SCIENTIFIC AMERICAN

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IMPROVED PLASTIC BRICKMAKING MACHINE.

The process of brickmaking by the machine we illustrate from *Engineering* is divided into four stages, viz., mixing, pugging, moulding, and pressing. The mixing process is performed in a long trough in which there revolves a shaft fitted with peculiarly shaped knives or stirrers. The clay after it has gone through a preliminary preparation of grinding to reduce it to a powder, or to crush any stones it may contain—this preparation being carried out by a perforated grinding pan or horizontal crushing rollers, whichever machine is most suitable to the clay to be worked—enters the end of the mixer furthest away from the machine. There it is met by a spray of water, if the clay is not damp enough in its natural condition; the rotation of the knives incorporates the clay and water, and a substance of uniform consistence is delivered to the pug mill of the machine.

The pugging and moulding processes follow immediately after the mixing, and these operations are completed by the pug mill; the clay, after it has been kneaded or pugged, is propelled by the action of the pug mill knives into moulds on the rotating table of the machine, which come in succession under the mouth of the pug mill. At this stage we have accurately formed bricks contained in the table moulds; the table rotates to a position directly opposite the powerful press shown in front of the machine, when the bricks are ejected from the moulds by a lever worked in connection with the rotating gear; during the time the moulding table is making another partial rotation, the pair of bricks which have just been lifted out of the moulds are pushed into a cage or receptacle designed to turn them upside down, the object being to reverse the side of the brick on which there has been the greatest pressure on the pug mill, so that both sides of the brick get an equal pressure. The next pair of bricks, entering the turning-over cage, push the pair just turned over into the finishing press, by which the final process of pressing is performed.

By the operations just described we have a brick of a plastic nature, densely moulded, well pressed, and highly finished, and one that contains the minimum amount of water to obtain plasticity, and therefore capable of being placed immediately in the kiln for burning.

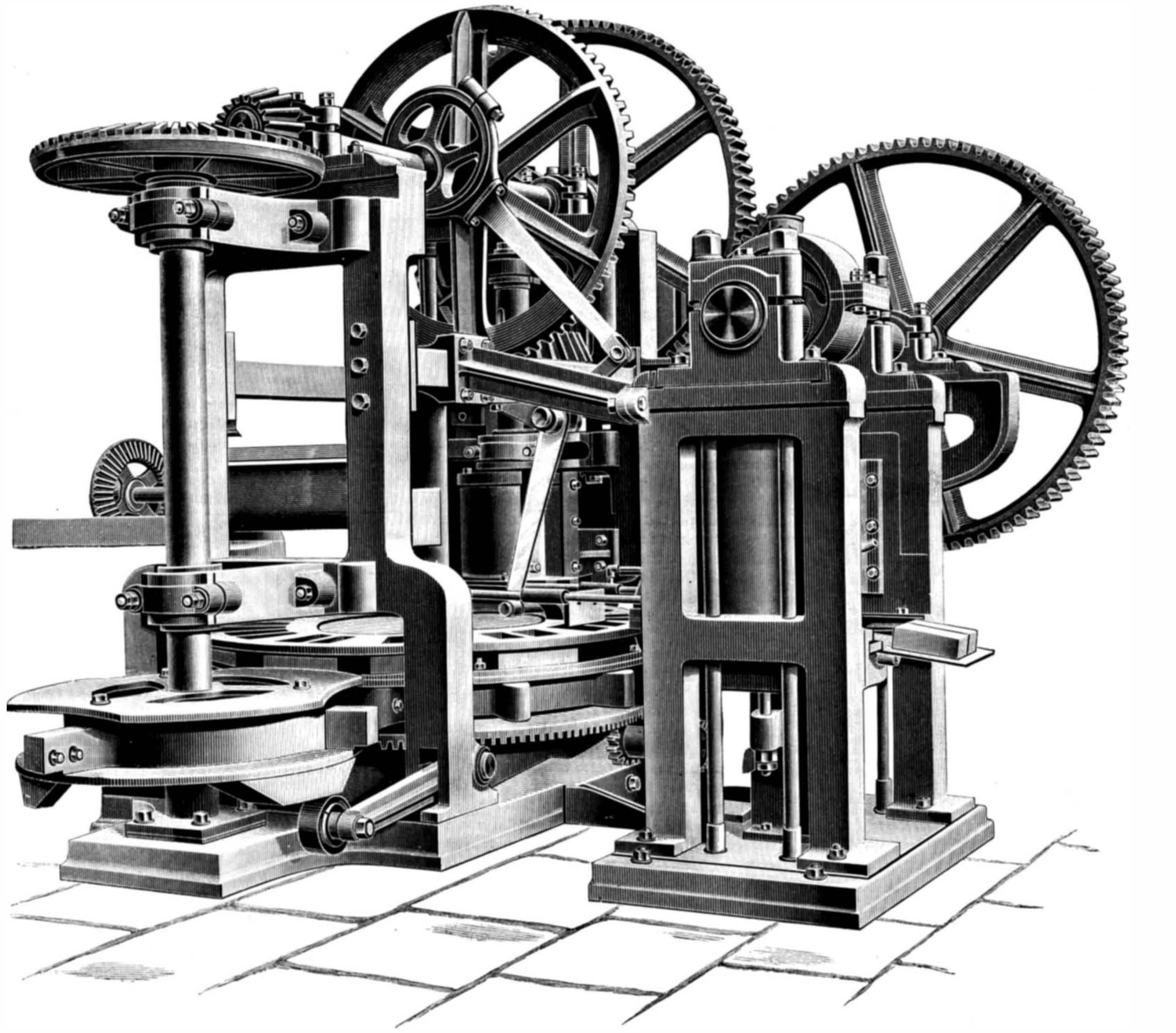
It will be readily conceived by those acquainted with brickmaking that if a brick can be made in the above manner from the crude clay in the space of a few minutes, there is a great saving in labor. It was to this kind of machine that the inventors gave the term "stiff plastic." The makers of this machine, Messrs. Bradley & Craven, of Wakefield, have adhered to this system of brickmaking, which they claim to have originated, for a period of thirty years.

