened to the front, thus removing all except the small central beam.

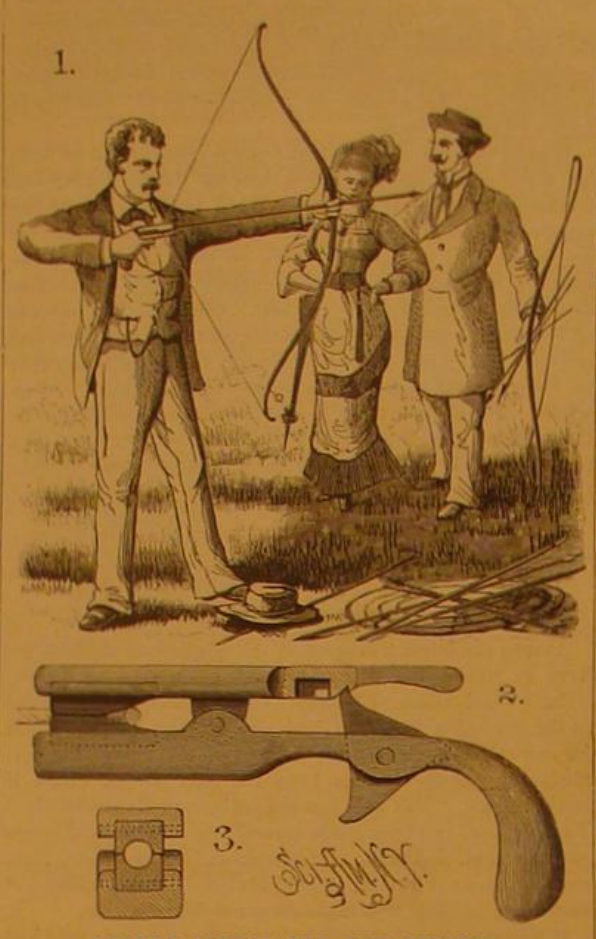
Fig. 3 represents a cheaper form of projector, which may be used on land or on river steamers. It has all the movements and will produce the same results as the more expensive type, shown in Fig. 2. The front glass is in strips to prevent breakage, due to the intense heat evolved. Either of these projectors will throw a beam of light strong enough to read by, at a distance of five miles on a clear night and many hundred feet in a dense fog.

Further information may be obtained by addressing the United States Electric Lighting Company, 120 Broadway, New York.

THE great Corliss engine of the Centennial Exhibition now drives the machinery of the San Francisco Mint.

CLUTCH FOR BOW STRINGS.

A novel arrow holder, which holds the arrow and the string while the bow is being drawn, is shown in the annexed engraving. It is designed to be held in the hand like a pistol, and it clamps the arrow as well as the bow string, and when the string is strained to the required tension, it may be instantaneously released by simply pulling the trigger, and without the relaxation of the muscles of the archer's arm. The manner of using the device is shown in Fig. 1, while the clutch is shown on a larger scale in Fig. 2. Fig. 3 is a cross section near the end.



BEARD'S CLUTCH FOR BOW STRINGS.

This invention was recently patented by Mr. C. M. Beard, of Elroy, Wis.

A Plucky and Intelligent Dog.

Recently a number of soldiers went from Fort Craig to the Rio Grande for a bath. Among them was Captain Jack Crawford. After being in the water about three quarters of an hour Captain Jack started to cross toward the other side of a sand bar, on which the water was only from six inches to a foot deep. Several of the others followed Jack, and they had considerable fun tripping each other and rolling over in the water, while two of the boys got Jack down in the shallow water and tickled him in the ribs until he was nearly exhausted with laughter, being very ticklish. In order to get away from his tormentors Jack rolled over toward the deep water on the lower edge of the bar, and when he got up on his feet he kept backing down stream, and although there was not more than two feet of water where he stood, yet the current was so strong that it would carry him down should he lose his footing. He kept splashing water on those who had been tickling him, and bantering them to come on after him, when suddenly he made two or three desperate efforts to get back, but failed. Yet he said not a word, or the others might have joined hands and reached for him. No one dreamed for a moment that he was trying to extricate himself from the quicksand. All at once he went down like a piece of lead.

The next instant Jack's dog Hero, a beautiful St. Bernard, was seen swimming toward his master, while he set up a howl that seemed to say "I'm coming." Jack came up about twenty-five yards below where he went down, and right in the center of a terribly swift current, near where the river made a quick, sharp turn. He was almost exhausted when the sand broke from under him, and, striking a whirlpool, he could make little or no headway, and had to use all his strength to keep from being caught in the suction. Hill, a soldier, as soon as he saw the dog go for Jack, also sprang in the current, but Hero got to Jack first, just as he was going down the second time, and, taking him by the hair of the head, brought him above water. Jack, who never lost his presence of mind, caught the dog by the back just above the hip, and the faithful Hero brought him safe to shore, almost a mile below where he first went down. This was a narrow escape, as an officer and five soldiers went down nearly in the same place a few years ago and were never seen. A wagon and team of mules disappeared in the river two years ago and have not turned up yet.

An old Mexican brought Jack over from the opposite shore in a boat, while Hero never ceased licking his hands and face until he came out of the boat.—*Denver (Col.) Tribune*

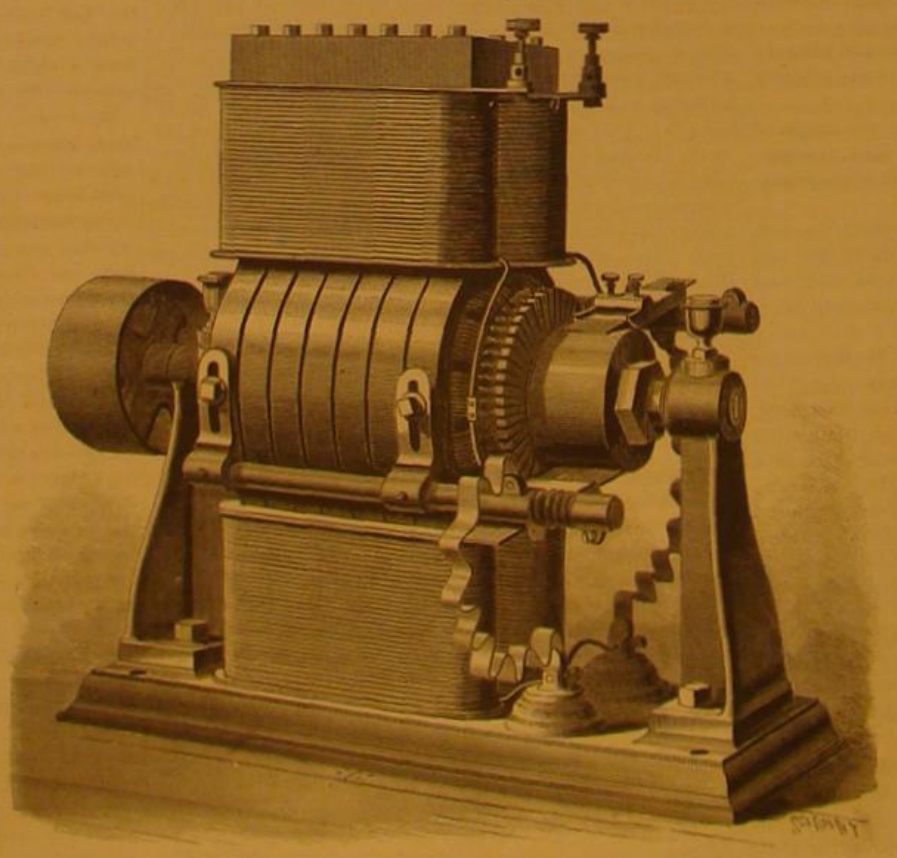


Fig. 1.—MAXIM'S DYNAMO-ELECTRIC MACHINE.

MECHANICAL INVENTIONS.

Mr. Herbert Symonds, of Detroit, Mich., has patented an improved hooded coal hod, which is so constructed that the coal cannot fall off at the sides and back while being emptied, and so that they cannot have their discharge aperture clogged while being filled.

An improved folding attachment for sewing machines has been patented by Messrs. James S. Foley and George W. Comee, of Waseca, Minn. The object of the invention is to fold the cloth once before it is hemmed, and it consists in a combination which cannot be clearly described without engravings.

Mr. Joseph Langlois, of St. Johns, Quebec, Canada, has patented an improvement in heel trimming machines, which consists of novel devices for holding, tightening, raising, lowering, centering, and otherwise adjusting the trimming knife, and for holding and releasing the boot or shoe operated upon, and of other novel auxiliary parts.

An improved attachment for sewing machines which will fold down the seam immediately in front of the needle, so that the basting and ironing will not be required, has been patented by Mr. Johann F. Schroeder, of Brooklyn, E. D., N. Y.

An improved portable elevator which is to take the place of ladders has been patented by Mr. Horace H. Barnes, of Dryden, Mich. It is simple and convenient, and it consists of a central post provided with a number of pivoted braces, and surrounded by a sliding box platform provided with a windlass, the rope of which passes over suitable pulleys and is fastened to the central post, so that by winding the rope on to the drum of the windlass the platform and the person on it are raised to any desired height, and may be held there by a pivoted brake pawl.

A simple and effective double action lifting jack has been patented by Mr. James F. McCormick, of Louisville, Ky. The invention consists of a hollow rack toothed column, in which moves a vertical working bar that carries pivoted on its head a bifurcated lever, within each end of which lever are pivoted curved swinging pawls that engage alternately with the rack teeth of the column as the lever is operated, and thereby elevate the working bar.

Mr. Charles H. Shippee, of Wickford, R. I., has patented an improvement in car couplings, the object of which is to permit of coupling the cars automatically and avoid danger to life and limb; also to construct couplings so that they will couple with the Miller coupling and with a common link to any usual form of drawhead.

Mr. Charles Seymour, of Defiance, O., has patented an improved hub turning lathe, the object of which is to obtain a more rapid reduction of the hub block than can be obtained by the ordinary means; also to dispense with complicated and rapidly wearing parts, and simplify the mechanism for shifting the cutters.

Mr. Albert F. Pflughaupt, Jr., of Brooklyn, N. Y., has patented an improved device for preventing the entrance of sewer gas into buildings. This device is so constructed as to operate automatically to discharge the sewage into the sewer.

A LENS WITH VARIABLE FOCUS.

The human eye has frequently been compared with the camera obscura, and in many respects this comparison serves to illustrate the formation and action of the eye; but one of its most sensitive members, the crystalline lens, is so far superior to all instruments that can be produced, that all attempts to illustrate its nature and functions by means of instruments have so far been in vain. The camera is only adapted to clearly produce the images of objects when they are within certain limited distances governed by the nature of the lens, whereas images are produced in the human eye with the greatest clearness, independently of distances. This property is due to the crystalline lens, which, under certain influences which we cannot examine here, changes its form and produces greater or less deviations in the directions of the pencils of luminous rays that enter the eye.

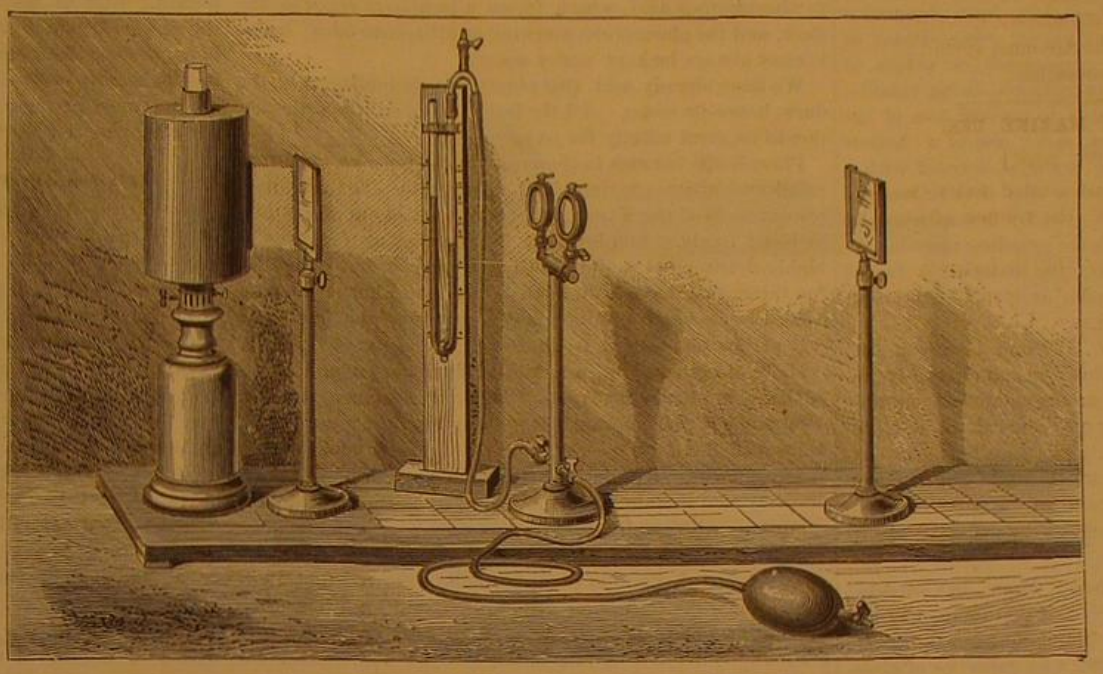
Dr. Cusco, who has occupied himself very extensively with ophthalmology, has invented a lens with variable focus which beautifully shows the action of crystalline lens. A metal ring of a suitable thickness is mounted on the top of a hollow standard, and two disks of glass are secured in the ring, one at each edge, with tight joints. The hollow disk thus formed is filled with water or some other transparent liquid, and the hollow standard is connected with a small reservoir that can be conveniently raised or lowered, as may be desired, or with a rubber syringe bulb connected by means of flexible tubing.

The reservoir must be adapted to be raised or lowered so as to permit of varying the pressure of the liquid in the apparatus. In this case two rings, or double disks, are shown, but they are provided with cocks so that either can be shut off from communication with the rest of the apparatus. The apparatus is connected with a siphon pressure gauge, filled with water or mercury. If the pressure gauge indicates zero the pressure in the apparatus and between the glass disks will be equal to the pressure of the exterior air, and the glass disks will remain plane, simply forming a refractive disk with two surfaces, which cannot produce any variation in the divergence and convergence of the pencil of light that traverses it; so that if a real image of a luminous object is produced on a screen by means of another lens, and the above described disk or water lens is interposed so as to cause the rays of light to traverse it, the clearness of the image will not be impaired; but if the pressure of the water in the apparatus is increased, the disk of glass will swell outward under this pressure, and the two disks will form a double-convex lens, which produces an augmentation of the convergence of the rays of light, and thereby destroys the clearness of the image on the screen. The changes of the pressure may be very minute, for the instrument is so very sensitive that the least compression of the rubber bulb, which corresponds to the most feeble variation of the pressure, will produce a change of the focal distance. But the experiments with this interesting instrument do not end here, for a concave lens can be produced in a similar manner. If the pressure gauge indicates zero, the rubber bulb or the reservoir is lowered and consequently produces a vacuum between the two disks, so that the pressure of the outer air presses them inwardly, forming a double-concave lens. This lens will diverge the rays of light and cause the images obtained by another lens to appear more distant.

This apparatus is very well adapted for obtaining and making lenses of a certain power. Each model is specially graduated according to the thickness of the glass used, its nature, the manner in which it is secured in the ring, etc., as all this influences the action of the pressure of the water.

It is necessary to determine directly the focal distance that corresponds to a certain given pressure. The method of doing this is represented in the engraving, which we take from *La Nature*.

In a dark chamber an opaque cylindrical hood, provided with a longitudinal slot, is placed over a lamp in such a manner that the rays of light can only pass through the slot, and are thrown upon a screen of ground glass, upon which graduated lines are drawn. Another similar screen is placed upon a standard provided with a scale, and the variable lens is placed in the middle between the two screens. The pressure in the variable lens is equal to the ordinary air pressure. A lens of known strength which produces a real image on the second screen is added to the combination. Then the lens and the second screen are gradually moved from the lamp, but always in such a manner that the lens is midway between the screens, until an image of the figures on the first screen is seen clearly on the second. The pressure of the water in the variable lens is then gradually increased until this lens produces a clear and exact image on the second screen. The subdivisions on the lines of the screens permit of comparing the sizes of the images very accurately.

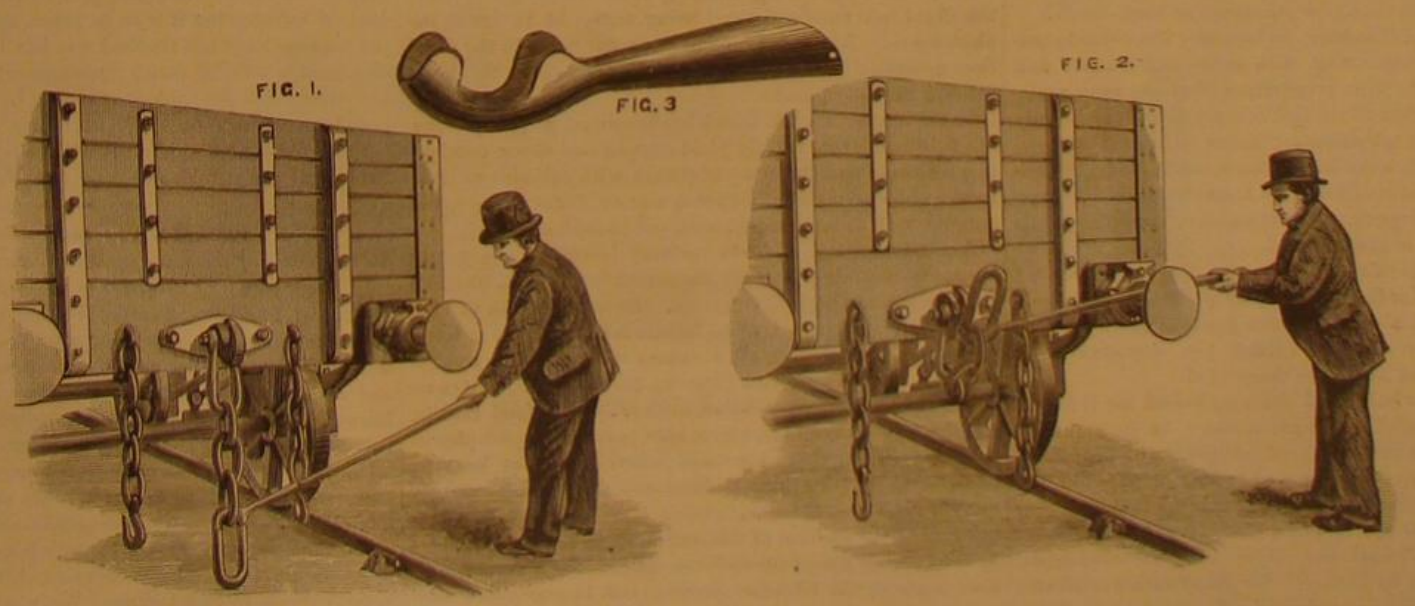


DR. CUSCO'S LENS WITH VARIABLE FOCUS.

NEW COUPLER.

During the past few years attention has been prominently directed to the dangers attending the coupling and uncoupling of railway trucks in shunting operations, and a good deal of ingenuity has been expended in devising means of diminishing this risk. The inventions which have been produced for this purpose may be broadly divided into two classes; namely, first, those in which the ordinary couplings are replaced by automatic appliances, which couple the trucks on the latter coming together; and, second, those which consist of appliances by means of which the ordinary couplings can be connected or disconnected without the necessity of a man going between the wagons for the purpose. As regards inventions of the first class, they are open to the objection that, however efficient they may be, they involve extensive alterations of rolling stock, and a large expenditure, which railway companies are little disposed to undertake, while, moreover, they also involve for their efficient introduction something like a concerted action between different railway companies and wagon owners—a most difficult thing to secure. Even for this latter reason alone appliances of the second class are far more likely to find favor.

These appliances of the second class above mentioned, may, in their turn, be divided into two sub-classes, the first comprising appliances fixed to the wagons (and some efficient arrangements of this kind have been devised), and the second comprising portable appliances to be carried by the men engaged in shunting operations. Mawlam's railway truck coupler, the illustration of which we take from *Engineering*, belongs to this last-named class. It consists simply of a light wooden handle, having mounted on it an instrument of the form shown in Fig. 3 of the annexed engravings, this instrument enabling an ordinary coupling link to be effectively grasped. The mode of using the instrument will be at once understood from an inspection of Figs. 1 and 2, but we may remark that many shunters prefer keeping the handle wholly below the buffers during the coupling operation instead of resting it upon the buffers, as shown in the last mentioned figure. Mawlam's coupler has now been in use about two years at the Northeastern yard at Stockton-on-Tees, England, and a shorter time at some other yards, and the testimony of the shunters using it is very strongly in its favor, both as to the rapidity and safety with which it enables the work to be done.



MAWLAM'S RAILWAY TRUCK COUPLER.

NEW INVENTIONS.

Mr. William R. Phillips, of Milford, Del., has patented an improvement in fruit driers, which consists in combining with slotted walls slides, cleats, and movable cross bars.

Mr. Gerhart Rauman, of Middletown, Conn., has patented a spring closer for doors, gates, and blinds, so constructed that it will close a door, gate, or blind however much or little may be opened.

An improved toy pistol has been patented by Mr. Henry S. Lockwood, of South Norwalk, Conn. The improvement relates to pistols having their barrels pivoted so that the breech may be swung upward to permit insertion of a cap or cartridge. The object of the invention is to dispense with the use of springs or catches for holding the barrel in place, and thereby simplify and cheapen the construction of the pistols.

Mr. Edward P. Haff, of New York city, has patented a double crochet needle formed of a tube, into each end of which a crochet needle is inserted. These needles may be fine or coarse, and may be replaced by others when desired and are inverted in the tube when not in use.

Mr. John McAnespey, of Philadelphia, Pa., has patented an improvement in ice cream beaters, which consists in a novel construction and combination of a vertical barred beater and an automatic scraper for removing the ice cream from the interior surface of the can.

Mr. Emil P. Raether, of New York city, has patented an improved bottle stopper especially adapted to bottles containing sirups, bitters, and other fluids used in restaurants

An apparatus for filling casks and bottles with lager beer or other liquid impregnated with air or gas under pressure, so constructed that the pressure may be regulated as desired and without wasting the liquid, has been patented by Mr. J. C. G. Hüpfel, of New York city.

A simple and efficient apparatus for extinguishing fires has been patented by Mr. Lewis A. Folsom, of Dalton, Ga. The invention consists of two barrels or other vessels, set one within the other, the outer one containing sulphuric or other acid, and the inner one carbonate of soda or other alkaline carbonate, and into the latter vessel a third vessel, containing gunpowder or other explosive, is introduced, the explosive vessel having a fuse or tube filled with powder connected with it and extending upward through the cover of the other vessels, so that fire applied to the tube or fuse will be communicated to the explosive in the interior vessel, and cause an explosion which will burst asunder the containing vessels, and thereby cause their contents to mingle, generating a sufficient volume of carbonic acid gas to extinguish the fire.

Mr. Gennaro Rossi, of New York, has patented a paint composition for woodwork, walls, and the bottoms of vessels, to produce a waterproof surface, and on vessels to prevent the adherence of barnacles and grass.

Mr. William L. Gerard, of Junction City, Kan, has patented an improved tether, which permits of keeping the animals within a limited space without requiring a long rope or strap or strong and insurmountable fences. The invention consists in an anchor or like device attached to the halter strap of the animal, so that if the animal steps over the low fence surrounding its pasture the anchor catches on the top wire of the fence, thus holding the animal.

An improved holder for tape, braid, etc., has been patented by Mr. Edward P. Haff, of New York city. It is formed of a U-shaped spring clamp, with a double slitted cross piece and roughened or serrated shanks adapted to clasp the sides of the material.

Messrs. Jules and Charles Schmerber, of Paterson, N. J., and Jules A. Arrault, of New York city, have patented a machine for grinding and mixing plastic compositions or substances, such as pyroxyline compounds or others of which the solvents or part of the ingredients, being volatile, require working in closed apparatus to prevent loss of the volatile portions The inventors make use of a hollow cylinder for receiving the plastic material, formed with a steam jacket and fitted with a piston that is to be reciprocated by suitable power, and the cylinder is connected by passages at its opposite ends with the grinding machine, so that by the movement of the piston the material is forced back and forth, through the grinder until the operation of mixing and grinding is completed.

Messrs. William Cornwall, Sr., William Cornwall, Jr., and Aaron Cornwall, of Louisville, Ky., have recently patented an improved machine for mixing materials suitable for making soap, also for mixing other plastic or pulverulent materials for other purposes. The improvement consists in the construction and arrangement of the rotating arms employed for creating currents, which move in opposite directions, but in different parts of the materials placed in the mixing vessel or receptacle.

Mr. Hollis C. Trout, of Minneapolis, Minn., has patented a receptacle for mail matter, so arranged that its interior can be quickly and easily inspected without opening the cover. The sides of the box are formed of wire gauze or of glass, or glass protected by an exterior covering of wire gauze or any material that will permit a quick inspection of the box through the sides. The box is intended principally for the use of residences and stores as a receptacle for newspapers, but it may also be used as a receptacle for other mail matter.

YELLOW AND RED PHOSPHORUS IN THE MANUFACTURE OF MATCHES.

BY DR. E. EICHLER.

Phosphorus is an element, that is to say, a simple chemical substance. The ease with which it ignites and the fact of its shining in the dark (to which it owes its name, from the Greek words signifying "light bearer"), have made it at all times an object of general interest. Uncombined phosphorus does not occur in nature, its chemical properties rendering it impossible for it to remain in a free state during the formation of the solid crust of the earth. Its occurrence is limited to compounds of its acid, "phosphoric acid," with alkalies, especially with lime. Apatite, which occurs in the oldest formations, is chiefly composed of phosphate of lime; then, too, there is wavellite, a hydrous phosphate of alumina, and pyromorphite or phosphate of lead.

In 1669, Brand, of Hamburg, accidentally discovered phosphorus while experimenting with urine, and Kunkel first described a method for its preparation from the same material. Until the middle of the last century urine was the only source of making phosphorus; hence it could be prepared only in small quantities, which made it very expensive. In 1737 Hellof obtained from 3 oxhoft (about 700 liters) only 1 ounce of phosphorus, which was then worth 10 ducats in England and 16 in Amsterdam.

In the second half of the last century Scheele discovered that bones consist for the greatest part of phosphate of lime, and thus opened an abundant source for phosphorus, which is still in use to-day. In recent times, too, important beds of phosphate of lime have been discovered.

Since phosphorus has found much technical use it is prepared on a large scale in chemical works. In its manufacture either bone-ash or the natural phosphate of lime from the mineral kingdom is employed. Its preparation depends on the reduction of phosphoric acid by means of coal at a white heat. The neutral phosphates furnished by nature cannot be directly employed, since only the acid phosphates are reducible by carbon. To obtain such a reducible acid phosphate the ordinary phosphate is covered with dilute sulphuric acid and warmed. The sulphuric acid deprives the phosphoric acid of two-thirds of its lime, forming with it an almost insoluble sulphate of lime (gypsum), while the acid phosphate formed goes into solution and can be separated from the gypsum by decanting and pressing. The solution is concentrated in leaden vessels, and then mixed with pulverized wood charcoal and heated in clay retorts, at first gently, then to a strong red heat. These retorts are connected with earthen receivers containing water, in which the gaseous phosphorus is condensed and collected under water. The crude product thus obtained is still very impure, and is purified by repeated distillation in iron retorts. Phosphorus generally comes into market in sticks formed by sucking the phosphorus, which has been melted under warm water, into conical glass tubes, which are then closed at both ends and dipped into a cylinder of cold water. The phosphorus soon solidifies and can be pushed out of the tubes.

Phosphorus as it comes into commerce in sticks (the yellow white, or common form) is colorless, or yellowish, and translucent; at ordinary temperature it can be cut with a knife, and exhibits a waxy luster on the cut surface. It is insoluble in water and alcohol; ether, ethereal, and fatty oils take it up in small quantity. The best solvent for it is sulphide of carbon; chloride of sulphur and sulphide of phosphorus dissolve it readily. It melts at 44° C. (111° Fah.), expanding considerably, and then refracts the light strongly. It boils at 290° C. (554° Fah). When heated in the air but little above its melting point it burns with a very luminous flame to phosphoric acid (anhydride). Exposed to the air at lower temperatures its also oxidizes and burns without flame to phosphorous acid, which forms a luminous vapor in the dark, and the phosphorus gives out an alliaceous odor; hence it must always be kept under water.

We have already said that phosphorus is luminous in the dark, hence its name. All the last mentioned properties are due to its great affinity for oxygen.

Phosphorus belongs to the most violent poisons, even very small quantities proving fatal. Burns on the skin may result fatally if the wound is not well washed out and caused to bleed freely. Employment in phosphorus factories is highly detrimental to the health of workmen, but especially for those that have bad teeth. The phosphorus necrosis caused by its vapor produces a destruction of the jaw bone.

If yellow phosphorus is exposed to the action of light, especially direct sunlight, under all circumstances and in all media, it gradually turns red. This red substance is not a compound of phosphorus; it is nothing but pure phosphorus, the so-called *red phosphorus*, *i. e.*, an allotropic modification of phosphorus. By allotropy we understand an unexplained property that certain elements possess of assuming different conditions with totally unlike properties.

Schroetter first made the observation that *heat* effects the same change of common phosphorus into the red that light does. When the former, or yellow, is heated for a long time in an atmosphere of carbonic acid to 240° or 250° C. it is gradually converted into the latter, or red. This conversion takes place far more rapidly by heating common phosphorus to 300° C. in closed iron vessels; no increase or decrease of weight takes place. The substance thus obtained has the following properties:

Red phosphorus does not change in the air, hence it is non-luminous; it is *insoluble* in sulphide of carbon; if perfectly free from common phosphorus it is not poisonous. In its tendency to chemical union it is far behind the other kind; rubbed with oxidizing substances it takes fire only at high temperature; except with chlorate of potash it explodes easily and with violence. Heated in carbonic acid at ordinary pressure to 261° C., it is reconverted into ordinary phosphorus; near this temperature it ignites by access of air.

Red phosphorus is now made in large quantities by continued heating of the yellow phosphorus. To obtain it perfectly pure the unconverted yellow phosphorus is dissolved out with sulphide of carbon, which leaves the red form uneffected.

Both modifications find their chief use in match making. The yellow is used in common matches, the red in so-called Swedish (or safety) matches.

In the former case the phosphorus is on the head of the match, which ignites by rubbing it on any rough surface, the slight heat thus generated being sufficient to ignite the phosphorus. As conveyance to carry the flame to the wood they generally use sulphur, which is applied to the wood beneath the phosphorus.

In the second case the match heads contain no phosphorus, but substances that readily yield oxygen and favor combustion (chlorate and chromate of potash with sulphide of antimony). These matches do not ignite on every surface, but only on such as are covered with red phosphorus.

Against ordinary matches the very justifiable charge can be made that they are very hazardous as regards fire, and that the mass is highly poisonous. Even the health of operatives employed in their manufacture is injured; the strictest precaution of excluding all workmen with defective teeth is but little use; in all match factories there are frequent cases of phosphorus necrosis, often attended with fatal results. Besides, how many children have been poisoned by phosphorus matches? Then there are cases where pieces of burning phosphorus fly from a match head and cause dangerous or fatal burns.

To show the amount of damage done in the last ten years by the careless use of phosphorus matches we give the estimate made by the *Chemiker Zeitung*, that in the years 1862 to 1871 inclusive, in Germany alone, the damages paid by public insurance companies for injury done to buildings through carelessness with matches amounted to $2,120,000. Add to this damages to furniture and to uninsured buildings the probable sum of $2,250,000, we have for the grand total of damage from careless use of phosphorus matches in ten years $4,370,000.

None of these evils and dangers accompany the use of so-called Swedish matches (invented by Prof. Boettger in 1848), since they are not poisonous and only ignite on prepared surfaces. (They ignite when rubbed on smooth porcelain or glazed paper.—*Trans.*) Although the use of these is already very large (in Germany), they are still very far from having totally displaced the old sulphur match. That the latter are somewhat cheaper causes many people to use them and many factories make them. It can be suppressed only by law. On December 23, 1879, Switzerland passed a law forbidding the introduction and sale of matches and tapers on which the common yellow phosphorus is used. In spite of all the agitation against this law it has been strictly enforced. Germany, too, is taking action in the matter, and the German Parliament of June 27 of this year proposed to check the use of yellow phosphorus by increasing the tax thereon.—*Badische Gewerbezeit.*

[The American parlor match is as little known in Germany as the Swedish match is here. The parlor match possesses so many advantages of being convenient and certain that our people seem willing to incur the extra danger rather than inconvenience themselves by the use of a match that will ignite only on the box, involving the inconvenience for smokers of always carrying the prepared surface in the pocket. One of the chief objections to parlor matches is the ease with which the heads fly off, carrying a spark perhaps to some dark corner, where it smoulders for hours, or lies innocently on the pavement until exploded by the foot of the unsuspecting pedestrian, who, if a lady, is in danger of having her skirts set on fire thereby.—ED.]

Hydraulic Pumping on the Comstock.

News from the Comstock announces that the Requa shaft is to be supplied with hydraulic pumping apparatus, a fact which marks just as great a change in the engineering of the famous lode as any which has preceded it.

The present system of pumping is by direct-acting compound engines, using steam at 100 to 110 pounds, and a vacuum of 26 or 27 inches. The Davey differential valve gear is used with the poppet valves introduced by Mr. Patton, the able designer of all the new Comstock machinery, and superintendent of the northern group of mines. Steam cylinders of 32 and 64 inches diameter, and pump cylinders of 13, 14, and 15 inches diameter and 7 to 10 foot stroke, complete this splendid system of drainage. One of the series of pumps—in fact, the one which is now doing duty in the Requa shaft—has a double line of pump cylinders, 14 inches by 10 feet.

It is a sign of the remarkable difficulties which are presented in mining at the depth of 3,000 feet, that the immense powers of this pump should have proved unequal to the task of draining the mine, and tanks have lately been running that raised the water to the surface, while the pump lifted it only from the 2,400 level to the Sutro tunnel, 800 feet above. Together, the two modes of drainage are reported to have raised 2,000,000 gallons, or 8,000 tons, of water daily, a quantity which is probably exaggerated. Even with this extraction of water, the work of the mine has been seriously impeded by the fear of flooding. It is true that the Requa shaft is now handling that remarkably persistent "water bonanza" that flooded the Savage so long.

At these great depths it has been found extremely troublesome to maintain the ponderous spear rods which the old system of pumping required. They are made of Oregon pine, in sections 80 feet long, and usually 14 x 14 inches in section; but with all their strength, they have broken repeatedly in the Comstock mines. Especially when the water is most abundant, and in those up-cast mines where labor is most severe in the shaft, are the breaks likely to occur.

Hydraulic pumping has been proposed for years as a remedy for these difficulties, and we are glad to see that the step of introducing it is to be taken at last. The details of the scheme have not reached us; but it is reported that the new pumps will be much more powerful than the old. In any event, it is probable that it will be more effective in the peculiar circumstances of the Comstock than the present system. The new apparatus will be ready, it is said, before the end of the year.—*Eng. and Min. Journal.*

Iron Tops not a Protection for Oil Tanks.

To the Editor of the Scientific American:

In your paper of July 17, is an article written by D. B. Mason, of Pittsburg, Pa., in which he states the remedy for protecting oil tanks from being struck by lightning has long since been solved—the use of iron tops instead of wood—and adds there has never been a tank of oil with iron top burned by lightning. This was believed to be true until this season. Mr. M. is sadly mistaken. There were three oil tanks in this vicinity (all iron tops) struck by lightning and burned, as well as others in other sections of the oil regions. We would be only too glad to learn of some method other than the old theory by which we could protect our property from lightning, as that has been demonstrated beyond a doubt to be a failure. We want information on the subject. J. C. M.

Bradford, Pa., August 5, 1880.

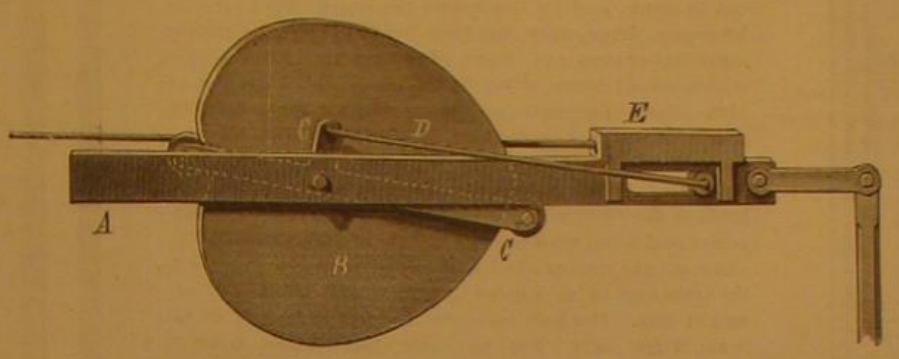
Mr. Daniel C. Beard tells us of a remarkable feat in gastronomy performed by the huge batrachian whose portrait we presented to our readers some time since. Then his tidbit was a common mouse, but now his epicurean taste is to be satisfied only with alligators, not of the largest size to be sure, but alligators nevertheless. Mr. Beard placed an alligator 11¼ inches long in the aquarium occupied by the bull frog. After a brief battle—the bull frog being the victor—the process of swallowing the vanquished began, and in due course the alligator passed from view.

A SUBSTITUTE FOR THE CRANK.

The engraving shows a device recently patented by Mr. Samuel W. Hanson, of West Union, West Virginia, intended to replace the crank in steam engines and other machinery where the crank is now used. On the end of the shaft, in the place usually occupied by the crank, there is a heart cam, B, across the face of which, and at right angles with the shaft, a bar, A, slides in suitable guides. The bar carries a lever, C, whose pivot is parallel to the main shaft and in the same horizontal plane. This lever has at each end a friction roller which rolls on the periphery of the heart cam, and from one side of the lever projects an arm which is connected by a rod, D, with a pin working in a slot in bar, A. A slide, E, on the bar, A, is provided with two pins projecting downward on opposite sides of the pin connected with the rod, D. The slide, E, is connected with a hand lever, by which it may be moved lengthwise on the bar, A.

The bar, A, is connected with the piston rod of a steam cylinder or any other prime motor either directly or by means of a lever. The bar being reciprocated exerts a pressure on the periphery of the cam though the medium of the lever, C, and its rollers. It will be noticed that one end of the lever, C, is below the center line of the bar, A, while the other end is above. This arrangement insures the rotation of the cam in one direction, and to reverse the motion of the cam all that is required is to reverse the position of the lever, C, by moving the slide, E.

The inventor claims that the cam has no dead points, that the power and motion are equal throughout the stroke, and that for this reason a flywheel is unnecessary. He also states that he gains a great deal of power over the crank, that it will run either very slowly or with any desired velocity, that it is capable of withstanding jars or shocks it is likely to receive, and is not liable to get out of repair. Further information in relation to the invention may be obtained by addressing the inventor as above.



HANSON'S SUBSTITUTE FOR CRANKS.

Tobacco Smoke Products.

MM. Le Bon and Noel presented, the other day, in the French Academy, three flasks containing the following products extracted from tobacco smoke: 1. Prussic acid; 2. An alkaloid of agreeable odor, but dangerous to breathe and as poisonous as nicotine; 3. Aromatic principles still undetermined, but contributing, with the alkaloid mentioned, to give tobacco smoke its perfume. The alkaloid in question is thought to be identical with a compound—collidine—the existence of which has been observed in distillation of various organic substances, but whose physiological and toxical properties have been overlooked.

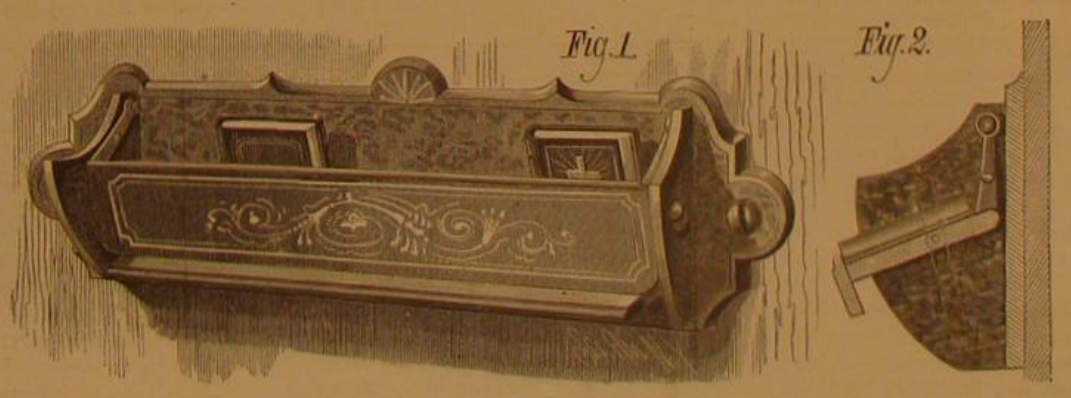
IMPROVED BOOK-RACK.

A novel book-rack which can be readily changed into a book-rest is shown in the engraving. It is designed more particularly for application to church pews, but there are numerous other uses to which it may be applied with advantage.

Fig. 1 is a perspective view showing the device when used as a book-rack, and Fig. 2 is a vertical transverse section showing the device in use as a book-rest. The front of the rack is pivoted at the ends so that it may be readily arranged either as a book-rack or book-rest.

On the inner surfaces of each end piece there is a latch which is adapted to hold the front of the rack securely in either of its positions. Ordinarily the front of the rack is in the position shown in Fig. 1, but it may be instantly changed to serve as a book-rest by raising the latches at the ends and turning the front of the rack on its pivots and bringing the latches against the upper edge of the front piece. The ends of the movable piece are rendered noiseless by rubber washers. The rack is neatly made in suitable designs and of suitable wood to match its surroundings, and it is readily secured in its place by two ornamental screws. It may be made in different lengths and widths to suit the different uses to which it is applied.

Further information in regard to this invention may be obtained by addressing the patentee, Mr. James Murphy, of San Antonio, Texas.



MURPHY'S BOOK-RACK AND BOOK-REST.

New York City as a Summer Resort.

Compared with other cities which furnish tables of mortality, New York may claim a condition of public health better than the average. In the latest published returns for June the weekly statement for New York represents an annual death rate of 23·5 per 1,000 inhabitants. But in Concord, N. H., it was 26; in New Bedford, Mass., 34·7; Marblehead, Mass., 27·8; Sing Sing, N. Y., 62·6; Plainfield, N. J., 26; Wilmington, Del., 26·6; Baltimore, Md., 25·7; Cincinnati, Ohio, 24·7. These are localities generally deemed healthy, and would probably resent the insinuation that a residence there is less conducive to longevity than one in New York. But here are the best and freshest figures we have at hand, and they tend to confirm that impression. Going well South we come upon statistics exhibiting even a more favorable contrast for New York. The death rate of the District of Columbia for the period mentioned was 29·4; Norfolk, Va., 29·4; Charleston, S. C., 32; Savannah, Ga., 31·4; Augusta, Ga., 29; Selma, Ala., 44·2; New Orleans, La., 37·2; Brownsville, Texas, 28·4; Nashville, Tenn., 33·4; Clarksville, Tenn., 43·4. A heated term in those cities, such as is scourging the Northern and Eastern States at the present time, would probably raise these percentages. New York need not fear to challenge comparison with foreign cities. She is the healthiest of all the crowded centers of population from which we have the tabulated returns, except London. The British metropolis reported a death rate of 18·5. But in Berlin it was 26·6; Hamburg, 25·4; Vienna, 25·8; Buda-Pesth, 41·1; Copenhagen, 25·8; Stockholm, 35·9; Geneva, 25; Amsterdam, 28·5; Rotterdam, 29·8; Cadiz, 32·9; Havana, 43·5; Shanghai (the foreign settlement), 104·4; and Kobe (Japan), 34·9. In Liverpool the rate was 23·4, closely approximating that of New York, and in the other large English towns it was but slightly less. These figures are fairly taken from the official data, and their accuracy cannot be impeached. They make out New York, if not exactly a grand sanitarium, yet a place where one's chances of health are good enough to warrant the selection of this city as a reasonably safe resort for the summer months—in fact, a good watering place. So it is regarded by the thousands of Cubans and South Americans who come here to pass the hot weather. For this comparatively salubrious state of things we have to thank our natural environments of ocean and rivers, owing little to the city authorities. If they would keep the streets clean and suppress some of the still flourishing nuisances so prejudicial to the public health, they could reduce the death rate still further and make New York incontestably the healthiest of the great cities of the world.—*New York Journal of Commerce.*

Measuring the Velocity of Light.

Professor Newcomb is engaged at Fort Whipple experimenting with the velocity of light. The distinctive feature of his method is a four-sided revolving mirror erected upon iron pillars. The mirror revolves at from one hundred and fifty to two hundred and fifty revolutions a second. The light reflected from an ordinary mirror outside is forced through a tube which strikes the revolving mirror and is reflected across the Potomac River, a distance of two miles, where it strikes a mirror on Observatory Hill. It is reflected back again, and the point upon which it strikes is noted by a telescope attached to a graduated scale. By this means the exact time is easily secured, and arrangements are being made by which the velocity can be noted at much greater distance. The new station will be near the Government Insane Asylum.—*Washington Star.*

DANGERS OF ELEVATED RAILWAYS.—In this city recently, on the Metropolitan Road, a locomotive and an empty passenger car were, by some stupidity of the train men, backed off the track and fell into the street twenty feet below. Fortunately no passengers were on board, the engineer and brakemen escaped, and no person was hurt.

MISCELLANEOUS INVENTIONS.

Mr. Mark L. Mount, of Pearsall's, N. Y., has patented an improved matched hook, made of two parts, one of which carries a square stemmed pivoted button and locking springs, the other part being slotted to pass the head of the button.

A simple and convenient machine for cutting potatoes and other vegetables into uniform slices and strips has been patented by Mr. Jessup Whitehead, of Leadville, Col.

An improved adjustable attachment for carriages, which furnishes a good support for baggage, has been patented by Emma J. Osborne, of Anderson Court-House, S. C. The invention consists in a frame or platform pivoted at its outer end between two arms, the inner ends of which are pivoted between two arms connected by a transverse rod and having the upper ends curved so as to form hooks, by means of which they are hooked on to the spring bar of the vehicle.

Mr. Daniel F. Hallahan, of Philadelphia, Pa., has patented a machine for trimming and burnishing the edges of soles of boots and shoes. It consists of two spiders of equal diameters and having an equal number of arms that are fixed upon a shank or shaft between two circular disks or guides, which guides are of slightly greater diameters than the spiders, together with the cutters or burnishers that the spiders carry on the ends of their arms; and it further consists of tangential cutters or burnishers (the cutters and burnishers being interchangeable) adjustably fixed upon the ends of the spider arms by means of screws that pass through slots in said arms, the spiders being so arranged that the cutters or burnishers on the one fit into or opposite the interspaces between the cutters or burnishers upon the other, and so that while one of the spiders remains fixed the other may be approached or withdrawn from it, whereby the device may be adjusted and applied to soles of any thickness.

An improvement in extension settee tables has been patented by Mr. Morgan Gossett, of Russellville, Ohio. The invention consists of a table having stationary legs and a movable leg and a pivoted extension top that can be horizontally or vertically adjusted, as may be desired, by a novel arrangement of devices, while between the legs seats are arranged.

A car for transporting live stock by railway has been patented by Mr. Francis Rieber, of Callicoon Depot, N. Y. It consists in novel details of construction and arrangement of stalls, feed racks, water troughs, hay lofts, and water tanks, and devices connected therewith, whereby provision is made for securing the comfort and preserving the health of the animals occupying the car.

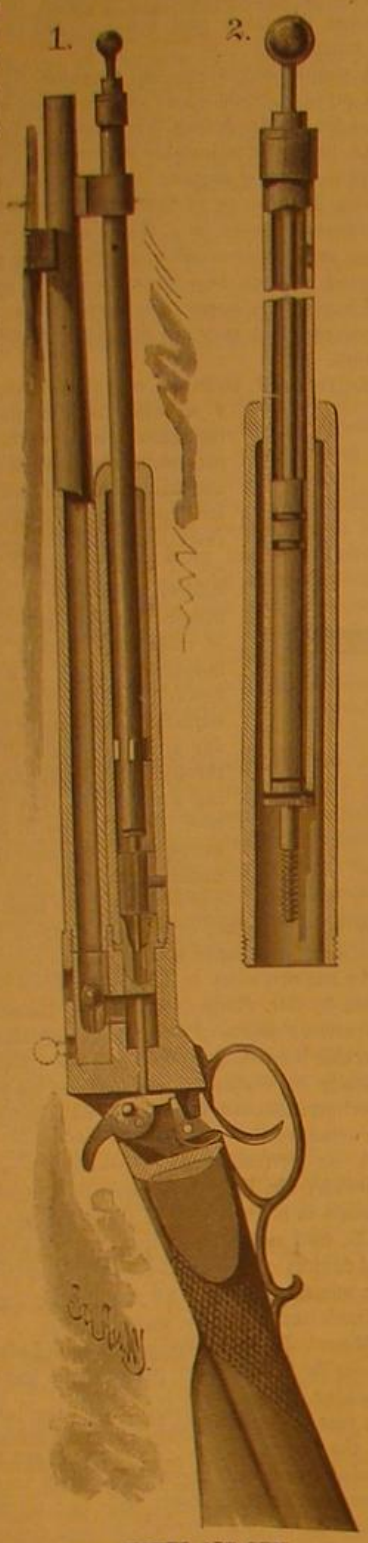
Messrs. Jacob A. Swinehart and Lafayette Jourdan, of Rushville, Ohio, have patented an improved drag sawing machine, which consists of a beam or bench supported at the rear by legs and in front by a guide block, which rests on the log to be cut. Two levers are pivoted in and extended downward through mortises in the beam, and are connected at their lower ends by a pitman, and to the forward one of these levers is pivoted the saw shank, the saw extending forward and through a cut in the guide block.

The curative properties of an electric current may be adapted to the treatment of different diseases by taking advantage of its different qualities as developed under varying conditions. The current may have great intensity and little quantity, or it may have great quantity and little intensity. It may be continuous or intermittent, or it may be made to alternate, so that electrical impulses of different name will rapidly succeed each other. There are two methods of generating electrical currents for curative purposes—one by chemical means, as in the various forms of battery, the other by the direct conversion of mechanical energy into electrical energy, as in the magneto-electric machine. Magneto-electric machines have not generally been considered as efficient for curative purposes as batteries, on account of the difficulty experienced in constructing a machine capable of yielding the different qualities of current required for the treatment of different subjects. Mr. Thomas W. Livingston, of Ainsworth, Iowa, has invented a magneto-electric machine capable of yielding currents varying in their character, so that its range of application will be wider than that of batteries, while it is more compact, more manageable, more easily adjusted, and operated by either skilled or unskilled persons.

VERY promising results are obtained with the eight-inch chambered rifle, converted from the old-fashioned ten-inch smooth bore, in the tests at Sandy Hook. The new gun bears a charge of 55 pounds of powder, carries a shot weighing 180 pounds, and penetrates 10 inches of iron at 1,000 yards. Originally, as a smooth bore, it was fired with 16 pounds of powder and carried a shot weighing 120 pounds.

NEW AIR GUN.

The engraving shows a very simple and effective air gun recently patented by Mr. A. G. Hyde, of this city. It is constructed so that the air may be compressed to a high pressure, and its entire volume released at each shot.



NOVEL AIR GUN.

In a cavity in the breech of the barrel, there is a tube of the same caliber as the barrel, closed at its rear end, and provided with a pin for preventing the backward movement of the ball. This tube is provided with a handle by which it may be turned, and which projects through a slot in the breech. There are two holes in the tube, one for receiving the ball, which is dropped in through an opening in the top of the barrel, and the other for communicating with the air chamber, located below the barrel. The holes in the tube are arranged relatively to each other, so that when one is open the other will be closed.

The air chamber contains a valve which is pressed against a packing at the end of the air reservoir, and is held in place by a dog, which, in turn, is retained by the trigger. The air-condensing pump projects into the air reservoir, and is provided with a single valve at its inner end, which prevents the air from re-entering the barrel after having been compressed. The air enters the compressing pump through a small aperture near its outer end. No valve is placed here, as communication between the external air and the space below the piston is shut off after the latter has moved inward a short distance. The piston rod of the air compressor is provided with a ball handle at the outer end.

The arrangement of the barrel and air reservoir may be clearly seen in Fig. 2.

When it is desired to use the gun it is only necessary to move the pump piston out and in a few times, when sufficient air will be compressed to project the ball with great force.

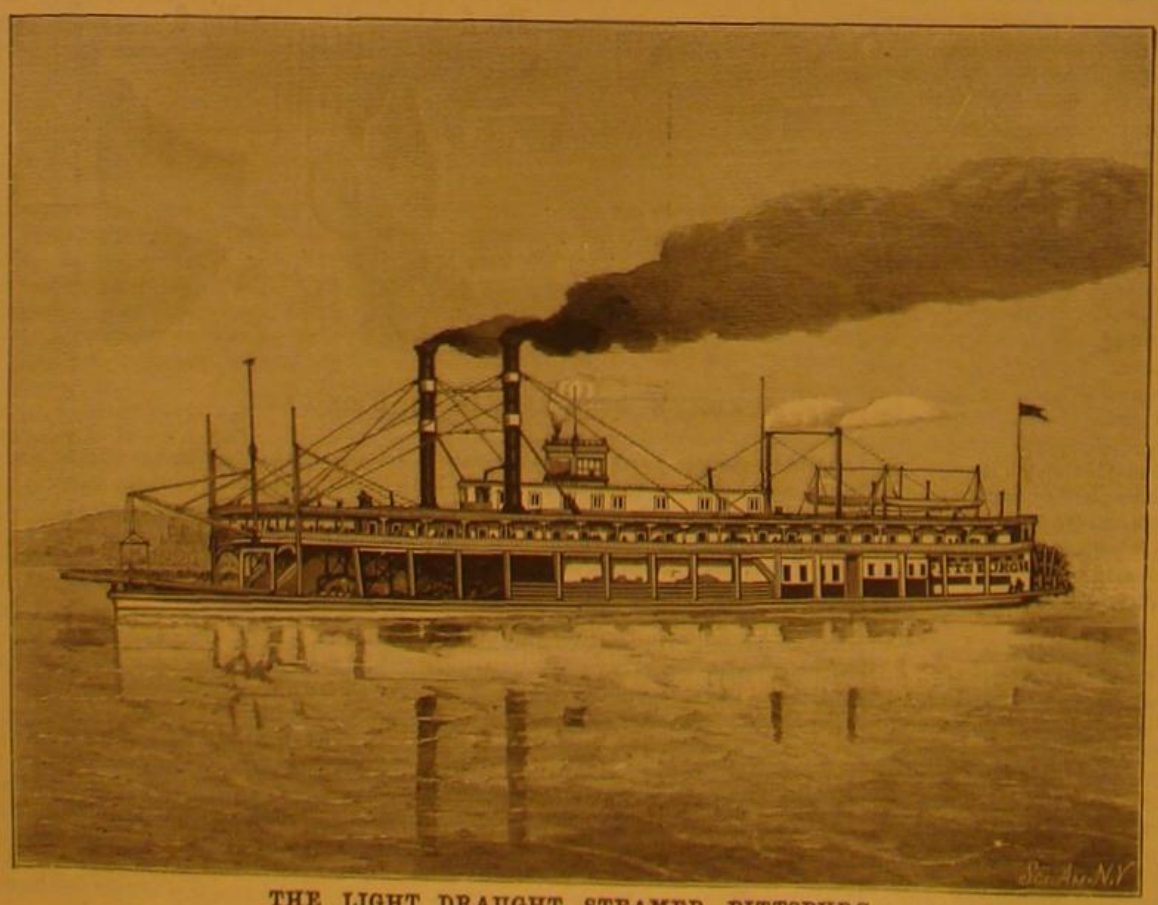
THE STEAMER PITTSBURG.

The light draught stern-wheel steamer, now the predominant type used on the Ohio and Mississippi rivers and their tributaries, is peculiar in many respects to the West. In former years the stern-wheeler was considered, on account of slowness, unfit for the river traffic, but the rapid strides in its perfection which have been made on the Ohio in recent years have placed it almost beside its rival side-wheeler in point of speed. The exterior appearance of these boats is strikingly graceful, the long unbroken lines from stem to stern, together with their very slight sheer, giving them great beauty. The boilers are located on the main deck, about one third the boat's length from the bow. The wheel is never housed, but remains open. The engine room aft occupies but a small space, and the remainder of the deck room is devoted to freight. The cabin is on the upper deck, and on all of the boats in the passenger carrying trades is complete and elegant in every respect. The officers' cabin occupies the hurricane deck. The saloon extends nearly the entire length of the boat, and on many steamers is palatial in its appointments.

The desideratum, of course, in all steam vessels is economy of power. In Western steamboats the very extreme of light draught is necessary. The hulls must be flat bottomed, and built as lightly as practicable with the requisite strength for large cargo carrying. The machinery must be as light as can be made, and for this reason the simple, high pressure, horizontal, lever engine has been found to meet the requirements better than any other. The long return-flue boilers, which, on all boats of late build, are made of steel of the highest tensile strength, are better adapted for several reasons to these boats on account of mud, etc. Besides, their shape distributes their weight over a larger area. There is no doubt that, for the weight of machinery used, the improved boats of the Ohio and Mississippi rivers develop a greater power and speed than any other class of steam vessels.

Among the remarkable specimens of the stern-wheeler on the Ohio may be mentioned the Pittsburg, build at Cincinnati in 1879. Her hull measures 252 feet in length, 39 feet beam, 6 feet hold. She has three steel boilers, 70,000 lb. tensile strength, 47 inches diameter, 28 feet long, 6 flues. Engines, 21 inches diameter, 7 feet stroke, working a wheel 21 feet diameter, 28 feet face. With fuel on board and steam up this boat draws only 24 inches water, and will carry 1,000 tons. She is one of the fastest steamers on the river. The large Golden City, plying between Cincinnati and New Orleans, is 276 feet long, 40 feet beam, 7 feet hold, and carries 1,600 tons. The steamer Buckeye State, of the Upper Ohio, is 240 feet long, and can carry a large cargo on 4 feet water.

These boats are complete with all the modern appliances of steam stages, capstans, windlasses, headlights, etc. The electric light has been applied with great success to several steamers during this year.



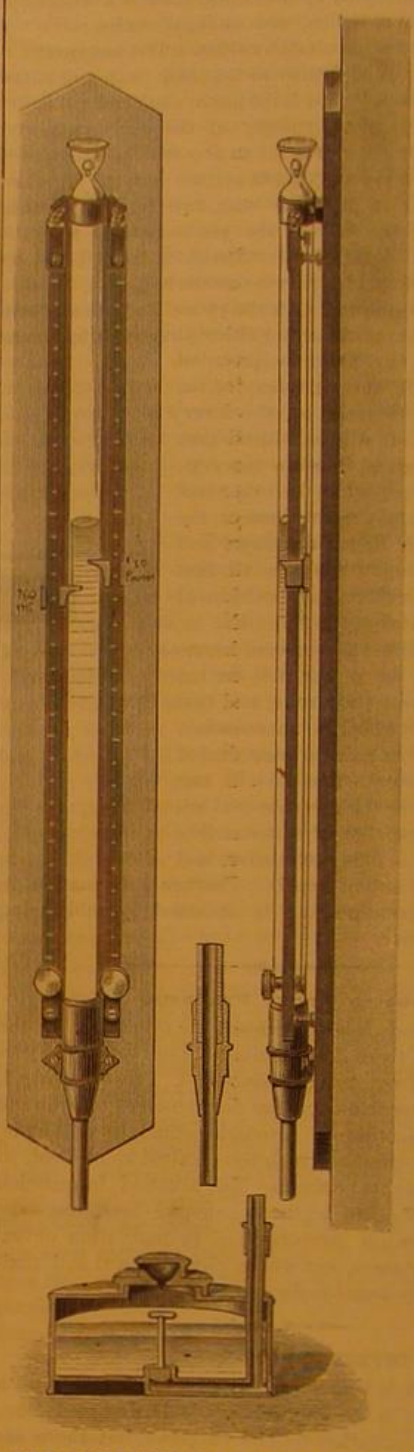
THE LIGHT DRAUGHT STEAMER PITTSBURG.

They Had all Had It!

A health officer writes to a Canadian medical journal as follows: "Inspected a house in the country at the request of the attending physician, as the general health of the family had been bad for a long time, they having suffered from a class of complaints that would indicate bad drainage, etc. Found under the floor a wooden drain with rotten cover, and soil saturated with sewage; trap on water-closet non-effective; water-closet foul; situation very bad; ventilation so arranged as to poison the room above it, a sleeping apartment occupied by a young man suffering for a long time from general ill health. No trap on kitchen sink; water supply, cistern connected directly with the sewer without traps in the overflow pipe. On my reporting the latter fact to the family, and expressing my surprise that they had not all had typhoid fever, they exclaimed in chorus, 'Oh, we have all had it!'"

THE GLYCERINE BAROMETER.

The marked influence of the variations in the pressure of the atmosphere upon the disengagement of carbureted gases in coal mines, has led the English engineers to devise a new barometer that will not only indicate the most minute variation of atmospheric pressure, but will indicate it so plainly that miners and others not experienced in making barometric observations can readily detect the variations.



THE GLYCERINE BAROMETER AT THE KEW OBSERVATORY.

Among the instruments of this class one of the most interesting is the large water barometer constructed for the Royal Society by Prof. Daniell, in 1830, which, however, was not a success, as the effects of the pressure were annulled by the effect of the temperature upon the vapor found in the Torricellian vacuum.

Mr. B. Jordan, a member of the office of the English mining archives, has spent several years in studying the different liquids that might possibly be applicable in constructing an accurate and highly sensitive barometer, and finally found that glycerine produced the best results. A glycerine barometer constructed by Mr. Jordan, 1870, is still in use. The glycerine, which is very pure, is manufactured by Price & Co., and has a specific gravity of 1·26, and on account of its high point of ebullition the vapors have no perceptible tension at the ordinary temperature, and it will only congeal at a very low temperature. The height of a column of glycerine is 26 feet 9 inches, and a variation of 1-16th of an inch of mercury corresponds to a variation of about 1 inch in the column of glycerine. As glycerine is very apt to absorb the moisture of the air, it is covered with a thin layer of prepared thickened petroleum in the cistern of the barometer. Mr. Jordan has constructed barometers for the South Kensington and Jermyn Street Museums; both have given perfect satisfaction, and to show the scientific value of the instrument the Royal Society has built one at the Kew Observatory.

This instrument is shown in the annexed engraving, and consists of a cylindrical cistern of tinned copper, about six inches high and ten inches in diameter, provided with a screw cover or cap, having a small opening leading into a recess containing cotton to act as filter and keep out the dust. The large barometric tube is made of

ordinary gas pipe, about three quarters of an inch in diameter, and is rigidly attached to the cylindrical cistern or cup. The upper end of this tube fits into a piece of bronze, into which a glass tube, three quarters of an inch in diameter and about four feet high, is securely cemented. This tube terminates in a cup inclosing a rubber packing. Graduated scales provided with indicators are placed at each side of the glass tube, the one on the left side indicating the inches and tenths of inches, and the right-hand scale shows the equivalent measure of a corresponding column of mercury. The scales are attached to an oaken plank, which is fastened to the wall of one of the upper stories of the observatory, and the large tube passes down to a room situated twenty-six feet nine inches lower. The glycerine in the barometer is colored with aniline red. Before putting the glycerine in the tube it is boiled at a temperature of about 180° to expel the air and to make it purer. The air is exhausted from the barometric tube by means of an air pump. Regular observations are made with the instrument at the Kew Observatory under the surveillance of Mr. Whipple, who considers the apparatus to be a scientific instrument of the greatest precision.

TAGUAN FLYING SQUIRREL.

The beautiful and active group of animals of which the English squirrel is so familiar an example, are found in almost every portion of the globe, and, with one or two exceptions, live almost exclusively among the branches of trees. In order to enable them to maintain a firm clasp upon the branches and bark, they are furnished with long, finger-like toes upon the fore-feet, which are armed with sharp curved claws.

In the flying squirrels, of which the taguan is a good example, the skin of the flanks is modified in a method similar to that which has already been noticed in the petaurists of Australia and the colugo of Java.

This skin is so largely developed, that when the animal is sitting at its ease, its paws but just appear from under the soft folds of the delicate and fur-clad membrane.

When the creature intends to make one of its marvelous leaps, it stretches all its four limbs to their fullest extent, and is upborne through the air on the parachute-like expansion which extends along its sides. This animal is a native of India, where it is tolerably common.

It is rather a large species, as its total length is nearly three feet, the tail occupying about one foot eight inches, measured to the extremity of the long hairs with which it is so thickly clothed. The general color of this animal is a clear chestnut, deepening into brown on the back, and becoming more ruddy on the sides. The little pointed ears are covered with short and soft fur of a delicate brown, and the tail is heavily clad with bushy hairs, grayish black on the basal portions of that member, and sooty-black toward the extremity. The parachute membrane is delicately thin, scarcely thicker than ordinary writing paper, when it is stretched to its utmost, and is covered with hair on both its surfaces, the fur of the upper side being chestnut, and that of the lower surface nearly white. A stripe of grayish-black hairs marks the edge of the membrane, and the entire abdomen of the animal, together with the throat and the breast, is covered with beautiful silvery grayish-white fur.

TAGUAN FLYING SQUIRREL.—*Pteromys Petaurista.*

Sharks in New York Bay.

A remarkable school of sharks was recently met with between the Narrows and Bay Ridge shore, in the lower part of New York Harbor. According to the story of Captain Alec Robertson, a well known fisherman of Fort Hamilton, there were thousands of them. His attention was first attracted to a dark spot in the water, moving toward the Long Island shore, and expanding rapidly. On sailing for the spot he suddenly discovered that it was a school of sharks, which snapped angrily at the boat's sides, and lashed the water into a foam. One fish, larger than the rest, leaped toward the stern and crushed the back strip and rudder between its jaws. It appeared to be fully ten feet in length. The water seemed alive with black fins, which darted in all directions. George Morris and John Haffey, the companions of Robertson, rushed to the forward part of the boat. Morris had been sitting on the stern seat, and narrowly escaped the bite of the infuriated fish. Robertson tore up one of the seats, with which the little craft was fitted, and used it effectively on the hard black snouts of more than one of the sharks. The breeze filled the sails and carried the boat steadily through the danger. Not until Bay Cliff was reached did the boat get clear of its pursuers.

Palm Fossils in Colorado.

Mr. E. Johnson, the expressman, brought into the *Gazette* office recently some very interesting fossils, which he had just discovered. In speaking of his discovery he said: "A year ago my son reported that he had found upon the bluffs northeast of the town a petrified fish tail, but embedded in too large a rock for him to carry. He has often urged me to go with him and get it. I finally went, and to my astonishment found that he had discovered a very fine impression of a palm leaf, and I soon found three other perfectly printed leaves of the same variety. The leaves were of enormous size, the ribs diverging from the base just like palm fans, but upon a very much larger scale. The estimated size of one leaf, calculated from reliable data furnished by the ratio of divergence, is found to be eight feet long by six feet wide." Mr. Johnson also found several sections of palm tree trunks, one of which he brought to the *Gazette* office, together with the impressions of the leaves.—*Colorado Springs Gazette.*

A North Carolina Industry.

During recent years the collection of medicinal and other plants has become a large and profitable industry in North Carolina. The trade centers at Statesville, where an enterprising firm have established one of the largest botanical depots in the world. Their stock comprises 1,700 varieties of roots, herbs, barks, seeds, flowers, and mosses, and all sorts of plants for herbariums, some of them peculiar to the flora of the State, and others found more abundantly there than elsewhere. The quantities now on hand vary from 50 to 35,000 pounds of each kind. They pay the collectors either in cash or goods, and last year they disposed in this way of $400,000 worth of merchandise. Their warehouses have 270,000 square feet of flooring, which will give an idea of their capacity for storage of the products they are collecting from all quarters. Their shipment last year, as given in the Raleigh *News*, amounted to 1,800,000 pounds. The collectors are largely Cherokees.

New Polarizing Prism.

M. Crova commends, for photometric purposes, in the *Journal de Physique*, M. Prazmowski's polarizer, which is a Nicol, with faces normal to the axis of a prism, the two halves of which are joined with linseed oil. It requires large pieces of spar, and the joining is long and difficult, but there are several advantages. Thus the layer of oil (unlike Canada balsam) causes hardly any loss of light; its index, 1·485, being nearly equal to the extraordinary index of spar, the polarized field is limited on one side, as in Nicol's, where the total reflection of the ordinary ray commences, by a red band; but the second limit, corresponding to total reflection of the extraordinary ray, is thrown out of the field of vision; the angular value of the polarized field is thus increased. The increase of field, the angular separation of the only colored band, and the direction of its bases, normal to the axis, are qualities to be appreciated in certain cases.

Spread of Disease by Earthworms.

Recent researches by M. Pasteur appear to throw considerable light on the origin of anthrax, or splenic fever, and allied diseases, which attack cattle, sheep, etc. When an animal dies of anthrax it is not uncommonly buried on the spot. The conditions of putrefaction prove fatal to the small parasitic organism, or *bacteridium*, which is abundant in the blood at death. The gas given off causes it to break up into dead and harmless granulations. But before this can occur not a little of the blood and humors of the body have escaped into the ground about the carcass, and here the parasite is in an aerated medium favorable to the formation of germs. These corpuscular germs M. Pasteur has found in the soil, in a state of latent life, months and years after the carcass was buried; and by inoculation of guinea pigs with them, has produced anthrax and death. Now, it is specially notable that such germs have been met with in the earth at the surface above the place of burial, as well as near the body. The question arises: How came they there? And it would appear that earthworms are the agents of conveyance. In the small earth cylinders, of fine particles, which these creatures bring to the surface and deposit after the dews of morning or after rain, one finds, besides a host of other germs, the germs of anthrax. (The same process was proved also by direct experiment; worms kept in ground with which *bacteridium* spores had been mixed were killed after a few days, and many of the spores were found in the earth cylinders in their intestines.) The dust of this earth, after the cylinders have been disaggregated by rain, gets blown about on the neighboring plants, and the animals eating these thus receive the germs into their system. It is suggested that possibly other disease germs, not less harmless to worms, but ready to cause disease in the proper animals, may be in like manner conveyed to the surface in cemeteries. This would furnish a fresh argument for cremation. The practical inference as to anthrax is, that animals which have died of this should not be buried in fields devoted to crops or pasturage, but (wherever possible) in sandy, calcareous ground, poor and dry—unsuitable, in a word, for worms.

