SCIENTIFIC AMERICAN

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Weekly.

THE BOYNTON UNICYCLE RAILROAD.

During several weeks last summer there were in regular and continuous operation, in railway passenger service, the locomotive and cars shown in the lower view herewith presented, the service being between Gravesend and Coney Island, on an abandoned section of an old standard gauge track of the Sea Beach and Brighton Railroad. The locomotive weighs nine tons, and has two 10 by 12 inch cylinders, the piston rods of both being connected with cranks on each side the single six-foot driving wheel, and the front of the locomotive being also supported by two 38-inch pony wheels, one behind the other. These wheels have double flanges, to contact with either side of the track rail, as also have similarly arranged pairs of 38-inch wheels arranged under and housed in the floors near each end of the cars.

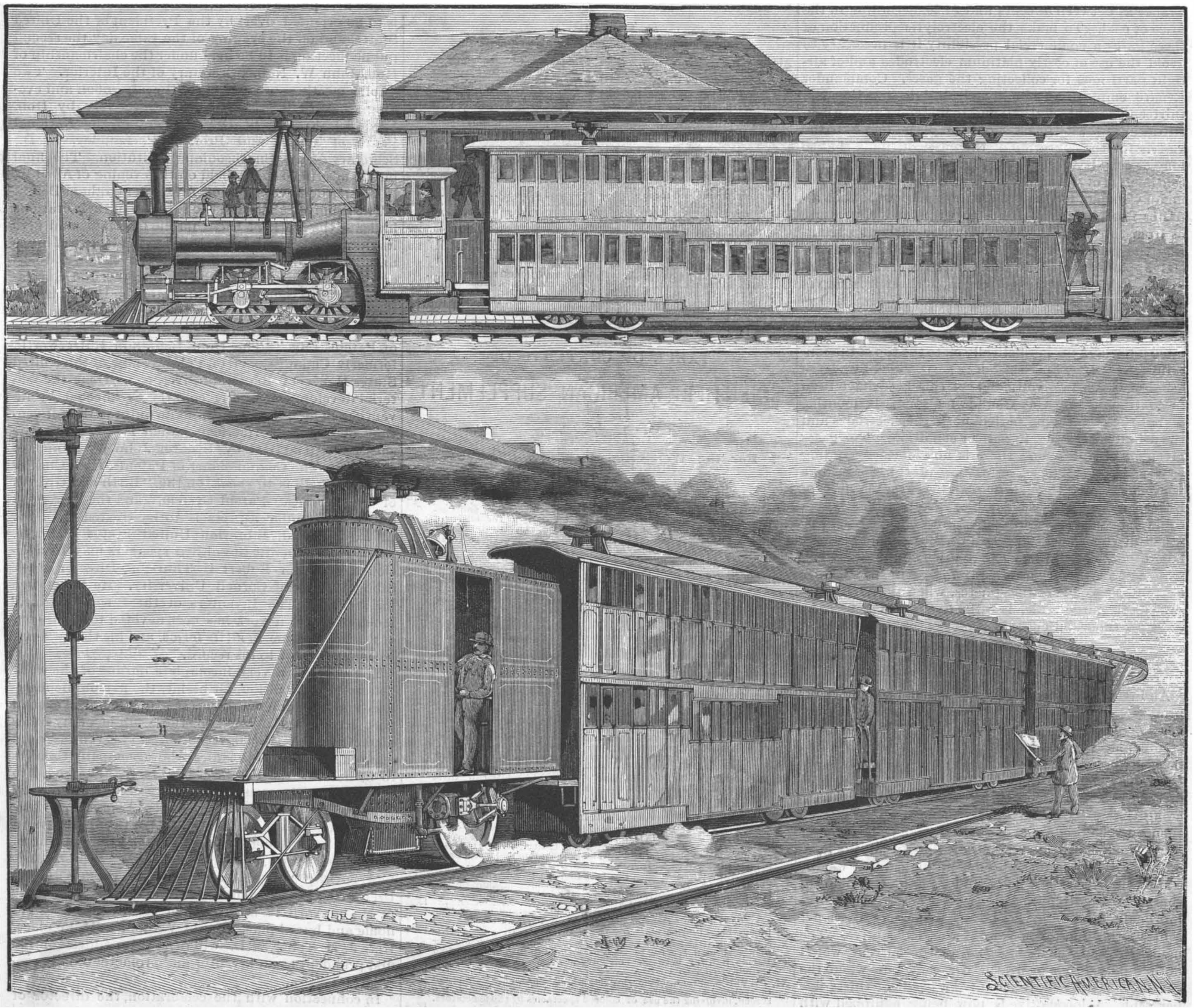
In the upper view is shown an improved locomotive especially designed for this method of traction, and built for use on a street railway of a Western city. It weighs sixteen tons and has a pair of five-foot drivers. The crank is only seven inches in length, and the engine is designed to readily make 600 revolutions a minute, and maintain a speed of 100 miles an hour with a full train of passenger cars. The first Boynton locomotive, described in the SCIENTIFIC AMERICAN in September, 1889, had an eight-foot driving wheel and weighed 23 tons. It proved too heavy for use on the old Coney Island road, although it was undoubtedly capable of making very high speed and easily drawing a heavy train of single-wheel cars on a properly arranged track.

In a true line with, and fifteen feet directly above, the face of the track rail is the lower face of a guide rail, supported from posts arranged along the side of the track, and on the sides of this guide rail run pairs of rubber-faced trolley wheels attached to the top of the locomotive and the cars. The guide rail is a simple stringer of yellow pine, 4¼ by 8 inches in section, and the standards on which the trolley wheels are journaled are placed far enough apart to allow a space of six inches between the contiguous faces of each pair of wheels, thus affording 1¾ inches for lateral play, or sidewise movement toward or from the guard rail, it being designed that the guide rail shall be arranged in the exact line of the true center of gravity of the cars and locomotive. The standards are bolted to six-inch wide strap iron attached to and extending across the top of the car.

The switching arrangement is remarkably simple. In addition to an ordinary track switch, in which, however, the switch bar is made to throw only one rail, a connection is made by means of a vertical rod and upper switch bar with a shifting section of the guide rail, whereby, on the moving of the track rail and the setting of the signal, the guide rail will be simultaneously moved, the adjustment being effected and both being locked in position according to the methods usual in ordinary railway practice.

The cars, as will be seen, are each two stories in height, each story being divided lengthwise into nine separate compartments, each of which will comfortably seat four passengers, thus providing seats for seventy-two passengers in each car. Each compartment has its own sliding door, and all the doors on the same floor of the car are connected by rods at the top and bottom with a lever in convenient reach of the brakeman, by whom the doors are all opened and closed simultaneously. The compartments are each four feet wide and five feet long, the seats facing each other. Only one rail of the old single track was used, as only one guide rail had been erected, except at the ends of the route, for switching purposes, but the width of the cars and motor was such that it only required the erection of another guide rail, for the utilizing of the other track rail, to form a regular double-track road of the Boynton pattern.

The section of road on which this system has been operated is only 1¾ miles long, in which distance the curves are considerable, but, although they are mostly in one direction, the indications of wear upon the traction wheels, and upon the guide rail and trolley wheels, were hardly perceptible. During a portion of the season, when the summer travel to Coney Island



THE BOYNTON UNICYCLE AND SINGLE-RAIL TRACK RAILROAD, FOR HIGH SPEED TRAFFIC.

was at its height, trains were run on regular schedule time, fifty three-car trains daily each way, carrying from one to three hundred passengers per trip. The regular time taken for the run was three minutes, but special trips were made in two and three-quarter minutes each, including starting and stopping. The daily consumption of coal in performing this service was but half a ton. The great economy of this method of traction is also evidenced by the smoothness with which the cars run, and the entire absence of side motion and vibration, there being no striking and grinding of the wheel flanges upon the rails, as is common on double-track roads. From a seat in the top part of the tender, where one could observe how the trolley wheels followed the guide rail, it was noticed that frequently, for considerable distances, these wheels did not touch the guide rail at all on either side, and when they did approach and bear upon the guide rail it was with a gently swaying movement, indicating no expenditure of power at this point, and apparently having no effect upon the motion of the car. This was, of course, to be expected, in this system of locomotion, when a high speed is attained, and it is upon this point that the claim is made by the advocates of such systems, that in this way only is it possible to obtain greatly increased speeds on railways with the present styles of motors.

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Hydrogen and Oxygen Produced by Electricity

In a paper recently read before the Société Française de Physique Commander Renard described his investigations on the electrolysis of water on a commercial scale, which he commenced as far back as December, 1887. Taking the counter E.M.F. at one and five-tenths volt, and the total plant efficiency at only 50 per cent, thirty-five and three-tenths cubic feet (one cubic meter) of hydrogen can be produced for every ten horse-power hours; and taking the coal consumption at two and two-tenths pounds (one kilogramme) per horse-power hour, the cost of fuel for every thousand cubic feet at atmospheric pressure of the mixed gases comes out in France at between 32 cents and $1.20, according to the price of coal. To make the electrolytic production of these gases a commercial possibility it is necessary to avoid the use of costly platinum electrodes and of air-tight partitions for collecting the gases. Commander Renard employs an alkaline electrolyte (caustic soda, thirteen per cent solution) and is therefore able to substitute cheap cast iron electrodes for platinum. As to the vessels for the collection of the gases, he finds that so long as they have a *capillary reaction* Δ equal to a few centimeters of water, the hydrogen and oxygen do not mix. Commander Renard employs porous pots of asbestos fiber, which are able to withstand a pressure of from thirty to fifty cms. of water without permitting the passage of the gases. The actual commercial apparatus used at the Chalais works is as follows: A large cylinder of common sheet iron serves at the same time as the containing vessel for the electrolyte and as the negative electrode. The positive electrode is a perforated iron tube, fixed on to an insulated lid, which fits hermetically on to the top of the containing vessel. This electrode is surrounded by a large asbestos bag. Two voltmeters of this kind have been in continuous work at Chalais for some six months, and at the end of this period both the electrodes and the asbestos bag were in perfect condition. The gases given off are pure, and there is no ozone. According to Commander Renard, a battery of thirty-six large voltmeters could generate about 200 cubic feet of hydrogen and 100 cubic feet of oxygen per hour, which could be compressed to a pressure of from 120 to 200 atmospheres in steel tubes, and utilized for therapeutic, laboratory, metallurgical, and other purposes. The *total* cost of these gases, ready for use in steel bottles at a pressure of 120 atmospheres, when produced on a sufficiently large scale, is estimated at from $2.92 to $3.54 per thousand cubic feet.

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Electrical Welding of Wheels and Rails.

An invention is now undergoing investigation which promises the improvement of railway traffic. The invention consists of a small dynamo and an auxiliary engine placed upon the locomotive in such a way as to be easily operated, furnishing a current of small force but large quantity, which is made to pass from one pole of the dynamo to one pair of driving wheels, thence along the rail to the other pair of driving wheels, thence to the other pole of the dynamo, thus forming a traveling circuit, moving at all times with the locomotive. By means of this current an incipient weld is caused between the wheels and rails at the point of contact, preventing the slipping of wheels. The working model of the device shows an increase of 400 per cent in the hauling power of the locomotive. The model without the application of the current would not mount a grade of fifteen per cent, but when the current was applied, it mounted a grade of thirty-five per cent. A locomotive is now being equipped with the invention to test it on the Baltimore and Ohio Railway.

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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 795.

For the Week Ending March 28, 1891.

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THE CELEBRATION OF THE BEGINNING OF THE SECOND CENTURY OF THE AMERICAN PATENT SYSTEM.

The coming month is to witness the celebration of the Beginning of the Second Century of the American Patent System. On April 8, 9, and 10, a grand convention of all who appreciate the value of the American patent system is called to meet at Washington, D. C. The programme, lists of committees, names of speakers and subjects of their addresses have been published. The occasion is an impressive one; the *personnel* of the meeting, it is not too much to say, seems to rise to the occasion. Without the encouragement of the patent system the inventors of America would never have worked as they have in the past. With no statutory right to the fruits of their intellectual toil they would never have appeared on the scene as the moving force in so many parts of the commercial, agricultural, and mechanical world. The gathering at Washington of the leading scientific and mechanical workers of the age and race, the oral exposition of the law and statistics of invention, of the science and practice of invention and of its specific applications, the interesting collections in science and art, and the historical models of inventions which will be produced, all co-operate to give the occasion an importance not exceeded in the case of any convention ever held in Washington.

Our views on the maintenance of the rights of the inventor and on the preservation of the force of the Patent Statutes are known, and have often been recorded. In this convention, to include the best minds of the day among its active participators, we recognize a tribute to the inventor and an auxiliary in the defense of his rights. The voices and opinions of the old-time federal judges, upholding the dignity of the inventor and his vital importance to America, will be re-echoed in no uncertain tones during the three days of commemoration. A chance will be afforded our legislators to hear the just views of the nation's thinkers upon the patent system. A barrier will be opposed to future attacks upon it, and the moral force of the convention will be great and lasting.

The first public meeting, on the afternoon of April 8, is to be presided over by the President of the United States, and on the evening of the same day the second public meeting is to be held under the chairmanship of Hon. John W. Noble, Secretary of the Interior. Two public meetings are called for the afternoon and evening of April 9, presided over respectively by Hon. Frederick Fraley, LL.D., president of the National Board of Trade, and Prof. S. P. Langley, LL.D., Secretary of the Smithsonian Institution. The final public meeting is to be held on the evening of April 10, to be presided over by Prof. Alexander Graham Bell.

The list of speakers and the subjects of their orations indicate the work of these public meetings, and give its character. Dr. John S. Billings, a scientist of international reputation, is to treat of "Invention and Discovery in the Field of Medicine, Surgery, and Sanitation." Judge Samuel Blatchford, of the United States Supreme Court, perhaps the leading judicial exponent of patent law, is to speak on the subject of "A Century of Patent Law." The Hon. Benjamin Butterworth, formerly Commissioner of Patents, now of the United States House of Representatives, is to treat the material development of the country as affected by invention. The "New South," as an outgrowth of invention and of the American patent law, is to be the subject of an address by Senator John W. Daniel, of Virginia. The Commissioner of Patents, Hon. Charles Eliot Mitchell, is to speak on the "Birth and Growth of the American Patent System," and the copyright system in similar aspects is to be treated by Hon. A. R. Spofford, Librarian United States Congress. Among the other distinguished speakers may be mentioned Professor Robert H. Thurston, Director of the Sibley College of Cornell University. He has chosen for subject "The Inventors of the Steam Engine." Much of his own work has been devoted to the theory of the heat engine in all its forms, and his theme seems peculiarly suited to his record.

The above is a very incomplete outline of the work before the convention, for besides the five public meetings and the numerous addresses, of which but a small part have been alluded to, there will be many other attractions. A special reception to inventors and manufacturers, and to ladies who accompany them, is to be held at the Patent Office on April 8, from 9 to 11:30 P. M. The guests are to be received by Secretary Noble and Commissioner Mitchell. Anniversary Day is the name given to April 10. On this date, over a century ago, General Washington, as President of the United States, signed the first American Patent Law, entitled "An Act to Promote the Progress of the Useful Arts." In commemoration of this act, at 10 A. M., on April 10, an excursion to Washington's old home and burial place, Mount Vernon, will take place. Here J. M. Toner, M.D., will deliver an address on the first president as an inventor and promoter of improvements.

In connection with the celebration, the director of the National Museum has consented to furnish space for a loan exhibition of relics, old models, and ancient patents. J. Elfreth Watkins as secretary of the executive committee has issued a request for the contribution of such articles from the citizens at large. Any one possessing such objects of interest should at once communicate with the secretary with a view to their exhibition.

The most permanent and lasting action has yet to be spoken of. It is proposed to hold meetings on the afternoon of April 7 and on the mornings of the succeeding days to organize the National Association of Inventors and Manufacturers. At these meetings addresses from representatives of the above branches of work are expected. This organization, if successful, may have far-reaching results, and in any case will serve to perpetuate the memory of what will, we believe, obtain recognition as one of the most important and significant conventions ever held in the national capital.

POSITION OF THE PLANETS IN APRIL.

URANUS

is morning star until the 19th, when he becomes evening star. He holds the place of honor on the April record, for his opposition to the sun takes place on the 19th, at 1 h. P. M. He is then on the meridian at midnight, at his nearest point to the earth, and in the best position for observation. He will be found about 8° east of Spica, retrograding or moving westward. He is visible to the naked eye as a faint star of the sixth magnitude. In the telescope he appears as a small disk, of a delicate sea-green color.

The moon is in conjunction with Uranus on the 23d, at 1 h. 26 m. P. M., being 2° 46′ north.

The right ascension of Uranus on the 1st is 13 h. 53 m., his declination is 10° 59′ south, his diameter is 3″.8, and he is in the constellation Virgo.

Uranus rises on the 1st at 7 h. 47 m. P. M. On the 30th he sets at 4 h. 30 m. A. M.

JUPITER

is morning star, and is joint actor with Venus in the most interesting event of the month. The regal planets are in conjunction on the 7th, at 4 h. 25 m. P. M. Jupiter is then only 13′ north of Venus, the space intervening between them being a little more than one-third of the diameter of the moon. Both planets are invisible at the time of conjunction, but will not be far apart on the morning of the 8th, rising about 4 o'clock, nearly an hour and a half before the sun. Jupiter is west of Venus, is receding from the sun, and approaching the earth, and when the month closes will rise more than two hours before the sun. Early risers who command a view of the southeast horizon will behold a charming celestial picture.

The moon is in conjunction with Jupiter on the 5th, at 5 h. 39 m. P. M., being 4° 34′ south.

The right ascension of Jupiter on the 1st is 22 h. 31 m., his declination is 10° 17′ south, his diameter is 32″.6, and he is in the constellation Aquarius.

Jupiter rises on the 1st at 4 h. 22 m. A. M. On the 30th he rises at 2 h. 42 m. A. M.

VENUS

is morning star. After her conjunction with Jupiter on the 7th there is nothing to vary the even tenor of her course as she draws nearer to the sun, rising later, lessening in size, and diminishing in luster. She is not half as brilliant as she was in January, her light number decreasing from 218 in January to 91 on the 1st. The illuminated portion of her disk increases during the month from 0·698 to 0·791.

The waning moon is in conjunction with Venus on the 5th, at 2 h. 32 m. P. M., being 4° 51′ south.

The right ascension of Venus on the 1st is 22 h. 12 m., her declination is 11° 31′ south, her diameter is 16″.4, and she is in the constellation Aquarius.

Venus rises on the 1st at 4 h. 7 m. A. M. On the 30th she rises at 3 h. 38 m. A. M.