The machine described weighs 21 tons, but it can be taken into pieces of convenient size for shipment. It is capable of producing 18,000 to 20,000 bricks per day, but it is made in a smaller size producing 10,000 to 12,000 per day.

A WRITER in the *Boston Evening Transcript* declares that the plantations made by the Boston and Albany Railway Company around its suburban stations have had a decided influence in improving the horticultural taste of the people living along its lines, and that good plants, like Forsythia fortunei and other hardy shrubs, have been made common and popular in this way. The scheme under which these plantations are made has already been described in these columns. The station grounds are decorated with trees and the best hardy shrubs, preference being usually given to native species, as being more hardy and generally more satisfactory than exotic plants; no bedding or tender plants whatever are used, the effect being obtained from well kept lawns, skillfully arranged shrubberies, in which it has been aimed to secure a succession of flowers, handsome fruit and brilliantly colored autumn leaves.

A Mountain Railway.

The most recently completed high mountain railway in Switzerland is that up the Rothhorn, 7,240 feet high, from the lake and town of Brienz, not far from Interlaken. The road was completed so that a locomotive reached the summit October 31, and will be opened the coming season. The Rothhorn will command a magnificent view of the Jungfrau, and the other mountains south and southeast of Interlaken. The material through which the eleven tunnels of this line were excavated consisted of *debris* which had slipped down the mountain, and which seemed disposed to go on sliding when disturbed. Subterranean springs also made the work difficult, and in places new beds had to be made for mountain streams. The work was done by contract for £70,000.



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NEW YORK, SATURDAY, JUNE 4, 1892.

Contents.

(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 857

For the Week Ending June 4, 1892.

Price 10 cents. For sale by all newsdealers.

SUDDEN RUPTURE OF A 1500 HORSE POWER ENGINE.

On April 30, at 9:58, the shaft of the new 1,500 horse power Corliss engine of the Willimantic Linen Co. Mill No. 4, Willimantic, Conn., broke, causing a complete wreck of the engine and engine house. The engine, when complete, was to be of the triple expansion type, with four cylinders in pairs, one side only being completed when the accident occurred. The part erected consisted of a 30 inch and a 55 inch cylinder arranged tandem on one side, the other side, when completed, to be 26 and 44 inches, 60 inch stroke. The belt fly wheel was 28 feet diameter, 9 feet 2 inches face, bolted together in 12 segments, with 12 arms terminating in a double-flanged hub, occupying a space of about 4 feet on the swelled part of the shaft. Weight of the belt fly wheel complete was 125,000 pounds. The shaft was 21 feet 4 inches in length—15 feet between bearings, which were 28 inches each in length. The swell of the shaft carrying the wheel was 18 inches diameter, 8 feet long, occupying the central portion of the shaft the balance, 6 feet 8 inches from the curved shoulders to each end, was 15 inches in diameter.