To Moisten the Air in Cotton Mills.

A device for moistening the air in cotton mills is suggested by Mr. L. E. Bicknell, of West Cummington, Mass., in a communication dated July 1. It consists of a line of steam pipes running under the rows of looms, with perforations under each loom. The pipes should be laid in grooves in the floor to prevent tripping, and should be laid upon asbestos paper to prevent the overheating of the floor. Under each loom the steam pipe should carry a perforated slide or sleeve, with holes corresponding with those in the pipe, by means of which the jets of steam could be regulated. The rising steam would act directly upon the extended warp above, and afterward by diffusion would secure that humidity of atmosphere essential to the satisfactory working of cotton mills.

American Cements.

At the recent convention of the American Society of Civil Engineers, an interesting paper on American natural cements was read by Mr. F. O. Norton, from which we condense the following:

The principal deposit of the magnesian limestone producing a cement possessing hydraulic energy occurs in the town of Rosendale, Ulster Co., New York. It was first brought into use about the year 1823, in the construction of the locks and other masonry of the Delaware and Hudson Canal, which passes through that county. Its production has gradually increased until there are now made from one million to one million and a half barrels in each season, of about eight to nine months, or during the period of navigation on the Hudson River between Rondout and New York. It is the chief industry of a large section of country, its reputation is extended, and it is sold in most of the large markets of the United States.

There has been a general impression that the use of a very small amount of water in mixing cement gave greater resulting strength than when sufficient water was used to form a paste of the consistency of stiff mortar. The tests recorded prove that the dry mixture does give decidedly higher tensile strength in twenty-four hours after mixture, and that it continues to be stronger than the stiff mortar for some three months. But after that time the reverse becomes true; the curve of strength of the stiff mortar rises to and passes above that of the dry mixture, and the strength of the cement mixed as a stiff mortar continues greater than that mixed with very little water, and this is the case continuously thereafter.

The strength of Portland cement, unmixed with sand, is, of course, very great. It develops a large proportion of its ultimate strength in the first seven days, say from one-half to two-thirds.

Rosendale cement of the best qualities develops great hydraulic energy in twenty-four hours, being at that time equal to the Portland. The Portland then gains very rapidly upon it up to seven days, the difference between the two then being the greatest; at the end of a month, however, the strength of the Rosendale cement begins to approach nearer to that of the Portland, and the difference between the two seems to be continually reduced after that time, this referring to mixtures of pure cement.

For practical purposes, however, neither of the cements is generally used without an admixture of sand. The addition of sand to Portland cement reduces its strength rapidly.

This reduction of strength is, in round numbers, as follows: One part of sand gives mortar one-half as strong as pure cement; two parts, one-third; three parts, one-fourth; four parts, one-fifth; five parts, one-sixth.

This reduction of strength of Rosendale cement by the admixture of sand seems to be somewhat less. The strength of the mortar of Portland cement in the proportion of one of cement to two of sand is, at the end of six months, say 224 pounds to the square inch. The strength of a mortar of Rosendale cement in the proportion of one of cement to one of sand is, at the end of six months, say 257 pounds to the square inch.

Careful experiments made by General Gillmore, and published in the appendix to the last edition of his treatise on "Limes, Hydraulic Cements, and Mortars," give the quantities of mortar produced from the mixture of cement, sand, and water, in various proportions, and using different kinds of cement. Adopting these results, and assuming the cost of the Rosendale cement at $1.10 per barrel, and the best English Portland at $3 per barrel (the market prices, May, 1880), and the cost of sand at 5 cents per barrel, we find that a mortar of Portland cement, in the proportions of one of cement to two of sand, will cost per barrel $1.22.

We also find that a mortar of Rosendale cement, in the proportions of one of cement to one of sand, will cost 68 cents per barrel.

Summarizing the comparison, we find that a mortar of Rosendale cement, in the proportions of one of cement to one of sand, has a tensile strength of 257 pounds to the square inch, and costs 68 cents per barrel; and that a mortar of foreign Portland cement, in the proportion of one of cement to two of sand, has a tensile strength of 224 pounds to the square inch, and costs $1.22 per barrel.

Therefore, the mortar of Rosendale cement, one to one, is 34 pounds per square inch stronger, and 54 cents per barrel less expensive, than a mortar of foreign Portland cement one to two.

This seems to show that for all uses which will be served by a mortar of the tensile strength of 257 pounds per square inch, the Rosendale cement is economical.

The remaining question is, whether this mortar of Rosendale cement, one to one, is strong enough for the practical purposes to which it may generally be applied.

The facts which answer this question are that for fifty years past, and up to within a very short time, *all* the important masonry in this country has been laid with American cement. The great fortifications on the coast, the Croton aqueduct, the Boston aqueducts, both old and new, all the government dry docks, the lighthouses, the locks, culverts, and aqueducts on the Erie and other canals; all the masonry of railroad bridges, viaducts, and culverts, the sewers of our cities, the masonry of our gas works, many hundreds of miles of wrought iron water pipe lined and laid in cement; the mills and mill dams in various localities; in fact, nearly all the masonry built under water and out of water in the United States up to within a few years has been constructed with American cement.

Professor Kirchhoff's Views on Connecting Lightning Rods with Gas and Water Pipes.

The city gas company of Berlin, having expressed the fear that gas pipes may be injured by lightning passing down a rod that is connected with the pipes, Professor Kirchhoff has published the following reply:

"As the erection of lightning rods is older than the system of gas and water pipes as they now exist in nearly all large cities, we find scarcely anything in early literature in regard to connecting the earth end of lightning rods with these metallic pipes, and in modern times most manufacturers of lightning rods, when putting them up, pay no attention to pipes in or near the building that is to be protected."

Kirchhoff is of the opinion, supported by the views of a series of professional authorities, that the frequent recent cases of injury from lightning to buildings that had been protected for years by their rods, are due to a neglect of these large masses of metal.

The Nicolai Church, in Greifswald, has been frequently struck by lightning, but was protected from injury by its rods. In 1876, however, lightning struck the tower and set it on fire. A few weeks before the church had had gas pipes put in it. No one seems to have thought that the new masses of metal which had been brought into the church could have any effect on the course of the lightning, otherwise the lightning rods would have been connected with the gas pipes, or the earth connection been prolonged to proximity with the pipe.

A similar circumstance occurred in the Nicolai Church in Stralsund. The lightning destroyed the rod in many places, although it received several strokes in 1856, and conducted them safely to the earth. Here, too, the cause of injury was in the neglect of the gas pipes, which were first laid in the neighborhood of the church in 1859, shortly before the lightning struck it. The injury done to the schoolhouse in Elmshorn, in 1876, and on the St. Lawrence Church, at Itzehoe, in 1877, both buildings being provided with rods, could have been avoided if the rods had been connected with the adjacent gas pipes.

"If it were possible," says Kirchhoff, "to make the earth connection so large that the resistance which the electric current meets with when it leaves the metallic conducting surface of the rod to enter the moist earth, or earth water, would be zero, then it would be unnecessary to connect the rods with the gas and water pipes. We are not able, even at immense expense, to make the earth connections so large as to compete with the conducting power of metallic gas and water pipes, the total length of which is frequently many miles, and the surface in contact with the moist earth is thousands of square miles. Hence the electric current prefers for its discharge the extensive net of the system of pipes to that of the earth connection of the rods, and this alone is the cause of the lightning leaving its own conductor."

Regarding the fear that gas and water pipes could be injured, the author says:

"I know of no case where lightning has destroyed a gas or water pipe which was connected with the lightning rod, but I do know cases already in which the pipes were destroyed by lightning because they were *not* connected with it.

"In May, 1809, lightning struck the rod on Count Von Seefeld's castle, and sprang from it to a small water pipe, which was about eighty meters from the end of the rod, and burst it. Another case happened in Basel, July 9, 1849. In a violent shower one stroke of lightning followed the rod on a house down into the earth, then jumped from it to a city water pipe, a meter distant, made of cast iron. It destroyed several lengths of pipe, which were packed at the joints with pitch and hemp. A third case, which was related to me by Professor Helmholtz, occurred last year in Gratz. Then, too, the lightning left the rod and sprang over to the city gas pipes; even a gas explosion is said to have resulted.

"In all three cases the rods were not connected with the pipes. If they had been connected the mechanical effect of lightning on the metallic pipes would have been null in the first and third cases, and in the second the damage would have been slight. If the water pipes in Basel had been joined with lead instead of pitch, no mechanical effect could have been produced.

"The mechanical effect of an electrical discharge is greatest where the electric fluid springs from one body to another. The wider this jump the more powerful is the mechanical effect. The electrical discharge of a thunder cloud upon the point of a lightning rod may melt or bend it, while the rod itself remains uninjured. If the conductor, however, is insufficient to receive and carry off the charge of electricity, it will leap from the conductor to another body. Where the lightning leaves the conductor its mechanical effect is again exerted, so that the rod is torn, melted, or bent. So, too, is that spot of the body on which it leaps.

"In the examples above given it was a lead pipe in the first case, a gas pipe in the last case, to which the lightning leaped when it left the rod, and which were destroyed. Such injuries to water and gas pipes near lightning rods must certainly be quite frequent. It would be desirable to bring them to light, so as to obtain proof that it is more advantageous, both for the rods and the building which it protects, as well as for the gas and water pipes, to have both intimately connected.

"Finally, I would mention two cases of lightning striking rods closely united with the gas and water pipes. The first happened in Dusseldorf, July 23, 1878, on the new Art Academy; the other August 19, last year, at Steglitz. In both cases the lightning rod, the buildings, and the pipes were uninjured."—*Deutschen Bauzeitung.*

A Sea-going Steam Pilot Boat.

Unlike the Pilot Commissioners of New York and New Jersey, the Baltimore Pilots' Association have taken kindly to the use of steam pilot boats, and are having built for their use a first-rate sea-going steamer. The new vessel is intended to carry sea pilots, with fuel, stores, and accommodations for a month's cruise. The hull will be of iron, with close iron bulwarks at each end, and, with iron siding, forming a quarter deck for about 68 feet of the middle run of the boat. The quarter deck will stand 3¼ feet above the main deck, which will extend about 30 feet from the stem and 20 feet from the stern. Both the main and quarter decks will have iron deck beams, and will consist of heavy pine deck stuff. The pilot house and captain's room will be on the quarter deck, where the boarding yawls will be carried. The length will be 113 feet between main posts, and 122½ feet over all; extreme moulded beam, 23 feet; depth, 12¾ feet; from base line to the top of quarter deck, 18 feet. There will be one iron athwartship collision bulkhead ⅜ inch iron, braced, and one forward of the boiler. Coal bunkers on either side of the boiler hold 40 tons each. Below the quarter deck will be the main cabin, with 20 sleeping berths, wash room, mess room, kitchen, pantry, chief-engineer's room, and store rooms. The forecastle will contain 10 bunks, store rooms, etc. The vessel will be heated throughout by steam. She will have two masts, schooner-rigged, two 17 foot yawls, two 1,000 gallon water tanks, three anchors of 800, 500, and 175 pounds weight, 120 fathoms chain cable, and a pump brake windlass.

The machinery will consist of an inverted direct-acting compound engine, with 22 and 36 inch cylinders, 26 inches stroke, fitted with tubular surface condenser, and air, feed, bilge, and circulating pumps, one cylindrical return tubular boiler, to carry a working pressure of 70 pounds of steam to the square inch, an independent feed pump to supply boilers, wash decks, fire service, etc.

This pioneer sea-going pilot steamer is now building at Wilmington, Del., by the Harlan and Hollingsworth Company.

CLOTHING IN ITS RELATION TO HEALTH.

The ideas and scientific views of Prof. Dr. Gustave Jaeger, of Stuttgart, regarding the properties of animal wool, gain more and more in popularity with German scientists, and in one of the latest numbers of the *Homœopatische Monatsblatter* (Homeopathic Monthly), which appears in Stuttgart, Dr. E. Schlegel, a well known physician of Tübingen, has published an essay, in which he speaks of Professor Jaeger's theories as follows:

Among the discoveries that have been made during the last few years in medical science, some facts brought to light by Dr. Gustave Jaeger regarding the amount of water contained in the human body may prove to be of the utmost importance. In his paper concerning "The resistibility of the human body against epidemic diseases and the power of constitution," * Professor Jaeger has proved that the specific gravity of several individuals is very different, and that the state of the health of those individuals is closely connected with their specific gravity. The greater the weight of the human body in comparison to the space which it occupies, *i. e.*, the greater its specific gravity, the more it is able to resist epidemic diseases. Persons of a low specific gravity are taken ill from very insignificant causes, such as a cold, and are very susceptible to contagious diseases. Such persons have usually a certain fullness of body, and are even corpulent, but just that which gives them a great size is useless ballast, namely, fat and water. These substances endow the heaviest bodies with a comparatively low specific gravity, giving at the same time to the constitution little power of resistance.

Very different is the case with bodies of high specific gravity. Here neither fat nor water is superabundant, the flesh feels solid, and the bodily constitution possesses a high power of resistance. Professor Jaeger has investigated these differences of constitutional resistibility by comparing the specific gravity of a number of persons with their state of health. An accumulation of water in the tissues of the body he calls "Hydrostasis chronica," an expression which, as the whole discovery itself, reminds us of the teachings of the homeopathist Von Grauvogel respecting hydrogenoid constitutions, while the theory that a chronic accumulation of water in the body is the cause of many sicknesses is in perfect accord with the "Sykosis" described by Hahnemann, and afterward by Wolf.

The investigations and measurements of Jaeger are of an entirely new date, and we would not mention them here had not this discovery proved to be of the highest value for hygiene, and had not the conclusions of Professor Jaeger already been corroborated in a most remarkable manner.

If it is true, namely, that the specific gravity of the body is the measure of its resistibility of disease, and if it is also true that few bodies have this resistibility, because of an overabundance of fat and water, then the question arises, Have we any means of counterbalancing this superabundance and therewith heightening the specific gravity? The

* "Seuchenschutz und Constitutionskraft."

homeopathists know a number of remedies for so-called hydrogenoid constitution, the most important of which is "Thuja." These remedies have to be chosen according to the individual constitution, and have proved to be of more or less benefit, sometimes even effecting a perfect cure. Allopathists use also several medicaments which are useful in cases of "Sykosis," but none of these remedies are entirely satisfactory.

Professor Jaeger has now, by his careful investigation, discovered a simple and natural expedient for preventing the accumulation of fat and water in the system, which is suitable alike for rich and poor. It consists in adopting a new sort of clothing, we might call it a normal clothing.

The Professor has tested the value of his discovery upon his own person and members of his family, and so has the writer of these lines, who, after having the honor of making the acquaintance of Professor Jaeger in 1879, adopted, at his suggestion, the normal clothing, and recommended it to some thirty or forty persons since. The experiments made by wearing the clothing in the heat of summer and the cold of winter has proved highly satisfactory.

The normal clothing has two essential properties:

1. It consists exclusively of wool, avoiding all materials woven from plant fiber (cotton or linen).

2. It makes a strong point of keeping warm the middle line of the front of the body.

The principal peculiarity of Professer Jaeger's clothing is the exclusive use of sheep's wool, even avoiding pocket and other linings of cotton.

To every thoughtful person it will be a source of satisfaction to know that Professor Jaeger has chosen for the warming of the body only those means which nature has given for the same purpose to those mammals which are the most nearly related to man. The fittest and the most suitable always predominates in nature, and if, in this case, we inquire why hair and wool clothing are the best protection against cold, the answer will be found in the physical properties of these matters. A cover of wool is far more porous than that of plant fiber. The latter, if exposed to moisture, becomes thoroughly soaked with the liquid and sticks to the body, so that no air remains between, and only one smooth evaporating surface is formed, whereas a hair or wool cover being never entirely soaked does not cling closely to the body, but forms a surface which is broken by air bubbles, permitting a great quantity of moisture to pierce to the outside, where it can evaporate. Moisture from the outside is prevented from piercing through the cover to the body on account of the layer of air between the cover and the body, which offers a kind of resistance.

These properties of hair and wool clothing are very important, for the skin of each animal is a source of evaporation, and continually renders moisture to the air.

That difference which exists between plant fiber and wool in regard to the conductibility of heat, renders the superiority of wool clothing in regard to health still more evident. Wool is a bad conductor of heat, therefore wool clothing conserves the heat produced by the body, while cotton, and still more linen, permits this heat to quickly escape and eradiate. This fact accounts for the cool, chilly feeling produced in putting on linen clothing, while in putting on woolen no loss of heat is felt.

The conservation of the heat of body produced by woolen clothing has the consequence that the skin remains in a blood-rich state, and may perspire more freely than when exposed to a quick refrigeration by cotton or linen clothing.

To these important properties of wool, which are sufficient proof of its suitability for clothing, a new one has been added by Professor Jaeger's latest investigations, which we will only mention briefly, as an explicit description would occupy too much space.

Jaeger has proved that in our organism there are certain gaseous volatile substances, called by him "Duftstoffe" (odorous substances), which play a very important part, as yet undivined. He endeavors to show that the actions of our mind are mediated by these substances, and that they are continually rendered free in the acts of breathing and perspiring. He discerns two different groups of odorous substances—"Lust and Unlust Stoffe" (substances of pleasure and disliking). The first ones are exhaled during a joyful and agreeable state of mind, and produce this state of mind if inhaled. Just the reverse is true of the second ones. Whoever will take the pains can discover for himself that the evaporation differs according to the condition of the mind as well as the condition of the body. During joy and happiness the odor of perspiration is not disagreeable, while during anguish and great nervous excitement it is offensive. The substances of disliking have, therefore, a bad odor. In an atmosphere of these substances the vitality is lowered and disadvantageously influenced. This accounts for the fact that in a state of anguish and fear the body is more susceptible to contagious diseases. The inhaling of the "substances of pleasure" heighten the vital actions and improve the resistibility of the body against sickness. Jaeger has now discovered that "sheep's wool" attracts the "substances of pleasure" [this property must not be confused with the great capacity of wool for absorbing odors in general], while clothing made of plant fiber favors the accumulation of the offensive "substances of dislike," with all their evil consequences.

Even with healthy persons, cotton and linen clothing, after long wearing, takes a distinctively repulsive odor, while woolen clothing, even in summer, when evaporation is strong, takes only the sour smell of perspiration, and never accumulates other offensive smells. This seemingly unimportant fact, the mention of which may be ridiculed by many, is, nevertheless, of the greatest value to medical science, and has proved of the highest importance for the "resistibility of the human body against contagious diseases."

Thus far Dr. E. Schlegel. The full responsibility of this report of the hypothesis of odorous substances we have to leave to the editor of the "Homeopathic Monthly," in Stuttgart, and its learned contributor, but we believe that the facts are very interesting and of great value, as they are based upon exact scientific investigation. Especially deserve to be mentioned the several thousand experiments regarding odorous substances which have been made with the "chronoscope," an instrument by which the celerity of nervous conduction is recorded.

ENGINEERING INVENTIONS.

Mr. Joseph W. Putnam, of New Orleans, La., has patented an improvement in the class of pile drivers in which the hammer guides or leaders are hinged to permit their inclination, for the purpose of driving piles at various angles.

Messrs. Martin E. Morningstar and John W. Roberts, of Arkona, Ontario, Canada, have patented an improved car coupling of the class called self-couplers; and the improvement consists in the peculiar construction of the link holder.

Mr. Peter Josserand, of Hockley, Texas, has patented an improved valve gear for engines, which consists of a lever, a shaft, and two friction wheels of different diameters for receiving motion from the crank shaft and transferring the motion at an increased velocity to the valve shaft.

Mr. Hans Knudson, of De Forest, Wis., has patented a dynamometrical engine governor, by means of which the work performed by the engine and the strain upon the driving wheel regulates and controls the steam supply.

Mr. Tiry S. Pylant, of Ridge Spring, S. C., has patented improvements in turbine water-wheels of that form in which a horizontal wheel is inclosed by a case having upon the top oppositely opening trunks or conduits for delivering the water to the wheel, which trunks have flaring mouths and taper downwardly into the plane of the wheel.

An improvement in well boring apparatus has been patented by Mr. Harry Samuel Gail, of Waukegan, Ill. The object of the invention is to provide means for holding the auger to the rotary shaft in such a manner that they may be easily disconnected to allow of the withdrawal of the auger without disturbing the shaft.

Mineral Veins.—How they were Filled.

We have examples that seem to settle the question in favor of chemical precipitation from ascending hot water and steam. In the Steamboat Springs of Western Nevada, for example, we in fact catch mineral veins in the process of formation. These springs issue from extensive fissures which have been or are filling with silicious veinstone that carries, according to M. Laur, oxide of iron, oxide of manganese, sulphide of iron, sulphide of copper, and metallic gold, and exhibits the banded structure so frequently observed in mineral veins.

In regard to the precise chemical reactions which take place in the deposition of ores in veins, there is much yet to be learned, and this constitutes an interesting subject for original investigation, which I earnestly commend to those who are so situated that they can pursue it.

It may be noticed, however, that the thermal springs which are now forming deposits like those in fissure-veins, contain alkaline carbonates and sulphides, and we have every reason to believe that highly carbonate alkaline waters containing sulphureted hydrogen under varying conditions of temperature and pressure are capable of taking into solution and depositing all the metals and minerals with which we meet in mineral veins.

To these necessarily brief notes on the filling of mineral veins should be added some interesting examples of the mechanical filling of fissures which have been recently brought to light in Western mining. These are furnished by the remarkable deposits of gold and silver ore in the Bassick and Bull Domingo, near Rosita, Colorado, and the carbonate mine at Frisco, Utah. All these are apparently true fissure-veins, filled to as great a depth as they have yet been penetrated, by well rounded pebbles and bowlders which have fallen or been washed in from above. The porous mass thus formed has been subsequently saturated with a hot ascending mineral solution, which has cemented the pebbles and bowlders together into a conglomerate ore. In the Bassick this ore consists of rich telluride of silver and gold, free gold, and the argentiferous sulphides of lead, zinc, copper, and iron. In the Bull Domingo and Carbonate mines the cementing matter is argentiferous galena. That the pebbles and bowlders have come from above is distinctly shown by the variety in their composition and the organic matters associated with them. In the Bull Domingo and the Bassick the pebbles consist of various kinds of igneous rock, mingled with which in the latter are masses of silicified wood and charcoal; while in the Carbonate mine the pebbles are mainly trachyte; but with these are others of limestone and quartzite.

Fossils and other foreign bodies have before this been found in mineral veins, and Von Cotta mentions the occurrence of quartz pebbles extending to the depth of 155 fathoms in the Grüner Lode at Schemnitz, Saxony; but no conglomerate veins like those mentioned above are known to exist elsewhere, and they constitute another of the many new forms of ore deposit which the exploration of the rich and varied mineral resources of the United States has brought to light.

In regard to the ultimate source of the metallic matters which give value to our ore deposits but little can be said with certainty. The oldest rocks of which we have any knowledge, the Laurentian, contain gold and copper, which are indigenous, hence as old as the rocks that contain them, and have been simply concentrated and made conspicuous in the process of their metamorphism. These rocks are all sediments and the ruins of pre-existing continents. By their erosion they have in turn furnished gold, copper, iron, etc., to later sediments by mechanical dispersion and chemical solution. We now find gold everywhere in the drift from the Canadian Highlands, and we have every reason to believe that all the sedimentary strata more recent than the Laurentian have acquired a slight impregnation of several metals from them in addition to what they have obtained from other sources, and we may conclude that the distribution of many of the metals is almost universal. Sea water has been proved to contain gold, silver, copper, lead, zinc, cobalt, nickel, iron, manganese, and arsenic; and there is little doubt that all the other metals would be found there if the search were sufficiently thorough. Hence, sedimentary rocks of every age must have received from the ocean in which they were deposited some portion of all the metals, and for the formation of metalliferous deposits some method of concentrating these would alone be required. A pretty theory to explain such concentration through the agency of marine plants and animals has been suggested by some German mineralogists, and amplified by Professors Pumpelly and T. S. Hunt. Plants have been credited with the most active agency in this concentration; but evidence is still wanting that either plants or animals have played any important part in the formation of our mineral deposits. The remains of sea weeds are found in the greatest abundance in a number of our Palæozoic rocks, and it is almost certain that the carbonaceous ingredient in our great beds of bituminous shale has been derived from this source; yet we find there no unusual concentration of metallic matter, and none of the precious metals has ever been detected in them.

The metallic solutions which have formed our ore deposits have been ascribed to two sources. One theory supposes that they have drained highly metalliferous zones deep in the interior of the earth; the other, that they have leached diffused metals from rocks of different kinds comparatively near the surface. The latter view is the one that commends itself to the judgment of the writer. However probable such a thing might seem, no evidence of the existence of distinct metallic or metalliferous zones in the interior of the earth has been gathered. On the contrary, volcanic emissions, which may be supposed to draw from a lower level than water could reach, are not specially rich in metallic matters, and the thermal waters which have by their deposit filled our mineral veins must have derived their metallic salts from a zone not many thousand feet from the surface. The mineral springs, which are now doing a similar work, are but part of a round of circulation of surface water, which, falling from the clouds, penetrates the earth to a point where the temperature is such as to drive it back in steam. This, with fluid water under pressure and highly heated, possessing great solvent power, may be forced through vast beds of rock, and these be effectually leached by the process. Should such rocks contain the minutest imaginary quantity of the metals these must inevitably be taken into solution, and thus flow toward or to the surface, to be deposited when, by diminished temperature and pressure, the solvent power of the menstruum is diminished. It is evident from these facts that we cannot trace the history of the metals back beyond the Laurentian age. And since we find them diffused in greater or less quantity through the sedimentary rocks of all ages, and also find processes in action which are removing and redepositing them in the form of the ore deposits we mine, it is not necessary to look further than this for a sufficient theory of their formation.—*Prof. J. S. Newberry.*

Steam Cable Towing in Erie Canal.

The Belgian cable towing system, as applied to several sections of Erie Canal, is giving strong evidence of success in arousing the strenuous opposition of those who are interested in the maintenance of the old system of towing. At a meeting of opposition boat owners and boatmen in Buffalo, August 3, it was resolved:

"That the New York steam cable towing system, as being operated on the Erie Canal, does greatly interfere with other ways and modes of towing boats on said route, and therefore it has forfeited its charter; that it is dangerous to boat property interests by reason of collision and delays, and is wholly impracticable. It is not a mode of rapid transit; it is not a cheap and economical method; it is not an improvement over other ways of towing; it is not necessary and it is not wanted in the canal, in consequence of which we unite in asking the Superintendent of Public Works to cause the New York steam cable towing system to be removed for obstructing navigation on the Erie Canal."

THE FASTEST TROTTING.—At Rochester, August 10, the fastest two-mile heat on record was trotted by the horse Steve Maxwell in 4 min. 48½ sec. Flora Temple's previously unequaled record was 4 min. 50½ sec.

FACTS ABOUT CHEESE.

The Mohawk Valley has lost its rank as the center of the cheese industry of the United States. The new head center is at Wellington, Ohio. The surrounding country abounds in cheese and butter factories. The principal cheese man in the State, Mr. C. W. Horr, has his establishment there, and it is one of the largest in the country. In a recent interview with a correspondent of the Cleveland *Leader*, Mr. Horr reported a very active demand for cheese at satisfactory prices. The home consumption has been greater this year than last, and the demand for export has been much increased.

The April milk this year netted about 100 per cent more than last year, the May milk about 80 per cent more, the June fully 40 per cent more, and for July the estimate was 50 per cent more than for last year. The prospect for the remaining four cheese months was very good. The yield per cow has also been more than last year, though not quite so many cows have been milked.

The chief American cheese districts comprise a small portion of New York, part of the Western Reserve in Ohio, a few counties in Illinois, Kansas, Michigan, Iowa, Vermont, and Pennsylvania, and a good many counties in Wisconsin. New York, Ohio, and Wisconsin, lead in the order named. Wellington, Ohio, is the largest country market, as shown by last year's statistics. Little Falls and Utica, N. Y., stand next. Wellington shipped 1,500,000 pounds more butter and cheese than Little Falls last year, the total shipment amounting to about 9,000,000 pounds.

During the past five years about 110,000,000 pounds have been exported annually; the rest is consumed in the United States. Most of that exported goes to Great Britain, which in 1878 took over 120,000,000 pounds, and last year a much larger quantity. The foreign demand for American cheese is increasing, but not so rapidly as it did ten years ago. From 1860 to 1865, owing to the introduction of the cheese factory system in this country, the increase was tremendous. Since then it has not been so rapid, but it has been steady. The export this year has been larger than the last, but not so large as in 1878. Commencing with the last week in May, there were exported during the following eight weeks of 1878, about 807,000 packages of cheese; during the corresponding weeks of 1879, about 528,000 packages, and of 1880, about 635,000 packages.

The foreign trade in American cheese is almost exclusively for what is called factory cheese, and covers every grade and quality, from the poorest skim milk cheeses to the richest full creams. The bulk of the poorest grades of cheese made in America goes to England, where the poorer classes use it in place of meat. Were it not for the market thus furnished for the cheaper grades of cheese the enormous May, June, and July makes of American cheese would have to be thrown to the fishes or sold at nominal prices.

The export of butter is also increasing rapidly. During the past two or three years there is an increasing demand for the very best creamery butter. "We have within the past six weeks sold nearly $7,000 worth of the finest creamery butter to one Liverpool house," said Mr. Horr, "and such a sale as this, until within the last three years, was unheard of in Ohio. This butter is shipped on a through bill of lading from Cleveland to Liverpool."

ARTIFICIAL COLD.

While sweltering under the relentless summer's sun people delight to talk about the production of cold, as if cold were a real substance, and just now a very desirable one. Not many years ago, when the caloric theory prevailed, we were told that heat was a substance, and cold was merely the absence of heat. The present generation of philosophers tell us that heat and cold are only sensations due to a more or less rapid vibration of the molecules. Although we willingly accept Tyndall's assertion that heat is only a mode of motion, which seems to be confirmed by the fact that the more we move about the hotter we get, yet it scarcely makes us any more resigned to our sweltering fate to know that the difference between summer and winter is merely a question of velocity in molecular motion. We read of the numerous icebergs that float down this way, and wish we had built our summer residence on top of one.

A correspondent at Council Bluffs sends us a refreshing account of a car which came in on the Chicago and Northwestern Railroad, the axle laden with icicles several inches long and the running parts covered with solid ice, which had formed there with the thermometer at 86° in the shade. The mystery is soon solved when he tells us that the car was loaded with gasoline, which was leaking through the bottom of the car. Gasoline, being extremely volatile, of course evaporated with great rapidity, and thus produced, as every volatile liquid does, a diminution of temperature, a principle made use of in all ice machines.

When a solid body passes into the liquid state a large quantity of heat is rendered latent, hence when any two solids (like salt and ice), which form a liquid when brought into contact, also reduce the temperature, on melting this heat is again set free.

A similar amount of heat is rendered latent when a substance passes from the liquid state to that of gas or vapor. This quantity of heat must be derived from surrounding bodies, and their temperature is correspondingly lowered. As a general rule the lower the boiling point of a liquid the lower the temperature that can be produced by its evaporation. Rhigolene, a petroleum product more volatile than gasoline, has been used with success in ice making. Ammonia and sulphurous acid gases, which are not combustible and therefore not explosive if mixed with air, are generally preferred. Nitrous oxide and carbonic acid gases, which are condensible only by very high pressure, are employed for obtaining very low temperatures. The former of these gases is now sold in large quantities in liquid form, and when allowed to escape often freezes in the escape pipe, beside covering the surroundings with ice, as did the gasoline at Council Bluffs. The evaporation of liquid carbonic acid produces a sufficient degree of cold to freeze the remainder of the acid, which then melts very slowly at ordinary temperatures and is at once volatilized. Liquid oxygen and hydrogen produce the most intense cold known by their evaporation.

The production of ice by the evaporation of gasoline is not so rare, however, as our correspondent supposes. A barrel of gasoline exposed to the air on a warm summer day frequently has a crust of ice or snow around the bung and wherever any escape of the gasoline can take place. A current of air blown over the surface of a volatile liquid causes it to evaporate more rapidly, and in the case mentioned above such a current was caused by the motion of the train. As soon as the surfaces were cooled below the dew point, moisture from the air began to be deposited, which was frozen when the temperature reached 32° Fah.

Many of our dwellings, our offices, our schoolhouses, and public buildings are supplied with complete sets of pipes and radiators for steam heating. In our climate these are seldom used from May to October—nearly half of the year. Will not some of our inventors devise a method of utilizing these costly pipes for cooling the air in summer? It could not be done by forcing a stream of gasoline through them, because this only reduces the temperature where it escapes into the air, and to allow it to escape would be to fill our houses with a poisonous, explosive, and bad smelling demon. Preferable would be a system whereby air could by any of the well-known principles circulate in our radiators and finally escape if pure, but return to boiler if impure. Perhaps some neutral liquid, which would neither freeze nor attack the radiators, could be made to flow through the pipes. This liquid passing through a coil of pipe surrounded by a suitable refrigerating substance would carry its cold freight to every part of the house. As cold liquids sink it might be necessary to put the refrigerating machinery in the garret instead of the cellar. If cold air were used this would be unnecessary.

We shiver with pleasure at the thought of being able to break off icicles from the dining room radiator, or scrape off enough snow from our office radiator to make a snow ball to throw at the luckless small boy or delinquent subscriber and merciless devil. We could laugh at the ice cream dealer, for we could bake our own cream in our cold oven, and ice would be an unnecessary luxury, for we need only set the water pitcher on the radiator to convert the croton into sparkling spring water.

The quantity of coal required to cool a house in summer need not exceed that required to warm it in winter, while the saving in doctor's bills, in profanity, and traveling expenses would be no small item, to say nothing of being able to freeze out the mosquitoes and benumb the flies.

Where is the genius who will solve the problem of house cooling and eclipse the fame of Carré, Pictet, and the rest of the ice makers? What delightful essays would our daily editors write in their cooled sanctums, and how many free puffs would they unconsciously bestow on this lucky inventor! New York would no longer be depopulated in summer and business would flourish the year round.

Effects of Lightning.

Mr. J. Johnstone writes to the Edinburgh *Daily Review*: "On the 7th of July, about 4:15 P.M., the lightning struck the craig which is named on the plan of Edinburgh "The Dasses," which overhangs the Hunter's Bog on the east. The rock struck is of the hardest basalt, commonly called whinstone. The lightning did not strike the sharp, serrated front edge of the craig, as might have been expected, but, on the contrary, it struck the flat top covered with sod at a distance of three feet from the present edge, and that must have been between six and eight feet from the edge before the accident, for the lightning detached several tons of the rock from the front of the craig, and sent six large masses of rock down into the Hunter's Bog; the largest of these measures four feet long by three feet broad and one foot thick, but of irregular shape. On the edge of the craig the lightning detached a mass of rock, which now stands in a very precarious position. This large mass measures four feet nine inches long by three feet broad and one foot four inches thick. The top of the craig, a short distance from the front of it, is covered with a coating of angular pieces of basalt, and on the top of these a covering of sod. It was on the sod the lightning struck, and made a hole two feet six inches long by one foot six inches broad. On placing a compass near the hole made by the lightning I found that the needle deviated from the N. to the E., and when the compass was in the hole the needle stood at E.S.E., instead of N., proving that the rock is still powerfully electrical at the spot where the lightning struck it. But, except in the vicinity of the hole, the craig does not affect the needle."

The American Science Association.

The annual meeting of the American Association for the Advancement of Science will begin at Boston, August 25, in the Massachusetts Institute of Technology.

RECENT INVENTIONS.

An improved railroad rail, intended to prevent the noise produced by its vibrations, has been patented by Messrs. Henry V. Piaget, of Jersey City, N. J., and Frederick A. Piaget, of New York City. The invention consists in applying a thick layer of cement or like material to the sides and bottoms of the rails, and fastening strips of wood to the sides and bottoms of the rails by means of the cement, thereby preventing the emission of sound by the vibrations of the rails.

Mr. John L. Taylor, of Las Vegas, Territory of New Mexico, has patented a telegraph pole that is more durable and lighter than ordinary poles, while having the requisite strength.

Mr. Nicholas Boren, Jr., of Haubstadt, Ind., has patented a novel arrangement of a churn dasher rod and a series of shafts and band wheels, and a drum and weight, whereby provision is made for obtaining a rapid movement of the dasher.

Mr. John H. Hodges, of Attleborough, Mass., has patented a separable button, which consists in a curved wire catch combined with a cup having a short beveled end lip and a protruding end, with opposite springs arranged between the side of cup and the curved parts of catches.

An improved ladies' dress guard, which will prevent the dress from clinging to and exposing the form when walking against the wind, has been patented by Tom O. Memery, of Key West, Fla. It consists of a rounded garment, stiffened by a number of flexible strips running from top to bottom. It is worn over the abdomen, and is held by bands passing around the waist.

An improved car coupling has been patented by Mr. Jesse T. Rice, of Grand Rapids, Mich. The invention consists of a novel combination of devices, which cannot be clearly described without engravings.

Mr. Abraham F. Denlinger, of Jamton, O., has patented an improved gate, so constructed that it can be opened and closed by the wheels of a passing vehicle. It is simple in construction and not liable to get out of order.

An improved blacking brush holder has been patented by Mr. Henry B. Perham, 665 West Lake street, Chicago, Ill. The invention consists in securing blacking brushes for transportation or packing in trunks with wearing apparel by an incasing crossbelt, which not only retains them in a compact form, but incases them so as to prevent the surrounding articles from being soiled.

A light, strong, and durable fence, which is easily set up, taken down, and moved from place to place, and is inexpensive in manufacture, has been patented by Mr. Henry E. McWhorter, of Blooming Grove, Ind.

The combination, with a map, of index sheets secured by their upper edges to the map roller and pendent on the side of the map, has been patented by Mr. Orson S. Haskell, of Evanston, Ill.

Hell Gate Improvements.

During the past year 15,195,561 gross tons of rock, the *débris* of the Hallett's Point explosion of 1876, have been removed under contract by the Atlantic Dredging Company, making in all 72,084,078 gross tons. The reef, for one-third of its extent, has a depth of twenty-six feet at low water. Over the remaining area there are a few shoal points still to be removed, some of which, near the shore, have only about seventeen feet at low water above them. The work is approaching completion, and progress is necessarily slower. The contract of the Atlantic Dredging Company has been extended to December 31, 1880, when it is supposed the work will be finished.

The work on Flood Rock, suspended since 1878 for lack of appropriations, has been resumed and is progressing satisfactorily. It is expected that the entire excavation will be completed within three years. A part of the rock taken from the galleries has been deposited in a deep hole off Ninety-second street, and another portion dumped in a dike closing the interval between Great and Little Mill Rocks, thus forming the western side of the new channel, improved by the removal of the reef at Flood Rock. This dike formed a part of the original project.

The drilling scow, recently employed on Diamond Reef, will be used on Frying Pan, Heel Tap Rock, and Pot Rock, which, with Flood Rock, forms the only barrier to a free use of the channel at Hell Gate.

A Natural Gas Well near Boston.

A notable discovery is reported from Ocean Spray, a new summer resort near Boston, Mass. While a driven well was being sunk, July 22, a vein of natural gas, which burns with a clear brilliant light, was struck at the depth of 122 feet. Being so near the house of Deacon Augustus Reed as to endanger its safety, the blaze was smothered and the well abandoned.

The adjoining lot was owned by Mr. J. H. Jessop, who, thinking the gas worth boring for, had another well driven. Gas was struck July 30, and since then the flow has been abundant and strong. Mr. B. R. Sturges, of South Boston, writes us that the pressure of the gas was measured August 5 by the State Gas Inspector, and found to be that of 31¾ inches of water. Photometric tests made by the Superintendent of the East Boston Gas Works showed the gas to be of 14 candle power, giving a pure and brilliant light with various styles of burners. An attempt will be made to utilize the gas for illumination, cooking, and heating.

NEW BOOKS AND PUBLICATIONS.

THE BOOK OF ENSILAGE; OR, THE NEW DISPENSATION FOR FARMERS. By John M. Bailey. Billerica, Mass.: Published by the author. 8vo, cloth, pp. 202. Price $2.

In this very enthusiastic volume Dr. Bailey relates his experience with ensilage at "Winning Farm." He frankly admits that the method of preserving fodder in pits under pressure is not so much a new dispensation as one of the lost arts, which, after the lapse of centuries, has just been rediscovered and improved. It is, however, "destined to be the means which shall produce a revolution in modern agriculture." For his part he has simply put into practice in America a system which M. Goffart has demonstrated to be practical in France. How far Dr. Bailey's zealous championship of silos leads him to exaggerate—if at all—the importance of the system of ensilage, only time and wider experience can determine. It is certainly to be hoped that he is not mistaken in his estimate of its advantages. At all events experimental silos are not expensive, and farmers will run no great risk in cautiously giving the system a fair trial. For this work the information furnished by Dr. Bailey's experience will be of value.

THE VOICE.

This is a sixteen page paper, issued monthly, at Albany, N. Y., and devoted to voice culture, special attention being paid to stammering and other defects of utterance. The Voice is the official organ of the Music Teachers' National Association, and seems to be admirably adapted to aid the professional work of teachers of singing, reading, and elocution, as well as physicians who make a specialty of the diseases of the vocal organs, Edgar S. Werner, editor and publisher. $1 a year.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) J. K. writes: In your answer No. 6, R. R. W., which of course is perfectly correct, it would be of great interest to the readers and R. R. W. to state that when in a storm the rain descends slantingly the resultant increase of lineal speed occasioned by the wind brings exactly the same quantity into the vessel. A. Suppose the wind strong enough to blow the rain horizontally, how much then?

(2) T. E. A. asks: 1. Will a telegraph sounder work on a line 600 feet long with ground wires without relays? 2. A. Yes. What makes the annunciators drop when it is tightning in a telephone exchange? Is it the free electricity in the air? A. The current induced in the line by lightning. 3. Should not Leclanche batteries be closed at night when not in use? A. No; the Leclanche should not be kept on a closed circuit longer than is absolutely necessary, as it soon polarizes. 4. Is it not dangerous to use the telephone during thunderstorms? A. Yes, unless a very good lightning arrester with a very good ground is provided. Even then severe shocks may be expected.

(3) O. W. E. asks: Will water explode by continued use in a boiler after all the air has been boiled out of it? If so, what prevents the boilers of ocean steamships from exploding where surface condensers are used? A. No; but the ebullition will be very irregular and the boiling point be raised. In ocean steamers a certain small amount of fresh (or new) water is added from time to time, or the water submitted to aeration before being returned to the boiler.

(4) J. F. E. writes: I want to belt from a twenty inch pulley on to a two inch pulley, and want to find the material that will be the most positive or will not slip, the distance between the pulleys being only about two feet. What can I find as the best thing? A. A woven cotton or canvas belt would be best, but no belt can work successfully under the conditions given, if much power is to be carried.

(5) W. F. L. asks: What is the cheapest and best way to transmit one horse power four to ten rods—speed of shaft from which the power is to be taken twenty-five revolutions per minute? A. By a wire rope three-eighths inch diameter, if you can use large pulleys say about five feet diameter, on your shaft.

(6) E. T. asks: What size engine would be required to drive a side wheel, iron hull yacht, 30 feet long, 7 feet beam, fifteen miles per hour? A. It is not practicable to drive a boat the size you name fifteen miles per hour with side wheels. To accomplish it with a propeller, everything else must be sacrificed to speed.

(7) F. M. D. asks (1) for the best and cheapest way of making electric batteries. A. See SUPPLEMENTS 157, 158, and 159. 2. How much pressure will a copper boiler, 6 inches in diameter, 8 inches long, stand? A. It depends on the thickness of copper of which your boiler is made. 3. Where can I obtain a small cheap engine that will run a three foot boat? A. You might find one at an instrument or toy store.

(8) W. O. G. asks: What power can be obtained from 250 cubic feet of water per minute having 4 feet fall? Also, the diameter of undershot wheel which would give best results, and size of buckets for same? A. Your fall of water will give you about one horse power. The velocity of the periphery of the wheel should be about five feet per second. A good diameter for mill purposes would be 9 to 10 feet outer diameter, and the diameter inside the buckets 6¼ to 7¼ feet.

(9) E. T. writes: On page 57 of the "Wrinkles and Receipts" it says: It may be fairly assumed that a non-condensing engine has on an average at least 2 lb. per square inch back pressure on the piston. By the application of a condenser it might be expected that there would be a negative pressure of 10 lb. per square inch on the back of the piston, so that the piston pressure would be increased by 12 lb. Question. How can there be a negative pressure of 10 lb. per square inch when there was only 2 lb. per square inch in the first place? In the example the piston pressure is increased 12 lb., whereas I can only make it 2 lb. increased. Which was taken from the back pressure? A. There is no such thing as negative pressure; we suppose you mean by 2 lb. back pressure, that much more than the atmosphere, or 14·75 lb. + 2 = 16·75 lb. If now by the use of the condenser you reduce this total back pressure to 3 lb., it is evident you have removed 13·75 lb. back or resisting pressure to the work of the piston.

(10) S. B. asks: 1. What rule must I work by to figure out the horse power transmitted by belts and pulleys? A. For belts the formula $\frac{WS}{600}$ = horse power, is a very safe and and convenient rule where W = width of belt in inches; S = speed of belt in feet per minute. With very short or narrow bolts divide by 800 instead of 600. 2. What do you consider to be the best book on the subject? A. Cooper on Belts and Belting. 3. Does Haswell treat on the subject in his pocket edition? A. Yes, briefly.

(11) H. W. S. writes: Our land is from three to five feet lower than the Hocking Canal, from which we wish to irrigate by means of underground pipes and hydrants. Could a hydraulic ram be used with success to force the water through the pipes? Suppose the main pipe is three inches, what size should the pipe next the canal be? Would it be better to run the water in an elevated tank. Could steam or wind power be used cheaper to produce the same or better effect? A. A hydraulic ram could be used with success; but of course the quantity of water taken from the canal will be very much greater than that discharged. If the discharge pipe be 3 inches diameter, the receiving pipe should be 7 inches to 7½ inches diameter.

(12) F. R. W. asks: 1. Can steel wire be galvanized in the same manner as iron wire? A. Yes; the steel wires for the Brooklyn bridge are galvanized. 2. Is there any way by which I can apply lead in solution to a tin roof so that it will adhere and prevent rust or leaking? A. We know of no way of doing this. Apply two coats of some good paint.

(13) F. A. D. asks: 1. Can a catamaran be built of solid logs or hulls, instead of hollow ones; say either of wood or cork, and of sufficient buoyancy for all practical purposes in rough or smooth water? A. Yes, but the hollow cylinders are to be preferred. 2. Can I melt brass for casting any small article without a regular furnace? A. Brass may be melted in an ordinary coal stove. Give it plenty of time and a good fire.

(14) D. B. asks: 1. What pressure per square inch will an upright copper boiler stand, shell No. 22, head sheets, No. 16, with four stays; boiler 16 inches diameter and 30 inches long, with 40 three-quarter brass tubes? A. 25 lb. per square inch. 2. Will the above boiler be large enough to drive a double engine, cylinder 2x4? A. No, except the engines are run very slow, say not more than 60 or 70 revolutions per minute. 3. Will it be safe and strong enough? A. Yes.

(15) L. S. writes: A friend and myself want to build a yacht 50 or 55 feet long. Have not had any experience in that line, and would like to get hull model, or drawings, if possible. We want something to work from, want it for speed. A. A model would cost about $30 to $40. 2. Which shall I use, iron or steel, for the hull? A. Steel would be the lightest and best. 3. What size engine do we require? Do you think the boat too small for double engine; if not, what size; also, size of boiler, shaft, and wheel? A. A double engine, 6 inch cylinder by 8 inch stroke. The dimensions of boiler would depend upon the kind. Wheel about 3 feet 8 inches diameter; shaft 2¼ inches diameter.

(16) T. W. C. asks at what temperature a low pressure engine uses its feed water, and if a high pressure engine uses any hotter; or, in other words, does a high pressure engine use hotter feed water than a low pressure engine? Also, how does the steaming qualities of anthracite coal compare with Pittsburg coal? A. For low pressure engines about 100°, for high pressure from 160° to 300°, according to efficiency of heater. Pittsburg coal a little the most efficient weight for weight.

(17) H. C. S. asks: 1. Should small spiral springs be made from right to left or left to right? A. They may be wound in either direction. It is generally more convenient to make them right-handed. 2. What is used to prevent small steel spiral springs from rusting, same being applied after spring is made? A. Dip them in boiled linseed oil and allow it to dry on. 3. Can shellac be used in place of glue in cementing wood joints? Is it as strong, and how long does it take to set? A. Shellac will not replace glue. It takes a long time to set in the middle of a joint, and is not as strong as glue.

(18) H. A. B. asks: 1. Does the magnetic needle point direct to the North Pole and the North Star? A. On certain lines on the earth's surface the needle points toward the pole. Such a line now passes near Wilmington, N. C., Charlotteville, Pa., and Pittsburg, Pa. 2. Are there magnetic poles 23 degrees out of line of the geographical poles? A. The magnetic meridian in some localities varies from the geographical meridian 23° or more. 3. Which is the nearest star, and its distance? A. So far as is known the nearest fixed star is Alpha Centauri, in the southern hemisphere. It is more than twenty millions of millions of miles distant. No other star is known to be within double the distance.

(19) A. H. asks: How can I make a strong paste for fastening bills in a file book? A. Rice or starch paste is best. The following is well recommended: 4 parts (by weight) of fine glue are allowed to soften in 15 parts of cold water, and then moderately heated until the solution becomes quite clear; 65 parts of boiling water are now added, with constant stirring. In another vessel 30 parts of starch paste are stirred up with 20 parts of cold water, so that a thin milky fluid is obtained without lumps. Into this the boiling glue solution is gradually stirred, and the whole kept at a boiling temperature for a short time. After cooling, a few drops of carbolic acid are added to the paste. This paste is exceedingly adhesive, and may be used for leather as well as for paper and cardboard. It should be preserved in corked bottles to prevent evaporation, and in this way will keep good for years.

(20) J. A. S. inquires: 1. How to make a cheap and serviceable emery wheel. A. Turn wheels from well seasoned pine, of the form desired; place emery upon an iron plate heated to 200° to 212°; coat the wheels with glue prepared as for uniting wood, and roll the wheels in the warm emery. After the glue dries, the surplus emery is brushed off and another coating of glue is applied and the wheels are again rolled in the warm emery. The wheels should be allowed to become thoroughly dry before use. 2. How can I make emery sticks? A. Prepare sticks of such forms as you may require, and coat them as directed for emery wheels, or attach to them emery paper by means of glue or paste.

(21) G. H.—To prepare good cider, choose ripe, sound apples, sweat them in small heaps for a few hours, and wipe dry. Then grind them, place the pomace between layers of clean straw, or preferably hair cloth, in a suitable screw press, and apply the pressure. As the juice runs from the press strain it through a hair cloth sieve into a large open cask capable of holding all the juice to be expressed in one day. In a day, or sometimes less, the pomace will rise to the top and grow very thick. When little white bubbles break through it draw off the liquid through a spigot placed about 3 inches above the bottom, leaving the lees behind. The cider must be drawn off into very clean casks, and repeatedly racked off until the first fermentation is over, which is known by no more of the white bubbles, before mentioned, forming. Then add a gobletful of sweet oil to each cask, fill it up with cider in every respect like that contained in it, and bung up tight. Sugar or glucose is sometimes added at this stage—8 to 15 pounds to the barrel, according to the character of the apples used—sweet or sour. When the cider has attained the proper taste, add one-quarter to one-half pound of isinglass dissolved in some of the cider, and then about one-quarter pound (not more) of freshly prepared sulphite of lime (common preserving powder), and draw off, after shaking and allowing to settle, into very clean barrels, or bottle. The sulphite (which must not be mistaken for *sulphide*) preserves the cider perfectly.

COMMUNICATIONS RECEIVED.

On a Natural Gas Well. By R. B. S.

On Curious Meteorological Phenomenon. By T. J. F.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

July 27, 1880,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1836, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1836; but at increased cost, as the specifications not being printed, must be copied by hand.

Acid, apparatus for the recovery of waste sulphuric, A. G. Sébillot 230,501
Agricultural implement, J. B. Gracey 230,414
Asphalt road and pavement, E. J. De Smedt (r) 9,325
Axle turner and screw cutter, T. B. Black 230,395
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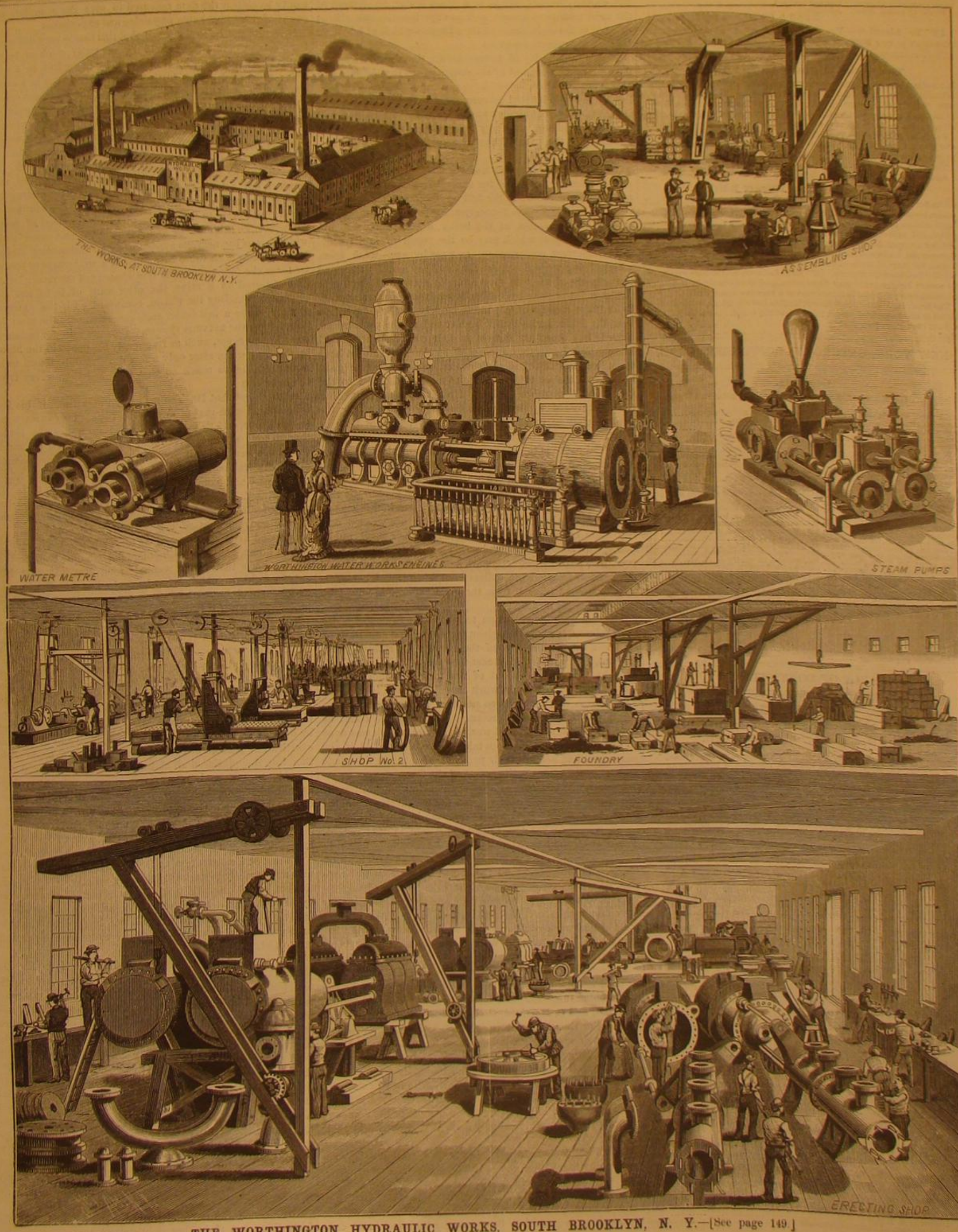

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NEW YORK, SATURDAY, SEPTEMBER 4, 1880.

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THE SCIENTIFIC AMERICAN SUPPLEMENT
No. 244,
For the Week ending September 4, 1880.

Price 10 cents. For sale by all newsdealers.

THE INSPECTION OF STEAM BOILERS.

There is no doubt that a steam boiler is in many respects a much more dangerous neighbor than a powder magazine. In order to be safe a steam boiler needs continual attention and care, while neglect or ignorance may have the most fatal results. In regard to a powder magazine, all it needs to be perfectly safe is to be left alone. Neither neglect in the watch nor absence of attendants can involve any danger; in fact, when the doors are securely fastened, no attendance whatever is needed. The only dangers are downright imprudence with fire, and lightning; both are easily guarded against by very simple precautions and well constructed lightning rods. Age will not deteriorate a powder magazine; on the contrary it will prove the reliability of its construction and management and the safety of its location; but, on the contrary, age is, in a steam boiler, an element of the most imminent danger, and, as experience shows almost daily, it is the main cause of the disasters which of late have become alarmingly frequent.

It is a peculiarity of human nature that familiarity with danger begets contempt of the same; hence that owners and managers of steam boilers have proved themselves so neglectful that all civilized governments have enacted laws to secure more safety against steam boiler calamities (we will not say accidents, as every thing has a cause) than are afforded by the care of the owners themselves and their engineers.

We have such laws, but unfortunately they are not sufficiently effective, and this for several causes: first, they are not framed according to the full light which science and experience has shed upon the subject; they only require a test of hydraulic pressure of the boiler, a test which will not reveal weak spots which may be the result of faultive design, imperfect construction, or wear by age—weak spots which, being worn down so far that they could just stand the pressure of the test, soon after, by continued wear, give out at a lower pressure. The Sewanhaka disaster appears to be due to a cause of this kind; namely, in the supposition that the boiler had actually been tested at the pressure required; but there are doubts in this regard, as it is well known that inspectors appointed by the government have often been neglectful in their duties, and, trusting to good luck, gave the certificates without making the test to the full extent as required by law. This is a second cause that the laws passed by the United States Government for the public safety in regard to steam boilers have not been as effective as intended and expected.

A third cause is the incapacity of many of the inspectors, who used to be appointed after an examination so ridiculously easy that any schoolboy who has learned his lessons in natural philosophy can pass it. We are glad to say that recently great improvements have taken place in this regard, so that when the old, ignorant inspectors are weeded out, and more capable ones are appointed in their stead, public safety will become greater in this regard, provided, however, that also the inspectors are men of integrity, who will not hesitate to condemn boilers even when the owner offers a bribe to save himself from the great expense involved by the purchase of new ones.

The thorough investigation to which the Sewanhaka disaster referred to above has given rise shows that a small weak spot in a tube in the rear of the furnace, by suddenly giving out, threw a jet of steam forward, which, like a back draught, threw the fire out of the furnace doors and ash pit, and set the dry woodwork around at once in a blaze. This escape of steam was so small as not to interfere perceptibly with the boiler pressure, as the engine could be kept running until the boat was run ashore, which was done so successfully that all lives might have been saved if the passengers had not lost their presence of mind in the panic which ensued after the discovery of the fire.

There is one consolation after such calamities, not for the poor victims and their relatives, but for the survivors and the public in general. It is that every such incident teaches a lesson which makes the future more safe in this regard. The disaster in question promises to be especially useful in this respect. It will result in a revision of the laws on steam boiler inspection, on the choice of the men to be appointed as inspectors, and on their behavior after being appointed, convincing them that they are not irresponsible for the consequences of their carelessness in giving certificates for old and worn out boilers, as was the case with the Sewanhaka. They have, as well as the owners of the boat, been arrested for manslaughter.

In regard to the revision of the law, the best which can be done is to adopt the mode of inspection practiced by the steam boiler inspection and insurance companies in London, England, and in Hartford, Connecticut. These companies, who make themselves responsible for damages to boilers under their charge, are not satisfied with the mode of inspection prescribed by the United States law, but add to this a thorough test of all parts of the boiler by means of the hammer handled by a practical expert, who in this way can detect any weak and dangerous spot. If such a spot is found the owner has to have it properly repaired, or the company will not insure it, which is only done after approval by their own inspectors.

Statistics are there to prove the results. While boilers approved by the United States inspectors have been continually exploding, sending death and destruction around, the explosion of boilers in charge of the insurance companies has very rarely caused any disasters, and if one gave out, it was always proved to be caused by the most gross carelessness or recklessness of those in charge. Many boiler owners, therefore, have grown disgusted with the United States inspection, calling it a farce and an imposition, and the flourishing condition of the inspection and insurance companies has been the necessary result.

DR. TANNER'S GREAT FAST.

We call the attention of our readers to the full account of Dr. Tanner's world celebrated great forty days' fast to be found in the SCIENTIFIC AMERICAN SUPPLEMENT of this week, No. 244. It is from the pen of Dr. Vander Weyde, who, in his position as one of the watchers, and in his capacity as Professor of Chemistry of the U. S. Medical College, when the fast took place, had charge of the chemical and microscopic investigations, and therefore ample opportunity to collect the data required to give the complete account of this remarkable physiological experiment.

It should not be lost sight of that this case is very different from cases where a fast is held by necessity, such as being compelled by disease, by shipwreck, by being lost in a wilderness or forest, being buried in a mine, or lost in a cave. Dr. Tanner had enormous advantages over all these cases, and hence that he could indulge at once in hearty meals, as his digestive apparatus was not impaired by disease, nor his nervous system shattered by anxiety; in such cases it would be very dangerous, if not fatal, at once to indulge immediately in such abundance of food. In the case of shipwreck, the exposure of the survivors, resulting in a total want of any comfort, but to the enduring a suffering from other distressing discomforts, and exposure to the elements, contributes as much if not more to the fatal results than the need of nourishment. To this must be added the anxiety and uncertainty which keeps the nervous system upon an exhausting strain. It is the same with those being lost in a wilderness or forest, Of these the forest gives the best chances of survival; but in case of burial in a mine, the utter want of light and the gloom surrounding the victim, combined with the extreme anxiety, make a fast under such circumstances the most destructive to the nervous system. Persons who, for instance, were lost in caves, such as frequently happened in the Mammoth Cave, were, after only a few days' search, found to be nearly insane, so much so that they hid themselves from the searchers.

It is evident that Dr. Tanner had an easy time, if his fast is compared with that of any of the fasters for causes mentioned above. If he had been locked up under the threat that no food would be given him for forty days, he surely would not have stood it so well, as the mere consciousness of the constrained situation would have affected his mind, and all ease and comfort would have been at an end. To the contrary, his mind was kept at peace because he had plenty of air and water, the comforts of good shelter, and all the conveniences of civilized life; he could read his papers and keep up his usual correspondence, walk, ride, or stay at home, converse with congenial friends, and, best of all, he knew that if he wanted food it would cost him only a word to obtain what he desired at once. Fasting under such circumstances can, of course, be much longer prolonged than if it is done by necessity.

These facts were overlooked by those who from the first declared a forty days' fast an impossibility, and staked money on it. They were not well informed about actual fasts for so long a period, of which there are instances on record, or they did not believe the truth of such records. They judged only from the results of many well known constrained fasts which ended fatally within thirty, twenty, and even ten days, and were kept under unfavorable conditions, often by delicate girls of comparatively tender age and of a feeble constitution, perhaps of consumptive tendency to begin with; therefore they declared all claims of those who pretended to be able to fast as long as forty or even only thirty days as fraudulent and impossible without the deception of secretly taking food. Having this as a fixed idea in their minds, they expected that a careful watch would surely cause the death of any man who pretended to be able to fast for so long a period, and hence the clamor of defective surveillance.

It must be a satisfaction to Dr. Tanner that his uprightness and honesty in regard to keeping strictly to the conditions of his self-imposed trial are now generally granted even by his former most violent opponents, who acknowledge freely that his behavior as a gentleman has proved him to be far above surreptitiously taking food while he was pretending to fast.

They have had their eyes opened to the fact that Dr. Tanner's case was very different from most other real or pretended fastings; that in him we have a man of a strong, tough, and wiry constitution, at an age between forty and fifty, which, for such a constitution, is that of the greatest resistance, a man provided with a copious layer of adipose tissue or fat around his body, and of a weight of one hundred and fifty-seven and a half pounds, which is far above the average for his height, which is rather below the medium, so that he must be classed among the small men. A tall man of that weight surely would not stand it as well. Even a tall man of greater weight would possess no advantages, as army statistics prove that large men, who may be stronger in regard to muscular power, are less strong in regard to their powers of endurance than smaller men, who, as is well proved by long experience, stand various sorts of privation and fatigue better than large men, who usually are the first to break down under each circumstances.

Dr. Tanner may not have proved that everybody can fast forty days, but if he has only proved that man can fast

longer than has generally been supposed, that we are all eating too much, and that for a family remedy, fasting affords a better, safer, and more economical cure than the taking of all sorts of patent medicine, to which many people are so much addicted, he has done a really good work.

We recommend to our readers the perusal of the full account of the fast.

EFFECT OF STARVATION ON THE BLOOD.

Further observations upon the gradual improvements of Dr. Tanner's blood have made it necessary to modify the statements made at the close of the article on this subject in the last number of the SCIENTIFIC AMERICAN (see page 128). It was noticed that the quality of the blood varied greatly in different specimens obtained from day to day, and even in specimens drawn the same evening. It was at last found that if the blood was drawn from a very small puncture, from which it had to be pressed out forcibly, it was found to be in a much worse condition than if drawn from a deeper puncture from which it flowed freely. It is evident that in the first case it was drawn only from the capillaries, and in the second case from the larger vessels, in which a regular circulation takes place. This appears to prove that the abnormal corpuscles linger in the capillaries, and that it takes time to remove them therefrom, while in the larger vessels, in which free circulation takes place, restoration may already have been accomplished to a considerable extent. Close observation appeared to show that this restoration was taking place in two ways, by a cleaning and healing process of the affected corpuscles, and by the formation of new ones. The first was proved by the observation of corpuscles in all stages of the healing process from the most abnormal to the perfect smooth ones. Some of those which had become free of fungoid spores appeared, however, to have suffered considerably, some were partially destroyed, some were only half or parts of perfect corpuscles, and no doubt such will be either eliminated from the system or the defective parts healed up. Which of these takes place is a question. The second process of restoration was proved by the appearance of fresh and small corpuscles, looking very smooth and perfect, and bearing the stamp of youthfulness upon their appearance—we would almost say countenance—a freshness which became more striking the higher the magnifying powers were by which they were observed, in comparison with the affected corpuscles, in which the higher powers showed the imperfections more strongly.

This corroborates what other microscopists have observed in regard to the formation of new young blood corpuscles. It has, however, been denied by others who failed to observe it; but this is merely negative testimony, of which there appears to be a great deal in the medical profession; it proceeds from a kind of conservatism, which lies at the basis of all the medical intolerance manifested by the so-called regular school against all supposed innovations, even among their own brotherhood.

A striking illustration was offered in this regard by the discovery of Prof. Cohnheim, of Kiel, who found that pus globules could originate from the white blood corpuscles, but whose observations were most strenuously opposed at first by the majority of the profession, who could not see it. It may be mentioned here, as it has some relation to Dr. Tanner's fast, by which fast the number of his white blood corpuscles was more than quadrupled. It is well known that persons subject to privation of food have a strong tendency to pus formation and running sores, and if starvation increases the number of white corpuscles, these combined facts appear to support Cohnheim's theory. The opposition against it was, however, set at rest by Dr. Bastian, in London, and Surgeon Woodward, U. S. Army in Washington, who verified Cohnheim's observation, and by Huxley, who adopted it in his great lecture on protoplasm.

The number of white corpuscles did rapidly diminish after the fast in Dr. Tanner's blood, and was soon reduced to the normal proportion; but the interesting change in the red corpuscles and their very gradual restoration during a length of time, is a contribution to science which Dr. Tanner has given after the end of his fast, and this should be acknowledged.

MAKING PROFITS OUT OF HUMAN WEAKNESS.

It is not only among lawyers that a certain class is found who induce quarrelsome or avaricious people to go into lawsuits by telling them they are right and must seek redress by law. They do this only for the purpose of obtaining their professional fees, in place of giving them the honest advice to settle amicably, by mutual agreement, as *in nine cases out of ten would be far better.*

We find the same class of men among doctors, who, when people mention some slight ailment, make them believe that they are sick, or soon will be very sick if they do not take a certain course of medical treatment which they will prescribe. They also do this for the purpose of obtaining a professional fee, in place of giving them the honest advice to fast for one or two days, to take rest, and to stop drinking and smoking, if they are addicted to these vices. *In nine cases out of ten this would be far better.*

The lawyer of this class makes the client believe that he has been wronged, and the doctor makes the patient believe that he is very sick. They all have their own profit in view, and play upon human weakness, which, in some individuals, consists in combativeness, in others in imaginary weakness of body, and again, in others, in conceit about their mental accomplishments.

There is no profession in which men can make money out of it by telling people about their weakness of mind. The only mental weakness of which people sometimes complain is defective memory, but they will never complain about defective judgment or defective common sense. This agrees perfectly with what a German physician has lately argued in an essay, that insanity is a blessing, as the insane live in an ideal sphere, which usually is far happier than the reality in the world of trouble through which they have passed and which made them insane. But the fools outside the asylums, which largely outnumber those in confinement, are happy also, while the sensible people have all the cares. How far it is right to attempt the cure of the insane is another question. The German physician referred to considers it an act of unkindness, if not cruelty, to restore the happy lunatics in asylums again to this world of troublesome realities, while we consider the cure of the lunatics out of the asylums an impossibility. Already Solomon had found this out when he said: "Though thou shouldst bray a fool in a mortar among wheat with a pestle, yet will not his foolishness depart from him."

NEW APPLIANCE FOR HARBOR FIRES.

The recent total loss of the steamer City of New York by fire in this harbor, as well as the extensive destruction of property at Hunter's Point caused by the going to pieces of the burning bark Nictaux, suggest the urgency of new appliances for our harbor fire service, which, had they been in use, would have greatly limited the damage.

If the fire boat Havemeyer had been provided with a ram, so as to be able to scuttle the burning ships as soon as it became evident that the engines were unable to subdue the fire, the ships as well as the cargoes would have been saved with comparatively little loss.

To furnish the Havemeyer with an orthodox ram now would scarcely be advisable, as she has not been built for that purpose, and therefore would have to undergo alterations which would necessitate her withdrawal from service for a considerable time. There is, however, a simple way of fitting her with a ramming apparatus without altering her at all. A long, heavy floating spar, lashed to her side, and protruding from twenty to thirty feet from her bow, might be carried on board, to be used when called for. Experiments alone can decide whether she will be able to bear the strain of the collision when this spar is fastened by strong ropes, which will not part by the contact, or whether the ropes ought to be so thin as to part by the shock. Perhaps it might be found most practicable to cut the lashings a second or two before the collision takes place, and leave it to the impetus of the spar alone to break the burning vessel's side, and enable the Havemeyer to steer clear of the wreck.

