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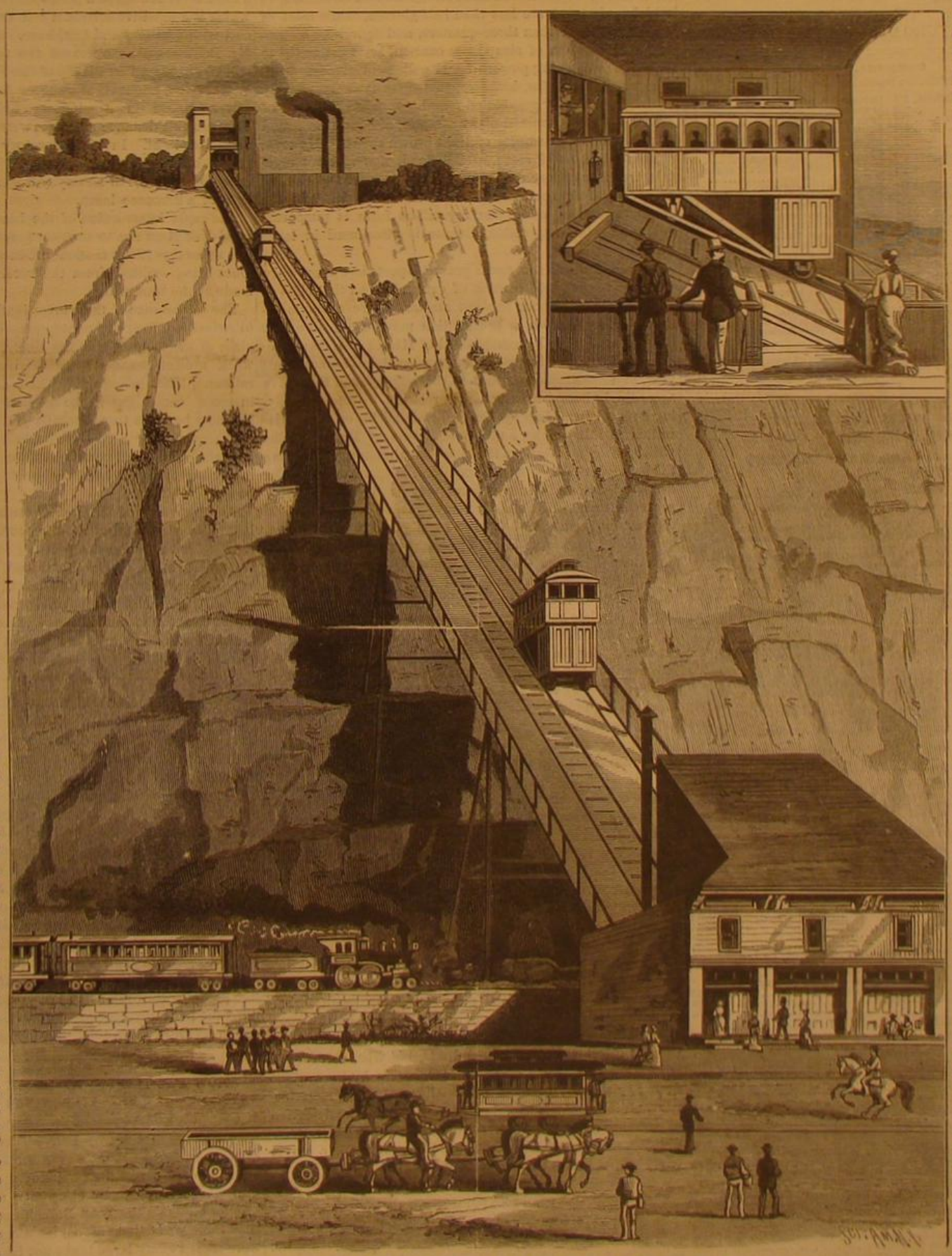
MODERN HILL CLIMBING.

The topography of many Western cities is such that, as the corporate limits enlarge, their most populous portions include districts embodying very rugged features. At Pittsburg and at Cincinnati steep hills, or rather mountains, bordering the Ohio, have long since been absorbed by the cities named, and these are covered with a dense and growing population. This has been of late years rendered the more possible by the general introduction of the inclined railway, which makes hill climbing a luxury. A fair sample of such a railway is noted in the Duquesne Incline Plane Company's roadway at Pittsburg, Pa. In this case the object in view was to surmount the hill known as Mt. Washington, located at the mouth of the Monongahela River and directly overlooking the site of the famous stronghold whose name is given the modern enterprise. The Duquesne is the latest and most complete of four similar enterprises climbing the same mountain. It was opened to the public in May, 1877, and up to September 1, 1880, had carried 500,000 passengers without injury to any one. The perpendicular height reached is 400 feet, length of incline 793 feet, rate of ascent 30½ degrees. The roadway comprises, of course, a double track, one car ascending while its fellow descends, and *vice versa*.

The motive power, consisting of a double engine of 70 horse power, is located at the top of the incline, and motion is communicated to the cars by the means of a large drum carrying steel wire cables of 1¼ inch diameter. A supplementary or safety cable, of 1⅛ inch diameter, is also in constant use. These cables are each 900 feet in length, and are capable of sustaining a perpendicular strain of 50 tons, while the actual working strain is about one-tenth that amount. The safety cable passes around a system of sheaves so arranged that should the working cable part the safety cable will tighten about the sheaves and bring the cars to stop. The cars, neatly and strongly built, will each seat 25 persons, and in the angle beneath them and between the upper and lower tracks there is a space available for light freight. In the Duquesne roadway there is a 360 foot section of wrought iron bridge work spanning the tracks of the "Pan Handle" Railroad. The rails are of the T pattern, 40 pounds to the foot, and the gauge is 5 feet, the double trackway being 20 feet wide, allowing 3 feet between the cars at the passing point.

Rollers of locust and "gum" wood, located at regular distances between the rails, bear the cables in their passage above them. In operating the cars, the engineer in the "cab" at the apex of the incline has absolute control of engine and cars by means of two levers. One operates the reversing mechanism of the engines and the other starts and stops the same. A brake, operated by the engineer's foot, brings sufficient friction to bear upon the cable drum to stop its revolutions even should steam be on. This drum, it might be added, is 12 feet in diameter, with a grooved periphery, and a width of 3 feet 10 inches. The cable winds into these grooves, and the movement of engines, drum, cables, and sheaves is almost noiseless, and indicates little or no strain upon any of the machinery. Experience in this plane has shown that popular prejudice against this mode of travel has ceased, and on Sundays during the summer 6,000 passengers are carried during the day and evening, the cars ascending and descending as rapidly as filled and emptied. Ordinarily trips are made every five minutes, the trip occupying two minutes. The engines, it might be added, are 24 inch stroke and 14 inch cylinders, operating a shaft bearing a driving pinion of 30 inches diameter, gearing into the main driving wheel, which is 12 feet in diameter, 12 inch face. To operate the entire affair for nineteen hours out of the twenty-four requires the services of only five men, namely, two engineers, one conductor, one fireman, and one trackman. The total cost of this incline, cars, real estate, etc., was $47,000, and it is considered a paying enterprise by the stockholders. The single fares are 6 cents. The road enjoys a growing popularity as a means of best obtaining a beautiful and comprehensive view of the "Iron City."



THE INCLINED PASSENGER RAILWAY, PITTSBURG, PA.

M. H. Bateham.

Mr. M. H. Bateham, one of the best known and most active of the promoters of scientific agriculture in Ohio, died recently at his residence in Painesville. Mr. Bateham was born in Kent, England, in 1813; came to this country in 1825, and for the next twenty years resided in Rochester, N. Y. During recent years he has been prominently identified with the agricultural and horticultural interests of Ohio, as Secretary of the State Board of Agriculture and as a leading member of the State Horticultural Society. He was for a number of years editor of the *Genesee Farmer*, after which he founded and edited for ten years the *Ohio Cultivator*. His contributions have been many and valuable in the *Ohio Farmer*, the *Rural New Yorker*, the *American Agriculturist*, and other papers of this class.

The American Institute Fair.

It is to be hoped that exhibitors at the coming fair of the American Institute will be prompt in getting their goods and machinery in place. It is a loss to exhibitors as well as a disappointment to the public to have the fair begin, as it so often does, in a general state of unreadiness.

The Chicago Mastodon.

Portions of a mastodon of enormous size were discovered recently in Wicker's Park, Chicago, in excavating for a sewer. The indications are that the huge animal perished in an ancient marsh or quagmire, and there is hope of the recovery of the rest of the skeleton. The curved tusks are about 7 feet long.

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NEW YORK, SATURDAY, SEPTEMBER 18, 1880.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF
THE SCIENTIFIC AMERICAN SUPPLEMENT
No. 246,
For the Week ending September 18, 1880.
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ADULTERATIONS AND SUBSTITUTIONS.

People who like to mix chiccory with their coffee *should* undoubtedly be allowed to do so, although, for one who knowingly uses coffee so adulterated, probably there are a dozen who do it without knowing. So, too, in regard to those who use oleomargarine instead of dairy butter, taking the former knowingly on account of its lower price, or because a good article of butter may not be obtainable. There are many other deteriorations, adulterations, and substitutions which are also allowable, if not even entirely harmless, provided, as between manufacturer, dealer, and consumer, there be a correct understanding as to the article dealt in, and no attempt at deception is practiced. The difficulty is that deception in some form, or at some stage, seems to be an invariable accompaniment of this kind of business. The manufacturer may not deceive the large dealer, who is supposed, equally with himself, to be an expert; from the large dealer to the retailer, and from the latter to the consumer, however, the opportunities for deception, *without* the commission of any fraud in the eye of the law, are wonderfully increased.

Perhaps one of the most successful of the comparatively new adulterations is that of the use of glucose, made from corn, for the adulteration of sugar and sirup supposed to be made from the sugar cane. Considerable prominence has been given to this matter on account of a trial which took place in Buffalo in July, the suit growing out of a difference as to the ownership of stock in a company which had made immense profits out of the business. Glucose, or starch sugar, is not necessarily harmful, but it has very little sweetening power. Mr. R. C. Kedzie, the president of the Michigan State Board of Health, in a recent report, gives a list of seventeen table sirups he had examined, of which only two were less than half glucose, while most of them were more than three-quarters, and four were *all* glucose. One gallon of sirup from cane sugar is estimated to have the sweetening power of 4·17 gallons of glucose sirup. The writer concludes, however, that there is comparatively little glucose in "granulated" and "crushed" sugars, of which he had examined many samples, although he found it easily in many samples of light brown sugars. He says: "The existence of clean, well-defined, non-coherent crystals, free from floury dust, is good evidence of the absence of glucose from commercial sugars," and adds: "In the common candies, where the crystalline form is purposely avoided as far as possible, glucose is often used in large quantities."

The case assumes a much graver aspect, however, when we come to the sophistication of drugs, and all that class of articles known to our *materia medica*, where a single instance of adulteration or substitution may put health or life in jeopardy. The National Board of Health has, therefore, done well, in the absence of any yellow fever damage this year, to devote some attention to this subject, and they have accordingly issued a pamphlet in relation thereto, embodying a report furnished by Mr. C. Lewis Diehl, on "Deteriorations, Adulterations, and Substitutions of Drugs." The writer, after mentioning the practical difficulties attending the collection of specific information in regard to particular drugs, to determine how general may be the adulteration, proceeds to set forth mainly such facts as are recorded in the current literature of the last twenty-five or thirty years, most of it coming within the published proceedings of the American Pharmaceutical Association. Previous to 1848 large importations of adulterated and inferior drugs were thrown on our market, but in that year Congress passed a law to regulate such importations, and designed to exclude inferior and adulterated drugs. Under this law the "special examiner" for the port of New York, at which most of the importations had been made, had occasion, during the first ten months, "to reject about 90,000 pounds of drugs, such as rhubarb, opium, jalap, gamboge, senna, yellow bark, iodine, croton oil, sarsaparilla, etc., while from 1848 to 1857 the same examiner rejected over 900,000 pounds of unsafe, adulterated, and improper drugs and medicines." It was at once demonstrated that the law had been of great benefit, for the quantity of drugs rejected within a short time after the appointment of the examiner was much larger than a brief period later, and continued to diminish for several years. The record of drugs rejected is not now kept, but the same law is in force, although it is complained that it is not as effective as it should be, because the examiners are not always appointed solely with reference to their fitness for the office.

The National Board of Health have no remedy to recommend for the present state of things, but from the printing of their report, and the diffusion of such information as is here presented, much good may ultimately result. The National Government can exercise more care, or make more stringent regulations if that be necessary, to prevent importations of inferior or adulterated drugs, but what seems even a more necessary than this is uniform action by the various State Legislatures to more effectually control the manufacture and the dealings in a class of goods where the detection of inferiority or deleterious adulterations are generally so difficult, and where any fraud is likely to have a direct effect on the health of the community.

THE PHOTOPHONE.

In May, 1878, Mr. Alexander Graham Bell, well known in connection with the telephone, announced before a scientific society in London his belief that it would be possible to hear a shadow by interrupting the action of light upon selenium. At the recent meeting of the American Science *Association* in Boston, Mr. Bell read a paper describing at length his experiments in the production and reproduction of sound by light, and the invention by Mr. Sumner Tainter and himself of an instrument for the purpose.

The influence of light upon the electric conducting power of selenium is well known. Mr. Bell found the electric resistance of same selenium cells of peculiar construction only one-fifteenth as much in the light as in the dark. It occurred to him that all the audible effects obtained in the telephone by variation of the electric current by sound waves, could also be produced by variations of light acting upon selenium; and that with suitable transmitting and receiving apparatus voices might be conveyed without a wire along a line of light.

The fundamental idea on which rests the possibility of producing speech by the action of light is the conception of what Mr. Bell terms an undulatory beam of light in contradistinction to an interrupted beam; meaning by the former a beam that shines continuously, but is subject to rapid changes of intensity.

The apparatus used to give the required undulatory character to light consists of a flexible mirror of silvered mica or thin glass. The speaker's voice is directed against the back of this mirror, as against the diaphragm of a telephone, and the light reflected from it is thereby thrown into corresponding undulations. In his experiments, chiefly with sunlight, Mr. Bell concentrates upon the diaphragm mirror a beam of light, which, after reflection, is again rendered parallel by means of another lens.

The beam proceeding from the transmitter is received at a distant station upon a parabolic reflector, in the center of which is a sensitive selenium cell connected in a local circuit with a battery and telephone. In a recent experiment, Mr. Bell's associate operated the transmitting instrument, which was placed on the top of the Franklin school house, in Washington, about eight hundred feet distant from the receiver, placed in a window of Mr. Bell's laboratory. Through this distance messages were distinctly conveyed by means of light. In his laboratory experiments Mr. Bell finds that articulate speech can be transmitted and reproduced by the light of an oxyhydrogen lamp, and even by the light of a kerosene lamp.

The rapid interruption of the beam of light by a perforated disk gives rise to musical tones, siren fashion. With this apparatus silent motion produces sound, loud musical tones being emitted from the receiver when no sound is made at the transmitter.

The importance of these investigations it is impossible now to estimate. That the photophone can practically take the place of the telephone is not likely, though it is likely to work radical changes in military and other signaling operations. The heliograph, which has proved so useful in recent campaigns in the Afghan country and elsewhere, can now be made to talk orally yet silently over the heads of an enemy or across impassable streams or other low barriers. For rapid communication between distant exploring or surveying stations, the photophone also promises to be serviceable.

Another result of Mr. Bell's researches in this connection is the discovery that many other substances are sensitive to light. He has found this property in gold, silver, platinum, iron, steel, brass, copper, zinc, lead, antimony, German silver, Jenkins' metal, Babbitt's metal, ivory, celluloid, gutta percha, hard rubber, soft vulcanized rubber, paper, parchment, wood, mica, and silvered glass. The only substances found insensible to light are carbon and thin microscopic glass.

AN ASTRONOMICAL DISCOVERY.

Professor E. C. Pickering, director of the Harvard Observatory, lately made a discovery which is regarded as one of the most important of the century in stellar physics. In the ordinary telescope a star appears as a point of light, brighter, but not larger than when looked at with the naked eye. Prof. Pickering finds that, on placing a prism between the object glass and the eyepiece of his telescope, the light of a star is drawn out into a continuous band. When, however, the telescope with the prism is directed to a planetary nebula, the light is collected into a star-like point without any band, enabling the astronomer to distinguish instantly between a star and a planetary nebula. This principle has already enabled Prof. Pickering to discover several planetary nebulæ. On Thursday evening, August 26, an object was observed which presented the appearance of two star-like points within the band in the modified telescope. It is different from anything heretofore observed in the telescope, and is regarded as an important object for investigation.

HOW ARE THE OIL TANKS SET ON FIRE BY THE LIGHTNING?

Again we have to record the destructive effects of lightning in the Bradford, Pa., oil regions. On the 28th of August, at 8:30 P.M., one of the 25,000 barrel oil tanks of the United Pipe Line Company, near State Line and Tarport, was set on fire by electricity and burned; also four smaller tanks on the West Branch near Bradford. At one time there was danger of a gigantic conflagration, as there were some twenty large tanks not far from the burning tank of the Pipe Company. By firing cannon shot into the tank its contents were run out and the adjacent property saved.

From all we can gather there seems to be good ground for the theory that these numerous lightning disasters in the oil regions are not generally due to direct lightning strokes upon the tanks, but rather to the occurrence of slight electrical sparks within, upon, or near the tank, whereby the explosive gas that hovers about the tank is instantly set on fire. We have in our previous remarks suggested various ways in which the fatal spark may possibly be induced, to which suggestions the reader is referred.

We have now to mention one other possible cause of the fires, and that is the electrified rain drops.

Strong electrical effects are sometimes observed during the fall of sleet, hail, and rain, without the accompaniment of thunder or lightning. Professor Tait, in a recent lecture in Glasgow, said: "Falling rain drops are often so strongly charged with electricity as to give a spark just before they touch the ground."

As the development of the slightest spark in connection with an explosive mixture of air and gas will produce intense fire, we here perceive the remarkable possibility that some of the great oil conflagrations may have been caused by rain.

The whole subject is one of much interest to electricians, and as we have before said, we hope they will investigate the matter so as to ascertain surely the cause of these frequent disasters and discover the proper means of safety.

THE HUDSON RIVER TUNNEL.

It will be remembered that on the 21st of July last a portion of the structure pertaining to the temporary entrance on the Jersey side of the river, opposite New York, suddenly caved in, by which sad accident twenty lives were lost. Steps were immediately taken by the directors of the Tunnel Company to recover the bodies of the buried workmen, repair the damages, and proceed with the tunnels under the river, of which some four hundred feet had been finished when the accident occurred. In our paper of August 7th last, we gave a diagram showing the position of the break, which was near the entrance shaft of the tunnel. The plan adopted by the engineers for the restoration was to sink a coffer dam around the damaged portion, which was also the supposed place where the unfortunate workmen were congregated when the walls fell. The earth at this place is what is termed "made ground;" it is composed of refuse filling matter of all descriptions, forming a most unstable and difficult material through which to drive a coffer dam; but it was thought that the bodies of the lost could be more quickly recovered by sinking the dam than by any other means; and, therefore, the directors ordered the attempt to be made. At a cost of nearly fifty thousand dollars, and the employment of several large gangs of men, working day and night, a coffer dam of the usual construction was made ready, and its sinking began about three weeks after the accident. But after losing nearly a month's time it was found impossible to keep the interior of the dam clear of water, which came in at the bottom, owing to the treacherous nature of the ground, faster than powerful pumps could lift it, and the effort to go down further by that means had to be abandoned.