When the shaft, crank disks, and hub, weighing 27 tons, were put in place the leveling showed a slight sagging in the center, and when the wheel was completed the sag amounted to 0·135 of an inch. Soon after the engine was started in January last a noise or slight squeaking was heard at the hub of the fly wheel, which, upon examination, was found to arise from the hub working upon the shaft, caused by the spring of the shaft. This had slightly bell-mouthed the outer ends of the hub, so that a thin piece of steel could be inserted between the shaft and hub on the under side, while on top there was contact between the hub and shaft.

To remedy this the engine was stopped and a pair of supplementary or re-enforcing hubs were made and applied on each side of the main hub. Each re-enforcement was made in three sections and bolted together so as to tightly hug the shaft and hub as if one piece. Six 2½ inch bolts were put through from side to side, passing through one of the bolt holes in six of the arms, the original bolts being removed and the holes bored larger, the hub having been turned off and faced to exactly fit the recess in the re-enforcing pieces. When the whole was screwed together it made the hub apparently a solid one, 8 feet in length, and covering the entire length of the 18 inch swell in the shaft. This tended to relieve the spring in the central portion of the shaft.

By this arrangement nine tons was added to the weight of the fly wheel, making the total weight upon the central portion of the shaft 143,000 pounds, or over 70 tons.

The engine was again started early in April with two 24 inch belts making a temporary connection with the mill shafting, and furnishing about 400 horse power, or about one-third of the power required by the mill, the balance being made from the three old duplex high speed engines within the mill. For two or three weeks the engine was apparently running well, when a slight creaking noise was heard coming from the vicinity of the hub.

Upon examination no visible signs of disturbance could be found; but, suspecting that a slight movement of the arms in the hub sockets might be the cause, melted sulphur was poured into the hub around the arms. On trial, this gave no indication of the cause of the noise, and it was decided to shut down at noon on Saturday, April 30, and make a thorough examination, but the engine could not wait, for at 9:58 on that morning the impending crash came.

The speed being 65 revolutions per minute, the rim of the fly wheel was running at over a mile per minute. The shaft parted at the junction of the curve with the straight part on the driving crank end. The immense momentum of the ponderous rim, which alone weighed 42 tons, acting like a gyroscope, seemed to prolong the canting fall of the wheel, as related by Mr. T. R. Schenck, for a second, when the roar of the crash made him seek safety by a dash through a window. He was standing in the corner of the engine room at the rear of the cylinders.

Dwight E. Potter, superintendent of the company, was in the corner near the fly wheel, and, comprehending the urgency of the case, dove through a glass door into the main body of the mill, only to see the wall of the mill and pieces of the wheel flying past him. The third person in the engine room, Andrew Darcey, was at the moment in the wheel pit, and only sheltered by the condenser and air pump, had a most miraculous escape, being covered with the falling debris. He crawled from under with only a few bruises.

A close examination of the broken shaft reveals the probable cause of the creaking noise during the last few days that the engine was running. A zone of laminated surface extended around the outer edge of the broken surface, showing by its smoothness evidence of the progressive extension of the crack during a number of days until it had reached a depth of about 1½ inches, leaving about twelve inches of the diameter of the shaft to support the load, when by the great weight the final break occurred. The surface within the laminated zone showed a nearly uniform crystalline grain usual with iron of large size suddenly broken.

PRESERVATION OF FLOWERS IN THEIR NATURAL FORM AND COLOR.

A "Constant Reader" asks how flowers can be preserved in their natural form and color. The following are some of the processes that have been recommended:

1. Take a wooden box of any convenient length and width, but at least five inches in height, and provide it with a sliding bottom. About a quarter of an inch above the latter fasten to the interior sides of the box a piece of wire gauze having wide meshes.