The shortest way to scuttle a ship, however, would be the application of *small torpedoes* loaded with some high explosive, for instance dynamite. The torpedoes could be constructed just powerful enough to knock a hole of certain dimensions in a ship's bottom, and might be applied either by a spar from the Havemeyer direct, or, when practicable, they could be fastened to the burning vessel by competent men in a rowboat, and then be exploded by electricity from a safe distance. In cases where the vessel's cargo consists of naphtha or other highly inflammable substances, the spar ram would have to be resorted to.

We have no doubt that General Abbot, commanding the United States Engineer Battalion at Willetts' Point, would be willing to instruct our fire commissioners about the proper charge of dynamite required for the operation, and the authorities of the Brooklyn Navy Yard would be able to give every facility and the best advice for rigging the necessary torpedo spar on board the Havemeyer.

RAIN THEORIES.

Some years ago, at the occasion of a long continued drought, several individuals published suggestions in the papers for means to produce rain. One which was brought prominently forward was that some big fire should be made. According to the theory suggested, the ascending hot air currents, aided by the water formed by the combustion of the hydrogen present in most all ordinary fuel, a copious rain would surely result. As an argument it was brought forward that rain storms have often succeeded large battles, when a great deal of gunpowder was burned. Unfortunately for this theory the amount of hydrogen present in the charcoal of gunpowder is so insignificant as practically to amount to nothing, while the chief products of its combustion are carbonic and sulphurous acids, with free nitrogen and some sulphide of potassium. Statistics also do not sustain the assertion that rains always follow great battles, as there are scores of instances that this was by no means the case. Unfortunately for the theory of the party who suggested the starting of fires for the promotion of rain, shortly afterward the woods took fire in several parts of the Northwest, and even also in New York State, as is frequently the case after long continued drought, but not the least impression was made, and rain did not fall for a long time afterward.

Mr. Bell's suggestion that a single timely rain would pay the cost of one of his rain-towers, described on page 113 of the SCIENTIFIC AMERICAN, may be very true, and that a nation who could control the rain would "prove her wealth and grandeur," but the questions are: Would such a tower have any influence on the rain at all? Are there not local and temporary circumstances which produce ascending and descending air currents much more powerful and extensive than can be produced by any number of such towers? What will the moisture amount to which can be conveyed by an ascending column of air of twenty feet diameter? How will we saturate this ascending air with moisture, or subtract the moisture from the descending clouds so as to diminish their enormous bulk before bottling them up? A mere superficial consideration of these and similar questions shows already the absurdity of the idea, and we would not think it worth while to answer them if the answers did not enable us to incorporate some useful practical ideas.

These questions are answered by the solution of the simple problem in physics, How much moisture such a tower can throw in the atmosphere? and this is easily found. Let us suppose that the inventor is able to saturate this air with moisture, which he cannot do, but for the sake of argument we will suppose the circumstances as favorable as possible, and grant that he succeeds to do this. Let this air have the medium temperature of 60°, then, as it has been demonstrated that such air when saturated can contain not more than seven grains of water per cubic foot, every cubic foot of air thrown upward through the tower will bring so much watery vapor in the atmosphere. As the interior shaft is 20 feet diameter, or nearly 300 square feet surface, and we suppose that he succeeds in moving this air upward at the rate of 15,000 feet per hour, he well get 15,000 × 300, or 4,500,000 cubic feet of air, which for 7 grains per cubic foot gives 7 × 4,500,000 = 31,500,000 grains, or nearly 4,100 pounds of watery vapor per hour. An ordinary locomotive evaporates more than twice this amount, and being high pressure without condensation, throws it all in the atmosphere, so that every working locomotive is, in regard to the cloud-making watery vapor it evolves, equivalent to two of Mr. Bell's rain towers, if not three, as an ordinary locomotive evaporates as much as 12,000 pounds of water per hour, consuming to do this 2,000 pounds of coal, producing from 6,000 to 7,000 pounds of carbonic acid gas and a variable amount of water, from the variable amount of hydrogen in the fuel.

Let us now consider that several hundred locomotives are at present daily running over the plains of Colorado, Utah, and adjacent almost rainless districts, where the air is exceedingly dry, where in many regions there are no lakes or rivers within more than a hundred miles distance, and where most of the rivers always dry up in summer, and are in any case insignificantly small, so small indeed that there exists no navigation even for a row boat. We meet people born there who had never seen even a small sailing vessel or steamboat. Consequently there is no evaporation, and all the moisture in the air and the clouds, seldom seen, must be wafted there by the winds from more favored regions. If, now, in such a region some hundreds of locomotives blow watery vapor in the dry atmosphere at the rate of 12,000 pounds per hour each, which as every pound of steam occupies a place of 25 cubic feet, every locomotive throws 300,000 cubic feet of steam per hour in the atmosphere, which for 100 locomotives, working 7 hours per day, is 100 × 7 × 300,000, or 210,000,000 cubic feet of steam, which mingled with ten times its amount of air may make a respectable little cloud.

This estimate will explain why the climate has changed in many regions of the West, and rains have become more frequent where formerly they were too scarce, and all this since railroads have been built and railroad trains travel daily through the formerly rainless districts.

Natural Silver Plating.

A curious instance of natural silver-plating is reported from the Lord of Lorne Mine, of the American Flat section, Nevada. The sides next to the veins and the hanging walls of the ledge are covered with a thin coating of natural plating of pure silver as smooth as glass. The vein itself is narrow, and is being prospected by means of a tunnel. The superintendent says this peculiar feature of the inclosing walls is observable so far as the tunnel has followed the ledge. The ore of the vein itself is of a soft, easily-worked nature, showing considerable chloride as well as sulphurets, yet not giving very high assays. The filmy deposit of silver on the walls was evidently condensed and forcibly deposited there under immense pressure, as it has a smooth, burnished appearance.

Cotton Factories at Petersburg, Virginia.

The following interesting particulars are given with regard to the cotton industry of Petersburg, Va.: The Ettrick Manufacturing Company have 6,060 spindles and 250 looms, and give employment to 215 operatives. The annual consumption of cotton is 3,000 bales, with a yearly manufacture of 2,900,000 yards of cloth. The Matoaca Manufacturing Company have 9,600 spindles and 260 looms, and give employment to 225 operatives. The consumption of cotton yearly is 2,500 bales, and they turned out last year 3,605,000 yards of cloth. The Battersea Manufacturing Company has 3,600 spindles and 100 looms, and employs 90 operatives. The annual consumption of cotton is 1,500 bales, and the yearly manufacture of cloth 1,300,000 yards. The Petersburg cotton mill has 3,288 spindles, 110 looms, and turns out daily nearly 5,500 yards of goods, such as fine sheetings, shirtings, and drillings. It consumes annually 1,000 bales of raw cotton. The Blandford factory, owned by the same company, located in Blandford, is run by steam, and turns out about 3,000 yards of cloth daily. The Mechanics' cotton factory has 3,600 spindles and 100 looms, and consumes a thousand bales annually, and the manufacture of cloth is 5,500 yards per day, or about 1,650,000 pards per annum.

LAWN MOWING MADE A PLEASURE.

As one recalls the comparatively few closely-cut and well-kept lawns to be seen a few years ago, and now looks about and beholds them on all sides, it becomes evident that the people are better provided with means to gratify the desire to beautify their homes and public grounds, and that at a much less expense than in former days.

The lawn mowers of ten and even five years ago were not only high priced, so that but few could afford to purchase them, but even the smaller sizes were made so heavy and cumbersome to handle, that it required a strong man to put them in practical operation. The cutting apparatus was imperfectly made, and the journals and gearing were unprotected, so that dirt and grass soon clogged up the machine, giving rise to complaints which have led inventors to devise new machines to obviate so far as possible the difficulties of the past; the result is that he who has a lawn can afford to purchase good mowers and cut his own grass.

Among the number of new mowers made with a view of overcoming the difficulties referred to, the one herewith illustrated is at present attracting public attention; and lawn owners in general will find it worthy of careful consideration on account of its marvelous ease of handling while in practical operation, and the numerous improvements which have been applied to it in a very desirable manner.

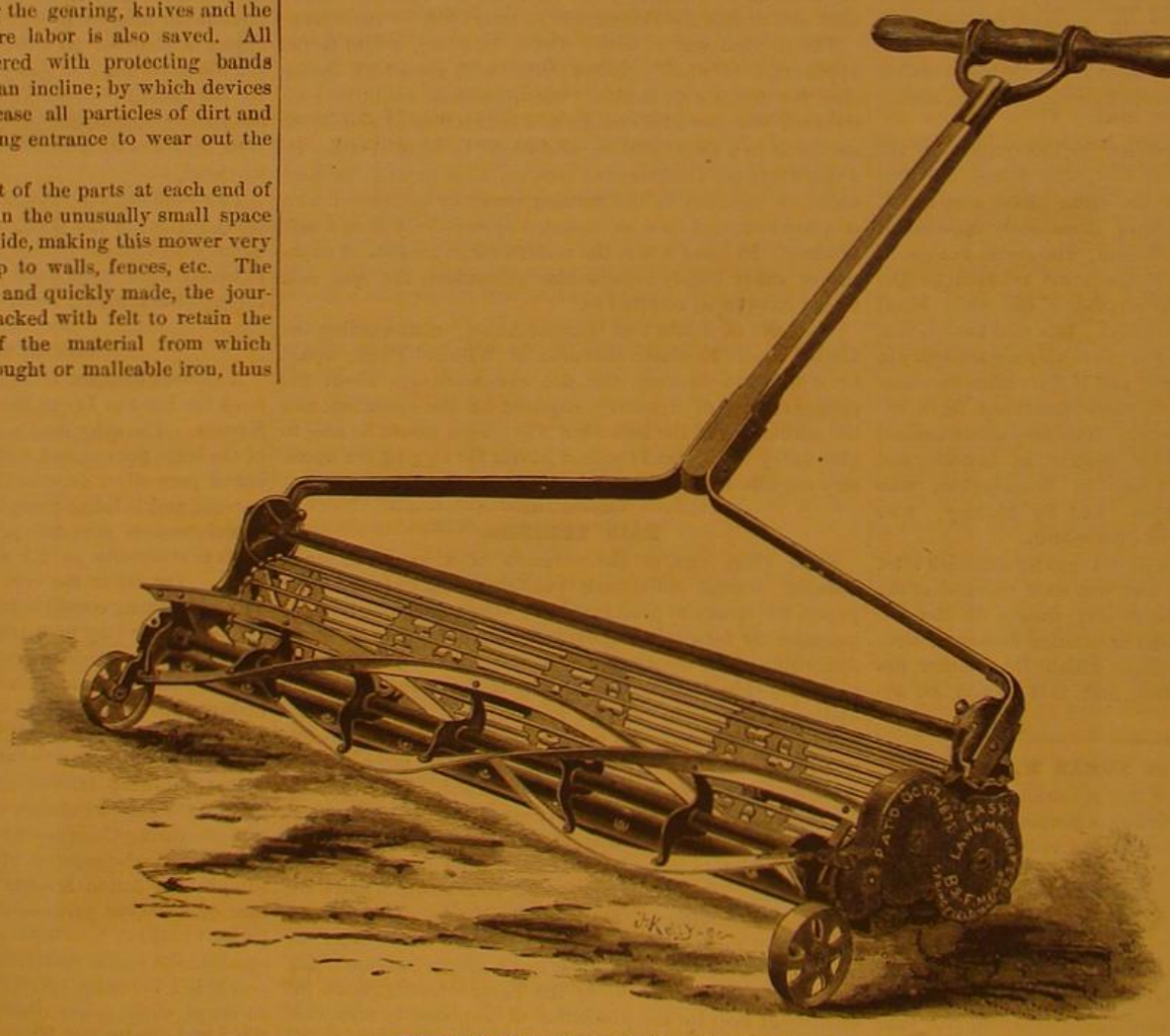
It is well known that a side-wheel mower always runs with one wheel in the standing grass, breaking it down, so that the next time the grass is passed over it is not all cut: and the day after mowing it is frequently the case that rows of standing grass may be noticed on various parts of the lawn.

In the mower herewith shown Mr. H. G. Fiske, the inventor and patentee, avoids using either side or rear wheels, or even a solid roller, the latter being objectionable by making the mower run hard and heavy, and being of but slight service as a means of rolling down the unevenness of the ground. To obtain a means of traction and to make the mower extremely light, he employs an open roller, which is made largely of steel wire, secured at intervals around the circumference of two end disks, and intermediate supports are placed in the longer rollers to make the whole rigid. By this method of construction the roller can be made extremely light; and since the openings are sufficiently large to allow the grass to protrude, the best possible traction is obtained, and that without bringing any of the usually necessary pressure to bear upon it. By this arrangement alone it is said about one half the power required to operate other mowers is saved, and by strictly adhering to true scientific principles in forming the gearing, knives and the journals throughout much more labor is also saved. All the exposed journals are covered with protecting bands and the oil holes are drilled on an incline; by which devices in addition to the tight gear case all particles of dirt and grass are prevented from finding entrance to wear out the movable parts of the mower.

By an ingenious arrangement of the parts at each end of the mower the knives cut within the unusually small space of one inch of the extreme outside, making this mower very convenient in cutting close up to walls, fences, etc. The several adjustments are easily and quickly made, the journals to the cutter shaft are packed with felt to retain the oil, and a large proportion of the material from which the mower is made is steel, wrought or malleable iron, thus procuring great strength with light weight.

The adjustment of the handle is quite convenient and novel in its way, as by means of sliding bolts it may be removed in an instant for the purpose of putting the mower in a small space. The handle may be as quickly applied at any desired elevation, or it may be secured at a forward angle, so that the cutting apparatus may be tilted up from the ground, and by swinging the handle backward to the ground, the entire mechanism is so elevated that by applying a crank to the end of the cutter shaft it may be turned backward, and oil and emery applied for grinding the knives, without specially preparing the mower therefor. The spiral knives are hardened and are made of a hooking shape, that they may be dressed on the front edge with a sharp file for the purpose of keeping a keen edge on them.

The mower, when in operation, is quite silent and would be scarcely noticed by a passer by, and what is not less important, its construction enables a young man to operate a forty inch machine, in quite high grass, for hours at a time with relatively little fatigue. A slight-built boy of ten years of age has been known to cut quite heavy grass for an hour at a time with a twenty-four inch machine. In general appearance the machine is compact, tasteful, and handsomely ornamented. The Blair & Fiske Manufacturing Company, of Springfield, Mass., are the manufacturers of this mower, which they have very appropriately named the "Easy" lawn mower. They are making them in seven sizes, beginning at ten inch cut and ending with a twenty-four inch. They also have a thirty and a forty inch machine, but these are made only to order. The latter is shown in our engraving. Naturally with the many advantages claimed for the "Easy" lawn mower there is little difficulty in attracting the attention of the public and the trade in general. Jobbers throughout the country are rapidly making arrangements for local agencies in their vicinity for next season and very large sales are anticipated.



THE 'EASY" LAWN MOWER.

WITHERS'S IMPROVEMENT IN TEA KETTLES.

IMPROVED TEA KETTLE.

The engraving shows an improvement in tea kettles patented by Mr. W. S. Withers, and now being introduced by Messrs. Withers & Wolfe, 84 Whitehall St., Atlanta, Ga.

This improvement is designed to prevent the possibility of the handle of the kettle becoming heated, a common occurrence with utensils of this class when placed over the fire, and also by the same arrangement to prevent the lid from raising or moving from off the kettle, holding it firmly pressed down when it is tipped or inclined, thus avoiding the escape of hot water and steam.

The invention consists in connecting the bail or handle with the lid or cover of the kettle by a rod, so that when the lid is closed upon the kettle the handle will be held erect, or, if the bail is turned over to the side, the lid, which is hinged to the kettle at that side, will be raised accordingly, and when the handle is grasped to raise the kettle, the lid is prevented from moving either vertically or laterally. When the lid of the kettle is closed the handle is held erect, and when the handle or bail is grasped and the kettle raised, the hinged lid will be held firmly against the body of the kettle over the orifice in its top, and thus prevent the escape of steam or water, as the lid cannot possibly raise or slip to the side, even though the kettle be turned half over in the direction of the spout.

The lid may be raised wholly or partially from off the kettle by depressing the handle, as represented by the view in the background, which dispenses with the trouble and inconvenience of taking hold of the lid for that purpose, as is the case with the ordinary class of vessels of like character. The great advantage of this improvement is that the handle, not being permitted at any time to be in contact with the side of the kettle, cannot become heated.

MISCELLANEOUS INVENTIONS.

Mr. Albert M. Da Costa, of Brooklyn, N. Y., has patented an improved finger guide for type writers, by means of which the keys may be quickly located without the aid of sight.

An improved match box has been patented by Mr. Georg Wenström, of Stockholm, Sweden. It is provided with a sliding cap or inner box, which is divided into two compartments—one for holding matches and the other for receiving the end of the cigar for lighting—and formed with a slit at one side for the insertion of a match within the lighting chamber; also, in a tongue formed on the inner box, which, in connection with an opening in the outer box, forms a cutting device, combined with a chamber formed at the inside of the match box to receive the cuttings.

An improvement in mechanism for mixing and feeding material to the stones of a grinding mill, whereby the action of the mixing and feeding devices is rendered uniform, one being started or arrested at the same time with the other and operated at the like rate of speed, has been patented by Mr. James P. Lowell, of Purcellville, Va.

A machine for sawing shingles from blocks, which is so constructed that the shingles may be sawed with their butts up and down alternately, so that the blocks will be kept square and the length of the shingles will always be in line with the grain of the wood, has been patented by Mr. Elias C. Schermerhorn, of Alder Creek, N. Y.

Mr. William T. Wainwright, of Dry Sawmill, Pa., has patented an improved bench plane, which may be used for square jointing, for beveling, and for rabbeting.

An improvement in stove boards has been patented by Mr. A. Irving Griggs, of New York city. The invention consists in constructing a stove board made with a bead and a hem, and having the lower ply of the hem corrugated and its edge turned up against the plate within the cavity of the bead, and the veneer cemented to the lower side of the middle part of the plate.

An improved coffin handle has been patented by Mr. George S. Eaton, of Brooklyn, E. D., N. Y. The object of this invention is to furnish coffin handles simple in construction, easily and quickly put together, and not liable to break.

Mr. Paul Crippen, of Bronson, Mich., has patented a waterproof paint compound, consisting of alum, coal tar, and sulphur boiled together.

Messrs. Marshall J. Allen, of New York city, and William E. Bradley, of Frankfort, Ky., have patented an improved process of saving the sugar and starch contained in a waste product in the manufacture of whisky and utilizing it. The process consists in freeing the slop from the bran, chaff, and coarse particles of grain, and introducing the liquid thus obtained in place of water in the succeeding operations with fresh grain.

An improved ironing machine has been patented by Mr. John Socias y Rubio, of New York city. This invention is an improvement in the class of machines in which the sad iron is suspended and adjusted vertically by a screw, and is designed to provide means for suspending a sad iron which will allow it to be moved in any direction over the ironing table; also, to suspend the sad iron by yielding or elastic devices, to enable it to be operated easily and efficiently.

Mr. Benjamin F. Sherman, of Ballston Spa, N. Y., has patented an improved hydrocarbon furnace, having the bottom of its combustion chamber made with a series of longitudinal pockets containing asbestos or analogous absorbent material, with perforated oil pipes embedded therein, and with alternating air chambers rising between said pockets and communicating below with the portion of the furnace corresponding to the ash pit, the said air chambers being perforated at the top and surmounted by inclined hoods or sheds which deflect the currents of air down upon the surface of the saturated asbestos.

Mr. Louis Graf, of Van Buren, Ark., has patented a process for producing colored photographs on linen or analogous material, which consists in the employment of a collodion mixture consisting, essentially, of distilled water, nitrate of silver, absolute alcohol, chloride of calcium, citric acid, and ordinary collodion.

An improved strap for baby chairs has been patented by Mrs. Mary W. Blacker, of Brentwood, N. Y. The invention consists in a waist belt having a forked strap attached to the front, which strap is connected with the belt by two side straps, which form loops for passing the baby's legs through, the belt being passed around the baby's waist and one of the rear rounds of the chair back, and then buckled, whereas the forked ends are fastened to the front legs of the chair. Further information may be obtained by addressing Mr. Frank E. Blacker, Brentwood, Suffolk Co., N. Y.

Mr. Frederic A. Weise, of Brooklyn, N. Y., has patented a glass mould designed more especially for making "fountain bottles" and the like, in which the glass may be more evenly or suitably distributed than in the present style of mould, and from which the bottle may be more easily and quickly removed.

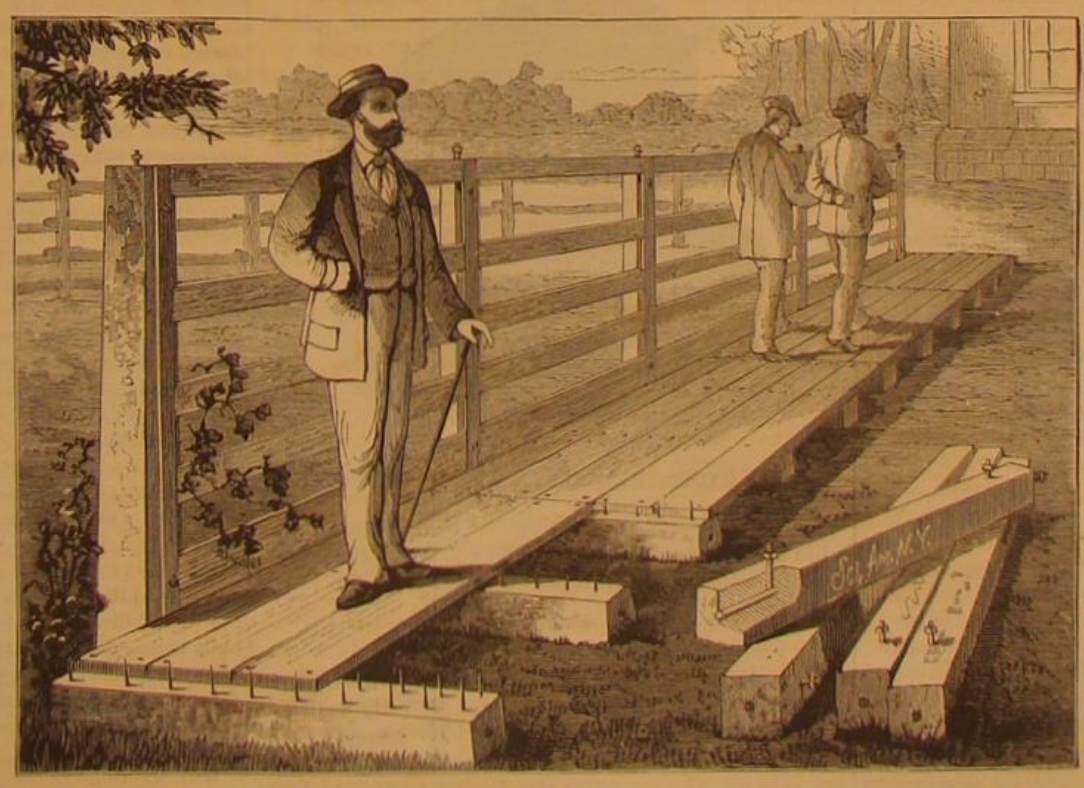
An improvement in the class of planters having reciprocating seed slides, with which auxiliary devices are combined to assist in regulating the discharge of seed, has been patented by Mr. Leonhard Grieser, of Minonk, Ill. The invention consists, mainly, in the employment of a curved reciprocating block or bar, which is located in the hopper and attached to the seed slide, with which it reciprocates simultaneously, so as to alternately open and close one of its two adjacent openings, and thereby alternately permit and prevent the escape of seed through the openings.

Mr. W. I. Wooster, of Harvard, Ill., has patented an improved blind fastener and slat operator, which consists of a slotted strip of wood or metal fixed vertically on a side of the blind and connected with each blind slat, said strip of wood or metal being moved vertically to open or close the slats and to bolt the blind by means of a rod that passes through the window frame.

CONCRETE FENCE POST AND SILL.

The engraving represents a novel fence post, also a sill for plank walks and plank roads, recently patented by Mr. Andrew Climie, of Ann Arbor, Mich. These articles are made of concrete strengthened by iron rods. The process of manufacture is exceedingly simple, and may be successfully conducted by any ordinary laborer. The moulds in which the posts and sills are formed are made of wood and arranged to hold the iron parts in position until the concrete sets. In the post the iron rod extends lengthwise through the center, and is provided with branches which project laterally through the concrete and beyond the surface of the post to receive nuts for holding the fence boards or rails, the ends of the branches being screw-threaded for receiving nuts for this purpose. The posts are planted in the ground like ordinary fence posts. If desired, a top rail or cap may be secured to the top of the post by a nut on the end of the central rod.

The sills or ties for plank walks and roads are moulded in the same way, and are provided with screws or spikes for securing the planks in place. These posts and sills are practically indestructible, and afford a means of building good and durable fences and walks where timber is scarce. This combination of iron and concrete insures great strength and rigidity, and when the question of durability is considered this will undoubtedly be found much cheaper than other kinds of posts.



CLIMIE'S CONCRETE FENCE POST AND SILL.

A Well that Needed Cleaning.

The following articles were taken from a well recently at Pollock, Missouri: Four wash pans, eleven half pint cups, two hats, four tin dippers, one brass tablespoon, one boot and one shoe, and one basket, one teacup and one saucer, two half gallon buckets, one piece of lightning rod. Evidently the family which had used that well was not lacking in small boys as well as general unthrift. Such a rubbish pit, however, might be a much less dangerous source of water supply than many seemingly clean wells with cess pool connections.

NOVEL FOLDING STAND.

The folding stand shown in the annexed engraving was recently patented by Messrs. Freeborn & Chase, and is being largely manufactured by Mr. T. W. Freeborn, of Newport, R. I. It has been well introduced, and has received the indorsement of prominent hotel men and others who have adopted it. It is very simple and practical, consisting of cross legs pivoted to each other, the jointed arms hinged to the upper part of these legs, and a two-part top attached to the jointed arm so as to elevate the stand in the center when folded, and is provided with handles formed by openings on opposite sides of the line between the two parts of the top, so that one motion of the arm of the person using it can be closed or opened instantaneously. It is made into various articles of which the butler's stand is one of the most important. Perhaps the leading feature of the patent is the cutting board, which is appreciated not only by dressmakers and milliners, but by every woman who has her family sewing to do. It has a great advantage over the ordinary lap board, as it can be left with the work on it without disarranging it. It also relieves the operator of all weight, and consequently entails no injury. It can be folded quickly when not desired for use. These stands are made up as chessboards and writing desks; they are also made in the form of a saddle rack, which is appreciated by those who have occasion to clean and dry harnesses.

FREEBORN'S FOLDING STAND.

The dotted lines in the engraving show the movement of the parts in folding. It is not often that a simple invention like this can be applied conveniently to so many useful purposes.

Further information may be obtained by addressing Mr. T. W. Freeborn, P. O. box 108, Newport, R. I.

NEW INVENTIONS.

Mr. Claude I. Wallis, of Memphis, Ala., has patented a simple and convenient pocket pen and brush for marking boxes, packages, etc. It consists of a tube or hollow handle containing an ink reservoir, a brush at one end of the handle inclosed in an elastic thimble, and in communication with the ink reservoir, and of a double-nibbed pen fixed in the opposite end of the handle from the brush.

A frog for timber chutes has been patented by Mr. Henry L. Day, of Truckee, Cal. The invention consists in attaching to the chute, at any convenient point, a frog, which consists of a long timber mortised obliquely into a timber of the chute, and of two or more shorter timbers, whose pointed ends may be entered into the ground, and whose larger ends rest on a cross piece that is set close against the chute in the angle made by the timber and the chute. It is stated that when other conditions are equal, this frog enables one to deliver in a given time one-third more logs than can be delivered by the old method of rolling them into the chute. Timber chutes are sometimes three or four miles long.

Simon J. Freeman, of New York City, has patented a fastener for meeting rails of sashes, so constructed as to fasten the sashes automatically as the sash is closed, which cannot be unfastened from the outer side of the window.

An apparatus for the manufacture of ice has been patented by Mr. Andrew J. Zilker, of Austin, Texas. The object of this invention is to provide means by which artificial ice may be detached from the moulds in unbroken blocks.

Mr. John R. Pafford, of Cuero, Texas, has patented a light, cheap, portable, and durable bed bottom, which can be fitted to any bedstead.

Mr. Horatio N. Bill, of Willimantic, Conn., has patented an improvement in fire kindlings and machine for manufacturing the same. The object of the invention is to make a cheap and readily-ignited kindling block.

Mr. Patrick W. Groom, of St. Louis, Mo., has patented an improved handle socket strap for shovels, spades, and scoops. The invention consists in combining a flanged socket with a recessed blade.

An improved gate has been patented by Mr. William H. Tobey, of Livonia, Mo. The invention consists in a gate having one or more of its lower rails made in two parts, correspondingly beveled where they meet between the braces, and one of them secured at its unbeveled end by a detachable pin.

An improvement in hame tugs has been patented by Mr. Jacob E. Moeller, of Centralia, Ill. This invention relates to that portion of carriage harness which is used for adjustably connecting the forward end of the trace with the hook or cockeye of the hames.

An improved seat lock has been patented by Mr. John L. Dolson, of Charlotte, Mich. The object of this invention is to furnish fasteners for the seats of spring wagons and other vehicles, so constructed as to hold the seats securely and allow them to be readily removed and adjusted.

Mr. Richard Ray, of Lake City, Fla., has patented an improved umbrella or sunshade, so constructed in the top or cover as to more effectually protect the person from the rays of the sun or from rain.

An improvement in umbrellas of that form in which some of the ribs are longer than the others, or in which the staff is connected eccentrically to the cover, to allow the person to occupy the center of shelter and be better protected from rain or the sun's rays, has been patented by Mr. Alexander H. Ege, of Mechanicsburg, Pa.

A compound rotary and reciprocating churn in which is employed a rotary dasher to whip the milk, in combination with a reciprocating dash to displace the liquid, so that the entire liquid contents of the churn may be quickly and continuously presented to the action of the rotary paddle or dash by the movement of the reciprocating dash, has been patented by Mr. Andrew Mearns, of Tolesborough, Ky.

Mr. Rhodes Arnold, of Waltham, Mass., has patented a novel arrangement of the bridle rein, whereby the rider is enabled to exercise control over the animal without exerting great power and without extraordinary strain upon the rein itself.

An improvement in horse collar fastenings has been patented by Messrs. Ebenezer Fisher and John Watson, of Kincardine, Ontario, Canada. This invention relates to an improved fastening for metallic horse collars, more particularly for that for which the same inventors have received letters patent of the United States No. 224,671.

An improved form of mail bag for horseback routes, designed to facilitate the packing of mail matter therein and its removal therefrom, has been patented by Mr. Thomas J. Mayo, of Paintsville, Ky.

Mr. Goldsborough Robinson, of Louisville, Ky., has patented a novel process and apparatus designed especially for drying leaf tobacco after saturation with alcohol for improving its color and quality, but applicable generally to the recovery of any volatile liquid which has been used in the treatment of another substance to which it adheres.

Mr. Ambrose Giraudat, of Neury, N. J., has patented a machine for cutting lace from paper to be used for ornamenting paper boxes, cigar boxes, and for other purposes.

Mr. Otis E. Drown, of Pawtucket, R. I., has patented an improved machine for breaking, rubbing, and stretching raw hide in the manufacture of leather for belting and lacing. This work has heretofore been done by winding the hides on shafts or drums while tension was applied by fixed bars between which the hides were stretched The object of this invention is to facilitate the operation and permit regulation of the tension.

A cheap and simple device, especially designed for railroad cars, to be affixed to the outsides thereof for holding and protecting cards of address, etc., has been patented by Mr. Frederick G. Hunter, of Moncton, New Brunswick.

An improved gate has been patented by Mr. Arza B. Minton, of Philomath, Oregon. The invention relates to that class of farm gates which are operated by means of cords suspended from posts, and has for its object to furnish an improved mechanism for opening and closing the gates.

Mr. Joseph C. Fowler, of Arcola, Texas, has patented an improvement in running gear for wagons. The improvement relates to king bolts and coupling devices for connecting the forward axle of wagons, carriages, and other vehicles, and it consists in a king pin or bolt which passes from a socket in the bolster through braces and enters a socket in the top bar of the axle, where it is held by a cross pin, the bolt and braces thereby sustaining the weight. The lower end of the bolt is formed as a rounded bearing in a direction transversely of the vehicle, so that the forward wheels and axle may conform to the ground without effect no the wagon body.

Mr. Edward Seyfarth, of Lanark, Ill., has patented an improved ear piercer, so constructed that the puncture can be made exactly in the desired spot and so quickly as to be painless.

Mr. John B. Haskell, of Staunton, Va., has patented an improvement in the class of pails and cans which are constructed with hollow walls or in part of some material which is a bad conductor of heat for the purpose of preserving food for a considerable time at a temperature which is either above or below that of the surrounding atmosphere.

An improvement in pipe couplings has been patented by Messrs David B. Hand and Ephraim H. Reitzel, of Columbia, Pa. This invention particularly relates to a means for connecting the heating pipes between the cars of a railway train, but is also applicable to other purposes. It consists in a novel construction and arrangement of coupling devices, whereby provision is made for affording a universal motion to the pipes

Native American Minerals.

Professor R. Pumpelly, Special Census Agent, Newport, R. I., wishes to obtain information, for use in the forthcoming census report, in regard to the occurrence in the United States of the *raw material* from which the substances named in the appended list are obtained.

Any aid which our readers can give us, either by a list of the localities where the raw material of one or more of the substances named is found, or by a list of the persons or firms from whom we can obtain such information, will be thankfully received by Professor Pumpelly, at the above address. The substances referred to are:

Apatite,	Iron pyrites (for sulphuric acid),
Asbestos,	Kaolin,
Asphaltum (albertite),	Lithium,
Arsenic,	Manganese,
Antimony,	Molybdenum,
Bismuth,	Magnesia,
Borax,	Mica,
Chrome,	Nickel,
Cobalt,	Niter,
Corundum and Emery,	Serpentine,
Hydraulic cement,	Slate pencils,
Fluorspar,	Soda,
Feldspar (for potash),	Soapstone,
Grahamite,	Talc,
Graphite,	Tin,
Gypsum,	Whetstone or novaculite,
Glass sand,	Wolfram or tungsten,
Infusorial earths,	Zinc.

Legal Recognition of the Nature of the Small Boy.

A Western railroad company was sued for damages on account of injuries to a small boy who was surreptitiously playing on a turn-table. The case was brought before the Kansas Supreme Court, which decided in favor of the plaintiff. The court said:

"Everybody knows that by nature and by instinct boys love to ride, and love to move by other means than their own locomotion. They will cling to the hind ends of moving wagons, ride upon swings and swinging gates, slide upon cellar doors and the rails of staircases, pull sleds up hill in order to ride down upon them on the snow, and even pay to ride upon imitation horses and imitation chariots swung around in a circle by means of steam or horse power. This last is very much like riding around in a circle upon a turn table. Now, everybody, knowing the nature and the instincts common to all boys, must act accordingly. No person has a right to leave, even on his own land, dangerous machinery calculated to attract and entice boys to it, there to be injured, unless he first takes proper steps to guard against all danger; and any person who thus does leave dangerous machinery exposed, without first providing against all danger, is guilty of negligence."

CONVENIENT PORTABLE BATHING APPARATUS.

The annexed cuts, which we take from *La Nature*, represent a simple, practical, and compact shower bath, or hydro-

Fig. 1.—HYDRO-THERAPEUTIC APPARATUS IN OPERATION.

therapeutic apparatus, as the inventor, Mr. Gaston Bozérian, of Paris, names it. In Fig. 1 the apparatus is shown in operation, and in Fig. 2 is shown folded and packed for storage or transporation. A description of this operation is scarcely necessary, as the engraving fully illustrates it.

A traveler can take such a bathing apparatus with him and enjoy all the comforts afforded him at home or in city hotels. The apparatus can be adjusted to deliver water from above or from below, or from above and below at the same time, as shown. The ring can be adjusted according to the height of the person, for adults or children, and in the latter case a grown person can do the pumping. As can be seen, the apparatus can be taken apart and packed to occupy the

Fig. 2.—HYDRO-THERAPEUTIC APPARATUS PACKED.

space of a large tin pan, and can be readily stored away when not in use. It has a slatted floor to which the pumps, etc., are fastened. This floor is removed when the pan is cleaned.

ROPE JUMPING.

As cooler weather approaches the jumping rope will be more and more in the hands of girls. Properly used it is not an objectionable plaything. But children cannot be too frequently cautioned against jumping against time or competing to see who can jump the greatest number of times without stopping. In an essay on popular customs on public health in the recently published annual report of the Department of Statistics of Indiana, Dr. J. W. Hervey, of Indianapolis, lays great stress on the danger of this practice. None, he says, is more injurious; and in illustration of its evil effects he mentions a case of real occurrence in that city. The patient, a girl of twelve years, was dead when he reached the house. He says: "On inquiry I learned that she had jumped the rope at school, a few days before, five hundred times. Think of five hundred rushes of blood upon the little heart in quick succession! No wonder I had to make the certificate of death, 'Emboli, or clot in the heart, caused by overheat and jumping straight up five hundred times.'"

Not only does this practice throw a great and sometimes killing strain upon the heart, but it often causes serious injury to the joints of the knees and hips and to the spine. The muscular and nervous exhaustion, due to long continued jumping, must also be injurious.

To Tie the Cotton Crop.

About seventy-five thousand miles of hoop iron—enough for a three-fold girdle around the earth—will be needed to bind the forthcoming cotton crop, if it reaches the number of bales predicted by statisticians, or 6,000,000 bales. The number of bands required is six to a bale, or 36,000,000 in all. They are of uniform size, 11 feet in length, and 1,200 weigh a ton. Hence there will be required 30,000 tons of hoop iron, with a total length of 396,000,000 feet. The cost of ties will be about $3,000,000.

Correspondence.

A Light Road Locomotive Wanted.

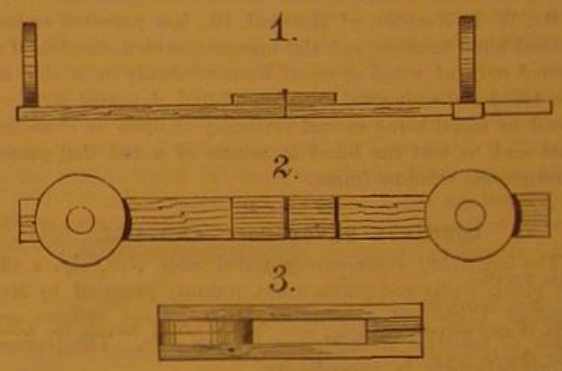
To the Editor of the Scientific American:

The bicycle, as now made, is a practical, and, to many, a valuable invention. Now, whoever will bring out a three-wheeled machine, that shall not weigh over two hundred pounds, that is driven by a neat, safe, and light motor, will not only realize a fortune, but confer a benefit on the race. We need a machine that can be started under full headway in five minutes or less from the time a match is ignited, that can run over our country roads as fast as ten miles per hour. D. H. S.

Folding Telescope.

To the Editor of the Scientific American:

It is rather singular that the spy-glass described in your paper (No. 5, Vol. XLIII.) should not long since have come into general use, and that it should so long have been considered necessary to have the lenses inclosed in a case and with so small an aperture in the eye-piece as is generally used. I have made spy-glasses with but two lenses, by fitting the lenses into flat wooden disks and hinging them to a flat bar a little wider than the lenses, the bar being made of two pieces connected together by a hinge, so that they could be folded together with the lenses between them, thus:



But no good effect can be produced with lenses of short focus, as the greater the length of focus the greater will be the magnifying power; convex lenses of not less than forty inches focus producing the best effect, with concave lenses anywhere between nine and fourteen inches, and with an aperture of sufficient size to allow of being held at a short distance from the eye.

JAMES A. BAZIN.

Canton, Mass., July 27, 1880.

The Accident at the Hudson River Tunnel.

To the Editor of the Scientific American:

1. In your excellent paper of August 7, I find a diagram of the tunnel disaster (page 80) which differs some from other sketches, in that the break occurred at the commencement of the tunnel, while in other representations it occurred at the end of the air lock. Which is correct?

2. Why was the *bottom* of the air lock placed on a level with the *top* of the tunnel?

3. Why was the tunnel *commenced* thirty feet from the shaft?

Doubtless some good reason exists for the plan, and I, for one, would like to know what it is.

4. Could the accident have occurred if the tunnel had been built square out from the bottom of the shaft, and the air lock put in on the floor of the tunnel?

I have conversed with many practical Colorado miners, and none can give a reason for the peculiar manner in which the tunnel is started. E. W.

Boulder, Col.

[ANSWER.—1. At the time of the accident it was not known exactly where the break first started; it was given to us, by Col. Haskins himself, as starting at the place shown in our diagram. 2. The location of the air lock was arbitrary; in the haste, after legal interferences, to test the compressed air system, it was placed where it now is—simply for convenience at the time. 3. The tunnel was commenced at the distance it now is for the reason that the limit of tests was reached; then the practical portion commenced. Col. Haskins says the New York end will be started as they are now arranging the New Jersey end—from a caisson with air locks from the top. 4. It is impossible to say if the accident could have occurred with the tunnel projected directly from the shaft, with the air lock at the bottom of the tunnel; but it is reasonable to suppose it would have been the strongest possible method.]

AMERICAN INDUSTRIES.—No. 55.

THE MANUFACTURE OF PUMPING ENGINES AND WATER METERS.

Perhaps no department of invention has developed more rapidly than the one we now illustrate. When the attention of Mr. Henry R. Worthington was first turned to the subject such a thing as an independent steam pump was hardly known. Steamboats and steamships had no provision for running either fire, bilge, or boiler-feeding pumps when the main engine was at rest—a condition of helplessness and danger hardly to be imagined at the present time. Steam pumps for mills, factories, hotels, office and public buildings, and the thousand and one uses to which they are now applied were not then known.

The Worthington steam pumping engine, in its latest and best form, has two steam cylinders and two pumps, which are cast together to form one machine, and the pistons and valves of the two engines are so connected that the right-hand division moves the steam valve of the left-hand one and *vice versa*. No tappet, crank, or other rotary device is employed. As the right-hand piston nearly reaches the end of its stroke the other starts, in such time as to keep the water flowing in a constant and unvarying stream. The plungers are thus permitted to halt momentarily, and allow the water valves to seat without slamming, while by the combined action of the two pistons a uniform pressure and velocity of water is maintained. In all other forms of steam pumps, especially when applied to heavy resistances, or run at quick speed, there is more or less concussion of the water valves at each stroke. In a number of important services this objection has led to the exclusive adoption of the Worthington. On oil pipe lines, for example, any jar strains the joints in the pipe and causes heavy losses from leaks. In this service Worthington pumping engines are entirely successful. Some of them now at work have a capacity of 1,500 barrels of oil per day, forced through 100 miles of pipe against a pressure of 1,500 pounds per square inch—equal to a vertical lift of 3,400 feet. This is the most severe pumping service yet undertaken in this country.

The arrangement of this engine allows the use of the ordinary slide valve, such as is found on locomotives and other forms of crank engines. Single cylinder pumps are usually constructed with auxiliary piston valve throws, more or less complicated in detail. The slide valve, on the contrary, is the simplest form of steam valve known to engineers. It has no cavities in which water can collect and freeze; no tight-fitting surfaces to become rusted or adhesive; no leaks resulting from wear, or trouble from unequal expansion of the parts. As one or the other of the steam valves must be open always, there can be no dead point in the stroke. The pump is therefore ready to start when steam is admitted, and is managed by the simple opening and shutting of the throttle valve.

Mr. Worthington's offices are at 239 Broadway, New York; 83 Water street, Boston; and 709 Market street, St. Louis. In the factory, which covers an area of nearly two blocks, in South Brooklyn, L. I., there are about 500 men employed at present, working full time, and large extensions of the works are now in progress to meet the unusual demand which has succeeded the long period of commercial depression. The increase in the demand for small steam pumps for ordinary work, such as hydraulic elevator service, fire protection, railway water stations, boiler-feeding pumps, etc., has been especially remarkable.

A large force of workmen are also engaged in the construction of Worthington water meters. These machines, of which there are now over 20,000 in daily use, have been adopted by all the principal water works in the United States and Canada.

In a pamphlet published by Mr. Worthington, we find a full and interesting history of the rise and progress of his pumping engine, from which we make a brief extract. It was written at the request of the Society of Civil Engineers for use at the Centennial Exhibition. He says:

"Somewhere about the year 1840 I was engaged in experiments with a steamboat designed for canal navigation. It frequently happened that the boat was suddenly stopped by unexpected impediments in navigation or detention at locks. This often brought a hand pump into lively requisition for keeping up the boiler supply, and naturally turned my thoughts toward a labor-saving method. The result was the independent feeding pump, patented on the 7th day of September, 1844. In the course of my experience I made many arrangements for using the spring, other than that exhibited in the patent of 1844.

"This, so far as I know, was the beginning of that numerous class of following inventions for storing power to act upon the steam valve, when the momentum of the moving parts was insufficient to throw it through its full distance of travel.

"The step from this spring motion to the use of an independent piston for driving the valve was obvious enough, and very soon made.

"I should weary you by undertaking to set forth any considerable part of the numerous engines made on the general basis here indicated. I believe almost every change was rung upon a steam valve throw, but in those days the amount of refinement and complication attending their construction and management seemed to be an insuperable bar to their rapid introduction. Upon the smallest provocation the use of a steam pump would be abandoned and the old well-tried arrangements resumed; for no work was fitted up with reference to the exclusive use of a steam pump—it was always secondary. Even so good an authority as the late Mr. James P. Allaire nearly reduced me to hopeless inaction, by saying he considered it his duty to tell me that I was trying to invent a machine that was not wanted; that no part of the machinery, either for steamboats or factory purposes, was more satisfactory and complete than that for pumping. And this appeared to be the opinion of almost every engineer. Another opinion expressed by a prominent engineer of the day, Mr. Alfred Stillman, of the Novelty Works, was sufficiently discouraging at the time, yet of great value, as compelling me to look still further. He came to my works one day to inspect the last and best arrangement of piston valve throw. After a careful and quiet consideration of the case for a few minutes, instead of the approval which I not only expected but needed, he said: 'This is all very well and very ingenious, but if you expect to bring these things into general use you must contrive to have a man see something he has seen before in his life, when he takes the cover off from a steam chest.' There was no appeal in those days from the decision of the Novelty Works, and this one might well be called conclusive.

"The desideratum of a direct-acting steam pump with a simple ordinary slide valve was at last accomplished, and from its discovery may date the real introduction and popularity of a class of machines which now covers the length and breadth of the land.

"I would call attention to a principle of construction first adopted in a pump used on board the steamer Washington in 1850. Up to that time my practice, and I believe the concurrent practice of the day, was to make a large water valve with considerable lift. A moment's reflection will show that when the motion of a pump changes, the valves are in a wrong relation thereto, and must be immediately changed. For an instant of time, therefore, the resistance is suspended much as in the case of a gear suddenly reversed and producing back lash. My idea was, by the employment of a large number of diminutive valves, each one insignificant, and with but a small fraction of an inch of lift, but aggregating in an ample water way, to reduce this lost interval and keep the valves nearer to their seats, thus enabling them to get home in less time. The valve adopted was a plain India-rubber disk half an inch thick, and working upon a central stem over a series of half inch holes, with a lift of not over a quarter of an inch. There were nine of these in each chamber of the Washington pump, making thirty-six in all. I offer a drawing of this pump with its valve arrangement, not only as marking the time of its introduction, but because it represents my present views in the construction of all pumps designed for important purposes.

"I come next to a point in my experience of great importance, involving new considerations and justifying much greater cost and complication of engineering than any hitherto called for in my business. I refer to the department of water works for cities and towns. My first connection with any important enterprise of this kind was at the city of Savannah in the year 1854.

"A duplicate of the Savannah engine was erected at Cambridge, Mass., in the year 1856. This engine was first tested by Messrs. W. E. Morris and Samuel McElroy, with the result of 70,463,750 pounds duty.

"From the time of its first introduction the progress of this engine toward its present popularity has been steady and rapid. They are now found in more than 200 water work stations in this country and Canada, numbering 230 engines, and aggregating, in a delivering capacity, 430,000,000 gallons per day. It may be said, without fear of contradiction, that they have been successful and well approved. Nothing approaching even an inconvenient stoppage of a water supply has yet been traced to their failure. While trivial breakages or the necessity for larger or more permanent repairs has occurred, no breakdown or disaster has ever taken place.

"The remarkable exemption of these engines from the numerous accidents to which ordinary pumping engines are liable, leads to a consideration of the philosophy of their action and cause of this immunity.

"How should a pumping engine be made to reciprocate quietly? A careful consideration of the causes at work suggests the answer. To think of the difficulty is almost to find the remedy.

"I claim that it should be accepted as proved that the cessation of motion at the end of the stroke, for a length of time sufficient to allow the seating of the valves by gravity, instead of by the action of the return currents, will completely obviate noisy, imperfect, and injurious action."

Mr. Worthington concludes this communication as follows:

"I have endeavored to touch upon every point upon which I depend to prove that I have made an important, radical, and permanent improvement in the hydraulic machinery upon which towns and cities depend for their water supply. If the question were only to decide between a durable and reliable engine, or one of opposite characteristics possessing great refinements of construction, it would be without doubt speedily answered in favor of the first-named engine, regardless of relative cost. On these points I trust I have shown that the engine which bears my name has taken and maintained the highest ground, and unless the calculations which I have offered as to the cost of investment be impeached and finally rejected, I may claim to have further shown that the engine is also superior in point of economy, commercially and practically considered. In addition, the size and cost of the requisite buildings are reduced at least twenty-five per cent, and the cost of foundations in much larger proportion. The necessity for stand-pipes or similar provision for softening the shock is obviated. In a word, I am able to point to a record of almost unqualified success in the performance of more than 200 large and important water work stations, unbroken by disaster or change. No water work engine of mine has yet been superseded by one of another form of construction, either for fault or by the demand for increased supply. I therefore respectfully ask that my case may be considered with care and candor, hoping that you will substantiate my claim to the high honor of having originated a pumping engine which is worthy to be mentioned as constituting a part of American progress in this most useful and arduous department of mechanical engineering."

Our first page represents various departments of these immense works, and the works themselves are shown in one of the upper views in the engraving. The central view represents the fine compound pumping engine of the Newark, N. J., water works, having a capacity of 8,000,000 gallons daily. On the right is shown one of the smaller pumping engines, and on the left a water meter. The lower view shows the department in which the heavy work is erected. The work in progress at the time of the sketch and shown in the engraving is one of the heavy engines for pumping oil under great pressure.

Grimmer's Prophecy.

An anxious reader submits a reprint of an extended and direful prophecy made about a year ago by C. A. Grimmer, of Kingston, Jamaica, and asks our opinion of it.

Mr. Grimmer professes to be an astrologist, and to base his predictions upon the position of the four great planets, whose conjunction in 1880 will produce "one universal carnival of death" from 1880 to 1887. During this period the elements are to play high jinks; things will be turned upside down generally by earthquakes and frightful storms, which will convert the whole world into a universal Sodom and Gomorrah. Famines, plagues, inundations, wars of mutual extermination, and other unpleasantnesses will conspire to exterminate pretty much all the animal and human life that escapes the elemental cahobbery, until August, 1887, when the Star of Bethlehem will arise, and things be worse than ever. "After that," the precise time being unhappily not stated, good times will come again, and whoever is lucky enough to remain alive, will live twice as long as he ever did, "owing to the healthy electricity or magnetism that will surround the globe."

This general outline is filled in by Mr. Grimmer with a parade of learning and a wealth of horrible detail well calculated to deceive and alarm the timid and superstitious. The circumstance that his astronomy is as wild as his insane imagination takes somewhat from the edge of his prophecy in the minds of the cooler and more intelligent. Comfort may also be drawn from the fact that the larger part of 1880 has already passed away, and yet the malefic influence of Saturn, Uranus, and the rest of the planetary malefactors, has not been able to inaugurate any of the pestilential storms, famines, civil wars, and other horrors predicted. If the rest of the seven years are off the same pattern, as they promise to be, a fair proportion of those now living will be able to look back upon them, by and by, with reasonable satisfaction. Anyhow, it is too early and too late to be badly scared.

An Exhibition of Gas and Electrical Appliances.

The Philosophical Society of Glasgow, Scotland, propose to have an exhibition of apparatus for the utilization of gas, electricity, etc., during the month ending October 25, next. The exhibits will include apparatus, models, and drawings relating to or illustrating:

1. *Coal Gas.*—Its manufacture, purification, storage, distribution, regulation of pressure and measurement. Its utilization in lighting, heating, cooking, ventilating, and as a motive power. Photometric testing of gas or other sources of light. Residual products of gas manufacture, coke, tar, benzole, aniline dyes, ammonia salts, etc.

2. *Oils, Oil Gases, Candles.*—Their manufacture and use for lighting, heating, cooking, and motive power.

3. *Electricity.*—Its generation and application for lighting, telegraphy, motive power, etc.

4. *Hydraulic Appliances.*—Motors suitable for comparison with gas motors, and apparatus for the measurement and regulation of the flow and pressure of water.

5. *Architectural Appliances.*—More especially those which relate to lighting, ventilation, heating, and lightning conduction, and architectural ironwork and sanitary appliances, such as can be exhibited in the open grounds.

6. *Miscellaneous Apparatus.*—Gas lighted buoys, fog horns, miners' safety lamps, fire damp indicators, and apparatus for lighthouse illumination, ventilation of mines, etc.

Hop Growing in the United States.

At a recent annual meeting of the Hop Growers' Association of Central New York, one of the speakers called attention to the remarkable growth of the hop industry of this country, as shown in the following statistics:

Total hops grown in the United States in 1839, 6,193 bales; in 1859, 55,055 bales; in 1879 (estimated), 110,000 bales.

The estimate for the current year runs between 120,000 and 125,000 bales. With the increase in quantity grown there has been a considerable increase in price, the average for the decade just ended being 8½ cents a pound more than the average of the decade just preceding the war.

The English Patent Laws.

The engineering journals and nearly all classes of industrial newspapers of London are seriously advocating a change in the English patent laws whereby the cost of patents shall be so reduced as to enable British workmen to secure to themselves their inventions. Under the present law, which seems to have been enacted for the sole benefit of the capitalist and manufacturer, the rights of the inventor are disregarded. The employer patents for his own benefit his workman's invention, and some of the newspapers find fault with Her Majesty's Parliament for the lack of interest which the members manifest on the subject in not bringing up the new patent bill for discussion.

The *Chemical Review*, lamenting over the inertness of Parliament on the proposed amendment bill, says the subject is attracting no attention within that body, and adds:

"As a nation we forget the old proverb: 'For want of a nail the shoe was lost, for want of a shoe the horse was lost, for want of a horse the rider was lost, and overtaken by the enemy.' A good patent law, which shall enable even the poor man to protect his right to his own ideas, is the nail. May we not then say, 'For want of a good patent law invention was lost, for want of invention our industrial pre-eminence was lost, and for want of industrial pre-eminence the nation was lost, being overtaken by its enemies, or, as they are called in the dialect of the day, its competitors'?

"It is sad, and at the same time almost farcical, to see what 'trifles light as air' engross public attention in preference to what is, in fact, the very key not merely to our prosperity, but to our very existence. The interests of invention ignored, and crowded meetings assembled to protest against the monument to the late so-called Prince Imperial! Surely John Bull must for ever abandon his old claim to practical common sense, and be content to rank for the rest of his days as a maudlin, moon-struck, hysterical sentimentalist!"

ENGINEERING INVENTIONS.

Mr. Marshall Wood, of Alderson, W. Va., has patented an improved railway switch which is adapted to be opened and closed by the passing engine, and it dispenses with the frog usually placed at the crossing of the rails of the switch and main track.

Mr. Eugene H. Angamar, of New Orleans, La., has patented improved apparatus for removing snow and ice from railroads and streets by heat; and the invention consists in a double furnace mounted on wheels, the wheels being incased within the fire boxes of the furnace, so that when used the whole apparatus will become highly heated, and the snow and ice melted by radiation of heat and contact with the heated surfaces.

Mr. John G. Curtis, of Ludlow, Pa., has patented a sectional boiler. The object of this invention is to provide a simple and inexpensive boiler, designed especially for burning wet tan, sawdust, etc. It is so constructed that the tubes may contract and expand without straining the joints, and so that any of the tubes may be removed for repairs and replaced without disturbing the others.

Mr. Junius Poitevent, of Ocean Springs, Miss., has patented an improved traction engine, so constructed that it may be used at will with full power for traction purposes, or as a stationary engine. The engine is especially adapted for plowing.

The Mexican Calendar Stone.

A Mexican archæologist, Señor Alfredo Chavero, has written a book to prove that the famous Aztec "calendar stone" was never intended or used as a calendar. His study of Aztec hieroglyphs leads him to the conclusion that the stone was an altar of the Mexican sun god, and the characters, hitherto supposed to be signs of the zodiac, are records of Aztec cosmogony and theogony. When they are fully interpreted, he says, we shall know positively what progress the Aztecs had made in science and religion.

Platinum and Iridium in Maine.

The list of metals now found in native condition in Maine comprises copper, silver, gold, antimony, bismuth, platinum, and iridium. The last two have recently been found in the Rangeley Lake region, associated with gold, by Mr. R. B. King, of Portland. In reporting upon some of the specimens furnished by Mr. King, the State Chemist, Mr. F. L. Bartlett, says:

"My analysis proved the compound to be gold, platinum, and iridium, and possibly osmium and some others of the rarer metals, although no tests were made for anything but gold, platinum, and iridium, the quantity not being large enough to operate on in testing for other metals, which at best occur only in minute quantities, yet usually associated with the platinum ores."

Mr. King also submitted for analysis some peculiar black sand, suspected to contain tin. It proved to be menaccanite or titaniferous iron, containing over twenty-five per cent of titanium. The finding of so many rare elements together, adds Mr. Bartlett, is interesting, and calls for further exploration. Platinum is a rare and valuable metal, and it appears to be quite abundant in the sands from Rangeley; it is not at all improbable that it may yet be worked to advantage in this region.

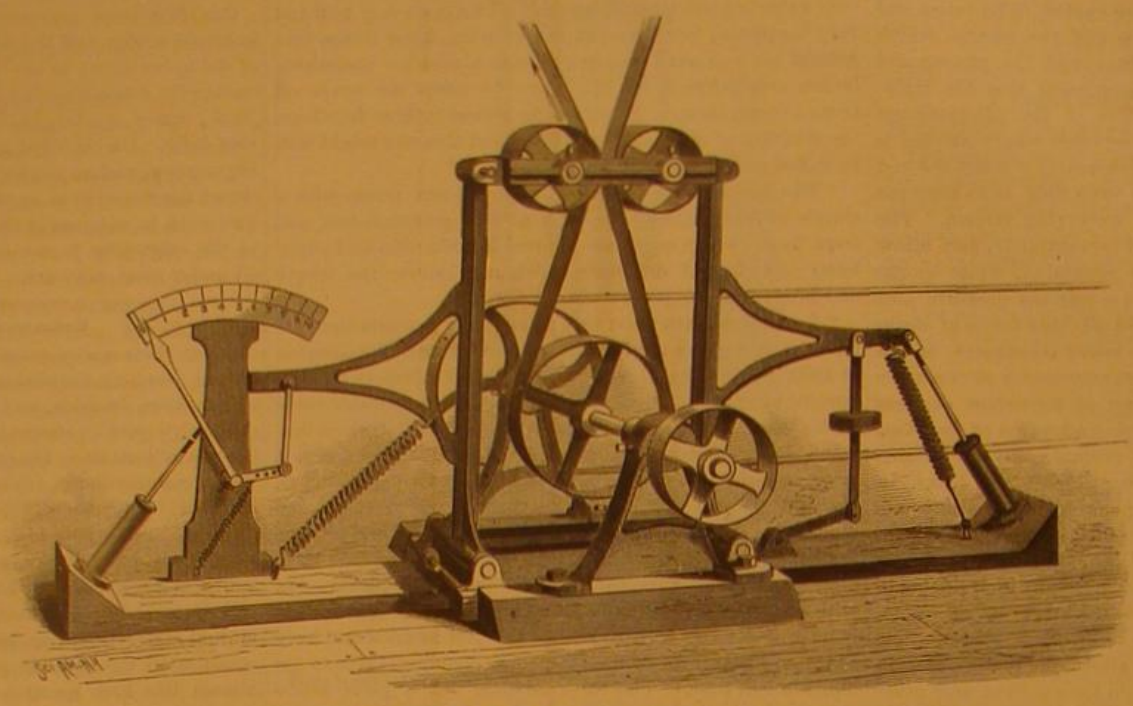


Fig. 1.—MAXIM'S DYNAMOMETER.

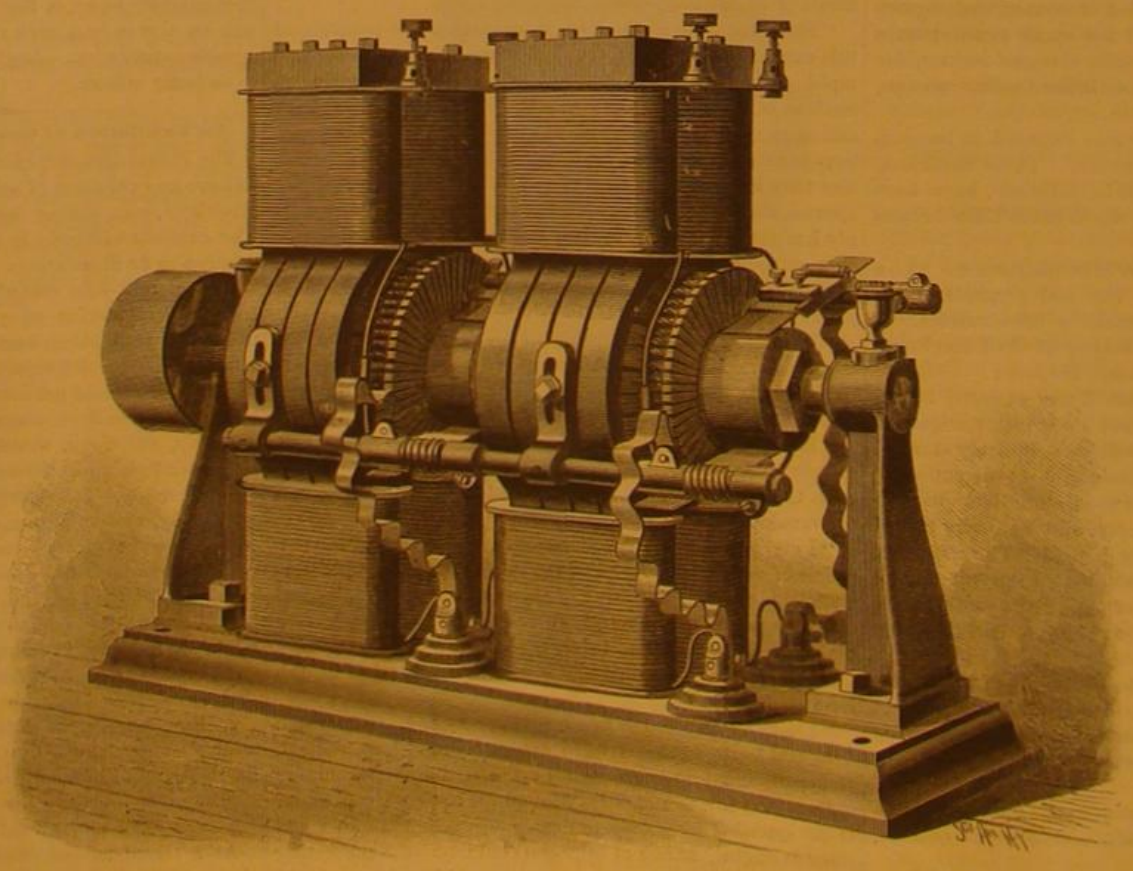


Fig. 2.—MAXIM'S DYNAMO-ELECTRIC MACHINE.

SOME NEW ELECTRICAL MACHINERY.

We give engravings of electric light machinery lately perfected by H. S. Maxim, M.E., of this city.

Fig. 1 represents a double current machine, so constructed that it furnishes two separate currents entirely independent of each other, that may be used to produce two large electric lights, or may be coupled for quantity in one very large light, or may be coupled for tension in one strong current of great electromotive force. It is, therefore, not only well calculated for the electric light, but makes an admirable machine for scientific and experimental purposes. Mr. Maxim calls machines of this kind dynamo-magneto-electrical, as they convert dynamic energy through the agency of magnets into electrical energy. In the construction of these machines great care is required to so arrange and proportion the parts that the greatest possible amount of the energy consumed appears in the electrical current. Not only must the current be accurately measured, but the power employed to produce it must also be measured.

Mr. Maxim has constructed a peculiar dynamometer, shown in Fig. 2, to measure the power consumed in these machines. It is driven from above by a large pulley, not shown. The two small pulleys that hold the belt together are mounted on a vibrating frame, pivoted at the bottom and operating freely. The belt for driving the machine is run from either pulley of the countershaft. When no load is on, the pull on both sides of the belt is the same, and there is no tendency to move the framework in either direction; but whenever anything offers resistance to the rotation of the countershaft, one side of the belt is pulled, while the other is correspondingly slackened. This, of course, draws the pulleys in the direction of the taut side, and just in proportion to the difference in the stress between the taut and slack sides of the belt. The greater the resistance to the rotation of the countershaft, the greater will be the deflection of the framework carrying the small pulleys. A weight and spring are provided for pulling against the belt. Dash pots at each end prevent a too rapid motion of the parts. The pointer is so connected with the frame that it moves through a considerable distance, so that a small fraction of a horse power may be noted.

In experimenting with the electric light in connection with this delicate dynamometer the following phenomena have been noticed: When two carbons, carefully filed to the shape ordinarily assumed in the process of consumption, were placed in a lamp and the machine started, the recorded power would go up to four (horse power). If they were drawn apart in the attempt to diminish this power, the light would go out; but when they became considerably heated, the power required would drop down in some cases to 1·75, only to remain for a few moments, when a slight evolution of gases would diminish the resistance in the voltaic arc, and the pointer would go up to 2·50, while a hissing sound would be produced and a considerable augmentation of the flame of the arc.

At times, when the light was perfectly steady and the play of the voltaic arc was confined to the points of the carbons, with no hissing and very little flame, the power required was the lowest. An iron wire touched to the positive carbon for only a moment would keep the pointer up to 4 for fully half a minute. It was found that pure carbons caused but little variation, while metallic vapors in the flame required the most power. Every fluctuation of the flame or change in the pitch of the note emitted was accompanied by a corresponding fluctuation in the power required to operate the

machine. When one machine, weighing 450 lb., driven from the dynamometer, was connected with another exactly like it, the current of electricity from the first machine would drive the second backwards, and the power recorded was 0·25 of a horse power. Any friction on the second machine showed instantly on the dynamometer, while to stop it completely sent the needle up to 7·50. Some points in this dynamometer resemble Edison's; but, we are informed, Mr. Maxim had his in operation some months before Mr. Edison made his.

Fig. 3 shows a new electrical lamp designed for use in stores, factories, etc. It is nicely incased in ornamental bronze work. One novel feature of this lamp consists of telescopic side rods, which facilitate the dropping of the bottom to remove or replace the glass globe.

The United States Lighting Company, 120 Broadway, New York, are the owners and manufacturers of Mr. Maxim's inventions.

THE SPOTTED TRITON.

BY C. FEW SEISS.

The spotted triton (*Diemyctylus viridescens*, Rafinesque) is of an olive green or brown color above and yellow beneath. On each side of the body is a row of three or more vermilion spots, each encircled by a black ring. These spots vary greatly in number and distribution. Thus, in specimen No. 1, there are two spots on the head, two on one side of the body, and five on the other; in No. 2, there are four on the head, and three on one, and four on the other side of the body; in No. 3, two on the head, and four on the right side and two on the left; No. 4, which is much darker in color, has seven spots on each side, three of the spots being double on one side, and one spot on the occiput; No. 5 has two small spots on the occiput and three on each side of the body. The throat, abdomen, legs, and tail are generally studded with black dots. The hind legs are twice the size in bulk of the front. The latter has four digits and the former five, the first and fifth being rudimentary. The tail is compressed laterally, of natatory form. The length of our largest specimen is $3\frac{3}{4}$ inches; of the medium, $3\frac{5}{16}$ to $3\frac{1}{8}$ inches.

The spotted triton is an aquatic species, but it must be remembered that it has lungs and is an air-breathing animal, and consequently is obliged to come frequently to the surface of the water for fresh air. The immature tritons or larvæ are gill bearers like other urodelans; they are of a dirty brown color, and the vermilion spots are wanting.

The food of this triton consists of insects and worms. The stomach of one which I lately dissected contained two mosquito larvæ. Our aquarium specimens have seemed to thrive on small bits of raw meat. In the aquarium they are sometimes attacked with a fungoid disease, which is common to many water animals in captivity. They become greatly emaciated, and at length are unable to eat, and subsequently perish.

At the pairing season the male embraces the female in a peculiar manner; not with his arms or forelegs, as might be supposed, but with his stronger posterior extremities he clasps her firmly immediately back of her forelegs. The female fastens her roundish jelly-like masses of eggs, which somewhat resemble frog spawn, to water plants, where they remain until hatched.

I agree with Dr. Hallowell and others in considering the yellow-bellied salamander, *D. miniatus*, Rafinesque (*Salamandra symmetrica* of Harlan), as merely a terrestrial variety of the present species.

The insect above the triton in my drawing is the *Prionotus novenarius*. I can find no English name for it, but as I have from childhood called it the *Devil's camel*, it may be well, even if it is not a pleasing name, to retain it. It is of a dark ash color and pubescent; its long cylindrical head is armed with a strong curved beak or rostrum; its thorax is arched, compressed laterally, and deeply serrated, and its abdomen is flattened above and turned up at the sides. With its forelegs, which are raptorial, it catches caterpillars and other insects, and inserting its beak sucks all the juices from the caterpillar's body before it will drop it. It inserts its beak into the different segments of its prey to make sure no good is lost. Three or four different kinds of caterpillars I have seen it devour; it is, therefore, beneficial, and should be protected.

The devil's camel is most numerous about Philadelphia during the month of September. I have a note of one that was captured as late as the 5th of November, 1879. The young are wingless, and have the abdomen turned upward and forward. I have never felt the evil effects of his rostrum, but Dr. Horn says, when it is caught by one not expert, it inserts its rostrum into the hand, causing a feeling of acute pain which may last for some hours, but gradually passes away, leaving a feeling of numbness in the part bitten.