MERCURY

is evening star. He reaches his greatest eastern elongation on the 19th, at 3 h. A.M., and is 20° 1′ east of the sun. The conditions at that time are most favorable for observation with the naked eye, and careful observers will be sure to find him, for he is in high northern declination, and sets about an hour and three-quarters after the sun. He must be looked for in the north west, about three-quarters of an hour after sunset, a few degrees southwest of the Pleiades. If the sky be cloudless and the atmosphere pure, he will surely be found, shining with fitful brilliancy on the twilight sky.

The slender crescent moon, when one day old, is in conjunction with Mercury on the 9th, at 6 h. 14 m. P. M., being 4° 37′ south.

The right ascension of Mercury on the 1st is 1 h. 17 m., his declination is 8° 16′ north, his diameter is 5″.4, and he is in the constellation Pisces.

Mercury sets on the 1st at 7 h. 3 m. P. M. On the 30th he sets at 7 h. 59 m. P. M.

SATURN

is evening star. He reaches the meridian on the 1st at 10 h. 15 m. P. M., and still continues in most favorable conditions for telescopic observation. He is moving westward, and, in telescopes of low power, his rings no longer look like rings, but resemble lines of light passing through the center of the planet, and extending from each side.

The moon is in conjunction with Saturn on the 19th, at 0 h. 33 m. P. M., being 3° 16′ north.

The right ascension of Saturn on the 1st is 10 h. 56 m., his declination is 9° 11′ north, his diameter is 18.″4, and he is in the constellation Leo.

Saturn sets on the 1st at 4 h. 45 m. A. M. On the 30th he sets at 2 h. 46 m. A. M.

MARS

is evening star. He is in conjunction with Neptune on the 28th at 11 h. 26 m. A. M., Mars being 2° 17′ north.

The right ascension of Mars on the 1st is 2 h. 58 m., his declination is 17° 22′ north, his diameter is 4″.6, and he is in the constellation Aries.

Mars sets on the 1st at 9 h. 18 m. P. M. On the 30th he sets at 9 h. 7 m. P. M.

NEPTUNE

is evening star. His right ascension is 4 h. 12 m., his declination is 19° 31′ north, his diameter is 2″.5, and he is in the constellation Taurus.

Neptune sets on the 1st at 10 h. 44 m. P. M. On the 30th he sets at 8 h. 51 m. P. M.

Mercury, Neptune, Mars, Saturn, and Uranus are evening stars at the close of the month. Jupiter and Venus are morning stars.

How to Mount Maps and Drawings.

A short time since, in the "Query" column of your paper, I noticed an inquiry in regard to the best method of mounting drawings, etc., on cloth. The answer you gave, while correct, so far as it goes, is apt to mislead a novice, and will not give the most satisfactory results.

To begin with, a paste of good quality is required. When paste is made at home, trouble often arises from scorching, or from the addition of too much water. Thoroughly made paste, when spread on paper, will not strike through, but will remain on the surface, like butter on a piece of bread. To enable the paste to keep for several months in a cool place, add dissolved alum as a preservative, in the proportion of a tablespoonful of pulverized alum in two quarts of warm or hot water.

Put the water in a tin pail that will hold six or eight quarts, as the flour, of which the paste is made, expands greatly while it is boiling. *As soon as the water has cooled*, stir in good rye or wheat flour until the liquid has the consistency of cream. Beat thoroughly with a paddle-shaped stick, and see that every lump is crushed before placing the vessel over the fire. Care should be exercised to have the water cool before adding the flour, otherwise the paste will be lumpy.

To prevent scorching the paste, place on the fire a pot or kettle partly filled with water, and set the pail containing the paste materials in the water, permitting the bottom to rest on a few large pebbles to prevent excessive heat. Of course, a "farina kettle," or "double boiler," is better, and will be less troublesome to handle, but the "ruling element" of the kitchen will not always permit its use. Add a teaspoonful of powdered resin, a few cloves tied in a cloth, so that they will flavor and not discolor the paste, let it cook until it assumes the consistency of "mush," then, if any lumps appear, strain through a sieve. Keep in a tight jar, and if it becomes too thick after standing, put the quantity required in a suitable dish, and thin by adding cold water and stirring thoroughly.

So much for the paste. Now let us proceed to the mounting. Cut the cloth from one to two inches larger all around than the drawing or paper to be mounted. Lay it on a drawing board or table, dampen well with a sponge, stretch lightly, and tack down; use small tacks, and place them four or five inches apart, or closer, if necessary.

Leave it for a moment, and while its surface is evaporating and absorbing the surplus dampness, lay the drawing, map, or paper to be mounted face downward on another table, and dampen the back with a wet sponge. Returning to the cloth, with a brush (a large, round fine-haired paint brush is best) lay the paste on evenly and smoothly, and then, after the surface is well covered, take the brush and BEAT *the paste* thoroughly into the pores of the cloth. After this is done, smooth the surface nicely.

Take up the paper by the corners, and, if the thickness of the paper seems to require it, apply the sponge again. The paper should be *limp, but not wet.* If it is not well prepared, my experience has been that the surface will "blister," particularly on large drawings, for the paste adheres much better to a damp surface than to a dry one.

At this stage it is best to obtain some assistance. Have your assistant grasp two of the corners of the drawing or paper while you manage the others, holding the paper suspended horizontally a few inches above the cloth. When it is in the right position place your end on the paste-covered cloth, while your assistant still holds his end up. Place a piece of clean paper on top to prevent smearing the sheet, and with the hands brush quickly from the middle of the end toward both sides, working constantly toward your assistant as he slowly lowers the paper to the cloth. Rapid manipulation is necessary to insure perfect contact and a smooth surface.

Should any "blisters" develop, rub them briskly with the bone handle of an eraser or any similar substance. Small undulations will disappear when the cloth dries. Stand the board aside with the cloth tacked to it, and allow to dry thoroughly, then cut off as required.

Ordinary bleached cotton cloth or sheeting makes a good backing for small sheets, while large ones are best mounted on a heavy grade of unbleached material. These directions are general, and have been found to work well in practice. Individual experience can alone, however, determine many of the details.

Other paste than that described may be used if desired, though it is doubted whether a better can be obtained. Should any of your readers know of a better method, many, including the undersigned, would doubtless be glad to hear of it. CHAS. L. BAILEY.

Washington, March 9, 1891.

The Water Beetle.

Lately I kept for a few days for inspection that very beautiful insect the water beetle. The specimen was large and splendidly colored, gold banded, and displaying brilliant iris hues on its legs. I placed it in a glass jar of water. On the surface of the water some leaves were laid. On one side of the jar, at the bottom, was pasted a square of paper, and to the shelter of this the beetle often retired. It seemed to take the greatest delight in darting, swimming, and diving, rising from the bottom of the jar to the top of the water by long, vigorous strokes of its hind legs. Then joining its second pair of legs before it, like a swimmer's hands, and stretching the hind pair out nearly together, it would dive to the bottom. It slept hanging head downward under the leaves, with the tip of the body above the water to secure air.

It showed the pleasure of a child in "blowing bubbles." Rising to the surface, it would put the tip of its body above the water, part the elytra, and take in air; then, closing its case, it would dive to the bottom, stand on its head, emit the air bubble by bubble until it was exhausted, and come up for a new supply. It seemed to need the daily renewal of the water in the jar. When it was hungry, or the water was not fresh enough, it became dull and sulky, and hid behind the paper. After the beetle had fasted twenty-four hours, I laid on the top of the water a wasp, a mosquito, a blue bottle fly, and a common fly, all dead. The beetle, being at the bottom of the jar, did not seem to see or smell these insects. Rising presently, he came up against the mosquito, seized the body in his jaws, and sucked it dry with one pull. He then found the blue bottle, carried it down to the shelter of the paper, trussed it neatly, cutting off the wings, legs, and head, and letting them float to the surface. He then held the body in his hands, or short front feet, pressed to his jaws, and sucked it dry. After this he rose to the surface, found the other fly, and served it in the same fashion. Next he found the wasp, a large one. Carrying this below, as he had the flies, he clipped off the wings and legs, but took the precaution to suck the head and thorax before turning them adrift. He also grasped the body in his hands, pressed the part that had been cut from the thorax to his mouth, and holding it exactly as if drinking out of a bottle, he drained it dry.

I found that he could eat all the time, except when he was asleep or playing, and his activity was in proportion to the quantity of his food. Cooked meat he would none of. Raw beef he did not greatly like, but raw veal he prized even above wasps and blue bottles. I cut an ounce of raw veal into dice, and dropped it in the bottom of the jar in a heap. He did not seem to see or smell it, but after a while happened to dive into it. He appeared to be full of joy at the discovery. One fragment after another he took in his hands, held it closely to his jaws, and sucked it dry by strong pulls. At each pull I could mark the receding red juice of the meat. When the veal was reduced to a pale fiber, he let it go and took a fresh bit. He always retired to the shelter of the paper to eat, with the sole exception of the mouthful he made of the mosquito. Like the King of Dahomey, he would not eat in public. —*Julia McNair Wright, in Science.*

Engineers Must Study.

A few years ago, says the *Stationary Engineer*, no one dreamed that in so short a time the electric light would become a regular part of the equipment of mills and factories. It was only when the dynamo found its place in the engine room and the incandescent light sparkled in the shops and workrooms that the engineer found anything of special interest to him in the study of electricity. Now he must study it whether he will or no, and though the knowledge he most requires must be of a practical nature, he must have a goodly amount of theoretical or "book" information in order to understand what he is doing.

What a Horse Would Say if He Could Speak.

Don't hitch me to an iron post or railing when the mercury is below freezing. I need the skin on my tongue.

Don't leave me hitched in my stall at night with a big cob right where I must lie down. I am tied and can't select a smooth place.

Don't compel me to eat more salt than I want by mixing it with my oats. I know better than any other animal how much I need.

Don't think because I go free under the whip I don't get tired. You would move up if under the whip.

Don't think because I am a horse that iron weeds and briars won't hurt my hay.

Don't whip me when I get frightened along the road, or I will expect it next time and may be make trouble.

Don't trot me up hill, for I have to carry you and the buggy and myself too. Try it yourself some time. Run up hill with a big load.

Don't keep my stable very dark, for when I go out into the light my eyes are injured, especially if snow be on the ground.

Don't say whoa unless you mean it. Teach me to stop at the word. It may check me if the lines break, and save a runaway and smash up.

Don't make me drink ice cold water, nor put a frosty bit in my mouth. Warm the bit by holding it a half minute against my body.

Don't forget to file my teeth when they get jagged and I cannot chew my food. When I get lean, it is a sign my teeth want filing.

Don't ask me to "back" with blinds on. I am afraid to.

Don't run me down a steep hill, for if anything should give way, I might break your neck.

Don't put on my blind bridle so that it irritates my eye, or so leave my forelock that it will be in my eyes.

Don't be so careless of my harness as to find a great sore on me before you attend to it.

Don't lend me to some blockhead that has less sense than I have.

Don't forget the old book that is a friend of all the oppressed, that says: "A merciful man is merciful to his beast."—*Farm Journal.*

◆

The Source and Force of Electricity.

"All the energy in the world," said Dr. C. F. Chandler, in a recent lecture before the Columbia School of Mines, "comes from sunshine. Even the energy in the electric battery that rings the door bells of our homes has its origin in the light of the great solar system. The force in the copper wire that sets the bell to ringing comes from the zinc plate in the battery jar. The energy in the zinc plate comes from the anthracite coal with which it was burned when taken from the mines, and, finally, the energy in the anthracite coal was put there by the sunlight that fed and nourished it when it existed, ages ago, as trees and plants.

"An interesting misapprehension that exists in the minds of a good many persons is concerning the vital dangers that lurk in the pressure of say a thousand volts. The newspapers often tell us that a man has been killed by such a pressure, whereas, in fact, such a pressure alone couldn't kill a humming bird. I have frequently caught in my hand sparks possessing an electro-motive force of 100,000 volts without feeling anything more than a very slight burn.

"The danger arises only when the volts are re-enforced by a good many amperes or currents, as when one takes hold of a charged wire. Then one feels a shock that is unmistakable, because the force of a great many currents in the wire suddenly decomposes all the fluids in his body. The salt in the blood at once turns to chlorine gas, and the man whose veins are charged with this deadly poison cannot in reason be expected to live long."

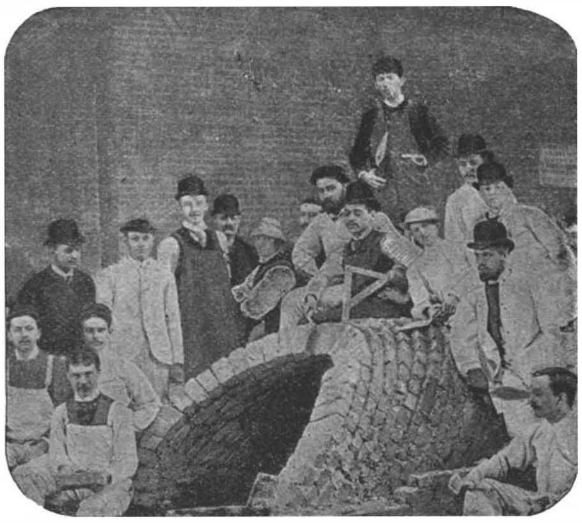
◆

IT is computed, in recently made statistics, that the glass bottle production of the world amounts to a daily output of a little over eleven million bottles. Of these, Germany, Belgium, and Austria-Hungary make more than three-fourths, England and Sweden coming next, while the production of France and the United States combined is said to be quite inconsiderable in comparison.

ORIENTAL METHOD OF VAULTING.

Layard describes some curious channels or drains found in excavating at Nimroud and Kouyundjik. At Khorsabad he found the same thing in better condition and more carefully constructed. The drains were formed of arches, pointed, semicircular, and elliptical. These are illustrated by very good engravings taken from Perrot and Chipiez's "History of Chaldea and Assyria."

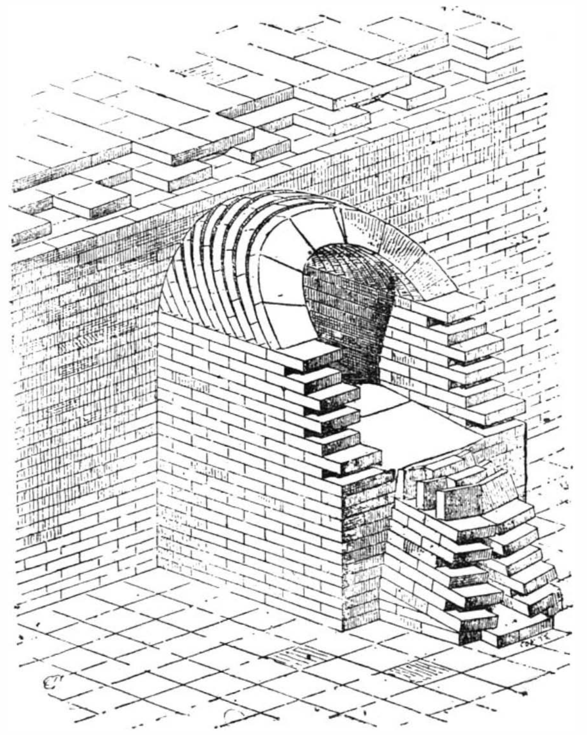
In the case of the pointed arches, there are no keystones. The openings left at the summits of the courses are filled in with brick earth beaten tight, and serving the purpose of keys; but the most remarkable peculiarity of these drains is the fact that the different courses of the arches have considerable inclination in the direction of the length of the drain or vault. The most plausible explanation of this peculiar construction is that it was adopted to facilitate the work of the bricklayers.



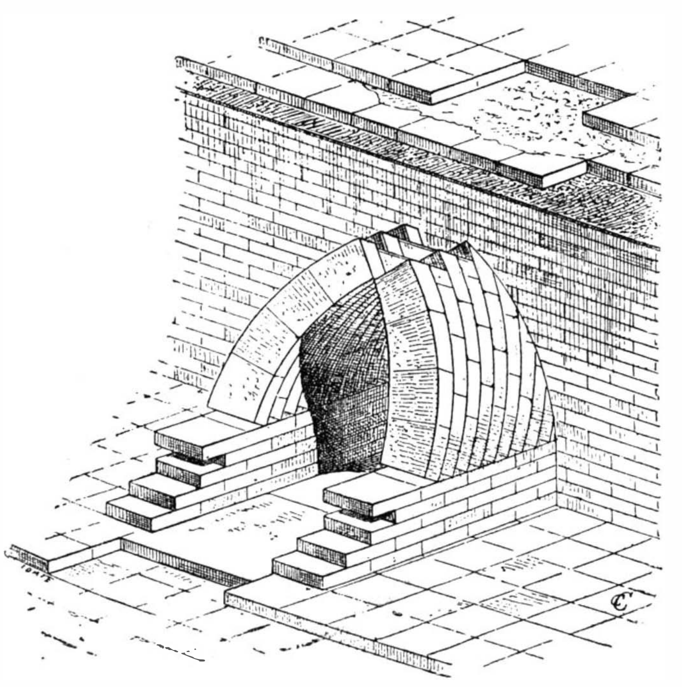
VAULT FORMED WITH SLANTING ARCHES.

According to this explanation, the first course of voussoirs would be sloped, and would rest upon a mass of crude brick at the center of the building; the bricks of the second course would lean against those of the first, and so on throughout the entire structure. This method of building could be easily carried out without an internal support, and as a consequence this kind of work could be rapidly carried forward with but few laborers.

In a lecture recently delivered before the Brooklyn Institute, by Prof. W. R. Ware, of the Department of Architecture, Columbia College, a very interesting description of this mode of vaulting without timber centers was given, and applications of the principle to the formation of large arches and vaults were illustrated. Among the noteworthy illustrations was one which we here present of a vault built upon this principle by some of the students of Columbia College School of Mines at Col. Auchmuty's Industrial School in this city. This experiment clearly proves that a vault can readily be built according to this system without timber centers.



SEWER AT KHORSABAD—SEMICIRCULAR VAULT.



DRAIN AT KHORSABAD—POINTED ARCH.

In view of the simplicity and practicability of this method, it would seem to be worthy of the attention of modern mechanics, as long stretches of vault suitable for many uses can be quickly made in this manner, and the time and material required for the erection of timber work can be wholly saved.

It will be seen that only enough inclination is required in the successive courses to cause the bricks to retain their position by their own friction until the course is complete.

Life of Incandescent Lamps.