Now procure some fine white sand, pass it through a hair sieve and wash it thoroughly in water, in order to remove every particle of foreign matter. Place the washed sand in an iron pot and raise it to a temperature of about 200° in a stove or oven. Add to the sand, while hot, a melted mixture of stearic acid and spermaceti in the proportions of six grains of each to one pound of sand. Stir thoroughly, and when the sand is cool enough rub it between the hands, in order that every grain may be coated with the fatty matter.

Place a layer of the prepared sand in the bottom of the box and carefully arrange thereon the plant to be dried. Then, with great care, cover the plant with a thin layer of sand, and, having placed a sheet of paper on the top of the box, place the latter in a stove or oven heated to a temperature of about 120°. The desiccation takes place very rapidly. When it is supposed that it is finished, remove the bottom of the box, when the sand will pass through the wire gauze, and the plant will remain upon the latter. Brush the plant with a badger and preserve it as will be directed below. The prepared sand adheres but slightly to the plants and is always easily removed. It suffices in most cases to give the stem a few fillips to get rid of all of the sand, provided the plants have not been moist.

It must be added that sand, prepared or otherwise, cannot be used for preserving plants that have a clammy or viscous coating. In this case, it is absolutely necessary to use grains of millet or rice.

As the dried plant, when left in contact with the air, absorbs a little moisture, and fades, it must be arranged in a jar or wide-mouthed bottle on the bottom of which has been placed a piece of quicklime wrapped in tissue paper and covered with moss. The jar must be sealed hermetically with a cement of gum lac or rubber.

2. Mr. James L. English's method consists in embedding the plants in a mixture of equal quantities of plaster of Paris and lime, and gradually heating them up to a temperature of 100°.

On removing a flower from the absorbent it presents a very dusty appearance, and is also somewhat brittle if it has been left in the plaster too long. It is best to lay the plant aside for an hour, during which time it will absorb sufficient moisture to prevent it from breaking when subjected to the necessary dusting to rid it of the superfluous plaster. After being dusted, the plants still have somewhat of a hoary appearance, and, for this reason, they should be coated with a varnish made as follows:

Powdered gum dammar	5 oz.
Turpentine	16 "

Dissolve the gum in the turpentine and add 16 ounces of benzoline. Strain through fine muslin.

The plants may receive a second coat of varnish, if need be.

3. The *Revue de Chimie Industrielle* recommends the following varnish for the preservation of flowers:

Ether	500 parts.
Transparent copal	20 "
Sand	20 "

The flowers are to be immersed in this varnish for a couple of minutes, then allowed to dry for ten minutes, and be submitted to this treatment five or six times.

4. Mr. Jules Poissan, of the Paris Museum of Natural History, recommends a solution of 30 grains of salicylic acid in one quart of water for the preservation of plants in their natural form and color.

Dried Bananas.

According to a report made by Vice-Consul Robinson, of Colon, on the Isthmus of Panama, the business of preparing banana meal for the New York market will soon be carried on in that region. He states that a company has been organized with a capital of $75,000, under the name of the Banana Food Company, for the purpose of drying and otherwise preparing bananas and plantains for food. He says it has been ascertained that while apples yield only 12 per cent. bananas with the skins removed yield 25 per cent of thoroughly desiccated fruit. The supply of bananas is practically unlimited. The fruit grows to maturity all the year round, and may be obtained every day throughout the year, so that the manufacture of the new food can be made continuous.

POSITION OF THE PLANETS IN JUNE.

VENUS

is evening star and is the central object around whom the planetary interest of the fair month of June clusters. It is her last appearance as evening star, and many a month (her whole synodic period of 584 days) will pass before she comes round to a similar position with regard to the sun and the earth. Observers should therefore improve the opportunity to watch her departing steps as she hastens to make her exit from the evening sky so long adorned by her gracious presence. Venus reaches her greatest brilliancy on the 2d at noonday, being then 39° east of the sun and having one-fourth of her illuminated disk turned to the earth. After her superior conjunction until this era in her course, although less of her illuminated surface is turned to the earth, her approach toward us more than counterbalances the lessening light, and her luster increases. After this era, the lessening light more than counterbalances the nearer approach, and the luster decreases. The light number, or the brilliancy of her disk, on the 2d is 183.7 the highest point. It is 44.6 on the 30th. Venus is on the meridian at 2 h. 48 m. P. M. on the 1st, and at 0 h. 57 m. P. M. on the 30th.