THE SPOTTED TRITON.

A Large Importation of Percheron Horses.

Ninety-seven horses of the Percheron breed, the largest lot ever brought to this country, recently passed through New York on their way to Wayne, Du Page County, Illinois, where their owner, Mr. M. W. Dunham, has a large stock farm. About one-fourth of them were colts, the rest were full-grown stallions, ranging in weight from 1,400 to 2,000

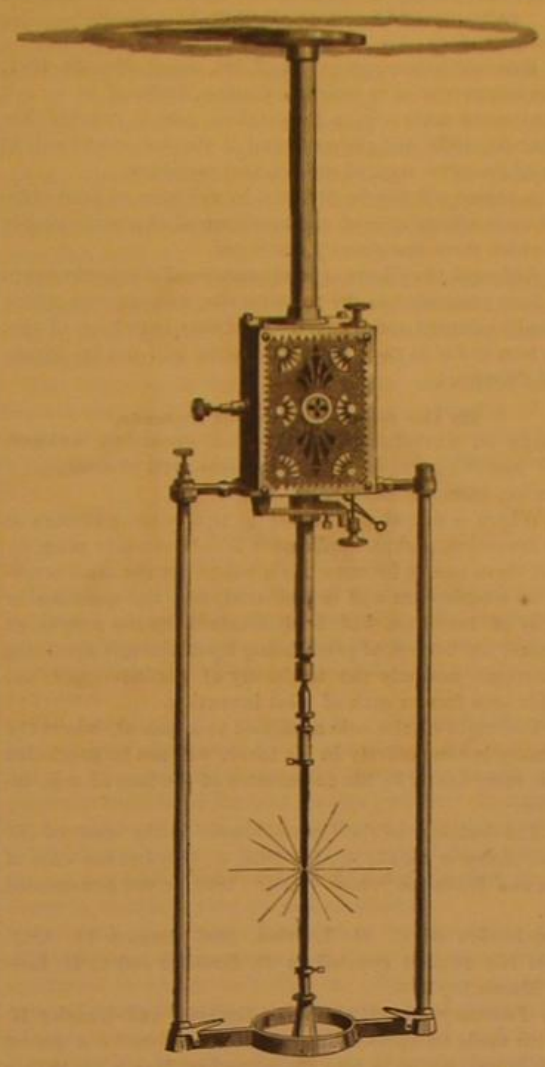


Fig. 3.—MAXIM'S ELECTRIC LAMP.

pounds. They cost in Perche, France, from $800 to $2,000 each, and were conveyed to the sea coast in a special train, the first ever run on a French railroad. To a reporter of the *Tribune* Mr. Dunham said:

"In 1873 it cost me $500 for every horse I brought across the ocean. Now, however, when I bring them in large numbers it costs only a little more than half as much for each. It will cost me $100 a car for my special train to Wayne. I put six of the horses in a car. I insure them when I start, and I have to pay four or five per cent on the insurance. You see there are large risks in this business. When I sell these stallions, however, I will get from $1,500 to $3,000 each for them."

The first Percheron stallions ever brought to this country were imported by Mr. William Harris, of Moorestown, N. J., in 1839. Mr. Charles Fullington, of Ohio, imported the next lot in 1851. In 1856 one of the stallions imported by Mr. Fullington was sent to Illinois, where for twelve years he was the only one of the kind in that State. In 1868 Mr. Dunham imported two Percheron stallions, and in 1872 went regularly into the business. Since then he has brought over between three and four hundred of them.

Drying a Specific Gravity Bottle or Flask.

It not unfrequently occurs that a clean, *dry* sp. gr. bottle or flask is wanted for use, and in hurried drying sometimes gets cracked. The following little device has been found useful: Wash the bottle or flask with distilled water and drain it for a moment or two. Then wash with a little strong alcohol and drain the bottle a second time. The alcohol need not be wasted, as it is but slightly diluted with the residual water from the first washing. When the bottle is again drained it remains wet with the diluted alcohol. Pour in a little dry ether and wash the bottle out with this. Again drain, and the warmth of the hand or very little extra heat will then completely dry the bottle or flask. The alcohol must of course be *strong*, and the ether *dry*, or the device fails.—*J. Shea, M.D.*

Evolution of Species in Butterflies.

As well known, many butterflies have two or even three broods in a year; one brood appears in spring, their larvæ having fed during the preceding autumn and passed the winter in the pupa state, while the others appear later in the year, having passed rapidly through all their transformations and thus never having been exposed to the cold of winter. In most cases the insects produced under these opposite conditions present little or no perceptible difference; but in others there is a constant variation, and sometimes this is so great that the two forms have been described as distinct species. In order to learn something of the origin and nature of the latter curious phenomenon, Dr. Weismann, of Freiburg, has, for many years, carried on a variety of experiments, breeding the species in large numbers, and subjecting the pupæ to artificial heat or cold for the purpose of hastening or retarding the transformation. The result of these experiments is, that by subjecting the summer brood to severe artificial cold in the pupa state, it may be made to produce insects, the great majority of which are of the winter form; but, on the other hand, no change of conditions that have yet been tried have any effect in changing the winter to the summer form. Taking this result in connection with the fact that in high latitudes, where there is but one brood a year, it is always the winter form, Dr. Weismann was led to the hypothesis that this winter form was the original type of the species, and that the summer form has been produced gradually, since the glacial epoch, by the summer becoming longer, and thus admitting of the production of the second or summer brood. This explains why the production of the winter form from summer larvæ is easy, it being a reversion to the ancestral type; while the production of the summer form from autumnal larvæ is impossible, because that form is the result of gradual development, and processes of development which have taken thousands of years to bring about cannot be artificially reproduced in a single season. Dr. Weismann lays great stress on the varied effects of temperature in modifying allied species or the two sexes of the same species, from which he argues that the essential cause of all these changes is to be found in the peculiarities of physical constitution, which causes different species, varieties, or sexes to respond differently to the same change of temperature; and he thinks that many sexual differences can be traced to this cause alone, without calling in the aid of sexual selection. The general result arrived at by the laborious investigation of these phenomena is that "a species is only caused to change through the influence of changing external conditions of life, this change being in a fixed direction which entirely depends on the physical nature of the varying organism, and is different in different species, or even in the two sexes of the same species; and, he adds: "According to my view, transmutation by purely internal causes is not to be entertained. If we could absolutely suspend the changes of the external conditions of life, existing species would remain stationary. The action of external exciting causes, in the widest sense of the word, is alone able to produce modifications; and even the never-failing individual variations, together with the inherited dissimilarity of constitution, appear to me to depend upon unlike external influences, the inherited constitution itself being dissimilar because the individuals have been at all times exposed to somewhat varying external influences." Almost exactly similar conclusions to these have been arrived at by Mr. Alfred R. Wallace, from a study of the geographical distribution and specific variation of animal forms.

To RELIEVE CASKS FROM MUSTINESS.—Burn a little sulphur in the empty casks, bung, and let them stand for a day.

FURTHER NOTES ON THE NORTHERN ARMY WORM.

BY PROF. C. V. RILEY.

HOW FAR IS BURNING OVER A PREVENTIVE?

That fields which have been burned over in the winter are free from the destructive presence of the worm is a fact in the history of its visitations. But opinion has varied as to the precise effect produced by the burning over. I have shown that it destroys the appropriate nidus for the laying of the eggs by the moth in the spring. Now that larval hibernation is established, we can readily see that the fires would destroy these hibernating larvæ and prevent the appearance of the moths and of a second destructive brood from them. But we must not suppose that the burning over would prevent *all* appearance of the worm; it merely prevents its appearance in destructive numbers. The moth will, when exceptionally numerous, lay her eggs without concealment and upon plants, such as clover, which the larva does not relish.* In such cases of exceptional abundance we may well suppose that the moth will fly into fields which had been burned over and supply them with eggs, but the instances in which this would result in material damage to the crop would be very rare.

CONNECTION OF WET AND DRY SEASONS WITH ARMY WORM INCREASE.

That the army worm appears in destructive numbers after a period of dry seasons is a fact already recognized, and is in accordance with the experience of the present year. The portions of our country visited by the worm this year were afflicted with drought last summer, and the winter was remarkable for its mildness and the slight fall of snow. Fitch's theory of the appearance of the worm required that this spring should be a wet one in order to drive the moths from the swamps and cause them to lay their eggs on the upland. But the facts are just the reverse. Farmers from Virginia to Vermont have complained loudly of the excessive drought. Rivers in some of the Atlantic States have not been so low for a generation, and alluvial meadows which have been subject to a spring flooding have this year remained dry. These facts clearly disprove Fitch's theory, and we must believe that the army worm is most likely to appear after dry seasons, *regardless* of the wetness or dryness of the season in which it occurs. A critical examination of Fitch's arguments in support of his theory shows that he not only had no personal acquaintance with the worm, but also made some astonishing errors in meteorology, such as comparing the rainfall of India (?) with the appearance of the worm here. With equal reason might we argue that 1879 was wet in our Atlantic States because of the excessive precipitation in the British Islands during that year. It is evident that Fitch was hard pressed for arguments to support the theory. That the season of 1861 was remarkably wet in the Eastern States Fitch gives no evidence. From the well known connection of the presence of plant lice with dry seasons, and from the memorable depredations of the grain aphis in that year throughout the Middle and New England States, it is very questionable whether 1861 was wet. It is far more probable that the season was a dry one like the present, in which also various plant lice have done great damage.

The view that the army worm has its proper home in the wild grasses in the swamps, as Fitch has assumed, must also be considered erroneous. The moth prefers matted grass amid which to lay its eggs, and the more tender grasses are those first selected by the worms. Old neglected fields, whether their location be low or high, are the most natural breeding places for the insects. That the worms most often appear in low lands, or in the neighborhood of such, doubtless finds more correct explanation, first, in the highly probable fact that the parent moth gets more appropriate food at such places, either in saccharine exudations, the natural "sweat" of the plants, or moisture from the ground; secondly, in the well observed fact that such lands afford the greatest extent of neglected meadows where the insect has opportunity to multiply unnoticed and undisturbed.

Dangerous Freight.

A case marked "benzine" or "benzoline" exploded with terrific force on the Pacific Steam Navigation Company's steamer Coquimbo, at Valparaiso, recently. A breach nearly twenty feet in length was made in the side of the vessel, fortunately above the water line. One man was killed. The immediate cause of the explosion is not given. The carrying of such dangerous freight may have something to do with the too frequent disappearance of ships at sea.

American Ironware in New Zealand.

A former resident in Birmingham, England, writes from New Zealand: "I was much interested in noticing how your staple trades were represented here. One article your town stands unrivaled in—lamps; but in every other branch of the hardware trade the vigorous Yankees beat you. In agricultural and gardening implements, stoves, domestic notions, and the thousand and one articles of hardware, English makers are nowhere here. For quality, adaptability, and price, the American articles bear the palm. I was one day in the store of one of our leading hardware merchants, when a miner came in for a pick and shovel. He was asked which he would look at, English or American. 'Oh, Yankee tools for me,' said the man; 'English are too clumsy.' My friend explained that the English will persist in making the tools their grandfathers used."—*N. Y. Sun.*

* I have recently received from Professor Lintner, State Entomologist for New York, what are apparently the pressed eggs and egg shells of this moth, thickly covering clover leaves, and mixed with an abundance of white gummy matter with which the moth usually secretes them, all indicating that in this instance the moths (doubtless from excessive numbers) had "slopped over." Professor Comstock likewise informs me that he has found the eggs laid between the folded lobe of a clover leaf.

DECISIONS RELATING TO PATENTS.

U. S. Circuit Court—Northern District of Illinois.

WHITTLESEY *et al. vs.* AMES *et al.* SAME *vs.* ZIMMERMAN. SAME *vs.* DEAN.—PATENT BEDSTEAD FRAMES.

Blodgett, J.:

1. Reissued letters patent No. 7,704, dated May 29, 1877, for an improvement in bedstead frames, declared to be for the invention embraced in the original patent, granted November 30, 1869, and claims 1 and 2 thereof construed, in view of the prior state of the art, and sustained.

2. A patent will not be defeated by evidence of prior similar devices which were of an experimental character simply and which were susequently destroyed.

3. Although the efforts of prior unsuccessful experimenters may have suggested to the patentee the construction which he finally adopted and perfected, and may have been of profit to him as far as they went, his patent will not be invalidated thereby.

By the Commissioner of Patents.

LOVRIEN *vs.* BANISTER *et al.*—APPEAL FROM THE EXAMINERS-IN-CHIEF.—INTERFERENCE.—PIPE TONGS.

Marble, Commissioner:

1. Where a patent has issued to two or more persons as joint inventors, and an application is subsequently made by one of them as sole inventor for a patent for the same invention, an interference will be declared, and the question of priority of invention will be determined by the weight of evidence, the burden of proof being upon the sole applicant to overcome not only the testimony of his adversary, but also his own former oath of joint invention.

2. The right of the sole applicant to a patent, where the testimony is conclusively in his favor, will not be precluded by the mere denial by his co-patentee of the fact of sole invention.

3. The decisions of the Commissioner in the case of *De Lill vs. Avery & De Lill* (C. D., 1870, p. 128) and the case of *Chase and White vs. Chase* (C. D., 1873, p. 99) commented upon.

Application of C. H. Lovrien, filed August 14, 1879. Patent No. 213,376 granted to H. Banister and C. H. Lovrien, March 18, 1879.

On February 10, 1879, Henry Banister and Charles H. Lovrien made an application as joint inventors for a patent for an improvement in pipe tongs, and on March 18, 1879, a patent was granted to them.

Charles H. Lovrien, one of the joint applicants and patentees, on August 14, 1879, filed an application as sole inventor for a patent for the invention already patented to himself and Banister jointly, and on September 16, 1879, an interference was declared between Lovrien, sole, upon the one part and Banister and Lovrien upon the other.

It is contended on behalf of Lovrien that the entire invention embraced in the patent and in this application was made by him alone; that he desired, however, that Banister, for a consideration, should have a half interest therein, and that by reason of his own ignorance of patent matters he allowed Banister to attend to the procuring of the patent, and supposed that the joint application, which he claims not to have carefully considered, simply secured to Banister his interest. Banister, on the other hand, claims that the invention was a joint one, and that it was so regarded by Lovrien at the time the joint application was made. The Examiner of Interferences decided priority of invention in favor of Lovrien, while the Board of Examiners-in-Chief held Banister and Lovrien to be joint inventors of the matter at issue, and decided in their favor.

The question to be determined in the case is clearly one of originality rather than of priority of invention. It is urged by counsel for patentees, and such appears to have been the ground taken by the Examiners-in-Chief, that where a patent has issued to joint applicants, and a sole application for the same invention is subsequently made by one of them, a patent cannot issue upon such application if the fact of sole invention is denied by the other party. Two decisions are cited in support of this position. In the first of these (the case of *De Lill vs. Avery & De Lill*, C. D., 1870, p. 128) the following language occurs:

"It is a matter of grave doubt whether one who joins another in an application for a patent, which he declares under his signature, verified by his oath, to be the joint production of himself and his co-applicant, ought ever be permitted to deny that oath and seek a sole patent. It would appear that a sound public policy would require that he should suffer the consequences of his mistake, even if it be innocent. But however this may be, it may be stated as a rule that wherever the facts are disputed the joint patent will not be disturbed. In the present case the burden of proof is of course upon De Lill to show that he was the sole inventor of the improvement covered by the joint patent. He must overcome his own oath, which cannot be treated as a nullity, and he must overcome the oath of Avery."

In the subsequent case of *Chase and White vs. Chase* (C. D., 1873, p. 99), Mr. Commissioner Leggett, in commenting upon the above decision, said:

"It was held by Commissioner Fisher in a similar case (*De Lill vs. Avery & De Lill*, decisions, 1870, p. 128), in substance, that a party to a joint patent was estopped from asserting his sole proprietorship where it was denied by the other party. I have no doubt of the soundness of this opinion. But certainly if this were not the case it ought to be clearly proved on the part of such an applicant that he was in fact a sole inventor. I concur with the board that 'Chase is very far from proving himself to have been the sole inventor.' The weight of evidence is decidedly the other way."

While from these cases it would appear that the ruling urged by counsel for the patentees was there made, yet in these very cases it is also seen that it was not followed, for in each a decision was rendered against the sole applicant, not upon the mere denial of the fact of sole invention by his co-patentee, but because the weight of evidence was found to be against him. Were I to give to these decisions the construction asked for by counsel for Banister and Lovrien, I should feel but little hesitancy in departing therefrom, as I fail to find, either in law or reason, any warrant for so arbitrary a rule. The Supreme Court of this district, in the case of *Ex parte L. O. Crocker* (MS. Appeal Cases, vol. 4, p. 269), held that where a patent had issued to two persons as joint inventors, and an application was subsequently made by one of them as the sole inventor of the same subject matter, the doctrine of estoppel did not apply, but the proper course for the Office was to declare an interference between the parties to determine the question of priority of invention, as in other cases.

In the late case of *Barsaloux, James & Lyon* (16 O. G., 233) the Attorney General used the following language:

"After a joint patent has once been issued upon an application of two or more persons as joint inventors, if the application erroneously described the invention as joint instead of sole, it is not, as I have just intimated, within the power of the Department to remedy the matter by changing the term of the patent already issued. The parties interested may file a new application, which, if seasonably done, can be made the basis for the issue of a new patent; but such new patent will not retroact by way of confirmation of the original."

If, then, a sole inventor is not estopped from making an application by reason of the fact that through mistake he has already applied for and obtained a patent for the same invention jointly with another, and if, as held by the court in the above cited case, an interference proceeding is the proper one in which the fact of such mistake can be determined, there can be, in my judgment, no sufficient reason for allowing the issue in such interference to depend upon the mere denial of one party, no matter how conclusive may be the proofs introduced by the other to rebut the same. The mistake of supposing that joint interest in an invention is the same as joint invention is a common one, to guard against which the Office has found it necessary to give notice in the rules that "the fact that one furnishes the capital and another makes the invention will not entitle them to make application as joint inventors; but in such case they may become joint patentees." Should a meritorious inventor, having made this common mistake, seek to have the same rectified by means of a sole application, the Office would readily declare an interference, which, under the ruling asked, would prove a mere nullity, if his co-patentee should prove dishonest enough to deny his rights. If the decisions cited are precedents for such a ruling, I must decline to be governed thereby. Undoubtedly, under familiar rules of evidence, the burden of proof is upon the sole applicant to show conclusively his right to a patent, and he is to overcome not only his adversary's testimony, but his own former oath of joint invention.

It appears from the evidence in the case that on the 23d or 24th of January, 1879, Banister and Lovrien first discussed together the invention in controversy. With regard to what occurred at this meeting the testimony is conflicting. Banister claims that Lovrien at that time suggested the cubical bit or block, while the adjusting screw and holding pin, both essential features of the device at issue, were supplied by himself. Lovrien, on the other hand, swears that he made the entire invention in controversy as early as the summer or fall of 1877, and at that time embodied the same in an operative device; that early in January, 1879, prior to his meeting with Banister, he disclosed such invention to others, and that on January 24, 1879, he fully communicated the same to Banister. This testimony of Lovrien as to the fact of his disclosure of the invention to Banister is contradicted by the latter, but is supported by the testimony of a party who was present at the time and who claims to have heard the conversation and to have seen the drawing made by Lovrien to illustrate his device. Further testimony is introduced by Banister to show that Lovrien regarded him as a joint inventor, and that he carefully considered and fully understood the joint application before the same was filed. This testimony, however, is not of a conclusive character, and is far from sufficient to overcome the direct and otherwise uncontroverted testimony of the several witnesses introduced by Lovrien to show that he had completed and disclosed to others the invention prior to his meeting with Banister, and which is fatal to the latter's claim as joint inventor. The weight of evidence is, in my judgment, clearly and conclusively in favor of Lovrien, and shows, beyond any reasonable doubt, that he had completed the invention long prior to his meeting with Banister, and such work as was done by the latter was but that of a mechanic and not of an inventor.

The decision of the Board of Examiners-in-Chief is accordingly reversed, and judgment is rendered in favor of Charles H. Lovrien.

Aurora Borealis.

BY PROF. E. R. PAIGE.

The cause of this singular phenomenon has been a prolific subject of both scientific and unscientific discussion for many years.

To the mind educated in cause and effect the canopy of night, lighted up by the dancing specter, presents a most alluring sight. While the unenlightened are filled with dark forebodings of a visitation of God's wrath, the scientist sees only the grand workings of the immediate laws of nature. The heavens illuminated with red light is to the superstitious a sure harbinger of impending wars. While the careful observer looks with delight upon the scene, and is impressed only with the sublimity of nature, poor unreasoning man is tortured with fears of coming evil.

In the slow development of scientific knowledge many and varied have been the theories put forth as to the origin of the Northern Lights, as we in this hemisphere call them. It is the reflection of sunlight by the ice at the pole, says one, while another contends that it is produced by great and internal fires whose chimney occupies the space devoted by Dr. Kane to an open polar sea; but the more patient observers have pronounced it electric light. It is my present purpose to look out through the light of a few known facts in search of the origin of this great wonder. Not that any direct good will follow a successful inquiry in the matter of utilizing the light for street purposes or for private illumination, but if we can find the cause to be natural, and not supernatural, then one more old superstition that has haunted the memory and made life unhappy is gone—one more bugbear of tormenting fear is consigned to the shades of past ignorance. Newton discovered the law that controls the universe, and every child should be taught this law, for without it we can comprehend nothing in nature. How life is produced, how worlds, how suns and planets are formed and held in their orbits, is known only through this law.

"Each atom has an attraction for each other atom in the universe, and the attraction is proportionate to their size, and is lessened as the square of the distance which separates them increases." Late developments in scientific research lead to the conclusion that all the varied original elements in nature, so-called, are resolvable back to one, and that one to energy; also, that light, heat, electricity, and sound are only different phases of motion.

Heat is the arrest of motion, and all the warmth we get from the sun is produced by the stoppage of the heat waves sent out by its throbbing power. Chemical heat is created by the clash of little worlds of gas beating together, and no exception is known to the rule that heat is the arrest of motion.

All the heat and all the energy we get on the earth come from the sun. The rain clouds are lifted from the ocean; the winds sweep over the mountains and across the moors; the blood of life, the sap of vegetation, all propelled by the power of the sun. The visible power expended on our little globe passes all efforts of comprehension, but it is naught compared with the latent hidden energy. The decomposition of one drop of water produces a power equal to the most terrific thunderstorm ever witnessed, while the decomposition of one grain of water produces a force equal to the discharge of 800,000 Leyden jars. All this but shadows the vast amount of energy that comes to us from the sun. Our earth is but a speck in space, and not a two-thousand-millionth part of the energy thrown off by the sun strikes us, but is expended out in dark, empty space. This involves a vast waste by the sun, and experiments show that the sun would be exhausted and cooled down in 5,000 years if not replenished from some source. The earth is passing around the sun once a year over a path of 555,000,000 miles long, traveling at the rate of 68,000 miles an hour. The speed of our flight is eighty times more rapid than the swiftest flying cannon ball. If the globe should strike a dead wall passing at this great speed, the concussion, we are told, would burn it instantly, creating a heat of which we have no comprehension; and yet the heat produced by such a catastrophe would not be sufficient to last the sun's waste for a period of thirty days.

We are taught, however, that if the earth should let go its place in space and be attracted into the sun, that body being 325,000 times more than the earth, and, therefore, possessing 325,000 times more power of attraction, its immense pull would draw us in with such a velocity that the kinetic force gathered in the passage would produce an impact in striking that would give off heat sufficient to last the sun's waste for a period of ninety-one years.

In any hour of a clear night that we watch we shall see at least six or eight stars fall. These stars are simply small pieces of iron gathered and formed in space that have fallen into our atmosphere in our flight around the sun; that is, have been attracted into the orbit of the world and picked up. Coming into our atmosphere when it is passing with such velocity creates a friction—a concussion—an arrest of motion, that immediately burns the iron. We see the explosion and call it a falling star. If an unaided eye can see six fall in one hour of the night, then what a vast shower must be constantly attracted by the whole earth. If the little earth, with its slight power of attraction, brings in such a constant shower of cosmic matter, how much more would be attracted by the sun, possessing 325,000 times more power of attraction than the earth. Such is the case, we are told, and our grand constant shower of cosmic matter is constantly falling into that body, forming a vast corona extending out from the sun 800,000 miles, by the clashing and impinging of particles and resultant burning. Thus, by virtue of the law of attraction, one constant stream of matter, which is energy, is pouring into the sun to replenish its waste. This matter must be formed in space, and is simply an aggregation of energy, or fire-mist, that pervades the atmosphere.

The cosmic matter that falls on the earth—that is, meteoric matter—is about 85 per cent iron, and is merely an aggregation of iron dust, which is itself an aggregation of invisible fire-mist. Great clouds of this fine iron dust gather in the heavens, and are occasionally attracted into our orbit. On striking our atmosphere, flying with such great speed, the concussion, the arrest of motion, instantly burns the iron dust and produces light colored according to the surrounding conditions that produce the refraction. This theory is not without its objections, and the chief one is, perhaps, the fact of these lights occurring toward the poles. This objection, I think, can be met, however, in the conditions that produce refraction of light, but our article affords no space to enter upon that field.

The facts I have alluded to as a basis for reasoning are, of course, not my own, and I shall not be deemed immodest, I hope, in saying that they are all well established and may be accepted as true grounds of reasoning.

This being so, it does seem that the wonderful aurora borealis may be fully accounted for in the burning of iron dust that gathers into great clouds, and floats into our flying atmosphere to be burned by the concussion.—*Inter-Ocean.*

NICKEL PLATING.

THE PLATING BATH.

The nickel salts commonly used are the nickel-ammonium sulphate (called double sulphate) and the corresponding chloride. Other salts, such as the nickel potassium cyanide, the acetate and sulphate, have been used, but not so successfully as these.

The double sulphate bath may be prepared by dissolving three-fourths of a pound of the salt in each gallon of water (soft). The salt costs about sixty-five cents a pound, and is generally considered the best for this purpose. It should be kept neutral and up to about six degrees of hydrometer.

The double chloride bath requires about four ounces of the salt per gallon, and works better slightly acid, the tendency in working being toward alkalinity.

The bath should be filtered when freshly prepared, and should be kept in a separate room, or at least away from the apartment in which the buffing or polishing is performed, to avoid contamination by dust as much as possible. Exposed to the air the bath (the water) evaporates, and the water thus lost must be replaced from time to time. To retard this and keep out dust as much as possible, it is well to cover the bath when not in use. Its surface should be skimmed occasionally, and it should be frequently mixed together to preserve a uniform degree of strength.

The tank or vessel in which the bath is contained is usually constructed of smooth two inch white pine stuff, grooved and well bolted together, and coated on the inside with good asphaltum, applied in the melted state.

Instead of this form a clean tub or a half barrel or hogshead, with an extra hoop, may be used, though from the shape of such a vessel there is necessarily much waste space to be filled with useless liquid.

For small baths a neat form of vessel consisting in a square porcelain-lined (enameled) iron tank of suitable dimensions is sold by some of the dealers in electroplating materials.

ANODES OR FEEDING PLATES.

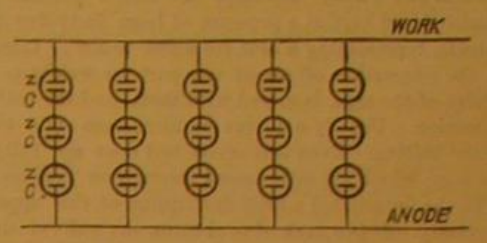
Good pure cast nickel anodes are now obtained at a moderate cost ($1.85 lb.), and are preferable to grain metal anodes. They usually come in sizes ranging from 1¾ x 4 inches, ⅛ inch thick, to 8 x 12 inches, ⅝ inch thick.

They may be suspended around the sides of the tank or across and facing the work (care being taken to avoid bringing them into such close proximity to the work that contact is likely to occur under any circumstance). They may be suspended by clean copper trusses or hooks—which should not be permitted to touch the liquid—from stout copper rods, to which connection with the battery is made.

THE BATTERY.

In nearly all large electroplating establishments some form of dynamo-electric machine is now used instead of the battery. They are cleanly, require little attention and space, and afford a current more easily adapted to the work, and at a much smaller cost.

But as their first cost is considerable, and they require power to operate them, the old battery is still in requisition in smaller establishments. The carbon or chromic acid battery* is more commonly used, as it admits of more rapid work with a smaller number of cells; but as it supplies a very intense current it often becomes necessary to introduce resistance coils to reduce it where small work is on hand. Some of the best work we have ever seen has been produced with the current derived from two or three Smee or sulphate of copper cells (in series). The amount of battery power for a given amount of work should be in zinc surface (exposed) about equal (when in proper working order) to the surface of the work exposed in the plating bath, with care to preserve the tension. If one cell has a zinc surface (exposed), of, say, one hundred square inches, and the work, say, five hundred, the one cell will require to be multiplied by five for quantity and (if the original tension was, say, three) by three to preserve the tension. Thus:



Of course this is equivalent to three large single cells, each exposing five hundred square inches of zinc (equal to a plate about sixteen inches square, exposing both sides). Large batteries of the dipping form, admitting of the immersion of the proper quantity of zinc, are often convenient.

If the current is too strong the deposited metal will present a dull (commonly termed burnt) appearance; if too weak it is apt to be imperfect, granular, or semicrystalline.

For practical purposes the electricity may be said to proceed from the copper or carbon pole of the battery, and care should be taken that this pole is invariably connected (by stout copper wires or rods) with the anodes or feeding plates in the plating bath, for if misconnected damage is done both to the work and the bath by the corrosion or partial solution of the former in the latter.

PREPARING THE WORK.

Before work can be plated its surface must be freed perfectly from all traces of oil or grease, oxides, lacquer, and other impurities. Oil, grease, etc., are removed by contact with a strong, hot aqueous solution of caustic potash, and, after rinsing off the adhering alkali, from oxide by an acid bath; or, if of brass, copper, or German silver, by scouring with fine pumice stone and strong aqueous solution of cyanide of potassium. Iron is pickled in dilute sulphuric or muriatic acid (acid 1, water 5 to 15), and scoured with fine white silicious sand or pumice stone. Brass or copper is sometimes brightened before entering to the plating bath by dipping it momentarily in nitric acid diluted with about twenty parts of water, and quickly rinsing it in running water. It should be placed in circuit immediately after this.

The hand must not come into contact with any part of the work after removal from the alkali, as the slightest touch may spoil all.

On removal of the plated work from the plating bath it should be quickly rinsed (without handling) in cold water, then transferred to hot water, which will cause it when taken out to dry quickly and perfectly. If the finished work is to present a smooth polishing surface it must present such a surface before entering the plating bath. Nickel is hard and will not readily submit to a burnishing tool.

When the work is placed in circuit in the plating bath (and it should not be permitted to remain many moments in the bath without being placed in circuit) it should be moved about to free it from bubbles.

The process of nickel plating is a simple one, and by a little practice and proper attention to the requirements the bath may be worked month after month, and the metal deposited smoothly and with certainty.

*See SCIENTIFIC AMERICAN SUPPLEMENTS, Nos. 157, 158, and 159, for descriptions of batteries.

Paper.—How it is Made.

The antiquity of the paper manufacture is, says the Boston *Journal of Commerce*, probably excelled by but few other products of civilization, Chinese historians carrying it back to a point far in the twilight of our history. In England it was first introduced near the close of the fifteenth century, and in this country in 1693, at Germantown, Pa. The materials from which paper is produced are numerous, but wholly of vegetable origin, neither wool nor hair possessing the capability of being reduced to fibrous pulp, a prerequisite to the formation of paper. Linen and cotton rags, straw, the leaves and stalks of the okra plant, jute stalks, manila, hemp, and even wood fiber, are all used in the manufacture of paper. No substance, however, can equal good linen rags, of which the toughest and finest paper is made. Next in rank are cotton rags, from which the best writing and note paper is made. In this manufacture great care is taken in the selection of the material and in every process.

Gathered from all parts of the country by tin peddlers and by peripatetic ragmen in cities, the rags arrive at the mill in bags, a portion of the stock, perhaps, coming in pressed bales from over the sea. The first process is sorting, and then the rags are cut, usually by girls, by means of a fixed blade in a bench, like a short upturned scythe, the operator picking them up by handfuls and drawing them over the edge of the blade. Each girl is furnished with a sandstone rifle, and when a large roomful of girls are at work the sounds remind one strongly of a gang of mowers at work before the days of the mowing machine. A second sorting, for the removal of all buttons, hooks and eyes, and hard seams, follows, and the rags are then dusted. The duster is a large cylinder, the surface of which is of fine woven wire, inside of which is a shaft carrying arms set around it in a spiral form, and revolving at a higher rate of speed than the cylinder. This difference in speed gives the rags a thorough stirring, while the spiral arrangement of the blades facilitates the exit of the rags, which traverse the cylindrical sieve from end to end. White paper can be made from colored as well as white rags, and for the removal of the color as well as the dirt they are submitted to a boiling with lime water. The

rags are placed in a large rotating boiler made of half-inch plate, mounted on journals and driven by proper gearing, as a worm and wheel. Through the hollow journal steam is admitted and kept at a pressure of from forty-five to sixty pounds, representing a heat from 292° to 308°. Lime water, in the proportion of about one part by weight to ten or twelve of the rags, is mixed with them, and the boiler is set in motion. Usually a charge requires from eight to twelve hours' boiling. Even this severe test does not fully purify the rags, which are next passed through an "engine."

To the uninitiated a brief description of this apparatus is necessary. It is a tank of oval form, the walls or sides rising two and a half feet from the floor. This is partially divided longitudinally by a straight upright partition, not extending to the ends, however, but leaving a space between its ends and the tank's sides, of a width corresponding to that between the sides of the partition and those of the tank. On one side of this partition, across the center of the tank, is a toothed drum, the teeth or blades of which alternate with fixed teeth at the bottom. These teeth tear the rags to tatters, but without destroying the fiber. A stream of water is constantly passing through the tank, and is constantly removed. This is done by a wheel of fine wire netting that revolves on the side opposite to the toothed drum, taking up the mass, but detaining the pulp, the water running off through the shaft of the wheel, which is hollow. Thus the water is used only while making a single passage around the tank, the current being produced and maintained by the rotary movement of the beater or tearer. The condition of the rag material when it comes from this cleansing engine is that of a coarse pulp, technically known as "half stuff," which is subsequently submitted to the action of another engine, known as a beating engine, but essentially the same as the cleaning engine.

But still further cleansing is necessary. The material is next mixed with chloride of lime and again passed through the engine. It is then heaped upon drainers, and looks like a mass of half-melted snow. The white, however, is a dead white, having no brilliancy. To receive this quality it must literally be colored. As the laundress blues her clothes to make them whiter, so must the paper stuff be blued, and when so tinted it has that same quality of whiteness as wind driven snow, which always shows a bluish tinge. This is quite different, however, from the blue writing paper so affected by the fashionable twenty and thirty years ago, and now the favorite tint in the South and in England. That is really blue paper, while our usual white paper is merely tinted sufficiently to remove the dead, yellow, lusterless appearance of absolute whiteness. The bluing is ultramarine, as used in calico printing and for other manufacturing purposes, made from silicate of soda, alumina, sulphurets of iron, and carbonate of soda, and not from lapis-lazuli. This is mixed in powder with the half stuff just before the final beating.

After the final beating the material is apparently a thin, milky fluid, having no trace, to the unaided eye, of the fibrous character that it really possesses. Formerly the paper was formed by hand, the workman dipping a rectangular sieve into the fluid pulp, and depositing the sheet of pulp on a piece of felt to dry. But very little paper is made so now, the Fourdrinier machine having taken the place of the hand workman. This "machine," as it is called *par excellence*, is a wonderful production of skill; it is almost wholly automatic in action, and works with marvelous exactness. It is scarcely possible to describe it without detailed engravings, but a brief account of its work may aid in its comprehension. Some of these machines are not less than six feet wide and seventy-five feet long, requiring a building by itself, and making a sheet of paper over five feet in width. The pulp is pumped into an elevated tank, from which it is delivered to the machine through an adjustable gate opening from a reservoir. The amount of pulp fed to the machine regulates and determines the weight of the paper, and of course it must be governed absolutely and exactly, the speed of the machine being a constant. The pulp flows on to a roller, which deposits it on an endless apron of fine woven wire, which has a constantly jarring motion, tending to shake out the water and aid in the homogeneous union of the particles. Thick rubber straps on each side of the endless apron determine the width of the sheet. Passing between rollers which compress it, the sheet of pulp goes over perforated boxes from which the air is exhausted by a pump, and much of the remaining moisture is driven out by atmospheric pressure. A bath of liquid glue gives a proper sizing to the sheet after it is fully dried by cylinders heated by steam. The sheets, dampened by glue, are taken to a drying room, from whence, all wrinkled, they are submitted to a calender consisting of a stand of rolls, three of chilled iron and two of paper. These latter are made of manila paper cut in disks, with a hole for the axis or shaft, and compressed by hydraulic pressure. When turned and finished, these paper rolls are as smooth and almost as hard as iron, presenting a highly finished surface. The sheets are then trimmed by a machine suggestive of the guillotine, and ruled. The pens used on the ruling machine are of peculiar form, made of sheet brass and fed with ink by a wick. Most of those used in this country are made by one concern in Harrisburg, Pa.

Book paper is made of old paper entirely. The processes are similar to those employed in making paper from rags, except that, owing to the more pliable nature of the material, they are not so long continued.

Juted is used for making coarse paper, such as is used extensively for flour bags, for which it is well adapted, being very tenacious of fiber, a full grown man having been carried by four persons, each lifting a corner of a sheet of jute paper from which bags are made, designed to hold a quarter of a barrel of flour—forty-nine pounds. The jute stalks come in lengths of from ten to fourteen inches. They are imported from Calcutta, and are the same material from which gunny cloth and gunny bags are made. The stalks pass through a rotary cutter, with stationary knives and knives set in a cylinder, by which they are torn to coarse shreds. A boiling under steam pressure, in a rotary boiler, with lime, follows, when the mass is heaped and allowed to "sweat" a few days. It passes through the cleaning engine, as do the rags described above, is bleached with chloride of lime, and sized with a size made of rosin and washing soda. The after machining is similar to that used on writing paper.

Envelope paper and fine wrapping papers are made from old manila rope, and paper for paper collars from cotton rags. In both cases the processes are of a similar character to those employed in the manufacture of paper for writing purposes. A necessary requisite for paper making is pure water; so paper mills are never found on the banks of sluggish streams or the shores of a marshy, muddy pond. The coloring matter for tints is introduced into the beating engine when finishing the half stuff.

Petroleum as Fuel.

The mail steamer Cesarewitch is described by the special correspondent of the London *Daily News*. It is English built, and is the swiftest mail steamer on the Caspian, being only surpassed in speed by the Nasr Eddin Shah war steamer. To convey it from the Baltic to the Caspian, it was necessary that it should traverse the whole of the Neva ship canal, and afterwards descend the Volga to Astrakan. On the Neva Canal are fifty-four locks, and the Cesarewitch's length was too great to allow of her entering them. Her present chief engineer, Mr. Vine, an Englishman, cut her into two pieces amidships, and filling up the open extremities with iron bulkheads, floated her in this guise through the canal. At Astrakan the same gentleman put her together again, and has remained ever since in charge of her machinery. Her boilers are heated by petroleum refuse instead of coal, a system which effects an enormous saving of expense and labor, the heating apparatus being as thoroughly under control as a gas jet, and requiring but one man to manipulate it. It consists of two tubes, about an inch in diameter, terminating at the same point in a small oblong brass box. Through one of these tubes the black residual naphtha (*astatki*) drops slowly, being blown into spray by a jet of steam from the boiler, conveyed through the second tube. This spray, when ignited, forms a great sheet of flame, which is projected into the hollow of the boiler. It has the immense advantage of requiring no stoking, as no ashes are produced; and by turning down the flame to the required degree, the steam can always be kept up to the pressure required for immediate starting without the tedious and more or less wasteful process of "banking" the fires. An arrangement like this is invaluable for cruisers lying off an enemy's port, and requiring to hold their steam in readiness. It is intended to apply the same system of heating to the locomotives on the Tiflis Baku Railway, when completed; and it will, doubtless, play an important part in the steam communications destined at no distant period to traverse the Steppes to Khiva and Samarcand.

Pork Making in Brief.

A correspondent of the London *Miller* describes his visit to a Chicago pork packing establishment as follows:

The place where I was to witness the prosecution of one of the greatest of the industries of the latter city was Union Stock Yard, where I arrived by street car at 9:5 A.M., and was introduced to one of the pig killing establishments. The animals to be operated upon are driven up an incline, for which, if they suspected to what fate it was the introduction, they would have no inclination. This leads to a large pen, from which they are driven into a smaller one, where a man is placed for the purpose of slipping a chain on one of the hind legs of the unsuspicious porkers, which are hauled to a position whence they slide to the sticker, who dispatches them while hanging. The stuck pig is then passed on to a man who unhitches the leg, and the animal falls into the scalding tank, which holds twenty at a time, and three men are there engaged stirring the carcasses up with long poles, so that the bristles which are to be removed are acted upon by the scalding water. At the end of the tank there is a sort of scoop which the pigs slide into, and are lifted out of the water to a bench, where they are subjected to the scraping and shaving process by the active hands of a dozen men. They are then passed to a functionary by whom they are decapitated, after which they are cut open and disemboweled by other practitioners, the division of labor principle being carried out there to the letter. The cutting up process follows the whole operation, taking a great deal less time than I have taken to describe it. A pig is killed and made ready for the market in a few minutes. At the Messrs. B. F. Murphy Packing Company they now employ 210 men, have a 24 horse power engine and four 50 horse power horizontal boilers, eleven lead tanks, 8 feet by 6, and three 24 feet by 6. They kill 1,600 pigs a day, and in winter twice that number. After being cut up the pigs are salted and put in icehouses.

I also visited one of the cattle killing establishments, where the work of slaughter is conducted with equal dispatch, the mode of killing being the cutting of the spinal cord at the back of the head by means of a steel pointed spear sharpened somewhat like a drill, the animal falling instantaneously and without a struggle. Every part and product of the animals, I may mention, is utilized, nothing here being allowed to go to waste.

Astronomical Notes.

OBSERVATORY OF VASSAR COLLEGE.

The computations in the following notes are by students of Vassar College. Although merely approximate, they are sufficiently accurate to enable the observer to recognize the planets. M. M.

POSITIONS OF PLANETS FOR SEPTEMBER, 1880.

Mercury.

Mercury rises before the sun on September 1, and may possibly be seen in the early morning.

On September 30 Mercury sets so nearly with the sun that it cannot be seen.

Venus.

On September 1 Venus sets at 7h. 6m. P.M. It is in conjunction with the crescent moon on the 5th.

The "Nautical Almanac" gives the conjunction of Venus and Mars on the 7th at 1 P.M., Venus being 31′ north of Mars in declination.

Mars.

On September 1 Mars sets at 7h. 12m. P.M. On September 30 Mars sets at 6 P.M.

On September 7 Mars and Venus pass the meridian very nearly at the same time. Mars precedes Venus by ten seconds.

Jupiter.

Jupiter is becoming more and more brilliant.

On September 1 Jupiter rises at 8h. 2m. P.M. On September 30 Jupiter rises at 6h. 2m. P.M.

It passes its perihelion on the 25th. The near approach of Jupiter to the earth will give amateur astronomers an excellent opportunity to watch the motions of the moons and the changes on the surface of the planet. A good opera glass will show the moons.

If we take the hour from 9 to 10 P.M. for our watch, the first satellite may be seen to come out from behind the planet on September 1; to move into the planet's shadow on the 15th; to pass from the planet's face on the 16th, and to enter upon the planet's face on the 23d.

During the same hour the second, or smallest satellite, is hidden by the planet on the 7th; is in eclipse, by the falling of Jupiter's shadow upon it, on the 14th; is near the limb of Jupiter on the 23d, having left the disk, and will be unseen because projected upon the disk on the 30th.

The third satellite in the order of distance from Jupiter, which is the largest and which will be most easily followed by amateurs, may, on September 3, be seen to go behind the planet, and on 28th may be seen to pass on to the disk of the planet, coming between the earth and Jupiter. September 23 will be the most favorable for watching the changes of the satellites, as one of the moons may be seen to move off from the face of Jupiter, and another will be seen to move toward the planet and to enter upon its transit across the disk almost at the same time. Jupiter is in conjunction with the moon on the morning of the 20th.

A close study of Jupiter during the month of September will be the most instructive as well as the most pleasing occupation to which young astronomical students can give their evenings. If no means of measurement are at hand, careful drawings should be made of changes on the surface of Jupiter.

Saturn.

Saturn follows Jupiter throughout the month of September.

Saturn rises on the 1st at 8h. 32m. P.M., and on the 30th at 6h. 34m. P.M., between 3° and 4° north of Jupiter in declination.

Although Saturn is not, like Jupiter, at perihelion, it is approaching its best position for this year, and should share with Jupiter the attention of observers.

Saturn is in conjunction with the waning moon after midnight of the 20th.

Uranus.

Uranus rises nearly with the sun in the early part of the month; on September 30 it rises at 3h. 44m. A.M.

A Table Land Across the Gulf Stream.

In a recent dredging expedition from Charleston, S. C., across the Gulf Stream, Commander Bartlett, of the United States Coast Survey steamer Blake, was surprised to find the depths much less than he expected. This induced him, although the trip was one primarily for dredging, to extend the work of sounding; and he accordingly ran a line of soundings nearly along the warmest band of the Gulf Stream, commonly called the axis of the stream, for a distance of 150 miles from latitude 32° to latitude 33° 30′ north, on which he obtained depths varying from 233 to 450 fathoms, where it was supposed that the depths would range from 600 to 1,000 fathoms. At the northeast end of this line, in about latitude 33° 30′ north, the depth suddenly increased, in a distance of 15 miles, from 457 to 1,386 fathoms.

These depths obtained by Commander Bartlett appear to indicate that a submarine table land may extend from the coasts of North and South Carolina across to the Northern Bahamas. The development of this table land Superintendent Patterson proposes to have completed next spring, when the weather will be better adapted to such work than in the autumn and winter months.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

☞ *The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.*

NEW BOOKS AND PUBLICATIONS.

A SELECTION OF SPIRITUAL SONGS WITH MUSIC, FOR THE SUNDAY-SCHOOL. Rev. Charles S. Robinson, D.D. New York: Scribner & Co. Price 50 cents.

An exceptionally judicious collection of Sunday-school hymns. Dr. Robinson's pure taste leading to a rigorous exclusion of the rant and doggeral unhappily so popular in many Sunday-schools.

MICROSCOPISTS' ANNUAL FOR 1879. New York: The Industrial Publication Company. Limp cloth, pp. 48. Price 25 cents.

Contains tables, rules, formulas, and memorada of use to microscopists. Also a list of American and European microscopic societies, with officers; a directory of prominent makers, dealers, and importers of microscopes; postal information for microscopists, etc.

DIE RADREIFEN-BEFESTIGUNGEN BEI EISENBAHNWAGEN-RAEDERN. EINE SAMMLUNG PATENTERTES CONSTRUCTION. Von C. Kessler, Civil Ingenieur. Berlin: 1880. Polytechnische Buchhundlung (A. Seydel). (Tire Attachments for Railroad Wheels.) 63 p.

This work consists of a digest of the English and German patents granted for improvements in attaching tires to railroad car wheels. Three hundred and twenty-one illustrations of patents are shown, arranged according to date and provided with a brief description or note. This publication will be of great value for the railroad engineer, car builder, and machinist.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) A. S. asks: What is the office of a check valve? A. It performs two offices: 1. It relieves the pump valves from the pressure. 2. It permits of opening the pump for examination without blowing off steam, and it retains the water in the boiler in case of the bursting of the feed pipe.

(2) S. R. asks how to letter with gold and silver leaf on glass. A. The size is prepared by dissolving one ounce isinglass in just enough water to cover it; when dissolved add a pint of rectified wine spirit and make up to a quart with water. Give the clean glass a flowing coat of this, and carefully lay on the leaf which will then readily adhere to the glass. Let it remain twenty four hours to dry. The design or letter is drawn on paper, and the lines pricked with needle holes. Place this against the gilded surface and dust it thoroughly with powdered whiting. When the paper is removed there will remain a correct copy of the design or letter on the gold. Now fill up the outline with oil gold size in which has been ground some orange chrome, thinned somewhat with boiled oil and turpentine. When this has thoroughly dried wash off the surplus gold with water, applied with a tuft of cotton.

(3) B. S. T. asks: 1. For a satisfactory process for waterproofing cloth. A. Saturate the fabric with a strong hot aqueous solution of soap, press out excess, and transfer to a second bath consisting of a strong aqueous solution of sulphate or acetate of alumina or acetate of lead, for several hours. Repeat if necessary, press out excess of liquid, and dry, not too rapidly, in the air. 2. Can you give me a process for determining quantitatively the presence of cinchonidine as an adulterant of quinine? A. Five to ten grammes of the mixed alkaloids are mixed with fifty grammes of ether, and the mixture, after well shaking, left at rest until next day. By this operation the alkaloids are separated into two parts: one soluble in ether, and another insoluble in that liquid. The part soluble in ether contains the quinine, while the insoluble part contains the cinchonidine. These two parts are separated by a filter, the insoluble part washed with some ether, and the ethereal solution evaporated. This insoluble part is now mixed with forty parts of hot water, and converted into neutral sulphate by careful addition of diluted sulphuric acid, so that a solution is obtained having a slight alkaline reaction upon red litmus paper. To this solution a solution of tartrate of potash and soda is added in sufficient quantity to convert the sulphates into tartrates, and after stirring with a glass rod, allowed to remain for twenty-four hours. If cinchonidine be present in appreciable quantity, its tartrate will be found separated in crystalline form. The tartrate of cinchonidine is collected upon a filter, washed with a little water, and dried on a water bath. One part of this tartrate represents 0·804 part of cinchonidine.

(4) A. R. G. asks how to detect small quantities of gold in sulphurets. A. Reduce the whole of a sample of several ounces of the ore, by grinding, to an impalpable powder, that will pass readily through an 80 mesh sieve; mix about a drachm of the well mixed powder with ten times its weight of pure lead and one or two fragments of borax glass the size of peas, place in a scorifier and expose in a closed muffle to bright red heat until the lead is all fused and the ore floats on top; then open the muffle and let a current of air pass slowly over the red hot scorifier and its fused contents until the ore has been absorbed and the fused metal has disappeared beneath a covering of litharge; then remove, cool, break, remove and clean the lead button, and place it carefully in a heated cupel weighing somewhat more than the bead; when the lead has melted the muffle is opened and the air allowed to pass over the fluid mass until the lead has all been converted into litharge, and the litharge absorbed by the cupel, leaving the gold and silver behind; if the bead is white, silver is present; add about twice the weight of the bead of pure silver, fuse together with the blowpipe flame on a charcoal support, flatten while hot on an anvil, and heat for some time to boiling with pure nitric acid, which dissolves the silver, leaving the gold, if any were present in the ore, as a brownish black mass, which shows the characteristic luster when pressed with a knife blade, and when brought into contact with a drop of aqua regia, and then with a crystal of stannous chloride, develops a purplish-red, violet, or brownish-red coloration—purple of Cassius.

(5) W. T. R. asks if a ground connection for a lightning rod will be a good one if soldered or attached to a gas pipe (iron) underground. Will it be attended with any danger to the occupants of house if struck with lightning, pipe full of gas? Will a lead water pipe do for ground connection for lightning rod? A. The rod should be soldered to the gas pipe, and that forms a good ground connection. No danger from the gas. A lead water pipe would do for ground connection if the rod is soldered thereto; but an iron pipe is much better. Lead is a poor conductor of electricity.

(6) D. P. asks for the proportion of chemicals used in the mixture of white or flint lime glass. A. Flint glass is composed of 300 parts of pure white sand, 200 parts of minium, 100 parts refined pearl ash, and 30 parts of niter. Crown glass consists of 22 per cent of potash, 12·5 per cent of lime, and 62 per cent of silicic acid.

(7) L. D. C. asks: 1. Suppose the motive power for an electric light should suddenly stop, would the lights immediately go out? A. Yes. 2. If they would, is there any known means by which the electricity or power could be stored or accumulated, so that the lights would not be impaired? A. No. 3. What I wish to know is, to make plainer, is there any way that electricity, as a motive power, can be stored up, the same as can be done by compressing air or raising water to a height? A. No.

(8) T. W. McN. writes: In the SCIENTIFIC AMERICAN, No. 26, June 26, 1880, page 404, is an article headed "Lunar Caustic for Purifying Spirits." Can you give me the full particulars as to the manner of treatment, or can you tell where to find them? A. According to M. Berlieu the silver nitrate is dissolved in 10 parts of soft water, and about one-quarter ounce of the solution is added to each 100 gallons of the spirit before rectification. The silver remains in the still.

(9) M. J. D. asks how to put up green corn and lima beans in glass fruit jars. A. Fill the cans completely, immerse them nearly to the top in boiling water for an hour or more, or until the contents are thoroughly cooked. Seal while hot.

(10) H. S. asks for a composition to make jars that will hold acid, beside clay, glass, or metal. A. For the stronger acids (nitric, hydrochloric, and sulphuric) the only suitable vessels are of glass, porcelain, stoneware, or enameled iron, excluding the metals, platinum, gold, lead, etc. When the muriatic or sulphuric acids are diluted with water, vessels of wood or *papier mache* coated with gutta-percha, rubber, or asphaltum, answer very well.

(11) W. H. S. writes: I have been informed that a few years since there was sold in London a prepared paper for making duplicate copies of manuscript by electricity. The mode of using it was to place the paper upon a metallic surface connected with one pole of a battery, while the writing was done with a metallic stylus attached to the other pole of the same battery. The electricity passing through the paper changed the color of the paper at every point the stylus touched. Can you tell me how the paper can be prepared to produce this result? Can it be done with dry paper? A. Saturate the paper (unsized) with a dilute aqueous solution of iodide of potassium, and dry. It should be slightly moist when used.

(12) S. asks how to make dry, black, typewriter ribbons. There are two kinds in the market, one known as "copyable" and one as lithographic. A. Triturate fine lamp black (or ivory black) and warm lard together to form a thin paste and stiffen with a little wax; or triturate fine (soluble) nigrosine with hot glycerine to form a smooth sirup. Fill the ribbons with either, and, with a light pressure, remove any excess.

(13) C. J. H. writes: I inclose an analysis of Massena water, and would be glad to have you state whether the introduction into it of the ordinary carbonic acid gas with which soda water is charged would at all injure the medical properties of the water; whether this water could be put into the tin-lined copper fountains and drawn up through, as soda water ordinarily is, without injury to the fountain or fixtures? If so, how the fountain could be afterwards cleansed, to rid it of the sulphurous smell? Would an ordinary whisky barrel be strong enough to charge with enough carbonic acid gas to force the water up to a floor above—say, 12 feet—to be drawn in the way mentioned? How much pressure would it require? A. The water may be charged with carbonic acid without danger of affecting any of its constituents. It is not safe to use a barrel in the manner proposed. Better use a porcelain-lined iron cylinder, if obtainable. Such water should not be drawn through tin pipes.

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

O. P.—The stone probably contains nothing of value—a variety of serpentine.—H. S.—Calcium carbonate—of little value.—B. M. L.—Hornblende rock containing pyrrhotine—a sulphide of iron. The pyrrhotine probably contains a little nickel.—G. R.—Nodular iron pyrites. It probably carries a trace of gold.—J. B.—Yes, it is horn silver—silver chloride.—E. M.—The green stone is phospho-calcite—phosphate of copper. The other, chalcopyrite—sulphide of copper and iron.—T. O. D.—1. Chrysolite—silicate of magnesia. 2. Chlorite—silicate of magnesia, alumina, and iron. 3. Biotite (hexagonal mica). 4. Fluorspar. 5. Quartz, feldspar, and iron pyrites.—D. F.—1. A fair quality of hematite iron ore. 2. Serpentine and quartz.

COMMUNICATIONS RECEIVED.

On Lightning and Lightning Rods. By E. G. A.
On the Chemistry of Electricity. By W. H. G.
On New Use for Spent Fruit Cans. By S. W. R.
On Track Straightening. By S. W. R.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

August 3, 1880,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

Addressing machine, T. A. Edison	230,621
Animal trap, A. Goodwin	230,628
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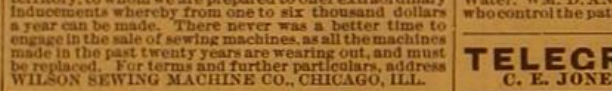

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Vol. XLIII.—No. 11. [NEW SERIES.] NEW YORK, SEPTEMBER 11, 1880. [$3.20 per Annum. [POSTAGE PREPAID.]

POINT BRIDGE, PITTSBURG, PA.

We give an engraving of the Point Bridge over the Monongahela River, at Pittsburg, Pa., built by the American Bridge Company, from the designs of Mr. Edward Hemberle, one of the engineers of the company.

Pittsburg is eminently a city of bridges—necessarily so on account of the three large rivers flowing through her limits. While some of them are of humble pretensions, others will compare favorably with bridges to be found anywhere. The Point Bridge was formally opened on March 31, 1877.

The structure is the first example of a stiffened chain suspension bridge of long span, and differs considerably from others in existence. The chain is designed as a catenary, and takes up all the permanent load of the structure without bringing strains on the stiffening trusses. This object was accomplished by erecting the bridge completely before connecting the ends of the straight top chords to the center joint. The tie rods are provided with turn buckles, and are so adjusted as to be strained under moving loads only. When the bridge is half loaded, the top chords of the trusses on the loaded side is in compression, and of the unloaded side in tension. The maximum strains for the different members of the trusses occur under different positions of the moving load.

There are lateral and vibration braces between the top chords, and also between the chains, proportioned to take up the strains from wind pressure upon chains and trusses. The floor is 34 feet wide between the stiffening girders, which are 8 feet high, forming the hand rails. The stiffening girders have expansion joints every 100 feet, and are suspended from the chains by flat bars 20 feet apart. At the expansion joints there are struts instead of suspenders, in order to make a rigid connection between the roadway trusses and the chains. Cross girders 3 feet in depth connect the stiffening girders every 20 feet, and support two lines of iron stringers. These stringers and the roadway trusses form the bearers across which are placed the wooden joists for the flooring.

The lateral stiffness of the floor is secured by a double system of tie rods, and the wind pressure is taken up by horizontal steel wire cables, placed under and connected to the floor.

The towers are entirely of wrought iron, except the bases of the columns. The columns are 30 inches square each, are connected by lattice bars and form the tower. The chains are carried over the top of the tower on wrought iron chairs or saddles, which are movable on rollers to allow for expansion and the elongation of the back chains under strain.

The bridge is proportioned for a moving load of 1,600 lb. per lineal foot, under which, together with the weight of structure, the chains are strained to 12,000 lb. per square inch, sectional area. The suspenders and roadway members are strained only from 8,000 to 10,000 lb. per square inch. The maximum compressive strains in the towers are 9,000 lb. per square inch.

The bridge consists of three spans. The center span is 800 feet and the end spans 145 feet each—the total length from back to back of the anchorage being 1,245 feet. The roadway rises from each end, and at the center of the channel is 83 feet above low water. The saddles on top of the towers, upon which the chains rest, are 180 feet above low water, and the deflection of the chain is 83 feet. The floor is divided by iron hand rails into a 21 foot wagon way, and two 6½ foot sidewalks. The piers are built of Baden sandstone laid in cement. There are two chains, one on each side of the bridge. The links are formed of from eleven to fourteen bars, 20 feet long and 8 inches by 2 inches to 8 inches by 1 inch in size, and are connected by 6 inch pin bolts, the same bolts also connecting the links.

The material used: Timber in foundations, 4,442 feet, board measure; masonry in anchor walls, 10,868 cubic yards; masonry in piers, 7,507 cubic yards; iron in foundations, 12 tons; wrought iron in superstructure, 2,084 tons; cast iron in superstructure, 52 tons; steel in superstructure, 32 tons; timber in superstructure, 810,000 feet, board measure; number of links in the chains, 1,832.

The cost of the bridge was $525,000, and although it was erected by a Chicago company, nearly all the ironwork was done by Graff, Bennet & Co., of Pittsburg.

The Fastest Trotting on Record.

The fast trotters, Maud S and St. Julien, both surpassed the best time on record for one-mile heats, at Rochester, N. Y., August 12. The time was 2 minutes 11¾ seconds. This wonderful speed was exceeded August 27, at Hartford, Conn., by St. Julien. Distance, one mile; time, 2:11¼.

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NEW YORK, SATURDAY, SEPTEMBER 11, 1880.

Contents.

(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 245,

For the Week ending September 11, 1880.

Price 10 cents. For sale by all newsdealers.

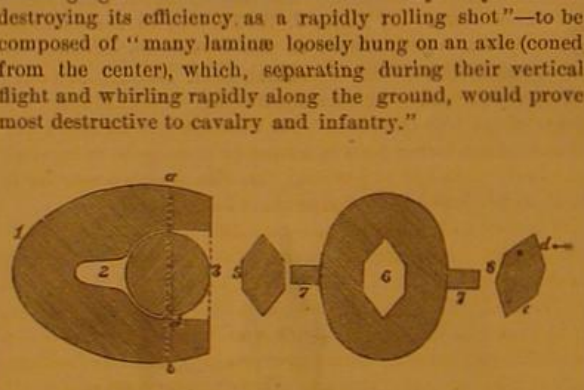
A NOVEL PROJECTILE.

A radically new type of cannon shot has been proposed by a general in the British army, to meet the novel conditions of penetration necessitated by the monitor-type of war vessels. However modified in details of construction the war ship of the present conforms more and more to the monitor principle, in the submergence of the hull and its protection by means of armored sides sloping at an angle calculated to send projectiles glancing off harmlessly; and the indications are that the war ship of the future will always present a turtle back to the enemy's guns, rather than the high vertical sides of the old style of ships.

Against armor of this sort but little is gained by increasing the weight of projectiles and the range of guns. The cylindrical bolts, spirally rotating, may be irresistible when fired against a vertical target; but they are hurled in vain against a ship with no sides to batter. Accordingly, General Hutchinson proposes, in the current issue of *Macmillan's Magazine*, a projectile having a disk-like form and a vertical rotation. Instead of glancing from a flat-armored ship, or from water, such a shot must of necessity maintain its line of motion; and with heavy shot no slope however slight given to armored decks or bottoms could save them from penetration. With the rotation of an advancing carriage-wheel the upper edge of the projectile, on striking a ship's bottom, would receive an impulse upward and crash through any double bottom or cellular compartments. With the reverse rotation the lower edge would receive an impulse downward, and the whole momentum of the projectile would be brought to bear like a heavy circular saw upon the deck impinged upon.

The rotation to be given to the projectile is determined by the position of the catch in the muzzle of the gun, as shown at 4 in the accompanying engraving. No rifling of the gun is required for such a projectile, and all the surfaces of the disk are therefore smooth, so that there is nothing to check rotation in the longest flights. Another advantage claimed arises from the shortness and corresponding lightness of the gun required for this projectile. The disk rolls out of the gun unretarded by rifling; there is little or no recoil of the gun; the initial velocity of the shot is great, since it does not have to drive out a column of air packed before it; and with its sharp edge, and little or no vacuum in its rear, the shot is calculated to have long-sustained velocity. That the rotatory motion must be preserved is shown by results obtained by a small experimental gun.

For land use General Hutchinson proposes a projectile of any shape having the rotation of an advancing wheel—"a projected mitrailleur, effective at an immense distance, discharging its bolts with a horizontal trajectory without destroying its efficiency as a rapidly rolling shot"—to be composed of "many laminæ loosely hung on an axle (coned from the center), which, separating during their vertical flight and whirling rapidly along the ground, would prove most destructive to cavalry and infantry."



The construction of the gun and the projectile will be made clear by the engravings. The reference figures indicate:

(1.) Vertical longitudinal section of gun. (2.) Powder chamber. (3.) Section of disk projectile through major axis. (4.) Notch in circumference of disk, and catch in muzzle. (5.) Section of disk through minor axis. (6.) Transverse section of gun through *a b*. (7.) Trunnion. (8.) Section of disk through minor axis inclined from a horizontal plane. A side wind blowing in the direction of the arrow acts more forcibly against *d* than *e*, and therefore tends to make the disk travel more vertically. The influence of a side wind on a flat-sided, round-edged disk (the central section of a sphere) would be just the reverse, as could be exemplified by throwing a flat stone with a spin.

STRIKING FIGURES ABOUT COTTON.

A prominent New England manufacturer, and the foremost authority on cotton statistics in the country, has recently written a letter giving some figures as to the growth and probable future development of the cotton industry, which are almost startling, and, coming from any less trustworthy source, would seem rather the dreams of a visionary than the sober conclusions of a well-informed business man. The writer first points out the increased product with free as against the former slave labor, and says: "The very habit of the cotton plant itself has been altered; it has been forced to mature earlier, and been made more prolific, and stronger to resist its insect enemies," so that, with probably a less number of laborers in the cotton fields now, the production is greatly in excess of what it formerly was, that of the present year being estimated as "at least 25 per cent in excess of the largest crop ever raised by slaves." The writer then says that from 6,000,000 bales of cotton fiber, after deducting enough seed for the next year's planting, there will remain 3,000,000 tons of seed, which, "if treated as a small portion is now treated," will yield about 90,000,000 gallons of oil, about 1,300,000 tons of oil-cake or meal, and hulls which it is thought may be profitably worked into "750,000 tons of paper," although, if these hulls be worked into the meal, they will serve as so much food for stock. The writer then figures out the possible proceeds, as an actual addition to the wealth of the country, of "the almost unrealized portion" of our present cotton crop in figures which seem almost startling, and says that "there never was so great a field suddenly opened for the introduction of new tools, new cotton gins, new presses, and for every variety of implements and processes."

Indeed, the principal object of the writer is to urge upon manufacturers and the public the importance of holding a great international exhibition, exclusively devoted to cotton. But why may not such an exhibition be held in connection with the great Fair which we are to have in New York in 1883? This city many years ago drew the great bulk of the cotton business from Boston, and is now the great mart of the country for productions in that line. It would probably require as large a building as we had in Machinery Hall at the Centennial to make a complete display of cotton machinery alone, but if the cotton manufacturers were all to enter earnestly into such a plan we cannot imagine any other one object to which so much space might profitably be devoted, and no one which would so readily command liberal contributions from New York merchants. Such an exhibition, if it gave, in the machinery shown, a sort of history of the growth of improvement in the cotton manufacture, would afford at once a help and a powerful incentive to further inventions and discoveries, whereby this large and at present "almost unrealized portion" of our cotton crop might be turned to profitable account, and nowhere else could the judgment of experts and the help of capitalists be so surely depended upon. We therefore earnestly commend this subject to the careful consideration of the Board of Commissioners who are now making the preliminary arrangements for the Exhibition of 1883.

The proposer of this plan of a comprehensive cotton exhibition puts his argument briefly as follows: "One or two men in agriculture (cotton raising), one in preparing and transporting, one or two women in spinning and weaving, are equal to the production of cotton cloth to meet the need of 1,000 to 3,000 inhabitants of the various parts of the world; yet this great force, this factor in commerce almost as potent as gold, and more so than silver, at the present day has had but the most meager attention. It needs now a place in which all new inventions may be concentrated." Inventors may know from the above something of the extended field which is before them as connected with this branch of business, and, although many very important improvements in the cotton manufacture have been made by American mechanics, the opportunities for a careful examination of machinery are not sufficiently general to promote that wide emulation which such an exhibition would invite and encourage. "The air is full of new efforts, new devices," says our author, to meet the needs of this industry, so let us by all means have such an exhibition, so that inventors can learn what has been done, and all join in the effort to bring out what is wanted.

A CURIOUS PHYSICAL PHENOMENON.

A curious physical phenomenon has, says *Nature*, been lately described by Dr. Grassi in the Proceedings of the Royal Institute of Lombardy. An apparatus is formed of three concentric vessels with an annular space of about two centimeters between the first and the second, and the second and the third. The outer space is filled with oil, and the next with water. The oil is heated by a gas furnace to a little over 100°, and the water boils. Then hot oil at, for example, 150°, is poured into the central space. This quickly cools to a temperature close to 100°. Dr. Grassi found that the central oil cooled more rapidly the higher the temperature of the outer oil; and with more delicate apparatus (in which the vaporized water was conducted and returned, and the outer oil kept at any requred constant temperature) he arrived at definite numerical results, which he tabulates. With the outer oil at a mean temperature of 129·9°, for instance, the time of cooling of the inner oil from 130° to 110° was 49 seconds; when the former was 105·1°, the latter was 57 seconds. Alcohol and ether gave more decided results. The maximum difference was obtained with ether; the outer oil being at 57·5°, the inner took 25 seconds to cool from 57° to 50° (7°); whereas the former being 39·3°, the latter became 39·5 seconds. In all the experiments the cooling of the inner oil commenced at a temperature little above the maximum of the external oil. When the outer oil is at a higher temperature, at a certain point the heat begins to prevail, which is transmitted directly from the outer to the inner oil. An analogous phenomenon (to which Dr. Grassi refers) was that of some members of the Accademia del Cimento, who found that the water in a vessel surrounded by ice cools more rapidly if the ice be heated to accelerate fusion.

DO PATENTS PAY?

The Washington correspondent of the Chicago *Times* has been making inquiries with respect to the benefits derived by inventors from patents, being incited thereto by a statement to the effect that not two patents in the hundred ever return to the applicant the amount of the government fees. On the authority of Mr. Arthur W. Crossley, chief of the issue division of the Patent Office, who for the past two years has made a special study of the value of patents, the statement above quoted is pronounced wholly unjustified by

facts; and Mr. Crossley's testimony will be abundantly substantiated by all who have had much to do with patent rights. Mr. Crossley refers to the weekly list of patents issued for evidence that a large part of them are assigned wholly or partly to manufacturing companies. In other words, the practical worth of the patents has been demonstrated, and Mr. Crossley has found, upon inquiry, that in nearly all cases the assignors obtain a good price for their inventions. He adds:

"Whenever I have had an opportunity to inquire of inventors as to the success they have had with their patents, the general testimony has been that the inventors have made something satisfactory out of their patents. A number of years ago, Secretary of the Interior Thompson caused an inquiry to be made in this same matter, and it was reported that the value of patents issued would average about $10,000 each."

When it is borne in mind that to a large extent patents are taken out to cover and protect devices and processes which are, so to speak, stepping stones to final inventions which alone are to be practically applied, this high average value is very significant. Then there must be taken into account the large number of inventions which the makers do not develop, not because of inherent worthlessness, but because the inventor's attention is turned to something else. In all such cases the patents pay indirectly in securing the registration and accurate description of the inventions, by which means they become a permanent part of the common stock of practical knowledge.