Recourse was now had to the plan of driving down a caisson, which is a species of diving bell. This method is now very commonly used in sinking the foundations of bridge piers into ground below the surface of the water. A caisson as ordinarily constructed consists of a timber foundation or platform of solid timbers several feet thick, interlocked in all directions to insure strength; the under side, at the edges, is provided with strong sharp lips, which rest upon the ground and support the caisson, leaving an air chamber of about five feet in height under the platform, in which the men work. Rising from the center of the caisson is an entrance tube and air lock, through which the workmen pass and the excavated material is discharged. The deck or upper surface of the caisson is loaded by building the pier thereon; the load so built on serves to carry down the caisson as fast as the men in the air chamber below dig away the earth. The rising of water within the air chamber, where the men work, is prevented by introducing compressed air into the chamber. It was in this manner that the piers of the great suspension bridge between New York and Brooklyn were sunk. The pier on the New York side goes down 78 feet below high water mark, and the caisson men were obliged to work for a considerable time in an atmosphere of compressed air having a pressure of 45 pounds to the square inch, although the average working pressure was 36 pounds.

In the present Hudson River Tunnel caisson the air chamber, instead of having an interior clear space or head room of only 5 feet, has a space of about 18 feet. The object of this is to afford room for the building of the permanent tunnel entrance within the caisson after the proper depth shall have been reached. The interior of the caisson air chamber has the form of a tunnel with a cylindrical roof. The caisson is 41½ feet long and 25 feet wide. The roof of the chamber is composed of strong timbers, heavily braced and filled in solidly with cement, which is carried up to a level, forming a deck on which the necessary sinking load will be built. The ends and sides of the caissons are built of planking, held in place by strong timber cross braces and iron tie rods, running from end to end and from side to side, through the air chamber, as shown in our diagram. This is believed to be by far the highest caisson air chamber ever built. It has been alleged in some engineering quarters that this caisson is not strong enough, and its failure is predicted. On the other hand, Mr. D. C. Haskin, the president of the company and designer of the caisson, avers that its strength is ample, and his plan is stated to be fully sustained by excellent engineers.

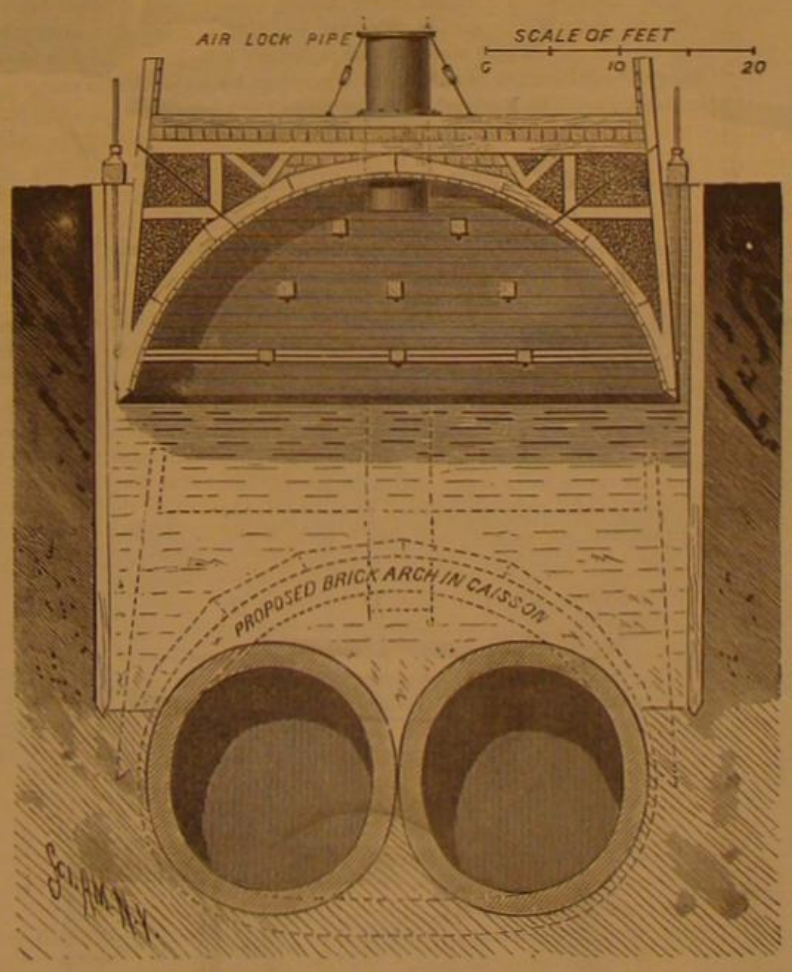
The whole enterprise from its inception has been criticised by certain know-all engineers, who predicted that the tunnel could never be carried under water on Mr. Haskin's plan. But he answered his critics by simply going ahead and building a section of the tunnel in the most difficult place probably of any on the line of the works.

The Hudson River Tunnel is one of the grandest and most important engineering enterprises now before the public, and those engaged in its execution deserve the highest praise for the skill they have displayed. Mr. Haskin and his coadjutors have so far achieved a great success with their plans. The unfortunate accident has hindered them a little; but we hope soon to be able to chronicle the interesting fact that the new entrance is completed and the tunnel building again going forward with rapidity.

Referring to our diagram, the new caisson is shown as it now stands suspended by iron side rods in the upper part of the abandoned coffer dam, the side lining of which extends down to a considerable depth.

The two tunnels below represent the mouths of the portions of the twin tunnels already built, which tunnels will form the main lines of the railway under the Hudson River. When the caisson is fully sunk home it will occupy the position shown by the dotted lines. A single broad arched tunnel will then be built within the caisson to inclose the mouths of the twin tunnels; and the single tunnel will extend thence on a proper grade to the surface of the ground in Jersey City.

The new caisson is now nearly ready. As soon as it is completed the nuts of the side suspension rods will be unscrewed and the caisson lowered until its bottom edges rest on the earth. The workmen will enter through the central tube; a smaller tube, not shown, will be used in addition to the central tube to facilitate removal of the excavated material. At the upper end of the central tube the air lock will be located, and during the descent of the caisson a pressure of air will be maintained within the caisson by air pumps in the usual manner. The descent will be accomplished by digging away the earth under the caisson, and at the same time building a weight of masonry on the flat deck of the structure, around the central tube.



THE NEW CAISSON—HUDSON RIVER TUNNEL.

The Superiority of American Locomotives.

Additional testimony as to the superior design and construction of American locomotives is given by Mr. R. M. Brereton, Chief Engineer of the Great Indian Peninsula Railroad. After noting the fact that under less favorable conditions of climate, road bed, steeper gradients and sharper curves, from 8,000 to 10,000 train miles greater duty per annum is obtained from locomotives in America than in England or in India, Mr. Brereton says: "The greater duty obtained cannot be due to better workmanship and superior materials, because it is well known that the English mechanic in skill of hand cannot be excelled, and the very best materials are employed by our English builders, and the hours of work in both countries are nearly the same. Hence I argue that the greater duty done by the American motor is due to the better designs and the better system of working the locomotives. The American builder excels in the system of framing and counterbalancing, and in the designs of the crank, axles, etc., so that the engine may run remarkably easy and without jar around short curves, and work not only on the light roads, but also diminish the wear and tear on the solid roads, and at the same time increase the effective tractive force. The English engine is a very heavy affair, and, in running, it not only wears and tears itself very rapidly, but also the roadway, and it greatly, by its unsteadiness and jar, fatigues the drivers and firemen."

Coal in Manitoba.

Notice was taken some months ago of the discovery of coal in Manitoba by the Canadian geological surveyors. Recently two barge loads of coal arrived at Winnipeg from the Souris country, the first installment from what is styled the future Pennsylvania of the Dominion. The coal was forty-three days coming down the river, and is said to be of a serviceable quality. The barges were constructed at the coal fields, out of timber made from trees felled on the spot. Much difficulty was experienced on the journey, as timber jams and other obstructions to navigation were met with, but all were overcome, and the feasibility of Souris navigation determined. It is anticipated that there will be sufficient water in the river until August in each year to float barges down. At present there is twenty feet of water in the river. Mr. Hugh Sutherland, proprietor of the mines, has expended some $15,000 on the experiment, and now that he is satisfied of its success, will go on with the work on a much larger scale. He intends to make one trip a year, building sufficient barges to bring down all the coal needed for a year's supply.

Improvements in Modes of Travel.

At the beginning of this century a passenger—more correctly, traveler—starting from New York Monday forenoon could, with good luck, arrive in Boston Friday afternoon, having stopped all night at New Haven, New London, and Providence. The fare for the trip varied from $15 to $18, and there was an additional outlay required of from $5 to $6 for board and lodging; that is, the trip took up four days of time and called for an outlay of from $20 to $24. After the war of 1812 there was an improvement, and the time between this city and Boston was cut down to about two days, and the cost of the journey to $14. In 1817 the fare between New York and Philadelphia was $10, and between New York and Albany by boat $7, and the average time twenty-four hours. A route was that year opened between Philadelphia and Quebec, the distance 700 miles, fare $47, and time required to make the journey 103 hours. In 1826 the Boston newspapers recorded the circumstance as one worthy of special comment that New York papers had been received in that city in twenty-four hours after the date of their publication. In 1828 the time required to make the journey between these two cities had been reduced to twenty-one hours, the route being from this city to Providence by steamboat, and from thence to Boston by stage. But in winter these trips were frequently given up in consequence of stormy weather, and those who wished to avoid danger and be certain in their movements still preferred the overland route. In 1832 there were two regular stage lines between this place and Boston, but competition had reduced the fare. The slow line made the distance in about fifty-two hours, and charged for passage $7.50, while the fast or mail line took its passengers through in about forty-five hours, and charged them $8.50 a trip. Since then railways have brought the journey within the compass of a few hours, and it is by no means improbable that the time may yet be materially reduced.

An old millstone, five and a half feet in diameter and seven inches thick, with a central hole seven inches in diameter, was left in an English orchard many years ago. In 1812 a filbert tree sprouted from the earth at the bottom of the hole, and gradually increased in size from year to year until, in 1868, it was found that the tree had completely filled the hole, and actually lifted the stone from the ground, wearing it as a girdle about its trunk.

The Connecticut State Board of Health has wisely decided that, in the optical tests of railway men, old employes, who cannot pass all the tests prescribed by the experts employed in the examinations, may be tested by flags and lanterns of the size and colors used by the railroads at a distance of 80 rods. Of the 1,085 persons thus far examined, 56 have failed to meet the requirements.

AGRICULTURAL INVENTIONS.

An improved sulky plow has been patented by Mr. Horace E. Reeves, of Fort Dodge, Ia. The object of this invention is to construct sulky plows in such a manner that the plows can be readily adjusted and controlled, will be firmly held while at work, and will yield should they strike an obstruction.

An improved horse hay rake of that form in which a revolving rake having teeth on opposite sides of its center is connected to an axle mounted on a set of running wheels and is provided with stop devices, which either hold the rake rigid while it is gathering the load or may be released to allow the rake to revolve and the load to be dumped, has been patented by Messrs. Isaac Q. Williams and Gustavus H. Osborn, of Goshen, Ark.

New Zealand Cast Steel.

The black beach sand, so abundant in certain New Zealand shores, is likely to prove of great industrial benefit to that rising colony. The government has lately employed a mechanic to test the ore; and although restricted to an expenditure of $500, he has succeeded in turning out five hundredweight of excellent steel. He mixed the iron sand with an equal quantity of clay and shelly sea sand to form bricks, which, after hardening in a kiln, were broken up and smelted in an ordinary cupola furnace. The product was fine cast steel, from which some promising specimens of fine cutlery were manufactured.

IMPROVED LACE CUTTER.

Since the universal adoption of belting as a means of transmitting power, no little attention has been paid to devising means of uniting the two extreme ends of a belt, in a manner both efficient and easy of application. Perhaps the first thing ever used for this purpose was a thong or lacing cut from thin tough leather, and passed alternately through holes punched in either end of the belt, very much after the fashion of lacing a shoe, from which the idea was probably taken.

Judging from the amount of lace leather annually made, it would seem that the method of lacing belts was by no means the least popular. The disadvantages of cutting these lacings with a knife are so great that many consumers prefer to buy "cut lacings," notwithstanding the fact that they are seldom just what is wanted.

This objection is fully obviated by the use of the little tool shown in our engraving, which cuts and points lacings of any length or width as wanted and without loss of time or leather.

ELLIOTT'S LACE CUTTER.

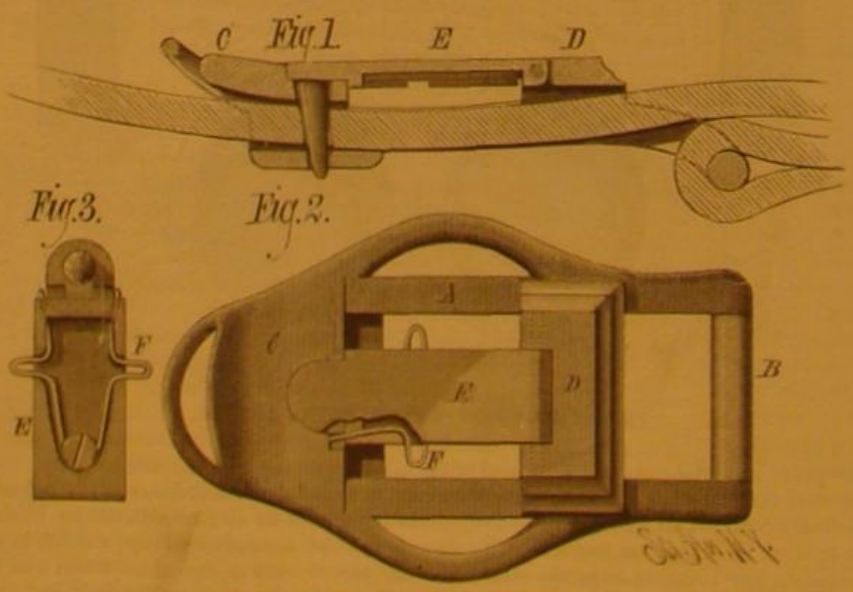
The construction of this lace cutter will be understood from the engraving. It is a practical and well made tool, the result of a long experience in the manufacture of tools of this class by the inventor, who was the first to place a lace cutter upon the market.

Manufactured exclusively by Sterling Elliott, 262 Dover street, Boston, Mass.

IMPROVED HARNESS BUCKLE.

The engraving shows a harness buckle possessing several points of novelty and several advantages over buckles of the ordinary style. In point of appearance it is certainly all that could be desired, and it is very easily operated.

Fig. 1 is a longitudinal section of the buckle; Fig. 2 is a face view, and Fig. 3 is a detail view of the tongue showing the arrangement of the spring. The free end of the tongue is circular, and fits in a recess formed in the plate, C. A finger is formed with the free end of the tongue, and when the tongue is closed, the prong passes through a hole in the head plate, C, and in the plate below it. The spring catch, F, holds the tongue closed, or prevents the prong from being accidentally disconnected from the strap or trace, which is inserted between the bar, C, and the lower bar. The catch is made of spring wire, which is bent so as to have approximately a U-shape, and is confined in a recess in the under side of the tongue, E, as shown in Fig. 3. The ends of the arms of the catch, F, enter lateral notches formed in the plate, C, on each side of the recess, in which the head of the tongue fits. To open or close the tongue, E, the spring arms of the catch are pressed inward or toward each other, forcing the ends of the arms out of notches in the bar, C.



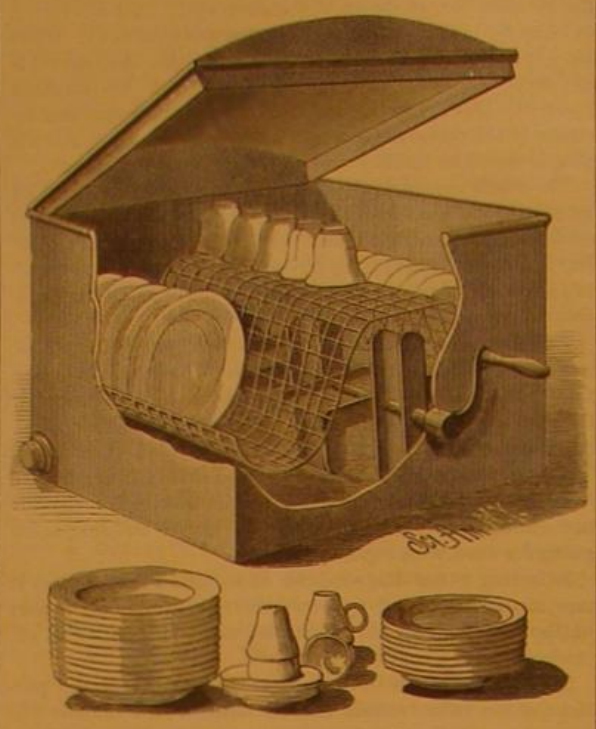
GAVITT'S HARNESS BUCKLE.

This buckle is very readily buckled and unbuckled, a great advantage when a horse gets down, as it can be unbuckled when the straps and traces are drawn tight. Where the buckle is applied all of the straps are kept perfectly straight, and the stitches are not worn or strained. The buckles may be of a uniform pattern throughout the harness, giving the harness a fine appearance. The spring is placed in a cavity in the tongue, and is thoroughly protected from dust, mud, and rain.

This improved buckle was recently patented by Mr. James A. Gavitt, of Dayton, Washington Ter.

NEW DISH WASHER.

Our engraving represents a very simple and effective machine for washing dishes, recently patented by Mr. Benjamin



HOWE'S DISH WASHER.

J. Howe, of Sing Sing, N. Y. The machine is shown in perspective, with a portion broken away to show the internal construction. A shaft carrying paddles revolves in a suitable vessel of tin or galvanized iron, and over the shaft is placed a curved grating which supports the dishes to be washed.

Cups and similar articles are placed on the elevated portion above the shaft, and plates and flat dishes are placed on either side of the shaft.

The paddles are of peculiar shape, being tapered and provided with flanges or lips which strengthen them and cause them to throw more water and with greater force than they would if made perfectly plain. The vessel containing the dishes and the paddle shaft has a tight-fitting cover, and the shaft is provided with a crank by which it is turned. The vessel is partly filled with water, with the addition of a little soap, and the crank is vigorously turned both ways for a moment or so, when the cover of the vessel is removed and a quantity of water is poured over the dishes to rinse them. The dishes are quickly and thoroughly washed, with the expenditure of very little labor, and the breakage and nicking of dishes is entirely avoided. It is claimed that as many dishes can be washed and thoroughly cleansed in five minutes by the use of this machine as can be done by one operator in the usual way in an hour.

It is of great utility to private families, and its use in restaurants and hotels will effect a great saving both in labor and in dishes. This machine can be made of any size, form or material, to hold from 50 to 1,000 dishes if desired.

Photographs by Lightning.

Mr. R. Crowe, of Liverpool, communicates to the *British Journal of Photography* an account of some attempts to photograph a landscape by the aid of lightning flashes. A gelatine plate, requiring by day an exposure of two seconds, was exposed from 10:15 P.M., to 10:45 P.M., during which time there were 120 brilliant flashes and about half as many minor ones. Most of these were in a horizontal direction, and five or six of them were imprinted on the negative. A perpendicular flash which struck a church tower half a mile away was rendered with extraordinary sharpness and brilliancy. The surrounding objects, in spite of the long exposure, were but feebly impressed; whence Mr. Crowe argues that though the light of a flash of lightning is of a very actinic character, there still is not sufficient volume of light to illuminate a landscape or building to allow a successful photograph to be taken. [The probable difficulty is that the photo-plates are not sufficiently sensitive. The duration of a lightning flash was found by Wheatstone to be less than a millionth part of a second. We believe there is no record of the successful photographing of any object with a plate exposure of so short a length of time, even in the strongest sunlight.—EDS.]

Bread Making in Spain.