In the manufacture of incandescent lamps, success may be said to depend on several small points. The exhaustion, we know, must be as complete as possible to insure long life and reasonable efficiency. During the exhausting process it is the usual practice to heat the carbon filament to incandescence, in order that all air contained in the substance may be expelled. It has been found that if the filament is heated at too early a point during the exhausting process, it produces a more or less porous condition of the carbon and that a lamp made in this manner has neither a very long life nor a high degree of efficiency after having been in use for a short time. As an improvement on this, the globes are exhausted to as great a degree as may be and in as short a time as possible; then the current is passed through the carbon, and it is brought to incandescence for a few moments while the vacuum pump is still working. The vacuum pump used in this process is wholly mechanical and very quick acting and is reported to be much quicker in its action than the mercury pumps commonly in use for this purpose. From two sets of lamps made from similar filaments, a writer in the *Stationary Engineer* has discovered that one set exhausted in the usual way by mercury pumps, while the filaments were heated by the current, the other set treated with the mechanical pump and the current sent through the filament just previous to sealing the lamps, showed in the latter case the highest efficiency and longest life. The reasons for this may be inferred to have been that in the former case the filaments were partially disintegrated in the rarefied atmosphere.

◆

The Chinese Can Sing.

An impressive scene recently was presented at the Congregational church in Stockton, California. The occasion was the celebration of the anniversary of the Chinese Mission in that city. A part of the exercises consisted of singing in chorus and solos and addresses by the Chinese. The singing, especially of solos and hymns, was a surprise, as it was generally supposed that the Chinese were destitute of capacity in that direction and incapable of appreciating harmony, judging by what travelers in China tell us and of the barbarous exhibitions given in this country by untaught immigrants. One soloist particularly carried the audience by storm and elicited applause that was with difficulty checked.

◆

Filing Commutators.

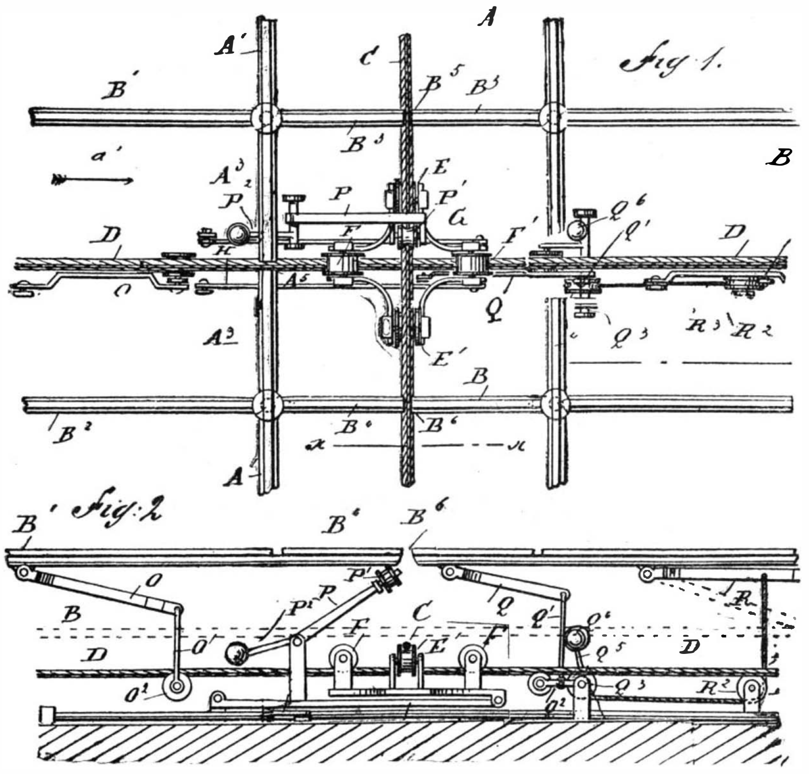
Whenever it becomes necessary to file the commutator of a dynamo or motor, the persistency with which the copper will stick in the creases of the file causes considerable annoyance, and not only this, but the particles will scratch the copper segments. Filing a commutator is not the best way of dressing one up, but it is infinitely superior to allowing it to run while in a rough condition.

If the filing is done steadily while the machine is running at a fair speed only, no difficulty need result from such practice. The greatest trouble will be found in the particles of copper sticking in the grooves of the file. This can be practically avoided, says the *Stationary Engineer*, by first wetting the file in a bucket of water, which will prevent the copper particles from sticking, although it allows them to accumulate, but that is no detriment, as they can be easily washed out simply by the application of water while rubbing with the fingers. To keep the file wet, a bucket of water should be kept close at hand, into which the file is to be dipped before commencing work and as often afterward as occasion may require. The small amount of moisture that will adhere to the file will not in any way injure the commutator or its insulation. The greatest difficulty to be met with will be in keeping the commutator round. If filed out of round to such an extent as to cause any trouble, the commutator should then be chalked and the high places filed down, which will bring it sufficiently true to work without trouble of any kind. From a number of experiments in drilling and filing copper we have found, says the writer, that the use of water assists materially in the work when the tools are kept wet with it.

AN IMPROVED CABLE RAILWAY CROSSING.

The illustration shows plan and sectional views of a cable railway crossing so arranged as to bring the crossing cables near each other, while preventing the cables from coming in contact. The main track, A, is crossed at right angles by the track, B, C being the main cable and D the crossing cable. Two pulleys, E E′, are arranged in line at right angles with pulleys, F F′, to turn in the frame, G, which is held in position by a lever, H, extending in the direction of cable, D. The pulleys, F F′, are supported by cable, D, and a counterpoised lever, not shown, but similar to lever, P. Cable, C, passes over the pulleys, E E′, which are so arranged with pulleys, F F′, to frame, G, that the cables are prevented from coming in contact with each other. When the crossing cable is elevated by a grip car approaching in the direction of arrow, *a′*, the grip carries the cable to the height shown by the dotted lines in Fig. 2. A pulley attached to the grip, but not shown, then engages the under surface of lever, O, which is raised to a horizontal position, its pulley, O², supporting the cable until the grip is swung to the left by a curve in the slot, when the mechanism swings down to allow the grip to pass over cable, C. In the path of the grip over cable, C, is a counterpoised broad lever, P, having mounted on its free end a pulley, P′, to engage cable, C, and prevent it from swinging upward as the crossing cable grip is passing over it. The grip next engages lever, Q, in the same manner as lever, O, the mechanism permitting the necessary upward motion of the cables as a car approaches the crossing, and, without bending either cable over the pulleys, preventing them from coming in contact with each other.

Further information relative to this invention may be obtained of the patentee, Dr. James P. Orr, No. 638 Fifth Avenue, Pittsburg, Pa.



ORR'S CABLE RAILWAY CROSSING IMPROVEMENT.

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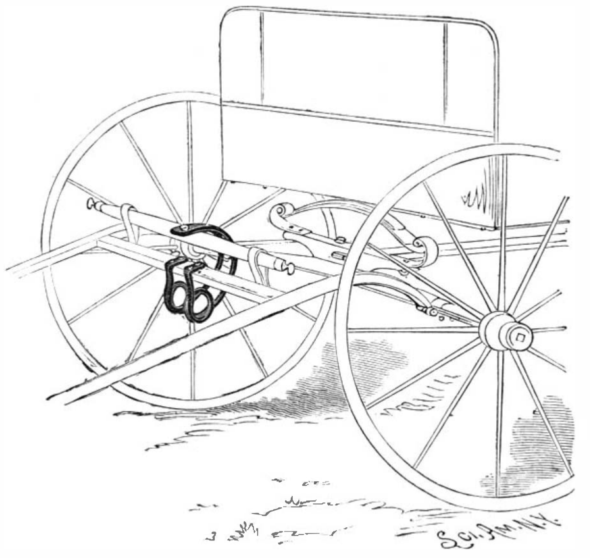
A SPRING DEVICE FOR SINGLETREES.

The device shown in the illustration, which has been patented by Mr. Benjamin B. Allen, is designed to lessen the racking of carriage tops from the sudden jerking of the vehicle, and prevent shock to the horse's shoulders in pulling carriages supplied with the attachment over rough or uneven roads. The attachment consists of a double or bifurcated coil spring, the coils being arranged parallel with each other, and having upwardly extending arms firmly riveted to the cross bar connecting the shafts. Bent rearwardly and upwardly curved arms of the spring meet in a common center portion where the bifurcated section terminates, and this free end is centrally pivoted to the singletree, which is free to swivel or vibrate as affected by opposite side pulls. To prevent too much movement of the singletree, and limit the pull on the spring attachment, the ends of the singletree are loosely held by flexible loops or straps fastened to the cross bar.



ALLEN'S SPRING-ATTACHED WHIFFLETREE.

Further information relative to this invention may be obtained of Messrs. Weisbaum & Wilson, P. O. box No. 186, Hanford, Cal.

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IT is said the largest mass of granite ever quarried was taken out by the Bodwell Granite Company, in Vinalhaven, Me. It exceeds in length any of the Egyptian obelisks, the tallest of which was brought from Heliopolis and subsequently taken to Rome, where it now stands. This monument is 105 feet high. The Vinalhaven shaft will be 115 feet high, 10 feet square at the base and weighs 850 tons. This would, perhaps, form a good monument to the memory of General Sherman.

Discovery of Chaldean Monuments in the City of London.

BY PROFESSOR DOUGLAS.

If the house of Mr. Augustus Franks or of any other well known collector of Oriental porcelain were overwhelmed and destroyed by a sudden catastrophe—which Heaven forbid !—and if, after two or three centuries, the old foundations were dug up, it is more than probable that the workmen would find such specimens of crackled china and blue and white porcelain as would rejoice the hearts of the frequenters of the Christie & Manson's sale room of the day. An analogous case to this has lately occurred in Knightrider Street, in the neighborhood of St. Paul's Churchyard.

In the reign of the Merry Monarch this quarter of the town was the favorite business haunt of Dutch merchants. During the fire of London the then existing tenements were gutted and overthrown, and, though houses have since risen on the site, many of the old foundations have never been stirred to their depths. A few weeks ago, however, the workmen employed in laying the foundations of a new house discovered in the rubbish which they were compelled to remove some old Dutch tiles and three black diorite stones bearing figures and characters which suggested to them that they were of more than ordinary interest.

This surmise was, on investigation, fully borne out, and on the stones being removed to the British Museum it was discovered that two of them bore inscriptions in the Accadian language, the pre-Semitic language of Chaldea, and that on the third were traced the usual grotesque animals and astrological signs commonly found on Chaldean boundary stones of the twelfth or thirteenth century B. C.

That these stones should have been found in the foundations of a Dutch merchant's house is to be accounted for by the facts that in the seventeenth century, and, indeed, before that period, the Dutch flag was well known in the Persian Gulf, and that Dutch merchants had extensive mercantile relations with the traders of Bussorah. What more natural, therefore, than that these stones should have been shipped on board the ship of some Dutch captain and brought to the house of the consignee in London ?

Unfortunately the inscriptions are, as is so often the case, purely religious, and do not add materially to our knowledge of the history of the country. In both cases they are dedicatory and contain the dedication of the objects—a door socket and a fragment of a basin for holy water "to the god Nina, the supreme Lord, the Lord of the written tablet." The only point of historical interest in the inscription on the basin is the mention of E-anna-du, who, according to a tablet in the Berlin Museum, was a son of A-kur-gal, who is mentioned on the well known Vulture stela at the Louvre, and who is recognized as the son of Ur-Nina.

The real importance of the inscriptions, however, consists in the forms of the characters employed. The script on the door socket is in the cuneiform character of the period of Gudea ; and the mention of that king's name in connection with the dedications has enabled Mr. Evetts, of the British Museum, to fix the date approximately at 4000 B. C. But, far-reaching as this date is, the inscription on the basin is still older. Before the adoption of clay as a writing material, and before, therefore, the introduction of the cuneiform character, the writing of the country was linear, and it is this form which appears on the basin. This characteristic guides us to a date about 4500 B. C., and we may therefore congratulate the British Museum on having acquired, by a happy chance, one of the oldest Chaldean monuments ever brought to Europe.—*Illustrated London News.*

◆

Copper Sulphate.

An establishment for the manufacture of copper sulphate was set up by M. Defrance (Societe des mines et usines de cuivres de Vigsnais Annus), at the beginning of the year 1890, to meet the wants of the vine growers, who use a large amount of this product to prevent mildew. In this works the sulphate is prepared from metallic copper, which is heated to redness with sulphur in a series of reverberatory furnaces, the subsulphide thus obtained being then roasted in order to form a basic sulphate. This sulphate is next brought into large vats, in which it is dissolved in dilute sulphuric acid, the liquid being maintained at the proper temperature.

The solution obtained is run into four series of twenty large leaden vessels, where the sulphate crystallizes out as the solution cools, the crystals being deposited on sheets of lead which dip into the liquid, and are supported by cross pieces of wood. When the crystallization is complete, the liquors are run off, and the crystals removed from the walls and the leaden sheets.

After removal from the crystallizing vat, the crystals are placed on an inclined table, and sorted according to size and color by workmen. They afterward are passed down to the lower story to the driers.

These consist of large inclined tables which allow the water to drain away. The crystals are spread on these in thin layers, and moved about from time to time. The temperature of the room is kept sufficiently high to dry them. After drying, the sulphate is packed and sent off.

◆

An Interesting Literary Relic.

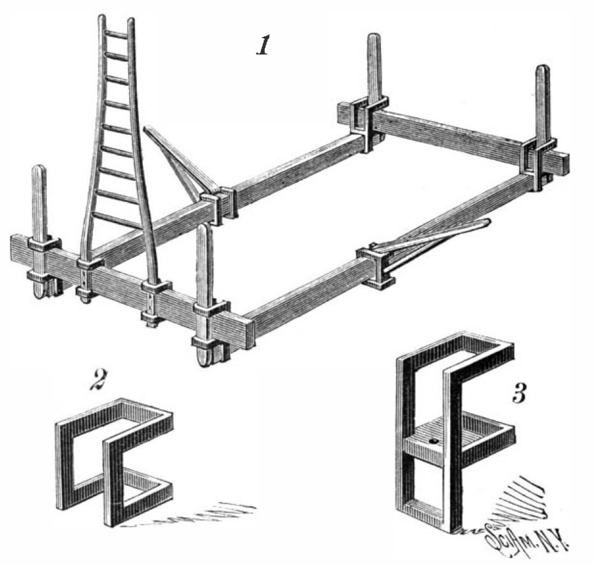
Mr. G. W. Davenport, the vice-president of the Thomson-Houston International Co., secured recently while in Europe a most interesting relic of which he is very justly proud. It is none other than Michael Faraday's own copy of Franklin's well known and rare collection of letters and papers on philosophical subjects. It has his book plate on the inside of the front cover, and bears signs of use.

As touching on a late memorable controversy, Mr. Davenport points out that on page 325 Franklin remarks that "death by electricity would be the easiest of all deaths."

◆

A CLASP FOR CONNECTING TIMBERS.

The device shown in the illustration, although especially adapted for use in connection with wagon racks, is also applicable where two or more timbers running at an angle to other timbers and parallel with each other are to be spliced or connected. It has been patented by Mr. Harold A. Salisbury, of Vinson, Oregon. Fig. 3 shows the device in perspective and Fig. 2 represents a form of clasp to be employed for securing a ladder or side extension to a wagon rack, the application of both forms of the improvement being shown in Fig. 1. By this means the timbers may be quickly and conveniently joined without mortising or otherwise disturbing the wood in a manner to weaken it.



SALISBURY'S CLASP FOR WAGON RACKS, ETC.

◆

THE national museum of Brazil has come into possession of an enormous aerolite. It weighs 11,800 pounds.

Belgian Food Adulteration Law.

On the 15th of January regulations fixed by the Belgian Legislature, having for their object the prevention of the adulteration of food products, were to come into force in Belgium.

The first relates to the sale of artificial butters, otherwise called margarine, and stipulates that warehouses, shops, depots, as well as market stalls where margarine is exposed for sale, must present to the public view, in distinct and indelible characters, the inscription, *Sale of margarine.*

Casks, covers, and receptacles in which margarine is placed for sale by a shop keeper, or which are employed by the makers, wholesale dealers, importers, exporters, consignors and consignees of this product, must also bear, in distinct and indelible characters, the word *Margarine.* Further, if the margarine intended for sale is contained in cases, casks, or receptacles not opened, the inscription will mention the name or description of the maker.

Articles and wrappers in which margarine is delivered to the purchaser by a retail dealer must bear, in distinct and indelible characters, the word *Margarine*, and the statement of the name or description of the seller must in the inscription immediately precede or follow the word *Margarine.*

As regards consignments, the makers, merchants, consignors or consignees of the margarine must state on the invoices and way-bills or bills of lading for each individual consignment that the merchandise dispatched is sold as margarine.

If the margarine is sold or exposed for sale in the form of cakes or loaves, these must take the form of a cube. They must be marked, moreover, with an imprint bearing the word *Margarine*, as well as the name or description of the maker, unless the receptacles themselves bear these indications.

The second of these regulations relates to the sale of food products containing saccharin. It provides as follows:

1. Under the name of products in which saccharin enters (*produits saccharines*) is understood any commodity sweetened by the aid of matters of which the chemical composition and physiological properties differ entirely from those of common sugar or sugars derived from amylaceous substances (maltose, glucose).

2. Proprietors of breweries, glucose factories, confectionery establishments, factories of liquors, chocolates, and other food products, who use saccharin in their manufacture, are obliged to have the following words painted in large characters: *Saccharin products* (*produits sacchariné*) on the outside of the principal entrance to their works and warehouses.

Warehouses, shops, depots, as well as stalls and all places of sale where saccharin products are exposed for sale, must exhibit in a conspicuous place, in distinct and indelible characters, the words *Saccharin products.*

3. Casks, covers, or any receptacles in which saccharin products are placed for sale by a dealer, or which are used by the makers, wholesale merchants, importers, exporters, consignors and consignees of these products, must also bear, in distinct and indelible characters, the word saccharin.

Further, if the product containing saccharin intended for sale is contained in cases, casks, or receptacles not opened, the inscription will mention the name or social position of maker.

4. Receptacles in which the product containing saccharin is delivered to the purchaser by a retail trader must bear, in distinct and indelible characters, the word saccharinated (sacchariné), as well as the name or social position of the trader or retailer.

5. As regards consignments, the makers, merchants, exporters, or consignees of the products containing saccharin must indicate on the invoices and way-bills or bills of lading, for each individual consignment, that the merchandise exported is sold as a product containing saccharin.

Two other sets of regulations, which come into force on the 1st October, 1891, deal with the artificial coloring of food products and with the utensils, etc., used in the industry and trade in food products.