THE CONCORD SCHOOL OF PHILOSOPHY.

The *Christian at Work*, alluding to the closing of the recent session of the Concord School of Philosophy, rather sneeringly suggests that no new problems were solved nor any new impulse given likely to lift the moral world out of its orbit. The editor further says that he believes it was Mr. Joseph Cook who pronounced Mr. A. Bronson Alcott "the modern Plato." Perhaps he meant the Concord Plato. Every New England village is supposed to have a Plato, and, for all we know, a Socrates as well. But hemlock is not drunk now as freely as it was, and the modern Socrates is not as anxious as his ancient prototype was to be rid of the prison house of his body. It must be a very happy thought to a New England philosopher to imagine himself going down to his grave a nineteenth century Plato. Still, we fear the Phædo will be read when the Concordia is forgotten; and if a modern Plato usurps the olden one in public regard, it will be when English is a dead language, when the theories of its pronunciation are as many as the stones of Trinity spire, and when that New Zealand itinerant shall wander among the ruins of the New York Post Office and puzzle over the lost order of American architecture, or, mayhap, some antiquarian shall puzzle over a translation of a poem of Emerson's, and search in vain for the key to the unsolvable enigma.

TIN IN MAINE.

Among the mining interests just now showing signs of early and profitable development in Maine, not the least in importance is that connected with tin. The country has no lack of mines of gold, silver, copper, and lead; and if any failure should occur in those now opening in Maine, it is not likely that many besides their particular owners would be conscious of the deficiency. Nor is it likely that any great or radical effect would be wrought upon the general industries of the country, should the yield of these metals in Maine prove as generous as the most enthusiastic miners there anticipate.

With tin the case is different. For that metal we are obliged to go abroad, chiefly to England, and so long as England controls the market for tin, there is little hope of our wresting from her the larger traffic in tin plate. The development of tin mining at home to a degree sufficient to secure the practical independence of our vast industries employing tin and tinned iron would be worth much more to the country, indirectly if not directly, than any mine of gold or silver. Accordingly it may be safely said that the announcement of the discovery of extremely promising deposits of tin ore in Maine is likely to awaken a heartier interest throughout the country than any other mining reports from that land of mining booms. If any of Maine's mineral products fail, it is sincerely to be hoped that the failure will not be in tin.

Indications of tin were discovered in Maine some ten years ago; but then it was the popular belief that Maine was not nor ever could be a mining State. Recent explorations in the town of Winslow, on the Kennebec, a few miles above the State capital, have discovered half a dozen metallic veins of rich tin ore, in a rock formation precisely like those in which tin is found in Cornwall, Germany, and New South Wales.

As described by Professor C. H. Hitchcock, the rock which incloses the tin ores of Winslow is a mica schist or killas, associated with somewhat calcareous layers, and adjacent to a hard quartzite band, called an *elvan* by miners. Thirty feet width of vertical sheets of killas show twelve granite veins from half of one inch to three inches width, crossed, occasionally, by stragglers. These veins are full of crystals of tin ore (cassiterite) with the associated minerals fluorspar, margarite, mispickel, beryl, lepidolite, etc. The mineral, geological, and physical feature of the Winslow mine are, Professor Hitchcock adds, "identical with those common to the stanniferous districts of Europe," and "the ore seems to be sufficiently abundant to remunerate quite extensive outlays for mining operations."

Professor Forrest Shepherd describes the mineralized belt at Winslow as from thirty to forty or more feet in width. In a shallow pit where it has been uncovered five or more veins appear within a space of eight feet, a promise unequaled in any Cornwall or Saxony mine. And what is particularly encouraging, the Winslow deposits are, at the surface, equal in quality, Professor Shepherd says, to the best in Cornwall, and in a series of veins most favorably situated, while in Cornwall and elsewhere the veins are rarely remunerative except at great depths.

A company has been formed to develop the Winslow mine and to extend the exploration for tin in other parts of the State. The prospect of success is, to say the least, very encouraging. Should the yield prove abundant a particularly favorable opportunity would seem to offer for the manufacture of tin plate in that State, owing to the abundance of suitable iron ore and the proximity of forests for supplying the charcoal required to smelt it.

THE AMERICAN SCIENCE ASSOCIATION.

The twenty-ninth meeting of the American Association for the Advancement of Science began in Boston, August 25. The meeting was called to order by the retiring President, Prof. Geo. F. Barker, of Philadelphia, who immediately resigned the chair to the President-elect, the Hon. Lewis H. Morgan, of Rochester. President Rogers, of the Massachusetts Institute of Technology, delivered an introductory address, which was followed by addresses of welcome by Mayor Prince and Governor Long.

The secretary reported the deaths for the past year as follows: George W. Abbe, New York; E. B. Andrews, Lancaster, Ohio; Homer C. Blake, New York; F. A. Cairns, New York; Caleb Cooke, Salem, Mass.; Benjamin F. Mudge, Manhattan, Kan.; Thomas Nicholson, New Orleans; Louis Francis de Pourtales, Cambridge, Mass.

A committee was appointed to draft resolutions on the death of Gen. Albert J. Myer, and another to send by cable the cordial greetings of the Association to the British Association at Swansea, on the occasion of its fiftieth meeting.

The general session was then adjourned, and the various sections and sub-sections organized. In the afternoon, Section A was addressed by Prof. Asaph Hall, of Washington, who reviewed the recent advances in the science of astronomy, and the services rendered by men who, like Fraunhofer, have aided the work by optical and mechanical skill.

In the sub-section of chemistry, Prof. John M. Ordway reviewed the recent achievements of practical chemistry, and discussed its methods. The sub-section of anthropology was addressed by Major J. W. Powell, on the social organization and government of the Wyandotte Indians. In the evening the retiring President, Prof. Barker, delivered the customary address, his subject being, "Some Modern Aspects of the Life Question." He took the ground that every action of the living body is, sooner or later, to be recognized as purely chemical or physical, the life that science has to deal with having no existence apart from matter.

The second day's meetings were held in Harvard College, Cambridge. The appointed eulogy on the late Prof. Henry was delivered by Prof. Alfred M. Thayer, who dwelt especially on Prof. Henry's work as a discoverer in science. The practical side of that work was touched in connection with the experiments which proved so beneficial to the lighthouse and fog-signal service. One discovery—that lard oil, when subjected to a heat of 280° Fahr., is superior to sperm oil in fluidity and illuminating power—saves the Government $100,000 a year.

Prof. Alexander Agassiz, Vice-President of Section B, followed with an address on "Paleontological and Embryological Development," choosing his illustrations from a limited group of marine animals—*zaurchins*—having less than 300 living species, and more than 2,000 known fossil species.

The rest of the day was spent in the museums, laboratories, libraries, the observatory, and other buildings of Harvard College.

The reading of the 218 papers comprised in the programme was to begin on the third day, Friday, and continues until the final adjournment on Wednesday, Sept. 1. Nearly 600 members were registered the first day, and fully 500 new members have been elected during the two days completed at this writing.

MINING DEBRIS IN CALIFORNIA.

The California Mining Debris Commission, with Capt. J. B. Eads as consulting engineer, have lately gone over the Yuba River country to consider the plans proposed for the disposal of mining debris. If correctly reported, Capt. Eads favors the construction of brush dams rather than those of stone, as originally recommended by the commission. In his opinion, a series of brush dams across the river would entirely arrest the flow of sand and clay; and as fast as the brush is buried other layers might be added from time to time, gradually raising the height of the dam until the catchment basin is full.

A dam of this sort is proposed about eight miles above Marysville, where there is tolerably high ground on opposite sides of the valley. The plan contemplates the building of a brush dam nearly two miles long and seven or eight feet high to begin with. This dam would catch and hold a large quantity of debris, and become buried and strengthened by the deposit. From time to time additions would be placed upon top of the new foundation thus formed. Proceeding up the river, the banks become higher, forming a broad and deep area between them for storage of matter to be checked by the dams. From this lower dam to the foot of the dumps from the mines there is an area of seven square miles to be filled by the debris, and were it filled to the depth of forty feet at the upper end it would not interfere with mining operations. Two miles higher is Point Du Guerre, a rocky point about sixty feet high, and extending into the canon or valley some distance. From this point to a higher one across the river it is proposed to extend the second dam, the length of which will be nearly a mile. Beginning with brush loaded with rock, and adding new material as it may be needed, a dam forty feet in height can safely and cheaply be built up. An abundance of willows can be cut for the dams along the river side, and Capt. Eads has great confidence in their efficiency for the work required. Below the dams, where the river banks are defective, brush wing dams will easily keep the current in place; and, with the stoppage of dams above, the concentrated water will quickly cut out a single deep channel.

Albert J. Myer.

Brigadier-General Albert J. Myer, Chief Signal Officer, United States Army, familiarly known as "Old Probabilities," died at Buffalo, N. Y., August 24.

General Myer was born in Newburg, N. Y., Sept. 20, 1828. He was graduated at Geneva College in 1847, and in 1851 received the degree of doctor of medicine from the University of Buffalo. In 1854 he was appointed assistant surgeon in the army. While on duty on the Texan frontier, where a clear atmosphere and broad reaches of plain offered superior facilities for signaling by vision, his attention was drawn to the possible advantages of a system of sight signals in military and naval operations. The result was the preparation of a "Manual of Signals for the United States Army and Navy," which was published in 1858. During the next two years he was engaged in developing a special signal service for the army, becoming Chief Signal Officer in 1860. His service during the war was brilliant and vitally important, and his advancement was correspondingly rapid. One of the most dramatic episodes of the war was the saving of Allatoona, Ga., in 1864, by bringing up troops by signals in time to relieve and defend that valuable post, the messages being sent over the heads of the enemy.

After the war General Myer introduced a course of signals at the naval and military schools at Annapolis and West Point, and was largely instrumental in establishing telegraphic communication with military posts on the extreme frontier, 5,000 miles of telegraph lines having been built under his supervision. In the spring of 1870 he was, by Act of Congress, charged with the special duty of developing a national system of meteorological service, which was accomplished within a year. The success of this system under his admirable management has led to the establishment of a uniform international system of simultaneous meteorological observation over nearly all the northern hemisphere; arrangements being made at the International Meteorological Congress at Vienna in 1873, for the exchange of one report of observations taken daily at the same instant over all the United States, nearly all of Europe, Northern Asia, and Northern Africa. It is seldom that a work begun by one man grows under his own supervision into a service of such far-reaching and comprehensive usefulness.

The Kelley Run Colliery Fire.

The attempt to quench the fire in the new slope of the Thomas Coal Company, near Shenandoah, Pa., by sealing the outlets and forcing in steam, has failed. The mine caved in August 24, and to all appearances the fire is beyond control. The alternative plan for quenching the fire with carbonic acid gas and nitrogen, undertaken by a Pittsburg firm, has also been abandoned, the flames having secured so large an opening to the outer air that there seems no possibility of cutting off the supply of oxygen.

A Rude Tramway.

Seven miles of log track are being laid at Essex Center, Ontario, connecting four saw mills with timber cuttings in the woods. The road is made of small trees, stripped of their branches, and laid end to end, like rails. Four cars are being built for the road, the rim of the wheels being concave, so as to run on the track, and the axles turned longer than the hubs of the wheels to allow play for any unevenness. The trains will be drawn by a steam locomotive.

Hollow Ground Razors.

It is not long since it was confidently asserted that, even if the required quality of steel could be produced here, the United States could never compete with England in the manufacture of razors and other fine cutlery, owing to the excessive cost of grinding and finishing. Like a good many other "insuperable" obstacles to American success in the arts, this seems to have been pretty well overcome, since large quantities of Sheffield razor "blanks" are now sent here expressly to be finished. It seems that the art of "hollow grinding," German style, requires a degree of skill a little beyond that of the Sheffield workmen. Accordingly Sheffield manufacturers have to pay double freight across the Atlantic to secure the fine finish to their razors that the trade now demands.

The Habit of Self-Control.

If there is one habit which, above all others, is deserving of cultivation, it is that of *self-control*. In fact it includes so much that is of value and importance in life, that it may almost be said that, in proportion to its power, does the man obtain his manhood and the woman her womanhood. The ability to identify self with the highest parts of our nature, and to bring all the lower parts into subjection, or rather to draw them all upwards into harmony with the best that we know, is the one central power which supplies vitality to all the rest. How to develop this in the child may well absorb the energy of every parent; how to cultivate it in himself may well employ the wisdom and enthusiasm of every youth. Yet it is no mysterious or complicated path that leads to this goal. The habit of self-control is but the accumulation of continued acts of self-denial for a worthy object; it is but the repeated authority of the reason over the impulses, of the judgment over the inclinations, of the sense of duty over the desires. He who has acquired this habit, who can govern himself intelligently, without painful effort, and without any fear of revolt from his appetites and passions, has within him the source of all real power and of all true happiness. The force and energy which he has put forth day by day, and hour by hour, is not exhausted, nor even diminished; on the contrary it has increased by use, and has become stronger and keener by exercise; and, although it has already completed its work in the past, it is still his well-tried, true, and powerful weapon for future conflicts in higher regions.—*Phila. Public Ledger.*

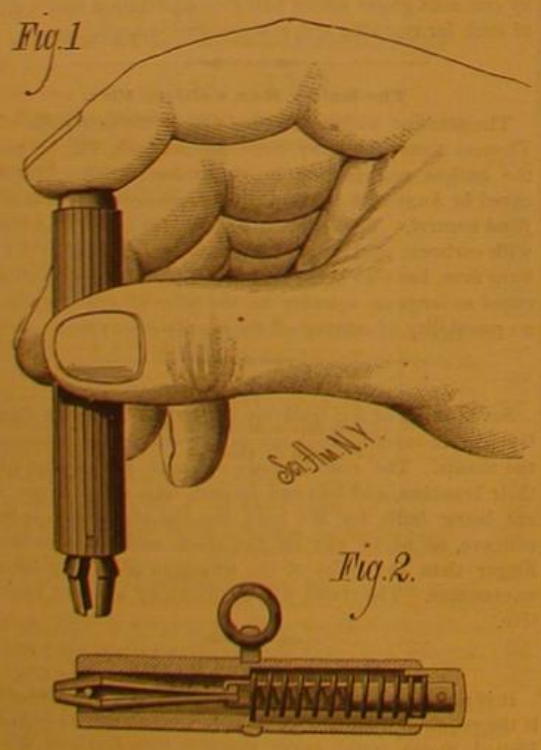
SELF-ADJUSTING WATCH KEY.

With few exceptions no article is more universally used than the watch key, and it is singular that an article even as simple as this should have been used for centuries without some improvement. It is only recently that any real improvement has been made in this direction. Our engraving represents an adjustable key—one that will wind any watch—which is manufactured by Messrs. J. S. Birch & Co., 38 Dey street, New York.

The engraving shows the construction and manner of using this key so clearly that scarcely a word of explanation is required. The instrument consists essentially of a pair of griping jaws held in the forked end of a spindle arranged to slide in the tube. The end of the spindle is attached to a cap, which slides in the tube and is pressed by a spiral spring resting on a shoulder in the tube. The tendency of the jaws is to spring apart, so that when the cap is pressed downward, so as to project the jaws from the tube, they are separated more or less. While in this position they are placed on the arbor to be turned, the cap is then released, and the jaws clamp themselves tightly on the arbor. The jaws are prevented from twisting or turning in the tube by a pin passing transversely through the tube between the jaws.

As to the usefulness of this invention it is only necessary to say that the key will fit any watch, and will not only answer the purpose of winding and setting the watch, but it will fit the abors perfectly, thus avoiding the wear of these parts, a thing unavoidable when common keys are used.

This key is absolutely proof against the danger of conveying dust to the movement. By springing the jaws open all



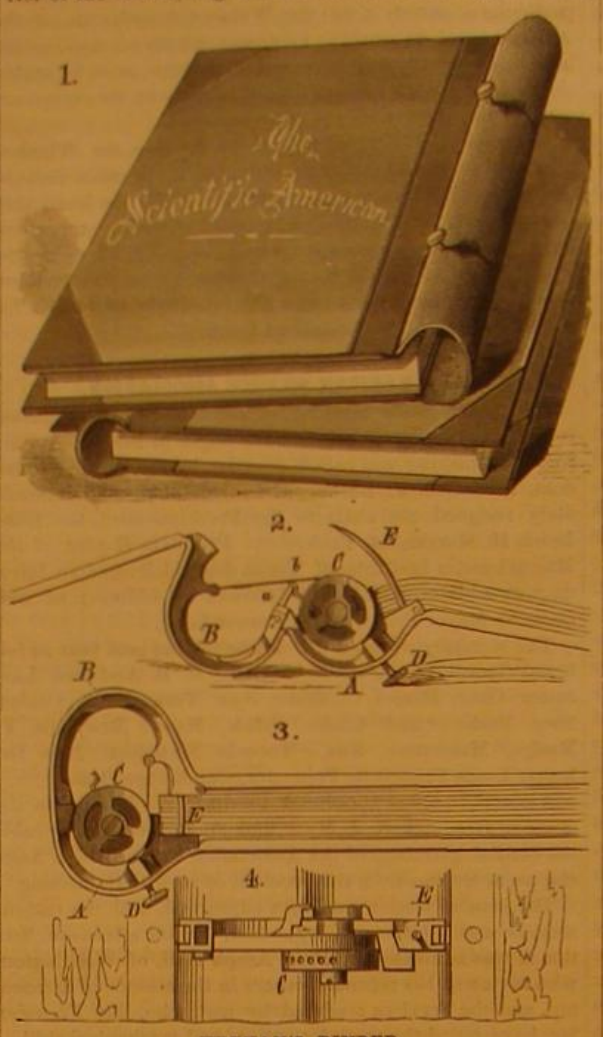
BIRCH'S SELF-ADJUSTING WATCH KEY.

accumulations in the pipe or jaws of the key are at once expelled. All the adjustable parts are made of the best tempered steel, and the shells are substantially mounted in a large variety of ornamental designs (some 37 in number), which render them appropriate and attractive charms to be worn on watch chains.

Full particulars may be obtained by addressing the sole manufacturers as above.

A NOVEL BINDER.

The engraving shows a new binder for binding newspapers, pamphlets, letters, bills, etc., recently patented by Mr. William Keenan, of 79 St. George street, Toronto, Ontario, Canada. Fig. 1 is a perspective view representing the exterior of the binder; Fig. 2 is an end view showing the back



KEENAN'S BINDER.

of the binder open and ready to receive papers; Fig. 3 is an end view showing the back closed, and Fig. 4 is a detail view of the fastening mechanism.

The binder has two covers connected by a back of leather, and also by jointed metallic frames, A B. The part, B, of each frame has a cam, *a*, which is engaged by a spring, *b*, on the part, A, when the binder is opened to receive a paper, and holds it open while the paper is being placed on the curved needles, E. The two parts of the jointed frames are drawn together as the binder is closed by springs in the drum, C, turning on a stud projecting from the part, A, of the jointed frame. The drum carries a band or piece of watch spring, which is attached to the opposite half of the frame, and serves to draw the two parts together. The part, B, is made hollow to receive the needle, E, and a milled screw, D, passes through the frame and enters one of several small cavities in a rim attached to the drum, C, to keep it from turning.

The articles to be filed are placed upon the curved needles when the device is arranged as shown in Fig. 2; then by closing the two halves of the back the spring, *b*, is released from the cam, *a*, and the spring in the drum, C, holds the binder closed. To secure it still more firmly the screw, D, may be brought into use.

It will be seen that no thread is used in this binder and that threading is consequently avoided. The covers may be opened wide and will be flat, and the papers can be easily referred to and read.

American Machines in England.

In his recent address before the Institution of Mechanical Engineers, President Cowper said:

"Sewing machines ought to be made here, and I urged English makers, years since, to go in thoroughly for making every part accurately and by machinery, so as to fit together at once without 'fitting;' but I could not get this carried out, and now sewing machines come from America literally by millions, though labor is dearer, metal is dearer, and there are upwards of 3,000 miles of carriage against them. But 'machine manufacture' is cheaper and better than 'hand making.'

"In gun making I counseled some of the Birmingham makers, years before they did anything in the matter, that they would actually lose their trade if they did not adopt good machinery to manufacture every part exact to size; and at last, when the government had the means of doing most of the work, they did adopt machinery, but many years too late.

"Then with regard to common pumps, they are now imported from America by thousands, and are sold here, without being commonly known to be American; clocks and watches also come in immense numbers, some of them very cheap and common, while others are very well made.

"Another trade, nearer perhaps to most of us, is that of rolled iron girders, which, I am sorry to say, are coming by hundreds and thousands from Belgium; indeed, almost every house that is now built in London with rolled iron girders is supplied from Belgium. These things should not be; we have iron in plenty, and labor in abundance, but we want special machines, schemed as fast as they are wanted, to fit the work properly, and turn it out accurately in large quantities; and we should show more enterprise in adopting a good 'new thing,' which I am sorry to say is what some of our old-fashioned manufacturers are slow to do, often little knowing how they damage the trade they are in by not adopting the best known process."

DE LOCHT'S PANTELEPHONE.

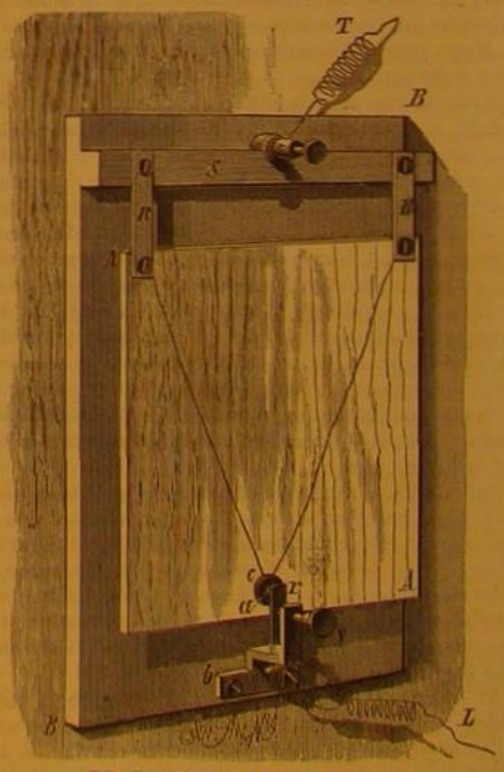
Leon de Locht, Mining Engineer and Professor at the College of Mining, Mont St. Martin 49, Liege, Belgium, after several years' experimenting with a view of overcoming the defects of the best telephones in use, and after the invention of one or two forms of apparatus, which have been the subject of patents in various countries, has finally perfected an instrument which he calls the pantelephone.

This apparatus is a microphonic transmitter which is sensitive to sonorous vibrations emanating at a great distance. It is capable of transmitting words spoken at forty-five feet from the apparatus to a distance of several miles through the medium of receiving telephones. The pantelephone, which is extremely simple, is composed essentially of a movable plate carrying a carbon contact, which presses against a disk of carbon or metal—silver or platinum.

Referring to the accompanying cut, the plate is seen figured at AA. It may be of aluminum, sheet iron, steel, brass, mica, cork, or of any substance whatever that is capable of being formed into plates of large superficial area, while at the same time possessing the requisite amount of lightness. It is preferable that its form should be rectangular, fifteen centimeters square in size, and, when made of metal, two to three tenths of a millimeter in thickness. It should be as inflexible as possible, and not liable to bend out of shape through the influences of temperature and humidity. It is suspended by two small very flexible steel springs, R R, from a support, S, which is perfectly straight and stands out from the fixed plate, B B, forming the framework of the apparatus. To the middle of the lower end of the plate is riveted or soldered a small carbon disk, *c*, which, when the apparatus is in a vertical position, rests against a small piece of silver or platinum fastened to the end of a short and somewhat inflexible spring, *r*, the latter being fixed by means of a screw, *v*, to the copper support, *b b*. By means of a thumb screw, V, passing through the support, the contact of the carbon, *c*, with the piece, *a*, may be regulated at pleasure.

The pantelephone is placed in the circuit of a voltaic pile in such a way, for example, that the current entering at L, proceeds to the support, *b b*, and from thence through the spring, *r*, to the contact, *a*, then to the carbon, *c*, and through the plate, A A, to the springs, R R, and leaves the apparatus at T.

There are other and secondary details of construction, by means of which the inventor is enabled to so regulate the apparatus as to insure of the greatest sensitiveness and of the best possible performance. There are certain arrangements employed, too, to deaden and stop all noises which might arise from tremors of the earth, or from the shaking of the wall to which the apparatus is attached. It is claimed that the pantelephone, when once properly regulated, is not liable to get out of order; and, moreover, that the expense



DE LOCHT'S PANTELEPHONE.

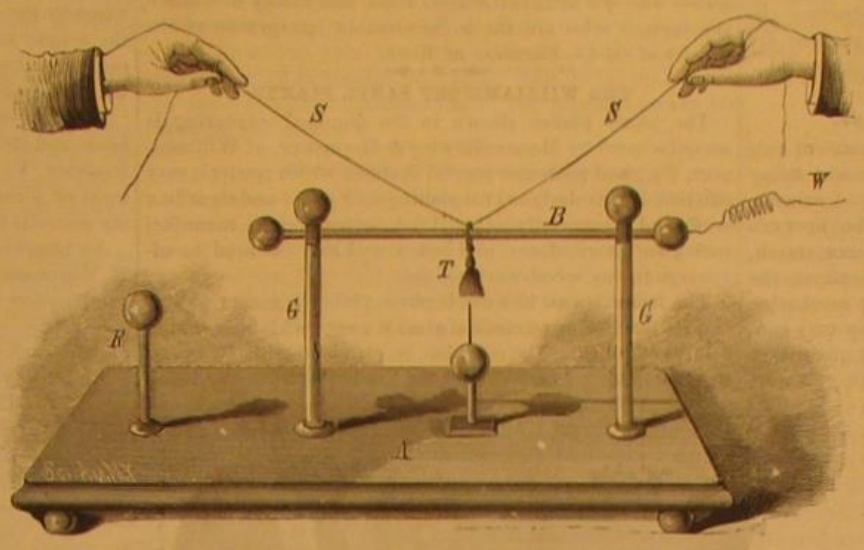
attending the use of the system is insignificant, since the apparatus under proper conditions requires for its making only the electromotive force of a single voltaic couple. The instrument transmits all sounds, articulate or inarticulate, which reach it, through the medium of either solids or the air. It is inclosed in a box (which may be made as ornamental as desired) in such a way that its sensitiveness to sonorous vibrations is in no way impaired.

EXPERIMENT ILLUSTRATING DISCHARGE OF ELECTRICITY FROM CLOUDS.

Mr. Loudon gives the following pretty experiment in the *Colliery Guardian*. It illustrates some of the phenomena of thunderstorms:

In the engraving, A is the base of the instrument, made of wood and brass. G G are glass legs supporting an arm of brass, B. The cloud is here represented by the moving tassel, T, pulled backwards and forwards by the strings of silk, S S. O is a ball provided with a point or lightning conductor. This ball is not insulated, that is, not supported by a glass leg. W is a wire leading to an electrical machine. On working the machine electricity is spread over the arm, B. The tassel consequently diverges, owing to each filament being charged with like electricity. On drawing the tassel (cloud) over the lightning conductor, O, an opposite kind is given off at the point and neutralizes the cloud and the leaves or fibers collapse. If we were to wholly detach the tassel and work the machine till we raised a large envelope of electricity around the arm, B, a vivid flash of light (lightning) would pass to uninsulated conductor, R. If the ball, O, was not provided with a point, on moving the electrified tassel along the arm, B, it would not collapse on passing the ball, except that a faint spark was given off. If this spark took place, you have what often happens in nature.

Persons ought never to stand near a tree nor a house, nor even a building provided with lightning conductors, for shelter. My reasons are these: Wood is a poor conductor, masonry worse, and if buildings provided with these conductors are not what they ought to be, they only invite destruction.



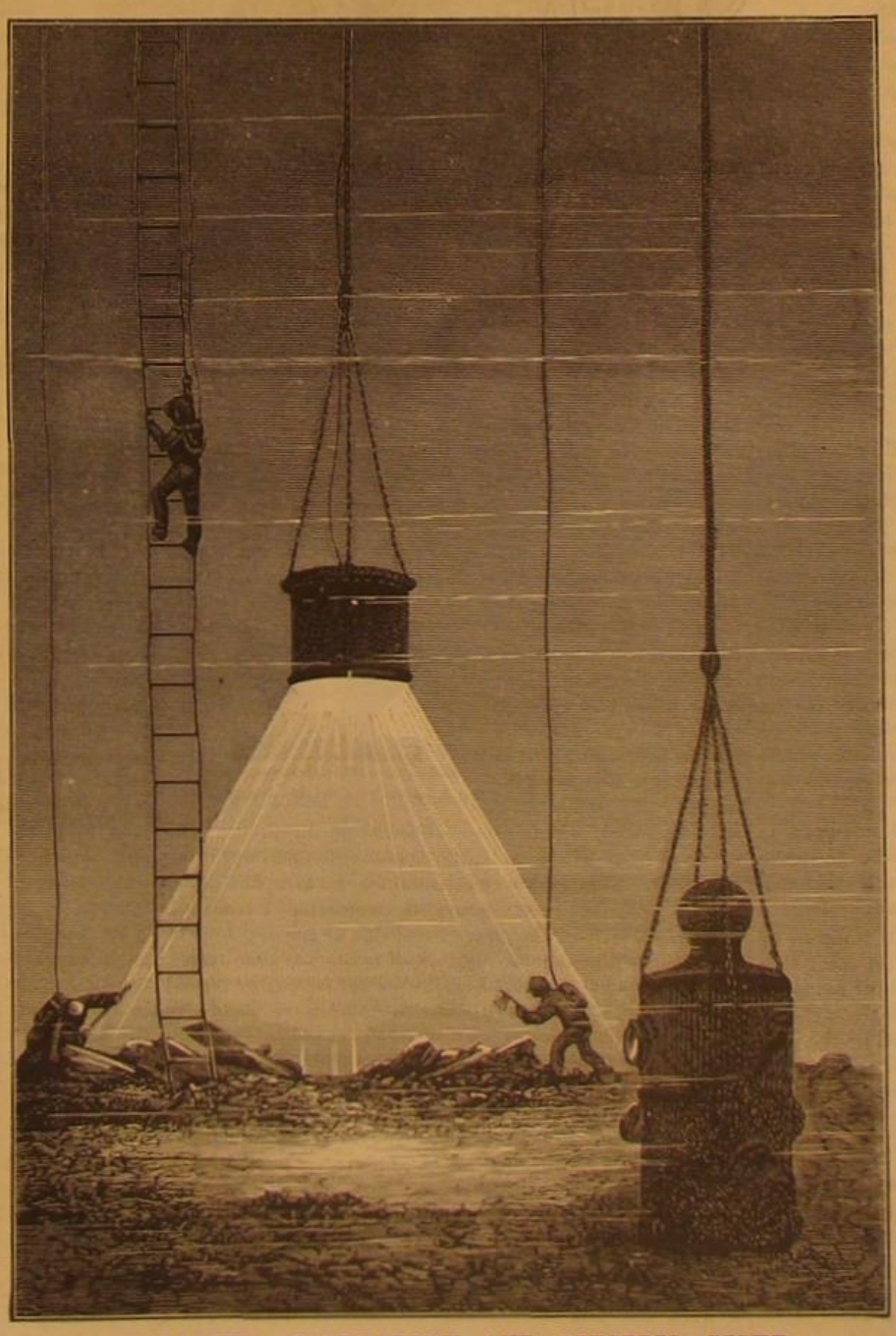
ILLUSTRATING DISCHARGE OF ELECTRICITY FROM CLOUDS.

SUBMARINE OBSERVATORY AND ELECTRIC LIGHT.

The accompanying engraving, taken from the *Leipziger Illustrirte Zeitung*, illustrates Bazin's submarine observatory and electric light, which has been found to be of the greatest service in examining wrecks, submarine foundations, etc. It was used for the first time in examining the wreck of the Confederate steamer Alabama, which was sunk off the French coast at Cherbourg. The electric light is contained in a heavy cylinder, about 4½ feet high and about 4 feet in diameter, and provided with a heavy plate glass bottom. The lower part of the cylinder contains alum water to counteract the pressure of the sea water, which increases very rapidly as the apparatus is lowered. The upper part of the cylinder contains a powerful electric lamp, the light rays of which pass through the alum water and the plate glass bottom, and lights up the bottom of the sea for a space about 100 feet in diameter.

Bazin's observatory, shown in the right hand corner of the engraving, is about 9 feet high and 2 feet in diameter. It is provided with two bull's-eye windows through which the person in the observatory can watch the divers that are at work on the wreck. As the water is an excellent conductor of sound the superintendent can converse with the divers very conveniently.

A person can remain in this observatory for about three quarters of an hour, and if any parts should break or leak he can enter the upper helmet and remain in the same from eight to ten minutes, thus allowing ample time to raise the entire apparatus to the surface.



SUBMARINE OBSERVATORY AND ELECTRIC LIGHT.

The Largest Sewing Machine.

The largest sewing machine in the world has lately been finished. It is of the Singer type. The machine weighs over four tons, and is in some respects of new design, uniting much simplicity of construction with great strength of parts. It is adapted for general manufacturing purposes of the heavier sort, although specially made for stitching cotton belting, an article which is just now taking the market as a cheap and serviceable institution for gearing and the ordinary leather belting. The material used is of great strength and toughness, and is sewed together in plies or layers, up to an inch in thickness. The belting in being sewed together is passed through heavy feed rollers some nine inches in diameter and over eight feet in length, getting stretched and pressed in the process. There are two needles at work with two shuttles, and the shuttles can be removed from the bottom without disturbing the overlying plies belting.

The rollers between which the work passes are actuated by reversible worm and cam motions, and the machine has, in addition to these roller feeds, what is known as a top feed motion, suitable for a lighter class of work.

The stitch, as in the ordinary sewing machine, can be adjusted from one eighth inch upward, and the pressure of the rollers on the work passing through the machine can be regulated at the will of the operator. The machine, which is driven by steam, has been made for a manufacturing firm in Liverpool.

More Oil Tanks Struck by Lightning.

On the 19th of August the Bradford oil regions, Pa., were visited by a severe thunderstorm which did much damage. Two oil tanks, each holding 25,000 gallons of oil, were struck at Dallas city, six miles from Bradford. Seven smaller tanks, located respectively at Parker City, Edinburgh, Steplersburg, Bullion, and Jefferson City, were also struck and burned. The loss in oil and tanks was about $100,000. Mr. Morian, telegraph operator, received a severe shock, caused by lightning running into his office on the wires.

Improved Iron Chains.

A public test of chains, made on the plan of Capt. Chas. A. Chamberlain, by the American Chain Company, of Philadelphia, lately resulted in a signal victory for the improved pattern. Mr. Charles Cramp, Mr. McCloud, Chief of the Testing Bureau of the Pennsylvania Railroad Company, Mr. Holman, Secretary of the Franklin Institute, Mr. Sargeant, of the Pennsylvania Railroad Company, Abram Barker, President of the Wharton Railroad Switch Company, and other prominent gentlemen were present.

The first test was with an ordinary chain, ⅝ of an inch in diameter, manufactured of iron from the Trenton Iron and Steel Company's works. The chain stood a strain of nearly ten tons, when it snapped at the end. The American Company's chain of the same size and weight stood a strain of 16½ tons before it was broken across the weld. Another test was made with the company's five-eighths chain to see the effect produced by the Admiralty proof test of seven tons strain. The result was that the chain showed but slight evidence of the great pressure. It was then run up to the breaking strain, which is 40 per cent greater, and still no further effect was produced. At another test the chain broke on the side with a strain of 15¾ tons. A five-eighths ordinary chain was again produced, and was snapped at the end with a strain of 9¼ tons. A one inch ordinary chain was then tested, and stood the severe strain of 29 tons before it showed any signs of separation. The chain of the American Company, however, stood a far greater test, a pressure of 42 tons—16½ tons more than the Admiralty—being used before a break occurred on the side. The concluding test was the weight of 15 fathoms of one inch ordinary and the same length of the American Company's chain. The former weighed 958 lb., and the new manufacture 990.

The secret of the strength of the new chain lies in the strengthening of the end of the link by taking an equal proportion of thickness from the two straight sides. This, it is claimed, so divides the strength of the link that one portion is no stronger than another, with this difference, that the link does not wear or break easily at the most important part—the end. On the other hand, the ordinary chain is constructed with equal thickness throughout, and it necessarily follows that as the two sides are more powerful than the end, the latter must give way first. The new chain has been tested by the United States Government for the last year in connection with signal buoys, and when taken up recently it was found, says the *Public Ledger*, in such good condition as to warrant the continuation of it in the same service for another year.

Tests for Purity of Water.

In copying our reply to a correspondent in a recent issue of the SCIENTIFIC AMERICAN for a simple test for indicating the purity of water, the *Plumber and Sanitary Engineer* adds: "Tannin precipitates albuminoids from drinking water, but it also affects other matters which may be present in wholesome waters. The smell and color of a water constitute the most satisfactory of the ready tests of quality. To detect organic matter by the odor, the water should be warmed to blood heat in a large bottle half filled and corked. It should then be shaken, and if organic matter is present it may be detected in the air with which the water has been thus washed. The color is best seen by looking down at a white reflector through a column of the water contained in a long glass cylinder. A column of pure water should be at hand for comparison. Organic impurity gives shades varying from yellow to brown."

The London *Lancet* also has an article on the "Microscopic Examination of Water," in which the writer claims that the microscope, as at present used, reveals only the coarser forms of animal life, and those only with uncertainty, and that the discovery of the microscopic organisms has hitherto been very much a matter of chance. Patience and skill are even of slight help. Fortunately, however, certain chemical reagents kill these organisms without changing their appearance; osmic acid is of especial value for this purpose.

In the examination of water M. Certes employs a one and a half per cent solution of osmic acid. One cubic centimeter of this solution will suffice for thirty or forty cubic centimeters of water, all animal and vegetable organisms being by it rapidly killed and fixed. In a few minutes, in

order to lessen the blackening action of the osmic acid, as much pure water as the test tube will hold is added. In certain waters rich in organisms the microscopical examination may be made in a few hours. If the water is comparatively pure, twenty-four or forty-eight hours must be allowed to pass. The liquid, with the exception of the last one or two centimeters, may then be decanted. The detection of the organisms in the residue is facilitated by the employment of coloring agents, such as Ranvier's picrocarminate, methyl violet, logwood, etc. It is always well to introduce the coloring agent mixed with glycerine; the organisms are thus better tinted, and can, if desired, be better preserved.

The Conversion of Starch into Sugar.

In the new era which is before the brewing trade of this country there will be many problems to solve, and many opportunities to practically apply the teachings of science. The principal change which takes place in the brewer's mash tun is the conversion of an insoluble substance, starch, into soluble substances, dextrine, maltose, and dextrose; the exact nature and proportion of these resulting saccharine bodies are not yet absolutely determined, and they vary considerably with changes of temperature, time, and quantities. The brewer's art consists largely in the production of a wort of suitable composition, by which we mean, one containing all the essential constituents for a healthy fermentation, and also a due proportion of such substances as will resist the disintegrating properties of yeast, and remain to fulfill their proper functions in the finished beer.

Hitherto the only converting agent at the disposal of the brewer has been the diastase of the malt, and in the future, in all probability, this will also be the principal converting agent, even if raw grain be used in conjunction with malt. But with a free mash tun, we shall be at liberty to avail ourselves of other methods of conversion if there be such, and if they can be practically applied. It is now well known that dilute sulphuric acid exerts a solvent action on starch very similar to diastase: but while malt extract converts starch into dextrine, maltose, and dextrose in varying proportions, with probably other intermediate products, boiling dilute sulphuric acid converts starch almost immediately into the ultimate product—dextrose, accompanied by only small quantities of dextrine.

This property of sulphuric acid is largely made use of by the glucose manufacturers, and in this way the enormous quantities of this substance, both home made and imported, are prepared; the process consists in boiling maize or other grain containing a large proportion of starch, with dilute sulphuric acid, sometimes under pressure, although this is not absolutely necessary, except for hastening the change, and after neutralizing the acid with carbonate of lime the saccharine liquid is concentrated to a sirup, which solidifies on cooling. A large amount of fuel is employed in evaporating the sirup, and as the solid glucose has to be dissolved again by the brewer, this represents a considerable loss. With perfect freedom in the choice and manipulation of his materials, it is more than probable that the brewer will learn to use sulphuric acid as a converting agent; but besides the conversion of starch into dextrose, sulphuric acid will be useful in inverting cane sugar.

The plant required for carrying on this conversion of starch into sugar by means of sulphuric acid is very simple, for pressure is only required when a complete conversion into dextrose or glucose is desired; but the brewer prefers to have a mixture of dextrine and intermediate products with his dextrose, and he would, therefore, probably obtain the most satisfactory result by conducting the operation at the ordinary pressure.

Distillers who now use large quantities of raw grain in their mashing process have already in some instances availed themselves of this property of sulphuric acid, and lead-lined mash tuns for the purpose are not unknown; brewers may in the future find it worth their while to do the same, and in answer to the objection by so doing they will be converting their breweries into chemical manufactories, we say the process of mashing is essentially a chemical operation, and that as the products obtained by the judicious use of sulphuric acid and malt extract are really identical, there can be no valid reason for not using the first-named agent, if it possesses any advantages over the latter. —*Brewer's Guardian.*

Learning Versus Common Sense.

Democritus long ago drew an emphatic distinction between learning and wisdom. Learning consists of knowledge acquired mainly from books, and often its possessor is developed by its acquisition only in his perceptive and retentive faculties. Though his memory may be a vast storehouse of useful facts and brilliant second-hand ideas, yet, owing to a judgment originally weak and only partially trained to discriminate, he may be the most inconsequent and uncertain of reasoners. Wisdom, on the contrary, is the outgrowth of native sagacity, sound judgment, wary discretion—in a word of good common sense, and yet of common sense acting under the enlightenment of more or less knowledge. Thus wisdom makes a man a true seer. He not only sees and grasps the best means to accomplish an end, but he instantly sees and selects the highest and best ends as the objects of his aim and life. Regarding learning and knowledge as the same thing, we may conclude with Cowper that

> Knowledge and wisdom, far from being one,
> Have oftimes no connection.

The paradox is, therefore, not unfrequently met of learned physicians who are destitute of skill as practitioners, of learned orators who are wretched statesmen, of learned linguists who are little better than fools, and finally of learned theologians who are the worst possible interpreters of the oracles of God.—*Christian at Work.*

THE WILLIAMSPORT PANEL PLANER.

The panel planer shown in the annexed engraving is manufactured by Messrs. Rowley & Hermance, of Williamsport, Pa., and possesses several features which render it very efficient. It is designed for planing door panel and cigar box stuff, and is especially adapted for general use in manufacturing furniture, doors, and boxes, and may be used to advantage in any wood-working shop.

The frame is cast in a single piece, giving it great rigidity, and its form being pyramidal gives it a very wide base, which insures stability. The machine is provided with two pressure bars, one on each side of the head; the front one being

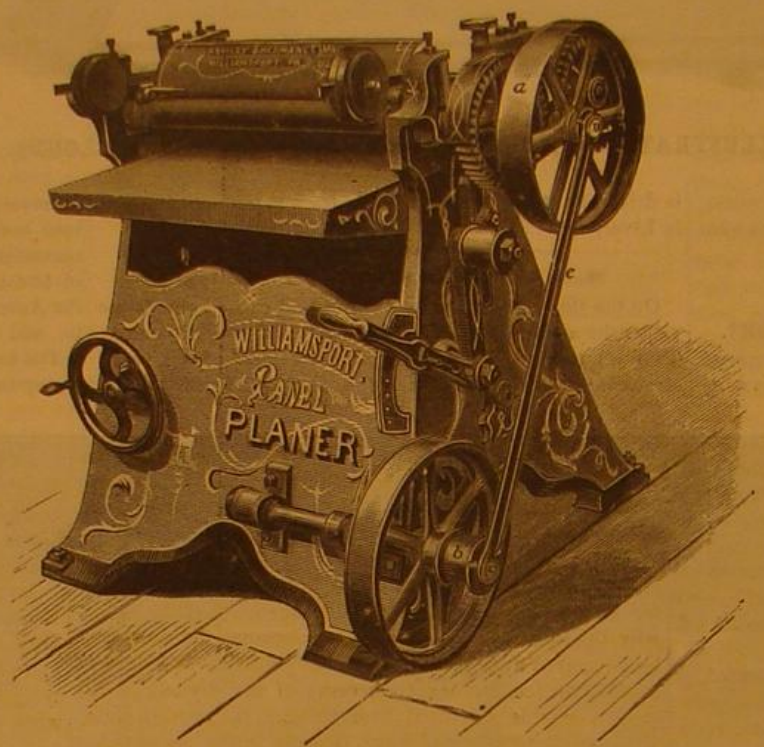


Fig. 1.—THE WILLIAMSPORT PANEL PLANER.

hinged and weighted adjusts itself automatically to different thicknesses of stuff. Both of these bars are placed very near the head to prevent the work from clipping or tearing out.

The cutter head is of forged steel, and being of small diameter may be run at a high rate of speed with perfect safety. This is very important, especially in working brash and cross-grained lumber. This machine is provided with two devices for preventing the marring of the surface of the lumber as it is delivered from the machine, one being a steel scraper attached to the delivering roll for preventing it from gumming and marking the lumber; the other is a shaving guard, which is so arranged as to prevent the shavings from getting under the smooth rolls and imprinting the work. This is a very essential feature in a smoothing planer. The feed is very powerful, the machine having two geared feed rolls. The planer is capable of planing long or short stuff with equal facility. Stuff as short as four inches, and from one-sixteenth to six inches thick, may be planed without clipping the ends. The machine is made in two sizes, adapted to lumber eighteen or twenty-four inches in width. The smaller machine weighs about 1,200 pounds, the larger one 1,400 pounds, and the speed of the head is from 4,000 to 5,000 revolutions per minute. It will be noticed that the planer is very heavy; it is strong, well built, and calculated to withstand constant use.

(Patented May 9, 1871, and September 23, 1879.)

Fig. 2.—Ellis's Adjustable Journal Box.

The journals of the head are provided with Ellis' journal box, the patents for which have been acquired by this firm at considerable expense and trouble. This box, which is shown in detail in Fig. 2, is entirely different from the ordinary cap box, and will keep the shaft central and tight until the box is worn out, and heating and trembling of the shaft, and the trouble of taking out liners, scraping, and readjusting, are avoided.

The construction of the box will be readily understood by referring to the engraving. It is made in three parts, the caps being held in place by bolts and adjusting screws, and they are tightened by loosening the bolts and setting down the adjusting screws at the ends of the caps, an operation requiring less than a quarter of the time required to adjust a box of the old style.

The advantages of a box of this description will be apparent to practical men, and there can be no question but that, other things being equal, a machine having journal boxes of this kind is to be preferred to one having the ordinary boxes.

MISCELLANEOUS INVENTIONS.

Mr. Aden K. Munson, of Marysville, Kan., has patented a yoke to be used with a pair of horses in driving a plow, whereby the horse in the furrow may at all times control the tongue and guide the plow, while the horse on the land can pass around any obstruction and come in place again without changing the direction of the plow.

A machine for forming flanges on counter-stiffeners for boots and shoes has been patented by Mr. Hiram G. Farr, of Brandon, Vt. The invention consists in a novel arrangement of a concave mould and convex mould for pressing the material into the required shape.

An improved baling press has been patented by Mr. John H. Simonson, of East Norwich, N. Y. It consists in the combination with the followers, of a series of levers, bars, and ropes, so arranged that the followers may be drawn toward each other with constantly increasing power.

An improved limekiln has been patented by Mr. William Hughes, of Avondale, and Joseph L. Foulk, of Strasburg, Pa. This invention relates to that class of kilns known as "continuous" kilns, or those in which the limestone is supplied to the top of the stack, and as it settles during the calcining process the lime is drawn off at the bottom of the heating chamber, and a fresh supply of limestone is added to the top of the unconsumed mass in the heating chamber or stack; and it consists, first, in an improved construction of combustion chamber, in combination with a peculiar arrangement of furnaces to direct the flame equally across the entire area of the combustion chamber to prevent the formation of cores or unburned masses of limestone, in connection with a relative arrangement of draw chute or delivery channel which will secure an economy of space together with the greatest effective volume of flame or caloric from the furnaces.

Mr. Christopher G. Calo, of Albany, N. Y., has patented a simple device for instantaneously fastening and unfastening hames. In consists in a combination of devices which cannot be clearly described without an engraving.

Mr. Josephus H. Rosson, of Columbus, Ky. has patented an improved holder for hair, bristles, broom straw, and like material, for making brushes or brooms in a simple and convenient manner.

Mr. John D. Baxter, of Mechanicsville, N. Y., has patented a double-edged chisel provided on each side with a groove, which extends from between the points upward to the shank of the chisel, said grooves widening as they extend upward, the object being to render the chisel self-clearing.

An improved wagon spring, patented by Mr. William G. Hughes, of Churubusco, Ind., consists of a spiral spring set on the end of a wagon bolster and held in a vertical position in a framework of arched rods, while resting centrally on the top of the spring is a slotted yoke, from the ends of which depend two eyebolts or clips and links, that pass down to or through cross bars which extend laterally from beneath the wagon bed, and thereby support the wagon body.

An improved gate, so arranged that it can be conveniently opened and closed from a vehicle or by a pedestrian, has been patented by Mr. Edward Lanning, of Iowa City, Iowa. It consists in a balanced gate, pivoted near its center, and provided with two pulleys, to which ropes or wires pass, by means of which the latch and the gate are opened and closed. The gate has an improved head containing a weighted lever and pulleys for the purpose of keeping the latch in its proper place or for drawing it.

Mr. Charles L. Wolff, of Edgewater, N. Y., has patented an apparatus for supporting the middle part or center of the top or arch of cisterns and other structures while being built, so constructed that it can be readily taken out through the man-hole when the work has set, and which will allow the floor and sides of the cistern to be cemented before the middle part of the top is built.

Mr. Frederik Alsing, of Copenhagen, Denmark, has patented a compass provided with mechanism so constructed as to record all changes of direction in the ship's course and divide the diagram of the course into hour spaces.

An improved compensating pendulum, patented by Mr. Charles T. Mason, of Sumter, S. C., consists in a compound bar of metal bent in curved form, hung on the pendulum rod, and connected by links with the sliding bob in such manner that the expansion and contraction of the compound bar shifts the bob in the direction of the length of the pendulum. The bob is sustained by the compound bar, and the latter hung on the pendulum rods by a screw rod, which permits adjustment for regulating the clock.

An improved grain toller has been patented by Mr. William J. Wilson, of Stephenville, Texas. This invention consists in a novel construction of a revolving cylinder provided with cavities representing certain measures, and of a casing in which the cylinder works, whereby provision is

made for measuring the grain by the revolution of the cylinder, and at the same time separating a certain proportion thereof to be retained as toll, and whereby, also, provision is made for varying the size of the toll measure, so as to enable it to separate different proportions from the main body of the grain, according to the amount of toll to be taken.

Mr. Charles S. Woodruff, of Troy, N. Y., has patented a toe weight for horses. The object of this invention is to provide, in addition to the ordinary strap by which toe weights are usually secured to the feet of trotting and road horses, a fastening device by which the weight is firmly secured in position.

An improved steam radiator has been patented by Messrs. Lewis G. Goldsmith and Nicholas Reed, of Jersey City, N. J. The object of this invention is to furnish steam radiators, constructed so as to have a much larger radiating surface than those constructed in the ordinary manner, and at the same time to induce a free circulation of air between and around their parts.

A clearing device for millstones, patented by William H. Hall, of DeWitt, Iowa, is designed to prevent the collection of the chop between the stones and the curb, and thus prevent the consequent glazing of the stones, rendering it unnecessary to dress the stones so frequently, and causing the stones to run with less resistance, consequently requiring less power to drive them.

Mr. August Hilpert, of Hoboken, N. J., has patented an improved method of inlaying sheets of card or leather board or like material, so as to produce novel and effective ornamental sheets, which may be used for various purposes. The invention consists in punching the desired design out of a sheet of card or leather board, thick paper, or like fibrous material, and filling in the apertures thus produced with corresponding pieces of the same or some other suitable material pressed into the apertures.

Mr. Jerome W. Dewey, of Chicago, Ill., has patented an ironing board formed of two parts, held together by dowel-pins, and is provided with a beveled rabbet along the edges, into which a metal frame for holding the goods to be ironed fits. This frame is drawn up tight by means of a cam lever, a spring, and screw.

Messrs. Jules A. Arrault, of New York city, and Jules Schmerber and Charles Schmerber, of Paterson, N. J., have patented a process for manufacturing nitro-derivatives from cellulose, etc., by using nitric acid in a gaseous state. By this process but little more acid is used than the theoretical quantity required to transform the substances into their nitro-derivatives.

Mr. John F. McLaughlin, of Aiken, S. C., has patented an improved bale tie, which is simple, strong, and reliable, and which is so constructed that the bands may be taken off without cutting or breaking them.

An improvement in pantaloon braces has been patented by Mr. Charles Laffite, of Paris, France. The invention consists in providing the suspender ends with short transverse straps or chains.

Mr. Henry G. Bardwell, of Winnton, Texas, has patented a buckle of novel design, especially adapted to bridles, check-lines, and hip straps for horses, and for trunk straps, gun straps, etc.

Mr. Louis J. Ryerson, of Paterson, N. J., has patented an improved starching machine, which consists in a pair of corrugated rubbers having a parallel reciprocating motion imparted thereto by eccentrics or a double crank, one of which rubbers is arranged to slide in a direction at right angles to the direction of the reciprocating movement of the rubbers, and is attached to one end of a bell crank lever pivoted to the frame of the machine and provided with an adjustable weight for the purpose of pressing the two rubbers together. A fixed and a hinged arm, provided with a suitable lock, are arranged above the rubbers for the purpose of holding the goods or articles to be starched.

Mr. Herman E. Briggs, of Center Star, Ala., has patented a simple device by which stock may be tethered and have free movement for grazing without becoming entangled in the rope.

An improved furrow-staff for millstones has been patented by Mr. Ura H. Palmer, of Green Spring, O. The object of this invention is to furnish a furrow-staff so constructed that by its use the furrows of a millstone-dress may be brought to a perfect gauge.

Mr. John Y. Lanfair, of Hill View, N. Y., has patented an improvement in that class of churns in which a suspended dasher is made to swing back and forth in the body of the churn; and it consists of a dasher composed of a number of downward projecting rigid fingers that are made to swing back and forth between a number of corresponding fingers that are fixed so as to project upward from the bottom of the churn.

Mr. John S. Butcher, of Yorktown, N. J., has patented an improved protector for lamp chimneys, which prevents breaking by the heat of the burner. It consists in a protector for lamp chimneys formed of two tapering metal tubes, one of which has a greater taper, and is suspended from the lower edge of the other, which in turn is suspended from a looped wire resting on the upper edge of the lamp chimney.

An improvement in tongs has been patented by Mr. Irving R. Le R. Boardman, of Snedekerville, Pa. The invention consists in a novel construction of the head of the tongs and arrangement of the legs therein, whereby provision is made for insuring the proper motion of the movable leg and preventing its lateral displacement.

Mr. John B. Stewart, of St. Johns, Mich., has patented an effective, cheap, and simple device for fastening buttons on clothes, and it may be used as a belt fastener, and for kindred purposes.

Mr. William H. Miller, of Philadelphia, Pa., has patented an improved mosquito netting device, by means of which mosquito netting can be put up or taken down easily.

A pigeon hole bottom for post office boxes, secretaries, and desks, consisting of a perforated plate bent down at the ends and having the edges lapped to form receptacles, has been patented by Mr. James E. McNair, of Webb City, Mo.

An improved gate has been patented by Mr. James H. Greenhow, of Eckmansville, Ohio. This invention consists in novel details of construction of the gate and means for opening and closing it.

The Cause of Perpetual Snow.

Dr. James Croll, in the current number of the *American Journal of Science and Arts*, says the reason why snow at great elevations does not melt, but remains permanent, is owing to the fact that the heat received from the sun is thrown off into stellar space so rapidly by radiation and reflection that the sun fails to raise the temperature of the snow to the melting point; the snow evaporates, but it does not melt. The summits of the Himalayas, for example, must receive more than ten times the amount of heat necessary to melt all the snow that falls on them, yet in spite of this the snow is not melted. Notwithstanding the strength of the sun and the dryness of the air at these altitudes, evaporation is insufficient to melt the snow. At low elevations, where the snowfall is probably greater, and the amount of heat received even less, the snow melts and disappears. This, Dr. Croll believes, must be attributed to the influence of aqueous vapor. At high elevations the air is dry and allows the heat radiated from the snow to pass into space, but at low elevations a very considerable amount of the heat radiated from the snow is absorbed by the aqueous vapor in the atmosphere. A considerable portion of the heat thus absorbed is radiated back on the snow, and, being of the same quality as that which the snow itself radiates, is for that reason absorbed by the latter. The consequence is that the heat thus absorbed accumulates in the snow till this is melted. Were the amount of aqueous vapor possessed by the atmosphere sufficiently diminished, perpetual snow would cover our globe down to the sea shore. In a like manner the dryness of the air will, in a great measure, account for the present accumulation of snow and ice on Greenland and on the Antarctic Continent. These regions are completely covered with snow and ice, not because the quantity of snow falling on them is great, but because the quantity melted is small. And the reason why the snow does not melt is not because the amount of heat received during the year is not equal to the work of melting the ice, but mainly because of the dryness of the air, the snow is prevented from rising to the melting point. In places like Fuego and South Georgia, where the snowfall is considerable, perennial snow and ice are produced by diametrically opposite means, namely, by the sun's heat being cut off by clouds and dense fogs. In the first place, the upper surfaces of the clouds act as reflectors, throwing back the sun's rays into stellar space, and in the second place, of the heat which the clouds and fogs absorb, more than one-half is not radiated downward on the snow, but upward into space. And the comparatively small portion of heat which manages to reach the ground and be available in melting the snow is insufficient to clear off the winter's accumulation.

Ballooning.

At a recent meeting of the Balloon Society of Great Britain, held in London, Mr. Simmonds reported some incidents of an ascent he had made at Bath a short time previous, under the auspices of the society. On this occasion the balloon entered altitudes varying from 4,000 feet to 12,000 feet, and traversed a distance in one direction of 16 miles in the same number of minutes. Allowing for the fact that the ascent and descent were both accomplished in a perfect calm, it follows that the balloon in certain stages of its career must have been impelled at a speed of not less than 120 miles an hour—a very remarkable result. A somewhat animated discussion which followed, as to the best system of ballooning in the Arctic regions, was adjourned to the next meeting. The president stated that the present system of inflating balloons was very defective. Instead of employing coal gas different kinds should be used together, namely, coal gas, oil gas, and hydrogen, the former for partial inflating, the second for making the balloon gas tight, and the third for reducing the weight of the two former. He considered that the only means of determining the law of currents at high altitudes, as shown by the before mentioned trip of Mr. Simmonds, at Bath, was by means of balloons.

The Bagdad Date Mark.

Bagdad, says one of our medical exchanges, is noted for a curious and mysterious malady, which affects everybody in the city, whether he be citizen or stranger. It is a sore called a "date mark," because after it has healed it leaves an indelible mark about the size and shape of a date. It generally makes its appearance upon the face, lasts a year, and then disappears. The cheek of nearly every man and woman in Bagdad shows the inevitable mark. Sometimes it settles upon the nose, and then the disfigurement is great; sometimes on the eyelid, when blindness is the result. Strangers are attacked even after a brief residence; but fortunately, if they are adults, the sore is more apt to come on the arm. In every case the attack runs its course for one year. No treatment, no ointment, nor medicine, it is said, has the slightest effect upon it. Once the sore appearing, the sufferer knows what to expect, and may as well resign himself to his fate. The Arabs say that every one who goes to Bagdad must get the "date mark"; or, if he does not get it while in the city, he will be followed by it—have it sooner or later he must. Dr. Thom, of the American Mission, states that he has examined the ulcer microscopically and found it to be composed of a fungoid growth; but nothing that he had ever tried had proved remedial.

AGRICULTURAL INVENTIONS.

Some improvements in corn planters have been patented by Mr. Charles G. Everet, of Bellefontaine, O. These improvements pertain to the construction and arrangement of devices forming the seed discharging mechanism proper and the devices for imparting regular or uniform motion to such mechanism; also to the devices for indicating the intermittent operation of the seed dropping slides.

An improved fertilizer attachment for seed drills has been patented by Mr. Adam C. Hendricks, of Duffield Station, W. Va. This improvement relates to the construction of a hand lever and the attachment of it and the gates for controlling the discharge of seed to a shaft which is arranged parallel to the side of the hopper.

Mr. William E. Hart, of Cedar City, Mo., has patented an improved harvester, which gathers the cut grain as it is deposited upon the binding platform into gavels and drop the gavels to the ground at the rear of the machine automatically.

An improved reaping and mowing machine has been patented by Mr. David Forrest, of Eastport, Me. The object of this invention is to obtain a smooth and continuous cutting action by revolving knives, and to construct a machine requiring comparatively small power for its operation.

Mr. William A. Reddick, of Niles, Mich., has patented a shovel. This invention relates to an improvement in shovels of that class which are formed of parallel open tines, for use in culling potatoes from the loose earth, screening coal, sifting ashes, and for other analogous purposes.

An improved sulky plow has been patented by Mr. Louis W. Powell, of Mexia, Texas. This invention consists in a novel construction and arrangement of hangers, braces, and levers, whereby provision is made for the attachment of plow beams of different sizes, and for adjusting the parts.

An improved grain binder has been patented by Messrs. Ransom K. Laraway and Jerome Laraway, of Battle Creek, Mich. This invention relates particularly to that class of grain binders which bind the gavel with a string or twine by tying a knot in it, although it is capable of doing the same work with fine wire.

The Light of Jupiter.

There has been for some years a discussion as to whether the planet Jupiter shines to any perceptible extent by his own intrinsic light, or whether the illumination is altogether derived from the sun. Some facts ascertained from spectroscopic observation by Prof. Henry Draper, and communicated by him to the current number of the *American Journal of Science and Arts*, seem to point to the conclusion that it is not improbable that Jupiter is still hot enough to give out light, though perhaps only in a periodic or eruptive manner. Most of the photographs hitherto made of the spectrum of Jupiter by Prof. Draper, bear so close a resemblance to those of the sun as to indicate that under the ordinary circumstances of observation, almost all the light coming to the earth from Jupiter must be merely reflected light originating in the sun. But on one occasion—September 27, 1879—a spectrum of Jupiter with a comparison spectrum of the moon was obtained by him which showed a different state of things. The photograph which was taken of this shows, not a change in the number or arrangement of the Fraunhofer lines, but a variation in the strength of the background. These modifications in the intensity of the background seem to Prof. Draper to point out two things that are occurring: (1.) An absorption of solar light in the equatorial regions of the planet. (2.) A production of intrinsic light at the same place. These two apparently opposing statements can be reconciled on the hypothesis that the temperature of the incandescent substances producing light at the equatorial regions of Jupiter did not suffice for the emission of the more refrangible rays, and that there were present materials which absorbed those rays from the sunlight falling on the planet. The strengthening of the spectrum in the portions answering to the vicinity of the equatorial regions of Jupiter, says Prof. Draper, bears so directly on the problem of the physical condition of the planet as to incandescence that its importance cannot be overrated.

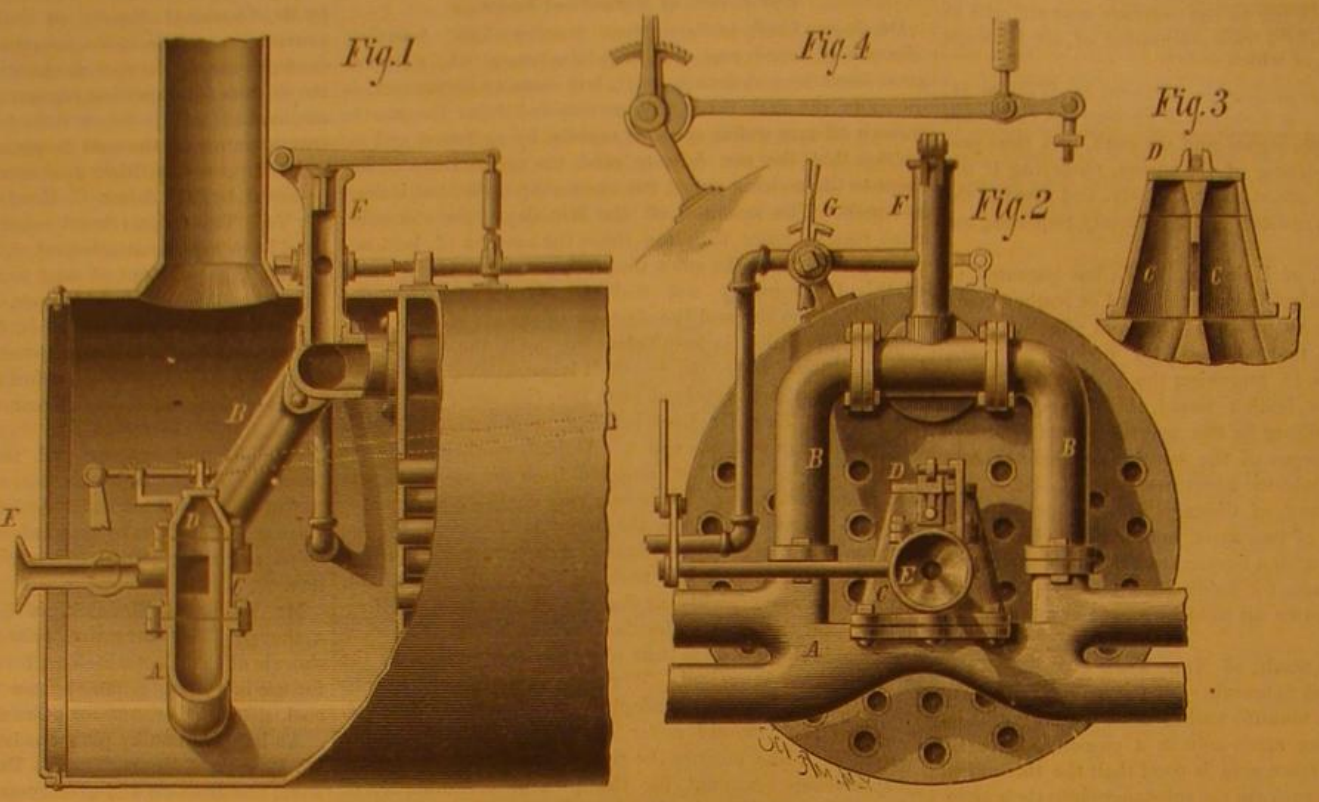
A Village Founded on Gold Rock.

The village of Las Placitas, about thirty miles from Santa Fé, New Mexico, is reported to be founded on a ledge of rock carrying from $3,000 to $6,000 worth of gold per ton. The value of the rock was detected by prospector Jesse Martin, who has "located" the streets of the town. Governor Lew Wallace describes the lead as eighty-four paces in width, and nine thousand feet have been located along the vein. The whole village is built on the ledge, and rock worth $3 a pound has been thrown about as worthless.

NOVEL AIR BRAKE.

It is well known among engineers and engine drivers that in reversing the valves of a locomotive in the usual way to check the speed of the engine the pistons draw in air and compress it in the steam chest and steam supply pipes, until, in some instances, the pressure is greater than the steam pressure in the boiler. Our engraving represents an invention for utilizing this action of the locomotive cylinders for the purpose of operating air brakes for checking or stopping the train, and it also avoids drawing cinders into the cylinders, a thing common to engines working in the ordinary way.

The engraving represents only such parts of the locomotive as are immediately related to the invention, Fig. 1 being a view of the front end of the smoke box with the cylinders left out; Fig. 2 a side view of the same parts; Fig. 3 a sectional view of the exhaust nozzle, and Fig. 4 is a detail view of the safety valve lever.



HALL'S AIR BRAKE.

A and B are, respectively, the exhaust and supply pipes, connected with the cylinders in the usual way, and C is an exhaust nozzle of the ordinary pattern, except that it is provided with a sliding valve or cover, D, and a pipe or nozzle, E, which projects through the cap of the smoke box, and is provided with a flaring mouth. The pipe, E, is provided with a plug valve or cock whose spindle extends through the side of the smoke box and is provided with an arm connected with a rod extending to the cab of the locomotive; on the inner end of the same spindle there is an arm connected by a link with the valve, D, the cock and the valve, D, being arranged relatively to each other so that when the valve, D, is open the cock will be closed, and *vice versa*.

From the top of the steam pipe, B, a pipe extends upward through the top of the smoke box, and has at the top a safety valve, F, of ordinary construction, whose lever extends over the smoke box and is held down by a spring connected with a lever fulcrumed on the top of the boiler, and moved so as to bring more or less pressure on the valve by turning the cam on the shaft, G, by means of the lever attached. This lever is provided with a pawl arranged to engage the teeth of a fixed segment.

Below the valve, F, a pipe extends a short distance laterally from the vertical pipe, and then passes downward and is connected with the pipe or pipes leading to pneumatic brake cylinders of any approved form. This pipe is provided with a three-way cock, whose spindle extends through the shaft, G, which is tubular and reaches to the cab, where it may be conveniently operated.

On shutting off the steam from the cylinders and reversing the valves, the valve, D, is closed and the valve in the pipe, E, is opened; the cylinders then act as powerful pumps drawing in air through the pipe, E, and forcing it into the steam chest and steam pipe, B. The required pressure is quickly reached, and the surplus air escapes through the valve, F. Should this operation fail to check the engine sufficiently the three-way cock in the air discharge pipe is opened and air is allowed to escape from the steam supply pipe, B, to the pipes leading to the brake cylinders. An abundant supply of compressed air is always ready, and more or less of it may be used in operating the brakes.

When it is desired to let off the brakes the three-way cock is turned so as to shut off the air supply and liberate the air contained in the brake cylinders and pipes connected with them. The inventor proposes also to connect the three-way cock with an air reservoir so that a quantity of air may be stored if desired. After letting the air out of the brake cylinders, the valve, D, is opened, and the valve in the pipe, F, is opened when the engine is in its normal condition.

Another feature of the invention, and a very important one, is that engines commonly used for drawing freight trains can be utilized to stop this class of train without the brakemen getting upon the top of the cars, and it enables railway companies to place such engines on passenger trains and have the advantage of the air appliances on the cars as described.

This invention dispenses with all special pumps and utilizes the momentum of the moving train for braking purposes. To any one doubting the ability of the engine cylinders to act as air compressors we mention the fact that an engine has been made to compress sufficient air in its boiler, while being drawn forward by another engine, to propel itself forward at the usual rate of speed for several miles by compressed air alone, there being neither fire nor water in the boiler. This invention was recently patented by Mr. John Hall, of Hamilton, Ontario, Canada.