The bread in the south of Spain is delicious; it is white as snow, close as cake, and yet very light; the flour is most admirable, for the wheat is good and pure, and the bread well kneaded. The way they make this bread is as follows: From large, long panniers filled with wheat they take out a handful at a time, sorting it most carefully and expeditiously, and throwing every defective grain into another basket. This done, the wheat is ground between two circular stones, as it was ground in Egypt two thousand years ago, the requisite rotary motion being given by a blindfolded mule, which paces around and around with untiring patience, a bell being attached to his neck, which, as long as he is in movement, tinkles on; and when it stops he is urged to his duty by the shout of "*arra mula*" from some one within hearing. When ground, the wheat is sifted through three sieves, the last of these being so fine that only the pure flour can pass through it; this is of a pale apricot color. The bread is made in the evening. It is mixed with sufficient water, with a little salt in it, to make into dough; a very small quantity of leaven or yeast in one batch of household bread, as in Spain, would last a week for the six or eight donkey loads of bread they send every day from their oven. The dough made, it is put into sacks and carried on the donkeys' backs to the oven in the center of the village, to bake it immediately after kneading. On arriving there the dough is divided into portions weighing three pounds each. Two long, narrow wooden tables on trestles are then placed down in the room, and a curious sight may be seen. About twenty men, bakers, come in and range themselves on one side of the table. A lump of dough is handed to the nearest, which he begins kneading and knocking about with all his might for about three or four minutes; and then passes it on to his neighbor, who does the same, and so on successively until all have kneaded it, when it becomes as soft as new putty and ready for the oven. Of course, as soon as the first baker has handed the first lump to his neighbor, another lump is given to him, and so on until the whole quantity of dough is kneaded by them all. The bakers' wives and daughters shape the loaves for the oven, and some of them are very small. They are baked immediately.

Electricity on the Stage.

In Paris, during the play of "*Le Pied de Mouton*," a table is brought on to the stage, and afterwards a candlestick carrying two lighted candles. One of the characters in the play blows out the candles; but as soon as he moves away one of them unaccountably becomes relighted. The actor again blows out this light, when the other one becomes kindled; and, becoming enraged, the man takes up the candlestick and blows furiously without being able to extinguish the lights permanently. This effect, which gives rise to some amusement and astonishment, is produced by means of an induction spark which inflames the vapor from a mixture of ether and spirits of turpentine contained within the vessels which represent the wax tapers.

A cable of four fine conductors connected the latter, and the points between which the spark passed, with the table, and through it with the induction coil below the stage.

A NEW ROCK DRILL.

The skill of a great many able mechanics and engineers, and a great deal of capital, have been employed in simplifying and perfecting machinery for drilling purposes, the principal object being to avoid breakages, which are far too common in the ordinary machines. It has been found by actual observation that where any great amount of work is being done it requires six drills to accomplish what should be done by four on account of the loss of time occupied in repairing broken parts.

In former machines the parts most liable to breakage were the valves, and as no modification of their construction has been sufficient to give them a durability which compares with that of other parts of the engine, the difficulty in many cases seems wholly irremediable, and the only recourse is to have a sufficient supply of duplicate parts on hand to be ready for emergencies.

Notwithstanding the many failures, mechanics and engineers, appreciating the immense benefits to be derived in case of success, have pluckily continued with their experiments. As valves could not be made sufficiently durable, the line of experiment naturally tended in the direction of valveless engines. These were known to be perfectly practicable in some respects, while in others, more particularly in the displacement of the compressed air or steam at the ends of the cylinder at the termination of the stroke, and giving a cushion for the piston to prevent severe concussion with the cylinder heads, the problem has remained unsolved until now.

Mr. S. G. Bryer, of Saugus, Mass., who has had an experience connected with rock drills of over ten years, after much experiment has devised the only thoroughly practicable valveless engine for a rock drill yet made. The piston of this drill is its own valve, thereby dispensing with the small valves and their consequent wear and breakage, together with many other small and weak parts common to other drills. As will be seen by reference to the engraving, it has fewer parts than any other rock drill in the market. Practically, there is nothing but the cylinder, the piston, and the rotating motion, which is perfectly simple and scarcely exposed to wear or breakage. The blow delivered is as positive and effectual as that from any other style of drill—a result which has never before been obtained with a valveless engine.

The advantages of this drill consists in such an arrangement of parts as to entirely obviate the use of tappets, valves, or other auxiliaries depending for their action upon percussion; while it is a perfectly effective and smoothly-working machine, free from liability to accident. It is sought to reduce it to the smallest number of unexposed parts, and so to simplify them that they can be easily repaired or duplicated and be interchangeable.

In the upper portion of the sectional cut, midway between the center and either end of the cylinder, are two annular grooves; these are connected on the back by a passage way, forming a steam chest, to which the supply pipe is attached. The exhaust port is located in the center of the cylinder. In the piston head are two grooves, which also pass entirely around, corresponding in width to those in the cylinder, distant from each other half the space of the latter from the exhaust port. In the right-hand portion of the piston, extending from the grooves in the same to either end, is shown a passage way for steam. In the lower part of the cut is what is termed the cushion valve, its lower end resting upon the lower head of the valve chamber. The valve is cylindrical, and reduced in size, between the ends and middle, to admit of free passage of steam to the exhaust ports of its chamber.

From this description, the operation of the drill can be easily understood. The steam forms a cushion at the end of each stroke, which prevents the piston from knocking. To the upper head of the cylinder is secured the usual device for rotating the piston and drill, consisting of a rod with spiral flutes, entering a socket in the piston head.

The improvements embodied in this drill secure a large percentage of useful effect, with the least supply of steam, the utmost expansive power of the same being utilized by its peculiar construction; and since no part strikes another to give it motion, the wear is insignificant. The inventor has displayed great skill in locating the control of the piston's action within itself, thus rendering the free and perfect operation of the drill wholly independent of auxiliary appliances. The drill may be operated equally well by the use of compressed air, and is absolutely non-freezing. In our opinion the claim of the manufacturer that this drill presents the greatest simplicity and efficiency is well founded; and we think that wherever it may be introduced, it will give satisfaction. Mr. J. Allston Newhall, 67 High street, Boston, Mass., is the proprietor and manufacturer.

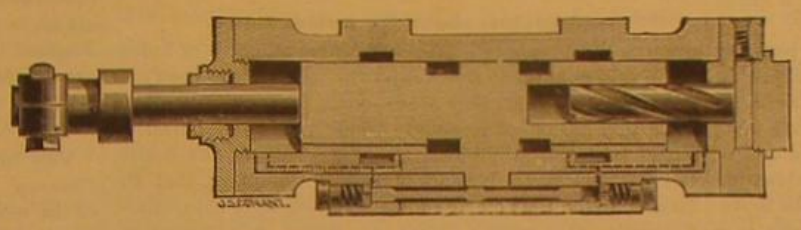


Fig. 2.—LONGITUDINAL SECTION OF ROCK DRILL.

Fig. 1.—THE BRYER ROCK DRILL.

NEW INVENTIONS.

An improvement in whiffletrees has been patented by Mr. Ferdinand O. Fischer, of Aptos, Cal. The invention consists in combining a lever spring, shouldered bar, and slide bar having end disk, with the end of a whiffletree.

Mr. John Flanagan, of Newburg, N. Y., has patented a hydrant formed of a case with waste opening, shouldered valve rod, fluted screw plug valve, and a ring. The arrangement of the several parts cannot be described without an engraving.

Messrs. Carl P. Cullmann, of Idar, and Carl A. Lorenz, of Oberstein, Germany, have patented a process of manufacturing onyx stones from agate, by immersing one side in a bath of dilute nitric acid and iron, the other side in a bath of carbonate of potassa and water, then drying the stones on a stove, and burning them to fix the color.

Mr. Carl J. Renz, of Hudson, N. Y., has patented an improved process of preserving fruits, and more particularly grapes, pears, strawberries, and other fresh whole fruits without the use of a mother liquor. It is an improvement in that general process of preserving in which the air is first exhausted from the receptacle in which the fruit is placed, and in which the gases subsequently evolved by the fruit are taken up by an absorbent. The improvement consists in deodorizing and absorbing the condensable gases by a block of quassia wood or other material impregnated with quassia.

A simple and efficient apparatus for obtaining a vacuum has been patented by Mr. Lyman H. Ward, of St. Mary's, Texas. The vacuum is formed in this apparatus by the displacement of water or other liquid.

Origin of Fires.

Theories of fire "origins" run in fashions, and at times, the *American Exchange and Review* thinks, the favorite presumptions become much overdone. Defective flue is the actual source of a great many ignitions, and it is not apt to be exaggerated, like newspaper "incendiarism," but occasionally we may go too much on "defective flue." A clothes press adjoining a flue in a Pittsburg dwelling lately took fire; defective flue was, of course, named as the flame maker, but, on further examination, it was found that the closet was a receptacle for soiled clothes and rags, and some of the latter were saturated with an oleaginous lotion for "rheumatiz." The combined oil and cotton, in a confined atmosphere, at a temperature produced by the heat radiations from the flue, were together inflammable. The "mishap" will perhaps go by the name of spontaneous combustion, yet this is solely due to the fact that the substance required a comparatively low temperature in order to ignite; flue was the inciting cause, so far as relates to the merely physical condition of the fire-making. Fires are generally of mixed origins.

American Manufactures by a Colonial Editor.

The last issue of the Victoria *Review*, the leading magazine published in Australia, pays the following tribute to American manufactures and to our series of illustrated articles on American industries. American manufactures, says the editor, are a perpetual source of wonder and of instruction to the foreign observer. In perfection of machinery, scientific division of labor, and completeness of execution, there is nothing in the world besides to be compared with them. To visit the great continent and inspect the leading manufactories must be equal to a good education for any man possessing a mechanical turn of mind. But, failing time and means to go forth on such an expedition, a foreign reader can make himself as well acquainted with the subject as if he were on the spot, simply by taking in the SCIENTIFIC AMERICAN and regularly perusing it. In the current numbers there are full descriptions, illustrated by excellent woodcuts, of the manufacture of printer's types by Messrs. Farmer, Little & Co., of New York; the manufacture of Mége oleomargarine and oleomargarine butter by a New York company; the brass manufacture of the Benedict and Burnham Company at Waterbury, Conn.; and of the great tunnel under the Hudson River, between New York and New Jersey, which is of a similar character to the London underground railway, and is in the hands of a company holding a capital of $10,000,000. The tunnel will be 5,000 feet long, or more than three times the length of the Thames tunnel. There seems to be but little doubt of its being carried through to completion.

The oleomargarine butter is a product extracted from beef fat, according to a principle discovered by M. Mége, a French chemist, about twelve years ago. The butter produced is pure, perfectly wholesome, and suitable for all domestic purposes. The company work up an average of 100,000 lb. of fresh caul fat daily, producing from 40,000 to 50,000 lb. of butter, selling at from 15 to 20 cents a pound. This invention of the French chemist has added many millions of dollars annually to the value of the staple products of the country. In addition to the foregoing articles, there is, in the numbers before us, a vast variety of illustrated descriptions of new inventions and improvements in many branches of mechanical construction. It was shrewdly observed by the English Consul at New Orleans, in a report he lately sent to the British Government, that the superiority of American over British manufactures is due, among other things, to the fact that the Americans never raise the objection to any novel "notion" or suggestion that it is "new-fangled." In fact, they rather prefer it on that account. The newer, the more likely to be an improvement on the old method, is the principle they go by. English manufacturers, on the other hand, proceed on the most rigid lines of custom and precedent, and are very jealous of anything in the shape of an innovation on the established methods. The result of this difference between the two nations is that the Americans are beating the British completely out of the field in many branches of manufacturing industry. Edison's "new-fangled" inventions are not alone revolutionizing the world of practical ideas, but are making their inventor rich beyond the dreams of avarice. It is to the Americans, rather than to their home friends, that Australian manufacturers should turn their eyes for precedents and examples. The SCIENTIFIC AMERICAN ought to secure a wide circulation in this part of the world. To manufacturers of every description it is simply invaluable.

MECHANICAL INVENTIONS.

Mr. Perry A. Peer, of Comstock, Mich., has patented a hinge peculiarly adapted to a V-shaped harrow. When it is desired to uncouple the two sections of the harrow, one of the sections is allowed to

lie flat on the ground, and the other is raised to about a vertical position, and it may then be readily detached.

Mr. John O. Grisham, of State Line, Miss., has patented a corn cutting and grinding mill, which is an improvement upon the form of corn crusher in which the ears of corn in the husk are fed through throats, sliced into sections by revolving knives, and these sections then rendered fine by passage between grinding surfaces. The invention consists in combining with the feeding throats and knives, a set of spring seated tables, which hold the ends of the ears of corn while being cut, and which allow the sections being cut off to press down to accommodate the thickness of the knife, thus preventing the knife from hanging in the ear, and rendering the cutting action easier.

Mr. Isaac S. Schuyler, of Brooklyn, N. Y., has patented a machine for cutting screw threads. The improvements relate to machines for cutting screw threads on pipes and couplings, internally and externally, and are designed to accomplish such work more rapidly and perfectly than has heretofore been done. Rotary cutters formed with serrated edges are employed. The arbors of the cutters are fitted in a revolving head that has an endwise motion proportioned to the pitch of the screw, so that while the cutters rapidly revolve with their arbors they also travel in a spiral path upon the surface being operated upon.

Mr. Charles G. Trafton, of Slatersville, R. I., has patented a thread guide for spooling machines that is self-adjusting to the yarn as the latter runs from the bobbin to the larger spool, so as to avoid friction. It consists in a guide plate provided at one end with a curved friction surface and at the other with a slotted flange and a plate, in combination with a rod having projections at its top to limit the move ments of the plate sidewise and a screw which serves as a pivot for the plate.

An improved gin saw sharpener has peen patented by Mr. Robert S. Mudford, of Texarkana, Ark. The object of this invention is to improve the construction of the gin saw sharpeners for which Letters Patent No. 20,933 were granted to A. H. Burdin, July 20, 1858, in such a manner that they will bring the teeth to a better condition.

Mr. James H. H. Taylor, of Lawrence, Mass., has patented a mechanism for stopping and starting street cars, so constructed that the momentum of the car can be used for stopping the car, stored up, and again used for starting the car.

Mr. William W. Rochelle, of Star Landing, Miss., has patented a tool for sharpening the teeth of cotton gin saws. It is made in three pieces—the sharpening bit proper, which is shaped at its outer end to enter between the teeth, the head or shank, which is formed to receive and support the bit, and a sliding collar, which clamps the bit in the head by a wedging action.

DECISIONS RELATING TO PATENTS.

By the Commissioner of Patents.

STEVENS *vs.* PUTNAM.—INTERFERENCE.—WIRE BARBING MACHINE.

Marble, Commissioner:

1. The earliest date at which an invention can be said to exist is that time when there was in the mind of the inventor a well defined idea of something which might rightfully constitute the subject of a patent.

2. The law is well settled that a mere unembodied principle or discovery is not a subject of a patent, and it must follow that the mere mental apprehension of the same is not the conception of an invention. When, however, the principle or discovery is rendered of practical service by its embodiment in material form, there exists something for which a patent can be allowed, and the union in the mind of the inventor of the principle or discovery with the means of its embodiment is conception of the invention.

3. A combination, as distinguished from a mere aggregation, may be defined as a union of elemental parts co-operating dependently to produce a desired result, and a conception of such combination must include not only the idea of associating the parts, but also that of so uniting them that there will be a dependent co-operation.

4. The fact of the conception of an invention is one which public policy demands shall have been so evidenced as to be capable of other proof than the mere allegation of the inventor that such invention was at a certain time in his mind before it can avail him anything, and so long, therefore, as he keeps his invention unembodied and undisclosed it cannot serve to antedate and thus defeat the invention of a contestant.

United States Circuit Court.—Southern District of New York.

BRICKILL *et al. vs.* THE CITY OF NEW YORK.—FEED-WATER HEATERS FOR STEAM FIRE ENGINES.

Wheeler, J.:

1. Letters patent No. 81,132, granted August 18, 1868, to William A. Brickill, for an improvement in feed-water heaters for steam fire engines construed and sustained.

2. Section 7 of the act of 1839, which provides that every person or corporation may use and vend to others to be used any specific machine, manufacture, or composition of matter which they have purchased or constructed prior to the application for a patent, applies in cases of patents for substantive things to the particular things so purchased or constructed only, and does not include the right to practice the invention without liability.

3. The patent involved in the case of *McClurg vs. Kingsland* was for a method of casting iron rollers, and it is not probable that the decision rendered in that case would be followed beyond cases of the same statutory class.

4. By the act of 1870 the right of a person constructing or purchasing a patentable article before the application for a patent is limited to the right to use or vend the specific thing, and this, whether it be regarded as a legislative construction of the former acts or not, may properly govern the right of recovery in actions brought since its passage.

5. For an infringement of a patent by its fire department a city is liable.

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

WASHBURN & MOEN MANUFACTURING COMPANY *vs.* HAISH.—BARBED FENCE WIRE.

Blodgett, J.:

1. A person has no right to mark his goods with any words or terms indicating that they are manufactured under a patent which he does not own and has no right to use.

2. A defendant, having so marked his goods, will not be allowed to defend himself by denying the validity of such patent.

Complaints about the Patent Laws.

There is a growing disposition in some branches of industry in this country to find fault with our patent laws and the manner in which they are enforced. There is hardly a trade that has not at frequent periods its crop of harassing patent suits, which perplex the manufacturer, the dealer, and the consumer. It is not surprising, therefore, that the dissatisfaction thus created finds expression in complaints. Naturally, the subject comes up before the associations formed among those belonging to the various trades for their mutual protection and the advancement of common interests. A committee is appointed, and, if its members are in earnest, a report is drawn up suggesting possible measures of reform. Such has been the course pursued by the millers, and we learn that the brewers have taken the first steps in that direction. All this is very well in its way, but it does not seem as though the agitation of the subject is conducted in the manner best calculated to secure the reforms desired. The reports of such committees are so evidently biased by the interests of the members, as defendants in patent suits, as to have, as the rule, little or no value. The one great and sole object of their efforts seems to be to beat the particular patent or patents which menace them, and the fact is lost sight of that it is to the interest of every enterprising manufacturer to aid in sustaining patents. In many cases where complaint against the patent system is loudest, known rights have been infringed, and the protests of patentees disregarded, in the belief that it was cheaper to take the chances of infringing than to recognize the demands of those whose claims were disregarded. Patents thus ignored almost always acquire an unexpected value before they expire, and it is quite usual for them to be made the basis of expensive suits. Often they are sustained by the courts and become very valuable, for the simple reason that they have been infringed without regard to consequences. Manufacturers who find themselves figuring as defendants in suits of this character commonly have a great deal to say about the injustice of our patent laws. Perhaps they are unjust in their requirements in some instances, but to modify them in any essential particular in points touching the value of valid patents would be to destroy an immense property right, and to make it extremely difficult for an inventor or the owner of a patent acquired by purchase to protect himself in the enjoyment of the rights it is designed to secure to him. It may be vexatious to settle or defend frequent demands for royalties and damages; but it is still more so to know that you have valuable rights in patents which you are unable to enforce, and that which should belong to you alone has become common property.

The only safe and honorable position for the manufacturer is one of justice and fair dealing. He should act advisedly with regard to the payment of royalties and the infringement of patents. If he manifests a fair and liberal disposition in this matter, and a willingness to recognize the rights of others as beginning where his own rights cease, he is not likely to have serious trouble. As the rule, it is cheaper to purchase a right under a patent than to defend an infringement; but when a manufacturer persistently disregards notices and warnings, and takes his chances as an infringer, he should stand by the consequences like a man, and not whine nor complain if called upon to pay for what he has taken without leave. He may, at least, have the satisfaction of knowing, under such circumstances, that every decision of the courts affirming the validity of patents increases the value of those he owns and controls, and that he has thus a direct interest in sustaining all good patents. But then we must make some allowance for human nature, and it certainly does make a great difference in a man's feelings whether he appears as plaintiff or defendant in a patent suit. He often does and says a great many things when he is defending an infringement suit which he would be very sorry to have quoted against him should he ever find it necessary to move for the protection of his own rights and interests. Our patent laws may be susceptible of improvement, but the men to improve them are not found on committees representing cliques of defendants interested in suits brought to recover damages for the wholesale infringement of valid patents. What they have to say may always be taken with some allowance.—*Iron Age.*

Apples for Foreign Markets.

Speaking of the magnificent apples shipped from the United States, the London *Magazine of Pharmacy* says that there is no reason why this splendid fruit should not be received in London as fresh and blooming as when first gathered from the tree. To secure this most desirable result each apple should be wrapped in soft tissue paper, previously soaked in a solution of salicylic acid and dried.