The first stipulates as follows:

It is forbidden to use for the coloring of food products, such as bonbons, pastilles, sweetmeats, pastries, food pastes, confections, marmalades, sirups, liqueurs, wines, fruits, vegetables, etc., intended for sale, any poisonous coloring matter.

A list of harmless coloring matters, and a list of colors considered as injurious, will be published by the ministry of agriculture, industry, and public works.

It is forbidden to sell, to expose for sale, to detain or to transport for sale any food product manufactured or prepared contrary to the above regulations.

The receptacles or wrappers in which colored or artificially colored food products are contained for sale, either wholesale or retail, must bear, in plain characters, the name and description as well as the address of the seller.

The second set of regulations prohibits the use, for the preparation, preservation, or packing of food products, intended for the sale of these commodities, of any utensils, receptacles, or different objects containing any properties which by contact with the substance they contain become poisonous or injurious to health.

Lead and zinc, as well as alloys, platings, solderings, and enamels containing these metals, arsenic, antimony, or their compounds, must especially be considered as poisonous or injurious to health in the sense of the present regulations.

The above regulations are not applicable to preserve boxes of iron plated with pure tin, of which the solderings are external and are made of an alloy of tin and lead in the proportion of a maximum of 10 per cent of the latter.

It is forbidden to sell, to expose for sale, to detain, or transport for sale prepared food substances, preserved or packed in any way contrary to the disposition of the present regulations.

It is forbidden to sell, to expose for sale, to detain, or transport for sale apparatus, utensils, or articles intended for the preparation, preservation, packing, sale, or manipulation of food products, of which the use is forbidden by the preceding articles.

Any apparatus, utensil, receptacle, or article, of which the parts placed or likely to be placed in contact with food products in a factory, warehouse, or store of the commodities contain tin, metallic alloys, enamels, or coloring materials, must bear, in legible characters, the name or position as well as the address of the maker.

Contraventions of the law will be punishable with fines prescribed by the law of the 4th of August, without prejudice to the application of the penalties prescribed by the penal code.

Talc or Soapstone.

The following was originally addressed to the Atlanta Talc, Mining, and Manufacturing Company, whose sample was analyzed and reported on by Prof. John M. McCandless:

As the general impression is that talc is used mainly for purposes of adulteration, I will give in detail some of the uses to which it may be applied. Talc possesses properties which adapt it to a great variety of economic uses. It is a highly infusible substance, resisting perfectly the greatest extremes of temperature reached in industrial processes. Slabs of it are, therefore, used as fire stones in hearths, stoves, and for register borders and pipe holes, also in tips for gas jets. A very extensive application of the material is opened up in the manufacture of linings for stoves and ranges; in short, wherever an excellent non-conducting and heat-resisting material is needed, there talc would be applicable. The fine varieties are also used in the manufacture of porcelain.

Talc is readily cut with a knife, and is reduced to the condition of a white powder with the greatest ease. This powder has a greasy, soapy feel, hence the name soapstone has been applied to the mineral. These qualities, it is evident, render it suitable for diminishing friction, and when ground it is largely used as a lubricant on the bearings of heavy wheels where the friction is great, lubricating and at the same time, by excellent non-conducting, preventing overheating.

The various other uses to which it may be put, both small and great, are almost numberless. It may be used as a filler in the manufacture of paper, especially in the manufacture of wall paper and shades of the best qualities, where a handsome surface is desired. It is very largely consumed in England, especially as a make-weight in the manufacture of cotton goods exported to China and other foreign countries. It is also very largely consumed in the manufacture of soaps, not only as filler, but also as having no mean cleansing properties of it own. It is also the base of nearly all the face powders and tooth powders, costing scarcely anything, and sold at high prices. Talc is also made into dustless crayons, being far superior to ordinary chalk where a fine line is needed. Tailors use it under the names of "French chalk," "Briancon chalk," and "Venice talc," in marking cloth before cutting. It writes readily on glass, and is used by glaziers for marking glass before cutting with the diamond. It readily absorbs oil and grease, and is used in powder for extracting such spots from silk and woolen goods. It is also used in dressing skins and leather in boots and shoes, and forms a large percentage of the composition of various patent greases, as axle greases. It is also used in imitating engraved stones, being easily cut and afterward hardened by heat, when it may be changed to any desired color by the use of metallic solutions. This is also the same stone known as the "figure stone" of the Chinese, from which exquisite figures and ornaments may be carved. This mineral is also very largely used in adulterations, though this use of it is to be deprecated. Still it is better that an inert, harmless material, such as this, should be used than many substances which are poisonous. As a proof of its harmless nature, it is a species of earth eaten by many savage tribes. It is consumed in the manufacture of candy, and is added to flour, pulverized sugar, baking powder, etc., as a make-weight and diluent, doing no other harm to the purchaser than the harm it does to his pocketbook.

I have examined the sample of talc or steatite received from you. . . . The sample has the following chemical composition:

Silica	63·60	per cent.
Magnesia	33·75	"
Protoxide of iron	1·46	"
Alumina	0·42	"
Moisture	0·48	"
Loss	0·29	"
Total	100·00	per cent.

The analyses of the best Italian talcs only vary slightly from these figures, the essential constituents being silica and magnesia.

Horse Breeding in New South Wales.

Mr. Coghlan, New South Wales Government Statistician, in his report on the wealth and progress of that colony, says that New South Wales is eminently fitted for the breeding of most descriptions of horses, and attention has long been directed to this industry. At an early period of its history the colony was enriched by the importation of some excellent thoroughbred Arabians from India; and the high name which was acquired by the horses of Australia was largely due to this cause. The abundance of good pasture everywhere obtainable also contributed to this result. The native kangaroo grass, especially when in seed, is full of saccharine matter, and young stock thrive exceedingly upon it. This abundance of natural provender allowed a large increase in the stock of the settlers, which would have been a great advantage, had it not been that the general cheapness of horses led to a neglect of the rules of breeding. In consequence of the discovery of gold, horses became very high priced. Under ordinary conditions this circumstance would have been unfavorable to the breed of horses, and such was the case in Victoria; in New South Wales it was far otherwise. The best of the stock of that colony, including a large proportion of the most valuable breeding mares, was taken by Victoria, with the result that, for twenty years after the gold rush, the horses of the colony greatly deteriorated. One class of stock only escaped. The thoroughbred racer was probably improved both by the importation of fresh stock from England and by the judicious selection of mares. The period of deterioration ended about the year 1870, since which year there has been a perceptible improvement in all classes of horses. As regards the actual number of horses in the colony, this shows but little increase for the last sixteen years, the figures for 1874 being 346,691; 1880, 395,984; 1885, 344,697; and in 1889 there were 430,777. The annual increase in the number of horses has not been more than 1·45 per cent during the whole period covered by these sixteen years, while the increase of population has been at the rate of 4·56 per cent. For purposes of classification, the horses of the colony have been divided into draught, light harness, and saddle horses, the number of each particular kind being as follows: Draught horses, 139,378; light harness horses, 109,659; and saddle horses, 181,740.

New South Wales is, says the government statistician, specially adapted for the breeding of saddle and light harness horses, and it is doubtful whether these particular breeds of Australian horses are anywhere surpassed. The bush horse is hardy and swift, and capable of making very long and rapid journeys, when fed only on the ordinary herbage of the country; and in times of drought, when the grass and water have become scanty, these animals often perform astonishing feats of endurance. Generally speaking, the breed of horses is improving, owing to the introduction of superior stud horses and the breeding from good mares. When there has been a deterioration in the stock, this has been due, it is stated, to breeding from weedy mares for racing purposes, and from the effect of the drought. The principal foreign markets for horses are the Indian and Chinese. The total number of horses leaving the colony for markets outside Australia during 1889 was only 668. Although the demand for horses in India is considerable, and Australia is a natural market from which supplies may be derived, there is no one, according to Mr. Coghlan, employed by the Indian government to make himself acquainted with the resources of the various colonies, or to furnish information to intending shippers. The speculation of sending horses to India is one open to many risks, as, apart from the dangers of the voyage, there is always an uncertainty as to the stock being accepted. It is stated that the number of horses in the Australian colonies in the year 1889 was as follows: New South Wales, 430,777; Victoria, 329,335; Queensland, 352,364; South Australia, 170,515; Western Australia, 42,816; Tasmania, 29,778; and New Zealand, 187,382; making a total for Australia of 1,542,957.

IMPORTANT seams of smokeless coal exist in the hills fringing the Gulf of Tonquin. According to Mr. William Warren, an engineer, one of the seams is 152 feet thick. The coal is an anthracite smokeless, and containing 87 per cent of carbon. The steamer Fatshan, making 14 knots, has been successfully tried with it, and the gulf will be of great service to the French as a coaling station in the far East.

Another Underground Electric Railway for London.

In the SCIENTIFIC AMERICAN of November 29, 1890, and in our SUPPLEMENT, No. 771, we gave descriptions and illustrations of the underground electric railway which was lately opened for traffic in London. This road, known as the City and South London Railway, is 3¼ miles in length and consists of two tunnels, each 11½ ft. exterior diameter, made of iron plates, extending from near the Monument in King William Street, thence under the Thames River to Binfield Road, Clapham. The operations of the road so far have been highly satisfactory; so much so that the parties interested have applied to Parliament for the privilege of building another line of railways, on the same general plan. These tunnels were built very economically and expeditiously by the use of an American invention known as the Beach hydraulic shield for tunneling. The new tunnels are to extend from Shepherd's Bush to Cornhill, and pass through or rather under some of the most important sections of the great city, namely, Cheapside, Newgate Street, Holborn, Oxford Street, Bayswater, and Notting Hill, with stations about half a mile apart at Lansdowne Road, Notting Hill Gate, Queen's Road, Wesbourne Road, Marble Arch, Davies Street, Oxford Circus, Tottenham Court Road, Bloomsbury, Chancery Lane, Newgate Street, and finally Cornhill. Total length six miles, and on an average about 50 ft. below the surface of the ground, rising to a nearer point in some places, but in other places being from 70 ft. to 80 ft. below the surface in the London clay. The proposed capital of the company is $15,000,000.

It was represented to the Parliamentary committee that this railway would do precisely what the existing underground lines did, viz., tap great business thoroughfares; but there would be no such nuisance as that which rose from smoke and steam on the present underground systems; and at the same time the proposed level would avoid any disfigurement of the streets. The sites for the thirteen stations would be excavated first; then the borings would begin, and the excavated material would be carried to the surface and carted away. There would be neither noise nor vibration nor blow holes. The two tunnels, one up and one down, would be perfectly distinct, and consequently each train as it passed through would make its own ventilation. Each tunnel would be 11 ft. 6 in. in internal diameter. The stations being about 50 ft. beneath the surface, special approaches were required. There would, therefore, be at the stations hydraulic lifts, and also stairs for those who preferred them, though it was believed that the majority of passengers would use the lifts, which would be at once easy, speedy, and comfortable.

With respect to speed, Mr. Pember stated that the company would get a maximum of 25 miles an hour, but, including stoppages, the rate would be about 15 miles an hour, and they expect to do the whole journey in 25 minutes, which was 25 per cent better than on the Inner Circle Railway.

Mr. J. H. Greathead, C.E., was the first witness called, and explained that he was jointly, with Sir John Fowler and Sir Benjamin Baker, engineer to this scheme, the object of which was to increase the traveling facilities between the western portion of London and the City.

The main line was nearly straight from end to end, the worst curve being at the junction of Cheapside and Newgate Street, and that was not more than half as bad as the worst curve on the City and South London Railway. The worst gradient would be 1 in 100. He stated that the surface would not be disturbed at all except at the stations.

The whole railway was to be made by boring, and the tunnels would be constructed of iron, as was the City and South London Railway. They would be made of cast iron, and composed in segments bolted together, forming rings of cast iron. In that way a continuous tube of iron would be formed.

In the construction of the tunnels the Beach hydraulic shields are to be used, similar in general make to that employed under Broadway, New York, in 1869–70. The method was described by Mr. Greathead as follows:

A "shield," composed of steel plates, smooth inside and out, fitting over the mouth of the tunnel, and having in front an opening and a cutting edge, and inside a number of hydraulic presses was fixed; this pressed against the end of the tunnel, and as the hydraulic pressure was increased, the shield was forced forward and drew out the clay to the outside diameter of the shield. The material brought out was thrown back to the opening of the tunnel in the front of the shield, and then taken up the shaft. When the tunnel had been advanced to the length of one ring, the segments were brought down and placed inside the shield and bolted together until the last ring was completed. When that was done the machine was ready to go forward again, but there was one other important feature. The space which was left by the advance of the shield—which was equal to the thickness of the plate of the shield—about 1 in., had to be filled up. That was done by "grouting," which forced some fluid cement through holes left for the purpose in such a way as to fill up the space left by the advance of the shield, and thus all chance of a sediment was prevented.

Mr. Greathead stated that on the City and South London line, after a little practice, they were able, by means of a shield of this kind, to tunnel 16 feet a day at one facing, and for several weeks together the rate was 15 feet 6 inches per day; while at one time they did over 100 feet of tunneling a day. The progress in six months was equal to 2¼ miles of completed tunnel, and the tunnels, when once completed in that way, were perfectly stable and safe.

To prevent corrosion in the iron in the proposed work, the iron would be dipped into a composition of tar while hot, and that, partly entering into the iron, formed a skin on the surface. The grouting was thus protected, and there was no chance of corrosion. The iron would be about an inch thick, and the flanges about four inches deep, the space being filled up with cement. This was the system adopted on the South London Railway, except at the stations, where, after the iron tunnels had been driven forward, larger tunnels of brickwork were constructed for the platform. That method enabled them to see how the grout had acted, and in all cases they found the space entirely filled up. In constructing the line, besides working in clay, they had in some places to go through water-bearing strata. He did not think in the new work it would be necessary to use compressed air (Haskins American system), but they would have the machinery ready if it should be required. At Stockwell, where they had to pass through gravel, there were overhead sewers, large water mains, tramways, and houses on each side, but there had been absolutely no subsidence even where they had to go through gravel. At Swan Lane, within 50 feet of the Thames, they passed from clay to gravel and the water entered, but they stopped it by bulkheads and then applied compressed air. The line passed close to and under warehouses, but he was not aware of any vibration being felt in those buildings, and no complaints had been made. Neither had there been any noise during or since construction. The stations had been constructed of brickwork, and some little damage had been done near the stations.

With respect to having two separate tunnels, Mr. Greathead explained that there was a great advantage in that arrangement, as a matter of ventilation, for by the mere movement of the trains perfect ventilation was secured. As the train entered a station it forced the air out, and as it left the station it drew air after it. The tunnel and train really formed a sort of tight-fitting cylinder, and in this case there would be no smoke or steam to vitiate the atmosphere. There would also be no soil vibration. The South London tunnels were perfectly free from moisture. The carriages would be entered at the ends, one reason for this being that it would be impossible to have side doors, because the Board of Trade required that there should be a sufficient space to allow of the doors being open, and in this case that would involve a tunnel 15 ft. or 16 ft. in diameter.

It was also found on the elevated railways in America that end entrances were most convenient, and the carriages on this new line would be very similar to those on the railways in New York. Each train would carry 336 passengers, and it was intended to have two classes. The motive power was to be electricity generated at Shepherd's Bush for the whole line, carried by a main conductor throughout the whole length of the two tunnels. The depot or generating station would be above ground. In addition to the main conductor there would be a working conductor, which was a naked conductor from which the locomotive drew the current as it proceeded. That might be laid between the rails or above. The direct current system would be adopted with a comparatively low tension, such as the Board of Trade had approved of on the South London line. He had no doubt whatever that electricity would prove as efficient in this case as it had on the South London line. It was not intended to erect any temporary shafts, but to make them so that they could afterward be used for hydraulic lifts giving access to the trains. The hydraulic power for working the lifts would be provided at Shepherd's Bush and conveyed through pipes to the various stations. After the water had done its work, it would be returned and used again.

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AT a recent meeting of the Cambridge Philosophical Society, a paper was read by Professor J. J. Thomson, on the electric discharge through rarefied gases without electrodes. A vacuum tube was exhibited, in which an electric discharge was induced by passing the discharge of Leyden jars through a thread of mercury contained in a glass tube coiled four times along it. The induced discharge was found to be confined to the part of the vacuum tube which was close to the primary discharge, and it did not show striæ. It was also demonstrated that an ordinary striated discharge is strikingly impeded by the presence of a strong field of magnetic force.

Overrated Aluminum.

If any one ought to know what aluminum is, and what it is good for, it should be one of the leading manufacturers of this metal; and if such leading manufacturer deliberately and publicly says that aluminum is not the extraordinarily good metal that it is popularly believed to be, then we have good reason to suspect that he is right and that popular belief in the matter is wrong. These remarks are suggested by a lecture delivered by Alfred E. Hunt, president of the Pittsburg Reduction Company, before the Boston Society of Arts, on February 12, on "The Properties, Uses, and Processes of Production of Aluminum." He states that the two chief difficulties which his company has met with in selling aluminum and introducing it into the arts and manufactures of the country during the past two years have been, first, the extravagant, erroneous and, in many cases, mischievously misleading claims which have been made concerning the properties of the metal; and second, the equally widespread, extravagant, and misleading claims by inventors of processes for the manufacture of aluminum at remarkably low prices.

We have been so surfeited lately with statements to the effect that aluminum is going to revolutionize the world that it is interesting to learn from such a source that it has some bad qualities. Among them are the following:

For many purposes the pure metal cannot be so advantageously used as that containing three or four per cent of impurity. The pure metal is very soft, and not so strong as the impure. The thin coat of oxide which it gains on exposure gives it a pewtery appearance, which makes it undesirable for table ware. It becomes pasty at a temperature as low as 1,000 degrees F., melts at 1,300 degrees F., and loses its tensile strength and much of its rigidity as low as 400 or 500 degrees. It is inferior to copper as a conductor of heat and electricity; in fact, being only half as good. Its lack of rigidity and hardness is an obstacle to its use for many purposes, such as castings. In rolling it, not nearly as much draught can be given to the rolls as in the case of steel.