NEW LINE-THROWING GUN.

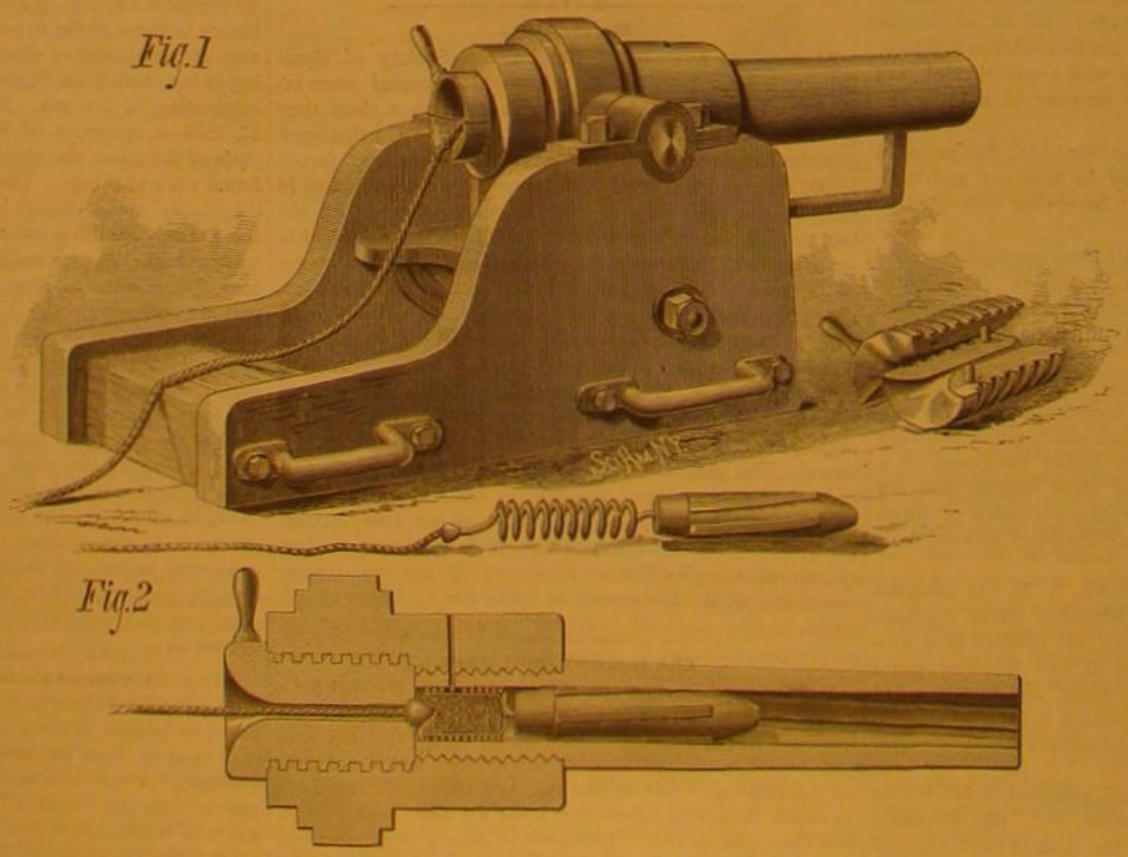
The engraving shows a breech-loading line-throwing gun lately patented by Mr. L. W. Spencer, of this city. In some respects this gun differs materially from others designed for the same purpose. It is rifled to insure accuracy and to increase the range. It is breech loading, and the projectile carries the line through the center of the breech.

Fig. 1 shows the gun in perspective, a detail view of the split breech piece being shown on the ground under the muzzle of the gun. Fig. 2 is a longitudinal section of the gun, showing the position of the line and load, and the projectile is shown at the side of the gun.

The gun is mounted on the carriage by means of trunnions in the usual way, and is secured in any desired position by the clamping screws at the sides of the carriage. The breech block is made in two parts, with a central longitudinal opening for the line, and it has a heavy screw thread which fits the threads in the chamber in the breech of the gun. The projectile has attached to it a tail piece of wire rope or other material that will resist the action of the exploding charge which is enveloped by it. The tail piece is attached to the life line, and carries a valve which closes the opening in the breech block through which the line passes and prevents the backward escape of gas.

When the gun is fired the shot passes straight out of the gun, the elastic tail uncoils, and the life line is drawn through the opening in the breech block, in a direct line, so that it does not in any way interfere with the course of the projectile.

With this gun the projectile is thrown out with no retardation except that caused by the weight of the life line. By the ordinary method, when the life line is fired out of the gun ahead of the projectile, the weight of the line compels the projectile to turn over, greatly retarding the speed of the projectile and line and affecting the accuracy of firing.



SPENCER'S LINE-THROWING GUN.

MECHANICAL INVENTIONS.

An improved wagon brake lever has been patented by Mr. Edward S. Plimpton, of Denison, Iowa. This invention consists in a novel arrangement of a double jointed lever, with a pawl and ratchet and a rod connecting with the brake shoe, whereby provision is made for locking the brake by the engagement of the pawl with the ratchet, and for disengaging the pawl to release the brake.

Mr. Israel Erickson, of Whitehall, Mich., has patented a simple and effective device for feeding sawdust, shavings, etc., to a fire and spreading them thereon. The invention consists of spreading bars or spreaders, having outwardly curved rear ends, and pivoted at about the center of their lengths to the under side of a reciprocating plate or frame supported on rollers, and works in a spout or conductor fixed in front of a fire door, the spreaders being opened or spread laterally by contact of their curved ends with fixed rollers, and being closed by a connecting spring.

An improvement in car couplings, invented by Mr. Philo B. Williams, of Edgerton, Ohio, relates to that class of couplers with which cars can be coupled without the brakeman going between the cars for that purpose; and it consists of a spear or dia-

mond-shaped pointed coupling bar, and of a draw head provided with an internal shoulder and a swinging metallic plate, which engage and hold the point of the coupling bar.

THE JAPANESE AND CHINESE SECTIONS OF THE BERLIN INTERNATIONAL FISHERIES EXHIBITION.

BY A. W. ROBERTS.

The fishes and marine animals in the Japanese and Chinese sections of the Berlin International Fisheries Exhibition were objects of the greatest interest. These specimens of the marine life of Eastern Asia were prepared by native taxidermists, and to obtain a more artistic and picturesque effect they were grouped (by Mr. K. Slemenroth) to represent Japanese and Chinese marine life.

No. 1 represents the polypus, or devil fish (*Megateuthus martensii*), the body measuring thirteen feet in length, the head being provided with eight arms, each being fourteen feet long, the ends of which are provided with powerful suckers.

short thick cylinder, the center of which can be raised so as to establish a vacuum between itself and the object to which it is attached. As the weight of a man in water is about five pounds, it would not be difficult for a medium sized devil fish to drag him under water. The food of the devil fish consists of crustaceans and bottom fishes.

In the illustration the devil fish is shown in the act of entangling a coral diver in his terrible embrace.

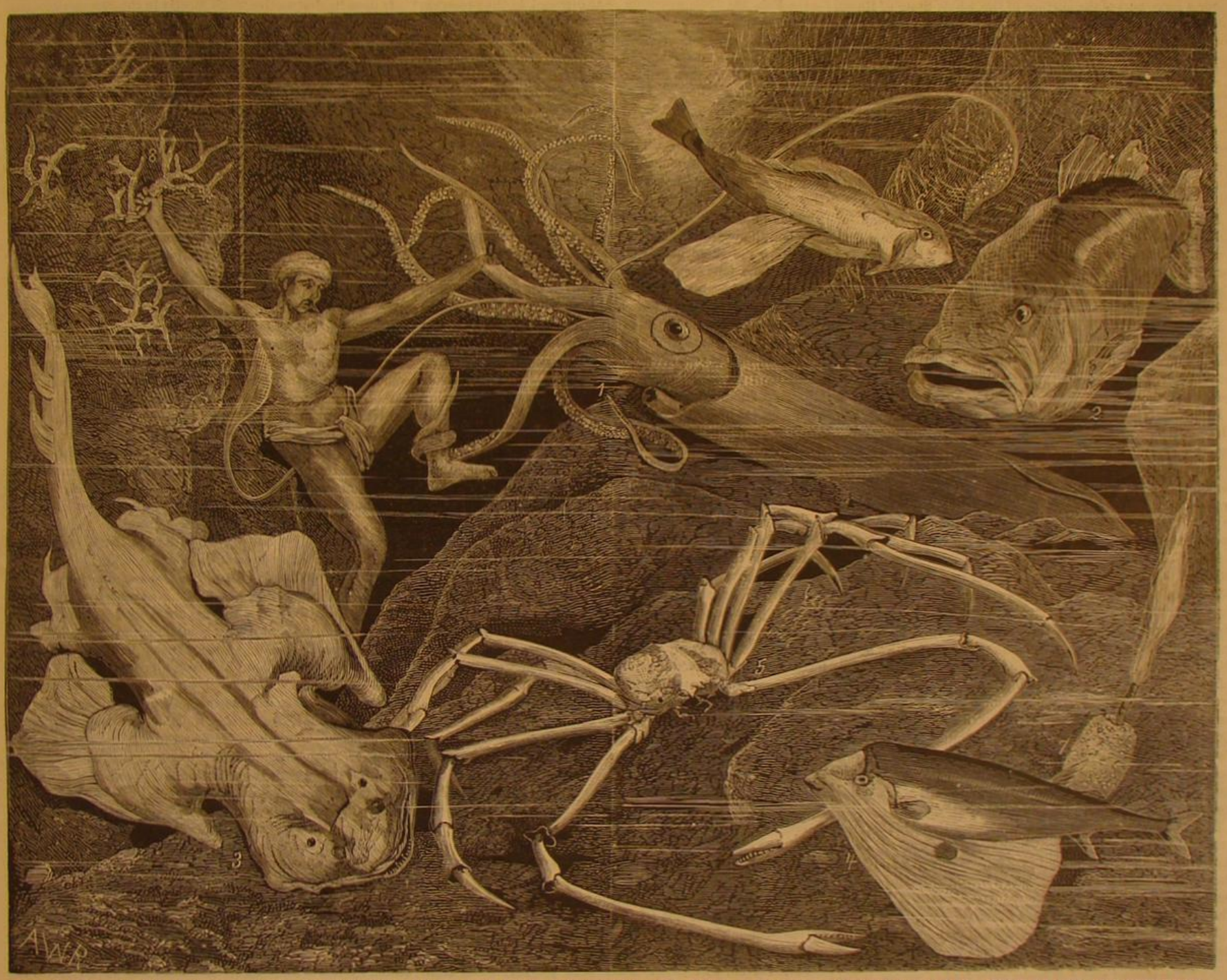
No. 2 is an example of Japanese perch, being only six feet in length, and is the largest known variety of the perch tribe.

At No. 3 we have the old-fashioned angel fish (not the exquisite angel fish (*Chætodon*) of the tropics). It got its name of angel fish from its supposed resemblance to a cherub, such as are to be seen at the present day on ancient headstones in Trinity churchyard. It is also known by the name of monk fish, exactly why I don't know, as it has anything but a holy look when fresh from the ocean. The most proper name it has received is the shark-ray, as it looks like an exact connecting link between the shark and ray or skate

I have had several living specimens of a variety closely resembling the one figured above, and known to fishermen as the flying sea robin. In coloring they were beyond describing, and for exquisite grace of motion were perfection itself. When resting on the bottom and with wings folded up close to their sides like a fan, they often gave forth a pleasant musical sound, from which is derived their tribe name, *volitans*. I lost several specimens of this gorgeous fish from their habit of leaving the aquarium at night, and their wings drying before they were able to return to the water. But one that I had kept for a long time had learned how to pass from one tank to another during the night, often making a run of six tanks. Their favorite food is the bait shrimp.

Some years ago great numbers of these fish, of a large size, visited our coast and were sold in the markets under the name "dolly vardens," on account of their brilliant colors.

The gigantic spider crab (Fig. 5), *Macrocheria*, or long-armed crab of Japan, is the largest crab known. In the cabinet at Rutgers College, N. J., is a specimen of this variety, which, when the claws are extended, measures eleven feet



MARINE ANIMALS OF THE JAPANESE AND CHINESE SECTIONS OF THE BERLIN INTERNATIONAL FISHERIES EXHIBITION.

1. Polypus. 2. Giant Perch. 3. Angel Fish. 4. Fan Fish. 5. Giant Crab. 6. Flying Fish. 7. Glass Sponge. 8. Coral.

The devil fish fisheries of Eastern Asia are of great importance, as the following figures will show: In 1873, 9,000 boats were engaged in capturing devil fish, each boat being manned by six fishers, the annual yield being over 14,520,080 pounds, valued at $375,000; 80,000 persons were also engaged in preparing and packing the flesh.

Through the establishment of public aquaria more correct information of the habits of these (the smaller varieties) wonderful fishes has been obtained.

We call them fishes, but they bear no resemblance to fish that have scales and swim by means of their fins and tail. Scientifically they are not fishes at all, but are very closely related to our oysters, clams, and other mollusks. Scientists classify the devil fish or octopus (meaning eight-armed) as belonging to the division of soft-bodied mollusca and of the class *Cephalopoda*, meaning feet projecting from the head.

They breathe by taking in water at the broad and open end of their bag-like body through two large gills, and ejecting it through a short and thick tube or funnel situated below the head in front. By this means they propel themselves backwards through the water.

One of the most curious features about a devil fish is that he has several hundreds of sharp and serrated sucking disks distributed in two rows along each arm. Each disk is a

tribes. It is a bottom fish and feeder, living on crustaceans, and is particularly partial to all the flat fish family. Its flesh, unlike the skate, is coarse and fibrous, and is seldom eaten, except by the very poorest classes. The only useful part of this fish is its skin, which, when dried, is used in place of sandpaper on woodwork, also for handles for swords, knives, etc.

In New York city this fish has been the means on several occasions of supplying our traveling shows with that class of circus natural history in the way of a mer-MAN. This wonderful production was the result of the artistic mind and delicate manipulation of a New York taxidermist (I use the term advisedly—stuffer would be better). I have seen white whales made out of sides of sole leather from the Swamp swim out of this same factory, and gorillas start up-town who, only a few days before, had been a living polar bear at Central Park.

Above the devil fish, at No. 6, is figured the flying fish (*Dactylopterus orientalis*). It derives its name from its ability to leave the water and skim over the surface, by means of its highly developed pectoral fins. It assumes this habit as a means of escape from its enemies.

No. 4 is the fan fish. Its beautiful pectoral fins are developed to an extent that enables it to rise out of the water and soar along its surface, after the manner of a bird.

and six inches. There was at Barnum's (old museum) a specimen of this crab, presented by Mr. Carsom Brevoort, Esq., of Brooklyn, which measured twenty feet. This specimen was lost at the burning of the museum. The long-armed spider crab common on our coast is a close relation to this Japanese variety.

At No. 7 is shown the *Hyalonema*, or glass sponge, the skeleton or spicula of which is shown in the illustration as looking like a long bunch of slightly twisted fibers. This spicula is transparent and consists of pure silica. The wonderful Venus horn is a close relation to this Japanese variety. Under a microscope the spicula of various sponges present the appearance of stars, spades, hooks, spears, etc. There is a variety of sponge that grows on our oysters called oyster beard. This sponge is so full of fine spicula that the fishers' wives use it for scouring and polishing their cooking utensils.

No. 8 is the well known red coral of commerce. In Persia, China, and Japan this red coral (or "the "daughter of the sea") used to bear the same value as gold. In Johnson's dictionary is the following definition: "Coral—a plant of as great hardness and stony nature while growing in the water as it is after long exposure to the air." Peyssonel was the first to make known its animal origin, but it was many years after that the scientists of Europe had to acknowledge that after all Peyssonel was right.

PROVIDENCE RIVER OYSTERS.

The residents or visitors in Rhode Island and Massachusetts find these bivalves are highly valued. Ask, in hotels and saloons, for the finest oysters; the answer will be: "We have Providence Rivers."

"Little Rhody," though indeed small in area, has great industries. Providence, her largest city and capital, is the center of vast interests, of commerce, manufactures, education, etc. Her communications with Newport, Bristol, Fall River, Pawtucket, and other places, in or near the State, are so many and so direct, these seem but her suburbs. The largest solid silver manufactory in the world is to be found at Providence. The largest tool shop also, employing over fifteen hundred persons. About one hundred and fifty jewelry factories are located there. The famous Corliss Steam Engine Works also. Impressed, as even the casual observer will be, by the immense proportions that these and other businesses have attained there, he may overlook the one we seek to bring to notice. Yet it really holds no second place to any. Bays, rivers, estuaries, harbors, and lakes cover a large part of the surface of the whole State of Rhode Island. Providence River, Narragansett Bay, with the waters immediately around, contain large extents of natural oyster fields.

The possibilities of oyster production in these waters are beginning to be very much talked of. They are, as yet, however, but feebly realized. The advantages there over most other places of equal extent in our country are quickly seen. These waters are well sheltered from storms. They are nowhere very deep. There is much of what is called good bottom. And many fresh water streams are continually flowing in.

Many persons are now taking up the available ground for cultivation. Yet the State laws are not very encouraging to a rapid increase of the enterprise. One can lease but not own the ground. The annual rent is ten dollars an acre. The expense of surveys, committee, and records must be paid by the person securing the ground.

From its earliest history, laws have been made in Rhode Island to regulate fish and oyster industries. It is now plain that some additional legislation is needed, if the enterprise of producing good oysters is to be fostered much in that State.

Indians were very numerous and powerful there when white men came to settle. These tribes were drawn to the region because of the abundant supplies of sea food as well as game. Geographers have recently fixed upon Rhode Island as the ancient *Vinland* said to have been discovered by the Northmen in A. D. 1000. If reliance is to be placed on the "Icelandic sagas," a critical examination of them leads to this result. Verrazzano visited the Bay in 1524.

Rev. William Blackstone and his wife Sarah were the first actual settlers of this territory. They came from Boston in 1634. He had been the first white settler of Boston. Having left England to get away from "lord bishops," he went from Boston to be out of the power of "lord brethren." He made his home on the river Blackstone, six miles north of Providence. He named his place "Study Hill."

In 1636 Roger Williams, fleeing from persecutions suffered from Puritans for his religious views and courses, came to the east bank of the Seekonk River. There were with him John Smith, William Harris, Francis Wickes, and a lad named Thomas Angel. As their boat was coming to the shore an Indian from the hill greeted them with "What cheer, netop [friend]?" A tract of land near that place has ever since borne the name of "What Cheer."

This company soon moved to the western side of the river and began a settlement, which has now grown to a city of over one hundred thousand people. Williams named the place *Providence*, because of "God's merciful providence to him in his distress." He gave the same name to his son, who was the first male child born there.

An early visitor reveals the sentiments which the people cherished, and the impressions he received:

> "This pleasant town doth border on the flood,
> Here's neighboring orchards, and, more back, the woods;
> Here's full supply to cheer our hungry souls,
> Sir Richard, strong, as well as wine, in bowls.
> Here men may soon any religion find,
> Which quickly brought brave Holland to my mind;
> For here, like there, one, with the greatest ease,
> May suit himself, or quit all, if he please."

When, many years later, a large church was built, a bell, weighing 2,515 lb., was hung in its tower. The following inscription was placed upon the bell, showing that the ancient sentiments of religious liberty still remained with the people:

> "For freedom of conscience the town was first planted,
> Persuasion, not force, was used by the people;
> This church is the eldest, and has not recanted,
> Enjoying and granting, bell, temple, and steeple."

The visitor, who can go by boat from Providence to Newport in little more than an hour, sees a change since the time, as he himself tells us, Roger Williams, starting in early morning, rowed all day till midnight to accomplish the same journey.

Providence is built on the Providence River, and around a sort of lake called "the Cove." Into this cove two small rivers, the Woonasquatucket and Moshassuck, empty. The Seekonk River is on the east side. These several rivers divide the city so as to make numerous bridges necessary. "The Cove," a mile in circuit, is surrounded by a Park. The city has a variety of surface. There is one height of 204 feet above high water. There are thus sightly locations, many of which are occupied by public buildings and beautiful private residences.

The first recorded act which reveals the early value of the oyster supplies is a vote taken on March 6, 1639, which declares "all the sea banks free for fishing." This was called for, because provisions were quite scarce, and some living by the shore seemed disposed to keep others away from the waters immediately upon their front.

The first movement which gave an exclusive right to private parties in the prosecution of fishing was on June 16, 1716. Then "Starve Goat Island" was granted, upon petition of the fishermen from Providence, for the purpose of curing and drying fish. This island is, to this day, the headquarters of a very busy trade in oysters and fish. It lies a short distance down the Providence River. In June, 1731, on the 14th, bounties were voted for whale and cod fisheries. These were to be five shillings for every barrel of whale oil, one penny for every pound of whalebone, and five shillings for every quintal of codfish brought in by Rhode Island vessels.

On Feb. 18, 1735, attention was directed to the preservation of oysters in the bay, for large quantities of them were being taken to be burned for lime. So eager were the people in procuring materials for lime, that they gathered the shells with the oysters still alive in them, and burned them. This, of course, threatened to cause wholesale destruction of the oyster beds. A law was passed putting a stop to it.

In the year 1766, on October 9, a law was made forbidding persons to take oysters by means of "drags." They were to use no instrument for this purpose but tongs, under penalty of ten pounds. Parents were also held liable for their children and servants. The owners of boats used by such as employ drags were made liable for double damages.

When the people voted upon the new Constitution proposed for the State after the famous Dorr rebellion, they felt its provisions concerning oyster protection were so indefinite they refused to adopt it. This one thing caused it to fail. Such things show how highly they valued their oyster privileges. Large numbers of families have in the past, and do so still, live on the shores of Providence and Seekonk rivers and the bay, seeking most of their substance by oystering and fishing. The growth of the city and the development of manufacturing have resulted in the destruction of the oyster beds in Providence River proper. In the memory of men now living, quantities of good oysters could be gathered above the bridges near the railroad depot. Mud and other deposits have made such changes that to find oysters you must go more than a mile below that point.

Increased demands and failure of natural supplies, here as elsewhere, prompted to efforts toward private cultivation. Robert Pettis, one of the largest dealers in the country, was a pioneer in the movement. Though partly blind from injuries received when a boy at school, he had sagacity to see the growing value of oysters and the necessity of raising them on private grounds.

Much opposition has been encountered, and, at first, a person could secure only one acre, on a lease for a limited term. Not much modification has yet been secured. But the natural beds are still failing, and the supplies from the South are becoming more costly. These are influences which are every year more pressing, and must modify the law in the letter as they already have done in the spirit.

Over 300,000 bushels of seed shells have been planted in the Providence River this spring. Parties from Boston and elsewhere are doing much to foster the enterprise. The grounds around Starve Goat Island, Bullock's Point, Sabin's Point, India Point, and the mouth of Seekonk River are very largely taken already for private beds. The prospect is that ere many years a considerable portion of Narragansett Bay will be portioned off for the purpose of cultivating oysters.

The "seed" at first raised was brought from Fire Island, on the south side of Long Island. Much is now procured up the Seekonk River and from natural beds in the bay and around Somerset, in Massachusetts.

Fair Haven, Ct., parties have been buying shells from Providence dealers for one cent and a half a bushel. They have taken them to Connecticut waters to obtain "sets." The next season they bring the shells back covered with "seed" oysters and sell to Providence men at sixty cents a bushel. This operation naturally prompts the Providence cultivators to make arrangements to obtain "seed" nearer home. They are securing beds at Freetown, Dighton, Somerset, and other places in Massachusetts. Rhode Island law is such that no shells can be carried off the beds where they are found. All gleanings beside the live oysters must be thrown back into the water where they were found. The "culling" must, therefore, be done on the beds.

For cultivating oysters, ground is selected which is a little muddy. The oysters are removed to hard bottom after two or three years. But the first three years' growth is better if there is a little mud. Thus Providence planters think. They discard the idea that deep muddy bottoms can be prepared by covering with gravel and shells. Such deposits sink through the mud at once; but living oysters will keep on the surface and manage to grow. Something in the movements or buoyancy natural to the living bivalves seems to keep them up.

Dealers have made much use of Virginia oysters for opening in cold weather. They are able to keep them alive longer in their waters than is possible on other portions of the New England coast. At most points they will die if left in the water after January.

The months of February and March seem to be trying seasons for even native oysters. Rhode Island planters think the ground goes through some change that seriously affects the oysters upon it at that time. They begin to turn black and many die.

Their beds are often injured by what is called "anchor frost." This is snowy ice that forms in the river, but because of the currents does not remain on the surface. Being carried by the streams to the bottom it catches on the beds. It kills the plants very quickly, seeming to chill them at once.

Dead sea weeds also collect on and smother the oysters. A sponge-like growth is often found, which is quite destructive also. A similar growth, of a red color, abounds and seems to feed and nourish the oysters. While the white kind kills them, the red sponge is good for them.

Five fingers, or "stars," "wrinkles," and "drills" are somewhat troublesome, but not so much so as in waters outside in Long Island Sound.

The theory of the "star" which is entertained there is as follows:

It does its destructive work mostly in the summer months. Then the oyster is growing and has a very thin and tender edge. Some of the oyster's body, a very thin slip, is in this new part of his shell. The "star," clasping his body and fingers around the oyster, breaks off some of this thin edge. Thus an opening is made for the star's stomach. He is able to make this thin enough to enter the thinnest little opening. It can go where edge of sharpest knife could not enter. Then through, his piece of his stomach he infuses gastric juice which paralyzes the oyster. He can then get in more of his stomach, open the shell, and possess himself of his prey. This he does very quickly, unless he is disturbed.

The most vexatious enemy to the cultivator, as they all claim, is what they call the "beach comber," or "barnegatter." These are persons who live around the shores, fish and dig clams, and steal oysters. Because they use iron rakes to rake or "comb" the flats for hard shell clams they are called "beach combers."

Being residents along the shores, they seem to feel that they have an inalienable right to all they can find in the water. Private ownership of sea bottom they regard as somehow abridging their natural privileges. They have apparently no compunctions in getting all they can from the cultivator's grounds. In skiffs with muffled oars, at night, they carry off whole boat loads. It is difficult to convict them, even when arrested and proven guilty. Public sentiment has always been much in their favor. If taken before a jury, some one interested in some way is very likely to be on the jury, whose course will secure a verdict for or a disagreement.

Moreover, unless one has his grounds surveyed and recorded he can really have no evidence against a depredator. The expenses attending securing and renewing leases, surveys, fees of committee, and making maps are considerable; and there must be a new survey and record each time a lease is renewed. At these renewals much expense is sometimes caused by parties bidding against each other. The law gives any resident the right to bid off such ground. Notice has to be given that application has been made for certain pieces of ground. Others who wish to object, or to make application for the same, can then be heard. This leads to rivalries and expense, as we have said. Cultivators are, however, finding it wiser to agree not to bid against each other. But a very desirable or favorably situated piece of ground is apt to excite considerable of a struggle, costing the planter much money that goes to lawyers or the State.

Against all these vexatious obstacles the business increases, because the demand for good oysters steadily increases. A change of public sentiment is gradually taking place, more favorable to the private cultivator, as the people see the value of this industry to the public at large.

Cultivation means good oysters at reasonable prices. Merely natural supplies mean inferior oysters at high prices. The oystermen are still restricted to the use of tongs or rakes to gather oysters with. The boats used are loaded down the river or bay and towed up to Providence wharves by steam tugs.

A large business is done with opened oysters as well as with those in the shell. Some Providence firms employ forty openers at a time. These are paid for their work at the rate of twelve cents a gallon of solid meats. They can earn good wages at it, one man being known to open nineteen gallons in four hours. The city, though containing over one hundred thousand people, does not use one hundredth part of the oysters raised and handled there. They are sent out through all the New England States and as far West as Toledo, O. These oyster cultivators are among the best known, substantial, and most respected business firms of the city and State. Large amounts of capital are likely to be invested in this industry during the next few years. Sagacious minds are seeing the wealth of returns that are likely to be obtained for their money cast into the sea. The facilities of communication by railroad and steamboat with even far distant places give the Providence oystermen special advantages in sending to market. Their ready sales in the future, as in the past, can only be limited by the amount they are able to produce in their waters.

Raw Oysters.

Dr. William Roberts, in an interesting series of lectures on digestive ferments, published in the *Lancet*, says: The practice of cooking is not equally necessary in regard to all articles of food. There are important differences in this re-

spect, and it is interesting to note how correctly the experience of mankind has guided them in this matter. The articles of food which we still use in the uncooked state are comparatively few; and it is not difficult in each case to indicate the reason of the exemption. Fruits, which we consume largely in the raw state, owe their dietetic value chiefly to the sugar which they contain; but sugar is not altered by cooking. Milk is consumed by us both cooked and uncooked, indifferently, and experiment justifies this indifference; for I have found on trial that the digestion of milk by pancreatic extract was not appreciably hastened by previously boiling the milk. Our practice in regard to the oyster is quite exceptional, and furnishes a striking example of the general correctness of the popular judgment on dietetic questions. The oyster is almost the only animal substance which we eat habitually, and by preference, in the raw or uncooked state, and it is interesting to know that there is a sound physiological reason at the bottom of this preference. The fawn-colored mass which constitutes the dainty part of the oyster is its liver, and this is little else than a heap of glycogen. Associated with the glycogen, but withheld from actual contact with it during life, is its appropriate digestive ferment—the hepatic diastase. The mere crushing of the dainty between the teeth brings these two bodies together, and the glycogen is at once digested, without other help, by its own diastase. The oyster in the uncooked state, or merely warmed, is, in fact, self-digestive. But the advantage of this provision is wholly lost by cooking, for the heat employed immediately destroys the associated ferment, and a cooked oyster has to be digested, like any other food, by the eater's own digestive powers.

NATURAL HISTORY NOTES.

Fertilization of the Tulip.—Mr. W. H. Patton, writing to the *American Entomologist*, says: It has been believed that the nectar of the tulip is poisonous to bees, and that they rarely escape from the flower alive. However this may be with the yellow tulip (*Tulipa Sylvestris*), in which Kerner has described a special contrivance for excluding small insects from the nectar secreted at the bases of the filaments, it cannot be applied to our common garden tulip (*T. gesneriana*), for in this species there are neither glands to secrete nectar nor tangles of hairs to protect it, and I have never found nectar in the flowers. It is, moreover, small insects which the plant appears to attract, although the smooth cup of the perianth probably excludes crawling insects. Some of the smaller species of bees of the genus *Halticus* I have, during the past five years, observed to be frequent guests, coming for the pollen. They always alight upon either the perianth or the stigma, most frequently upon the latter, and crawling down from their alighting place to the base of the stamens, they then climb up to reach their booty. Whatever pollen they bring from other flowers has, therefore, a chance of reaching the stigma first. The perianth of the flower is red, the stigma is yellow, and the stamens—which are deeper down in the cup of the flower, and thus to a certain extent out of the line of the bee's flight—are black; and it is probable that the marked difference in the color of the stigma serves to attract the bees to the proper and most convenient landing. There appears to have been no direct observations hitherto made upon the fertilization of the tulip by insects. It may be that in the native home of the plant large insects are concerned in its fertilization, or that *T. sylvestris* thus differs from *T. gesneriana;* but Kerner's supposition that the trichomes on the filaments of *T. sylvestris* are intended to exclude small insects from the nectar, is open to doubt, in view of the observations upon the visits of small bees to the other species. A similar structure for protecting the nectar in *Geranium sylvaticum* was believed by Sprengel to serve as a shield against rain, and it may be that this is the real purpose in the tulip. Whether the supposition that the nectar of the tulip is poisonous is founded upon authenticated facts is also worthy of further investigation.

English Birds Compared with American.—Mr. H. D. Minot, in an interesting article in the August *Naturalist*, claims that after a residence of over four summer months in England, he found birds less abundant there than with us; but that, on the other hand, their companionship is more readily obtained abroad, and the naturalist need not seek for birds so often as he must in the United States, for the "respect and consideration" shown them there gives some of them, at times, almost a social ease with man, while the English public at large are more reasonable in their instincts and customs than the free and thoughtless American, who must fire his gun whenever he gets a chance, regardless of the true interests of all concerned. Wild pigeons, though heavier than ours, have a more than correspondingly slower flight; and it is curious to observe how heavy the English atmosphere seems to British birds, and how general it makes this difference in speed. The English snipe seemed to the author less quick and dashing than his American cousin, as is also the grouse; While English birds are inferior to those of New England in variety, so are they, on the whole, in coloration and in song. Among English song birds none correspond to our hermit thrush, house wren, water warbler, song sparrow, or solitary vireo. "To all England's song birds that I have heard, on the contrary, except two or three," says Mr. Minot, "we have singers corresponding; and to all absolutely, I may say without prejudice, equals or superiors, as well as I can judge." The nightingale, says he, has a voice of most wonderful compass, and is the greatest of all bird vocalists, but with a less individual and exquisite genius than our own wood thrush. The wood lark is an exquisite songster, while the note of the song thrush is exceedingly pleasing." As for the English sparrow, Mr. Minot was delighted, almost on his first day among British birds, to meet a genuine old English woman, who assured him that the year before she was "nigh heat hout of 'ouse and 'ome by them sparrows."

Vegetable Wax.

In the island of Java a species of wax is obtained from *Ficus gummiflua*, probably by drying the pith. This wax is used for lights, and is manufactured in hard lumps of a chocolate color; it becomes soft in heat, melts at 60°–70° C.; loses in boiling water its brown coloring matter, and becomes nearly white. It is partially dissolved in boiling alcohol, about one-third of it entering into solution and being deposited on cooling in a mammillated form. When treated with cold ether it separates into two parts, which are unequally soluble. These can be isolated by means of solutions in ether and by fractional precipitations after repeated and numerous additions of alcohol. The least soluble part melts at 62°, and, by analysis, it is found to have a composition which is expressed by the formula $C_{54}H_{54}O_3$. With perchloride of phosphorus it gives a chloride which is insoluble in water. The most soluble part crystallizes in a mixture of ether and alcohol, and melts at 73°. Its composition seems to be $C_{30}H_{30}O_2$. The decolorated wax, if submitted to a dry distillation, yields, among other products, a crystalline substance and an oil. The first one, if crystallized in petroleum ether, forms beautiful clusters of crystals, which melt at 67°, and form a liquid, the boiling point of which is 250° ($C_{12}H_{12}O_2$); nitric acid transforms it into a crystallizable nitrate.

Inversion of Gelatine Negatives.

M. Isard's method consists in making two layers of caoutchouc dissolved in benzine; when the first of these layers is dry he interposes a film of ordinary collodion containing about 1·5 per cent of pyroxyline, and covers it with the second layer of caoutchouc, this latter being itself again coated with a film of ordinary collodion. When this is finished, strips of the peculiar black paper called *papier à aiguilles* are glued all round the plate, so as to form a frame of the required dimensions, and the whole is then allowed to become thoroughly dry. If now it be desired to at once transfer the negative, it is only necessary to cut through the layer along the outer edge of the paper frame, and by raising one of the corners of the pellicle with the point of a knife the whole may be stripped off in one continuous movement. Provided care has been taken to let the paper get perfectly dry, the pellicle is sure to come off without its dimensions being in any way distorted. It will be seen that by nearly all similar processes we are enabled to get films which are so thin that we can, by inverting, print on either side. We can, therefore, in case of necessity, prepare for the inversion, while leaving the pellicle adherent to the glass plate on which a negative image has been taken; and when we wish to invert the negative, we have only to cut through the edges of the film as above described, and to strip it off the plate.

Moistening the Air in Mills.

To the Editor of the Scientific American:

On page 135, No. 9, current issue, Mr. L. E. Bicknell suggests the plan of moistening cotton mills with jets of steam running under the rows of looms for the purpose of moistening the warps, etc. This method has been in operation for many years (thirty years at least) here, and was always considered a success until recently, when a better plan has been adopted, which consists of pipes arranged overhead on the floor beams, and supplied with small glass sprinklers, through which, by means of an air pump (force pump), air mingled with water is forced at about twenty pounds pressure, and forms a very fine spray, which is all evaporated before it reaches the floor. This plan gives a better atmosphere for the operatives to breathe by supplying a proper quantity of oxygen to take up and purify the deadly carbonic acid gas given off their lungs. It also sweetens up the room, and there is not a foul sickening smell that steam always gives off, and the operatives are more cheerful, and there is less sickness among them since its introduction.

J. J. I.

A False Meteoric Report.

The Cleveland *Leader* states that at midnight on Saturday, August 16, Caledonia, Marion county, was visited by a terrific thunderstorm, accompanied by hail and the most vivid lightning, flash following flash in quick succession. There had been a political meeting there that evening, and the people from the neighboring villages and surrounding country were detained by the storm. Suddenly the sky appeared as bright as noonday, in fact fine print could easily have been read, so great was the light, but strange to say the light was steady, not flash after flash, as it would have been had the light been caused by lightning. A deafening roar was heard, continuing to become louder as the light became brighter. Gradually the roaring changed to a hissing, sparkling sound. It is needless to say that the people were frightened, and upon running into the street a ball of seeming fire came moving through the air from the northeast. The ball seemed to be at least twenty-five feet in diameter. As it neared the earth the heat could be plainly felt. The body struck the earth just north of the village and buried nearly one-half of itself in the ground. Good judges estimate the weight at three to five tons, but the heat is yet so great that it is uncomfortable to go nearer than thirty or forty feet. It looks like a mass of pig iron. It was visited by hundreds yesterday. The gentleman who owns the land on which it fell has been offered $300 for it.

We learn from the editor of the Caledonia (O.) *Argus* that the above statement of the Cleveland *Leader* is untrue.

ENGINEERING INVENTIONS.

Mr. Samuel L. Marsden, of New Haven, Conn., has patented an improvement in that class of crushers which operate with a reciprocating moving jaw or jaws. The invention consists in constructing a vertical jawed ore crusher with an adjustable pitman, friction driving pulleys, toggle lever, toggle, and jaw plates, arranged so as to increase the efficiency, durability, and convenience of the machine.

Messrs. Alvin R. Bailey and James B. Glass, of East Somerville, Mass., have patented packing for the piston rods of pumps, and of compressors for compressing air or chemical gases for refrigerators and ice-making, and for other uses. It is so constructed that it will not lose its pliability and usefulness from long use, and which will require only a light pressure to keep it tight, so that the piston rod may work free and cool.

An improved apparatus for increasing the production from oil wells has been patented by Mr. Charles S. Shoup, of Franklin, Pa. The object of this invention is to increase the production of oil wells by inducing and stimulating the flow from the oil rock when it falls. The invention consists in a return pipe connected with the tubes of the pump and the casing head of the well and fitted with cocks, whereby the oil may be passed to the tanks or directed through the casing head, and thence conducted down between the casing and the pump tubing alongside of the steampipe to the oil rock at the bottom of the well, for the purpose of clearing the well of paraffine.

Mr. Conrad H. Matthiessen, of Odell, Ill., has patented an improved road scraper which may be used for scraping and planing roads, and for ditching and other similar purposes. It consists in a novel arrangement of devices for raising and lowering the blade, and for adjusting it to different positions.

Ancient Man in Missouri.

The finding of numerous relics of a buried race, on an ancient horizon, from twenty to thirty feet below the present level of country in Missouri and Kansas, was noted in this paper a few months ago. The St. Louis *Republican* gives particulars of another find of an unmistakable character made last spring in Franklin county, Missouri, by Dr. R. W. Booth, who was engaged in iron mining about three miles from Dry Branch, a station on the St. Louis and Santa Fé Railroad. At a depth of eighteen feet below the surface the miners uncovered a human skull, with portions of the ribs, vertebral column, and collar bone. With them were found two flint arrow heads of the most primitive type, imperfect in shape and barbed. A few pieces of charcoal were also found at the same time and place. Dr. Booth was fully aware of the importance of the discovery and tried to preserve everything found, but upon touching the skull it crumbled to dust, and some of the other bones broke into small pieces and partly crumbled away, but enough was preserved to fully establish the fact that they are human bones.

Some fifteen or twenty days subsequent to the first finding, at a depth of twenty-four feet below the surface, other bones were found—a thigh bone and a portion of the vertebra, and several pieces of charred wood, the bones apparently belonging to the first found skeleton. In both cases the bones rested upon a fibrous stratum, suspected at the time to be a fragment of coarse matting. This lay upon a floor of soft but solid iron ore, which retained the imprint of the fibers.

Overlying the last found bones was a stratum of what appeared to be loam or sod from two and a half to three inches thick, below which was a deposit of soft red hematite iron ore, lying upon two large bowlders of hard ore standing on edge, standing at an angle of about forty-five degrees, the upper ends leaning against each other, thus forming a considerable cavity, which was filled with blue specular and hard red ore and clay, lying upon a floor of solid red hematite. It was in this cavity that the bones, matting, and charred wood were found, intermixed with ore.

The indications are that the filled cavity had originally been a sort of cave, and that the supposed matting was more probably a layer of twigs, rushes, or weeds, which the inhabitants of the cave had used as a bed, as the fiber marks cross each other irregularly. The ore bed in which the remains were found, and part of which seems to have formed after the period of human occupation of the cave, lies in the second (or saccharoidal) sandstone of the Lower Silurian.

Postage Stamp Mucilage.—Gum dextrin, 2 parts; water, 5 parts; acetic acid, 1 part; dissolve by aid of heat and add 1 part of spirits of wine.

DECISIONS RELATING TO PATENTS, TRADE MARKS, ETC.

U. S. Circuit Court—Northern District of Illinois.

ADAMS *vs.* ILLINOIS MANUFACTURING COMPANY.—PATENT LANTERNS.

Blodgett, J.:

This is a bill for injunction and account. Complainant is admitted to be the owner of two letters patent issued by the United States to J. H. Irwin, the first, No. 47,551, dated May 2, 1865, and the other, No. 50,591, dated October 24, 1865, for improvements in lanterns.

The defense is want of novelty in the complainant's patents. It is admitted that defendant has made, and is making, lanterns in all respects like those described in the specifications and drawings of Irwin's patent No. 50,591. If that patent is valid, complainant must have a decree in this suit.

The leading feature of this patent is the construction of a loose-globe lantern, so arranged that the globe can be readily removed and replaced, and at the same time have the metallic parts of the frame permanently attached together so as to make a basket in which the globe will be held or retained even if the catch holding the top or dome to the frame of the lantern is unfastened. This is obtained by hinging the top or dome to the guard on one side, so that it can be closed firmly to the guard by the operation of a hinge and a catch on the side opposite the hinge, so that when the top or dome is lifted or thrown back on the hinge the globe can be removed from the guard. The conveniences of this arrangement are obvious. It makes a lantern simple in construction, with few complications, easily cleaned, and perhaps less liable to accidents than any other form of lantern which has been devised.

It is admitted that loose-globe lanterns had been made long prior to that made by Irwin in the form described in his patent. The idea of so constructing the lantern that the globe was simply held in place by the guard, and could be readily removed, was not new when Irwin entered the field; but I am satisfied that the Irwin patent can be sustained so far as its particular device is concerned. It is evidently useful, and by its application a very useful lantern is obtained.

The loose-globe lanterns which had been made prior to that of Irwin's, as shown in the proof, are:

First, Westlake, where the arrangement was such that you are obliged to remove the oil-pot, then the top, and then remove the guard from the globe. Second, Max Miller. By this the parts of the lantern can be separated by the means of springs and catches, so that finally the globe can be taken out through the top of the guard. Third, Waters' lantern. This is separated. Fourth, Evans, English patent. Fifth, Chappell, English patent. Sixth, Butterfield. Guard clasps around lantern should be called a removable guard. Seventh, Morley. Eighth, Colburn.

All these devices have some provision by which the parts of the lantern can be to a greater or less extent separated, but they none of them can, I think, be said to suggest the specific mode by which Irwin made his globe removable and preserved the connection of the parts of his frame.

Patent may be sustained as a special device, and, as defendant infringes that device, complainant must have a decree.

By the Commissioner of Patents.

EX PARTE FARNUM & CO.—TRADE MARK.—TICKINGS.

Appeal from Examiner of Trade Marks.

Marble, Commissioner:

Applicants in this case seek to register as a trade mark for ticking the word "Lancaster," accompanied by the symbolical representation of a rose.

As this case was presented in the first instance the word alone was described and claimed as constituting the one essential feature of the mark; but the registration having been refused by the Examiner upon the ground that this word was geographically descriptive, an amendment to the application was made, and the symbolical representation of a rose was also included. This amendment was held by the Examiner not to relieve the case of the previous objection, and from his unfavorable decision upon this point the present appeal has been taken.

Counsel for applicants, in support of their appeal, have urged that the action of the Examiner is erroneous for the reasons (1) that it is inconsistent with the previous practice of the Office, the word "Lancaster" being a proper trade mark, and (2) that, even admitting that the word alone is not properly registrable, this objection is avoided by the use in connection therewith of the arbitrary symbol of a rose.

Held by the Commissioner:

1. That as a rule geographical names cannot be allowed registration as trade marks.

2. That before any geographical name can be said to be registrable it must clearly appear that the place of that name is such a one that the word will be understood by the general purchasing public as primarily fanciful, and that manufacturers of like goods at such place cannot so mark their wares and claim the protection of our laws.

3. That the essential features of a trade mark are those only which serve in whole or in part to distinguish the goods of the party by whom such mark is adopted, and it is not proper that anything should be described as essential which the courts would hold otherwise; and

4. That words calculated to deceive the public as to the place of manufacture should not be allowed registration.

The decision of the Examiner of Trade Marks is accordingly affirmed.

U. S. Circuit Court—District of Massachusetts.

CROWELL *vs.* PARMENTER.—CURING AND PUTTING UP FISH.

Where, in his contract with the defendant, the plaintiff agreed that he would sell no licenses for less than a certain price, and it conclusively appears that he has broken such agreement in a way calculated to injure the defendant, a preliminary injunction will be denied, notwithstanding the fact that the defendant has admittedly failed to pay his stipulated royalty.

The motions in this case and several others (No. 944*a*, *vs. George G. Tarr;* No. 945, *vs. George W. Adams;* No. 945*a*, *vs. Sylvanus Smith;* No. 946, *vs. Charles H. Pew;* No. 946*a*, *vs. James G. Tarr;* No. 947, *vs. J. J. Stanwood;* No. 947*a*, *vs. James L. Shute;* No. 948, *vs. Charles G. Cressey,* and No. 948*a*, *vs. Samuel Lane*) are founded on the same patent for curing and putting up fish which is relied on in *Crowell vs. Harlow.*

In the cases now under consideration the several defendants had, as tenants in common, an exclusive license or grant, which, as they contend, gives them full power to use the invention to the end of the term. They admit a failure to pay the royalties agreed on, but contend that the license is not conditional, and that no right of resuming his grant has been reserved to the plaintiff, but that he must bring his action at law for the royalties, or his suit in equity for an account of those royalties, from time to time as he may be injured—a different and less stringent remedy than that which is sought by this bill.

I shall not discuss this issue at the present time. I shall assume that, under the frame of the bill, the plaintiff can have some remedy in this court as well as in a court of law. The reason why I refuse this preliminary and peremptory injunction moved for is that by the contract between the parties, and as a part of it, in consideration of the agreements on the part of the defendants, the plaintiff agreed that he would sell no licenses for less than a certain price, and there are numerous affidavits which declare that he has sold such licenses for a very much smaller consideration, and in a way which seemed intended to deceive the defendants, and which would seem calculated to injure them in their exclusive rights. These affidavits are wholly uncontradicted, and must be taken at this hearing to be true. Under these circumstances a court of equity cannot lend its most stringent remedy to the plaintiff in advance of the trial or hearing at which the accounts and damages may be properly adjusted between the parties.

Motion denied.

The Great Steamship City of Rome.

At the recent meeting of the Institution of Mechanical Engineers, Barrow-in-Furness, an interesting paper, from which we take the following, was read by Mr. James Humphrys, on the Inman steamship City of Rome, now in course of construction by the Barrow Shipbuilding Company. We hope in an early number to publish Mr. Humphrys' paper in its complete form, with diagrams, but in the meantime we may give some of the leading particulars of the vessel to which it relates. This splendid steamer will, when completed, be the largest vessel afloat, with the exception of the Great Eastern. Her dimensions are: Length between perpendiculars, 546 feet; length over all, 600 feet; extreme breadth, 52 feet 3 inches; and depth of hold, 37 feet. She will have staterooms for 271 passengers, and accommodation for 1,500 emigrants, provision being made for carrying about 260 emigrants at the fore end and 240 at the aft end on the main deck, and for 1,000 more on the lower deck. The grand dining saloon is 72 feet long, 52 feet wide, and 9 feet high, or 17 feet in the way of the large opening through the drawing room above; this saloon will afford accommodation for dining 248 persons at once. The estimated weight of the City of Rome complete and ready for sea is 8,000 tons, while her displacement on 28 feet mean draught is 13,500 tons, so that she will have a dead weight-carrying power of 5,500 tons. Her holds, however, have a cubical capacity of 38,600 cubic feet, equivalent to 7,720 tons measurement at 50 cubic feet per ton.

In the constructive details of the City of Rome every endeavor has been made to insure strength combined with high-class accommodation. The hull is divided into water-tight compartments by a number of bulkheads, the maximum of any one of these compartments being about 60 feet. All the bulkheads are fitted with water-tight doors of the Admiralty pattern, worked either from above or below, and provided with tell-tales on deck. At the fore end a double bottom is provided for a length of about 150 feet from the stern to give greater safety in the event of stranding. The framing is of the ordinary type. The vessel has two complete iron decks above, while the lower deck is complete for half its length, and has wide side plating for the remainder. There are nine tiers of keelsons running fore and aft, the five central ones being of uniform height, and being carried unbroken through engine and boiler rooms. The stern frame, which is now being made at the Mersey Steel and Iron Works, is estimated to weigh 33 tons when finished, and will be the largest single forging of its kind ever made.

The City of Rome will have a single screw, 24 feet in diameter, driven by three sets of compound engines of the inverted tandem type, these engines actuating cranks set at 120°. Each engine has a high-pressure cylinder 43 inches, and low-pressure cylinder 86 inches in diameter, the stroke being 6 feet. The high-pressure cylinder is supported above the corresponding low-pressure cylinder by three wrought iron columns, the arrangement giving ready access to the stuffing boxes, etc. The cylinder covers are made in halves for easy removal. The valve faces are on the fronts of the cylinders, the valves being driven by eccentrics on an independent shaft coupled to the main shaft at each end by a pair of mortise wheels. The crank-shaft is a built-up shaft, and is being made by Sir Joseph Whitworth & Co., of their compressed steel. It will weigh complete 64 tons, and will have main bearings 25 inches in diameter by 33½ inches long, and crank-pins 26 inches in diameter by 28 inches long. The screw shafting is also being made of the Whitworth compressed steel, and will be hollow. The intermediate shafting is 24 inches in diameter, with a 14 inch hole through it, while the propeller shaft is 25 inches in diameter by 30½ feet long, and will weigh 18 tons. The thrust shaft will weigh 17 tons, and will have 13 collars 39½ inches in diameter, giving a surface of 6,000 square inches. The engine bed plate will weigh 100 tons. The surface condensers contain nearly 17 miles of tubing, exposing 17,000 square feet of surface, and the condensing water will be supplied by two double-acting circulating pumps, 26 inches in diameter, with 3 feet stroke, worked by the forward and aft engines respectively, as are also the bilge and feed pumps, and the air pumps, the latter being 39 inches in diameter, with 3 feet stroke. There are also a large centrifugal pumping engine (for pumping heavy leaks, and which can be arranged to discharge through the condensers), and three auxiliary pumping engines for boiler feeding, bilge pumping, etc.

The boilers are eight in number, arranged in two boiler rooms of moderate size separated by a water-tight bulkhead. The boilers, which are of the cylindrical double-ended type, 14 feet in diameter by 19 feet long, are arranged fore and aft in four blocks of two each, the two central blocks being separated by the transverse bulkhead just mentioned. The coal bunkers are along the sides of the ship and form part of the structure; it is intended to make these bunkers and keelsons water-tight so as to constitute the inner skin at the points where they occur. Each boiler has six furnaces, 3 feet 9 inches in diameter, and with separate combustion chambers. The fire grates are 6 feet long, the total area being 1,080 square feet. Each boiler has a steam receiver, 13 feet long by 4 feet diameter. The furnaces and combustion chambers are of Bowling iron, and the shells of iron made by Sir John Brown & Co., the plates being 24 feet 8 inches long by 4 feet 4½ inches wide and 1¼ inches thick, the weight being nearly 2½ tons each. The boilers are made for a working pressure of 90 pounds per square inch.

The engines are intended to develop in regular work 8,000 indicated horse power, but to be capable of developing 10,000 horse power. The speed expected is 18 knots per hour. The vessel will have four masts, and will be full ship-rigged, with the addition of the fore and aft rigged jigger mast; she is expected to be ready for service next summer, and will ply between New York and Liverpool.

Steam Cable Towing on Erie Canal.

Notice was taken a few weeks since of a protest by certain boat owners and others against the use of the steam cable towing system on Erie Canal. The charges entered against the system, especially with reference to its inconvenience and unprofitableness, do not appear to be well supported by fact. At any rate, the traffic of the canal so far this year has been uncommonly large, and much of the increase is attributed to the speedy and economical cable service.

The official returns received at the Produce Exchange show the total movement on the canals since they were opened until August 14, to be fully 30 per cent greater than for the same period last year, as follows:

	1879.	1880.
Total tons	2,210,450	3,258,896
Total miles boats cleared	3,993,725	5,325,649
Total tolls	$343,537	$504,259

Seven hundred boats have abandoned the old system of towing and adopted the new; and it is claimed that the increase of speed secured by the cable has increased the capacity of the canal fully 15 per cent. At the same time the boat owners, through the more rapid movement of their cargoes and more frequent trips, have been able to make larger profits, and the revenue of the State has been materially augmented. If no serious breaks occur in the canal it is expected that the toll-sheet at the end of the season will show a revenue far in excess of anything recorded heretofore.

The Dying Fish of Lake Ontario.

Notice was recently taken in this paper of the wholesale destruction of fish, supposed to be young land-locked shad, in Lake Ontario. Mr. Seth Green, Fish Commissioner, says that they are a different fish, belonging to another branch of the shad family. They appear to be very prolific, and travel in schools so large that all are unable to find food. Those at the head of the schools pick up all the food, and those behind starve to death. Mr. Green says he has picked up and examined hundreds of them. They are but little more than skin and bones, and have nothing whatever in their stomachs. The same fish have also appeared in Cayuga Lake, but are not as large as those of Lake Ontario. During a recent visit to the former lake he observed a school feeding. He followed in their wake, as he had done before in Lake Ontario, and picked up several not yet dead, and found they were dying from starvation. They have made their appearance in both Seneca and Cayuga lakes, and it is a mystery how they got there. In order to get to these lakes from Lake Ontario—that is, if they come that way—there are several dams which it would seem impossible for them to get over.

Business and Personal.

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Wanted, first-class large Planer, new or second-hand. Address Lambertville Iron Works, Lambertville, N. J.

C. B. Rogers & Co., Norwich, Conn., Wood Working Machinery of every kind. See adv., page 140.

2d-hand Machinists' Tools, Lathes, Planers, and Drills, for sale. Address Hawes Machine Co., Fall River, Mass.

Recipes and Information on all Industrial Processes. Park Benjamin's Expert Office, 50 Astor House, N. Y.

Dish Washing Machine wanted; one that is capable of washing 25,000 daily. A liberal offer will be made any party possessing such a machine, by addressing D. W. M., Box 773, New York city.

Experts in Patent Causes and Mechanical Counsel. Park Benjamin & Bro., 50 Astor House, New York.

Telephones repaired, parts of same for sale. Send stamp for circulars. P. O. Box 205, Jersey City, N. J.

Corrugated Wrought Iron for Tires on Traction Engines, etc. Sole mfrs., H. Lloyd, Son & Co., Pittsb'g, Pa.

Malleable and Gray Iron Castings, all descriptions, by Erie Malleable Iron Company, limited, Erie, Pa.

Apply to J. H. Blaisdell for all kinds of Wood and Iron Working Machinery. 107 Liberty St., New York. Send for illustrated catalogue.

Our new Stylographic Pen (just patented), having the duplex interchangeable point section, is the very latest improvement. The Stylographic Pen Co., Room 13, 169 Broadway, N. Y.

Advertising of all kinds in all American Newspapers. Special lists free. Address E. N. Freshman & Bros., Cincinnati, O.

Skinner & Wood, Erie, Pa., Portable and Stationary Engines, are full of orders, and withdraw their illustrated advertisement. Send for their new circulars.

Sweetland & Co., 126 Union St., New Haven, Conn., manufacture the Sweetland Combination Chuck.

Power, Foot, and Hand Presses for Metal Workers. Lowest prices. Peerless Punch & Shear Co., 52 Dey St., N. Y.

The Brown Automatic Cut-off Engine; unexcelled for workmanship, economy, and durability. Write for information. C. H. Brown & Co., Fitchburg, Mass.

For the best Stave, Barrel, Keg, and Hogshead Machinery, address H. A. Crossley, Cleveland, Ohio.

Best Oak Tanned Leather Belting. Wm. F. Forepaugh, Jr., & Bros., 531 Jefferson St., Philadelphia, Pa.

National Steel Tube Cleaner for boiler tubes. Adjustable, durable. Chalmers-Spence Co., 40 John St., N. Y.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Stave, Barrel, Keg, and Hogshead Machinery a specialty, by E. & B. Holmes, Buffalo, N. Y.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, importers Vienna lime, crocus, etc. Condit, Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

Peck's Patent Drop Press. See adv., page 140.

Presses, Dies, and Tools for working Sheet Metal, etc. Fruit & other can tools. Bliss & Williams, B'klyn, N. Y.

Hydraulic Jacks, Presses and Pumps. Polishing and Buffing Machinery. Patent Punches, Shears, etc. E. Lyon & Co., 470 Grand St., New York.

Sheet Metal Presses, Ferracute Co., Bridgeton, N. J.

Wright's Patent Steam Engine, with automatic cut off. The best engine made. For prices, address William Wright, Manufacturer, Newburgh, N. Y.

For Mill Mach'y & Mill Furnishing, see illus. adv. p. 147.

Burgess' Non-conductor for Heated Surfaces; easily applied, efficient, and inexpensive. Applicable to plain or curved surfaces, pipes, elbows, and valves. See p. 284.

Eclipse Portable Engine. See illustrated adv., p. 125.

For best low price Planer and Matcher, and latest improved Sash, Door, and Blind Machinery, Send for catalogue to Rowley & Hermance, Williamsport, Pa.

Blake "Lion and Eagle" Imp'd Crusher. See p. 141.

Special Wood-Working Machinery of every variety. Levi Houston, Montgomery, Pa. See ad. page 142.

Saw Mill Machinery. Stearns Mfg. Co. See p. 141.

Improved Solid Emery Wheels and Machinery, Automatic Knife Grinders, Portable Chuck Jaws. *Important*, that users should have prices of these first class goods. American Twist Drill Co., Meredithville, N. H.

For Standard Turbine, see last or next number.

Fire Brick, Tile, and Clay Retorts, all shapes. Borgner & O'Brien, M'f'rs, 23d St., above Race, Phila., Pa.

The $4 Drill Chuck sent free on receipt of price. A. F. Cushman, Hartford, Conn.

Machine Diamonds. J. Dickinson, 64 Nassau St., N. Y.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

4 to 40 H. P. Steam Engines. See adv. p. 125.

Wanted—The address of 40,000 Sawyers and Lumbermen for a copy of Emerson's Hand Book of Saws. New edition 1880. Over 100 illustrations and pages of valuable information. Emerson, Smith & Co., Beaver Falls, Pa.

For Separators, Farm & Vertical Engines, see adv. p. 157.

For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad. p. 157.

For Wood-Working Machinery, see illus. adv. p. 157.

Tight and Slack Barrel machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus. adv. p. 157.

Elevators, Freight and Passenger, Shafting, Pulleys and Hangers. L. S. Graves & Son, Rochester, N. Y.

For Patent Shapers and Planers, see ills. adv. p. 156.

Comb'd Punch & Shears; Universal Lathe Chucks. Lambertville Iron Works, Lambertville, N. J. See ad. p. 78.

Wheels and Pinions, heavy and light, remarkably strong and durable. Especially suited for sugar mills and similar work. Circulars on application. Pittsburg Steel Casting Company, Pittsburg, Pa.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 157.

C. J. Pitt & Co., Show Case Manufacturers, 236 Canal St., New York. Orders promptly attended to. Send for illustrated catalogue with prices.

Catechism of the Locomotive, 625 pages, 250 engravings. The most accurate, complete, and easily understood book on the Locomotive. Price $2.50. Send for a catalogue of railroad books. The Railroad Gazette, 73 Broadway, New York.

Elevators.—Stokes & Parrish, Phila., Pa. See p. 157.

Machine Knives for Wood-working Machinery, Book Binders, and Paper Mills. Large knife work a specialty. Also manufacturers of Soloman's Parallel Vise. Taylor, Stiles & Co., Riegelsville, N. J.

Penfield (Pulley) Blocks, Lockport, N. Y. See ad. p. 157.

Lightning Screw Plates and Labor-saving Tools, p. 108.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) F. W. L. asks if there is any way to test for gold as an alloy of other metals, and if so, what? A. Rub the alloy upon a piece of hard slate (the touchstone used by jewelers is better), warm the stone and moisten it with strong nitric acid. If the metallic streaks do not disappear gold is present in the alloy.

(2) J. A. G. writes: 1. In making a dynamo-electric machine, half the size of the one described in SUPPLEMENT No. 161, what Nos. of wires should be used? The Nos. given are 16 and 18. A. Use Nos. 18 and 20. There is no object in making a dynamo machine smaller than the one referred to. 2. Is there any process by which the melting point of paraffine may be raised, leaving it tasteless and inodorous? A. We know of no way. 3. Are celluloid collars, etc., injurious or poisonous to the wearer? Dealers here say so, but I think only because they wish to discourage the use of celluloid goods. A. They are not considered poisonous.

(3) V. V. S. writes: I wish to drill a hole one-quarter inch in diameter through a piece of 21-ounce glass. How can I do so without breaking it? A. It can be done by means of an ordinary steel drill hardened in mercury, and moistened while drilling with turpentine containing a little gum camphor. A safer way, however, is to use a one-quarter inch copper tube as a drill, and apply emery and oil or water to it as it revolves.

(4) O. & G. ask: 1. For a cheap substitute for shellac varnish. Is there another solvent for shellac, besides alcohol, that will answer as a varnish, and which will dry moderately quick? A. Shellac is soluble in alcohol, wood naphtha (crude methylic alcohol), in aqueous solution of borax (borax 1, shellac 6), and to some extent in strong ammonia water. 2. What is the most practical book with receipts for staining woods, making cheap varnishes, etc. A. You should address the bookdealers who advertise in these columns for their catalogues, etc.

(5) A. R. C. asks: 1. Would a square foot of cold iron be larger or smaller if heated to 4,000° or 5,000° Fah.? A. It would occupy less space. 2. Why is it that a piece of solid iron will float on a ladle of melted iron? A. For the same reason that ice floats on water. See p. 116, *et seq.*, Tyndall's "Forms of Water." 3. What are the relative amounts of carbon in cast iron, wrought iron, and steel? A. Cast iron, 2·0 to 5·0 per cent; wrought iron, 0·1 to 0·25; steel, 0·15 to 5·5. 4. Is there more carbon in hard cast iron than in soft? A. Yes.

(6) J. W. writes: 1. I should like to know how to make a sample of strong nitric acid, 48°, for nitro-sulphuric. I took all the moisture I could out of nitrate of soda, and used sulphuric acid at 62°, but could not get any stronger than 44° nitric; perhaps I may have used too much sulphuric acid; namely, equal quantity to nitrate. A. Dry the nitrate thoroughly, use strong sulphuric acid, and do not overheat or force the distillation or drive it too far. See Mowbray's "Trinitroglycerine." 2. Also how to make a pure sample for chemical purposes, as it is too red? A. Redistill at a gentle heat, rejecting the first and last portions.

(7) W. C. B. asks if there is anything that will render canvas fireproof. I am making an awning for steam launch, and she throws sparks so badly as to burn the awning. Would it be practicable to get an asbestos awning, and would it be very expensive? A. Saturate the awning with a strong aqueous solution of tungstate of soda (comml.). Asbetos cloth is rather expensive.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

August 10, 1880,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

Acid, pulverulent preparation of phosphoric, E. N. Horsford 230,874
Air compressing apparatus, R. M. Catlin 231,097
Aluminous cake, manufacture of, F. Laur (r) 9,240
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Brewers' cellars, apparatus for purifying the air in, F. W. Wiesebrock 231,129
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Cars on inclined planes, operating, J. Delaney 231,020
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Carriage body corner brace, Anderson & Hastings 230,852
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Harvester rake, D. L. Emerson 230,867
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Hats, machine for flanging and curling, A. P. Quinby 231,096
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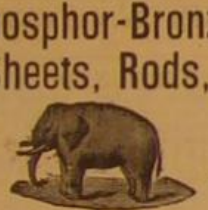

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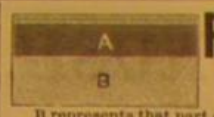

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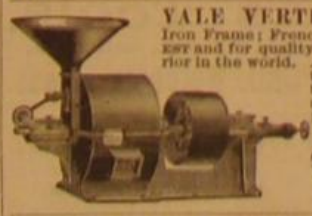

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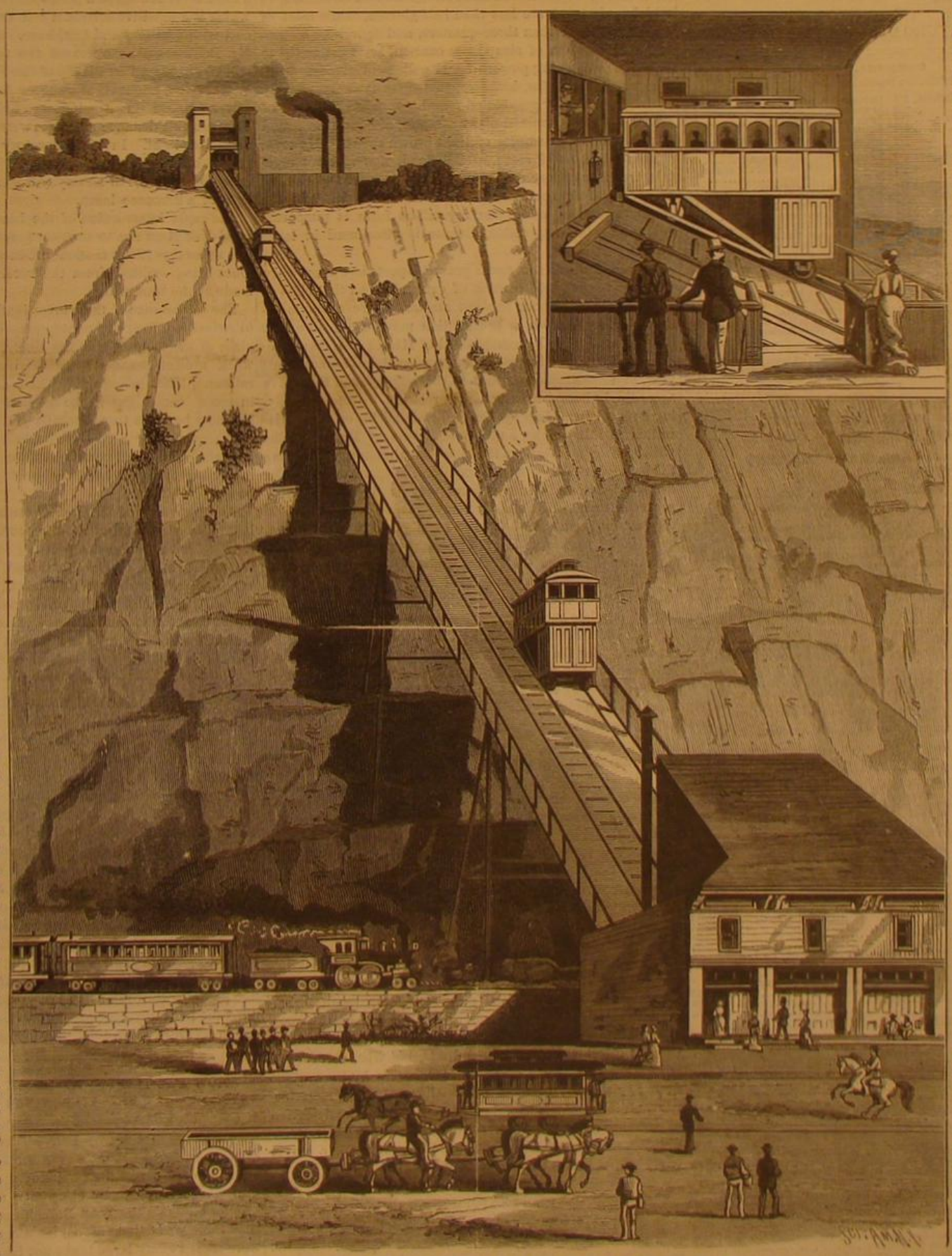
MODERN HILL CLIMBING.

The topography of many Western cities is such that, as the corporate limits enlarge, their most populous portions include districts embodying very rugged features. At Pittsburg and at Cincinnati steep hills, or rather mountains, bordering the Ohio, have long since been absorbed by the cities named, and these are covered with a dense and growing population. This has been of late years rendered the more possible by the general introduction of the inclined railway, which makes hill climbing a luxury. A fair sample of such a railway is noted in the Duquesne Incline Plane Company's roadway at Pittsburg, Pa. In this case the object in view was to surmount the hill known as Mt. Washington, located at the mouth of the Monongahela River and directly overlooking the site of the famous stronghold whose name is given the modern enterprise. The Duquesne is the latest and most complete of four similar enterprises climbing the same mountain. It was opened to the public in May, 1877, and up to September 1, 1880, had carried 500,000 passengers without injury to any one. The perpendicular height reached is 400 feet, length of incline 793 feet, rate of ascent 30½ degrees. The roadway comprises, of course, a double track, one car ascending while its fellow descends, and *vice versa*.

The motive power, consisting of a double engine of 70 horse power, is located at the top of the incline, and motion is communicated to the cars by the means of a large drum carrying steel wire cables of 1¼ inch diameter. A supplementary or safety cable, of 1⅛ inch diameter, is also in constant use. These cables are each 900 feet in length, and are capable of sustaining a perpendicular strain of 50 tons, while the actual working strain is about one-tenth that amount. The safety cable passes around a system of sheaves so arranged that should the working cable part the safety cable will tighten about the sheaves and bring the cars to stop. The cars, neatly and strongly built, will each seat 25 persons, and in the angle beneath them and between the upper and lower tracks there is a space available for light freight. In the Duquesne roadway there is a 360 foot section of wrought iron bridge work spanning the tracks of the "Pan Handle" Railroad. The rails are of the T pattern, 40 pounds to the foot, and the gauge is 5 feet, the double trackway being 20 feet wide, allowing 3 feet between the cars at the passing point.