The best preparation of salicylic acid for this purpose is the alcoholic solution, made with the strongest spirit, and then diluted with as much water as it will bear without precipitating the acid, so as to make the solution go as far as possible. Each apple should be enveloped in at least three or four folds of salicylated paper, and every possible precaution should be taken to prevent bruising when loading into the casks or cases. Well-packed apples should not move at all during the voyage, and the shaking of a railroad train should have little effect upon them. Nevertheless, a certain amount of contusion is inevitable, and to avoid the ulterior results of this, the salicylated paper is indispensable. As to the cost, it would be a mere trifle when we consider the result gained, and the splendid condition of the fruit when it would enter the London market. Besides, it is very probable that the salicylic acid paper used for packing the apples in America might be used over again, or applied in England to some similar antiseptic purpose, and an allowance made for it accordingly.

Prehistoric Mexico.

Very interesting discoveries have been made by M. Desire Charnay in ancient cemeteries high up on the slopes of the volcanoes Popocatapetl and Itztaccihuatl. The burial place on the latter mountain is high above the line of vegetation. Just below it is a small valley almost concealed on three sides by a natural bulwark of stupendous rocks.

Access to this singular dell seemed at first impossible; in fact, was so difficult as to lead M. Charnay to doubt the tradition of a Chichimecan village having existed in such a place. Excavations have led to the supposition that this narrow valley had been a temporary refuge of the Toltecs, perhaps as early as the year 600. It bore evidence too of having been inhabited by the Chichimeca Indians. Idols and household utensils similar to those found in ruined Chichimecan villages were dug up from a depth of from three to four feet. Singularly, too, there were found near the surface Aztec relics, which proved that at a comparatively recent date this natural stronghold had served as a place of concealment for a third tribe. Tradition says that after the Spanish conquest in 1520 a few spirited Aztecs and Tlatelolcos, rather than submit to slavery or accept the doctrines of the invaders, fled with their "lares and penates" to this mountain fastness and subsisted on corn, frijoles, and other vegetables, burying their dead as near the "snow line" as possible. Many Aztec idols, vases, and jars were unearthed there.

Pacific Coast Fishes.

The United States Fish Commission have obtained on the Pacific coast 270 species of fish. Among these are nineteen species of sharks. Two large toothed man-eater sharks, caught in Monterey Bay, measured from 23 to 24 feet in length, and weighed fully two tons each. Another variety of shark found on the coast averages 32 to 33 feet in length, and weighs three tons. Their teeth are small, and they are not dangerous. Monterey is a middle ground where the fishes from north and south meet, and no locality on the Atlantic coast is so rich in species. It has about 130 species; San Francisco about the same; Santa Barbara, 95; San Diego, 80; and Puget Sound, 90. The so-called perch, found on the California coast, are not true perch. A million and a half of salmon, averaging from 25 to 30 pounds each, are taken from the Columbia River, and from seven to eight millions of pounds of fish are taken from San Francisco Bay and marketed.

Monument to the Original Promoters of the Union Pacific Railway.

Norcross Bros., of Chicago, have contracted with the Union Pacific Railway Company for a monument to the memory of Oliver and Oakes Ames. The monument is to be located at Shannon, Wyoming Territory, at a point about 400 miles west of Omaha. It is at the highest point in the Rocky Mountains which is crossed by the railroad. The monument is to be 50 feet square at the base, and 60 feet high, pyramidical in outline, with three slopes. The material will be Black Hills granite. There are to be two medallions representing the heads of Oliver and Oakes Ames in alto-rilievo. One will face the east and the other the west, at a height of 40 feet from the ground. On the side next to the railroad will be an inscription, "In Memory of Oliver and Oakes Ames." The medallions are to be cut out of McGregory quarry brown stone. There is also to be a bronze tablet, which will more particularly show why the monument was erected. The contractors are to complete the work in about two years. The cost is to be about $80,000.

AN accidental dropping of a cipher in our recent description of the heavy Worthington oil pumping engines leads to an obvious understatement of their efficiency. The work actually done by some of these pumps is the pumping of 15,000 barrels of oil through 100 miles of pipe, against the enormous pressure of 1,500 pounds per square inch.

RECENT INVENTIONS.

Mr. George Steinson, of East Chester, N. Y., has patented an improved leg for bedstead frames, which furnishes to the bed an elastic support. The leg is formed of flat curved springs, and a spiral spring placed in a box, the whole being supported on casters.

Mr. Fredrick A. Baker, of Brooklyn, N. Y., has patented a fire escape ladder for the use of firemen. It can be readily secured to the windows of buildings from story to story to form a fire escape.

An improved legging, which fits closely to the foot and ankle, and can be opened or closed easily, has been patented by Mr. Casper Riese, of Berlin, Prussia, Germany.

Improvements in electric burglar alarm for safes have been patented by Mr. Edwin J. Leland, of Worcester, Mass. These improvements relate to burglar alarm telegraphs connected with safes, vaults, and similar places, and arranged to give a signal at a central office in case the circuit is broken or the wires tampered with. Such lines usually have combined with them a galvanometer, so that any change of resistance caused by an attempt to put a loop in the line, and thereby cut out a safe or vault without breaking circuit, or from any cause, shall be indicated by the galvanometer. The object of this invention is to provide means for testing the line at any time and determining whether the safe or vault is is circuit, so that it will not be necessary to make a personal inspection of the vault or safe every time the indicator shows a change of resistance or the signal is operated, as such effects are often produced by crossed wires and electrical disturbances in the atmosphere.

An improved bottle stopper has been patented by Mr. Thomas G. Austen, of Oswego, N. Y. This invention relates to that class of devices that are designed so close the mouth of a bottle and yet to permit the gradual ejection or sprinkling of its contents.

Mr. Joseph T. Maybury, of Mobile, Ala., has patented a process of canning oysters, which consists in placing them in cans and pouring over them a hot mixture composed of water, salicylic acid, and vinegar, in the proportions of about ten gallons, one and six-tenths gill, and one-half gallon, respectively, and then closing the cans and placing them in boiling water for a short time.

A novel skylight bar, in which provision is made for collecting the condensed moisture which accumulates on the interior surface of the glass and conducting it to the roof, has been patented by Mr. Fred Ruemping, of Kansas City, Mo.

An improved well casing, which is simple and effective, has been patented by Messrs. Henry Shear and Henry M. Toomey, of Arcola, Ill. The invention consists in a well and cistern casing formed of a number of segmental sections of earthenware or burned clay, provided with tongues and grooves at the ends and with strengthening ribs on the inner sides.

Messrs. William P. Lyon and Samuel Vail, of Port Chester, N. Y., have patented a fastening for the end boards of wagons and carts, so constructed that it will fasten automatically when the end board is raised into place, and which, when locked, will hold the end board securely.

Mr. John H. Reed, of Cowles, Neb., has patented a new penmanship-instructing chart, which will permit persons who are not good penmen themselves to instruct others in the art of penmanship and to explain the proper formation and inclination of letters.

An improved trunk fastener, patented by Mr. George A. Sofield, of Jersey City, N. J., consists in the combination with a bolt tongue having a transverse groove of a socket provided with a longitudinal groove to receive the bolt, and with a transverse groove containing a spring latch fitting into it and catching into the transverse groove of the bolt tongue.

Mr. Patrick H. Duke, of Richmond, Va., has patented a package of plug tobacco having the faces of its plugs formed into perfect squares, one set of which is raised and the alternate set depressed, with the raised and sunken faces of one layer or set of plugs fitting into and over the sunken and raised faces of the crossed piled plugs forming the next layer.

An improved apparatus for distributing fertilizer, which may be made either an attachment of an ordinary seeder or planter, or used independently thereof, has been patented by Mr. Luther A. Horine, of Jefferson, Md.

Mr. Carey Inskeep, of Ottumwa, Ia., has patented an improved hairpin, which is so constructed that it cannot become detached accidentally, but may be inserted and removed without disturbing the contiguous hair further than requisite to allow space for the body of the pin.

Mr. Edward A. Smith, of Greeley, Col., has patented an improved earth auger, which consists in a novel arrangement of the casing, the cutter, and the drill point in a well auger.

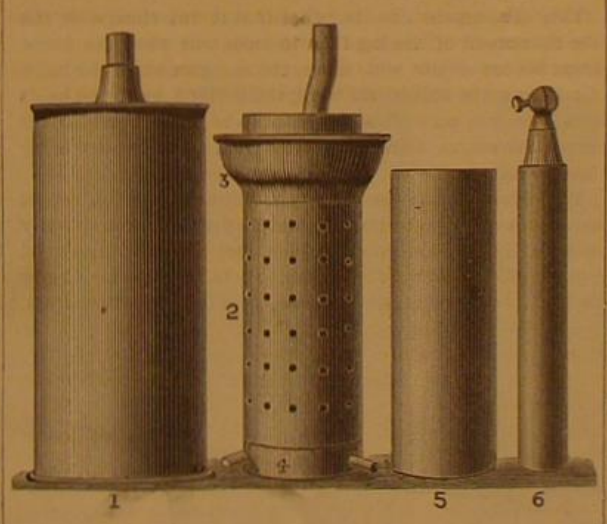
Mr. Benjamin Le Coultre, of Geneva, Switzerland, has patented a chronograph having both second and minute hands indicating by one dial and mounted on the same arbor. The inventor fits upon the central arbor of the watch a loose sleeve that carries the minute hand and a driving wheel, and outside of this fits a second loose sleeve carrying the second hand and a driving wheel. Upon a lever fitted for movement by a ratchet wheel in the usual manner are fitted the wheels that operate the second hand from the center pinion when moved into gear, and upon a pivoted arm that is connected with the lever is a pinion that connects a fixed pinion on the center arbor with the driving wheel of the minute hand. The driving wheels of both the second and minute hands are fitted with heart cams that are acted upon by a T arm to bring both hands back to the starting point. By this construction a simultaneous action is obtained on both hands—first, to set them in motion; second, to arrest them; and, third, to return them to the starting point.

Welding by Pressure.

Pursuing his researches on the welding of solid bodies by pressure, M. Spring has subjected to various strong pressures (up to 10,000 atmospheres—150,000 lb. per square inch) more than eighty solid pulverized bodies; this was done in vacuo, and in some cases at various temperatures. The results are highly interesting. All the crystalline bodies proved capable of welding, and in the case of bodies accidentally amorphous the compressed block showed crystalline fracture; crystallization had been brought about by pressure. Softness favors the approximation of the particles and their orientation in the direction of the crystalline axes. The amorphous bodies, properly so called, fall into two groups, one of substances like wax (*circoid* bodies), which weld easily, the other of substances like amorphous carbon (*acircoid* bodies), which do not weld. The general result is that the crystalline state favors the union of solid bodies, but the amorphous state does not always hinder it. M. Spring says the facts described do not essentially differ from those observed when two drops of a liquid meet and unite. Hardness is a relative, and one may even say subjective term. Water may appear with a certain hardness to some insects, and if our bodies had a certain weight we should find the pavement too soft to bear us. Again, prismatic sulphur is changed by compression to octahedric sulphur; amorphous phosphorus seems to be changed to metallac; other amorphous bodies change their state, and mixtures of bodies react chemically if the specific volume of the product of the reaction is smaller than the sum of specific volumes of the reacting bodies. In all cases the body is changed into a denser variety, whence may be inferred that the state taken by matter is in relation to the volume it is obliged to occupy under action of external forces. This (M. Spring points out) is merely the generalization of a well known fact. Some curious results are deduced from it. The researches described have important bearings on mineralogy and geology.

A MODIFIED DANIELL CELL.

Mr. S. J. Browning, of Portsmouth, England, has devised a modified form of Daniell cell, which he thus describes in the *Electrician:*



"While using the same materials, and the same strength of solutions as those of the ordinary Daniell, it gives twice the amount of current.

"It can be clearly perceived that my main object has been the reduction of the internal resistance, which I believe I have accomplished to the utmost without reducing its constancy."

The accompanying diagrams illustrate this cell: 1. Outer copper cylinder. 2. Inner copper cylinder, which encircles the porous cell within one-eighth of an inch of same. 3. The copper shelf surrounding No. 3, for holding sulphate of copper. 4. A wooden cylinder with step turned inside, to keep porous cell in center of No. 2, and with three wooden plugs, to keep No. 2 in center of No. 1. 5. Ordinary eight inch porous cell. 6. Cylinder of zinc.

Mr. Browning uses small blocks of vulcanized India rubber to keep the zinc in the center of the porous jar, and again to keep the porous jar in the center of the cylinder. He also uses a disk of felt for the zinc to rest upon.

High Lighting by Electricity.

There was very little to encourage the project to illuminate Holyoke, Mass., by means of lofty electric light towers, in the result of the similar experiment tried in Rouen, France, during the *fêtes* of July 13 and 14. On that occasion eight electric lights were placed on the spire of the cathedral with a view of illuminating the town. Though the quantity of light was estimated at 5,000 Carcel burners, the effect was practically *nil*. The spire seemed merely to have a huge lamp on it, which threw its light beyond the town rather than in the neighborhood of the cathedral.

A New Process of Refining Petroleum.

The Philadelphia *Record* says that a new process for treating the products of petroleum is being tested in that city. At present all oils are brought to heat tests by distillation, and in the process lose from 30 to 65 per cent. By the old process oil at a fire test of 110° costs 6½ cents per gallon. In bringing this grade of oil to a test of 150° it loses 30 per cent in the process of distillation; to raise it to 175° it loses 45 per cent, and to 185° 65 per cent. By the new patent process the oil is treated without heat and loses nothing.

Oil at 110° that cost 6½ cents per gallon, on being raised to a fire test of 150 is worth 13½ cents per gallon; to 175, from 15 cents to 17 cents per gallon, and if raised to 185° is worth from 18 to 20 cents per gallon. The cost of raising it to any of these tests is 1 cent per gallon. Here, also, is another advantage over the old system, as by the present method of distillation the profit on oil at a fire test of 110 is only half a cent per gallon, and at a test of 150 the profit is the same; whereas by the new process, the oil losing nothing in the manipulation, the profit is in a ratio to the number of degrees to which the fire test is raised. In the process the oil is deodorized, and at the same time the illuminating quality is improved so that the oil burns longer and brighter, and this is effected without the aid of any heat whatever. This is what the inventors claim for the new process, but until a rigid and satisfactory test has been made they will disclose neither their plans nor their names.

Eruption of Fuego.

A letter from San José de Guatemala, dated the 2d of July, to the *Panama Star and Herald*, says: "At 3 A.M. on the 29th of June, the volcano Fuego suddenly became active, throwing out vast showers of fire and cinders, with great darts of flame shooting up from 350 feet to 500 feet above the mouth of the crater. The whole country to the east and south was magnificently illuminated. At 3:40 A.M. two streams of lava could be seen running down the sides of the volcano, one to the south and east, the other to the westward. Dense masses of steam and smoke rose from the courses of the lava streams, as the shrubbery and foliage were burnt. The river Guacalate rose suddenly, and its waters were quite warm. Fuego continued to belch fire until daylight, by which time the whole northern horizon looking from San Jose, was dark with the smoke from the volcano. The lava streams continued in view until 4:30 A.M. The first grand column of fire rose at least 500 feet in height, solid and smooth, and then the top, expanding, opened out like an umbrella, the sparks coruscating like those from a brilliant rocket. The pulsations of flame during the first two hours of the eruption were about 30 seconds apart, strong and regular. The eruption was less active until, at 7:30 P.M. on the 1st of July, a column of flame rose to a height, probably, of 150 feet or more. At the hour of writing Fuego smokes away steadily."

A Queer Locomotive.

The *National Car Builder* condenses from the Paterson (N. J.) *Guardian*, a description of a new locomotive now in process of construction at the Grant Locomotive Works, which, it is thought, will eclipse for speed anything yet built. It will look like an ordinary engine turned upside down. The machinery will be on top of the boiler instead of under it, as usual, and the boiler will hang very low on the wheels. There will be two pairs of driving wheels, but instead of having them follow each other, one pair will be on top of the other. The real driving wheels will be the upper pair, and they will turn in the opposite direction from that in which the engine is going. They will rest upon the rims of the other pair, which will in turn rest on the track. The revolution of the upper pair, by friction, is expected to drive the lower pair, the tires of the latter serving as tracks for the upper ones. It is thought that a good deal greater speed can be got out of the machinery by this construction, and it is expected by the inventor that it will be the fastest locomotive ever made. Practical workmen, however, think it won't go at all. It will look very funny as it is running through the country, with the upper pair of driving wheels, five feet in diameter, revolving up in the air in the wrong direction at a tremendous speed, and the eccentrics, rocking bars, link motion, and pistons on the top of the boiler.

After Graduation.

A few years ago a young man of promise was graduated at Harvard University. He determined to become a cotton manufacturer. Instead of relying upon his general education, and waiting for an opening, as many of his classmates did, he began at once to prepare specially for the business he had chosen, by entering a machine shop as a workman—making full hours and acquainting himself with every part of the machinery of a cotton mill. From the machine shop he went into the cotton mill, and by hard work and close attention rapidly acquired a thorough knowledge of all the processes of cotton manufacture. While some of his classmates were waiting and looking for an opening in business, and others were with difficulty filling subordinate positions, he was rapidly rising, step by step, until he is, to-day, in charge of one of the largest cotton mills in New England, with ample salary, and what is better, is discharging the duties of his position with great satisfaction to the company he serves.—*Providence (R. I.) Journal.*

Human Refrigeration.

Some experiments which seem to throw light on the physiological effects of bathing have been recently made by Dr. Paul Delmas, of Bordeaux. The action of cold and heat on the human system was studied by subjecting the whole body, except the head, of a healthy and robust subject to refrigeration with water at + 10° C., in a suitable apparatus, the time of exposure varying from 15 seconds to 5 minutes. In some cases heat was applied previously. The pulse and temperature were noted all the time, and every five minutes in succeeding hours; the temperature by means of a thermometer placed in the mouth. The following effects were observed: During application of the cold, while the subject shows every sign of very intense sensations (painful or otherwise), the temperature of the body scarcely varies at all, or varies at most one to two tenths of a degree, from that noted before; and previous heating does not affect this result. If, immediately after the application of cold, the subject remain perfectly still, after having been carefully dried and dressed, so as to avoid all active muscular movement, the temperature still varies little or not at all; but if he exert himself actively (in dressing, running, or walking), either immediately after the cold application or after a time of immobility, so as to bring on all the external phenomena of cold reaction, the temperature suddenly falls. The reduction persists several hours, and is more pronounced the stronger the sensation of heat in the subject. On the other hand, if chill continue or reappear owing to long immobility or suspension of exercise, the animal temperature does not fall, or immediately rises again. The amount of lowering of the temperature two or three hours after a cold application was, in eleven cases out of twelve, 0·1° to 0·6°. The *maximum* in a very vigorous subject never exceeded 1·3°. At the commencement of the cold application the pulse suddenly becomes very quick; after 10 to 15 seconds the velocity rapidly diminishes; and at the end of the experiment has returned to the previous figure or below it. If the subject, carefully dried and dressed, keep quiet, the retardation of the pulse stops or progresses slowly; but in the opposite case it is very pronounced, and persists the more the subject gives signs of energetic reaction and a general sensation of heat. Two or three hours after the cold application the pulse showed (in eleven cases out of twelve) two to twenty pulsations fewer than before the experiment.

IMPROVED VALVE-GEAR FOR ENGINES.

A novel device for reversing a steam engine is shown in the annexed engraving. The arrangement is such as to admit of reversing the valves when the engine is either at rest or in motion.