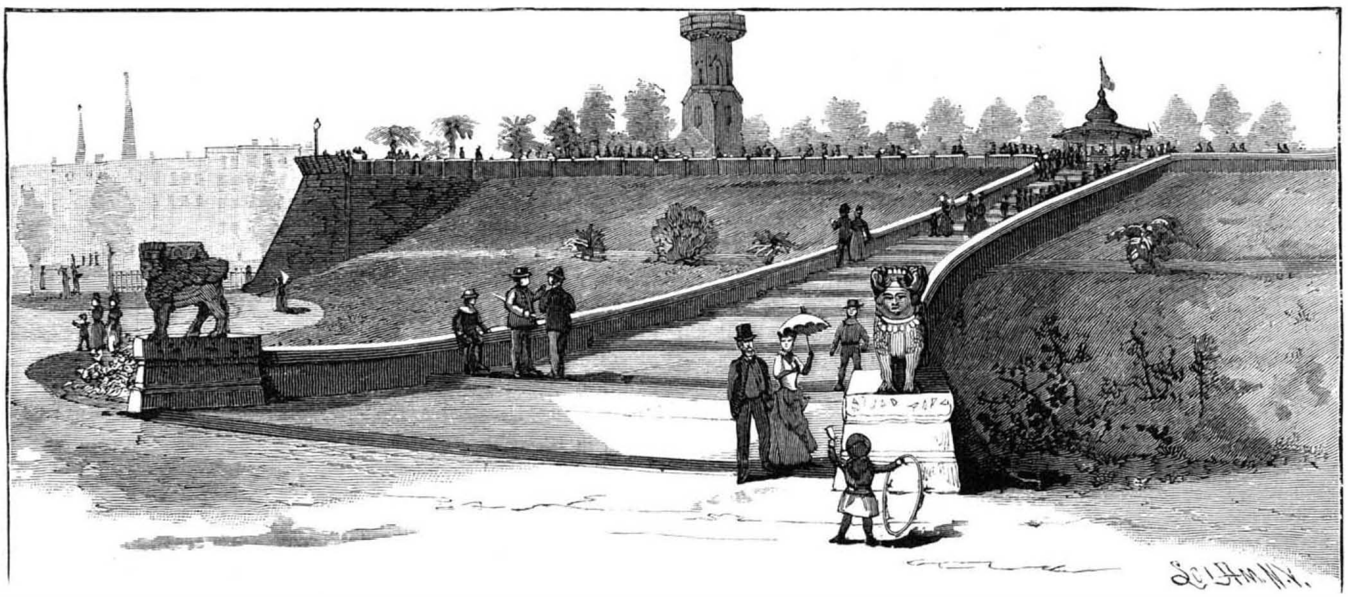
In cold rolling it requires to be annealed oftener than steel. Alloys of the metal increase in brittleness more than they do in hardness. Its tensile strength per square inch is not greater than that of common cast iron, and only about one-third that of structural steel, while its compressive strength is less than one-sixth that of cast iron. Under transverse test, a 1 inch square bar of cast iron, 4 feet 6 inches between supports, will sustain a load of 500 pounds with a deflection of 2 inches, while a similar bar of aluminum would deflect over 2 inches with a load of 250 pounds. The modulus of elasticity of cast aluminum is about 11,000,000, being only about one-half that of cast iron and one-third that of steel. It combines with iron in all proportions, but none of its alloys with that metal are of value, except those with very small percentages of aluminum. Other elements than aluminum can be better employed to harden iron, and its presence in iron is to be regarded as deleterious, and to be avoided if possible. The addition of aluminum does not lower the melting point of steel, as has been claimed, nor does it increase its fluidity.

One of the most important statements made by Mr. Hunt concerning aluminum is that of its cost. It is not a cheap metal, as now manufactured in the works of the Pittsburg Reduction Company at the rate of 375 pounds per day and selling at about $2 per pound, but he gives what may be called a theoretical estimate of its probable cost when made in great quantities in the future as follows: Two pounds alumina (Al_2 O_3 contains 52·94 per cent Al), 6 cents; one pound of carbon electrode, 2 cents; chemicals, carbon dust, and pots, 1 cent; 22 electrical horse power exerted an hour, water power being used, 5 cents; labor and superintendence, 3 cents; general expense, interest, and repairs, 2 cents; cost of a pound of aluminum, 20 cents.

The above statements are made simply as an antidote to the extraordinary claims which have been made regarding the value of aluminum as a metal of construction, and are by no means intended to disparage the value of the metal for the uses to which it is well adapted. These uses are very numerous, and are constantly increasing, and there are great possibilities yet remaining for the metal, especially in the shape of its alloys with other metals, the properties of which alloys are now being made a subject of research. Mr. Hunt's paper treats largely of the uses of aluminum and of its good qualities which recommend it for these uses. He also tells us that the difficulty which has hitherto been found in soldering aluminum has at last been overcome, and that it can now be soldered by the use of the blowpipe with ordinary hard or soft solder, or with pure zinc, or with an alloy of zinc and aluminum as the soldering metal. The novelty, which has just been covered by letters patent, is in the soldering salt, which allows the solder to flow freely on the surfaces to be united. The difficulty of the softness of aluminum is also now overcome by the method of alloying pure aluminum with a few per cent of hardening metal, and by cold rolling, hammering, or drop forging.—*Engineering and Mining Journal.*

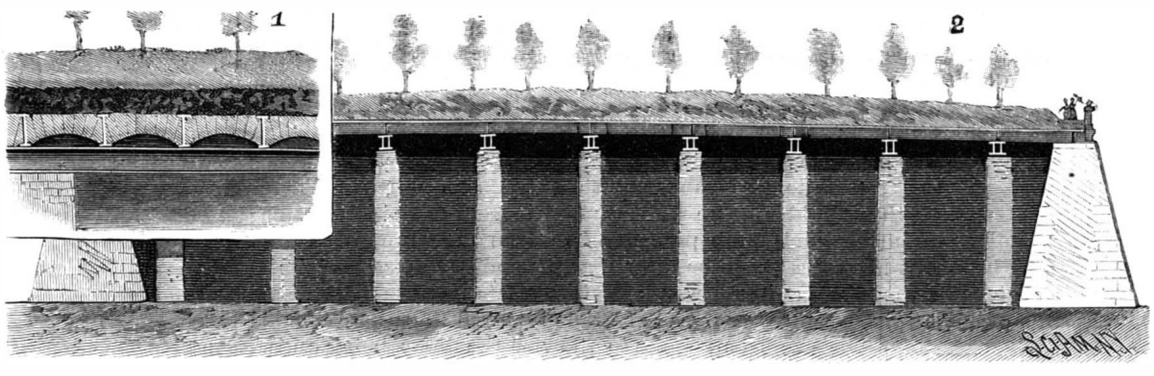
A NEW PARK FOR NEW YORK.

Great interest is shown by the public in the bill that is now pending in the legislature of the State of New York for the conversion of the reservoir on Fifth avenue between 40th and 42d streets into a hanging garden. The bill for covering over the water receptacles has already passed the House and is awaiting the approval of the Senate, but it seems doubtful whether the bill will ever pass, owing to the determined opposition that has been offered by many prominent citizens, and by property owners in the neighborhood. It is claimed by those who oppose the plan that in case the reservoir were covered over, the water would become polluted and stagnant, and the general health of the city would be seriously affected. This argument is met by the claim that on the contrary the covering would protect the water from the dust, dirt, soot, and the impurities in the air of a great city.

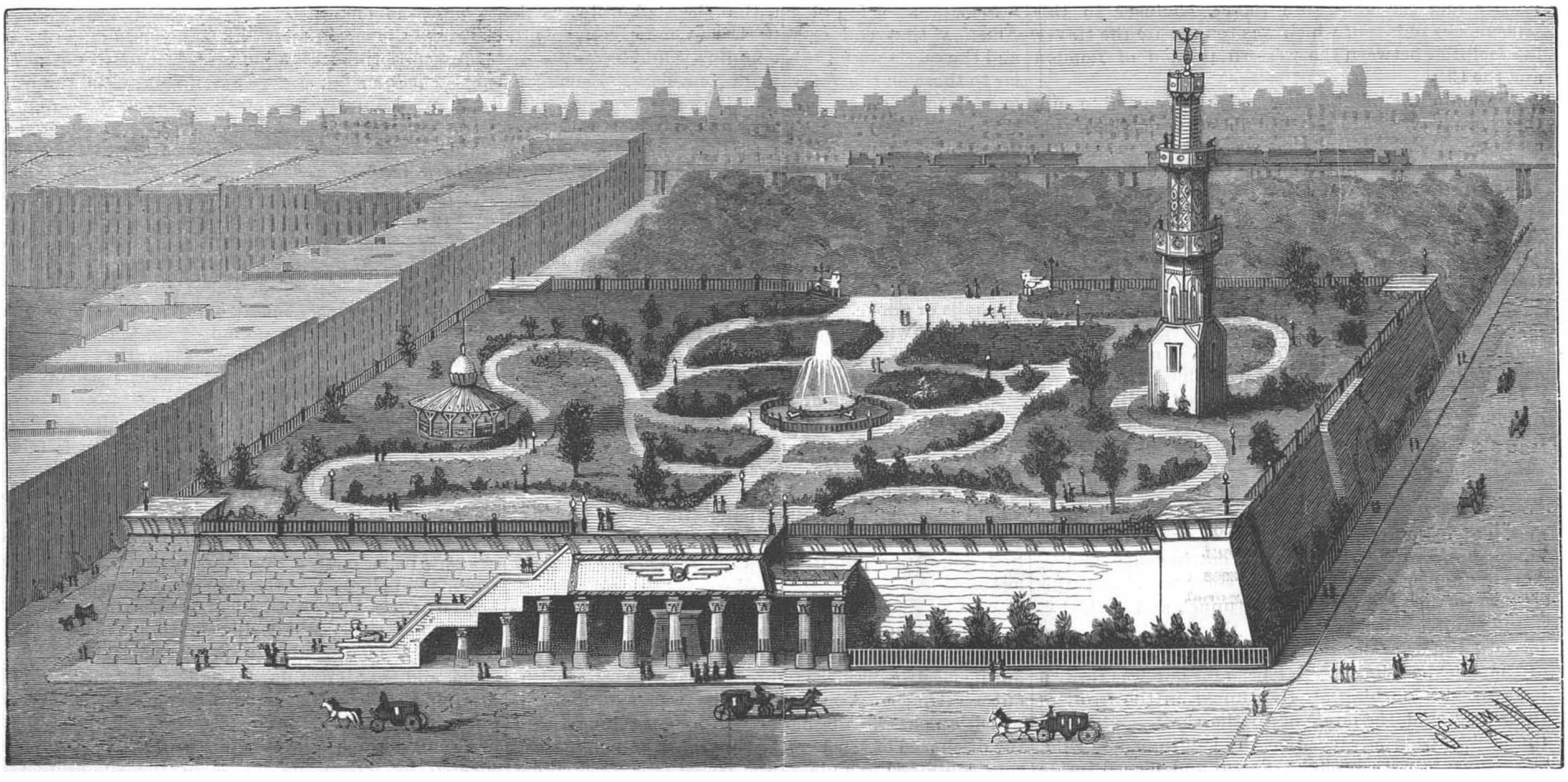


TERRACES AND INCLINED PATHWAY TO RESERVOIR GARDEN.

The method to be employed in constructing the superstructure is shown in one of the views, and in the others are shown how the garden could be made to appear attractive without an enormous expense to the city. The present reservoir covers nearly four acres, and as it is located in the very heart of the city, such an addition would add materially to the attractiveness of Bryant Park that adjoins it, and would prove a great benefit to the public. In the proposed plan the erection of anything in the nature of a concert hall, restaurant, or in fact a building of any description has been carefully avoided, as it is believed that anything of this nature would be a great injury to the neighborhood and to the park itself. What the public want is fresh air, more parks, and plenty of breathing spaces, and this is not to be attained if the few vacant spaces that remain are permitted to be filled with unsightly pavilions or lofty buildings. In case the authorities, after a careful examination into the sanitary and hygienic conditions that affect the case, should conclude that the plan is feasible. it is to be hoped that this will be borne in mind, and that the area will be devoted exclusively to the uses of a park, which from the beauty of its situation and from the novelty of its plan would prove a boon to the public, an attraction to visitors, and a pride to the city.



METHOD OF BUILDING SUPERSTRUCTURE.



PLAN FOR CONVERSION OF FIFTH AVENUE RESERVOIR INTO A PUBLIC GARDEN.

Beer Drinking in the United States.

The following extract, which appeared in the SCIENTIFIC AMERICAN of April 19, 1879, has been so frequently inquired for by various correspondents that we again reproduce it:

For some years past a decided inclination has been apparent all over the country to give up the use of whisky and other strong alcohols, using as a substitute beer and bitters and other compounds. This is evidently founded on the idea that beer is not harmful and contains a large amount of nutriment; also that bitters may have some medicinal qualities, which will neutralize the alcohol it conceals, etc. These theories are without confirmation in the observations of physicians and chemists where either has been used for any length of time. The constant use of beer is found to produce a species of degeneration of all the organism, profound and deceptive. Fatty deposits, diminishing circulation, conditions of congestion, and perversion of functional activities, local inflammations of both the liver and kidneys, are constantly present. Intellectually, a stupor amounting to almost paralysis arrests the reason, precipitating all the higher faculties into a mere animalism—sensual, selfish, sluggish, varied only with paroxysms of anger that are senseless and brutal; in appearance the beer drinker may be the picture of health, but in reality he is almost incapable of resisting disease. A slight injury, severe cold, or shock to the body or mind will commonly provoke acute disease ending fatally. Compared with inebriates who use different forms of alcohol, he is more incurable, and more generally diseased. The constant use of beer every day gives the system no time for recuperation, but steadily lowers the vital forces. It is our observation that beer drinking in this country produces the very lowest forms of inebriety, closely allied to criminal insanity. The most dangerous class of tramps and ruffians in our large cities are beer drinkers. It is asserted by competent authority that the evils of heredity are more positive in this class than from alcoholics. If these facts are well founded, the recourse to beer as a substitute for alcohol merely increases the danger and fatality.

In bitters we have a drink which can never become general; but its chief danger will be in strengthening the disordered cravings, which later will develop a positive disease. Public sentiment and legislation should comprehend that all forms of alcohol are more or less dangerous when used steadily, and all persons who use them in this way should come under sanitary and legislative control.—*Quarterly Journal of Inebriety.*

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Cheaper Electric Meters Wanted.

While it cannot be very long before electric meters will be considered a necessity in every central station from which incandescent lights are supplied, *Modern Light and Heat* does not believe that it will be until some meters are made in a less complicated and expensive manner. We cannot, adds the editor, understand why so much time, energy, and money should be spent on meters which, when ready for the market, are too complicated for the every-day treatment to which meters are liable to be subjected, and too expensive for either customer or central station to buy. The meter which is to come into most general use is the one combining accuracy and simplicity, for no manager will buy them unless they possess the former feature, and the greater the simplicity the less cost to user, and consequent greater adoption.

A FISH HABITATION.

BY WM. P. SEAL.

The common toad fish, *Batrachus tan*, owing to its extreme hardiness, wide distribution, and the ease with which it is kept in salt water aquaria, is perhaps the best known of our more curious marine fishes.

They are generally considered to be ugly and repulsive in appearance. Studied as examples of harmony in design and color, they might be called beautiful. As a compromise of the two ideas, they might appropriately be called beautifully ugly.

They are not generally much valued as food, although in some parts of Chesapeake Bay the fishermen esteem them very highly, the meat being firm, white, and delicate. They may, therefore, some day occupy a high place in the esteem of the epicure.

They usually deposit their eggs (in a single layer) on the under side of stones or in crevices of the rocks, the male guarding the eggs, and also the young, which remain attached where deposited for a considerable period after they are hatched.

The accompanying illustration represents a habitation selected by a toad fish. It is one of two (the other a jug with neck broken off) which were taken from Great Harbor, at Wood's Holl, Mass., and sent to the aquaria of the United States Fish Commission at Washington, D. C., where they are now exhibited.

When found each of the vessels had the eggs of a toad fish adhering to the upper inside surface and was occupied by the male fish, which guards the eggs and young until they are ready to take up the thread of life on their own account. The toad fish is often found ensconced in pieces of drain tile and even old shoes and boots or other hollow receptacles affording it the necessary protection. The writer found a small one in Chesapeake Bay enjoying possession of a beer bottle having the bottom knocked out. The outside of the bottle was beautifully ornamented with a luxuriant set of oyster spat.

In the aquarium at Washington there are frequent battles for possession of the pitcher and jug, but the ones having occupancy at the time are always able to hold them against aggressors, demonstrating that possession is a great advantage outside the jurisdiction of courts.

The selection of habitations by some species and the actual building of quite elaborate ones by others seems to indicate an æsthetic sense as well as a comprehension of the problems of life, not so much different, perhaps, from those of prehistoric man or of the lowest existing races. Much observation of what are called the lower forms of life is apt to impress one with the idea that their perceptive faculties are more acute than our own concerning the actual necessities of existence, that the emotions or feelings which actuate them are not dissimilar from those we experience, and that their judgment is possibly quite as nearly infallible as our own.

A FISH HABITATION—BATRACHUS TAN.

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Oxalic Acid from Waste Sulphite Liquor.

Waste liquors produced in manufacturing wood fiber by the sulphite process are filtered either through felt bags or through filter boxes filled with sawdust, and are thus freed from mechanical impurities. It is found that 100 parts of waste liquor give an average of 12 parts of dry residue on evaporation, which contains 9·5 parts of organic and 2·5 parts of mineral matter.

This filtrate, which contains chiefly lime salts, besides the organic matters, is mixed with more than sufficient sulphuric acid to combine with the lime under constant stirring in wooden tubs or vats provided with steam pipes, so that the gypsum can separate out. The warming and stirring are continued until all free and combined sulphurous acid is expelled, which may be condensed and utilized if desired. The completion of this part of the process can be easily found by the well-known iodate of starch reaction, and at the same time all lime contained in the liquor sinks to the bottom as sulphate. If any excess of sulphuric acid has been added, it is removed by carefully neutralizing with either quicklime or else chalk.

The clear liquor above the sediment is removed either by being carefully drawn off as it clears quickly or by the use of filter presses. If no attention is to be paid to the recovery of the sulphurous acid, and the only question is to quickly purify the waste liquor, then a suitable quantity of lime is added to the filtered liquid, so that the lime added to that contained in the waste liquor is deposited as insoluble monosulphite of calcium. Warming is an advantage for quick separation.

The purified liquors are concentrated to about 40° B. in special evaporators constructed for the purpose, and the evaporation is sometimes even carried to dryness. While still warm the mass is mixed with double its weight of a mixture of 2 parts of caustic or quick lime and 1 part of caustic soda, or, if required, with an equivalent quantity of alkalies.

The next process is the heating of the mixture, with constant stirring, and avoiding any carbonization, in iron vessels, to a temperature of above 180° C. The product so obtained is treated in the usual way for the preparation of pure oxalic acid or of compounds of the same acid.