Rollers of locust and "gum" wood, located at regular distances between the rails, bear the cables in their passage above them. In operating the cars, the engineer in the "cab" at the apex of the incline has absolute control of engine and cars by means of two levers. One operates the reversing mechanism of the engines and the other starts and stops the same. A brake, operated by the engineer's foot, brings sufficient friction to bear upon the cable drum to stop its revolutions even should steam be on. This drum, it might be added, is 12 feet in diameter, with a grooved periphery, and a width of 3 feet 10 inches. The cable winds into these grooves, and the movement of engines, drum, cables, and sheaves is almost noiseless, and indicates little or no strain upon any of the machinery. Experience in this plane has shown that popular prejudice against this mode of travel has ceased, and on Sundays during the summer 6,000 passengers are carried during the day and evening, the cars ascending and descending as rapidly as filled and emptied. Ordinarily trips are made every five minutes, the trip occupying two minutes. The engines, it might be added, are 24 inch stroke and 14 inch cylinders, operating a shaft bearing a driving pinion of 30 inches diameter, gearing into the main driving wheel, which is 12 feet in diameter, 12 inch face. To operate the entire affair for nineteen hours out of the twenty-four requires the services of only five men, namely, two engineers, one conductor, one fireman, and one trackman. The total cost of this incline, cars, real estate, etc., was $47,000, and it is considered a paying enterprise by the stockholders. The single fares are 6 cents. The road enjoys a growing popularity as a means of best obtaining a beautiful and comprehensive view of the "Iron City."



THE INCLINED PASSENGER RAILWAY, PITTSBURG, PA.

M. H. Bateham.

Mr. M. H. Bateham, one of the best known and most active of the promoters of scientific agriculture in Ohio, died recently at his residence in Painesville. Mr. Bateham was born in Kent, England, in 1813; came to this country in 1825, and for the next twenty years resided in Rochester, N. Y. During recent years he has been prominently identified with the agricultural and horticultural interests of Ohio, as Secretary of the State Board of Agriculture and as a leading member of the State Horticultural Society. He was for a number of years editor of the *Genesee Farmer*, after which he founded and edited for ten years the *Ohio Cultivator*. His contributions have been many and valuable in the *Ohio Farmer*, the *Rural New Yorker*, the *American Agriculturist*, and other papers of this class.

The American Institute Fair.

It is to be hoped that exhibitors at the coming fair of the American Institute will be prompt in getting their goods and machinery in place. It is a loss to exhibitors as well as a disappointment to the public to have the fair begin, as it so often does, in a general state of unreadiness.

The Chicago Mastodon.

Portions of a mastodon of enormous size were discovered recently in Wicker's Park, Chicago, in excavating for a sewer. The indications are that the huge animal perished in an ancient marsh or quagmire, and there is hope of the recovery of the rest of the skeleton. The curved tusks are about 7 feet long.

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NEW YORK, SATURDAY, SEPTEMBER 18, 1880.

Contents.

(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT
No. 246,
For the Week ending September 18, 1880.
Price 10 cents. For sale by all newsdealers.

ADULTERATIONS AND SUBSTITUTIONS.

People who like to mix chiccory with their coffee *should* undoubtedly be allowed to do so, although, for one who knowingly uses coffee so adulterated, probably there are a dozen who do it without knowing. So, too, in regard to those who use oleomargarine instead of dairy butter, taking the former knowingly on account of its lower price, or because a good article of butter may not be obtainable. There are many other deteriorations, adulterations, and substitutions which are also allowable, if not even entirely harmless, provided, as between manufacturer, dealer, and consumer, there be a correct understanding as to the article dealt in, and no attempt at deception is practiced. The difficulty is that deception in some form, or at some stage, seems to be an invariable accompaniment of this kind of business. The manufacturer may not deceive the large dealer, who is supposed, equally with himself, to be an expert; from the large dealer to the retailer, and from the latter to the consumer, however, the opportunities for deception, *without* the commission of any fraud in the eye of the law, are wonderfully increased.

Perhaps one of the most successful of the comparatively new adulterations is that of the use of glucose, made from corn, for the adulteration of sugar and sirup supposed to be made from the sugar cane. Considerable prominence has been given to this matter on account of a trial which took place in Buffalo in July, the suit growing out of a difference as to the ownership of stock in a company which had made immense profits out of the business. Glucose, or starch sugar, is not necessarily harmful, but it has very little sweetening power. Mr. R. C. Kedzie, the president of the Michigan State Board of Health, in a recent report, gives a list of seventeen table sirups he had examined, of which only two were less than half glucose, while most of them were more than three-quarters, and four were *all* glucose. One gallon of sirup from cane sugar is estimated to have the sweetening power of 4·17 gallons of glucose sirup. The writer concludes, however, that there is comparatively little glucose in "granulated" and "crushed" sugars, of which he had examined many samples, although he found it easily in many samples of light brown sugars. He says: "The existence of clean, well-defined, non-coherent crystals, free from floury dust, is good evidence of the absence of glucose from commercial sugars," and adds: "In the common candies, where the crystalline form is purposely avoided as far as possible, glucose is often used in large quantities."

The case assumes a much graver aspect, however, when we come to the sophistication of drugs, and all that class of articles known to our *materia medica*, where a single instance of adulteration or substitution may put health or life in jeopardy. The National Board of Health has, therefore, done well, in the absence of any yellow fever damage this year, to devote some attention to this subject, and they have accordingly issued a pamphlet in relation thereto, embodying a report furnished by Mr. C. Lewis Diehl, on "Deteriorations, Adulterations, and Substitutions of Drugs." The writer, after mentioning the practical difficulties attending the collection of specific information in regard to particular drugs, to determine how general may be the adulteration, proceeds to set forth mainly such facts as are recorded in the current literature of the last twenty-five or thirty years, most of it coming within the published proceedings of the American Pharmaceutical Association. Previous to 1848 large importations of adulterated and inferior drugs were thrown on our market, but in that year Congress passed a law to regulate such importations, and designed to exclude inferior and adulterated drugs. Under this law the "special examiner" for the port of New York, at which most of the importations had been made, had occasion, during the first ten months, "to reject about 90,000 pounds of drugs, such as rhubarb, opium, jalap, gamboge, senna, yellow bark, iodine, croton oil, sarsaparilla, etc., while from 1848 to 1857 the same examiner rejected over 900,000 pounds of unsafe, adulterated, and improper drugs and medicines." It was at once demonstrated that the law had been of great benefit, for the quantity of drugs rejected within a short time after the appointment of the examiner was much larger than a brief period later, and continued to diminish for several years. The record of drugs rejected is not now kept, but the same law is in force, although it is complained that it is not as effective as it should be, because the examiners are not always appointed solely with reference to their fitness for the office.

The National Board of Health have no remedy to recommend for the present state of things, but from the printing of their report, and the diffusion of such information as is here presented, much good may ultimately result. The National Government can exercise more care, or make more stringent regulations if that be necessary, to prevent importations of inferior or adulterated drugs, but what seems even a more necessary than this is uniform action by the various State Legislatures to more effectually control the manufacture and the dealings in a class of goods where the detection of inferiority or deleterious adulterations are generally so difficult, and where any fraud is likely to have a direct effect on the health of the community.

THE PHOTOPHONE.

In May, 1878, Mr. Alexander Graham Bell, well known in connection with the telephone, announced before a scientific society in London his belief that it would be possible to hear a shadow by interrupting the action of light upon selenium. At the recent meeting of the American Science *Association* in Boston, Mr. Bell read a paper describing at length his experiments in the production and reproduction of sound by light, and the invention by Mr. Sumner Tainter and himself of an instrument for the purpose.

The influence of light upon the electric conducting power of selenium is well known. Mr. Bell found the electric resistance of same selenium cells of peculiar construction only one-fifteenth as much in the light as in the dark. It occurred to him that all the audible effects obtained in the telephone by variation of the electric current by sound waves, could also be produced by variations of light acting upon selenium; and that with suitable transmitting and receiving apparatus voices might be conveyed without a wire along a line of light.

The fundamental idea on which rests the possibility of producing speech by the action of light is the conception of what Mr. Bell terms an undulatory beam of light in contradistinction to an interrupted beam; meaning by the former a beam that shines continuously, but is subject to rapid changes of intensity.

The apparatus used to give the required undulatory character to light consists of a flexible mirror of silvered mica or thin glass. The speaker's voice is directed against the back of this mirror, as against the diaphragm of a telephone, and the light reflected from it is thereby thrown into corresponding undulations. In his experiments, chiefly with sunlight, Mr. Bell concentrates upon the diaphragm mirror a beam of light, which, after reflection, is again rendered parallel by means of another lens.

The beam proceeding from the transmitter is received at a distant station upon a parabolic reflector, in the center of which is a sensitive selenium cell connected in a local circuit with a battery and telephone. In a recent experiment, Mr. Bell's associate operated the transmitting instrument, which was placed on the top of the Franklin school house, in Washington, about eight hundred feet distant from the receiver, placed in a window of Mr. Bell's laboratory. Through this distance messages were distinctly conveyed by means of light. In his laboratory experiments Mr. Bell finds that articulate speech can be transmitted and reproduced by the light of an oxyhydrogen lamp, and even by the light of a kerosene lamp.

The rapid interruption of the beam of light by a perforated disk gives rise to musical tones, siren fashion. With this apparatus silent motion produces sound, loud musical tones being emitted from the receiver when no sound is made at the transmitter.

The importance of these investigations it is impossible now to estimate. That the photophone can practically take the place of the telephone is not likely, though it is likely to work radical changes in military and other signaling operations. The heliograph, which has proved so useful in recent campaigns in the Afghan country and elsewhere, can now be made to talk orally yet silently over the heads of an enemy or across impassable streams or other low barriers. For rapid communication between distant exploring or surveying stations, the photophone also promises to be serviceable.

Another result of Mr. Bell's researches in this connection is the discovery that many other substances are sensitive to light. He has found this property in gold, silver, platinum, iron, steel, brass, copper, zinc, lead, antimony, German silver, Jenkins' metal, Babbitt's metal, ivory, celluloid, gutta percha, hard rubber, soft vulcanized rubber, paper, parchment, wood, mica, and silvered glass. The only substances found insensible to light are carbon and thin microscopic glass.

AN ASTRONOMICAL DISCOVERY.

Professor E. C. Pickering, director of the Harvard Observatory, lately made a discovery which is regarded as one of the most important of the century in stellar physics. In the ordinary telescope a star appears as a point of light, brighter, but not larger than when looked at with the naked eye. Prof. Pickering finds that, on placing a prism between the object glass and the eyepiece of his telescope, the light of a star is drawn out into a continuous band. When, however, the telescope with the prism is directed to a planetary nebula, the light is collected into a star-like point without any band, enabling the astronomer to distinguish instantly between a star and a planetary nebula. This principle has already enabled Prof. Pickering to discover several planetary nebulæ. On Thursday evening, August 26, an object was observed which presented the appearance of two star-like points within the band in the modified telescope. It is different from anything heretofore observed in the telescope, and is regarded as an important object for investigation.

HOW ARE THE OIL TANKS SET ON FIRE BY THE LIGHTNING?

Again we have to record the destructive effects of lightning in the Bradford, Pa., oil regions. On the 28th of August, at 8:30 P.M., one of the 25,000 barrel oil tanks of the United Pipe Line Company, near State Line and Tarport, was set on fire by electricity and burned; also four smaller tanks on the West Branch near Bradford. At one time there was danger of a gigantic conflagration, as there were some twenty large tanks not far from the burning tank of the Pipe Company. By firing cannon shot into the tank its contents were run out and the adjacent property saved.

From all we can gather there seems to be good ground for the theory that these numerous lightning disasters in the oil regions are not generally due to direct lightning strokes upon the tanks, but rather to the occurrence of slight electrical sparks within, upon, or near the tank, whereby the explosive gas that hovers about the tank is instantly set on fire. We have in our previous remarks suggested various ways in which the fatal spark may possibly be induced, to which suggestions the reader is referred.

We have now to mention one other possible cause of the fires, and that is the electrified rain drops.

Strong electrical effects are sometimes observed during the fall of sleet, hail, and rain, without the accompaniment of thunder or lightning. Professor Tait, in a recent lecture in Glasgow, said: "Falling rain drops are often so strongly charged with electricity as to give a spark just before they touch the ground."

As the development of the slightest spark in connection with an explosive mixture of air and gas will produce intense fire, we here perceive the remarkable possibility that some of the great oil conflagrations may have been caused by rain.

The whole subject is one of much interest to electricians, and as we have before said, we hope they will investigate the matter so as to ascertain surely the cause of these frequent disasters and discover the proper means of safety.

THE HUDSON RIVER TUNNEL.

It will be remembered that on the 21st of July last a portion of the structure pertaining to the temporary entrance on the Jersey side of the river, opposite New York, suddenly caved in, by which sad accident twenty lives were lost. Steps were immediately taken by the directors of the Tunnel Company to recover the bodies of the buried workmen, repair the damages, and proceed with the tunnels under the river, of which some four hundred feet had been finished when the accident occurred. In our paper of August 7th last, we gave a diagram showing the position of the break, which was near the entrance shaft of the tunnel. The plan adopted by the engineers for the restoration was to sink a coffer dam around the damaged portion, which was also the supposed place where the unfortunate workmen were congregated when the walls fell. The earth at this place is what is termed "made ground;" it is composed of refuse filling matter of all descriptions, forming a most unstable and difficult material through which to drive a coffer dam; but it was thought that the bodies of the lost could be more quickly recovered by sinking the dam than by any other means; and, therefore, the directors ordered the attempt to be made. At a cost of nearly fifty thousand dollars, and the employment of several large gangs of men, working day and night, a coffer dam of the usual construction was made ready, and its sinking began about three weeks after the accident. But after losing nearly a month's time it was found impossible to keep the interior of the dam clear of water, which came in at the bottom, owing to the treacherous nature of the ground, faster than powerful pumps could lift it, and the effort to go down further by that means had to be abandoned.

Recourse was now had to the plan of driving down a caisson, which is a species of diving bell. This method is now very commonly used in sinking the foundations of bridge piers into ground below the surface of the water. A caisson as ordinarily constructed consists of a timber foundation or platform of solid timbers several feet thick, interlocked in all directions to insure strength; the under side, at the edges, is provided with strong sharp lips, which rest upon the ground and support the caisson, leaving an air chamber of about five feet in height under the platform, in which the men work. Rising from the center of the caisson is an entrance tube and air lock, through which the workmen pass and the excavated material is discharged. The deck or upper surface of the caisson is loaded by building the pier thereon; the load so built on serves to carry down the caisson as fast as the men in the air chamber below dig away the earth. The rising of water within the air chamber, where the men work, is prevented by introducing compressed air into the chamber. It was in this manner that the piers of the great suspension bridge between New York and Brooklyn were sunk. The pier on the New York side goes down 78 feet below high water mark, and the caisson men were obliged to work for a considerable time in an atmosphere of compressed air having a pressure of 45 pounds to the square inch, although the average working pressure was 36 pounds.

In the present Hudson River Tunnel caisson the air chamber, instead of having an interior clear space or head room of only 5 feet, has a space of about 18 feet. The object of this is to afford room for the building of the permanent tunnel entrance within the caisson after the proper depth shall have been reached. The interior of the caisson air chamber has the form of a tunnel with a cylindrical roof. The caisson is 41½ feet long and 25 feet wide. The roof of the chamber is composed of strong timbers, heavily braced and filled in solidly with cement, which is carried up to a level, forming a deck on which the necessary sinking load will be built. The ends and sides of the caissons are built of planking, held in place by strong timber cross braces and iron tie rods, running from end to end and from side to side, through the air chamber, as shown in our diagram. This is believed to be by far the highest caisson air chamber ever built. It has been alleged in some engineering quarters that this caisson is not strong enough, and its failure is predicted. On the other hand, Mr. D. C. Haskin, the president of the company and designer of the caisson, avers that its strength is ample, and his plan is stated to be fully sustained by excellent engineers.

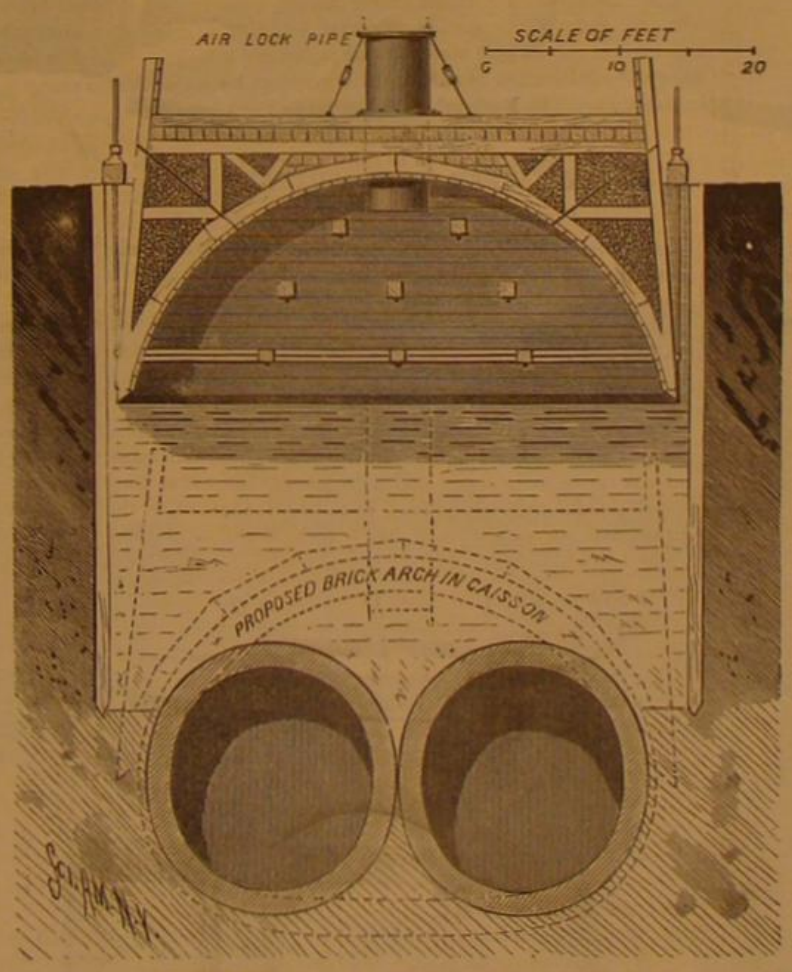
The whole enterprise from its inception has been criticised by certain know-all engineers, who predicted that the tunnel could never be carried under water on Mr. Haskin's plan. But he answered his critics by simply going ahead and building a section of the tunnel in the most difficult place probably of any on the line of the works.

The Hudson River Tunnel is one of the grandest and most important engineering enterprises now before the public, and those engaged in its execution deserve the highest praise for the skill they have displayed. Mr. Haskin and his coadjutors have so far achieved a great success with their plans. The unfortunate accident has hindered them a little; but we hope soon to be able to chronicle the interesting fact that the new entrance is completed and the tunnel building again going forward with rapidity.

Referring to our diagram, the new caisson is shown as it now stands suspended by iron side rods in the upper part of the abandoned coffer dam, the side lining of which extends down to a considerable depth.

The two tunnels below represent the mouths of the portions of the twin tunnels already built, which tunnels will form the main lines of the railway under the Hudson River. When the caisson is fully sunk home it will occupy the position shown by the dotted lines. A single broad arched tunnel will then be built within the caisson to inclose the mouths of the twin tunnels; and the single tunnel will extend thence on a proper grade to the surface of the ground in Jersey City.

The new caisson is now nearly ready. As soon as it is completed the nuts of the side suspension rods will be unscrewed and the caisson lowered until its bottom edges rest on the earth. The workmen will enter through the central tube; a smaller tube, not shown, will be used in addition to the central tube to facilitate removal of the excavated material. At the upper end of the central tube the air lock will be located, and during the descent of the caisson a pressure of air will be maintained within the caisson by air pumps in the usual manner. The descent will be accomplished by digging away the earth under the caisson, and at the same time building a weight of masonry on the flat deck of the structure, around the central tube.



THE NEW CAISSON—HUDSON RIVER TUNNEL.

The Superiority of American Locomotives.

Additional testimony as to the superior design and construction of American locomotives is given by Mr. R. M. Brereton, Chief Engineer of the Great Indian Peninsula Railroad. After noting the fact that under less favorable conditions of climate, road bed, steeper gradients and sharper curves, from 8,000 to 10,000 train miles greater duty per annum is obtained from locomotives in America than in England or in India, Mr. Brereton says: "The greater duty obtained cannot be due to better workmanship and superior materials, because it is well known that the English mechanic in skill of hand cannot be excelled, and the very best materials are employed by our English builders, and the hours of work in both countries are nearly the same. Hence I argue that the greater duty done by the American motor is due to the better designs and the better system of working the locomotives. The American builder excels in the system of framing and counterbalancing, and in the designs of the crank, axles, etc., so that the engine may run remarkably easy and without jar around short curves, and work not only on the light roads, but also diminish the wear and tear on the solid roads, and at the same time increase the effective tractive force. The English engine is a very heavy affair, and, in running, it not only wears and tears itself very rapidly, but also the roadway, and it greatly, by its unsteadiness and jar, fatigues the drivers and firemen."

Coal in Manitoba.

Notice was taken some months ago of the discovery of coal in Manitoba by the Canadian geological surveyors. Recently two barge loads of coal arrived at Winnipeg from the Souris country, the first installment from what is styled the future Pennsylvania of the Dominion. The coal was forty-three days coming down the river, and is said to be of a serviceable quality. The barges were constructed at the coal fields, out of timber made from trees felled on the spot. Much difficulty was experienced on the journey, as timber jams and other obstructions to navigation were met with, but all were overcome, and the feasibility of Souris navigation determined. It is anticipated that there will be sufficient water in the river until August in each year to float barges down. At present there is twenty feet of water in the river. Mr. Hugh Sutherland, proprietor of the mines, has expended some $15,000 on the experiment, and now that he is satisfied of its success, will go on with the work on a much larger scale. He intends to make one trip a year, building sufficient barges to bring down all the coal needed for a year's supply.

Improvements in Modes of Travel.

At the beginning of this century a passenger—more correctly, traveler—starting from New York Monday forenoon could, with good luck, arrive in Boston Friday afternoon, having stopped all night at New Haven, New London, and Providence. The fare for the trip varied from $15 to $18, and there was an additional outlay required of from $5 to $6 for board and lodging; that is, the trip took up four days of time and called for an outlay of from $20 to $24. After the war of 1812 there was an improvement, and the time between this city and Boston was cut down to about two days, and the cost of the journey to $14. In 1817 the fare between New York and Philadelphia was $10, and between New York and Albany by boat $7, and the average time twenty-four hours. A route was that year opened between Philadelphia and Quebec, the distance 700 miles, fare $47, and time required to make the journey 103 hours. In 1826 the Boston newspapers recorded the circumstance as one worthy of special comment that New York papers had been received in that city in twenty-four hours after the date of their publication. In 1828 the time required to make the journey between these two cities had been reduced to twenty-one hours, the route being from this city to Providence by steamboat, and from thence to Boston by stage. But in winter these trips were frequently given up in consequence of stormy weather, and those who wished to avoid danger and be certain in their movements still preferred the overland route. In 1832 there were two regular stage lines between this place and Boston, but competition had reduced the fare. The slow line made the distance in about fifty-two hours, and charged for passage $7.50, while the fast or mail line took its passengers through in about forty-five hours, and charged them $8.50 a trip. Since then railways have brought the journey within the compass of a few hours, and it is by no means improbable that the time may yet be materially reduced.

An old millstone, five and a half feet in diameter and seven inches thick, with a central hole seven inches in diameter, was left in an English orchard many years ago. In 1812 a filbert tree sprouted from the earth at the bottom of the hole, and gradually increased in size from year to year until, in 1868, it was found that the tree had completely filled the hole, and actually lifted the stone from the ground, wearing it as a girdle about its trunk.

The Connecticut State Board of Health has wisely decided that, in the optical tests of railway men, old employes, who cannot pass all the tests prescribed by the experts employed in the examinations, may be tested by flags and lanterns of the size and colors used by the railroads at a distance of 80 rods. Of the 1,085 persons thus far examined, 56 have failed to meet the requirements.

AGRICULTURAL INVENTIONS.

An improved sulky plow has been patented by Mr. Horace E. Reeves, of Fort Dodge, Ia. The object of this invention is to construct sulky plows in such a manner that the plows can be readily adjusted and controlled, will be firmly held while at work, and will yield should they strike an obstruction.

An improved horse hay rake of that form in which a revolving rake having teeth on opposite sides of its center is connected to an axle mounted on a set of running wheels and is provided with stop devices, which either hold the rake rigid while it is gathering the load or may be released to allow the rake to revolve and the load to be dumped, has been patented by Messrs. Isaac Q. Williams and Gustavus H. Osborn, of Goshen, Ark.

New Zealand Cast Steel.

The black beach sand, so abundant in certain New Zealand shores, is likely to prove of great industrial benefit to that rising colony. The government has lately employed a mechanic to test the ore; and although restricted to an expenditure of $500, he has succeeded in turning out five hundredweight of excellent steel. He mixed the iron sand with an equal quantity of clay and shelly sea sand to form bricks, which, after hardening in a kiln, were broken up and smelted in an ordinary cupola furnace. The product was fine cast steel, from which some promising specimens of fine cutlery were manufactured.

IMPROVED LACE CUTTER.

Since the universal adoption of belting as a means of transmitting power, no little attention has been paid to devising means of uniting the two extreme ends of a belt, in a manner both efficient and easy of application. Perhaps the first thing ever used for this purpose was a thong or lacing cut from thin tough leather, and passed alternately through holes punched in either end of the belt, very much after the fashion of lacing a shoe, from which the idea was probably taken.

Judging from the amount of lace leather annually made, it would seem that the method of lacing belts was by no means the least popular. The disadvantages of cutting these lacings with a knife are so great that many consumers prefer to buy "cut lacings," notwithstanding the fact that they are seldom just what is wanted.

This objection is fully obviated by the use of the little tool shown in our engraving, which cuts and points lacings of any length or width as wanted and without loss of time or leather.

ELLIOTT'S LACE CUTTER.

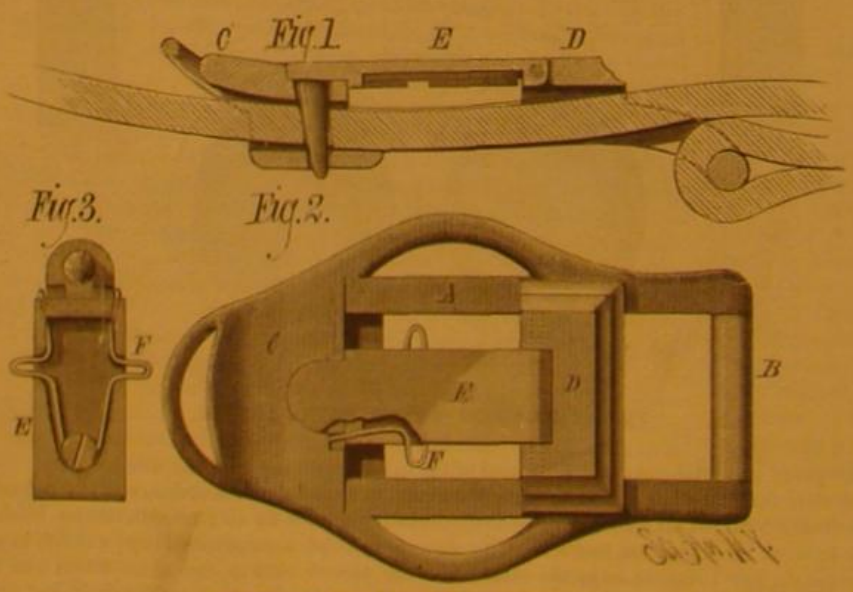
The construction of this lace cutter will be understood from the engraving. It is a practical and well made tool, the result of a long experience in the manufacture of tools of this class by the inventor, who was the first to place a lace cutter upon the market.

Manufactured exclusively by Sterling Elliott, 262 Dover street, Boston, Mass.

IMPROVED HARNESS BUCKLE.

The engraving shows a harness buckle possessing several points of novelty and several advantages over buckles of the ordinary style. In point of appearance it is certainly all that could be desired, and it is very easily operated.

Fig. 1 is a longitudinal section of the buckle; Fig. 2 is a face view, and Fig. 3 is a detail view of the tongue showing the arrangement of the spring. The free end of the tongue is circular, and fits in a recess formed in the plate, C. A finger is formed with the free end of the tongue, and when the tongue is closed, the prong passes through a hole in the head plate, C, and in the plate below it. The spring catch, F, holds the tongue closed, or prevents the prong from being accidentally disconnected from the strap or trace, which is inserted between the bar, C, and the lower bar. The catch is made of spring wire, which is bent so as to have approximately a U-shape, and is confined in a recess in the under side of the tongue, E, as shown in Fig. 3. The ends of the arms of the catch, F, enter lateral notches formed in the plate, C, on each side of the recess, in which the head of the tongue fits. To open or close the tongue, E, the spring arms of the catch are pressed inward or toward each other, forcing the ends of the arms out of notches in the bar, C.



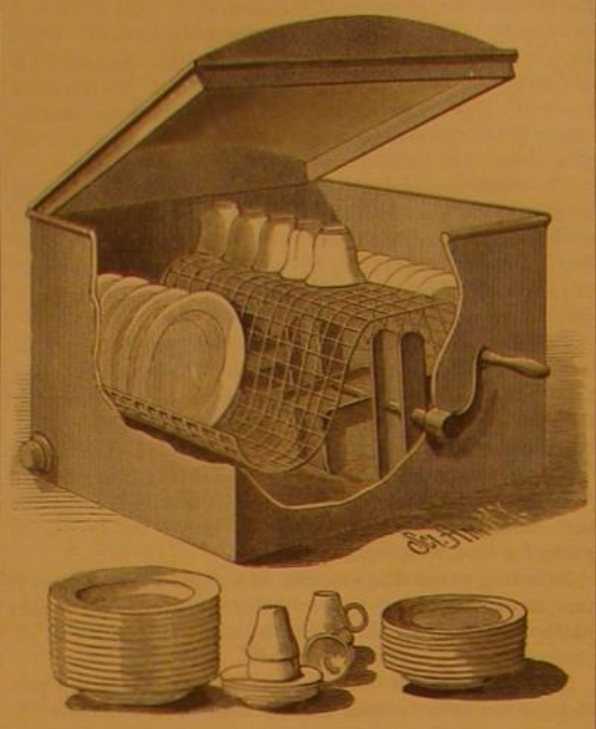
GAVITT'S HARNESS BUCKLE.

This buckle is very readily buckled and unbuckled, a great advantage when a horse gets down, as it can be unbuckled when the straps and traces are drawn tight. Where the buckle is applied all of the straps are kept perfectly straight, and the stitches are not worn or strained. The buckles may be of a uniform pattern throughout the harness, giving the harness a fine appearance. The spring is placed in a cavity in the tongue, and is thoroughly protected from dust, mud, and rain.

This improved buckle was recently patented by Mr. James A. Gavitt, of Dayton, Washington Ter.

NEW DISH WASHER.

Our engraving represents a very simple and effective machine for washing dishes, recently patented by Mr. Benjamin



HOWE'S DISH WASHER.

J. Howe, of Sing Sing, N. Y. The machine is shown in perspective, with a portion broken away to show the internal construction. A shaft carrying paddles revolves in a suitable vessel of tin or galvanized iron, and over the shaft is placed a curved grating which supports the dishes to be washed.

Cups and similar articles are placed on the elevated portion above the shaft, and plates and flat dishes are placed on either side of the shaft.

The paddles are of peculiar shape, being tapered and provided with flanges or lips which strengthen them and cause them to throw more water and with greater force than they would if made perfectly plain. The vessel containing the dishes and the paddle shaft has a tight-fitting cover, and the shaft is provided with a crank by which it is turned. The vessel is partly filled with water, with the addition of a little soap, and the crank is vigorously turned both ways for a moment or so, when the cover of the vessel is removed and a quantity of water is poured over the dishes to rinse them. The dishes are quickly and thoroughly washed, with the expenditure of very little labor, and the breakage and nicking of dishes is entirely avoided. It is claimed that as many dishes can be washed and thoroughly cleansed in five minutes by the use of this machine as can be done by one operator in the usual way in an hour.

It is of great utility to private families, and its use in restaurants and hotels will effect a great saving both in labor and in dishes. This machine can be made of any size, form or material, to hold from 50 to 1,000 dishes if desired.

Photographs by Lightning.

Mr. R. Crowe, of Liverpool, communicates to the *British Journal of Photography* an account of some attempts to photograph a landscape by the aid of lightning flashes. A gelatine plate, requiring by day an exposure of two seconds, was exposed from 10:15 P.M., to 10:45 P.M., during which time there were 120 brilliant flashes and about half as many minor ones. Most of these were in a horizontal direction, and five or six of them were imprinted on the negative. A perpendicular flash which struck a church tower half a mile away was rendered with extraordinary sharpness and brilliancy. The surrounding objects, in spite of the long exposure, were but feebly impressed; whence Mr. Crowe argues that though the light of a flash of lightning is of a very actinic character, there still is not sufficient volume of light to illuminate a landscape or building to allow a successful photograph to be taken. [The probable difficulty is that the photo-plates are not sufficiently sensitive. The duration of a lightning flash was found by Wheatstone to be less than a millionth part of a second. We believe there is no record of the successful photographing of any object with a plate exposure of so short a length of time, even in the strongest sunlight.—EDS.]

Bread Making in Spain.

The bread in the south of Spain is delicious; it is white as snow, close as cake, and yet very light; the flour is most admirable, for the wheat is good and pure, and the bread well kneaded. The way they make this bread is as follows: From large, long panniers filled with wheat they take out a handful at a time, sorting it most carefully and expeditiously, and throwing every defective grain into another basket. This done, the wheat is ground between two circular stones, as it was ground in Egypt two thousand years ago, the requisite rotary motion being given by a blindfolded mule, which paces around and around with untiring patience, a bell being attached to his neck, which, as long as he is in movement, tinkles on; and when it stops he is urged to his duty by the shout of "*arra mula*" from some one within hearing. When ground, the wheat is sifted through three sieves, the last of these being so fine that only the pure flour can pass through it; this is of a pale apricot color. The bread is made in the evening. It is mixed with sufficient water, with a little salt in it, to make into dough; a very small quantity of leaven or yeast in one batch of household bread, as in Spain, would last a week for the six or eight donkey loads of bread they send every day from their oven. The dough made, it is put into sacks and carried on the donkeys' backs to the oven in the center of the village, to bake it immediately after kneading. On arriving there the dough is divided into portions weighing three pounds each. Two long, narrow wooden tables on trestles are then placed down in the room, and a curious sight may be seen. About twenty men, bakers, come in and range themselves on one side of the table. A lump of dough is handed to the nearest, which he begins kneading and knocking about with all his might for about three or four minutes; and then passes it on to his neighbor, who does the same, and so on successively until all have kneaded it, when it becomes as soft as new putty and ready for the oven. Of course, as soon as the first baker has handed the first lump to his neighbor, another lump is given to him, and so on until the whole quantity of dough is kneaded by them all. The bakers' wives and daughters shape the loaves for the oven, and some of them are very small. They are baked immediately.

Electricity on the Stage.

In Paris, during the play of "*Le Pied de Mouton*," a table is brought on to the stage, and afterwards a candlestick carrying two lighted candles. One of the characters in the play blows out the candles; but as soon as he moves away one of them unaccountably becomes relighted. The actor again blows out this light, when the other one becomes kindled; and, becoming enraged, the man takes up the candlestick and blows furiously without being able to extinguish the lights permanently. This effect, which gives rise to some amusement and astonishment, is produced by means of an induction spark which inflames the vapor from a mixture of ether and spirits of turpentine contained within the vessels which represent the wax tapers.

A cable of four fine conductors connected the latter, and the points between which the spark passed, with the table, and through it with the induction coil below the stage.

A NEW ROCK DRILL.

The skill of a great many able mechanics and engineers, and a great deal of capital, have been employed in simplifying and perfecting machinery for drilling purposes, the principal object being to avoid breakages, which are far too common in the ordinary machines. It has been found by actual observation that where any great amount of work is being done it requires six drills to accomplish what should be done by four on account of the loss of time occupied in repairing broken parts.

In former machines the parts most liable to breakage were the valves, and as no modification of their construction has been sufficient to give them a durability which compares with that of other parts of the engine, the difficulty in many cases seems wholly irremediable, and the only recourse is to have a sufficient supply of duplicate parts on hand to be ready for emergencies.

Notwithstanding the many failures, mechanics and engineers, appreciating the immense benefits to be derived in case of success, have pluckily continued with their experiments. As valves could not be made sufficiently durable, the line of experiment naturally tended in the direction of valveless engines. These were known to be perfectly practicable in some respects, while in others, more particularly in the displacement of the compressed air or steam at the ends of the cylinder at the termination of the stroke, and giving a cushion for the piston to prevent severe concussion with the cylinder heads, the problem has remained unsolved until now.

Mr. S. G. Bryer, of Saugus, Mass., who has had an experience connected with rock drills of over ten years, after much experiment has devised the only thoroughly practicable valveless engine for a rock drill yet made. The piston of this drill is its own valve, thereby dispensing with the small valves and their consequent wear and breakage, together with many other small and weak parts common to other drills. As will be seen by reference to the engraving, it has fewer parts than any other rock drill in the market. Practically, there is nothing but the cylinder, the piston, and the rotating motion, which is perfectly simple and scarcely exposed to wear or breakage. The blow delivered is as positive and effectual as that from any other style of drill—a result which has never before been obtained with a valveless engine.

The advantages of this drill consists in such an arrangement of parts as to entirely obviate the use of tappets, valves, or other auxiliaries depending for their action upon percussion; while it is a perfectly effective and smoothly-working machine, free from liability to accident. It is sought to reduce it to the smallest number of unexposed parts, and so to simplify them that they can be easily repaired or duplicated and be interchangeable.

In the upper portion of the sectional cut, midway between the center and either end of the cylinder, are two annular grooves; these are connected on the back by a passage way, forming a steam chest, to which the supply pipe is attached. The exhaust port is located in the center of the cylinder. In the piston head are two grooves, which also pass entirely around, corresponding in width to those in the cylinder, distant from each other half the space of the latter from the exhaust port. In the right-hand portion of the piston, extending from the grooves in the same to either end, is shown a passage way for steam. In the lower part of the cut is what is termed the cushion valve, its lower end resting upon the lower head of the valve chamber. The valve is cylindrical, and reduced in size, between the ends and middle, to admit of free passage of steam to the exhaust ports of its chamber.

From this description, the operation of the drill can be easily understood. The steam forms a cushion at the end of each stroke, which prevents the piston from knocking. To the upper head of the cylinder is secured the usual device for rotating the piston and drill, consisting of a rod with spiral flutes, entering a socket in the piston head.

The improvements embodied in this drill secure a large percentage of useful effect, with the least supply of steam, the utmost expansive power of the same being utilized by its peculiar construction; and since no part strikes another to give it motion, the wear is insignificant. The inventor has displayed great skill in locating the control of the piston's action within itself, thus rendering the free and perfect operation of the drill wholly independent of auxiliary appliances. The drill may be operated equally well by the use of compressed air, and is absolutely non-freezing. In our opinion the claim of the manufacturer that this drill presents the greatest simplicity and efficiency is well founded; and we think that wherever it may be introduced, it will give satisfaction. Mr. J. Allston Newhall, 67 High street, Boston, Mass., is the proprietor and manufacturer.

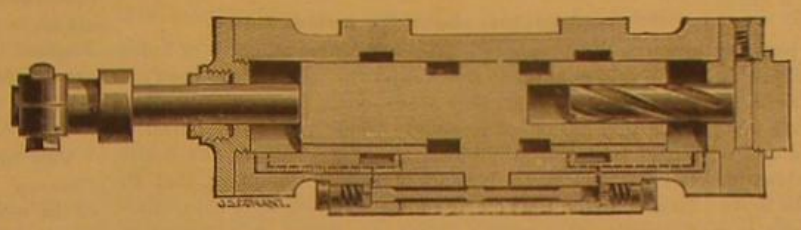


Fig. 2.—LONGITUDINAL SECTION OF ROCK DRILL.

Fig. 1.—THE BRYER ROCK DRILL.

NEW INVENTIONS.

An improvement in whiffletrees has been patented by Mr. Ferdinand O. Fischer, of Aptos, Cal. The invention consists in combining a lever spring, shouldered bar, and slide bar having end disk, with the end of a whiffletree.

Mr. John Flanagan, of Newburg, N. Y., has patented a hydrant formed of a case with waste opening, shouldered valve rod, fluted screw plug valve, and a ring. The arrangement of the several parts cannot be described without an engraving.

Messrs. Carl P. Cullmann, of Idar, and Carl A. Lorenz, of Oberstein, Germany, have patented a process of manufacturing onyx stones from agate, by immersing one side in a bath of dilute nitric acid and iron, the other side in a bath of carbonate of potassa and water, then drying the stones on a stove, and burning them to fix the color.

Mr. Carl J. Renz, of Hudson, N. Y., has patented an improved process of preserving fruits, and more particularly grapes, pears, strawberries, and other fresh whole fruits without the use of a mother liquor. It is an improvement in that general process of preserving in which the air is first exhausted from the receptacle in which the fruit is placed, and in which the gases subsequently evolved by the fruit are taken up by an absorbent. The improvement consists in deodorizing and absorbing the condensable gases by a block of quassia wood or other material impregnated with quassia.

A simple and efficient apparatus for obtaining a vacuum has been patented by Mr. Lyman H. Ward, of St. Mary's, Texas. The vacuum is formed in this apparatus by the displacement of water or other liquid.

Origin of Fires.

Theories of fire "origins" run in fashions, and at times, the *American Exchange and Review* thinks, the favorite presumptions become much overdone. Defective flue is the actual source of a great many ignitions, and it is not apt to be exaggerated, like newspaper "incendiarism," but occasionally we may go too much on "defective flue." A clothes press adjoining a flue in a Pittsburg dwelling lately took fire; defective flue was, of course, named as the flame maker, but, on further examination, it was found that the closet was a receptacle for soiled clothes and rags, and some of the latter were saturated with an oleaginous lotion for "rheumatiz." The combined oil and cotton, in a confined atmosphere, at a temperature produced by the heat radiations from the flue, were together inflammable. The "mishap" will perhaps go by the name of spontaneous combustion, yet this is solely due to the fact that the substance required a comparatively low temperature in order to ignite; flue was the inciting cause, so far as relates to the merely physical condition of the fire-making. Fires are generally of mixed origins.

American Manufactures by a Colonial Editor.

The last issue of the Victoria *Review*, the leading magazine published in Australia, pays the following tribute to American manufactures and to our series of illustrated articles on American industries. American manufactures, says the editor, are a perpetual source of wonder and of instruction to the foreign observer. In perfection of machinery, scientific division of labor, and completeness of execution, there is nothing in the world besides to be compared with them. To visit the great continent and inspect the leading manufactories must be equal to a good education for any man possessing a mechanical turn of mind. But, failing time and means to go forth on such an expedition, a foreign reader can make himself as well acquainted with the subject as if he were on the spot, simply by taking in the SCIENTIFIC AMERICAN and regularly perusing it. In the current numbers there are full descriptions, illustrated by excellent woodcuts, of the manufacture of printer's types by Messrs. Farmer, Little & Co., of New York; the manufacture of Mége oleomargarine and oleomargarine butter by a New York company; the brass manufacture of the Benedict and Burnham Company at Waterbury, Conn.; and of the great tunnel under the Hudson River, between New York and New Jersey, which is of a similar character to the London underground railway, and is in the hands of a company holding a capital of $10,000,000. The tunnel will be 5,000 feet long, or more than three times the length of the Thames tunnel. There seems to be but little doubt of its being carried through to completion.

The oleomargarine butter is a product extracted from beef fat, according to a principle discovered by M. Mége, a French chemist, about twelve years ago. The butter produced is pure, perfectly wholesome, and suitable for all domestic purposes. The company work up an average of 100,000 lb. of fresh caul fat daily, producing from 40,000 to 50,000 lb. of butter, selling at from 15 to 20 cents a pound. This invention of the French chemist has added many millions of dollars annually to the value of the staple products of the country. In addition to the foregoing articles, there is, in the numbers before us, a vast variety of illustrated descriptions of new inventions and improvements in many branches of mechanical construction. It was shrewdly observed by the English Consul at New Orleans, in a report he lately sent to the British Government, that the superiority of American over British manufactures is due, among other things, to the fact that the Americans never raise the objection to any novel "notion" or suggestion that it is "new-fangled." In fact, they rather prefer it on that account. The newer, the more likely to be an improvement on the old method, is the principle they go by. English manufacturers, on the other hand, proceed on the most rigid lines of custom and precedent, and are very jealous of anything in the shape of an innovation on the established methods. The result of this difference between the two nations is that the Americans are beating the British completely out of the field in many branches of manufacturing industry. Edison's "new-fangled" inventions are not alone revolutionizing the world of practical ideas, but are making their inventor rich beyond the dreams of avarice. It is to the Americans, rather than to their home friends, that Australian manufacturers should turn their eyes for precedents and examples. The SCIENTIFIC AMERICAN ought to secure a wide circulation in this part of the world. To manufacturers of every description it is simply invaluable.

MECHANICAL INVENTIONS.

Mr. Perry A. Peer, of Comstock, Mich., has patented a hinge peculiarly adapted to a V-shaped harrow. When it is desired to uncouple the two sections of the harrow, one of the sections is allowed to

lie flat on the ground, and the other is raised to about a vertical position, and it may then be readily detached.

Mr. John O. Grisham, of State Line, Miss., has patented a corn cutting and grinding mill, which is an improvement upon the form of corn crusher in which the ears of corn in the husk are fed through throats, sliced into sections by revolving knives, and these sections then rendered fine by passage between grinding surfaces. The invention consists in combining with the feeding throats and knives, a set of spring seated tables, which hold the ends of the ears of corn while being cut, and which allow the sections being cut off to press down to accommodate the thickness of the knife, thus preventing the knife from hanging in the ear, and rendering the cutting action easier.

Mr. Isaac S. Schuyler, of Brooklyn, N. Y., has patented a machine for cutting screw threads. The improvements relate to machines for cutting screw threads on pipes and couplings, internally and externally, and are designed to accomplish such work more rapidly and perfectly than has heretofore been done. Rotary cutters formed with serrated edges are employed. The arbors of the cutters are fitted in a revolving head that has an endwise motion proportioned to the pitch of the screw, so that while the cutters rapidly revolve with their arbors they also travel in a spiral path upon the surface being operated upon.

Mr. Charles G. Trafton, of Slatersville, R. I., has patented a thread guide for spooling machines that is self-adjusting to the yarn as the latter runs from the bobbin to the larger spool, so as to avoid friction. It consists in a guide plate provided at one end with a curved friction surface and at the other with a slotted flange and a plate, in combination with a rod having projections at its top to limit the move ments of the plate sidewise and a screw which serves as a pivot for the plate.

An improved gin saw sharpener has peen patented by Mr. Robert S. Mudford, of Texarkana, Ark. The object of this invention is to improve the construction of the gin saw sharpeners for which Letters Patent No. 20,933 were granted to A. H. Burdin, July 20, 1858, in such a manner that they will bring the teeth to a better condition.

Mr. James H. H. Taylor, of Lawrence, Mass., has patented a mechanism for stopping and starting street cars, so constructed that the momentum of the car can be used for stopping the car, stored up, and again used for starting the car.

Mr. William W. Rochelle, of Star Landing, Miss., has patented a tool for sharpening the teeth of cotton gin saws. It is made in three pieces—the sharpening bit proper, which is shaped at its outer end to enter between the teeth, the head or shank, which is formed to receive and support the bit, and a sliding collar, which clamps the bit in the head by a wedging action.

DECISIONS RELATING TO PATENTS.

By the Commissioner of Patents.

STEVENS *vs.* PUTNAM.—INTERFERENCE.—WIRE BARBING MACHINE.

Marble, Commissioner:

1. The earliest date at which an invention can be said to exist is that time when there was in the mind of the inventor a well defined idea of something which might rightfully constitute the subject of a patent.

2. The law is well settled that a mere unembodied principle or discovery is not a subject of a patent, and it must follow that the mere mental apprehension of the same is not the conception of an invention. When, however, the principle or discovery is rendered of practical service by its embodiment in material form, there exists something for which a patent can be allowed, and the union in the mind of the inventor of the principle or discovery with the means of its embodiment is conception of the invention.

3. A combination, as distinguished from a mere aggregation, may be defined as a union of elemental parts co-operating dependently to produce a desired result, and a conception of such combination must include not only the idea of associating the parts, but also that of so uniting them that there will be a dependent co-operation.

4. The fact of the conception of an invention is one which public policy demands shall have been so evidenced as to be capable of other proof than the mere allegation of the inventor that such invention was at a certain time in his mind before it can avail him anything, and so long, therefore, as he keeps his invention unembodied and undisclosed it cannot serve to antedate and thus defeat the invention of a contestant.

United States Circuit Court.—Southern District of New York.

BRICKILL *et al. vs.* THE CITY OF NEW YORK.—FEED-WATER HEATERS FOR STEAM FIRE ENGINES.

Wheeler, J.:

1. Letters patent No. 81,132, granted August 18, 1868, to William A. Brickill, for an improvement in feed-water heaters for steam fire engines construed and sustained.

2. Section 7 of the act of 1839, which provides that every person or corporation may use and vend to others to be used any specific machine, manufacture, or composition of matter which they have purchased or constructed prior to the application for a patent, applies in cases of patents for substantive things to the particular things so purchased or constructed only, and does not include the right to practice the invention without liability.

3. The patent involved in the case of *McClurg vs. Kingsland* was for a method of casting iron rollers, and it is not probable that the decision rendered in that case would be followed beyond cases of the same statutory class.

4. By the act of 1870 the right of a person constructing or purchasing a patentable article before the application for a patent is limited to the right to use or vend the specific thing, and this, whether it be regarded as a legislative construction of the former acts or not, may properly govern the right of recovery in actions brought since its passage.

5. For an infringement of a patent by its fire department a city is liable.

U. S. Circuit Court—Northern District of Illinois.

WASHBURN & MOEN MANUFACTURING COMPANY *vs.* HAISH.—BARBED FENCE WIRE.

Blodgett, J.:

1. A person has no right to mark his goods with any words or terms indicating that they are manufactured under a patent which he does not own and has no right to use.

2. A defendant, having so marked his goods, will not be allowed to defend himself by denying the validity of such patent.

Complaints about the Patent Laws.

There is a growing disposition in some branches of industry in this country to find fault with our patent laws and the manner in which they are enforced. There is hardly a trade that has not at frequent periods its crop of harassing patent suits, which perplex the manufacturer, the dealer, and the consumer. It is not surprising, therefore, that the dissatisfaction thus created finds expression in complaints. Naturally, the subject comes up before the associations formed among those belonging to the various trades for their mutual protection and the advancement of common interests. A committee is appointed, and, if its members are in earnest, a report is drawn up suggesting possible measures of reform. Such has been the course pursued by the millers, and we learn that the brewers have taken the first steps in that direction. All this is very well in its way, but it does not seem as though the agitation of the subject is conducted in the manner best calculated to secure the reforms desired. The reports of such committees are so evidently biased by the interests of the members, as defendants in patent suits, as to have, as the rule, little or no value. The one great and sole object of their efforts seems to be to beat the particular patent or patents which menace them, and the fact is lost sight of that it is to the interest of every enterprising manufacturer to aid in sustaining patents. In many cases where complaint against the patent system is loudest, known rights have been infringed, and the protests of patentees disregarded, in the belief that it was cheaper to take the chances of infringing than to recognize the demands of those whose claims were disregarded. Patents thus ignored almost always acquire an unexpected value before they expire, and it is quite usual for them to be made the basis of expensive suits. Often they are sustained by the courts and become very valuable, for the simple reason that they have been infringed without regard to consequences. Manufacturers who find themselves figuring as defendants in suits of this character commonly have a great deal to say about the injustice of our patent laws. Perhaps they are unjust in their requirements in some instances, but to modify them in any essential particular in points touching the value of valid patents would be to destroy an immense property right, and to make it extremely difficult for an inventor or the owner of a patent acquired by purchase to protect himself in the enjoyment of the rights it is designed to secure to him. It may be vexatious to settle or defend frequent demands for royalties and damages; but it is still more so to know that you have valuable rights in patents which you are unable to enforce, and that which should belong to you alone has become common property.

The only safe and honorable position for the manufacturer is one of justice and fair dealing. He should act advisedly with regard to the payment of royalties and the infringement of patents. If he manifests a fair and liberal disposition in this matter, and a willingness to recognize the rights of others as beginning where his own rights cease, he is not likely to have serious trouble. As the rule, it is cheaper to purchase a right under a patent than to defend an infringement; but when a manufacturer persistently disregards notices and warnings, and takes his chances as an infringer, he should stand by the consequences like a man, and not whine nor complain if called upon to pay for what he has taken without leave. He may, at least, have the satisfaction of knowing, under such circumstances, that every decision of the courts affirming the validity of patents increases the value of those he owns and controls, and that he has thus a direct interest in sustaining all good patents. But then we must make some allowance for human nature, and it certainly does make a great difference in a man's feelings whether he appears as plaintiff or defendant in a patent suit. He often does and says a great many things when he is defending an infringement suit which he would be very sorry to have quoted against him should he ever find it necessary to move for the protection of his own rights and interests. Our patent laws may be susceptible of improvement, but the men to improve them are not found on committees representing cliques of defendants interested in suits brought to recover damages for the wholesale infringement of valid patents. What they have to say may always be taken with some allowance.—*Iron Age.*

Apples for Foreign Markets.

Speaking of the magnificent apples shipped from the United States, the London *Magazine of Pharmacy* says that there is no reason why this splendid fruit should not be received in London as fresh and blooming as when first gathered from the tree. To secure this most desirable result each apple should be wrapped in soft tissue paper, previously soaked in a solution of salicylic acid and dried.

The best preparation of salicylic acid for this purpose is the alcoholic solution, made with the strongest spirit, and then diluted with as much water as it will bear without precipitating the acid, so as to make the solution go as far as possible. Each apple should be enveloped in at least three or four folds of salicylated paper, and every possible precaution should be taken to prevent bruising when loading into the casks or cases. Well-packed apples should not move at all during the voyage, and the shaking of a railroad train should have little effect upon them. Nevertheless, a certain amount of contusion is inevitable, and to avoid the ulterior results of this, the salicylated paper is indispensable. As to the cost, it would be a mere trifle when we consider the result gained, and the splendid condition of the fruit when it would enter the London market. Besides, it is very probable that the salicylic acid paper used for packing the apples in America might be used over again, or applied in England to some similar antiseptic purpose, and an allowance made for it accordingly.

Prehistoric Mexico.

Very interesting discoveries have been made by M. Desire Charnay in ancient cemeteries high up on the slopes of the volcanoes Popocatapetl and Itztaccihuatl. The burial place on the latter mountain is high above the line of vegetation. Just below it is a small valley almost concealed on three sides by a natural bulwark of stupendous rocks.

Access to this singular dell seemed at first impossible; in fact, was so difficult as to lead M. Charnay to doubt the tradition of a Chichimecan village having existed in such a place. Excavations have led to the supposition that this narrow valley had been a temporary refuge of the Toltecs, perhaps as early as the year 600. It bore evidence too of having been inhabited by the Chichimeca Indians. Idols and household utensils similar to those found in ruined Chichimecan villages were dug up from a depth of from three to four feet. Singularly, too, there were found near the surface Aztec relics, which proved that at a comparatively recent date this natural stronghold had served as a place of concealment for a third tribe. Tradition says that after the Spanish conquest in 1520 a few spirited Aztecs and Tlatelolcos, rather than submit to slavery or accept the doctrines of the invaders, fled with their "lares and penates" to this mountain fastness and subsisted on corn, frijoles, and other vegetables, burying their dead as near the "snow line" as possible. Many Aztec idols, vases, and jars were unearthed there.

Pacific Coast Fishes.

The United States Fish Commission have obtained on the Pacific coast 270 species of fish. Among these are nineteen species of sharks. Two large toothed man-eater sharks, caught in Monterey Bay, measured from 23 to 24 feet in length, and weighed fully two tons each. Another variety of shark found on the coast averages 32 to 33 feet in length, and weighs three tons. Their teeth are small, and they are not dangerous. Monterey is a middle ground where the fishes from north and south meet, and no locality on the Atlantic coast is so rich in species. It has about 130 species; San Francisco about the same; Santa Barbara, 95; San Diego, 80; and Puget Sound, 90. The so-called perch, found on the California coast, are not true perch. A million and a half of salmon, averaging from 25 to 30 pounds each, are taken from the Columbia River, and from seven to eight millions of pounds of fish are taken from San Francisco Bay and marketed.

Monument to the Original Promoters of the Union Pacific Railway.

Norcross Bros., of Chicago, have contracted with the Union Pacific Railway Company for a monument to the memory of Oliver and Oakes Ames. The monument is to be located at Shannon, Wyoming Territory, at a point about 400 miles west of Omaha. It is at the highest point in the Rocky Mountains which is crossed by the railroad. The monument is to be 50 feet square at the base, and 60 feet high, pyramidical in outline, with three slopes. The material will be Black Hills granite. There are to be two medallions representing the heads of Oliver and Oakes Ames in alto-rilievo. One will face the east and the other the west, at a height of 40 feet from the ground. On the side next to the railroad will be an inscription, "In Memory of Oliver and Oakes Ames." The medallions are to be cut out of McGregory quarry brown stone. There is also to be a bronze tablet, which will more particularly show why the monument was erected. The contractors are to complete the work in about two years. The cost is to be about $80,000.

AN accidental dropping of a cipher in our recent description of the heavy Worthington oil pumping engines leads to an obvious understatement of their efficiency. The work actually done by some of these pumps is the pumping of 15,000 barrels of oil through 100 miles of pipe, against the enormous pressure of 1,500 pounds per square inch.

RECENT INVENTIONS.

Mr. George Steinson, of East Chester, N. Y., has patented an improved leg for bedstead frames, which furnishes to the bed an elastic support. The leg is formed of flat curved springs, and a spiral spring placed in a box, the whole being supported on casters.

Mr. Fredrick A. Baker, of Brooklyn, N. Y., has patented a fire escape ladder for the use of firemen. It can be readily secured to the windows of buildings from story to story to form a fire escape.

An improved legging, which fits closely to the foot and ankle, and can be opened or closed easily, has been patented by Mr. Casper Riese, of Berlin, Prussia, Germany.

Improvements in electric burglar alarm for safes have been patented by Mr. Edwin J. Leland, of Worcester, Mass. These improvements relate to burglar alarm telegraphs connected with safes, vaults, and similar places, and arranged to give a signal at a central office in case the circuit is broken or the wires tampered with. Such lines usually have combined with them a galvanometer, so that any change of resistance caused by an attempt to put a loop in the line, and thereby cut out a safe or vault without breaking circuit, or from any cause, shall be indicated by the galvanometer. The object of this invention is to provide means for testing the line at any time and determining whether the safe or vault is is circuit, so that it will not be necessary to make a personal inspection of the vault or safe every time the indicator shows a change of resistance or the signal is operated, as such effects are often produced by crossed wires and electrical disturbances in the atmosphere.

An improved bottle stopper has been patented by Mr. Thomas G. Austen, of Oswego, N. Y. This invention relates to that class of devices that are designed so close the mouth of a bottle and yet to permit the gradual ejection or sprinkling of its contents.

Mr. Joseph T. Maybury, of Mobile, Ala., has patented a process of canning oysters, which consists in placing them in cans and pouring over them a hot mixture composed of water, salicylic acid, and vinegar, in the proportions of about ten gallons, one and six-tenths gill, and one-half gallon, respectively, and then closing the cans and placing them in boiling water for a short time.

A novel skylight bar, in which provision is made for collecting the condensed moisture which accumulates on the interior surface of the glass and conducting it to the roof, has been patented by Mr. Fred Ruemping, of Kansas City, Mo.

An improved well casing, which is simple and effective, has been patented by Messrs. Henry Shear and Henry M. Toomey, of Arcola, Ill. The invention consists in a well and cistern casing formed of a number of segmental sections of earthenware or burned clay, provided with tongues and grooves at the ends and with strengthening ribs on the inner sides.

Messrs. William P. Lyon and Samuel Vail, of Port Chester, N. Y., have patented a fastening for the end boards of wagons and carts, so constructed that it will fasten automatically when the end board is raised into place, and which, when locked, will hold the end board securely.

Mr. John H. Reed, of Cowles, Neb., has patented a new penmanship-instructing chart, which will permit persons who are not good penmen themselves to instruct others in the art of penmanship and to explain the proper formation and inclination of letters.

An improved trunk fastener, patented by Mr. George A. Sofield, of Jersey City, N. J., consists in the combination with a bolt tongue having a transverse groove of a socket provided with a longitudinal groove to receive the bolt, and with a transverse groove containing a spring latch fitting into it and catching into the transverse groove of the bolt tongue.

Mr. Patrick H. Duke, of Richmond, Va., has patented a package of plug tobacco having the faces of its plugs formed into perfect squares, one set of which is raised and the alternate set depressed, with the raised and sunken faces of one layer or set of plugs fitting into and over the sunken and raised faces of the crossed piled plugs forming the next layer.

An improved apparatus for distributing fertilizer, which may be made either an attachment of an ordinary seeder or planter, or used independently thereof, has been patented by Mr. Luther A. Horine, of Jefferson, Md.

Mr. Carey Inskeep, of Ottumwa, Ia., has patented an improved hairpin, which is so constructed that it cannot become detached accidentally, but may be inserted and removed without disturbing the contiguous hair further than requisite to allow space for the body of the pin.

Mr. Edward A. Smith, of Greeley, Col., has patented an improved earth auger, which consists in a novel arrangement of the casing, the cutter, and the drill point in a well auger.

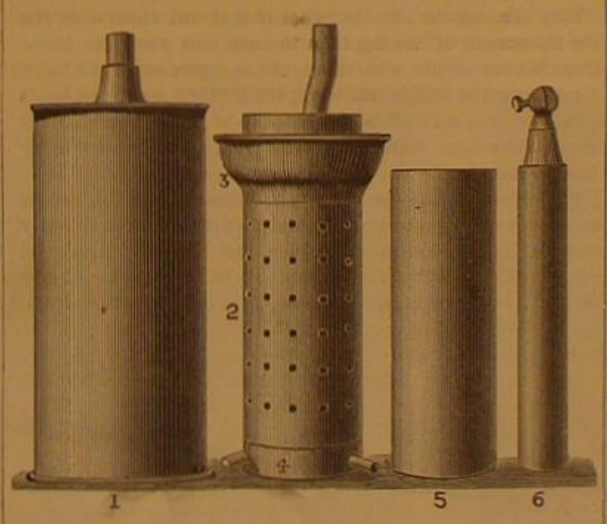
Mr. Benjamin Le Coultre, of Geneva, Switzerland, has patented a chronograph having both second and minute hands indicating by one dial and mounted on the same arbor. The inventor fits upon the central arbor of the watch a loose sleeve that carries the minute hand and a driving wheel, and outside of this fits a second loose sleeve carrying the second hand and a driving wheel. Upon a lever fitted for movement by a ratchet wheel in the usual manner are fitted the wheels that operate the second hand from the center pinion when moved into gear, and upon a pivoted arm that is connected with the lever is a pinion that connects a fixed pinion on the center arbor with the driving wheel of the minute hand. The driving wheels of both the second and minute hands are fitted with heart cams that are acted upon by a T arm to bring both hands back to the starting point. By this construction a simultaneous action is obtained on both hands—first, to set them in motion; second, to arrest them; and, third, to return them to the starting point.

Welding by Pressure.

Pursuing his researches on the welding of solid bodies by pressure, M. Spring has subjected to various strong pressures (up to 10,000 atmospheres—150,000 lb. per square inch) more than eighty solid pulverized bodies; this was done in vacuo, and in some cases at various temperatures. The results are highly interesting. All the crystalline bodies proved capable of welding, and in the case of bodies accidentally amorphous the compressed block showed crystalline fracture; crystallization had been brought about by pressure. Softness favors the approximation of the particles and their orientation in the direction of the crystalline axes. The amorphous bodies, properly so called, fall into two groups, one of substances like wax (*circoid* bodies), which weld easily, the other of substances like amorphous carbon (*acircoid* bodies), which do not weld. The general result is that the crystalline state favors the union of solid bodies, but the amorphous state does not always hinder it. M. Spring says the facts described do not essentially differ from those observed when two drops of a liquid meet and unite. Hardness is a relative, and one may even say subjective term. Water may appear with a certain hardness to some insects, and if our bodies had a certain weight we should find the pavement too soft to bear us. Again, prismatic sulphur is changed by compression to octahedric sulphur; amorphous phosphorus seems to be changed to metallac; other amorphous bodies change their state, and mixtures of bodies react chemically if the specific volume of the product of the reaction is smaller than the sum of specific volumes of the reacting bodies. In all cases the body is changed into a denser variety, whence may be inferred that the state taken by matter is in relation to the volume it is obliged to occupy under action of external forces. This (M. Spring points out) is merely the generalization of a well known fact. Some curious results are deduced from it. The researches described have important bearings on mineralogy and geology.

A MODIFIED DANIELL CELL.

Mr. S. J. Browning, of Portsmouth, England, has devised a modified form of Daniell cell, which he thus describes in the *Electrician:*



"While using the same materials, and the same strength of solutions as those of the ordinary Daniell, it gives twice the amount of current.

"It can be clearly perceived that my main object has been the reduction of the internal resistance, which I believe I have accomplished to the utmost without reducing its constancy."

The accompanying diagrams illustrate this cell: 1. Outer copper cylinder. 2. Inner copper cylinder, which encircles the porous cell within one-eighth of an inch of same. 3. The copper shelf surrounding No. 3, for holding sulphate of copper. 4. A wooden cylinder with step turned inside, to keep porous cell in center of No. 2, and with three wooden plugs, to keep No. 2 in center of No. 1. 5. Ordinary eight inch porous cell. 6. Cylinder of zinc.

Mr. Browning uses small blocks of vulcanized India rubber to keep the zinc in the center of the porous jar, and again to keep the porous jar in the center of the cylinder. He also uses a disk of felt for the zinc to rest upon.

High Lighting by Electricity.

There was very little to encourage the project to illuminate Holyoke, Mass., by means of lofty electric light towers, in the result of the similar experiment tried in Rouen, France, during the *fêtes* of July 13 and 14. On that occasion eight electric lights were placed on the spire of the cathedral with a view of illuminating the town. Though the quantity of light was estimated at 5,000 Carcel burners, the effect was practically *nil*. The spire seemed merely to have a huge lamp on it, which threw its light beyond the town rather than in the neighborhood of the cathedral.

A New Process of Refining Petroleum.

The Philadelphia *Record* says that a new process for treating the products of petroleum is being tested in that city. At present all oils are brought to heat tests by distillation, and in the process lose from 30 to 65 per cent. By the old process oil at a fire test of 110° costs 6½ cents per gallon. In bringing this grade of oil to a test of 150° it loses 30 per cent in the process of distillation; to raise it to 175° it loses 45 per cent, and to 185° 65 per cent. By the new patent process the oil is treated without heat and loses nothing.

Oil at 110° that cost 6½ cents per gallon, on being raised to a fire test of 150 is worth 13½ cents per gallon; to 175, from 15 cents to 17 cents per gallon, and if raised to 185° is worth from 18 to 20 cents per gallon. The cost of raising it to any of these tests is 1 cent per gallon. Here, also, is another advantage over the old system, as by the present method of distillation the profit on oil at a fire test of 110 is only half a cent per gallon, and at a test of 150 the profit is the same; whereas by the new process, the oil losing nothing in the manipulation, the profit is in a ratio to the number of degrees to which the fire test is raised. In the process the oil is deodorized, and at the same time the illuminating quality is improved so that the oil burns longer and brighter, and this is effected without the aid of any heat whatever. This is what the inventors claim for the new process, but until a rigid and satisfactory test has been made they will disclose neither their plans nor their names.

Eruption of Fuego.

A letter from San José de Guatemala, dated the 2d of July, to the *Panama Star and Herald*, says: "At 3 A.M. on the 29th of June, the volcano Fuego suddenly became active, throwing out vast showers of fire and cinders, with great darts of flame shooting up from 350 feet to 500 feet above the mouth of the crater. The whole country to the east and south was magnificently illuminated. At 3:40 A.M. two streams of lava could be seen running down the sides of the volcano, one to the south and east, the other to the westward. Dense masses of steam and smoke rose from the courses of the lava streams, as the shrubbery and foliage were burnt. The river Guacalate rose suddenly, and its waters were quite warm. Fuego continued to belch fire until daylight, by which time the whole northern horizon looking from San Jose, was dark with the smoke from the volcano. The lava streams continued in view until 4:30 A.M. The first grand column of fire rose at least 500 feet in height, solid and smooth, and then the top, expanding, opened out like an umbrella, the sparks coruscating like those from a brilliant rocket. The pulsations of flame during the first two hours of the eruption were about 30 seconds apart, strong and regular. The eruption was less active until, at 7:30 P.M. on the 1st of July, a column of flame rose to a height, probably, of 150 feet or more. At the hour of writing Fuego smokes away steadily."

A Queer Locomotive.

The *National Car Builder* condenses from the Paterson (N. J.) *Guardian*, a description of a new locomotive now in process of construction at the Grant Locomotive Works, which, it is thought, will eclipse for speed anything yet built. It will look like an ordinary engine turned upside down. The machinery will be on top of the boiler instead of under it, as usual, and the boiler will hang very low on the wheels. There will be two pairs of driving wheels, but instead of having them follow each other, one pair will be on top of the other. The real driving wheels will be the upper pair, and they will turn in the opposite direction from that in which the engine is going. They will rest upon the rims of the other pair, which will in turn rest on the track. The revolution of the upper pair, by friction, is expected to drive the lower pair, the tires of the latter serving as tracks for the upper ones. It is thought that a good deal greater speed can be got out of the machinery by this construction, and it is expected by the inventor that it will be the fastest locomotive ever made. Practical workmen, however, think it won't go at all. It will look very funny as it is running through the country, with the upper pair of driving wheels, five feet in diameter, revolving up in the air in the wrong direction at a tremendous speed, and the eccentrics, rocking bars, link motion, and pistons on the top of the boiler.

After Graduation.