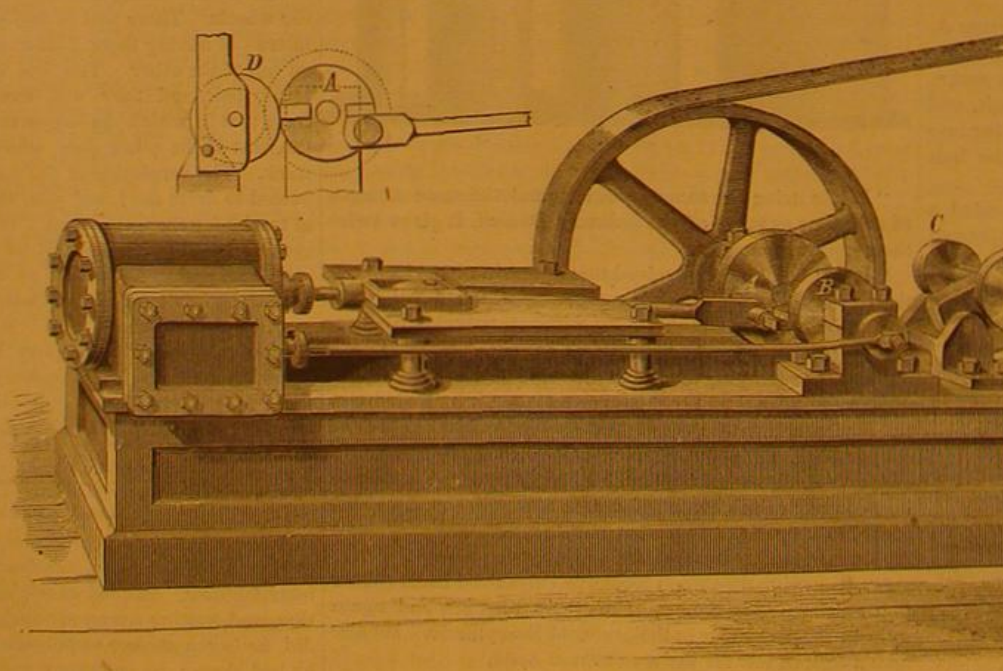
The crank pin projecting from the crank disk, A, is elongated so as to be capable of engaging either of two lugs projecting from the face of a wheel, B, mounted on the inner end of a shaft placed on the axial line of the main shaft. The shaft of the wheel, B, carries a crank or eccentric which operates the slide valve, and it is driven by the engagement of the crank pin with one of the lugs. When the engine is to be reversed the wheel, B, is turned so as to bring the opposite lug into position to be engaged by the crank pin. The valve is shifted by this operation, and when the engine is started its motion will be reversed.

To reverse the engine while in motion, an appliance consisting of a lever pivoted to the engine bed and carrying a shaft having friction wheels, C D, at opposite ends, is brought into use.

These wheels are capable of engaging with the wheels, A B, as shown in the detail view, and the wheel, C, is made smaller than the crank disk, A, so that when it is brought into engagement with the crank disk it will communicate motion to the wheel, B, through the friction wheel, D. By this means the wheel, B, will be turned ahead much more rapidly than its normal rate of speed, the valve will be reversed, and the lug on the opposite side of the wheel, B, will be engaged by the crank pin, and the engine will move in a reversed direction.

When the crank shaft carries a regular crank instead of the disk and crank pin, said crank is provided with a projection for engagement with the lugs on the wheel, B. These lugs may be secured to the wheel, B, by means of bolts working in slots, so as to enable the stops to be adjusted in order to regulate the lead of the valve.

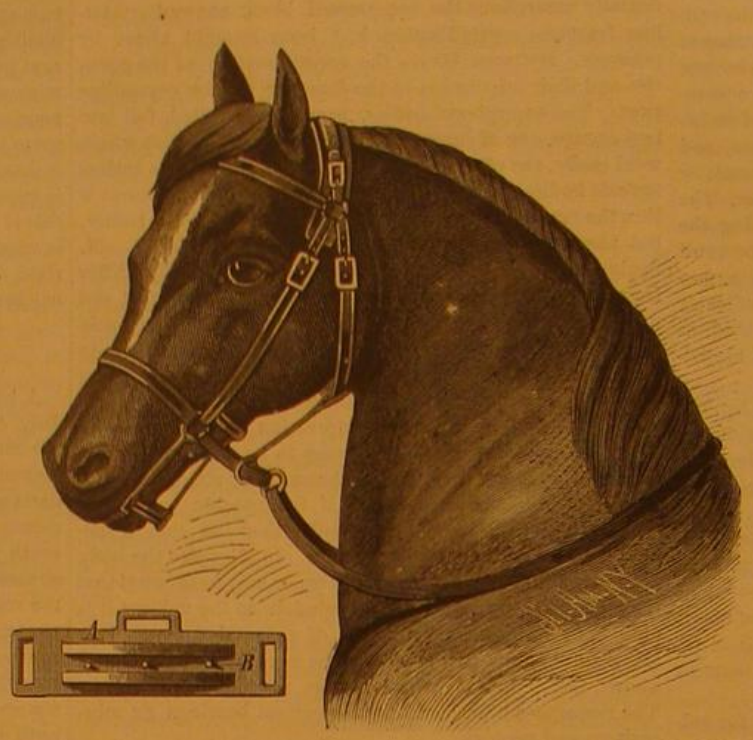
This invention was lately patented by Mr. Peter Josserand, of Hockley, Texas.



JOSSERAND'S VALVE-GEAR FOR ENGINES.

HALTER TO PREVENT HORSES FROM CRIBBING.

The engraving shows an attachment to be applied to halters to prevent horses from cribbing and for curing them of this habit. The invention is shown in use in Fig. 1, and in detail in Fig. 2. A plate, A, carrying a row of spikes, B, is connected with the halter by means of rigid arms and straps, and is held beneath the animal's under lip. Ordinarily the spikes are prevented from pricking the horse by the curved springs arranged on opposite sides of the row of spikes; but the motion of the horse in the act of cribbing compresses the springs and brings the horse's lip into contact with the points of the spikes.



MADDEN'S HALTER FOR PREVENTING HORSES FROM CRIBBING.

This attachment does not in any way interfere with the free movement of the head and mouth, but when the horse drops his lower jaw and seizes the manger, as in the habit of cribbing, the spikes will prick the under lip and the habit is soon broken up. This attachment is equally useful for vicious horses, as it prevents them from biting and tearing their blankets.

The invention has been thoroughly tested, and its merits are approved by horse trainers and owners. It was recently patented by Mr. Ambrose Madden, and is being introduced by Messrs. Madden & Sullivan, P. O. box 283, Asbury Park, N. J., who should be addressed for further information.

MISCELLANEOUS INVENTIONS.

Mr. Louis Prince, of Nashville, O., has patented an improved car door operating mechanism for street or elevated railroads, arranged with transverse seats extending the entire width of the car, and provided with a series of doors upon the sides of the car which communicate separately with each seat. The object of the invention is to provide means for operating a series of such doors simultaneously from the end of the car, so that they may be under the control of the driver or conductor.

Mr. Johann W. R. Vogdt, of Potsdam, Prussia, Germany, has patented a curtain formed of a series of vertical strips or bands of cloth, or other suitable material, alternately attached to two rollers pivoted parallel to and adjoining each other in the top of the window casing, and provided with suitable cords or devices for rotating them both at the same time.

A blind adjuster and fastener, so constructed as to hold blinds in any position into which they may be adjusted, and prevent them from rattling, and which at the same time can be operated from the inside of the window and without raising the sash, has been patented by Mr. Charles L. Rainhart, of Catskill, N. Y.

A new attachment for basket handles, which is simple and durable, has been patented by Mr. Amedee Hourdeaux, of Lichtenfels, Bavaria, Germany. It consists of a staple passing through an eyelet at the end of the handle and through two slotted disks on the outer and the inner sides of the wicker work of the basket; the ends of the staple are then lapped down on the surface of the inner disk to prevent the staple from being drawn out by the handle.

Mr. Samuel P. Fraley, of Columbus, O., has patented a broom-brush that may be cheaply made by mechanical means, and is held together independently of the holder and handle without the use of stitches.

An improved terra cotta kiln has been patented by Mr. Alfred Hall, of Perth Amboy, N. J. The object of this invention is to construct the doors of kilns for burning terra-cotta in such a way that the heat will be distributed equally through the door and the other parts of the kiln, so that all parts of the kiln will have a uniform temperature, and all the articles will be burned evenly.

Heretofore, where bells have been used for giving notice of fire, either by a general alarm or by striking the number of the signal box, much confusion has resulted from indistinct alarms or errors in counting. In some cases the fire alarm telegraph has been arranged to strike the number of the box, and bells not connected with the system are rung by hand, and it is of frequent occurrence that the box number is not heard at all except by the bell ringers. Mr. John H. Tilley, of Newport, R I., has invented a transmitter for fire alarm telegraphs that will first act to give a general alarm, and, after an interval, strike the box number and repeat the number, as required, thus calling attention, first, to the fact of the fire by an alarm which is likely to be heard, and then giving the locality.

Mr. David Untermeyer, of New York city, has patented an improvement in the class of necklace clasps which are provided with spring catches or fastenings for attaching the neckchain or necklace proper.

A rowing vehicle has been patented by Messrs. Charles E. Tripler and William H. Roff, of New York city. The object of this invention is to furnish wheeled vehicles that are operated by hand levers, and so moved that the operator, in propelling the vehicles, pulls the hand levers in substantially the same manner that the oars of a boat are pulled.

Messrs. Henry J. Mark and William F. Martinek, of St. Louis, Mo., have patented a wrapper or jacket for bottles and analogous articles having spiral or diagonally arranged grooves or corrugations.

Mr. William T. McLean, of Sidney, Ohio, has patented an improvement in the class of earth scrapers or scoops having a thin metal body, formed preferably of rolled sheet steel, and a wooden back, which is secured to the body by means of clamps, etc. The improvement consists in the arrangement of the devices for securing the wooden back to the steel body of the scraper, and in providing the latter with a single longitudinal steel wearing piece or shoe, which is arranged centrally, and beveled on the sides and front end.

Amédée G. Sébillot, of Paris, France, has patented an improved apparatus for the recovery of waste sulphuric acid. The object of the invention is to improve the product obtained from treating argentiferous ores, as well as to save the acid used in the process.

An automatic fire extinguisher has been patented by Mr. Edward Bocker, of New York city. The object of this invention is to furnish mechanism to be connected with the faucets of water pipes, and so constructed that upon the rise of temperature in case of fire the faucets will be opened automatically and discharge water.

THE INDIA-RUBBER AND GUTTA PERCHA INDUSTRIES.*

The lecture, of which the following is an extract, lately given by Mr. Thomas Bolas, F.C.S., before the Society of Arts, formed one of those admirable Cantor Lectures which are annually given to members. The importance of the India-rubber tree in connection with the many and useful purposes to which it is applied will be seen, upon a perusal of the lecture, which was opened by a description of the sources of India-rubber.

The earliest rumor of the existence of caoutchouc reached Europe nearly 500 years ago, the first visit of Columbus to Hayti having brought to light the fact that the natives of this island were in the habit of making playing balls of an elastic gum. Nothing more appears to have been heard of India-rubber until Torquemada, rather over 250 years ago, described the Mexican Indians as not only making balls of India-rubber, but also as fabricating helmets, shoes, waterproof fabrics, and other articles of elastic gum. We do not hear, however, of samples of India-rubber reaching Europe until long after this, and little more appears to have been learned regarding the substance until the celebrated French naturalist, La Condamine, made a communication to the Academy of Sciences at Paris concerning caoutchouc, he having had ample opportunities of studying the subject in Para. He tells us that the substance in question was used for making torches, these being only an inch and a half in diameter by two feet long, and yet burning for twelve hours. Again we hear of the use of India-rubber for playing balls, and it appears that the natives were in the habit of using enema or ejection bottles made of caoutchouc.

Soon after La Condamine's communication to the Academy of Sciences, samples of India-rubber frequently reached Europe, and scientific men began to make investigations regarding this remarkable body. Between 1760 and 1770 we find Fresneau and Macquer studying the subject, and the last named investigator made tubes and other articles of caoutchouc by dissolving it in ether and coating moulds with the solution, so that a solid skin of caoutchouc should remain adherent to the mould on the evaporation of the solvent.

From this time until the end of the eighteenth century, the India-rubber industry may be considered to have been undergoing its period of gestation, and to have been born with the dawn of the present century. Among the first of the important patents regarding the utilization of caoutchouc is that granted in 1823 to Charles Macintosh, for dissolving the substance in coal oil, or coal naphtha, and the use of this solution as a waterproofing agent.

About the same time, elastic webbing was first made with threads cut from the raw rubber, and other minor applications of caoutchouc to the industrial arts were adopted from time to time, until the great discovery of vulcanization inaugurated a new epoch in this branch of industry, rendering it possible to so far alter caoutchouc as to make it capable of resisting, to a great extent, the action of heat on the one hand and cold on the other hand.

The milky sap of many plants contains caoutchouc, suspended in the form of minute transparent globules, these being frequently as small as one twenty-thousandth and one fifty-thousandth of an inch in diameter; but comparatively few plants contain sufficient caoutchouc to render them important sources of this body.

The trees which yield the largest supply of the best quality of caoutchouc consist of various species of hevea, which flourish in the northern districts of South America, especially in the province of Para, some portions of the valley of the Amazon being crowded to an extraordinary extent with heveas. The abundance of the India-rubber trees in Para may be judged of by the fact that this province alone exported 7,340 tons of caoutchouc in the year 1877, more than half of this being sent to Liverpool.

Fig. 1.—HEVEA GUIANENSIS.

Fig. 2.—COLLECTING THE JUICE.

Among the heveas most productive of caoutchouc may be mentioned the *Hevea brasiliensis*, which flourishes in Para, and yields some of the finest caoutchouc, and often attains a height of sixty to seventy feet, with a diameter of nearly three feet; and the *Hevea guianensis*, a similarly magnificent tree, likewise abundantly productive of caoutchouc; and the *Hevea spruceana*, a smaller tree, which grows almost exclusively in the province of Para. The lecturer here projected on a screen a lantern slide, representing the foliage and flower of the *Hevea guianensis*, of which Fig. 1 is an illustration.

In collecting the juice, an illustration of the process being given by Fig. 2, a series of cuts are made through the bark of the tree; either shells or clay vessels are attached to receive the exuding milky sap, and when sufficient of this has been collected, the operation of drying it is performed as follows: A kind of wooden bat, thinly covered over with clay, is dipped into a pail filled with the juice, and the bat thus coated is held over a fire, fed with certain wild nuts, which in burning give off abundance of aromatic smoke. In Fig. 3, which represents this operation, it will be seen that a kind of short chimney is fixed over the fire to lead the smoke compactly upwards. As soon as the first layer of juice has become indurated, the bat is again dipped, and the drying operation is repeated, layer after layer being thus dried on the bat, until a thickness of nearly an inch is attained. A knife cut is now made in the bottle or biscuit of caoutchouc thus obtained, so that it can be removed from the wooden bat and exposed to the air to become still furthur indurated. Para caoutchouc, if prepared in this manner, gives forth a fragrant aromatic odor.

The residues of juice left in the various vessels employed, the scrapings of the incisions, together with other materials which the ingenious native thinks he can shuffle off on the unsuspecting merchant as caoutchouc, are made into balls, and sold as "negro head." The negro-head rubber is frequently made into crude representations of animals, which will pass about equally well for a horse, a pig, or a crocodile.

The milky juice of the Para rubber trees has approximately the following composition:

Caoutchouc	32
Albuminous, extractive, and saline matters	12
Water	56
	100

As a rubber producing tree, the *Ficus elastica* stands next in importance of the heveas. The *Ficus elastica* grows abundantly in India and the East Indian Islands, one district in Assam, thirty miles long by eight miles wide, being said to contain about 43,000 trees, many of them attaining a height of a hundred feet. This tree also grows freely in Madagascar, and it is well known to us as a greenhouse plant, a sketch of which may be seen on Fig. 4.

The juice of the *Ficus elastica* contains notably less caoutchouc than that of the American trees, the proportion very often falling as low as ten per cent of the juice. A vine-like plant, the *Urceola elastica*, which grows abundantly in Madagascar, Borneo, Singapore, Sumatra, Penang, and other places, yields a considerable amount of caoutchouc of very good quality.

Africa yields a considerable quantity of caoutchouc, but generally soft and of inferior quality. It is believed to be yielded by various species of landolphia, ficus, and toxicophlea.

Caoutchouc is nearly colorless, and when in thin leaves tolerably transparent. It, like very many other substances, contains nothing but carbon and hydro-

* Land and Water.

gen, but its properties differ very widely from those of other hydrocarbons almost identical in composition. It has been found to contain, in one hundred parts, 12·5 of hydrogen and 87·5 of carbon.

Caoutchouc, as might be supposed, burns very readily, and leaves no residue. It is soft, and very imperfectly elastic, in the true sense of the term; that is to say, it does not return to its original dimensions after having been considerably stretched.

As regards the stretching of India-rubber, there is a point at which it requires a greatly increased force to stretch it, and at this point it seems to become fibrous in texture, as you may perceive by examining this extended sample by the aid of a magnifying lens. India-rubber has valuable electrical properties, as you are no doubt aware, it being an admirable insulator, and having a remarkable tendency to become electrical by friction.

Freshly cut surfaces of India-rubber cohere very strongly when brought into contact, and this is well illustrated by the old way of making a tube of unvulcanized caoutchouc.

Cold has a remarkable effect on caoutchouc, rendering it rigid and inelastic, and this circumstance considerably detracts from the value of unvulcanized India-rubber. A strip of India-rubber, soft and pliable, will, upon exposure for a few minutes to a temperature of 0° Cent., or the freezing point, become rigid and stiff, but its original pliability may be restored, either by warming or by applying sufficient tensile strain to it, to extend it to three or four times its length. In each case it is restored to its original condition. In the case of the stretching it is very likely that the effect is due to heat evolved during that operation.

The effects of heat on India-rubber present many points of interest. A band of caoutchouc attached one end to an index, stretched to the zero of a paper scale, will, if a gentle heat be applied to it, contract, as regards length, but expands in a transverse direction, causing the index to move rapidly through a space of several degrees. This property, which stretched caoutchouc possesses, of contracting by heat, may be described by saying that within certain limits the tensile elasticity of caoutchouc is increased by an elevation of temperature. Caoutchouc, however, if heated to 100° Cent., softens considerably, and almost entirely loses its elasticity, while a heat of 120° Cent. produces a most decided softening effect on caoutchouc of the best quality, but after exposure to this temperature it recovers its pristine state by exposure to cold for a moderate period. If, however, the action of heat has been pushed still further, say to 200° Cent., the caoutchouc becomes converted into a permanently viscous body, which has little or no tendency to harden again. This viscous substance possesses the same composition as unaltered caoutchouc, and is of value as a medium for making air-tight joints, which can be easily undone.

When caoutchouc is subjected to a temperature somewhat above 200° Cent., it becomes converted into a variety of volatile hydrocarbons, which present many points of interest, and you will find a tolerably full account of them in the manuals of chemistry. India-rubber is subject to two kinds of deterioration and decay. In one instance it tends to become soft, and loses its elasticity, while in the other it becomes friable, yellowish, and resinous in its nature. The last mentioned kind of deterioration has been clearly and indubitably traced to an oxidation of the caoutchouc. This oxidation is tolerably rapid when the caoutchouc exists in a finely divided state and when it is exposed to damp at the same time; but the alternate damping and drying of the caoutchouc tends more towards its rapid oxidation than does a continual state of dampness. The resinous matter resulting from the oxidation of caoutchouc has been carefully studied by Spiller, who found that a sample of felt, originally composed of cotton fibers and India-rubber, had become so far changed during six years as to contain no trace of caoutchouc; but in its place he found a resinous substance resembling shellac. This resinous body, of which a sample is before you, is easily soluble in alcohol, and also dissolves in benzole. Alkalies dissolve it readily, and acids precipitate it from the alkaline solution. It contains 27·3 per cent of oxygen.