Another method consists in concentrating the purified liquors to about 30° B., and mixing this sirup to a thick and uniform consistency with sawdust, ground shavings or bark or other organic matter. After this is mixed with a due proportion of caustic alkali, it is treated in the manner described above.

The inventor of these processes is Dr. A. S. Nettle, of Prague, Bohemia, who claims that in many cases a yield is obtained by these methods far superior to that produced by hitherto known processes.—*Paper Trade Journal.*

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Professor Liebreich's Remedy for Tuberculosis.

We have received by telegram from our Berlin correspondent an account of the remedy which Professor Liebreich has introduced as a means of combating tubercular disease, and the good effects of which were vouched for by Professor B. Fraenkel in his speech at the Berlin Medical Society on February 18. It was at the meeting of this society on the 25th that Professor Liebreich gave an account of his remedy, which consists of cantharidate of potash, a combination of 0·2 grm. pure cantharidin and 0·4 grm. of potassic hydrate in 20 cubic centimeters of water. In his opening remarks Professor Liebreich regretted that the older methods of treating disease had been so much lost sight of, and he said that he had been led to think of cantharidin in the present connection by the good effects observed from the prescription of cantharides in skin diseases. The specific property of cantharidin is to excite serous exudation from capillary vessels, and he argued that this effect would more readily occur if those vessels were already irritated. In applying the drug to cases of tuberculosis he proceeded very cautiously, commencing with injections of 1-50 of a decimilligramme of the solution of the cantharidate of potash, and gradually increasing the dose. It was found that the expectoration was thereby increased, and that the ordinary dose required to produce substantial effect was one to two decimilligrammes. It is likely that six decimilligrammes would be the maximum amount that could be safely used. No cures have yet been effected, but, as already said, Professor B. Fraenkel and Dr. Heymann have been struck with the remarkable amelioration of cases so treated, and with the absence of any untoward symptoms. The drug probably only affects the diseased tissues, and it may be applicable to other affections than tubercle. The address was followed by great applause.—*Lancet.*

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Cholera and Snake Bite.

It is a somewhat remarkable circumstance that while the advanced physicians of Europe are seeking remedies for certain of the most dire diseases, in the attenuated virus of such diseases, or in the blood of animals immune to them, the same principle is advocated in India for the cure of snake bite and cholera. We have received, says the *Chemist and Druggist*, from Mr. Dinshah Ardeshir, municipal commissioner to the Maharajah of Baroda, a copy of "A Note on the Probable Discovery of Snake Bite and Cholera Cure." Mr. Ardeshir informs us that a certain tribe of serpents yield in their skull a semi-transparent, yellowish substance, which is called the serpent's *mohara*, and the application of which to a snake bite prevents any evil consequences. But it is not this which Mr. Ardeshir would investigate, nor the roots and other antidotes which have been brought under his notice. The remarkable fact that the common weasel attacks serpents, whose bites have no fatal effect upon it, has led him to the "belief that the blood of the weasel must in itself be an antidote for snake poison." Accordingly, he proposes to inoculate various animals, which have been bitten by a venomous serpent, with the blood serum of a weasel. This proposal conforms exactly with the line of the diphtheria research which has recently been completed. As "an alternative process" Mr. Ardeshir also proposes to "attenuate" the serpent virus, if we may use the expression in this case, by inoculating the blood of animals with serpent virus, "and then constituting an extract for inoculation into the blood of a human being bit by a serpent," provided the method is first shown to be successful on the lower animals. This looks like sound science according to Koch and his disciples. Koch's failure with cholera does not intimidate Mr. Ardeshir, whose opinion is that the reason why we have not "an infallible cure for cholera is our failure in getting at the root of this fell disease."

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The Milk of the Egyptian Buffalo.

According to the researches of Messrs. Rappel and Richmond, of the Khedival Laboratory, Cairo, the milk of the Egyptian buffalo, or gamoose (*Bos bubalus*), presents several characteristics distinguishing it from that of the cow, which may well be remembered by medical men who have to treat patients, especially infants, in Egypt or in other countries where this animal is common. The amount of fat, as we learn from the *Lancet* of August 23, 1890, was found to be a good deal larger than in cow's milk, the percentage in the specimens examined varying from 5·15 to 7·35. The sugar, which appeared to be a hitherto undescribed variety, differing from milk sugar, was also found to be of larger amount than that in cow's milk, the average percentage being 5·41. It is suggested that this sugar should be called *tewfikose*. The fat, too, was found to differ from that of cow's milk, containing minute quantities of sulphur and phosphorus, and yielding four times as much caproic acid as butyric acid, whereas in cow's milk the quantity of caproic acid is only double that of butyric acid. The milk also contained citric acid.

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THE reduction in the price of commercially pure aluminum from $2 per pound to $1 has been announced by the Pittsburg Reduction Company. The price of the metal below 97 per cent and above 90 per cent pure, containing neither sulphur nor phosphorus, which is suitable for alloying with iron and steel, has been further reduced to 90 cents per pound.

Early History of Steam Navigation.

At a recent meeting of the American Society of Mechanical Engineers a chronological statement was read by William Kent of the several experiments in propulsion by steam which were made before Fulton's time, with lantern views illustrating many of them.

The following is an abstract of Mr. Kent's chronological lecture on steamboat experiments down to the time of Fulton. In it he gives due credit to all claimants of the honor of being the first inventor of the steamboat, arranging them in order of their dates.

1543.—Spanish writers tell a somewhat apocryphal story of a boat of 200 tons moved by paddle wheels, built by Blasco de Garay. Part of the machinery was said to be a vessel of boiling water. Objection was made to this part of it on account of the danger of explosion. No credence can be given to this story, as far as it has any reference to steam power.

1621.—Witsen's treatise on shipbuilding, published at Amsterdam in 1621, has an engraving of what is called a Liburnian or Leghorn vessel propelled by paddle wheels turned by oxen. A reproduction of this engraving is given in vol. xix. of the *Mechanic's Magazine.*

1651.—An English pamphlet, supposed to be by the Marquis of Worcester, contains an indefinite reference to what may have been a steam engine, and it was said to be capable of propelling boats.

1690.—*Denys Papin* proposed to use his piston engine to drive paddle wheels to propel vessels.

1707.—Papin applied his pumping engine to raise water to turn a water wheel, which in turn drove the paddle wheels of a boat. He drove a model boat in this way on the Fulda at Cassel. This was probably the first actual experiment in driving a boat by steam power.

1736.—*Jonathan Hulls* took out an English patent for the use of a steam engine for propelling ships. There is no record of it having been carried into effect.

1752.—*Bernouilli* obtained a prize from the French Academy of Science for the best essay on the manner of propelling vessels without wind. He proposed a set of vanes like those of a windmill (a screw propeller in fact) driven by either animal or steam power. He also proposed jet propulsion, or the driving of a vessel by the reaction of a jet forced out of her stern. About the same time Gautier proposed to use the Newcomen engine to drive paddle wheels.

1760.—*Genevois*, a Swiss, proposed to compress springs by steam or other power, and apply their efforts to propel vessels.

1763.—*William Henry*, of Lancaster, Pa., went to England in 1760, and there became acquainted with Watt's engine, which was then new. He returned to America, and in 1763 built an engine and put it in a boat fitted with paddle wheels on the Conestoga River. The boat sank on her trial. He built another, but nothing seems to have come of it. In 1783 he said to a German traveler: "I am doubtful whether such a machine will find favor with the public, as every one considers it impracticable against wind and tide." In 1777 Robert Fulton, then twelve years old, visited Henry to study the paintings of Benjamin West, who had long been a friend and protege of Henry, and there he probably got his first ideas of steam navigation.

1770.—*D'Auxiron*, in France, prepared plans for adapting Watt's engine to propulsion, and in 1772 was granted the monopoly of the use of steam in river navigation in France for fifteen years, provided he should prove his plans practicable.

1774.—D'Auxiron and his friends, Mounin and Jouffroy, built a boat which, when near completion, sank at its wharf. D'Auxiron died before the boat was recovered and completed. After his death his monopoly was turned over to Jouffroy, who consulted Perier, a distinguished mechanic. The latter built the boat on new plans, and it was tried in the Seine, but failed to develop speed, and Perier abandoned it.

1776.—*Jouffroy* built a boat 14 feet long, 6 feet wide, with a Watt engine and a chain carrying duck-foot paddles. The paddles proved unsatisfactory and he adopted a paddle wheel, driven by a ratchet wheel motion by the piston rod of the engine.

1783.—This boat of Jouffroy's was tried in public at Lyons, July 15, 1783, and is said to have been successful, but the French government declined to confirm to Jouffroy the monopoly on the ground that the experiment was not made at Paris. Jouffroy became discouraged and abandoned further attempts.

1774.—*James Rumsey*, of Virginia, began experiments in steam navigation.

1786.—Rumsey succeeded in driving a boat four miles an hour in the Potomac, Shepherdstown, W. Va., in presence of General Washington. He used the system of jet propulsion which had been proposed about thirty years before by Bernouilli.

1787.—Rumsey obtained a patent for the State of Virginia. He wrote a treatise on the application of steam, and organized a Rumsey Society at Philadelphia for the encouragement of steam navigation. He died in London in 1793 while explaining his scheme to a London society. A boat of his was tried in the Thames in 1793 and made four miles an hour.

1785.—*John Fitch*, who was born at Windsor, Conn., in 1743, and died at Bardstown, Ky., in 1798, in April, 1785, conceived the idea of applying steam to locomotion on land, and a few days afterward was led to consider plans for applying steam to propulsion of vessels. In August he showed a model of his boat to Dr. Ewing, of the University of Pennsylvania, and in September presented a model to the American Philosophical Society at Philadelphia.

1786.—Fitch made experiments on a skiff, with a three-inch engine, driving paddles; he besieged Congress and the Legislature of Pennsylvania for funds, but was unsuccessful. In the same year he was granted a patent for fourteen years by the State of New Jersey.

1787.—Fitch raised $800, and in February began a boat of 60 tons, 45 feet long by 12 feet beam, with six oars or paddles on each side. The engine had a 12-inch cylinder. In May, 1787, a trial trip revealed some defects, which were corrected, and on August 27 of the same year a successful trial trip was made at Philadelphia. Patents were obtained in Pennsylvania, New York, and Maryland. About the same time Fitch had a controversy with Rumsey concerning priority of the invention.

1788–1790.—Fitch built larger boats, which ran regularly in 1790 between Philadelphia and Burlington, making as high as seven miles an hour.

1791.—Fitch received a United States patent August 26.

1793.—Fitch went to France. The "Cyclopedia of Biography" says that he deposited his plans with the American consul at L'Orient, while he went to London. The consul showed his plans to Fulton, who was then in France, in whose hands they remained several months. Failing to get the privilege of building his boats in France, he returned to America in 1794.

1796.—Fitch experimented on a ship's yawl, fitted with a screw, in the Collect Pond, N. Y.

1798.—Fitch made a three-foot model boat at Bardstown, Ky. He committed suicide the same year.

1787.—*Patrick Miller*, of Dalswinton, Scotland, experimented with paddle wheels.

1787.—*James Taylor* suggested the employment of steam instead of manual labor. This is denied, however, by the son-in-law of Symington in a letter to *Mechanic's Magazine*, vol. xxviii., 1838, claiming the invention for Symington.

1787–1788.—*William Symington* was employed by Miller to construct an engine for a new boat with two cylinders four inches in diameter. It was tried October 14, 1788, and made five miles an hour.

1789.—Symington built another boat for Miller December, 1789; it made seven miles an hour. Miller then dropped the matter. He condemned Symington's engine as being "the most improper of all steam engines for giving motion to a vessel."

1801.—Symington's third boat, the Charlotte Dundas, built under patronage of Lord Dundas, was tried in 1802. Mr. Symington's son-in-law says (*Mechanic's Magazine*, vol. xix.) that in July, 1801 or 1802, Fulton visited Symington and made a trip on his vessel on the Forth and Clyde Canal, and obtained his designs and ideas. This statement is shown to be untrue by letters of Fulton now in existence, which prove that Fulton never was out of France during either of these years.

1802.—Symington's Charlotte Dundas, in March, 1802, towed two 70 ton vessels in the Forth and Clyde Canal, but the proprietors of the canal disapproved of them, fearing injury to the banks. The Duke of Bridgewater gave Symington orders for eight boats for his canal, but died shortly afterward, and the completion of the contract was thus prevented. Symington became discouraged and gave up in despair.

1811.—*Henry Bell*, of Glasgow, who had seen the Charlotte Dundas, built the first passenger vessel in Europe. He was a loser by his venture, but the boat was a success. In 1815 he built several other boats, and his success was then complete. Symington beginning his experiments in the winter of 1787–1788, and trying his first boat October 14th, 1788, is clearly anticipated by John Fitch in America, who made his first experiment with a paddle-wheel boat driven by a steam engine in 1786, and his first public trial on August 22, 1787. The *Mechanic's Magazine*. vol. xxviii., 1838, p. 25, credits Fitch with being an independent but second inventor, claiming Symington as the first; but it erroneously states that Fitch did not begin his operations until 1788. Between the time of Symington's second boat, 1789, and his third, 1801, much was done in America.

1792.—*Elijah Ormsby* built a small steamer at Narragansett Bay, using an atmospheric engine and duck-foot paddles. It made three or four miles an hour.

1798.—*Nicholas Roosevelt* is said to have built the Polacca, a vessel 60 feet long, with a 20-inch engine having a 2-foot stroke, which drove it eight miles an hour. Livingston and Stevens had induced Roosevelt to try their plans still earlier, they paying the expense of the experiments. Livingston used jet propulsion, and Stevens a screw.

1798.—The State of New York gave *Livingston* the right to steam waters in the State for 20 years, if he should succeed, within 12 months, in producing a boat that should go four miles an hour.

1803.—Livingston procured the re-enactment of the law in favor of himself and Robert Fulton, who was then experimenting in France.

1791—*John Stevens* experimented on steamboats. In 1789 he had petitioned the New York Legislature for a grant similar to that made to Livingston, and he stated that his plans were then completed and on paper.

1804.—While Fulton was in Europe, Stevens completed a steamboat 68 feet long and 14 feet beam. This was a twin-screw boat. Its machinery is preserved in the Stevens Institute of Technology, Hoboken, N. J. In May, John Stevens and R. L. Stevens crossed the Hudson River in this boat.

1807.—John Stevens and his sons built a paddle-wheel boat, the Phœnix, which made its trial just too late to anticipate Fulton's successful trial with the Clermont.

1808.—The Phœnix went to Philadelphia by sea, being the first steamboat to make a sea voyage.

1804.—*Oliver Evans* built a combined wagon and steamboat called the "Oruktor Amphibolis." It was a flat scow with a five horse power engine. He propelled it up Market Street, Philadelphia, launched it in the Schuylkill, and sailed down to the Delaware. This was the first application of steam to carriage on land in America. Evans was the inventor of the high pressure engine, copied later by Vivian, Trevethick and others. He died, "poor, neglected, and broken hearted."

1789.—*Nathan Reid* built a paddle wheel boat turned by a hand crank. He designed a steam boiler, the first vertical tubular boiler, in 1788, intending it to be used in steamboats. He does not appear to have made any successful experiments in steam navigation.

1790.—*Samuel Morey*, Oxford, N. H., built a paddle-wheel steamboat and tried it successfully on the Connecticut River.

1791.—*Rumsey*, Fitch, Stevens, and Morey all obtained patents in 1791 for various methods of propelling vessels by steam power.

1793.—Morey made a trip from New York to Hartford. He built a larger boat at Bordentown, N. J., in 1797 and made a trip to Philadelphia. His funds gave out and he gave up his project. Fulton, Livingston, and Stevens met Morey in New York, but nothing definite is known of the dimensions of his boats or machinery.

1793.—*Robert Fulton* (born at Little Britain, Lancaster County, Pa., 1765, died at New York, 1815) proposed plans for steam vessels, both to the United States and the British governments. In 1779, when only 14 years of age, he experimented with paddle wheels turned by hand on the Conestoga River. In 1802, while in France, he made drawings and a model of a side-wheel steamboat. In 1803 he had a boat built by MM. Molar, Bordel, and Montgolfier, on the Seine, and it made 4½ miles an hour on its trial, August 9. The water tube boiler of this boat, known as Barlow's boiler, is still preserved in the Conservatoire des Arts et Metiers, in Paris. In 1804 Fulton ordered from Boulton & Watt an engine from his own plans, 2 feet in diameter and 4 foot stroke. This engine was completed in 1806, and shipped to the United States, Fulton having preceded it. He immediately contracted for a hull in which to set it up.

1807.—In 1807 the engine was fitted to the Clermont, the hull of which was 133 feet long, 18 feet wide, and 9 feet deep, a far larger steam vessel than any hitherto constructed. In August, 1807, it made a successful trip to Albany, 150 miles, in 32 hours, returning in 30 hours. Its success was such that it soon afterward ran as a regular passenger vessel between New York and Albany, and the era of steam navigation was at last begun. In 1808 two new steam vessels, the Car of Neptune and the Paragon, each of which was nearly double the size of the Clermont, were built by Fulton.

The Spanish story of 1543 has been settled by Mr. Botsford, who has shown that it had been investigated in Madrid in 1858, and that it was then proved that Blasco de Garay's boat had been moved by men secreted in the hull. He has also disposed of Symington's claim by showing that if an unsuccessful experimenter, who abandoned his work in despair, is entitled to be ranked with Fulton, then Symington must give place to John Fitch, who both antedated him and more nearly reached success. But the higher honors must be given to Fulton, as the inventor, the engineer, and the successful business man by whose labors steam navigation became an accomplished fact.

In connection with the equipment, for fire protection, of woodworking establishments, *Fire and Water* recommends placing a gallon pail filled with fine sand within convenient reach of each workman employed where oiling and finishing. This practice might well be followed wherever there is a possibility of fire starting in oil or oil-soaked materials. There is nothing which will squelch an oil-fed fire in its incipiency more quickly and effectually than sand; and there are no afterclaps in the way of water damage, either.

Type-Setting Machines—Important Patent Decision.

In the United States Circuit Court, New York, on March 11, Judge E. Henry Lacombe granted a preliminary injunction against the New York Typograph Company and others, representing the Rogers patented type-setting machines, and in favor of the National Typographic Company and others, representing the Mergenthaler system. Strictly speaking, neither of the machines sets type, but type matrices are arranged, by the fingering of a keyboard in proper order and position for the casting of a line of type, and the latter operation is automatically performed, so that bars or slugs, representing a line of type each, are the product of the machine. It can be readily run by an expert operator at a speed of four to five thousand ems per hour, equal to more than a column of the SCIENTIFIC AMERICAN. The Mergenthaler machine was fully described and illustrated in the SCIENTIFIC AMERICAN of March 9, 1889, and August 9, 1890. Almost the entire work of the New York *Tribune* has been done on this machine for more than six years past, and other daily papers in different cities are using it, to the exclusion of type-setting in the ordinary way.