A few years ago a young man of promise was graduated at Harvard University. He determined to become a cotton manufacturer. Instead of relying upon his general education, and waiting for an opening, as many of his classmates did, he began at once to prepare specially for the business he had chosen, by entering a machine shop as a workman—making full hours and acquainting himself with every part of the machinery of a cotton mill. From the machine shop he went into the cotton mill, and by hard work and close attention rapidly acquired a thorough knowledge of all the processes of cotton manufacture. While some of his classmates were waiting and looking for an opening in business, and others were with difficulty filling subordinate positions, he was rapidly rising, step by step, until he is, to-day, in charge of one of the largest cotton mills in New England, with ample salary, and what is better, is discharging the duties of his position with great satisfaction to the company he serves.—*Providence (R. I.) Journal.*

Human Refrigeration.

Some experiments which seem to throw light on the physiological effects of bathing have been recently made by Dr. Paul Delmas, of Bordeaux. The action of cold and heat on the human system was studied by subjecting the whole body, except the head, of a healthy and robust subject to refrigeration with water at + 10° C., in a suitable apparatus, the time of exposure varying from 15 seconds to 5 minutes. In some cases heat was applied previously. The pulse and temperature were noted all the time, and every five minutes in succeeding hours; the temperature by means of a thermometer placed in the mouth. The following effects were observed: During application of the cold, while the subject shows every sign of very intense sensations (painful or otherwise), the temperature of the body scarcely varies at all, or varies at most one to two tenths of a degree, from that noted before; and previous heating does not affect this result. If, immediately after the application of cold, the subject remain perfectly still, after having been carefully dried and dressed, so as to avoid all active muscular movement, the temperature still varies little or not at all; but if he exert himself actively (in dressing, running, or walking), either immediately after the cold application or after a time of immobility, so as to bring on all the external phenomena of cold reaction, the temperature suddenly falls. The reduction persists several hours, and is more pronounced the stronger the sensation of heat in the subject. On the other hand, if chill continue or reappear owing to long immobility or suspension of exercise, the animal temperature does not fall, or immediately rises again. The amount of lowering of the temperature two or three hours after a cold application was, in eleven cases out of twelve, 0·1° to 0·6°. The *maximum* in a very vigorous subject never exceeded 1·3°. At the commencement of the cold application the pulse suddenly becomes very quick; after 10 to 15 seconds the velocity rapidly diminishes; and at the end of the experiment has returned to the previous figure or below it. If the subject, carefully dried and dressed, keep quiet, the retardation of the pulse stops or progresses slowly; but in the opposite case it is very pronounced, and persists the more the subject gives signs of energetic reaction and a general sensation of heat. Two or three hours after the cold application the pulse showed (in eleven cases out of twelve) two to twenty pulsations fewer than before the experiment.

IMPROVED VALVE-GEAR FOR ENGINES.

A novel device for reversing a steam engine is shown in the annexed engraving. The arrangement is such as to admit of reversing the valves when the engine is either at rest or in motion.

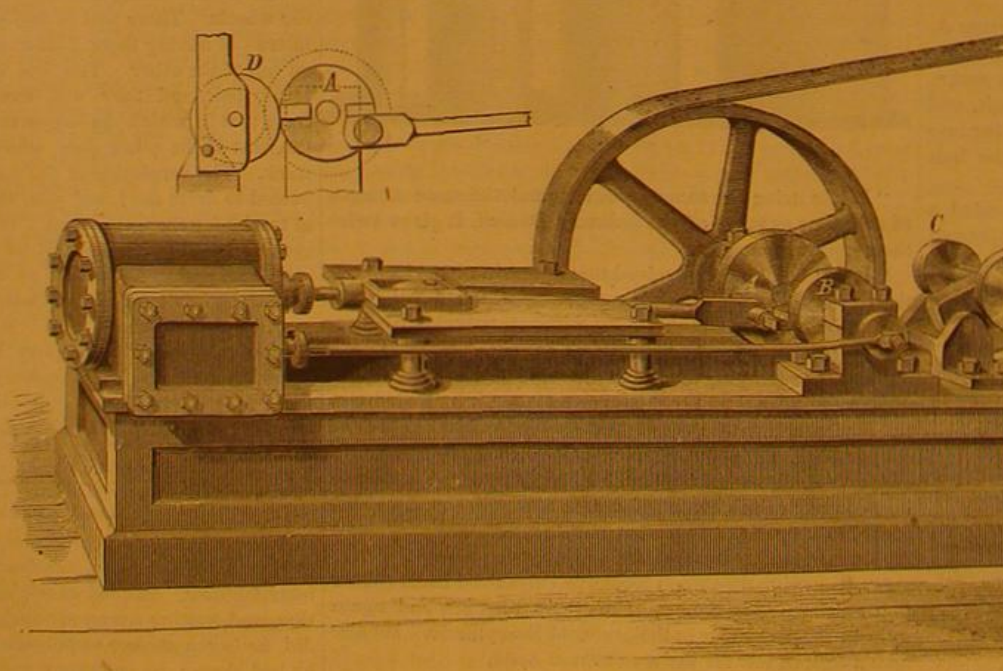
The crank pin projecting from the crank disk, A, is elongated so as to be capable of engaging either of two lugs projecting from the face of a wheel, B, mounted on the inner end of a shaft placed on the axial line of the main shaft. The shaft of the wheel, B, carries a crank or eccentric which operates the slide valve, and it is driven by the engagement of the crank pin with one of the lugs. When the engine is to be reversed the wheel, B, is turned so as to bring the opposite lug into position to be engaged by the crank pin. The valve is shifted by this operation, and when the engine is started its motion will be reversed.

To reverse the engine while in motion, an appliance consisting of a lever pivoted to the engine bed and carrying a shaft having friction wheels, C D, at opposite ends, is brought into use.

These wheels are capable of engaging with the wheels, A B, as shown in the detail view, and the wheel, C, is made smaller than the crank disk, A, so that when it is brought into engagement with the crank disk it will communicate motion to the wheel, B, through the friction wheel, D. By this means the wheel, B, will be turned ahead much more rapidly than its normal rate of speed, the valve will be reversed, and the lug on the opposite side of the wheel, B, will be engaged by the crank pin, and the engine will move in a reversed direction.

When the crank shaft carries a regular crank instead of the disk and crank pin, said crank is provided with a projection for engagement with the lugs on the wheel, B. These lugs may be secured to the wheel, B, by means of bolts working in slots, so as to enable the stops to be adjusted in order to regulate the lead of the valve.

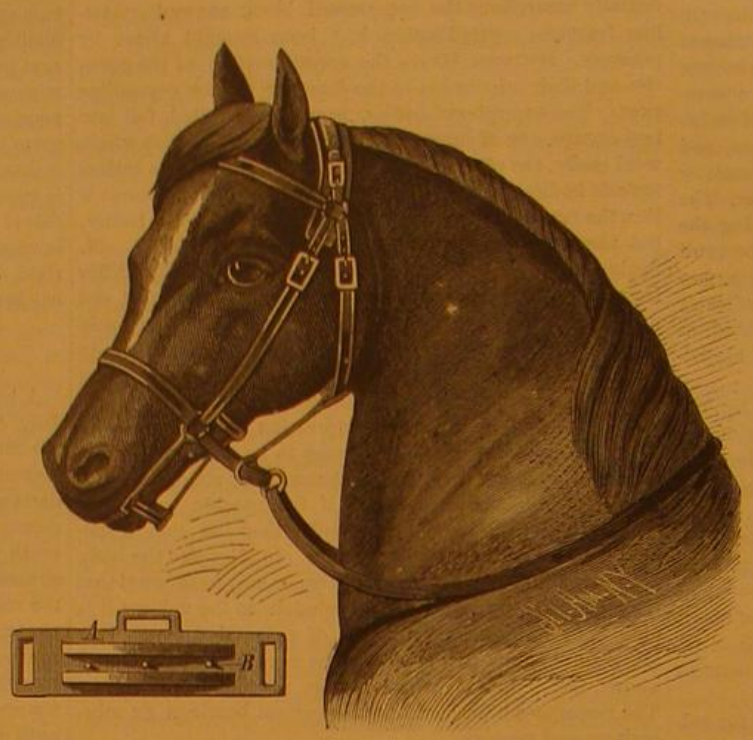
This invention was lately patented by Mr. Peter Josserand, of Hockley, Texas.



JOSSERAND'S VALVE-GEAR FOR ENGINES.

HALTER TO PREVENT HORSES FROM CRIBBING.

The engraving shows an attachment to be applied to halters to prevent horses from cribbing and for curing them of this habit. The invention is shown in use in Fig. 1, and in detail in Fig. 2. A plate, A, carrying a row of spikes, B, is connected with the halter by means of rigid arms and straps, and is held beneath the animal's under lip. Ordinarily the spikes are prevented from pricking the horse by the curved springs arranged on opposite sides of the row of spikes; but the motion of the horse in the act of cribbing compresses the springs and brings the horse's lip into contact with the points of the spikes.



MADDEN'S HALTER FOR PREVENTING HORSES FROM CRIBBING.

This attachment does not in any way interfere with the free movement of the head and mouth, but when the horse drops his lower jaw and seizes the manger, as in the habit of cribbing, the spikes will prick the under lip and the habit is soon broken up. This attachment is equally useful for vicious horses, as it prevents them from biting and tearing their blankets.

The invention has been thoroughly tested, and its merits are approved by horse trainers and owners. It was recently patented by Mr. Ambrose Madden, and is being introduced by Messrs. Madden & Sullivan, P. O. box 283, Asbury Park, N. J., who should be addressed for further information.

MISCELLANEOUS INVENTIONS.

Mr. Louis Prince, of Nashville, O., has patented an improved car door operating mechanism for street or elevated railroads, arranged with transverse seats extending the entire width of the car, and provided with a series of doors upon the sides of the car which communicate separately with each seat. The object of the invention is to provide means for operating a series of such doors simultaneously from the end of the car, so that they may be under the control of the driver or conductor.

Mr. Johann W. R. Vogdt, of Potsdam, Prussia, Germany, has patented a curtain formed of a series of vertical strips or bands of cloth, or other suitable material, alternately attached to two rollers pivoted parallel to and adjoining each other in the top of the window casing, and provided with suitable cords or devices for rotating them both at the same time.

A blind adjuster and fastener, so constructed as to hold blinds in any position into which they may be adjusted, and prevent them from rattling, and which at the same time can be operated from the inside of the window and without raising the sash, has been patented by Mr. Charles L. Rainhart, of Catskill, N. Y.

A new attachment for basket handles, which is simple and durable, has been patented by Mr. Amedee Hourdeaux, of Lichtenfels, Bavaria, Germany. It consists of a staple passing through an eyelet at the end of the handle and through two slotted disks on the outer and the inner sides of the wicker work of the basket; the ends of the staple are then lapped down on the surface of the inner disk to prevent the staple from being drawn out by the handle.

Mr. Samuel P. Fraley, of Columbus, O., has patented a broom-brush that may be cheaply made by mechanical means, and is held together independently of the holder and handle without the use of stitches.

An improved terra cotta kiln has been patented by Mr. Alfred Hall, of Perth Amboy, N. J. The object of this invention is to construct the doors of kilns for burning terra-cotta in such a way that the heat will be distributed equally through the door and the other parts of the kiln, so that all parts of the kiln will have a uniform temperature, and all the articles will be burned evenly.

Heretofore, where bells have been used for giving notice of fire, either by a general alarm or by striking the number of the signal box, much confusion has resulted from indistinct alarms or errors in counting. In some cases the fire alarm telegraph has been arranged to strike the number of the box, and bells not connected with the system are rung by hand, and it is of frequent occurrence that the box number is not heard at all except by the bell ringers. Mr. John H. Tilley, of Newport, R I., has invented a transmitter for fire alarm telegraphs that will first act to give a general alarm, and, after an interval, strike the box number and repeat the number, as required, thus calling attention, first, to the fact of the fire by an alarm which is likely to be heard, and then giving the locality.

Mr. David Untermeyer, of New York city, has patented an improvement in the class of necklace clasps which are provided with spring catches or fastenings for attaching the neckchain or necklace proper.

A rowing vehicle has been patented by Messrs. Charles E. Tripler and William H. Roff, of New York city. The object of this invention is to furnish wheeled vehicles that are operated by hand levers, and so moved that the operator, in propelling the vehicles, pulls the hand levers in substantially the same manner that the oars of a boat are pulled.

Messrs. Henry J. Mark and William F. Martinek, of St. Louis, Mo., have patented a wrapper or jacket for bottles and analogous articles having spiral or diagonally arranged grooves or corrugations.

Mr. William T. McLean, of Sidney, Ohio, has patented an improvement in the class of earth scrapers or scoops having a thin metal body, formed preferably of rolled sheet steel, and a wooden back, which is secured to the body by means of clamps, etc. The improvement consists in the arrangement of the devices for securing the wooden back to the steel body of the scraper, and in providing the latter with a single longitudinal steel wearing piece or shoe, which is arranged centrally, and beveled on the sides and front end.

Amédée G. Sébillot, of Paris, France, has patented an improved apparatus for the recovery of waste sulphuric acid. The object of the invention is to improve the product obtained from treating argentiferous ores, as well as to save the acid used in the process.

An automatic fire extinguisher has been patented by Mr. Edward Bocker, of New York city. The object of this invention is to furnish mechanism to be connected with the faucets of water pipes, and so constructed that upon the rise of temperature in case of fire the faucets will be opened automatically and discharge water.

THE INDIA-RUBBER AND GUTTA PERCHA INDUSTRIES.*

The lecture, of which the following is an extract, lately given by Mr. Thomas Bolas, F.C.S., before the Society of Arts, formed one of those admirable Cantor Lectures which are annually given to members. The importance of the India-rubber tree in connection with the many and useful purposes to which it is applied will be seen, upon a perusal of the lecture, which was opened by a description of the sources of India-rubber.

The earliest rumor of the existence of caoutchouc reached Europe nearly 500 years ago, the first visit of Columbus to Hayti having brought to light the fact that the natives of this island were in the habit of making playing balls of an elastic gum. Nothing more appears to have been heard of India-rubber until Torquemada, rather over 250 years ago, described the Mexican Indians as not only making balls of India-rubber, but also as fabricating helmets, shoes, waterproof fabrics, and other articles of elastic gum. We do not hear, however, of samples of India-rubber reaching Europe until long after this, and little more appears to have been learned regarding the substance until the celebrated French naturalist, La Condamine, made a communication to the Academy of Sciences at Paris concerning caoutchouc, he having had ample opportunities of studying the subject in Para. He tells us that the substance in question was used for making torches, these being only an inch and a half in diameter by two feet long, and yet burning for twelve hours. Again we hear of the use of India-rubber for playing balls, and it appears that the natives were in the habit of using enema or ejection bottles made of caoutchouc.

Soon after La Condamine's communication to the Academy of Sciences, samples of India-rubber frequently reached Europe, and scientific men began to make investigations regarding this remarkable body. Between 1760 and 1770 we find Fresneau and Macquer studying the subject, and the last named investigator made tubes and other articles of caoutchouc by dissolving it in ether and coating moulds with the solution, so that a solid skin of caoutchouc should remain adherent to the mould on the evaporation of the solvent.

From this time until the end of the eighteenth century, the India-rubber industry may be considered to have been undergoing its period of gestation, and to have been born with the dawn of the present century. Among the first of the important patents regarding the utilization of caoutchouc is that granted in 1823 to Charles Macintosh, for dissolving the substance in coal oil, or coal naphtha, and the use of this solution as a waterproofing agent.

About the same time, elastic webbing was first made with threads cut from the raw rubber, and other minor applications of caoutchouc to the industrial arts were adopted from time to time, until the great discovery of vulcanization inaugurated a new epoch in this branch of industry, rendering it possible to so far alter caoutchouc as to make it capable of resisting, to a great extent, the action of heat on the one hand and cold on the other hand.

The milky sap of many plants contains caoutchouc, suspended in the form of minute transparent globules, these being frequently as small as one twenty-thousandth and one fifty-thousandth of an inch in diameter; but comparatively few plants contain sufficient caoutchouc to render them important sources of this body.

The trees which yield the largest supply of the best quality of caoutchouc consist of various species of hevea, which flourish in the northern districts of South America, especially in the province of Para, some portions of the valley of the Amazon being crowded to an extraordinary extent with heveas. The abundance of the India-rubber trees in Para may be judged of by the fact that this province alone exported 7,340 tons of caoutchouc in the year 1877, more than half of this being sent to Liverpool.

Fig. 1.—HEVEA GUIANENSIS.

Fig. 2.—COLLECTING THE JUICE.

Among the heveas most productive of caoutchouc may be mentioned the *Hevea brasiliensis*, which flourishes in Para, and yields some of the finest caoutchouc, and often attains a height of sixty to seventy feet, with a diameter of nearly three feet; and the *Hevea guianensis*, a similarly magnificent tree, likewise abundantly productive of caoutchouc; and the *Hevea spruceana*, a smaller tree, which grows almost exclusively in the province of Para. The lecturer here projected on a screen a lantern slide, representing the foliage and flower of the *Hevea guianensis*, of which Fig. 1 is an illustration.

In collecting the juice, an illustration of the process being given by Fig. 2, a series of cuts are made through the bark of the tree; either shells or clay vessels are attached to receive the exuding milky sap, and when sufficient of this has been collected, the operation of drying it is performed as follows: A kind of wooden bat, thinly covered over with clay, is dipped into a pail filled with the juice, and the bat thus coated is held over a fire, fed with certain wild nuts, which in burning give off abundance of aromatic smoke. In Fig. 3, which represents this operation, it will be seen that a kind of short chimney is fixed over the fire to lead the smoke compactly upwards. As soon as the first layer of juice has become indurated, the bat is again dipped, and the drying operation is repeated, layer after layer being thus dried on the bat, until a thickness of nearly an inch is attained. A knife cut is now made in the bottle or biscuit of caoutchouc thus obtained, so that it can be removed from the wooden bat and exposed to the air to become still furthur indurated. Para caoutchouc, if prepared in this manner, gives forth a fragrant aromatic odor.

The residues of juice left in the various vessels employed, the scrapings of the incisions, together with other materials which the ingenious native thinks he can shuffle off on the unsuspecting merchant as caoutchouc, are made into balls, and sold as "negro head." The negro-head rubber is frequently made into crude representations of animals, which will pass about equally well for a horse, a pig, or a crocodile.

The milky juice of the Para rubber trees has approximately the following composition:

Caoutchouc	32
Albuminous, extractive, and saline matters	12
Water	56
	100

As a rubber producing tree, the *Ficus elastica* stands next in importance of the heveas. The *Ficus elastica* grows abundantly in India and the East Indian Islands, one district in Assam, thirty miles long by eight miles wide, being said to contain about 43,000 trees, many of them attaining a height of a hundred feet. This tree also grows freely in Madagascar, and it is well known to us as a greenhouse plant, a sketch of which may be seen on Fig. 4.

The juice of the *Ficus elastica* contains notably less caoutchouc than that of the American trees, the proportion very often falling as low as ten per cent of the juice. A vine-like plant, the *Urceola elastica*, which grows abundantly in Madagascar, Borneo, Singapore, Sumatra, Penang, and other places, yields a considerable amount of caoutchouc of very good quality.

Africa yields a considerable quantity of caoutchouc, but generally soft and of inferior quality. It is believed to be yielded by various species of landolphia, ficus, and toxicophlea.

Caoutchouc is nearly colorless, and when in thin leaves tolerably transparent. It, like very many other substances, contains nothing but carbon and hydro-

* Land and Water.

gen, but its properties differ very widely from those of other hydrocarbons almost identical in composition. It has been found to contain, in one hundred parts, 12·5 of hydrogen and 87·5 of carbon.

Caoutchouc, as might be supposed, burns very readily, and leaves no residue. It is soft, and very imperfectly elastic, in the true sense of the term; that is to say, it does not return to its original dimensions after having been considerably stretched.

As regards the stretching of India-rubber, there is a point at which it requires a greatly increased force to stretch it, and at this point it seems to become fibrous in texture, as you may perceive by examining this extended sample by the aid of a magnifying lens. India-rubber has valuable electrical properties, as you are no doubt aware, it being an admirable insulator, and having a remarkable tendency to become electrical by friction.

Freshly cut surfaces of India-rubber cohere very strongly when brought into contact, and this is well illustrated by the old way of making a tube of unvulcanized caoutchouc.

Cold has a remarkable effect on caoutchouc, rendering it rigid and inelastic, and this circumstance considerably detracts from the value of unvulcanized India-rubber. A strip of India-rubber, soft and pliable, will, upon exposure for a few minutes to a temperature of 0° Cent., or the freezing point, become rigid and stiff, but its original pliability may be restored, either by warming or by applying sufficient tensile strain to it, to extend it to three or four times its length. In each case it is restored to its original condition. In the case of the stretching it is very likely that the effect is due to heat evolved during that operation.

The effects of heat on India-rubber present many points of interest. A band of caoutchouc attached one end to an index, stretched to the zero of a paper scale, will, if a gentle heat be applied to it, contract, as regards length, but expands in a transverse direction, causing the index to move rapidly through a space of several degrees. This property, which stretched caoutchouc possesses, of contracting by heat, may be described by saying that within certain limits the tensile elasticity of caoutchouc is increased by an elevation of temperature. Caoutchouc, however, if heated to 100° Cent., softens considerably, and almost entirely loses its elasticity, while a heat of 120° Cent. produces a most decided softening effect on caoutchouc of the best quality, but after exposure to this temperature it recovers its pristine state by exposure to cold for a moderate period. If, however, the action of heat has been pushed still further, say to 200° Cent., the caoutchouc becomes converted into a permanently viscous body, which has little or no tendency to harden again. This viscous substance possesses the same composition as unaltered caoutchouc, and is of value as a medium for making air-tight joints, which can be easily undone.

When caoutchouc is subjected to a temperature somewhat above 200° Cent., it becomes converted into a variety of volatile hydrocarbons, which present many points of interest, and you will find a tolerably full account of them in the manuals of chemistry. India-rubber is subject to two kinds of deterioration and decay. In one instance it tends to become soft, and loses its elasticity, while in the other it becomes friable, yellowish, and resinous in its nature. The last mentioned kind of deterioration has been clearly and indubitably traced to an oxidation of the caoutchouc. This oxidation is tolerably rapid when the caoutchouc exists in a finely divided state and when it is exposed to damp at the same time; but the alternate damping and drying of the caoutchouc tends more towards its rapid oxidation than does a continual state of dampness. The resinous matter resulting from the oxidation of caoutchouc has been carefully studied by Spiller, who found that a sample of felt, originally composed of cotton fibers and India-rubber, had become so far changed during six years as to contain no trace of caoutchouc; but in its place he found a resinous substance resembling shellac. This resinous body, of which a sample is before you, is easily soluble in alcohol, and also dissolves in benzole. Alkalies dissolve it readily, and acids precipitate it from the alkaline solution. It contains 27·3 per cent of oxygen.

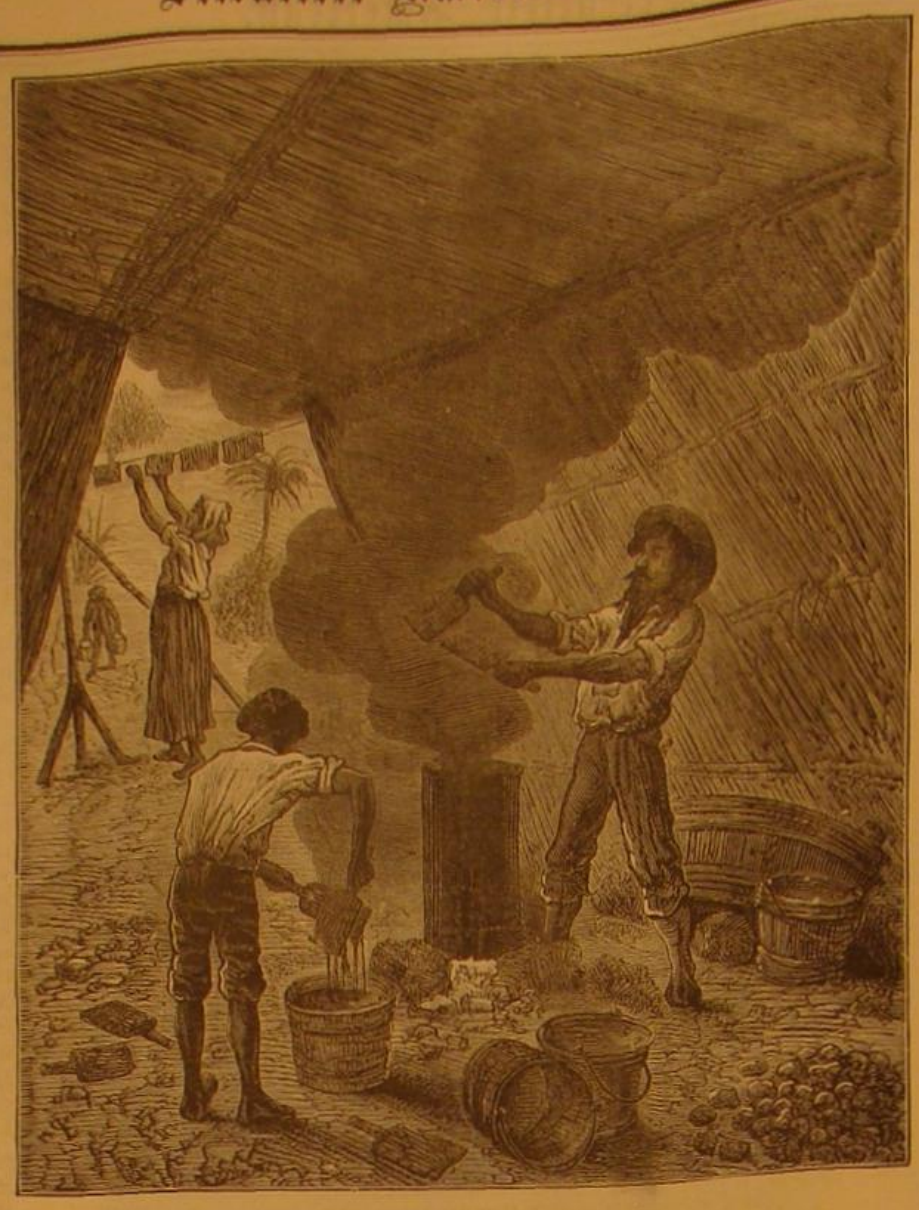


Fig. 3.—SMOKING THE GUM.

The conditions under which the softening of the India-rubber takes place are not so well understood, but there is some reason to believe that this is due to incipient oxidation. Ozone oxidizes caoutchouc with extreme rapidity, as Warren pointed out in 1877.

It is extremely probable that the rapid deterioration of caoutchouc, which is known to take place under conditions which are not perfectly understood, is frequently due to the corrosive and oxidizing action of ozone.

Ozone, or some agent nearly resembling it, is often produced when oil of turpentine is exposed to the air, and this circumstance may perhaps explain the destructive influence which oil of turpentine occasionally exercises on India-rubber.

Exposure to sunlight often causes the destruction of India-rubber, either converting it into a soft and sticky substance, or into a hard body, less soluble in benzole than unaltered caoutchouc; and it is quite possible to obtain a photographic print by exposing a film of India-rubber under a negative, and then dissolving away those parts on which the light has not acted by means of benzole. It is generally a discreet thing to keep India-rubber where it will not be exposed to the prolonged action of a powerful light, although there are cases in which exposure to light is a useful aid to the process of vulcanization. India-rubber is, to a certain extent, porous and cellular in its texture, as may be seen by a microscopical examination of a thin section. Again, if a thin leaf of caoutchouc is boiled for a long time in water it absorbs a considerable proportion of this liquid. The amount may, in some cases, rise as high as 25 per cent. In a similar manner alcohol is absorbed by India-rubber, but this fluid is absorbed more readily than is the case with water.

Now we pass on to a more important matter, namely, the action of such liquids as benzole or coal naphtha on caoutchouc. Here are two cubes of Para rubber, each being three-eighths of an inch across the face. One of these I will preserve as a pattern, and the other I will suspend in a bottle containing benzole. The cube suspended in the benzole will immediately begin to swell, and will continue to do so until it has attained a bulk about one hundred times as large as its original size. During the time that the cube is swelling in the benzole a certain proportion of the caoutchouc will become dissolved out, and incorporate itself with the bulk of the solvent. Now, as a matter of fact, every kind of natural India-rubber contains two distinct modifications of caoutchouc, one of which tends to swell up in such a liquid as benzole, while the other dissolves and forms a true solution. The first mentioned of these bodies may be referred to as the fibrous constituent of caoutchouc, while the second may be spoken of as the viscous constituent. The proportions in which these two bodies occur in raw rubber varies extremely; Para rubber, of good quality, containing only a small proportion of the viscous constituent, while African tongue, on the other hand, consists principally of the viscous modification of caoutchouc. The viscous constituent of caoutchouc is the agent principally concerned in the joining together of freshly cut edges of India-rubber. The treatment of the juice of the India-rubber trees is often of such a nature as to greatly deteriorate the caoutchouc obtained; a considerable proportion being thus changed from the fibrous to the viscous condition. This kind of injury to the caoutchouc can be obviated by coagulating the milky juice, and carefully drying the clot after it has been subjected to pressure. For experimental purposes alcohol may be employed as a coagulating agent; while, on an industrious scale, alum has been tried with apparently an excellent result. The milk is strained to remove solid impurities, after which a small proportion of alum solution is added. The clot which separates is next drained or pressed, after which it is dried. Caoutchouc dissolves more or less perfectly, according to its condition, in various liquids, among which may be mentioned the various fixed and hydrocarbon oils, chloroform, ether, and carbon disulphide. Unless, however, the caoutchouc has been masticated or otherwise degenerated, it is doubtful whether a true solution is obtained. When a clear limpid solution is required, one of the best solvents is that proposed by Payen, namely, carbon disulphide, mixed with 5 per cent of absolute alcohol. If one part of masticated caoutchouc is dissolved in thirty parts of the above solvents a solution is obtained which can be filtered through paper, and may be employed in covering the most delicate moulds with successive layers of caoutchouc.

Fig. 4.—FICUS ELASTICA.

Caoutchouc may be utterly ruined by the use of impure solvents, and those experimenting with India-rubber solutions should in cases where it is desirable to regenerate the caoutchouc, by allowing the solvent to evaporate, take the utmost care not to employ any solvents which contain fatty or greasy matter.

Weak or diluted acids have little or no action on caoutchouc in the majority of cases, but strong sulphuric acid slowly acts on it, the action becoming rapid if heat be applied. Strong nitric acid acts on it with some energy, causing its entire destruction, and in a similar manner it is destroyed by the prolonged action of chlorine, bromine, or iodine; although these reagents, when their action is kept under control, have a vulcanizing or strengthening action.

A Peculiar Steamboat.

A propeller of novel construction has just been finished in San Francisco, California, to ply between that city and the Eel River Valley. The condition of the route required a staunch sea boat, which should also be of light draught, to be able to cross the bar at the mouth of Eel River.

The vessel is 152 feet in length, 140 feet length of keel, 26 feet beam, 9 feet depth of hold, and will register 250 tons. When loaded with 300 tons of freight she will draw only 7 feet of water. She is flat-bottomed, but has a tapering bow and stern, and her lines are as beautiful and graceful as those of a yacht. The peculiarity of the boat consists in the arrangement of the two propellers. Instead of projecting from either quarter on either side of a single rudder there will be two rudders, and each propeller will be arranged with respect to its corresponding rudder, just the same as it would be if there were a single propeller. There are in reality three keels, the center one curving up at the stern, following the line of the vessel. Those on either side, however, are 12 or 15 feet apart, and run straight out beneath the stern, where there are two stern posts and two rudders. The spaces between the keels and the hull proper are filled in solidly with knees, strongly bolted in every direction. There is left between the two keels a wide space, which will give free access to water, so that each propeller will act as well as if it were the only one used to draw the boat. The propellers are 6½ feet in diameter, of the Hirsch patent, and the pitch of the blades is set opposite, so that in going ahead both will turn to the center. They will be driven by twin compound engines, set 9½ feet between centers, with a surface condenser between. The condenser will contain 753 tin-plated brass tubes, ⅝ inch in diameter, secured in end plates with a wooden ferrule, and affording 618 feet of cooling surface. The condenser will be operated by a Blake compound air circulating pump, throwing 300 gallons per minute. The engines will have high and low pressure cylinders, the high pressure being 11 inches in diameter and low pressure 20 inches, with a 15-inch stroke. The steam will be supplied by a tubular boiler, with 3-inch return tubes. The engines will be so arranged that the engineer will face the bow, and will regulate his propellers by levers on either hand—pushing them forward when the bell signals "Go ahead," and bringing them back when he is signaled to back the vessel. The arrangement of the propellers is such that one may be backed while the other moves ahead, and the boat can thus be turned in her own length. This is of especial importance, on account of the narrow and crooked channel across the Eel River bar, where boats often ground because of their inability to turn quickly enough. The two keels under the stern will serve to protect the propellers if the boat grounds.

Water as a Prophylactic and a Remedy.

At the recent meeting of the American Neurological Society in this city, a paper was read by Dr. S. G. Webber, of Boston, upon this subject, from which we abstract the following:

Many people had a notion that it was injurious to drink at meals, but a moderate quantity of fluid taken at meal time was rather beneficial than otherwise. A large class of patients were affected with symptoms of an indefinite character—a vague unrest, showing itself by discomfort or even pain, sometimes in one place, sometimes in another. They were usually subject to constipation, often had an unhealthy hue of the skin. They were frequently classed as hypochondriacal or hysterical. There was no well defined disease. These patients usually drank too little water. The waste of the tissue changes in the system must pass into the blood, and could only leave the system in a state of solution. During comparatively good health, the amount of blood was maintained at nearly the same figure, and only so much water would be parted with through the skin, lungs, and kidneys as could be restored from other sources. If too little water was ingested, the perspiration would be slight, the elimination of urine would be diminished, and the excretion of waste material would be lessened. The blood would be continually saturated, or nearly so, with the results of disassimilation. The removal of the waste of tissue changes was not accomplished with sufficient regularity, and the tissues became clogged with used up material and nutrition was interfered with. The balance each day against health was very slight; but after a time there was such an accumulation that unpleasant symptoms were developed. If the person continued to eat heartily, either the surplus food passed off by the intestines, or was deposited in the shape of fat, the nitrogenized portions assisting to load the urine with urea and the urates. Let such a person drink a large amount, and the blood, having a sufficient supply of water, more urine would be secreted, the loss made good to the blood by absorption, and a larger amount of waste products would be taken up to be eliminated; more urea or phosphoric and sulphuric acids passed off by the urine, which was increased in amount, and there was more disintegration of the tissues. This last was made up by new material, so nutrition was increased. The doctor found that neurasthenic patients did not drink enough.

Dr. Beard remarked that he had found thirst a prominent symptom of neurasthenic patients. He had been using Summit water with good results. He used the bromides alternately with tonics and a free supply of water. The plan was very satisfactory.

Dr. Webber said that patients who drank no more than a pint or twenty ounces of water per day, had told him that they were not thirsty, and were surprised when he told them to drink more water. These directions being complied with, the patients, in the course of the week, developed thirst, and drank as many as three pints a day.

Analyses of Barley, Rice, and Maize.

The following comparative analyses of the three grains are by Pillitz:

		BARLEY.		RICE.		MAIZE.	
		Air dried.	Dried at 257° F.	Air dried.	Dried at 257° F.	Air dried.	Dried at 257° F.
Moisture		13·88	—	12·51	—	13·89	—
Starch		54·07	62·65	74·88	85·41	62·69	72·27
Insoluble ash		1·07	1·23	0·39	0·45	0·33	0·38
Fatty matters		2·66	3·08	0·78	0·90	4·36	5·03
Cellulose		7·76	8·88	0·76	0·87	4·19	4·82
Insoluble albuminoids		12·43	14·28	8·78	10·01	8·63	9·95
Soluble matters	Dextrine,	1·70	1·96	1·11	1·27	0·76	0·83
	Sugar,	2·43	2·71	traces	traces	1·38	1·59
	Soluble albuminoids,	1·77	2·05	0·41	0·46	1·87	2·16
	Soluble ash,	1·26	1·45	0·45	0·51	1·15	1·32
	Extractive matter,	1·50	1·71	0·11	0·12	1·43	1·65
		100·53	100·00	100·18	100·00	100·68	100·00

Enemies of the Tea Plant.

Speaking of blight, we think that if more care was taken to watch its first appearance, many of the remedies prescribed might be possibly effectually applied. But when blight has been allowed to spread over a large area, it becomes almost impossible to stop it. Bushes on which blight appears should be promptly treated, wherever possible, and different known remedies tried. It is seldom that an area is attacked all at once, and there is no doubt that with spider and some other blights, they are carried about by the coolies from bush to bush. It is generally supposed that heavy rain washes away the red spider. To a certain extent, no doubt, it does, but the creature has a trick of getting underneath the leaf when he finds the moisture too strong for him, and when the warm sun comes out again he recommences his peregrinations and destructive action over the surface of the leaves. The activity of the insect is something surprising, and an investigation, under the microscope, of the leaves attacked will show them transparently red, and covered with hundreds of eggs, with little spiders emanating therefrom and cutting about with amazing vigor. The unhatched eggs (that is those not yet matured) are unfortunately not destroyed or washed off the bush by the rains, in consequence of being practically gummed to the leaf, and thus a second syringing or treatment should follow very quickly. If *heavy* rain falls at the right time, it may save the trouble of syringing.

Besides the red spider blight, the Darjeeling district is suffering from green fly blight. This pest eats the outside of the stem of the flush, causing the leaf to curl up and wither by reason of the sap being prevented from rising. There is also the red bug, which cuts through the upper shoot of the flush, and makes it droop off. Then the mosquito blight, which, puncturing the leaf, and preventing the distribution of sap, hardens it.—*Indian Tea Gazette.*

Distortion of Lenses by Pressure or Strain.

Many photographers have from time to time remarked that it is occasionally impossible to focus an object sharply and clearly, even with a lens known to yield a satisfactory result in ordinary cases. Setting aside such obvious causes as light shining into the lens, or the presence of moisture on one of the glasses, there can be little doubt that the most frequent source of the difficulty in question is a bending or distortion of the objective by some mechanical force acting on it. In the case of lenses burnished into their mounts, a contraction of the ring by cold may distort the lens uniformly, if its fit in the mount is accurate, merely altering the focus and disturbing the corrections of the instrument. If, however, the cell in which the lens may be mounted is not turned with extreme accuracy, or if the outside of the lens itself is not truly round, so irregular a distortion may arise as to altogether destroy the defining power of the combination to which the lens belongs. There is no question that the practice of burnishing lenses into their mounts has its disadvantages, for when this plan is adopted the operator has no easy remedy against a "frost-bound" lens, excepting to keep the instrument warm during the time he is using it. If, on the other hand, the glasses are not cemented in their cells, they are liable not only to be misplaced by careless persons, but also to be distorted by being screwed down in their places by an undue degree of force. Lenses should generally be left just the least bit loose in their mounts—not quite enough to cause any possibility of shaking, but the right degree of looseness can generally be estimated by making an attempt to turn the lens in its setting. Few persons realize the ease with which glass bends and yields to pressure.—*Photographic News.*

ENGINEERING INVENTIONS.

An improvement in endless cable railways has been patented by Mr. Samuel M. Pettengill, of Brooklyn, N. Y. It relates to railways provided with a moving endless cable, rope, or chain, for propulsion of the cars. The object of this invention is to furnish the cars with means for seizing and firmly holding to the rope or cable without shock.

Mr. James B. Jenkins, of Warren, Ill., has patented a grapple for lowering pipes into wells that may be detached from the pipe automatically by sliding it down on the pipe until it comes in contact with a coupling.

An improvement in that class of railways in which no wooden ties are used, and the pot sleepers or chairs are flared to rest directly upon the ground, and are cast in one and the same piece with a jaw which is perforated with holes for the fish bolts, between which jaw and the fish plate the rails are bolted, has been patented by Mr. William Rainbow, of Chancery Lane, England. The improvement consists, mainly, in the means for connecting the chairs so as to preserve the gauge of the road.

A clock device to be used on railroads to be operated by passing trains, whereby the time elapsing between the passing of one train and its next succeeding one will be correctly indicated to the engineer of the succeeding train, has been patented by Mr. Alma P. Burroughs, of Seneca Falls, N. Y.

Mr. Augustus B. Wood, of Fountain Hill, Ark., has patented a cheap and economical oscillating engine furnished with a valve so arranged and controlled that friction and pressure upon the valve seat are reduced simply to that which is necessary for preserving a steam tight joint between the two.

An improved low-water alarm for boilers has been patented by Mr. Nathan L. Adams, of Fort Collins, Col. The object of this invention is to furnish steam boilers with an improved device that will indicate automatically and give an alarm when the water in the boiler falls below the safety point.

Mr. Anton Pohl, of Baltimore, Md., has patented an improved spark arrester, in which the joint action of gravity, deflection, and centrifugal force is employed to separate the sparks, cinders, and solid matter from the smoke as it escapes through the stack of a locomotive, whereby the work may be effectually accomplished within the limited space of the stack without materially intercepting the draught. The improvement consists in arranging an annular chamber around a cylindrical stack, and providing the stack with a spiral deflector plate, which will give a rotary motion to the smoke and cause the solid matter to be thrown off against the side walls of the stack, where it is intercepted by projecting plates and conducted through openings into an adjoining annular chamber and deposited at the bottom.

An improved car coupling has been patented by Mr. Edward S. Plimpton, of Denison, Ia. This invention is an improvement in the class of car couplings in which the coupling pin is provided with an arm that projects from the head thereof and rests in a socket in the front top portion of the draw head, so as to constitute a fulcrum on which the pin may swing when pushed back by the link in the operation of coupling.

A Magic Lantern and Six Slides for Six Cents.

A small tin lantern, about three inches high, with lamp, slides, and two lenses, is actually being now sold in London at the above mentioned price; while a larger one of a similar character costs the somewhat more extravagant sum of fifteen cents. The small lantern is of German make, and when one considers that the manufacturer cannot get more than four cents for the article, it is a matter of wonder how it can be produced for the price. Very little can be said as regards the artistic merits of the slides, but like the old Dutch tiles, they at least possess the merit of being hand-painted—if, indeed, this be a merit. The lenses, which, as regards optical work, are superior to many spectacle glasses sold in London, give, as an advertisement would put it, "a brilliant illuminated disk six inches in diameter." There is also sold in London at the present time, a toy camera obscura about the same size as the magic lantern in question. Who knows but what the present pushing age may produce a small tin photographic camera, double slide, two dry plates, and lens for about 25 cents? It could certainly be done if the work were executed on the same scale of cheapness as in the case of the magic lantern. It is, perhaps, not generally known that a very passable photograph can be taken with a common penny magnifying glass, if it be stopped down and a proper adjustment made for the difference existing between the chemical focus and actinic focus.—*Photographic News.*

Brilliant Tints of Californian Flowers.

Under the title of "A Botanist in Southern California," Mr. J. F. James contributes to the *American Naturalist* some interesting sketches of the vegetation of the country in the vicinity of Los Angeles. Rain falls there only from November to March, and the rest of the year is hot and dry. By the middle of June or July vegetation is parched up, and the country has a very depressing aspect; but the spring is glorious. Then the plains surrounding the city, the hills, and the valleys are one mass of gorgeous, brilliant flowers. They are there by thousands upon thousands, and of almost endless variety. Most conspicuous of all, both for its abundance and its color, is the Californian poppy, *Eschscholtzia californica*. It covers acres of ground, and the bright

golden-yellow or orange of its flowers is visible for miles. When the sun is shining full upon it, it is too dazzling for the eye. In places where the ground was plowed paths of it had been left, and they seemed like tongues of fire running over the ground. Among other showy plants are *Sidalcea malvæflora*, with large purple flowers; *Platystemon californicus*, called cream-cups; *Dodecathon meadia; Baria gracilis*, a composite with bright yellow flowers, covering acres of ground; *Paonia brownii*, in tufts, with large purple or reddish flowers; various species of *Gillia, Pentstemon, Lobelia, Phacelia, Nemophila*, together with *Clarkia, Salvia, Castilleia, Convolvulus*, and *Colochortus*, making up such a wealth of color as is rarely seen elsewhere.

THE CONCH FISHERIES OF THE BAHAMAS.

BY W. H. WEED.

Conch fishing in the Bahama Islands is quite an extensive industry. There are about 500 vessels engaged in this and the sponge and turtle fisheries. Most of these from time to time engage in conch fishing according to the demand for the shells.

The vessels employed are either sloops or small schooners, and carry from three to ten men, most of them of the "colored persuasion." These negroes are expert divers and swimmers, being accustomed to the water from childhood. They enjoy the distinction of being perfectly fearless, even in the presence of that dreaded enemy of divers, the shark, who is found in abundance in these waters. It is a current saying in Nassau, when a stranger asks if the negroes are not afraid of sharks, that "a shark will not attack a nigger." The men usually work on shares, and their reward being thus dependent upon their own exertion, each one spurs the others at their work; they all labor with more energy than is usually characteristic of their race in this climate. The conch, which is like an enormous snail, is found in the shallow waters of this vicinity, the sea bottom of the numerous shoals being a favorite place for them. The larger crews work in parties of two, three, or four, in separate boats and independent of each other.

In order to locate the position of the fish they use what is called a "water glass." This is a rectangular water-tight box about thirty inches long, with one end a foot square, and closed by a pane of ordinary glass. The other end is slightly larger and is open. In using the "glass" the closed end is immersed in the water a few inches below the surface, when the sea bottom is distinctly visible through the glass, the water being clear as crystal.

Having discovered the position of the conch the diver leaps in and obtains it, and in a few moments is back in the boat looking for more. Some of the fishermen use a double pronged hook attached to a long staff, such as is used in sponging, and with this secure the conch instead of by diving.

When a boat load is secured the conchs are taken ashore to some convenient beach and left to die. When dead the shells are beaten against the soft sand, which loosens the flesh so it may be easily removed.

The meat of the pink conch is carefully examined for pearls, but the other varieties have no pearls.

The shells of the pink conch are scraped to remove the seaweed, serpulæ, or other incrustation, but the others are naturally pretty clean and are sold in the rough state.

The length of the cruise varies, of course, but the usual time is three or four weeks. On the return to Nassau the shells are sold to the conch dealers or merchants, who sort and pack them for shipment. The finer specimens are packed in cases with sponge clippings, but the ordinary kinds are packed in bulk or shipped loose.

Most of the exports are to England and the United States, though France takes a good many from English consignees.

The four varieties of conch which form the basis for this industry are the common or pink conch, the milk conch, and the king and queen conchs. The first, the *Strombus gigas*, is the most common, and is the well-known conch used for ornamental purposes. It is also the same formerly used for the dinner horn by many old farmers; indeed, it still does good service in that line in the far West.

The flesh of the animal is edible, making, when cooked and properly dressed, a very fair salad, as the writer can testify from experience.

The shell is used for turning into sleeve buttons and brooches, much in vogue in Naples, Italy, but for some unknown reason they do not take well in the United States. Exquisite pink cameos are cut from this shell, and are often mistaken for coral by novices.

Many tons of this shell are also used in the porcelain manufactories of France and Germany.

The milk conch is also one of the strombs and is much smaller than the pink conch. The name is derived from the milk-white color of its interior. The shell is much less fragile than the other species, and it is used in the United States for ornamental purposes.

The queen (*Cassis madagascariensis*) is a much more valuable shell than the preceding varieties. Its flat face is egg shaped and of a handsome salmon red color, being of a beautiful brownish black near the teeth. The shell of this and the king conch is very valuable in cameo cutting, and are much used for this purpose in England and France.

The king conch is of the same species as the queen, but it differs somewhat from it in having a triangular face of a brownish yellow, and the interior of the shell and around the teeth is of a purple black.

Several very handsome specimens with cameos cut in the shell may be seen in the Bethnal Museum, London, and at the American Museum of Natural History in New York.

The pearls taken from under the apron of the pink conch are either pink, yellow, or black. The pink are, however, the only valuable kind. These are of that exquisite shade of pink which gives the name to the conch from which they are taken. Many of the pearls are beautifully water lined, and this, together with their size and color, determines their worth. The lucky fisherman who has any of these pearls for sale finds a ready market for them in Nassau, where the buyers offer very good prices for the pearls, £20, or $100, is not a very unusual price, though the majority of the pearls bring a very much lower figure, of course.

The buyers export them to England, where the demand is good. They may be seen in London set in all sorts of ways, the favorite being in the form of rings, which can be bought from £2 up.

The value of the pearls annually exported from Nassau was recently estimated at £10,000, or $50,000.

The value of the different conch shells in New York is, for the pink conch, $4 per one hundred shells; milk conch, $6.50; king conch, $25; queen conch, $20.

NATURAL HISTORY NOTES.

Old Seeds versus New.—There is a widespread impression that old seeds of many plants are preferable to new, especially in the production of double flowers. Desirous of putting his view to the test, an experimenter, whose results are recorded in a recent number of the *Revue Horticole*, undertook a series of experiments with the seeds of the camellia-flowered balsams of varying age. The conclusion arrived at—diametrically opposite to the generally received opinion—is that it is the youngest seeds which give the largest proportion of double flowers.

The Potato Grafted on the Bitter Sweet.—An experiment has been performed by M. Lambotte, the record of which, together with an illustrative woodcut, may be found in a recent number of the *Revue Horticole*. M. Lambotte tells us that in the spring of the year, while picking out some potatoes for culinary purposes, he remarked one sprouting and more fit for planting than for cooking. He had at the time, close at hand, a plant of the bitter sweet (*Solanum dulcamara*), the stem of which he cut to a sloping point, which he introduced into a hole in the potato as deftly as possible. Some days afterward the potato had regained its hardness and speedily sprouted from the eyes, the principal stem measuring more than sixty centimeters. The tuber became green, excessively hard, and developed little shoots bearing smaller tubers and rootlets. In point of fact there was a tuber growing in the same manner as it would in the ground, and only differing from an ordinary tuber in its hard consistence. Things went on in this manner till the end of September, when suddenly the leaves withered and the shoots became pendent, and the tuber gradually became soft and decomposed after its ten months' sojourn on the stem of the bitter sweet, the latter continuing its growth in the ordinary manner, unaffected by the fate of its quondam associate.

The Eggs of the Great Auk.—The numerous bones of the great auk found on the shores of Greenland, Newfoundland, Iceland, and Norway attest the former great abundance of this bird, but within the last century it has gradually become more and more scarce, and is now believed to be extinct, none having been seen or heard of alive since 1844, when two were taken near Iceland. There are but three specimens in the United States—one in the Academy of Natural Sciences at Philadelphia, one in the Smithsonian Institution, and one in the Cabinet of Vassar College. The last is the most perfect specimen, and possesses the greatest historical value, as it is the one from which Audubon made his drawing and description. The eggs of this extinct bird are also extremely rare, and it is, therefore, interesting to learn that two specimens have been recently discovered in an old private collection in Edinburgh and sold at auction. The prices realized on these two rarities were $560 and $500 respectively. The purchaser was Lord Lilford.

A Case of Apparent Insectivorism.—Professor Baillon, at a recent meeting of the Linnæan Society of Paris, read the following notes on the apparent insectivorism of a plant often seen in cultivation, *Peperomia axifolia*, of which the variety *Argyreia* is cultivated in so many greenhouses, has the leaves more or less deeply peltate. I have seen stalks on which the peltation on certain leaves was so exaggerated as to show on cross section a depth of nearly four centimeters. When the concave stalks take a suitable direction, water (principally that from sprinkling) would accumulate and rest in these receptacles, so well prepared to preserve it. Many small insects would fall into this water and be drowned. Last year, when the season was warm and when the windows of the house were often open, the number of insects was very considerable, and these, soaking in the water, gradually fell into decay, and it was remarkable that there was during this not the least sign of any putrescent odor. Those who believe in the theory of insect-eating plants may perhaps in this be led to find an argument favorable to such doctrines. They will add that the variety of colors so strikingly seen in these leaves constitutes the agent of attraction for the insects to come and be drowned. These reflections, each of a different sort, here present themselves: 1. Is it not remarkable that the exaggerated peltation of these leaves is in this case accompanied by an apparent insectivorism, and that the leaves of the plants known up to this time by botanists as carnivorous owe their sac-like, horn-like forms only to an excessive peltation of their limb, as we demonstrated in the evolution of the leaves of *Sarracenia* (*Comp. Rend.* lxxi. 630)? 2. How can it be considered as a proof of insectivorism, that plants such as the *Utricularia* grow better in a fluid containing albuminoid compounds, when other plants grow equally favorably in the same kind of fluid, and which latter are never for a moment thought of as carnivorous? 3. How do the chief priests of our science reconcile the two ideas, that the surface of the leaves of plants is unable to absorb pure water in contact with them, and that the same surface daily absorbs water charged with albuminoid substances and the like?

Albino Arethusa.—A white flowered variety of this rare and beautiful North American orchid has recently been discovered in Rhode Island by Professor W. W. Bailey. It has the yellow markings of the labellum, as in the ordinary red flowered form. In his "Wild Flowers of America," Professor Goodale states that the plant grows in bogs, with its corm embedded in peat moss, sometimes two or three inches below the surface.

CURIOUS FACTS ABOUT THE ALBATROSS.

The tracts of lower, nearly flat land of Marion Island, skirting the sea, and the lower hills and slopes along the shore, presented a curious spectacle, as viewed from the ship as it steamed in towards a likely-looking sheltered spot for landing. The whole place was everywhere dotted over with albatrosses, the large white albatross or goney (*D. exulans*). The birds were scattered irregularly all over the green in pairs, looking in the distance not unlike geese on a common.

The albatrosses were all around, raised from the ground. Their nests are in the style of those of the mollymanks, but much larger, a foot and a half at least in diameter at the top.

They are made up of tufts of grass and moss, with plenty of adhering earth beaten and packed together, and are not so straight in the sides as those of the mollymanks, but more conical, with broad bases. The female albatross is sprinkled with gray on the back, and is thus darker than the male, which is of a splendid snow white, with the least possible gray speckling, and which was now, of course, seen in his full glory and best breeding plumage; the tails and wings of both birds are of course dark.

The albatrosses one meets with at sea are most frequently birds in young plumage or bad condition, and have a rather dirty, draggled look. The brooding birds are very striking objects, sitting raised up on the nest, commonly with the male bird beside it. They sit fast on the nest when approached, but snap their bills savagely together, making thus a loudish noise. They will bite hold of a stick when it is pushed up against their bills. They need a good deal of bullying with the stick before they stand up in the nest and let one see whether they have got an egg there or no. Then the egg is seen to appear slowly out of the pouch in which it is held during incubation. It is nearly five inches long, or about as big as a swan's, and is white, with specks of red at the large end. Only one egg is laid. In most of the nests there were fresh eggs; in some, however, nearly full-grown young birds.

At Campbell Island, of the Campbell and Auckland group, the young of *Diomedea exulans* were found just breaking the shell in February, by an exploring party.*

Charles Goodridge, who was one of a sealing party on the Prince Edward Islands in 1820, and spent two years on the Croyets, says that the albatrosses there lay at about Christmas, and that the period of incubation is about three months (?). The young, he says, were wing-feathered, and good to eat about May, and did not fly off till December.†

The young albatrosses are dark-gray in plumage. They snap their bills, like the old ones, to try and frighten away enemies. The old birds never attempt to fly, though persistently ill-treated or driven heavily waddling over the ground.

Very many were killed by the sailors that their wing bones might be taken out for pipe stems, and their feet skinned to make tobacco pouches. The old males tried to run away when frightened, but never even raised their wings.

It is amusing to watch the process of courtship. The male, standing by the female on the nest, raises his wings, spreads his tail and elevates it, throws up his head with the bill in the air, or stretches it straight out forwards as far as he can, and then utters a curious cry, like the mollymanks, but in a much lower key, as would be expected from his larger larynx. While uttering the cry the bird sways his neck up and down. The female responds with a similar note, and they bring the tips of their bills lovingly together. This sort of thing goes on for half an hour or so at a time. No doubt the birds consider that they are singing. Occasionally an albatross flies round and alights upon the grass, but I saw none take wing.—*H. N. Moseley.—Challenger Notes.*

A WISCONSIN cow died not long ago, after a lingering illness, attended by a persistent cough. After her death a veterinary surgeon opened the windpipe to discover the cause of the irritation, and found in the upper part of the lung a live striped frog of ordinary size. The surrounding portion of the lung was much discolored.

* "Notes on the Geology of the Outlying Islands of New Zealand. Reported by Dr. Hector, F.R.S."—Trans. N. Zealand Inst., vol. xi., 1869, p. 75.

† "Narrative of a Voyage to the South Seas, and Eight Years' Residence in Van Diemen's Land," p. 36. By C. M. Goodridge. London: Hamilton & Adams. 1833.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

☞ *The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.*

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) G. A. A. asks: Which is the best pipe to use for heating a room with steam: two rows of one inch pipe or one row of two inch pipe? A. If the radiating surface in the two cases is the same theoretically there should be no difference, but practically we believe the smaller pipes have proved more efficient.

(2) O. V. D. asks: 1. How many pounds ought a three-eighths inch bar magnet hold up, like that described in the SUPPLEMENT, No. 142, in the article "How to Make a Working Telephone," Fig. 4, so that I could tell if it was charged powerful enough? A. About three-fourths its own weight. 2. What would be the numbers of the lenses required to construct a spy glass like that on page 68, SCIENTIFIC AMERICAN, No. 5, Vol. 43? A. Only two lenses are required. The object glass should be achromatic, the eye lens is double concave.

(3) Dr. A. M. C. says: I want to make a sidewalk 10 feet long, 2½ feet wide. What can I use in place of stone or wood, something that is durable and hard? A. You might use ordinary cement, three inches thick, which any mason can put down for you. See SUPPLEMENTS, 33, 36, and 82.

(4) W. H. D. asks: 1. Will a magnet that will lift a one pound weight make a small machine that will make a small current to show how it works? A. Yes. 2. Will sheet glass covered with tin foil on both sides make a Leyden jar, and by combining a large number together, having the negative sides connected and all the positive sides connected, make a powerful battery? A. Yes, but the jars are better. 3. Would not sheet lead answer as a substitute for tin foil? A. Tin foil is best.

(5) J. S. M. inquires as to the best method of preventing woodwork in mills saturated with oils from taking fire in the event of a blaze touching the woodwork. A. Woodwork strongly impregnated with tungstate of soda or silicate of soda (by treatment in strong aqueous solution of these salts) becomes uninflammable.

(6) G. E. writes: 1. I have bought some woolen underclothing which are so much filled with sulphur that they are very unpleasant to wear. Is the sulphur injurious to health? A. Yes, if present in considerable quantity. 2. What will remove the sulphur? A. Sulphur is soluble in bisulphide of carbon. If the bisulphide used is pure the small quantity adhering to the cloth after wringing will quickly and completely evaporate on exposure to the air.

(7) R. P. asks if there is any indelible preparation for stenciling on unplaned lumber, such as posts, etc., in black or other colors? A. Use a strong turpentine solution of asphaltum, tempered with common printer's ink.

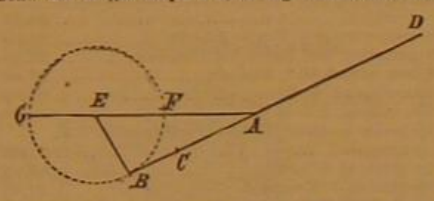
(8) J. G. asks what are the plates on which photographic pictures commonly called tintypes are taken coated with? A. The plates are flowed evenly with japan varnish, and the coating hardened in a japanner's oven. The varnish may be procured at almost any paint store.

(9) P. T. asks how to take stains made by Payson's indelible ink out of linen? A. Moisten with a little iodine, then with ammonia water, and rinse in clean water.

(10) E. H. writes: 1. Referring to your description of Blake's transmitter, on p. 274, vol. 41, SCIENTIFIC AMERICAN, how is the brass button filled with carbon? A. The brass is spun over the carbon. 2. Is it the carbon that weighs three pennyweights, or brass and carbon together? A. Both.

(11) W. S. H. asks: Can you give a simple test for oxygen water; that is, water supposed to contain an extra amount of oxygen—all it will take up? This water is called by some oxygensqua. A. Fill a quart bottle, provided with a perforated cork (tightly fitting) to admit a glass tube, with the water; heat nearly to boiling, and collect the gases given off in a small test tube, by displacement, over the pneumatic trough. Examine the gas with an ignited taper or splint of wood. Momentary increase in the intensity of combustion indicates an unusual amount of oxygen in the water. Compare results with ordinary well or cistern water.

(12) E. T. S., St. Clair, Mich., says: In your issue of August 14, G. G., in the article, "Evolution of Ideas," speaks of the "golden cut." Will you please illustrate what is meant? A. To divide by the "golden cut" is an expression used by mathematicians for dividing by "extreme and mean ratio," and this means, as G. G. correctly remarks, the dividing (of a line, for example) in such a manner that the whole has the same relation to the larger part as the larger part to the smaller, and *vice versa*. Let A B be the given line which is to be divided by the "golden cut." At B draw to A B the perpendicular B E, equal to one-half of A B. With E as center and A B as radius describe a circumference. Draw the straight line A E G, cutting the circumference



in F and G. On A B lay off A C = A F, and on the prolongation of B A lay off A D = A G. Then the line A B is divided interally at C (and externally at D) by the "golden cut," or in extreme and mean ratio. For since A B is a tangent and A G a secant, A B is, according to a well known thesis of geometry, a mean proportional between A G and A F.

$$AG : AB :: AB : AF$$
$$AG - AB : AB :: AB - AF : AF$$

Now, $FG = AB$ also $AC = AF$

$$AC : AB :: BC : AC$$
$$AB : AC :: AC : BC$$

The first proportion by composition gives:

$$AG + AB : AG :: AB + AF : AB$$

Since A G = A D and A B = F G we have

$$BD : AD :: AD : AB.$$

(13) F. P. S. asks: 1. Can paper be made to have the same strength and elasticity as leather? Can it be moulded into a form 6x2x1 inches, and so treated that it will have the same qualities as leather (several pieces glued together) would of these dimensions? A. See "Vulcanized Fiber," p. 10, vol. 38, SCIENTIFIC AMERICAN. 2. How can I make the edges of leather cut by a disk very smooth, and how can I polish them? A. Try a heated iron, or an ivory or bone burnishing tool. 3. How can I make a cement that will be a great deal stronger than glue, for cementing several pieces of leather together? A. See p. 2310, No. 158, SCIENTIFIC AMERICAN SUPPLEMENT.

(14) C. W. H. writes: I wish to learn how to mix shellac in liquid form, to be used in shellacking a cedar boat; that is, how much alcohol to a certain amount of shellac should be used, and how it should be applied so as to obtain a thin hard coating that will wear well. A. Place two pounds of orange shellac in a jug or demijohn, and pour over it one gallon of 95 per cent alcohol; allow it to stand for a day or so, shaking it occasionally, and stirring if it becomes solid at the bottom. When the shellac is entirely dissolved strain the varnish through a piece of flannel. Apply with a flat, soft brush.

(15) F. E. T. asks: What is nickel silver jewelry? I wish to get some of the metal, but find none advertised. A. German silver (a nickel silver) is composed of: 1. (for casting)—copper 5, zinc 2¼, nickel, 2½; 2. (for rolling)—copper 6, zinc 2, nickel 2½. The specimen metal sent is lead superficially rolled with tin.

(16) C. T. F. writes: I observe in your journal of July 31, p. 69, an article pertaining to the value of swamp muck. Please inform me how nitrogen is manufactured from swamp muck? A. Muck contains a large per cent of certain nitrogenous compounds, the products of the decomposition of which in the soil are readily assimilated by plants. The amount of nitrogen in the muck is an index of its richness in these *foods*. Free nitrogen is not readily obtainable from muck. In analysis it is usually determined in the form of ammonia (NH_4OH).

(17) M. F. P. writes: I would like to get the details of lacquering brass goods, such as lamps, springs, etc., to keep them bright and prevent them from tarnishing. See pp. 395 (15), vol. 42; 44 (39), vol. 38; 44 (53), and 188 (52), vol. 37; 242, vol. 34; 139 (41), and 336, vol. 32, SCIENTIFIC AMERICAN, and p. 630, No. 38, SCIENTIFIC AMERICAN SUPPLEMENT.

(18) J. J. M. asks (1) if a dynamo-electric machine will run of itself, or if a battery is applied to it. A. A dynamo-electric machine will generate an electric current without the aid of a battery. 2. What number of wire would I need to make bobbins 2 inches long, 1 inch in diameter? A. It depends on the style of the machine. See article on small electric machine in SUPPLEMENT 161.

(19) C. E. W. writes: I have both copper and brass moulds for small articles, but meet with failure in the metals not running sharp in the small lines. Have tried smoking, but does not work. What can I do to remedy it? I use the most fusible alloys. A. Heat the moulds well before pouring, and coat them smoothly with black lead.

(20) G. M. B. asks: 1. How is nitroglycerine made. A. Nitroglycerine is prepared by bringing glycerine drop by drop into a cooled mixture of very strong nitric and sulphuric acids. The nitroglycerine collects at the bottom of the vessel and is subsequently freed from the acids by carefully washing in a copious supply of water. 2. Is the explosion caused by the rapid transformation of a solid into a gas? A. Yes, in the case of nitroglycerine from the liquid to the gaseous state. 3. Would not iron, wood, or any substance cause explosion if instantaneously changed into a gaseous form? A. Yes. 4. Are the nitrates the only explosive substances known? A. No, gunpowder prepared with chlorate of potash explodes more violently than that in which niter is used.

(21) H. B. C. writes: Will you please inform me the best way to cut carnelian and moss agates? A. Some specimens may be readily cut by means of a thin rotating iron disk charged with emery and water. Extremely hard specimens require diamond dust. It should be mixed with a little olive oil and applied sparingly to the edge of the disk. To cut plane surfaces and facets on these stones use a flat lead lap wheel charged with emery and water. Polish with rotten stone and water applied to a pewter lap.

(22) E. F. L. asks how to cut and finish carnelians and agates. I have a United States dental lathe. A. See reply to H. B. C. above.

(23) C. & W. write: 1. We are putting in a sixty horse power locomotive pattern boiler. Shell 60 inches in diameter. We use the exhaust steam in a dry house. As we cannot use exhaust steam for heating water, we have extended the space behind the tubes four feet, and propose putting in a coil of 400 feet of 1¼ inch pipe through which water will be forced. The heat after passing through the tubes will strike this coil. Is the plan a good one? A. Your plan would heat a limited quantity of water. 2. Is it advisable to use steam jet instead of scraper, for cleaning tubes? A. The steam jet is used very successfully. 3. Should we run exhaust steam through a boiler, say thirty minutes, then close all openings except a pipe running down to water fifteen feet below; would not the steam condense and partially fill the boiler? If so, how full? 3. Yes, probably fill the boiler entirely.

(24) W. E. F. writes: In your SCIENTIFIC AMERICAN and the SUPPLEMENT you speak of preserving iron in water and ships' bottoms by the application of creosote. Is it oil of creosote as sold by druggists, and can it be applied with a brush on the outside? I am putting in a flume 90 feet long by 22x12; can I so coat the timbers? Also, I have a fine yacht: can I, when I haul her out for the season, and get her well dried under cover, paint her inside and out with oil of creosote and hope to make her last longer? A. Commercial creosote is commonly a mixture of creosote, picamar, and light tar oil. The colorless transparent liquid usually sold by pharmacists is the purified creosote. The former is the substance used for wood. The wood is impregnated with the creosote by immersing it in the liquid, usually under pressure. It is not usually applied with a brush, as you suggest, and is not suitable for inside woodwork.

(25) H. A. C. writes: A diploma on parchment was, as I thought, greatly injured by dropping writing ink near and adjoining the printing on the side of the diploma. Framing would not hide the blots. Not knowing what I was doing I used a strong solution of tartaric acid for the purpose of removing the stain. This only served to change the color of the blots from black to blue. It was much fainter, however, than before, and appeared to be in the parchment rather than on it, as before. The parchment had shrunken somewhat now after drying, but as the spot was not larger than a silver quarter, it was not noticeable. I now took chloride of lime to remove the blue stain, but this solution served to shrink the parchment where it was wet to a considerable extent. Not having any means of stretching the spot, and not knowing what to use for that purpose, I laid the diploma away as soon as it dried and have never since opened it. Will you tell me how can I get the spot back to its former dimensions? A. You may try the following: Moisten the spot with water, and rub it over gently at first with the white of an egg mixed with a small quantity of freshly prepared flour paste. Press between blotting paper with a warm iron. A little alum and a trace of oil may be added to the paste if found necessary.

(26) E. Y. D. writes: I have a sun dial made in Germany for 48° 15′ latitude, and I want to know if I get correct time with it in latitude 38° 50′; if

not, why? And how much difference will there be at 12 o'clock noon? A. We should infer yours to be a horizontal sun dial, and will give correct time only in latitude for which it was made, save when sun in meridian; because the gnomon or style by which the shadow is cast must be placed parallel with the polar axis of the earth, and the base upon which the shadow is cast parallel with the horizon, both of which cannot be done when a change of latitude is made. If the style of your dial is set truly in the meridian of your place, and depressed to correspond with your latitude, it will give you 6 o'clock A.M. and 6 o'clock P.M., also the exact sun or true time, at noon.

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

W. N. W.—Galena—lead sulphide, a rich lead ore. It probably carries a little silver—worth assaying.

COMMUNICATIONS RECEIVED.

On the Motion of the planets. By A. K.
On a New Theory of Planetary Movement. By J. H. S.
On Declination of the Magnetic Needle. By J. L. R.
No Current in Magnets. By W. B. F., M.D.
On Protecting Oil Tanks from Lightning. By W.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

August 17, 1880,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1865, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

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Carpet, app. for exhibiting, A. Peterson, Brooklyn, N. Y.
Leather splitting machine, J. A. Safford, Boston, Mass.
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Printer's quoin, H. C. Beach *et al.*, New York City.
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Advertisements.

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LIQUID FUELS FOR STEAM ENGINES. The opinion of an expert as to the economic value of naphtha as a substitute for coal in the production of heat and the generation of motive power. The recent experiments on the Long Island Railroad with naphtha fuel, and their results. Claims of the inventor of the Holland hydrocarbon retort. The modus operandi of the apparatus, and a criticism of the inventor's claims. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **238**. Price 10 cents. To be had at this office and from all newsdealers.

NAVIGATION OF THE AIR.—BY FRED. W. Breary, Hon. Sec. to the Aeronautical Society of Great Britain. A review of what has thus far been accomplished toward a solution of the problem of aerial locomotion; the errors of former experimenters pointed out; and the present and future aspect of the question considered. The direction in which future experiments should be made in order that success may be attained. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **240**. Price 10 cents. To be had at this office and from all newsdealers.

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