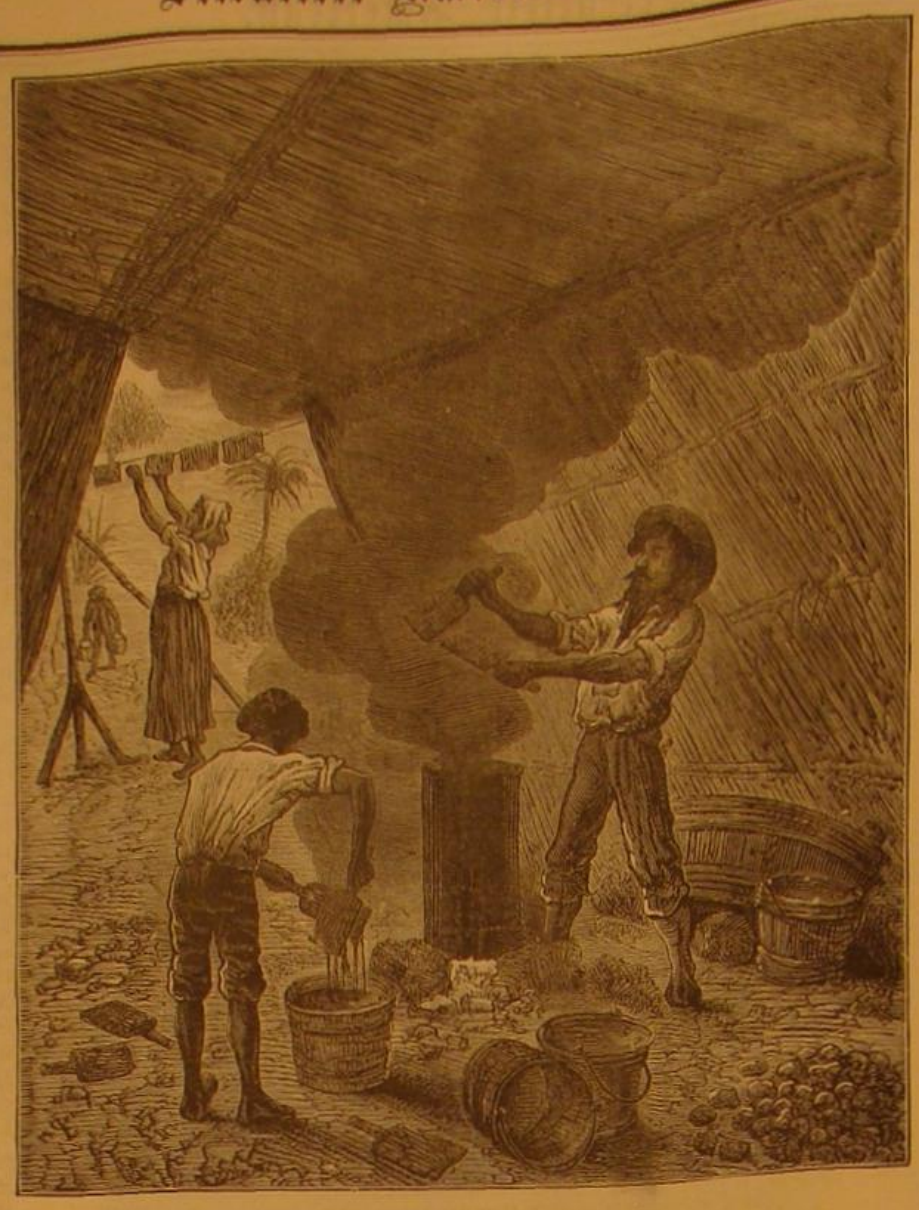


Fig. 3.—SMOKING THE GUM.

The conditions under which the softening of the India-rubber takes place are not so well understood, but there is some reason to believe that this is due to incipient oxidation. Ozone oxidizes caoutchouc with extreme rapidity, as Warren pointed out in 1877.

It is extremely probable that the rapid deterioration of caoutchouc, which is known to take place under conditions which are not perfectly understood, is frequently due to the corrosive and oxidizing action of ozone.

Ozone, or some agent nearly resembling it, is often produced when oil of turpentine is exposed to the air, and this circumstance may perhaps explain the destructive influence which oil of turpentine occasionally exercises on India-rubber.

Exposure to sunlight often causes the destruction of India-rubber, either converting it into a soft and sticky substance, or into a hard body, less soluble in benzole than unaltered caoutchouc; and it is quite possible to obtain a photographic print by exposing a film of India-rubber under a negative, and then dissolving away those parts on which the light has not acted by means of benzole. It is generally a discreet thing to keep India-rubber where it will not be exposed to the prolonged action of a powerful light, although there are cases in which exposure to light is a useful aid to the process of vulcanization. India-rubber is, to a certain extent, porous and cellular in its texture, as may be seen by a microscopical examination of a thin section. Again, if a thin leaf of caoutchouc is boiled for a long time in water it absorbs a considerable proportion of this liquid. The amount may, in some cases, rise as high as 25 per cent. In a similar manner alcohol is absorbed by India-rubber, but this fluid is absorbed more readily than is the case with water.

Now we pass on to a more important matter, namely, the action of such liquids as benzole or coal naphtha on caoutchouc. Here are two cubes of Para rubber, each being three-eighths of an inch across the face. One of these I will preserve as a pattern, and the other I will suspend in a bottle containing benzole. The cube suspended in the benzole will immediately begin to swell, and will continue to do so until it has attained a bulk about one hundred times as large as its original size. During the time that the cube is swelling in the benzole a certain proportion of the caoutchouc will become dissolved out, and incorporate itself with the bulk of the solvent. Now, as a matter of fact, every kind of natural India-rubber contains two distinct modifications of caoutchouc, one of which tends to swell up in such a liquid as benzole, while the other dissolves and forms a true solution. The first mentioned of these bodies may be referred to as the fibrous constituent of caoutchouc, while the second may be spoken of as the viscous constituent. The proportions in which these two bodies occur in raw rubber varies extremely; Para rubber, of good quality, containing only a small proportion of the viscous constituent, while African tongue, on the other hand, consists principally of the viscous modification of caoutchouc. The viscous constituent of caoutchouc is the agent principally concerned in the joining together of freshly cut edges of India-rubber. The treatment of the juice of the India-rubber trees is often of such a nature as to greatly deteriorate the caoutchouc obtained; a considerable proportion being thus changed from the fibrous to the viscous condition. This kind of injury to the caoutchouc can be obviated by coagulating the milky juice, and carefully drying the clot after it has been subjected to pressure. For experimental purposes alcohol may be employed as a coagulating agent; while, on an industrious scale, alum has been tried with apparently an excellent result. The milk is strained to remove solid impurities, after which a small proportion of alum solution is added. The clot which separates is next drained or pressed, after which it is dried. Caoutchouc dissolves more or less perfectly, according to its condition, in various liquids, among which may be mentioned the various fixed and hydrocarbon oils, chloroform, ether, and carbon disulphide. Unless, however, the caoutchouc has been masticated or otherwise degenerated, it is doubtful whether a true solution is obtained. When a clear limpid solution is required, one of the best solvents is that proposed by Payen, namely, carbon disulphide, mixed with 5 per cent of absolute alcohol. If one part of masticated caoutchouc is dissolved in thirty parts of the above solvents a solution is obtained which can be filtered through paper, and may be employed in covering the most delicate moulds with successive layers of caoutchouc.

Fig. 4.—FICUS ELASTICA.

Caoutchouc may be utterly ruined by the use of impure solvents, and those experimenting with India-rubber solutions should in cases where it is desirable to regenerate the caoutchouc, by allowing the solvent to evaporate, take the utmost care not to employ any solvents which contain fatty or greasy matter.

Weak or diluted acids have little or no action on caoutchouc in the majority of cases, but strong sulphuric acid slowly acts on it, the action becoming rapid if heat be applied. Strong nitric acid acts on it with some energy, causing its entire destruction, and in a similar manner it is destroyed by the prolonged action of chlorine, bromine, or iodine; although these reagents, when their action is kept under control, have a vulcanizing or strengthening action.

A Peculiar Steamboat.

A propeller of novel construction has just been finished in San Francisco, California, to ply between that city and the Eel River Valley. The condition of the route required a staunch sea boat, which should also be of light draught, to be able to cross the bar at the mouth of Eel River.

The vessel is 152 feet in length, 140 feet length of keel, 26 feet beam, 9 feet depth of hold, and will register 250 tons. When loaded with 300 tons of freight she will draw only 7 feet of water. She is flat-bottomed, but has a tapering bow and stern, and her lines are as beautiful and graceful as those of a yacht. The peculiarity of the boat consists in the arrangement of the two propellers. Instead of projecting from either quarter on either side of a single rudder there will be two rudders, and each propeller will be arranged with respect to its corresponding rudder, just the same as it would be if there were a single propeller. There are in reality three keels, the center one curving up at the stern, following the line of the vessel. Those on either side, however, are 12 or 15 feet apart, and run straight out beneath the stern, where there are two stern posts and two rudders. The spaces between the keels and the hull proper are filled in solidly with knees, strongly bolted in every direction. There is left between the two keels a wide space, which will give free access to water, so that each propeller will act as well as if it were the only one used to draw the boat. The propellers are 6½ feet in diameter, of the Hirsch patent, and the pitch of the blades is set opposite, so that in going ahead both will turn to the center. They will be driven by twin compound engines, set 9½ feet between centers, with a surface condenser between. The condenser will contain 753 tin-plated brass tubes, ⅝ inch in diameter, secured in end plates with a wooden ferrule, and affording 618 feet of cooling surface. The condenser will be operated by a Blake compound air circulating pump, throwing 300 gallons per minute. The engines will have high and low pressure cylinders, the high pressure being 11 inches in diameter and low pressure 20 inches, with a 15-inch stroke. The steam will be supplied by a tubular boiler, with 3-inch return tubes. The engines will be so arranged that the engineer will face the bow, and will regulate his propellers by levers on either hand—pushing them forward when the bell signals "Go ahead," and bringing them back when he is signaled to back the vessel. The arrangement of the propellers is such that one may be backed while the other moves ahead, and the boat can thus be turned in her own length. This is of especial importance, on account of the narrow and crooked channel across the Eel River bar, where boats often ground because of their inability to turn quickly enough. The two keels under the stern will serve to protect the propellers if the boat grounds.

Water as a Prophylactic and a Remedy.

At the recent meeting of the American Neurological Society in this city, a paper was read by Dr. S. G. Webber, of Boston, upon this subject, from which we abstract the following:

Many people had a notion that it was injurious to drink at meals, but a moderate quantity of fluid taken at meal time was rather beneficial than otherwise. A large class of patients were affected with symptoms of an indefinite character—a vague unrest, showing itself by discomfort or even pain, sometimes in one place, sometimes in another. They were usually subject to constipation, often had an unhealthy hue of the skin. They were frequently classed as hypochondriacal or hysterical. There was no well defined disease. These patients usually drank too little water. The waste of the tissue changes in the system must pass into the blood, and could only leave the system in a state of solution. During comparatively good health, the amount of blood was maintained at nearly the same figure, and only so much water would be parted with through the skin, lungs, and kidneys as could be restored from other sources. If too little water was ingested, the perspiration would be slight, the elimination of urine would be diminished, and the excretion of waste material would be lessened. The blood would be continually saturated, or nearly so, with the results of disassimilation. The removal of the waste of tissue changes was not accomplished with sufficient regularity, and the tissues became clogged with used up material and nutrition was interfered with. The balance each day against health was very slight; but after a time there was such an accumulation that unpleasant symptoms were developed. If the person continued to eat heartily, either the surplus food passed off by the intestines, or was deposited in the shape of fat, the nitrogenized portions assisting to load the urine with urea and the urates. Let such a person drink a large amount, and the blood, having a sufficient supply of water, more urine would be secreted, the loss made good to the blood by absorption, and a larger amount of waste products would be taken up to be eliminated; more urea or phosphoric and sulphuric acids passed off by the urine, which was increased in amount, and there was more disintegration of the tissues. This last was made up by new material, so nutrition was increased. The doctor found that neurasthenic patients did not drink enough.

Dr. Beard remarked that he had found thirst a prominent symptom of neurasthenic patients. He had been using Summit water with good results. He used the bromides alternately with tonics and a free supply of water. The plan was very satisfactory.

Dr. Webber said that patients who drank no more than a pint or twenty ounces of water per day, had told him that they were not thirsty, and were surprised when he told them to drink more water. These directions being complied with, the patients, in the course of the week, developed thirst, and drank as many as three pints a day.

Analyses of Barley, Rice, and Maize.

The following comparative analyses of the three grains are by Pillitz:

		BARLEY.		RICE.		MAIZE.	
		Air dried.	Dried at 257° F.	Air dried.	Dried at 257° F.	Air dried.	Dried at 257° F.
Moisture		13·88	—	12·51	—	13·89	—
Starch		54·07	62·65	74·88	85·41	62·69	72·27
Insoluble ash		1·07	1·23	0·39	0·45	0·33	0·38
Fatty matters		2·66	3·08	0·78	0·90	4·36	5·03
Cellulose		7·76	8·88	0·76	0·87	4·19	4·82
Insoluble albuminoids		12·43	14·28	8·78	10·01	8·63	9·95
Soluble matters	Dextrine,	1·70	1·96	1·11	1·27	0·76	0·83
	Sugar,	2·43	2·71	traces	traces	1·38	1·59
	Soluble albuminoids,	1·77	2·05	0·41	0·46	1·87	2·16
	Soluble ash,	1·26	1·45	0·45	0·51	1·15	1·32
	Extractive matter,	1·50	1·71	0·11	0·12	1·43	1·65
		100·53	100·00	100·18	100·00	100·68	100·00

Enemies of the Tea Plant.

Speaking of blight, we think that if more care was taken to watch its first appearance, many of the remedies prescribed might be possibly effectually applied. But when blight has been allowed to spread over a large area, it becomes almost impossible to stop it. Bushes on which blight appears should be promptly treated, wherever possible, and different known remedies tried. It is seldom that an area is attacked all at once, and there is no doubt that with spider and some other blights, they are carried about by the coolies from bush to bush. It is generally supposed that heavy rain washes away the red spider. To a certain extent, no doubt, it does, but the creature has a trick of getting underneath the leaf when he finds the moisture too strong for him, and when the warm sun comes out again he recommences his peregrinations and destructive action over the surface of the leaves. The activity of the insect is something surprising, and an investigation, under the microscope, of the leaves attacked will show them transparently red, and covered with hundreds of eggs, with little spiders emanating therefrom and cutting about with amazing vigor. The unhatched eggs (that is those not yet matured) are unfortunately not destroyed or washed off the bush by the rains, in consequence of being practically gummed to the leaf, and thus a second syringing or treatment should follow very quickly. If *heavy* rain falls at the right time, it may save the trouble of syringing.

Besides the red spider blight, the Darjeeling district is suffering from green fly blight. This pest eats the outside of the stem of the flush, causing the leaf to curl up and wither by reason of the sap being prevented from rising. There is also the red bug, which cuts through the upper shoot of the flush, and makes it droop off. Then the mosquito blight, which, puncturing the leaf, and preventing the distribution of sap, hardens it.—*Indian Tea Gazette.*

Distortion of Lenses by Pressure or Strain.

Many photographers have from time to time remarked that it is occasionally impossible to focus an object sharply and clearly, even with a lens known to yield a satisfactory result in ordinary cases. Setting aside such obvious causes as light shining into the lens, or the presence of moisture on one of the glasses, there can be little doubt that the most frequent source of the difficulty in question is a bending or distortion of the objective by some mechanical force acting on it. In the case of lenses burnished into their mounts, a contraction of the ring by cold may distort the lens uniformly, if its fit in the mount is accurate, merely altering the focus and disturbing the corrections of the instrument. If, however, the cell in which the lens may be mounted is not turned with extreme accuracy, or if the outside of the lens itself is not truly round, so irregular a distortion may arise as to altogether destroy the defining power of the combination to which the lens belongs. There is no question that the practice of burnishing lenses into their mounts has its disadvantages, for when this plan is adopted the operator has no easy remedy against a "frost-bound" lens, excepting to keep the instrument warm during the time he is using it. If, on the other hand, the glasses are not cemented in their cells, they are liable not only to be misplaced by careless persons, but also to be distorted by being screwed down in their places by an undue degree of force. Lenses should generally be left just the least bit loose in their mounts—not quite enough to cause any possibility of shaking, but the right degree of looseness can generally be estimated by making an attempt to turn the lens in its setting. Few persons realize the ease with which glass bends and yields to pressure.—*Photographic News.*

ENGINEERING INVENTIONS.

An improvement in endless cable railways has been patented by Mr. Samuel M. Pettengill, of Brooklyn, N. Y. It relates to railways provided with a moving endless cable, rope, or chain, for propulsion of the cars. The object of this invention is to furnish the cars with means for seizing and firmly holding to the rope or cable without shock.

Mr. James B. Jenkins, of Warren, Ill., has patented a grapple for lowering pipes into wells that may be detached from the pipe automatically by sliding it down on the pipe until it comes in contact with a coupling.

An improvement in that class of railways in which no wooden ties are used, and the pot sleepers or chairs are flared to rest directly upon the ground, and are cast in one and the same piece with a jaw which is perforated with holes for the fish bolts, between which jaw and the fish plate the rails are bolted, has been patented by Mr. William Rainbow, of Chancery Lane, England. The improvement consists, mainly, in the means for connecting the chairs so as to preserve the gauge of the road.

A clock device to be used on railroads to be operated by passing trains, whereby the time elapsing between the passing of one train and its next succeeding one will be correctly indicated to the engineer of the succeeding train, has been patented by Mr. Alma P. Burroughs, of Seneca Falls, N. Y.

Mr. Augustus B. Wood, of Fountain Hill, Ark., has patented a cheap and economical oscillating engine furnished with a valve so arranged and controlled that friction and pressure upon the valve seat are reduced simply to that which is necessary for preserving a steam tight joint between the two.

An improved low-water alarm for boilers has been patented by Mr. Nathan L. Adams, of Fort Collins, Col. The object of this invention is to furnish steam boilers with an improved device that will indicate automatically and give an alarm when the water in the boiler falls below the safety point.

Mr. Anton Pohl, of Baltimore, Md., has patented an improved spark arrester, in which the joint action of gravity, deflection, and centrifugal force is employed to separate the sparks, cinders, and solid matter from the smoke as it escapes through the stack of a locomotive, whereby the work may be effectually accomplished within the limited space of the stack without materially intercepting the draught. The improvement consists in arranging an annular chamber around a cylindrical stack, and providing the stack with a spiral deflector plate, which will give a rotary motion to the smoke and cause the solid matter to be thrown off against the side walls of the stack, where it is intercepted by projecting plates and conducted through openings into an adjoining annular chamber and deposited at the bottom.

An improved car coupling has been patented by Mr. Edward S. Plimpton, of Denison, Ia. This invention is an improvement in the class of car couplings in which the coupling pin is provided with an arm that projects from the head thereof and rests in a socket in the front top portion of the draw head, so as to constitute a fulcrum on which the pin may swing when pushed back by the link in the operation of coupling.

A Magic Lantern and Six Slides for Six Cents.

A small tin lantern, about three inches high, with lamp, slides, and two lenses, is actually being now sold in London at the above mentioned price; while a larger one of a similar character costs the somewhat more extravagant sum of fifteen cents. The small lantern is of German make, and when one considers that the manufacturer cannot get more than four cents for the article, it is a matter of wonder how it can be produced for the price. Very little can be said as regards the artistic merits of the slides, but like the old Dutch tiles, they at least possess the merit of being hand-painted—if, indeed, this be a merit. The lenses, which, as regards optical work, are superior to many spectacle glasses sold in London, give, as an advertisement would put it, "a brilliant illuminated disk six inches in diameter." There is also sold in London at the present time, a toy camera obscura about the same size as the magic lantern in question. Who knows but what the present pushing age may produce a small tin photographic camera, double slide, two dry plates, and lens for about 25 cents? It could certainly be done if the work were executed on the same scale of cheapness as in the case of the magic lantern. It is, perhaps, not generally known that a very passable photograph can be taken with a common penny magnifying glass, if it be stopped down and a proper adjustment made for the difference existing between the chemical focus and actinic focus.—*Photographic News.*

Brilliant Tints of Californian Flowers.