In the Rogers machine the solid printing bar is cast, but the mechanism by which it is accomplished differs in many respects from Mergenthaler's. Judge Lacombe in his decision holds :

That the machines manufactured and sold by the defendants may be lighter, smaller, cheaper, more easily operated, and more efficient ; that they may be a decided improvement on the Mergenthaler machine, and may as such commend themselves more readily to the public ; that they are themselves patented, and that, if put in open competition with the earlier machines, they would prove more attractive to purchasers and users—each of which points is pressed with great force by the defendants—is wholly immaterial if the complainants' main contention is a sound one, viz., that the Mergenthaler "linotype" is covered by a foundation patent ; that it embodies a combination wholly new in the printing art, which marks the first great step in advance taken for over 400 years, and which, though susceptible, as all new foundation patents are, of subsequent improvement, has yet demonstrated its ability, practically and efficiently, to perform the work which it was designed to do. If, upon the case now presented, it appears that Mergenthaler is a pioneer inventor, he is to be secured the fruits of what he invented and covered by his patent, even as against a subsequent inventor, who, though he may have greatly improved it, still uses the original invention which lies at the foundation of the art. (See cases cited in notes to Section 894, Robinson on Patents.)

The product of the combination of machinery described in the patent and thus claimed is a line of type, cast in a solid bar, presenting on its printing edge any combination of letters and printer's marks which the operator may desire—produced automatically. By its use a great change is introduced in the printer's art, whereby the type-setting of single types is dispensed with, and the matter is set up from "slugs," or "bars," each containing, not a single letter, nor a single word, but any conceivable combination of words and figures. That such a change in the art is almost revolutionary seems to be practically conceded, the defendants insisting, however, that the merit of the invention which effected it must be shared so largely with others, earlier in the field, that Mergenthaler can at most claim but an extremely small part of it for himself. Upon the papers, however, it appears that Mergenthaler was the first man who united in a single machine the instrumentalities which, by means of the operation of finger keys, assembled, from magazines or holders, independent disconnected matrices, each bearing a single character, carried each individual character independently one by one to a common composing point, where they were placed in line, and were thereupon brought in contact with and closed the face of a mould, of the exact length of a predetermined line, into which mould, by the subsequent operation of the same machine, molten metal was injected and a cast taken, which cast consists of a line bar of type metal, having on its printing edge any desired combination of characters, and which is ready as it leaves the machine for imposition on the form. Some such combination was required to solve a problem with which inventors in the field of the printer's art had struggled for years, and there is not found in any of the earlier patents and methods which have been put in evidence by the defendants anything which fairly anticipates it.

The patent which covers it may, therefore, be fairly considered a foundation patent, and its claim should be broadly construed. When thus construed, infringement seems plain. Though there are differences in the form and structure of the intermediate mechanism, tending to simplicity and perhaps improvement, and in the form of the casting mechanism, still each of these mechanisms as it is embodied in the defendants' machine performs the same function as the corresponding mechanism in the Mergenthaler machine, in substantially the same way, and they are combined to produce the same result. The combination which is covered by the claim is the same in both. There is sufficient here to fortify the presumption of the patent, especially as there seems so little real question about either its validity or the infringement of the claim above quoted by defendants' machine.

EXPERIMENT IN SPECIFIC GRAVITY OF FLUIDS.

T. O'CONOR SLOANE, PH.D.

The illustration shows a very interesting experiment on the law of the specific gravity of liquids, which, simple as it is, presents a very good exposition of the phenomena brought out by the operation of this law. A strong solution of potassium bichromate in hot water is made in a test tube. By boiling the water and adding the salt as long as it dissolves, an exceedingly strong solution can be produced. It is then cooled. This cooling is best effected by placing the test tube in a beaker of cold water with its mouth upward in the regular position. As it cools, the bichromate of potash rapidly crystallizes from the supersaturated solution, and the building up of these crystals is in itself an exceedingly interesting process to watch. When it has cooled, the experiment proper can be carried out.

A beaker is filled with cold water. The test tube is next filled to the brim. It is closed with the thumb, and the mouth of the test tube is immersed in the water of the beaker and then released. The object is to prevent the admission of any air whatever. As soon as this is done, the bichromate of potash in what is now the upper end of the test tube begins to dissolve. As it dissolves, it forms a solution heavier than the water, and pours in a stream down the lower side of the test tube, through the water, to the bottom of the beaker. It inevitably mixes more or less with the water surrounding the streams, but at the same time the course can be distinctly traced by holding the beaker against the light. At the same time a stream of clear water can be observed, rising along the upper walls of the test tube to supply the place of the heavy fluid escaping therefrom. It is easy to see that carried out with the proper tank and a small test tube, this experiment would form an admirable illustration for projection by the magic lantern.


EXPERIMENT IN SPECIFIC GRAVITY OF FLUIDS.

The same experiment has its useful application. The principle is used in the laboratory for dissolving the melted mass from sodium carbonate fusions, as in the analysis of iron ores, etc. For cleaning out battery jars, in which very hard crystals of chrome alum often form, or for dissolving the same crystals in bottles in which battery solutions which are partially exhausted have been kept, the same method is applicable. By a little manipulation the battery jar or bottle can be inverted in a bucket of water, itself being full. It is well to support it on a couple of bricks, or by other means, as far above the bottom of the bucket as possible, in order to admit of the free escape of the strong solution thus formed. An inclined position, as favoring the regular ascent and descent of the two columns of liquid, is also to be recommended where the process is practically applied. Crystals quite irremovable by ordinary means can thus be dissolved, and the bottle or jar saved. Sometimes several hours are required, and it is also well to renew the water in the bucket or other receptacle. Care must be taken to admit no air.

Canal Enterprises.

Up to December last over $45,000,000 had been expended on the Manchester ship canal, to provide an adequate waterway to the ocean from this great manufacturing center of the north of England. It is now found that about $20,000,000 more will be required to complete the work, which is a good deal larger sum than the canal company can command, and the city of Manchester has been asked to extend its credit to the enprise to the amount of $15,000,000, the outside public having failed to subscribe for debentures to form a first charge on the property. The work has been somewhat interfered with during the winter, but is now being energetically pushed forward at many points. A committee of the Manchester corporation has advised the giving of the required assistance to the enterprise.

The constructors of the ship canal across the Isthmus of Corinth appear to have met with unexpected difficulties. This company was reorganized in 1889, and great preparations were then made for pushing the work, workshops being erected along the line and an adequate plant provided. It is now stated, however, that sufficient slope was not given to the argillaceous banks, and that it has been necessary to protect large sections with solid masonry. The section to be cut being frequently as much as 250 feet vertically, it is now apparent that the amount of earth to be removed will be enormously in excess of what had been contemplated, or the canal will have to be protected throughout its whole length with solid masonry—in either case greatly increasing the cost.

Although it would seem that the Panama Canal is now quite dead, there yet appear to be people in France who entertain hope of a revival of the project in some form. One scheme to this end is that of M. Amedée Lebillot, who proposes to connect the two unfinished portions of the canal by means of a ship railway, the work to be completed in three years at a cost of $50,000,000. The locomotive it is proposed to use on this railway is in the form of a ship's cradle having propelling mechanism in the interior, the cradle to be sunk under the vessel, draw it out of water, make the journey overland in two hours, and as promptly float the ship in the other section of the canal.

In spite of the disaster that has overtaken the work at Panama, there is every reason to feel encouraged by the progress that has been made at Nicaragua. The latter route was equally open to the French engineers, and it is safe to say that, with half of the money which has been irretrievably sunk at Panama, they might by this time have had in successful operation a practical ship canal for the largest vessels through Lake Nicaragua to the Pacific Ocean. Ex-Senator Warner Miller, President of the Nicaragua Canal Construction Co., with several engineers and other assistants, sailed from New York for Nicaragua on March 14. Only about four million dollars have now been expended upon the work, but very substantial results are apparent in the opening of a safe harbor at Greytown, the clearing away of the route and the construction of a railway on the line to the principal "divide," with the erection of workshops and the providing of all necessary facilities for an energetic attack upon the main difficulties of the undertaking.

The engineers estimate the cost of the whole work at $65,000,000, but Mr. Miller places it at about $100,000,000, with interest accruing during construction. The projectors hope, as do the Foreign Affairs Committee of the United States Senate, that the government will become interested to the extent of guaranteeing the bonds of the company at a low rate of interest, thus keeping the control of the canal in American hands, but they have no distrust of their own ability to provide all the funds necessary, and are not delaying the construction to wait for government assistance. Mr. Miller has a high reputation as a capable and successful business man, and he has entered upon this enterprise as a practical project, to be worked out by dollars and cents, in the full confidence that the investment will be a good paying one to all who put money in it, as well as of high importance in the development of American commerce.

Among other important canal projects, one which of late attracted considerable local attention is the plan for a water connection of Pittsburg with Lake Erie. The route has been several times surveyed, but the exact course which would be most practical has not yet been fully determined. The matter was recently reported upon by a Pennsylvania State commission, and the cost of such a canal was put at $27,000,000. Pittsburg is now using such large quantities of Lake Superior ores that the railroad freights have become a large item in her iron and steel manufactures, and the competition of Southern iron producers has become so sharp that every possible economy must be studied or Pittsburg will be in danger of losing her established prestige in this branch of industry. It is figured that the construction of this canal would reduce the cost of transporting ore to Pittsburg from Lake Superior by about two dollars a ton.

HIGH PLACES.—The highest place in the world regularly inhabited is stated to be the Buddhist monastery Halne, in Thibet, which is about 16,000 feet above sea level. The next highest is Galera, a railway station in Peru, which is located at a height of 15,635 feet. Near it, at the same level, a railway tunnel 3,847 feet in length is being driven through the mountains. The elevation of the city of Potosi, in Bolivia, is 13,330 feet ; Cuzco, Peru, 11,380 feet ; La Paz, Bolivia, 10,883 feet ; and Leadville, Colo., 10,200 feet.

RECENTLY PATENTED INVENTIONS.

Engineering.

ROTARY ENGINE.—Willis and Lyman Carter, Spokane Falls, Washington. In this engine the main shaft has central bores extending from each end to an opening in a central crank portion of the shaft, upon which a compound cylinder is mounted, in connection with various novel features, whereby it is designed the engine may be run at high speed, will be evenly balanced, and very durable, while generating power with a small amount of steam.

Railway Appliances.

CAR AXLE BOX. — William Cross, Winnipeg, Canada. By this invention the bearing block has a pendent tapered front end forming side passages for the lubricant, while the tallow box has a bottom outlet in front of the block and directly over the cross bar, being an improvement in that class of boxes in which the journals rotate in contact with a liquid lubricant held in the bottom of the boxes.

TRAIN ORDER ANNUNCIATOR. — Leonard T. Crabtree, Oconto, Wis. This invention provides a device designed to prevent the operator from receiving train orders on a telegraph instrument until he has set a train order signaling device for display on the track, and to insure the exhibition of the signaling device while the operator has an order for an approaching train, the registration being such that each train conductor will be enabled to ascertain without inquiry if one or more orders are awaiting his arrival.

Mechanical.

CUTTING TOOL.—Richard Gabel, Dresden, Germany. This tool has an internally threaded open rear end and a centrally apertured front, with centrally apertured cutting and centering plates held spaced apart at its front, and is adapted for use as a mandrel or spindle head upon turning lathes, drill making machines, etc., or as a hand implement for cutting or shaping material under rotation.

COP SPINDLE FOR REELS. — Isaac Walker, Philadelphia, Pa. This is an improvement in spindles used in a reel to hold the cop while the yarn is drawn off to form a skein, and provides means whereby the cop tube will be held in firm engagement with the spindle until all the yarn has been reeled off, thus preventing waste.

CAN CAPPING MACHINE. — Mathias Jensen, Astoria, Oregon. A conveyer is mounted to swing vertically and longitudinally to carry the can body forward to a stationary bed mould, while a clamping mould actuated from the arm is adapted to clamp the can body on the stationary bed mould while the caps are forced on to its ends, thus automatically applying the caps on a certain class of can bodies.

Electrical.

ELECTRIC DOOR OPENER. — Louis Bates, Jersey City, N. J. This invention is designed to improve door openers where a pivoted latch is employed, which is held in closed position by a pawl that is pressed forward by a spring and adapted to be forced out of engagement with the pivoted latch by an armature-controlled electro-magnet.

CORNSTALK HARVESTER. — Peter S. Lundgren, Marysville, Kansas. This is a machine to be operated by two men and a horse drawing the machine between the rows, the stalks being cut from two rows at the same time, the machine being simple in construction and effective for its purpose.

DRAUGHT EQUALIZER. — Thomas Thompson, Townsend, Montana. This is a device especially adapted for use in connection with mowing machines, and is designed to lighten the work for the team, being so constructed that as the machine is moved forward the draught bar will exert sufficient forward pressure on the rear edge of the finger bar to overcome any tendency toward a side movement, thereby holding the finger bar always at a right angle to the tongue and the tongue straight with the team.

Miscellaneous.

THERMOMETER FOR SAD IRONS. — August Nicolaus, New York City. A thermostat bar, formed of two parallel strips of metal expanding unequally, is attached to the sad iron, and one section is connected to a movable pointer, which is operated by the flexing of the bar to indicate by means of a dial whether the iron is sufficiently heated, or cold, or too hot to do proper work.

HYDRANT. — William R. Thropp, Trenton, N. J. This is an improvement for a hydrant such as ordinarily used by the fire department of towns and cities, the vertically movable valve stem having a collar loosely mounted on its lower end, and a socket aligning with the valve stem to hold the collar from turning, the valve being easily controlled and there being no danger of the hydrant being frozen up and becoming inoperative.

DENTAL SERVICE STAND.—Walter E. Warner, Brooklyn, N. Y. This is an improvement in stands adapted for use by a dentist, and is designed to hold a drinking glass and spittoon in convenient position for use, the invention covering various novel features.

SASH HOLDER. — Albert Ayers, Rahway, N. J. Combined with a spring-pressed plug is a rod having at its outer end a rack received by a slotted plate, there being pivoted in the plate a handle having teeth to fit the rod rack, with other novel features, the device being easily applied to a window, and designed to firmly hold it in any desired position.

GARBAGE FURNACE. — Alexander Brownlee, Dallas, Texas. This furnace has a chamber with feed openings in its top, a fire box at each end and in different planes, a sand box between the fire boxes, and a grate to receive the garbage, the grate being about as high as the grate bars of one fire box and extending partly over the grate bars of the other fire box, the furnace effectively burning wet or dry garbage.

GLOBE HOLDER. — Howard R. Burk, New York City. A series of springs is secured on a frame and adapted to press on the globe, arms extending from the springs to form convenient handles, the device being readily applicable to a gas or other fixture to permit of conveniently attaching or detaching the globe and securely holding it in place.

STARCH TABLE.—John A. Ostenberg, Des Moines, Iowa. This is a continuous automatic device for use in the manufacture of starch to recover the starch from the water or alkaline solutions, a tube supplying the starch liquid to an annular table with raised edges, a scoop lifting the starch from the table, a conveyer removing the starch, and a discharge pipe carrying off the water, thus saving manual labor and avoiding the difficulties of the old system.

EDUCATIONAL APPLIANCE. — Adolph F. C. Garben, Hoboken, N. J. This is a readily manipulated game board or chart in which examples in arithmetic may be performed with precision and ease, the board having vertical channels whose lower ends are connected by a transverse channel, an outer storage channel, and numeral buttons sliding in the channels.

TREATING SEWAGE. — Charles W. Chancellor, Baltimore, Md. This invention covers an improvement on a formerly patented process and apparatus of the same inventor for discharging solid and liquid matters from the soil pipe under a column or bed of water, separating continuously the solid matters in a sealed receptacle, and filling the supernatant fluids, putrefactive fermentation of the solids being prevented by exclusion of air, and the formation of deleterious gases avoided.

TYPEWRITING MACHINE.—Audley E. Harnsberger, Staunton, Va. This machine has two type wheels, a letter and a character wheel, and a shifter, whereby three kinds of letters or characters may be operated by one set of key levers, with other novel features, the machine being compact in form and designed to be easily manipulated, while it is less expensive than the machines most commonly used, and presents a key board that is simple in arrangement and easily comprehended.

DRAUGHTING INSTRUMENT. — Robert L. Barnhart, Pittsburg, Pa. This is an instrument designed for use in the offices of architects, civil engineers, etc., for drawing machines and elevations and plotting contours of ground, the instrument having different scales and being readily adjustable for a considerable variety of work.

CARDBOARD MACHINE. — John McCoy, York, Pa. As cards are ordinarily made by pasting two or more layers of paper together, this invention provides a machine for easily and effectively performing such work, comprising paper supports, pressure rolls, tension devices, and driers, the machine being designed to unite linen, cotton, or other cloth with the paper when so desired.

HORSESHOEING RACK. — Samuel M. Martin, Sidney, Ohio. This is an adjustable device adapted to fit all sized animals, to hold any part of the animal in any desired position, as may be most convenient for the operator, while relieving the animal of all strain, a supporting rack being suspended from a scaffold, in connection with a transverse shifting bar and rope and pulley attachments.

CUSPIDOR. — Charles L. Beers, Scranton, Pa. This invention provides a reversible bowl beneath which is arranged a discharge trough, a source of water supply being arranged to wash against the bowl when inverted, in connection with devices for reversing the bowl and turning on the water supply.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

WEDDING'S BASIC BESSEMER PROCESS. Translated from the German by William B. Phillips and Ernst Prochaska. New York: Scientific Publishing Company. 1891. Pp. v, 224. Price $3.50.

This excellent work goes into the details of the Bessemer steel process from a largely Continental standpoint. Its numerous plates and illustrations elucidate the text, and it contains large numbers of analyses and physical tests, and various formulas and tables of dimensions. Thoroughness is everywhere conspicuous. The utilization of the slag is treated of in a short chapter, and among the results of the process dephosphorization in the open hearth process, the natural sequence of the Bessemer process, is spoken of.

MAXIMUM STRESSES UNDER CONCENTRATED LOADS, TREATED GRAPHICALLY. By Henry T. Eddy. Illustrated by twenty-one figures in text and one folding plate. Reprinted from the Transactions of the American Society of Civil Engineers. May, 1890. New York: D. Van Nostrand Company. 1890. Pp. vi, 100.

This useful work introduces a new graphical method for determining what position loads upon bridges must have in order to produce the greatest stress. A class of polygons or curves, which the author has named reaction polygons, is utilized for the method.

THE METALLURGY OF SILVER, GOLD, AND MERCURY IN THE UNITED STATES. By Thomas Egleston. In two volumes. Vol. II. Gold and Mercury. John Wiley & Sons, New York. Offices of *Engineering*, London. 1890. Pp. xv, 920. Price $7.50.

This is the second volume of Prof. Egleston's great work, and is devoted to gold and mercury, thereby concluding the series. It is beautifully printed and very fully illustrated. Prof. Egleston's standing in Columbia College and his many years' familiarity with the work done in different parts of America give his work a peculiar value. Of course, it is impossible to review so extensive a work in the space allotted it in this column. So we can do no more than to recommend it to all progressive metallurgists.

SPINNING TOPS. With numerous illustrations. By Professor John Perry. London: Society for Promoting Christian Knowledge. New York: J. B. Young & Co. 1890. Pp. 136. Price $1.

A very pleasing addition to the well known "Romance of Science Series" is presented in this book. The subject of top spinning is of fascinating interest to two classes of observers, the boy and the advanced scientist. Prof. Perry treats his subject in a very popular way and shows its applicability to explaining some of the most recondite laws of nature, notably those of polarized light.

SOAP BUBBLES AND THE FORCES WHICH MOULD THEM. By C. V. Boys. Illustrated. (Publishers as above.) 1890. Pp. 178. Price $1.

Mr. Boys has won a world-wide reputation by his exquisite skill in handling and operating with the minute forces of nature. His lectures on soap bubbles have met with great appreciation, and it seems none too soon to have them presented in book form. The numerous illustrations and the elaborate explanations of manipulations give the work interest for young and old. We feel that it deserves special recommendation to our readers.

DYNAMOS AND ELECTRIC MOTORS, AND ALL ABOUT THEM. By Edward Trevert. Illustrated. 1891. Bubier Publishing Co., Lynn, Mass. Pp. 96. Price 50 cents.

The subject of dynamo and motor construction for amateurs is treated of in this little work. The descriptions are entirely practical, little or nothing in the way of calculations being given. One of the cleverest things in the book is the motor with field magnets made out of gas pipe.

☞Any of the above books may be purchased through this office. Send for new book catalogue just published.

Business and Personal.

Notes & Queries

HINTS TO CORRESPONDENTS.

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

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

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

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(2903) H. K. G. asks: 1. What is the composition of the cement used to repair rubbers? A.

a.	Masticated caoutchouc	10 parts.
	Chloroform	280 "
b.	Masticated caoutchouc	10 "
	Resin	4 "
	Venice turpentine	2 "
	Oil of turpentine	40 "

Melt the cut-up caoutchouc and resin together before solution *b*, add the Venice turpentine and then dissolve. Mix both solutions. Dip a piece of cloth in the solution and apply to surface, previously brushed over with cement. 2. Please give also a receipt for a leather cement. A. Bisulphide of carbon solution of gutta percha. See "Rubber Hand Stamps and the Manipulation of India Rubber," $1 by mail.

(2904) H. C. O. sends photos. of a fine optical lantern made from suggestions obtained from "Experimental Science," also a successful home-made cycloidotrope constructed at a small expense. He also sends a photo. of a lantern experiment representing a volcanic eruption in full blast. The apparatus consists of a glass tank with a crater projecting down into it. In the crater are inserted two drop tubes, one containing aniline red, the other black. By dexterous manipulation the jets of red and black are ejected with fine effects.

(2905) R. S. F. and A. E. S.—The following is an excellent hair tonic:

Quinine	5 grns.
Cantharides	1 dchm.
Alcohol	2 oz.

Apply morning and evening. Also see SUPPLEMENT No. 388 for an excellent paper on hair hygiene, 10 cents by mail.

(2906) W. L. S. asks how a circular opening three inches in diameter may be made in the center of a plate of glass ten by ten. A. With a good diamond make a circular cut in the glass of the diameter of the hole, then within it make a number of circular cuts By dexterously hammering the glass at the center of the circle, the break may be started. After this the removal of the remainder is comparatively easy.

(2907) C. P. R. asks: A leather bellows is closed and placed 10 feet under surface of water; bellows is of proper size to displace 1 cubic foot of water when opened 8 inches wide; a ½ inch tube runs from surface into bellows. What force will be required to open bellows, it taking air through the ½ inch tube? A. The area of the bellows will be $\frac{1728}{8}=216$ square inches. The pressure due to a column of water ten feet high is about 4·35 pounds. 4·35×216=939·6 pounds. As it opens the pressure will diminish about 7·83 pounds per inch of opening.

(2908) W. P. N. asks : Would you please oblige me by publishing a recipe for the cure of catarrh? A. Take equal parts of salt, soda bicarb., and borax. Mix them thoroughly. Use saltspoonful of mixture to cup of warm water. Always have the water warm. Gargle and snuff up the nose three or four times daily. Better consult a good specialist.

(2909) R. A. M. asks : A solid floats at a certain depth in a liquid when the vessel which contains it is in air; if the vessel be placed in a vacuum, will the solid sink, rise or remain stationary ? A. The weight of the water would remain unchanged in a vacuum, consequently the floating body would behave as if the water were under atmospheric pressure.

(2910) H. L. B. asks : Is there anything that will eradicate smallpox pits without injury to the skin ? If so, what is it ? A. No. There is nothing; the connective tissue is destroyed and it cannot be replaced.

(2911) J. L. S. asks : What will kill the odor of camphor dissolved in alcohol? A. Any essential oil will tend to destroy the odor—bergamot, lavender, etc.

(2912) Old Subscriber asks : I have some old engravings that are stained and spotted by age and dampness. How can these stains be removed without injuring the pictures? A. Immerse them in javelle water of solution of chloride of lime. Wash off in clear water and immerse in a solution of hyposulphite of soda. Use first solution as weak as possible consistent with efficacy.

(2913) W. F. writes : I am very badly in want of a recipe for making in quantity a very quick-drying solution of either gum arabic or dextrine, to be quite free from unpleasant taste or smell when either wet or dry. A. Water 5 parts, alcohol 1 part, acetic acid 1 part, dextrine 2 parts.

(2914) H. L. N. asks (1) how to make a marking ink, either blue or black, without the use of oils, to be used principally for marking sacks. A. An excellent medium is solution of 20 parts shellac in strong borax water (borax 30 parts, water 300 parts). Use any desired pigment. Dissolve borax and shellac by heat. An aniline coloring may be used. 1 part coal tar, 1 part benzine, and one-tenth part lampblack is also used. 2. How can I make a cheap paste that will make labels stick to smooth tin cans ? A. Fresh solution of gum tragacanth is good. Also see SCIENTIFIC AMERICAN, vol. 63, No. 15.

(2915) P. C. Manufacturing Co. asks : Can you give us a receipt for preventing paste made from flour from foaming while being agitated or stirred up by machinery ? A. It is almost impossible to advise anything effectual. Vapor of ether might do some good.

(2916) J. B. W. asks for a liquid that will have no injurious effect on phosphorus and will not freeze readily. A. Use a strong solution of calcium chloride or sulphate of soda.

(2917) W. H. L. writes for a receipt for making mucilage such as put up for sale in bottles. A. See queries 2913 and 2914. Plain solution of gum arabic in water just perfumed with oil of cloves is an excellent mixture.

(2918) G. M. P. asks for receipts (1) for cleaning and polishing marble such as marble top stand tables, bureau tops, etc. A. Brush off the marble and apply following: ¼ pound whiting, ¼ pound soft soap, 1 ounce washing soda, a piece of blue vitriol the size of a walnut. Rub over the marble and let it stand 24 hours, then wash off and polish with a piece of flannel. To remove stains use a mixture of 1 ounce ox gall, 1 gill of lye, 1½ tablespoonfuls of turpentine, made into a paste with pipe clay. Apply as above. For oil stains use perfectly dry clay saturated with benzine, and applied over the spot and allowed to stay for some time. 2. For cleaning and polishing furniture. A. Dissolve 4 ounces best shellac in 2 pints 95 per cent alcohol, add 2 pints linseed oil, 1 pint turpentine, mix and add 4 ounces ether and 4 ounces ammonia, mix, shake before applying. Use a sponge. 3. For cleaning and polishing ivory, such as piano keys, etc. A. For piano keys use the finest crocus or whiting. You cannot whiten them except by special treatment, such as exposure under turpentine to the sun's rays. 4. For taking all kinds of stains, etc., out of fine clothing. A. Use benzine. Apply in a circle around the spot, and work into the center and sponge off.

(2919) J. B. V. asks (1) how to make blue print paper. What are the formulæ used ? A. See our SUPPLEMENT, Nos. 585, 741, 514, 584, and 714. 2. Can dextrine be made from starch with the use of water alone ? If so, how, or how can it be made without diastase? 2. No. Starch is boiled with a weak acid. 3. How may a bottle be cut off near the bottom without injuring the rest of the bottle ? A. File a notch, start a crack with a red hot poker, and lead it around. 4. What is the formula for the liquid used in mixing gold paint, bronze, gilding, etc. ? A. Use copal varnish or linseed oil and liquid drier. 5. Can you give me a formula for a mucilage that I can stick paper to tin with ? A. Use gum tragacanth. Also see SCIENTIFIC AMERICAN, No. 15, vol. 63.

(2920) F. G. asks : Kindly give the recipe for putting gold leaf letters on leather. A. The cover is first washed with clear gum water. The parts to be gilded are then coated twice with white of egg beaten into a froth and allowed to subside into a clear liquid. A little ammonia may be added. To gild, spread a leaf of gold on the gilding cushion with a knife, and blow it flat, then cut it into strips about one-fifth inch wide. Heat the tool until it is just hot enough to fizz under the wet finger; if it sputters it is too hot and will burn the leather; touch its edge with a rag slightly moistened with sweet oil, and with the same rag rub over the part of the book to be gilt. Roll the tool softly on the strips of gold, which will adhere to it, and when enough is taken up, roll it with a heavier pressure along the places to be gilt, and the gold will be transferred to the leather, the excess being wiped away with a soft rag.

(2921) W. McP. F. writes : I have in my possession a certificate of membership issued by the "Society of the Cincinnati" to my paternal grandfather. It was signed, I imagine when issued (in the eighth year of the independence of the United States), by the President and Secretary. Both names are becoming obliterated by the gradual fading of the ink. "J. Knox" is quite indistinct now. Is there any means by which partial restoration may be effected, or is there any way of arresting the entire disappearance of the signatures ? A. We can only advise careful painting over the signatures with a solution of tannic acid in water. This you should try on a very small portion of the signature first, applying it with a small sable or camel's hair pencil.

(2922) P. J. L. asks (1) how to take the smell out of kerosene, say a gallon at a time. A. Agitate with a perfectly cold solution of bichromate of potash in oil of vitriol; after standing decant, wash with weak soda solution, then with water and decant. 2. How to make vaseline ? A. It is obtained by distilling off the lighter portions of petroleum and purifying the semi-solid residue. It is described in the U. S. Dispensatory. 3. How to make camphorated oil in small quantities. A. Dissolve 2 ounces camphor by heat in one pint of olive oil. 4. Have you any book or printed descriptions giving full details ? A. We know of no book treating of above subjects.

(2923) I. J. A. asks : Please inform me what paste I can use to stick photographs on concave glass for the purpose of painting them, after making them transparent with oil. Common starch used to do it, but now I fail to make them stick, as they seem to shrink and pull off before putting oil on. A. Try fresh thick solution of gum tragacanth or the "paste that will stick anything," described in the SCIENTIFIC AMERICAN, vol. 63, No. 15.

(2924) A. H. G. asks : 1. Please state how a guitar or violin is taken apart (top or bottom off). If steamed, what would be the proper way to proceed ? Please state also how the tail piece or piece that the strings are fastened in on the guitar may be removed. A. Never apply steam, as you may ruin it. Use a rather blunt short table knife. Start the belly off, by forcing the knife in between side and belly at one of the inner bouts, then do same for upper and lower bouts, and finally go all around it. At the neck two short cuts at right angles have to be made. It can then be pulled off. The back is never removed. As regards the guitar, you may pry off the string piece, but it is risky. All this work should be done by an expert, as there is every chance of spoiling the instrument. 2. Please name a few oils other than lard oil and cod liver oil, that are cheap and of a white or creamy color. It matters not whether thick or thin, as long as it is of a very light color or pure white. A. You apparently confuse oils with emulsions. None of the oils you name are white or creamy. 3. What will entirely dissolve gum tragacanth ? A. For ordinary purposes water comes the nearest. A strong solution of borax in water might act better.

(2925) C. S. M. asks : Can you tell me whether there is any metallic solution that could be used to coat over the surface of an electrotype wax mould, which would insure the deposition of copper thereon as thoroughly as the plumbago now used for that purpose ? A. Nitrate of silver, to be reduced by exposure to phosphorous or other vapor, can be used. Thus the articles may be dipped in a solution of nitrate of silver in alcohol. The solution must be saturated. The objects are then exposed under a glass shade or bell jar to the vapor emitted from a solution of phosphorus in bisulphide of carbon. The trouble with the phosphorus process is that it is apt to render copper brittle, if the latter is deposited on a phosphorized surface.

(2926) H. W. asks for some formula for detecting arsenic in paper hangings, draperies, etc. A. If a sample of the paper or drapery is burned, it will, while burning, emit an odor of garlic, if it contains arsenic in quantity. Other tests should be executed by a chemist.

TO INVENTORS.

An experience of forty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

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March 17, 1891.

AND EACH BEARING THAT DATE.

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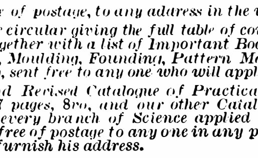

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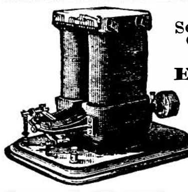

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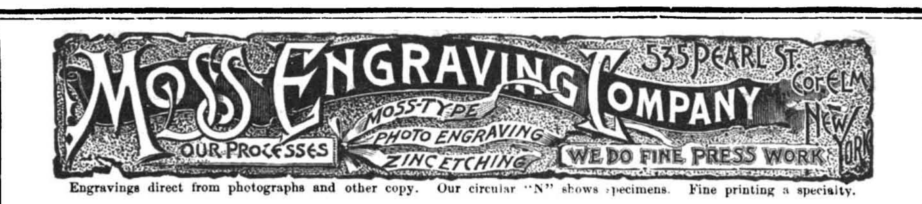

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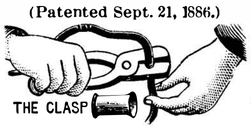

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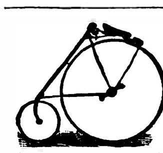

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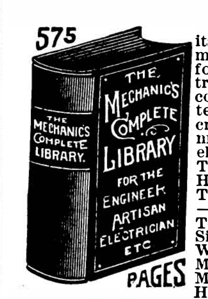

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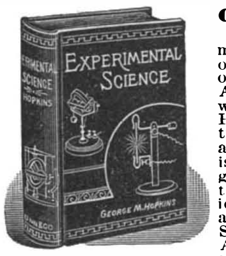

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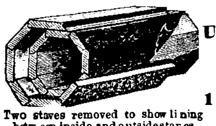

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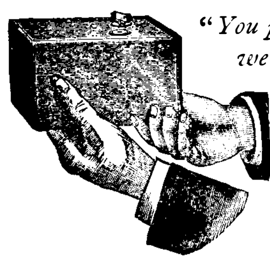

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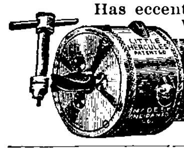

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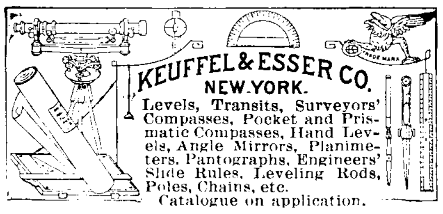

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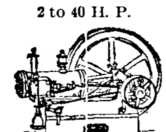

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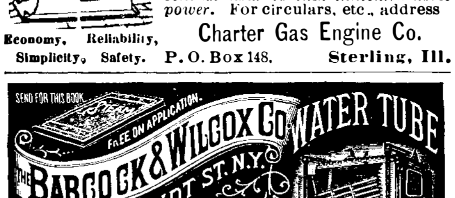

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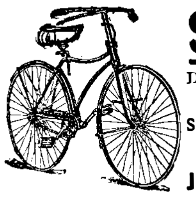

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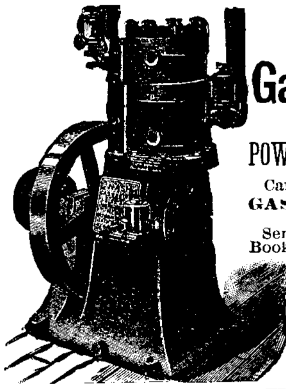

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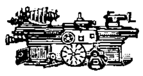

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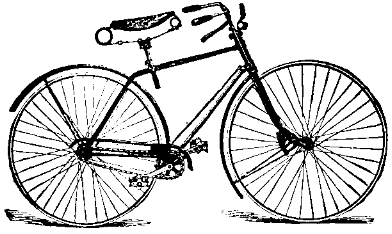

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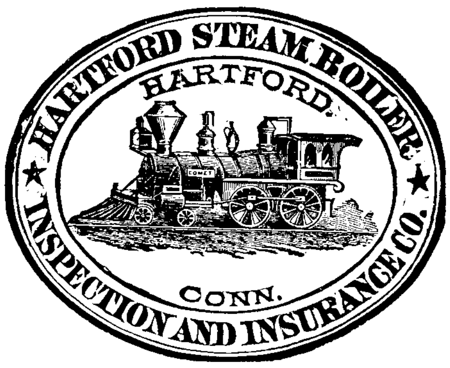

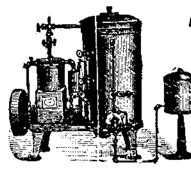

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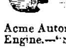

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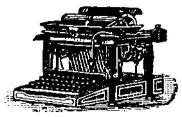

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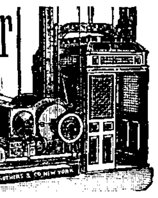

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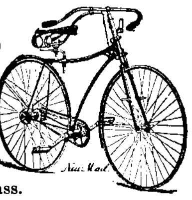

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