Under the title of "A Botanist in Southern California," Mr. J. F. James contributes to the *American Naturalist* some interesting sketches of the vegetation of the country in the vicinity of Los Angeles. Rain falls there only from November to March, and the rest of the year is hot and dry. By the middle of June or July vegetation is parched up, and the country has a very depressing aspect; but the spring is glorious. Then the plains surrounding the city, the hills, and the valleys are one mass of gorgeous, brilliant flowers. They are there by thousands upon thousands, and of almost endless variety. Most conspicuous of all, both for its abundance and its color, is the Californian poppy, *Eschscholtzia californica*. It covers acres of ground, and the bright

golden-yellow or orange of its flowers is visible for miles. When the sun is shining full upon it, it is too dazzling for the eye. In places where the ground was plowed paths of it had been left, and they seemed like tongues of fire running over the ground. Among other showy plants are *Sidalcea malvæflora*, with large purple flowers; *Platystemon californicus*, called cream-cups; *Dodecathon meadia; Baria gracilis*, a composite with bright yellow flowers, covering acres of ground; *Paonia brownii*, in tufts, with large purple or reddish flowers; various species of *Gillia, Pentstemon, Lobelia, Phacelia, Nemophila*, together with *Clarkia, Salvia, Castilleia, Convolvulus*, and *Colochortus*, making up such a wealth of color as is rarely seen elsewhere.

THE CONCH FISHERIES OF THE BAHAMAS.

BY W. H. WEED.

Conch fishing in the Bahama Islands is quite an extensive industry. There are about 500 vessels engaged in this and the sponge and turtle fisheries. Most of these from time to time engage in conch fishing according to the demand for the shells.

The vessels employed are either sloops or small schooners, and carry from three to ten men, most of them of the "colored persuasion." These negroes are expert divers and swimmers, being accustomed to the water from childhood. They enjoy the distinction of being perfectly fearless, even in the presence of that dreaded enemy of divers, the shark, who is found in abundance in these waters. It is a current saying in Nassau, when a stranger asks if the negroes are not afraid of sharks, that "a shark will not attack a nigger." The men usually work on shares, and their reward being thus dependent upon their own exertion, each one spurs the others at their work; they all labor with more energy than is usually characteristic of their race in this climate. The conch, which is like an enormous snail, is found in the shallow waters of this vicinity, the sea bottom of the numerous shoals being a favorite place for them. The larger crews work in parties of two, three, or four, in separate boats and independent of each other.

In order to locate the position of the fish they use what is called a "water glass." This is a rectangular water-tight box about thirty inches long, with one end a foot square, and closed by a pane of ordinary glass. The other end is slightly larger and is open. In using the "glass" the closed end is immersed in the water a few inches below the surface, when the sea bottom is distinctly visible through the glass, the water being clear as crystal.

Having discovered the position of the conch the diver leaps in and obtains it, and in a few moments is back in the boat looking for more. Some of the fishermen use a double pronged hook attached to a long staff, such as is used in sponging, and with this secure the conch instead of by diving.

When a boat load is secured the conchs are taken ashore to some convenient beach and left to die. When dead the shells are beaten against the soft sand, which loosens the flesh so it may be easily removed.

The meat of the pink conch is carefully examined for pearls, but the other varieties have no pearls.

The shells of the pink conch are scraped to remove the seaweed, serpulæ, or other incrustation, but the others are naturally pretty clean and are sold in the rough state.

The length of the cruise varies, of course, but the usual time is three or four weeks. On the return to Nassau the shells are sold to the conch dealers or merchants, who sort and pack them for shipment. The finer specimens are packed in cases with sponge clippings, but the ordinary kinds are packed in bulk or shipped loose.

Most of the exports are to England and the United States, though France takes a good many from English consignees.

The four varieties of conch which form the basis for this industry are the common or pink conch, the milk conch, and the king and queen conchs. The first, the *Strombus gigas*, is the most common, and is the well-known conch used for ornamental purposes. It is also the same formerly used for the dinner horn by many old farmers; indeed, it still does good service in that line in the far West.

The flesh of the animal is edible, making, when cooked and properly dressed, a very fair salad, as the writer can testify from experience.

The shell is used for turning into sleeve buttons and brooches, much in vogue in Naples, Italy, but for some unknown reason they do not take well in the United States. Exquisite pink cameos are cut from this shell, and are often mistaken for coral by novices.

Many tons of this shell are also used in the porcelain manufactories of France and Germany.

The milk conch is also one of the strombs and is much smaller than the pink conch. The name is derived from the milk-white color of its interior. The shell is much less fragile than the other species, and it is used in the United States for ornamental purposes.

The queen (*Cassis madagascariensis*) is a much more valuable shell than the preceding varieties. Its flat face is egg shaped and of a handsome salmon red color, being of a beautiful brownish black near the teeth. The shell of this and the king conch is very valuable in cameo cutting, and are much used for this purpose in England and France.

The king conch is of the same species as the queen, but it differs somewhat from it in having a triangular face of a brownish yellow, and the interior of the shell and around the teeth is of a purple black.

Several very handsome specimens with cameos cut in the shell may be seen in the Bethnal Museum, London, and at the American Museum of Natural History in New York.

The pearls taken from under the apron of the pink conch are either pink, yellow, or black. The pink are, however, the only valuable kind. These are of that exquisite shade of pink which gives the name to the conch from which they are taken. Many of the pearls are beautifully water lined, and this, together with their size and color, determines their worth. The lucky fisherman who has any of these pearls for sale finds a ready market for them in Nassau, where the buyers offer very good prices for the pearls, £20, or $100, is not a very unusual price, though the majority of the pearls bring a very much lower figure, of course.

The buyers export them to England, where the demand is good. They may be seen in London set in all sorts of ways, the favorite being in the form of rings, which can be bought from £2 up.

The value of the pearls annually exported from Nassau was recently estimated at £10,000, or $50,000.

The value of the different conch shells in New York is, for the pink conch, $4 per one hundred shells; milk conch, $6.50; king conch, $25; queen conch, $20.

NATURAL HISTORY NOTES.

Old Seeds versus New.—There is a widespread impression that old seeds of many plants are preferable to new, especially in the production of double flowers. Desirous of putting his view to the test, an experimenter, whose results are recorded in a recent number of the *Revue Horticole*, undertook a series of experiments with the seeds of the camellia-flowered balsams of varying age. The conclusion arrived at—diametrically opposite to the generally received opinion—is that it is the youngest seeds which give the largest proportion of double flowers.

The Potato Grafted on the Bitter Sweet.—An experiment has been performed by M. Lambotte, the record of which, together with an illustrative woodcut, may be found in a recent number of the *Revue Horticole*. M. Lambotte tells us that in the spring of the year, while picking out some potatoes for culinary purposes, he remarked one sprouting and more fit for planting than for cooking. He had at the time, close at hand, a plant of the bitter sweet (*Solanum dulcamara*), the stem of which he cut to a sloping point, which he introduced into a hole in the potato as deftly as possible. Some days afterward the potato had regained its hardness and speedily sprouted from the eyes, the principal stem measuring more than sixty centimeters. The tuber became green, excessively hard, and developed little shoots bearing smaller tubers and rootlets. In point of fact there was a tuber growing in the same manner as it would in the ground, and only differing from an ordinary tuber in its hard consistence. Things went on in this manner till the end of September, when suddenly the leaves withered and the shoots became pendent, and the tuber gradually became soft and decomposed after its ten months' sojourn on the stem of the bitter sweet, the latter continuing its growth in the ordinary manner, unaffected by the fate of its quondam associate.

The Eggs of the Great Auk.—The numerous bones of the great auk found on the shores of Greenland, Newfoundland, Iceland, and Norway attest the former great abundance of this bird, but within the last century it has gradually become more and more scarce, and is now believed to be extinct, none having been seen or heard of alive since 1844, when two were taken near Iceland. There are but three specimens in the United States—one in the Academy of Natural Sciences at Philadelphia, one in the Smithsonian Institution, and one in the Cabinet of Vassar College. The last is the most perfect specimen, and possesses the greatest historical value, as it is the one from which Audubon made his drawing and description. The eggs of this extinct bird are also extremely rare, and it is, therefore, interesting to learn that two specimens have been recently discovered in an old private collection in Edinburgh and sold at auction. The prices realized on these two rarities were $560 and $500 respectively. The purchaser was Lord Lilford.

A Case of Apparent Insectivorism.—Professor Baillon, at a recent meeting of the Linnæan Society of Paris, read the following notes on the apparent insectivorism of a plant often seen in cultivation, *Peperomia axifolia*, of which the variety *Argyreia* is cultivated in so many greenhouses, has the leaves more or less deeply peltate. I have seen stalks on which the peltation on certain leaves was so exaggerated as to show on cross section a depth of nearly four centimeters. When the concave stalks take a suitable direction, water (principally that from sprinkling) would accumulate and rest in these receptacles, so well prepared to preserve it. Many small insects would fall into this water and be drowned. Last year, when the season was warm and when the windows of the house were often open, the number of insects was very considerable, and these, soaking in the water, gradually fell into decay, and it was remarkable that there was during this not the least sign of any putrescent odor. Those who believe in the theory of insect-eating plants may perhaps in this be led to find an argument favorable to such doctrines. They will add that the variety of colors so strikingly seen in these leaves constitutes the agent of attraction for the insects to come and be drowned. These reflections, each of a different sort, here present themselves: 1. Is it not remarkable that the exaggerated peltation of these leaves is in this case accompanied by an apparent insectivorism, and that the leaves of the plants known up to this time by botanists as carnivorous owe their sac-like, horn-like forms only to an excessive peltation of their limb, as we demonstrated in the evolution of the leaves of *Sarracenia* (*Comp. Rend.* lxxi. 630)? 2. How can it be considered as a proof of insectivorism, that plants such as the *Utricularia* grow better in a fluid containing albuminoid compounds, when other plants grow equally favorably in the same kind of fluid, and which latter are never for a moment thought of as carnivorous? 3. How do the chief priests of our science reconcile the two ideas, that the surface of the leaves of plants is unable to absorb pure water in contact with them, and that the same surface daily absorbs water charged with albuminoid substances and the like?

Albino Arethusa.—A white flowered variety of this rare and beautiful North American orchid has recently been discovered in Rhode Island by Professor W. W. Bailey. It has the yellow markings of the labellum, as in the ordinary red flowered form. In his "Wild Flowers of America," Professor Goodale states that the plant grows in bogs, with its corm embedded in peat moss, sometimes two or three inches below the surface.

CURIOUS FACTS ABOUT THE ALBATROSS.

The tracts of lower, nearly flat land of Marion Island, skirting the sea, and the lower hills and slopes along the shore, presented a curious spectacle, as viewed from the ship as it steamed in towards a likely-looking sheltered spot for landing. The whole place was everywhere dotted over with albatrosses, the large white albatross or goney (*D. exulans*). The birds were scattered irregularly all over the green in pairs, looking in the distance not unlike geese on a common.

The albatrosses were all around, raised from the ground. Their nests are in the style of those of the mollymanks, but much larger, a foot and a half at least in diameter at the top.

They are made up of tufts of grass and moss, with plenty of adhering earth beaten and packed together, and are not so straight in the sides as those of the mollymanks, but more conical, with broad bases. The female albatross is sprinkled with gray on the back, and is thus darker than the male, which is of a splendid snow white, with the least possible gray speckling, and which was now, of course, seen in his full glory and best breeding plumage; the tails and wings of both birds are of course dark.

The albatrosses one meets with at sea are most frequently birds in young plumage or bad condition, and have a rather dirty, draggled look. The brooding birds are very striking objects, sitting raised up on the nest, commonly with the male bird beside it. They sit fast on the nest when approached, but snap their bills savagely together, making thus a loudish noise. They will bite hold of a stick when it is pushed up against their bills. They need a good deal of bullying with the stick before they stand up in the nest and let one see whether they have got an egg there or no. Then the egg is seen to appear slowly out of the pouch in which it is held during incubation. It is nearly five inches long, or about as big as a swan's, and is white, with specks of red at the large end. Only one egg is laid. In most of the nests there were fresh eggs; in some, however, nearly full-grown young birds.

At Campbell Island, of the Campbell and Auckland group, the young of *Diomedea exulans* were found just breaking the shell in February, by an exploring party.*

Charles Goodridge, who was one of a sealing party on the Prince Edward Islands in 1820, and spent two years on the Croyets, says that the albatrosses there lay at about Christmas, and that the period of incubation is about three months (?). The young, he says, were wing-feathered, and good to eat about May, and did not fly off till December.†

The young albatrosses are dark-gray in plumage. They snap their bills, like the old ones, to try and frighten away enemies. The old birds never attempt to fly, though persistently ill-treated or driven heavily waddling over the ground.

Very many were killed by the sailors that their wing bones might be taken out for pipe stems, and their feet skinned to make tobacco pouches. The old males tried to run away when frightened, but never even raised their wings.

It is amusing to watch the process of courtship. The male, standing by the female on the nest, raises his wings, spreads his tail and elevates it, throws up his head with the bill in the air, or stretches it straight out forwards as far as he can, and then utters a curious cry, like the mollymanks, but in a much lower key, as would be expected from his larger larynx. While uttering the cry the bird sways his neck up and down. The female responds with a similar note, and they bring the tips of their bills lovingly together. This sort of thing goes on for half an hour or so at a time. No doubt the birds consider that they are singing. Occasionally an albatross flies round and alights upon the grass, but I saw none take wing.—*H. N. Moseley.—Challenger Notes.*

A WISCONSIN cow died not long ago, after a lingering illness, attended by a persistent cough. After her death a veterinary surgeon opened the windpipe to discover the cause of the irritation, and found in the upper part of the lung a live striped frog of ordinary size. The surrounding portion of the lung was much discolored.

* "Notes on the Geology of the Outlying Islands of New Zealand. Reported by Dr. Hector, F.R.S."—Trans. N. Zealand Inst., vol. xi., 1869, p. 75.

† "Narrative of a Voyage to the South Seas, and Eight Years' Residence in Van Diemen's Land," p. 36. By C. M. Goodridge. London: Hamilton & Adams. 1833.

Business and Personal.

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

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

Notes & Queries

HINTS TO CORRESPONDENTS.

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

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

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

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

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

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

(1) G. A. A. asks: Which is the best pipe to use for heating a room with steam: two rows of one inch pipe or one row of two inch pipe? A. If the radiating surface in the two cases is the same theoretically there should be no difference, but practically we believe the smaller pipes have proved more efficient.

(2) O. V. D. asks: 1. How many pounds ought a three-eighths inch bar magnet hold up, like that described in the SUPPLEMENT, No. 142, in the article "How to Make a Working Telephone," Fig. 4, so that I could tell if it was charged powerful enough? A. About three-fourths its own weight. 2. What would be the numbers of the lenses required to construct a spy glass like that on page 68, SCIENTIFIC AMERICAN, No. 5, Vol. 43? A. Only two lenses are required. The object glass should be achromatic, the eye lens is double concave.

(3) Dr. A. M. C. says: I want to make a sidewalk 10 feet long, 2½ feet wide. What can I use in place of stone or wood, something that is durable and hard? A. You might use ordinary cement, three inches thick, which any mason can put down for you. See SUPPLEMENTS, 33, 36, and 82.

(4) W. H. D. asks: 1. Will a magnet that will lift a one pound weight make a small machine that will make a small current to show how it works? A. Yes. 2. Will sheet glass covered with tin foil on both sides make a Leyden jar, and by combining a large number together, having the negative sides connected and all the positive sides connected, make a powerful battery? A. Yes, but the jars are better. 3. Would not sheet lead answer as a substitute for tin foil? A. Tin foil is best.

(5) J. S. M. inquires as to the best method of preventing woodwork in mills saturated with oils from taking fire in the event of a blaze touching the woodwork. A. Woodwork strongly impregnated with tungstate of soda or silicate of soda (by treatment in strong aqueous solution of these salts) becomes uninflammable.

(6) G. E. writes: 1. I have bought some woolen underclothing which are so much filled with sulphur that they are very unpleasant to wear. Is the sulphur injurious to health? A. Yes, if present in considerable quantity. 2. What will remove the sulphur? A. Sulphur is soluble in bisulphide of carbon. If the bisulphide used is pure the small quantity adhering to the cloth after wringing will quickly and completely evaporate on exposure to the air.

(7) R. P. asks if there is any indelible preparation for stenciling on unplaned lumber, such as posts, etc., in black or other colors? A. Use a strong turpentine solution of asphaltum, tempered with common printer's ink.

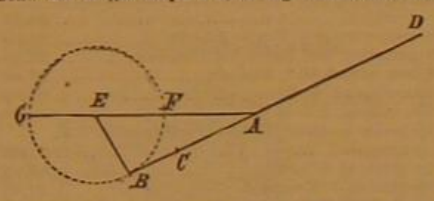
(8) J. G. asks what are the plates on which photographic pictures commonly called tintypes are taken coated with? A. The plates are flowed evenly with japan varnish, and the coating hardened in a japanner's oven. The varnish may be procured at almost any paint store.

(9) P. T. asks how to take stains made by Payson's indelible ink out of linen? A. Moisten with a little iodine, then with ammonia water, and rinse in clean water.

(10) E. H. writes: 1. Referring to your description of Blake's transmitter, on p. 274, vol. 41, SCIENTIFIC AMERICAN, how is the brass button filled with carbon? A. The brass is spun over the carbon. 2. Is it the carbon that weighs three pennyweights, or brass and carbon together? A. Both.

(11) W. S. H. asks: Can you give a simple test for oxygen water; that is, water supposed to contain an extra amount of oxygen—all it will take up? This water is called by some oxygensqua. A. Fill a quart bottle, provided with a perforated cork (tightly fitting) to admit a glass tube, with the water; heat nearly to boiling, and collect the gases given off in a small test tube, by displacement, over the pneumatic trough. Examine the gas with an ignited taper or splint of wood. Momentary increase in the intensity of combustion indicates an unusual amount of oxygen in the water. Compare results with ordinary well or cistern water.

(12) E. T. S., St. Clair, Mich., says: In your issue of August 14, G. G., in the article, "Evolution of Ideas," speaks of the "golden cut." Will you please illustrate what is meant? A. To divide by the "golden cut" is an expression used by mathematicians for dividing by "extreme and mean ratio," and this means, as G. G. correctly remarks, the dividing (of a line, for example) in such a manner that the whole has the same relation to the larger part as the larger part to the smaller, and *vice versa*. Let A B be the given line which is to be divided by the "golden cut." At B draw to A B the perpendicular B E, equal to one-half of A B. With E as center and A B as radius describe a circumference. Draw the straight line A E G, cutting the circumference



in F and G. On A B lay off A C = A F, and on the prolongation of B A lay off A D = A G. Then the line A B is divided interally at C (and externally at D) by the "golden cut," or in extreme and mean ratio. For since A B is a tangent and A G a secant, A B is, according to a well known thesis of geometry, a mean proportional between A G and A F.

$$AG : AB :: AB : AF$$
$$AG - AB : AB :: AB - AF : AF$$

Now, $FG = AB$ also $AC = AF$

$$AC : AB :: BC : AC$$
$$AB : AC :: AC : BC$$

The first proportion by composition gives:

$$AG + AB : AG :: AB + AF : AB$$

Since A G = A D and A B = F G we have

$$BD : AD :: AD : AB.$$

(13) F. P. S. asks: 1. Can paper be made to have the same strength and elasticity as leather? Can it be moulded into a form 6x2x1 inches, and so treated that it will have the same qualities as leather (several pieces glued together) would of these dimensions? A. See "Vulcanized Fiber," p. 10, vol. 38, SCIENTIFIC AMERICAN. 2. How can I make the edges of leather cut by a disk very smooth, and how can I polish them? A. Try a heated iron, or an ivory or bone burnishing tool. 3. How can I make a cement that will be a great deal stronger than glue, for cementing several pieces of leather together? A. See p. 2310, No. 158, SCIENTIFIC AMERICAN SUPPLEMENT.

(14) C. W. H. writes: I wish to learn how to mix shellac in liquid form, to be used in shellacking a cedar boat; that is, how much alcohol to a certain amount of shellac should be used, and how it should be applied so as to obtain a thin hard coating that will wear well. A. Place two pounds of orange shellac in a jug or demijohn, and pour over it one gallon of 95 per cent alcohol; allow it to stand for a day or so, shaking it occasionally, and stirring if it becomes solid at the bottom. When the shellac is entirely dissolved strain the varnish through a piece of flannel. Apply with a flat, soft brush.

(15) F. E. T. asks: What is nickel silver jewelry? I wish to get some of the metal, but find none advertised. A. German silver (a nickel silver) is composed of: 1. (for casting)—copper 5, zinc 2¼, nickel, 2½; 2. (for rolling)—copper 6, zinc 2, nickel 2½. The specimen metal sent is lead superficially rolled with tin.

(16) C. T. F. writes: I observe in your journal of July 31, p. 69, an article pertaining to the value of swamp muck. Please inform me how nitrogen is manufactured from swamp muck? A. Muck contains a large per cent of certain nitrogenous compounds, the products of the decomposition of which in the soil are readily assimilated by plants. The amount of nitrogen in the muck is an index of its richness in these *foods*. Free nitrogen is not readily obtainable from muck. In analysis it is usually determined in the form of ammonia (NH_4OH).

(17) M. F. P. writes: I would like to get the details of lacquering brass goods, such as lamps, springs, etc., to keep them bright and prevent them from tarnishing. See pp. 395 (15), vol. 42; 44 (39), vol. 38; 44 (53), and 188 (52), vol. 37; 242, vol. 34; 139 (41), and 336, vol. 32, SCIENTIFIC AMERICAN, and p. 630, No. 38, SCIENTIFIC AMERICAN SUPPLEMENT.

(18) J. J. M. asks (1) if a dynamo-electric machine will run of itself, or if a battery is applied to it. A. A dynamo-electric machine will generate an electric current without the aid of a battery. 2. What number of wire would I need to make bobbins 2 inches long, 1 inch in diameter? A. It depends on the style of the machine. See article on small electric machine in SUPPLEMENT 161.

(19) C. E. W. writes: I have both copper and brass moulds for small articles, but meet with failure in the metals not running sharp in the small lines. Have tried smoking, but does not work. What can I do to remedy it? I use the most fusible alloys. A. Heat the moulds well before pouring, and coat them smoothly with black lead.

(20) G. M. B. asks: 1. How is nitroglycerine made. A. Nitroglycerine is prepared by bringing glycerine drop by drop into a cooled mixture of very strong nitric and sulphuric acids. The nitroglycerine collects at the bottom of the vessel and is subsequently freed from the acids by carefully washing in a copious supply of water. 2. Is the explosion caused by the rapid transformation of a solid into a gas? A. Yes, in the case of nitroglycerine from the liquid to the gaseous state. 3. Would not iron, wood, or any substance cause explosion if instantaneously changed into a gaseous form? A. Yes. 4. Are the nitrates the only explosive substances known? A. No, gunpowder prepared with chlorate of potash explodes more violently than that in which niter is used.

(21) H. B. C. writes: Will you please inform me the best way to cut carnelian and moss agates? A. Some specimens may be readily cut by means of a thin rotating iron disk charged with emery and water. Extremely hard specimens require diamond dust. It should be mixed with a little olive oil and applied sparingly to the edge of the disk. To cut plane surfaces and facets on these stones use a flat lead lap wheel charged with emery and water. Polish with rotten stone and water applied to a pewter lap.

(22) E. F. L. asks how to cut and finish carnelians and agates. I have a United States dental lathe. A. See reply to H. B. C. above.

(23) C. & W. write: 1. We are putting in a sixty horse power locomotive pattern boiler. Shell 60 inches in diameter. We use the exhaust steam in a dry house. As we cannot use exhaust steam for heating water, we have extended the space behind the tubes four feet, and propose putting in a coil of 400 feet of 1¼ inch pipe through which water will be forced. The heat after passing through the tubes will strike this coil. Is the plan a good one? A. Your plan would heat a limited quantity of water. 2. Is it advisable to use steam jet instead of scraper, for cleaning tubes? A. The steam jet is used very successfully. 3. Should we run exhaust steam through a boiler, say thirty minutes, then close all openings except a pipe running down to water fifteen feet below; would not the steam condense and partially fill the boiler? If so, how full? 3. Yes, probably fill the boiler entirely.

(24) W. E. F. writes: In your SCIENTIFIC AMERICAN and the SUPPLEMENT you speak of preserving iron in water and ships' bottoms by the application of creosote. Is it oil of creosote as sold by druggists, and can it be applied with a brush on the outside? I am putting in a flume 90 feet long by 22x12; can I so coat the timbers? Also, I have a fine yacht: can I, when I haul her out for the season, and get her well dried under cover, paint her inside and out with oil of creosote and hope to make her last longer? A. Commercial creosote is commonly a mixture of creosote, picamar, and light tar oil. The colorless transparent liquid usually sold by pharmacists is the purified creosote. The former is the substance used for wood. The wood is impregnated with the creosote by immersing it in the liquid, usually under pressure. It is not usually applied with a brush, as you suggest, and is not suitable for inside woodwork.

(25) H. A. C. writes: A diploma on parchment was, as I thought, greatly injured by dropping writing ink near and adjoining the printing on the side of the diploma. Framing would not hide the blots. Not knowing what I was doing I used a strong solution of tartaric acid for the purpose of removing the stain. This only served to change the color of the blots from black to blue. It was much fainter, however, than before, and appeared to be in the parchment rather than on it, as before. The parchment had shrunken somewhat now after drying, but as the spot was not larger than a silver quarter, it was not noticeable. I now took chloride of lime to remove the blue stain, but this solution served to shrink the parchment where it was wet to a considerable extent. Not having any means of stretching the spot, and not knowing what to use for that purpose, I laid the diploma away as soon as it dried and have never since opened it. Will you tell me how can I get the spot back to its former dimensions? A. You may try the following: Moisten the spot with water, and rub it over gently at first with the white of an egg mixed with a small quantity of freshly prepared flour paste. Press between blotting paper with a warm iron. A little alum and a trace of oil may be added to the paste if found necessary.

(26) E. Y. D. writes: I have a sun dial made in Germany for 48° 15′ latitude, and I want to know if I get correct time with it in latitude 38° 50′; if

not, why? And how much difference will there be at 12 o'clock noon? A. We should infer yours to be a horizontal sun dial, and will give correct time only in latitude for which it was made, save when sun in meridian; because the gnomon or style by which the shadow is cast must be placed parallel with the polar axis of the earth, and the base upon which the shadow is cast parallel with the horizon, both of which cannot be done when a change of latitude is made. If the style of your dial is set truly in the meridian of your place, and depressed to correspond with your latitude, it will give you 6 o'clock A.M. and 6 o'clock P.M., also the exact sun or true time, at noon.

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

W. N. W.—Galena—lead sulphide, a rich lead ore. It probably carries a little silver—worth assaying.

COMMUNICATIONS RECEIVED.

On the Motion of the planets. By A. K.
On a New Theory of Planetary Movement. By J. H. S.
On Declination of the Magnetic Needle. By J. L. R.
No Current in Magnets. By W. B. F., M.D.
On Protecting Oil Tanks from Lightning. By W.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

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

August 17, 1880,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1865, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

Advertising, automatic device for, R. M. Westlake 231,304
Aging liquors, apparatus for, J. H. Thierman 231,377
Air brake for railway trains, J. Hall 231,311
Axle cutting device, L. A. Young 231,387
Bale band tightener, C. T. Christmas 231,273
Bale tag, P. Cohen 231,277
Baling press, P. K. Dederick 231,215
Belting, machine for making rubber, J. D. Joslin 231,327
Berth, self-leveling ship's, H. A. Darrin 231,284
Blasting charges, primer for, A. Nobel 231,348
Boat detaching apparatus, J. L. Knight 231,179
Boiler furnace, steam, W. H. Harrison 231,315
Bolt cutter, A. Fisher 231,299
Book holder, W. F. Eppler 231,295
Boot and shoe, waterproof, C. A. Ensign 231,293
Boot, India-rubber, C. A. Ensign 231,294
Bottle stopper, J. Flee 231,300
Bracelet clasp, H. Murray 231,335
Brewers' grains, drier for, F. W. Wiesebrock 231,384
Bridge, triangular truss, C. W. Wheeler 231,383
Buckle, harness, J. A. Gavitt 231,304
Buckle levers, machine for making, L. A. Sprague 231,199
Burring and ginning cylinder, J. K. Proctor 231,357
Button and stud, C. H. Mumford 231,224
Buttons from plastic materials, manufacture of, P. L. Sylvester 231,372
Cams for machinery, construction of, J. Brady 231,145
Canal lock and dam, G. W. Parsons (r) 9,345
Cans and other vessels, nozzle for, L. F. Betts 231,144
Car brake, S. Emery 231,291
Car brake, electro-magnetic, J. Cochran 231,276
Car brake mechanism, F. W. Chaffee 231,271
Car coupling, J. A. Dickinson 231,216
Car motor, street, J. Lockhart 231,183
Car roof, J. D. Felthousen 231,229
Car spring, E. Cliff 231,150
Carpet stretcher, W. O. Hogue 231,167
Carriage curtain fastening, F. A. Neider 231,345
Carriage curtain roller support, O. S. Osborn 231,227
Carriage, side bar, J. W. Magoun 231,339
Carriage spring, J. S. Corban 231,278
Cartridge capping and uncapping implement, S. Glover 231,162
Cartridge capping and uncapping implement, A. Worden 231,250
Casks, cleansing beer, G. S. & J. M. Fanning 231,219
Ceiling, fireproof, J. D. Ottiwell 231,351
Cement compound, H. Jordan 231,172
Chain bolt, H. E. Russell, Jr. 231,195
Chair brace, Sorenson & Stanton 231,245
Check rower attachment, J. M. Shackelford 231,242
Clamp for attaching handles to earthenware and glass vessels, C. J. Brackebush 231,203
Cock, stop, C. H. Cushing 231,285
Collar sweat pad, horse, E. R. Jones 231,326
Cultivator tooth, spring, H. Springer 231,368
Curtain fixture, A. Cosand 231,279
Damper, stove pipe, W. Scully 231,241
Dentures, method of and apparatus for making, R. Telschow 231,375
Disks of varying thickness, apparatus for gauging and assorting, M. M. Rhodes 231,359
Ditcher and scraper, combined, G. Palmer (r) 9,344
Doffer combs, mechanism for operating, G. Fowler 231,160
Drag or harrow, sulky, M. H. Woodruff 231,385
Drying kiln, E. & B. Holmes 231,168
Fare register, J. B. Benton 231,207
Fare register, J. N. Hardy 231,165
Faucet, Kohler & Arnold 231,178
Faucet, R. W. Tavener 231,246
Fence, D. T. Hazen 231,313
Fence wires, applying barbs to, E. Children 231,272
Fertilizer drill, J. Taylor 231,374
Fifth wheel, T. L. Andrews 231,140
File holder, T. B. Finn 231,356
Filter, J. Kroog 231,335
Fire engine boiler, T. S. La France 231,336
Fire extinguisher, D. T. Perkins 231,190
Flue stopper, J. B. Jewell 231,227
Folding table, F. F. Atkinson 231,252
Fruit picker, F. M. Taylor 231,373
Furnaces, apparatus for promoting combustion in, J. Mahoney 231,232
Gas and generating steam, combined apparatus for producing illuminating, J. H. Needles 231,344
Gas, apparatus for the purification of coal, A. Klonne 231,177
Gas burner, J. F. Barker 231,256
Gate, S. S. Speicher 231,244
Glazier's tool, I. W. Heysinger 231,235
Gleaner and binder, W. N. Whiteley 231,248
Gold, apparatus for saving float, J. Wilkins 231,205
Gong and alarm, door, F. N. Cottle 231,153
Governor, J. D. Churchill 231,274
Grain heater, W. N. Durant 231,157
Grate, J. B. Faris 231,296
Grate, fireplace, Brown & Miller 231,206
Grinding mill, E. G. Good 231,222
Grinding mill, Patterson & Hale 231,354
Hammer, steam, T. R. Morgan 231,185
Harrow, J. H. Barley 231,257
Harrow, C. E. Wyman 231,386
Harrow, spring tooth, H. A. Kilts 231,175
Harrow tooth, spring, C. D. Carter 231,268
Hay rake, horse, Reed & Rogers 231,358
Hay tedder, R. J. Clark 231,211
Hedge trimmer, Cunningham & Bailey 231,282
Hinge, stove door, I. Maguire 231,184
Hoe, J. W. Gladding 231,306
Horse power, S. Scott 231,364
Horse rake, J. Hollingsworth 231,170
Ice grooving plow, H. Ware 231,201
Index tab, R. H. Welch 231,202
Indexing books, spring clip for, C. L. Norton 231,349
Ironing board, G. D. File 231,298
Knob attachment, S. Harris 231,223
Label, J. H. Small 231,365, 231,366
Lamp, student, E. A. Parker 231,353
Latch, C. E. Billings 231,260
Latch, reversible, C. S. Jennings 231,171
Lightning rod coupling, J. H. Weston 231,203
Limekiln, Hughes & Foulk 231,321
Lock casings, machine for making, Brooks & Willard 231,209
Locomotive ash pan, C. Bresnahan 231,208
Locomotive fire box, W. H. Rushforth 231,240
Locomotive lift pipe, T. Plain 231,356
Locomotive, tank, G. Lentz 231,337
Log conveyer, T. J. Neacy 231,186
Loom shuttle box mechanism, Crompton & Wyman 231,153
Looms, retracting device for the picker sticks of, J. J. Geobegan 231,305
Lumber polishing machine, B. Beehler 231,259
Lunch box, J. A. Doherty 231,156
Meat chopper, G. P. Norton 231,187
Meat tenderer, J. B. Fleck 231,301
Metal plates, machine for beveling the edges of, R. Briggs 231,146
Microphone transmitter, T. A. Watson 231,247
Middlings purifiers, millstone curbs, etc., apparatus for catching dust generated in, C. E. Thayer 231,376
Mining, apparatus for hydraulic, W. B. Farwell 231,221
Mower, lawn, Dille & McGuire 231,286
Musical instrument, mechanical, G. H. Ireland 231,323
Nail extractor, F. Kraengel 231,332
Nail pointing die, J. M. E. Baackes 231,255
Nails, die for pointing wire, J. M. E. Baackes 231,254
Nut lock, G. Lyon 231,338
Nut lock, Strub & Stoeffler 231,371
Oiling device, C. A. Luther 231,182
Ore concentrator, L. M. Kellogg 231,330
Oven grate or shelf, F. E. Avery 231,141
Oven, hot blast, H. L. Brooke 231,265
Packing, piston, J. Seeberger 231,196
Packing, piston, G. E. Smith 231,198
Paper making machinery, G. Holloway 231,169
Paper pasting and folding machine, Goldsmith & Shedlock 231,307
Passenger register, Fowler & Lewis 231,161
Permutation lock, Herbert & Dougherty 231,166
Picture exhibitor, T. Muench 231,343
Picture nail, E. E. Kraus 231,344
Pills, coating, J. P. Nemours 231,226
Pipe bends, machine for boring and tapping, T. F. Hammer 231,312
Pipe gripe, M. G. Lewis 231,181
Plane bench, F. Kraengel 231,331
Planter, seed, D. D. Briggs, Jr. 231,264
Plow, M. A. Elliott 231,218
Plow, J. S. Gum 231,308
Plow, L. P. Thompson 231,378
Plow beam, C. P. Buckingham 231,147
Plow point, detachable, M. M. Bowers 231,261
Plow, sulky, H. H. Canaday 231,210
Plow, wheel, J. L. Reuss 231,193
Pocket, safety, M. A. Adler 231,251
Printing machine, P. D. Hedderwick 231,316
Printing press, E. L. Gilman (r) 9,346
Pump, N. J. Tubbs 231,379
Pump, air, H. R. Drake 231,217
Railway switch, G. W. Sherer 231,197
Ratchet drill, W. H. Richards 231,361
Rattan machine, N. H. Richardson 231,361
Reflector, lamp, C. H. Farley 231,159
Refrigerating can, P. S. Smout 231,367
Refrigerator, C. P. Jackson 231,324
Refrigerator and dumb waiter, combined, C. E. Stewart 231,369
Registering machine, W. N. Durant 231,158
Ribbon, wire stiffening, T. Kohn 231,176
Rock drill support and clamp, H. Richmann 231,238
Roofing, metallic, J. M. Hess 231,317
Rotary engine, D. L. Cross 231,281
Safes and vaults, constructing metal, A. J. Klein 231,331
Sash fastener, W. S. Owen 231,352
Saw filing machine, gin, A. F. McAllister 231,340
Saw mill head block, J. P. McKinley 231,341
Saw mill, reciprocating, D. C. Prescott 231,192
Saw mill, reciprocating, W. M. Wilkin 231,249
Scraper, earth, A. R. Byrkett 231,148
Scroll, adjustable, A. Paul 231,188
Sewing machine, A. S. Dinsmore 231,155
Sewing machine power attachment, A. D. Pentz 231,189
Sewing machine shuttle bobbin, C. F. Denison 231,285
Sewing machines, braid guide for straw braid, G. F. Stone 231,370
Shaft bearing, H. L. Moulton 231,342
Shaft coupling for two-wheeled vehicles, W. R. Clark 231,212
Sheet metal pipes, grooving, C. Letterman (r) 9,343
Sheet metal tube joint, G. C. Bowker 231,262
Shoe nail, J. Hyslop, Jr 231,322
Shoe quarters, machine for marking and punching holes in, P. R. Pickering 231,191
Shoe tree, C. Stoddard 231,200
Show box, I. Neuburger 231,346
Shuttle, I. Eaton 231,288
Sifter, flour, G. A. Wells 231,382
Sled, bob, C. E. Cain 231,267
Sole fastenings, machine for driving, O. R. Chaplin 231,149
Sound, device for refracting, reinforcing, and modulating, A. C. Engert 231,292
Spirits, rectifying, C. Kalthoff 231,328
Spooling machine yarn guide, Upton & Partridge 231,380
Spring or bulkhead, artificial, A. A. Crane 231,214
Station indicator, J. L. Ferguson 231,297
Steam and hot air pipes, covering for, H. M. Fitzhugh 231,300
Steam boiler attachment, G. Kratz (r) 9,347
Steam generator, A. P. Holcomb 231,320
Steam generator, sectional, D. Renshaw 231,194
Steam or fluid brake, H. I. Bearup 231,143
Steamer, culinary, A. Burbank 231,266
Still, oil, G. Crane 231,280
Stone grinding and polishing machine, M. Hirschbeck 231,318
Stove, C. A. Hamlin 231,163
Stove, cooking, R. J. & W. A. King 231,174
Stoves, smoke and gas consumer for, C. T. Barnes 231,142
Stump puller, J. B. Sherrill 231,243
Surveying instrument, C. F. Jespersen 231,325
Telegraphic sounder, J. R. Edwards 231,290
Telephone, electric speaking, A. W. Rose 231,239
Telephone support, hand, M. Keich 231,328
Telephone transmitter, G. M. Hopkins 231,236
Tenoning machine, G. O. Hall 230,310
Tobacco curing apparatus, F. Schwarb 231,362
Tobacco nonsting apparatus, W. S. Guy 231,309
Trace carrier, E. Hanrahan 231,314
Truck, plow, W. S. Fleming 231,302
Tubular fabrics, machine for drying, S. A. & A. M. Case 231,269
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Turbine wheel, M. L. Hallenbeck 231,154
Type case, printer's, J. T. Edson 231,289
Vacuum and air brake, J. F. Batchelor 235,258
Valve gear, steam engine, W. Johnson 231,228, 231,229
Valve, safety, N. Curtis 231,214
Vapor burner, P. Hiekisch 231,244
Vehicle wheel, G. W. Kraft, Jr. 231,333
Velocipede, R. Newton 231,347
Ventilating and damper attachment, W. H. Allen 231,139
Watch key, F. B. Kendrick 231,173
Watch plates, etc., machine for stoning, A. H. Cleaves 231,275
Water gauge, Nunns & Clough 231,350
Weather strip, W. H. Cosper 231,151
Wells, electric heater for oil, Dingman & Argue 231,287
Wheelbarrow, C. R. Hight (r) 9,342
Whiffletree hook, J. A. Vare 231,381
Wick tube, flat, J. W. Knubley 231,180
Windwheel, J. Austin 231,255
Window adjusting device, J. Holbrook 231,319
Wood, ornamentation of, F. W. Martin 231,233
Wrench, T. P. Franke 231,303
Yoke ring, neck, M. J. Curtiss 231,154

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