Figures are unnecessary to convince observers of the quickly-coming changes in the aspect of this bright planet. She will be seen to set earlier every night, seemingly to approach the sun and lose a portion of her light, and when the month closes will be so near the sun that it will take bright eyes to find her.

The one-day-old moon is in conjunction with Venus on the 25th at 8 h. 5 m. P. M., being 6° 16′ north, but crescent and planet are near the sun, and are above the horizon together scarcely an hour after the sun has set.

The right ascension of Venus on the 1st is 7 h. 35 m., her declination is 24° 14′ north, her diameter is 37″.2, and she is in the constellation Gemini throughout the month.

Venus sets on the 1st at 10 h. 19 m. P. M. On the 30th she sets at 8 h. 5 m. P. M.

MARS

is morning star. We place him second on the June annals, not for his present but for his coming importance. He is within two months of his opposition, when he will attract more attention and be more carefully observed than the rest of the heavenly bodies put together. Astronomers and amateurs will vie with each other in seeking to find out something new on his surface, when, about August 4, he makes his neighborly call, approaching the earth's domain 13,000,000 miles nearer than he does when his opposition takes place near his aphelion. He is now a somewhat insignificant red star of about one-third his future brightness, rising about half past 11 o'clock in the early part of the month, and reaching the meridian about 4 o'clock. Observers will find him at 2 o'clock about half way between the horizon and the zenith. These are the conditions for the first part of the month. Later, he will rise earlier, perceptibly increase in size and ruddy light as the month draws to a close, and give unmistakable signs of the grandeur and majestic mien to which early astronomers paid tribute when they named him for the god of war.

The moon four days after the full is in conjunction with Mars on the 14th, at 1 h. 15 m. P. M., being 1° 25′ south.

The right ascension of Mars on the 1st is 20 h. 57 m., his declination is 20° 23′ south, his diameter is 15″.8, and he is in the constellation Capricornus.

Mars rises on the 1st at 11 h. 26 m. P. M. On the 30th he rises at 10 h. 0 m. P. M.

JUPITER

is morning star. There is a law of compensation in matters celestial as well as terrestrial. When Venus falls from her high estate in the evening sky, Jupiter asserts his right to reign in the morning sky. He is now a superb object in the early morning of the month of June, rising on the 1st of the month two hours before the sun, and on the last of the month four hours before the sun. A glance at the morning sky will reveal his presence in the east, for this princely planet is always bright when visible. He must be looked for a few degrees north of the eastern point of the heavens, and his benignant presence in the dawn is worth getting up to see. Northern observers have two things to be thankful for, that Jupiter is moving northward, and approaching perihelion, two events that will make him the grandest object in the heavens when the month of October is ushered in.

The moon, two days after her last quarter, is in conjunction with Jupiter on the 19th, at 6 h. 40 m. A. M., being 1° 9′ south.

The right ascension of Jupiter on the 1st is 1 h. 5 m., his declination is 5° 41′ north, his polar diameter is 34″.4, and he is in the constellation Pisces. Jupiter rises on the 1st at 2 h. 1 m. A. M. On the 30th he rises at 0 h. 17 m. A. M.

SATURN

is evening star. One event enlivens his course. He is in quadrature on the 14th at 3 h. A. M., being 90° east of the sun. This brings Saturn near the meridian at sunset, and during the rest of the month he will be visible only in the west, setting at the close of the month four hours after the sun and three hours later than Venus.

The moon is in conjunction with Saturn, when eight days old, on the 3d at 1 h. 15 m. A. M., being 2° 5′ north.

The right ascension of Saturn on the 1st is 11 h. 39 m., his declination is 4° 48′ north, his polar diameter is 17″.0, and he is in the constellation Virgo. Saturn sets on the 1st at 1 h. 12 m. A. M. On the 30th he sets at 11 h. 16 m. P. M.

MERCURY

is morning star until the 20th, and then evening star. He is in superior conjunction with the sun on the 20th at 11 h. 44 m. A. M., when he appears on the sun's eastern side, as evening star, and makes a rapid approach to Venus, whom he almost overtakes when the month closes. He is in conjunction with Neptune on the 10th at 11 h. 50 m. P. M., being 1° 2′ north, neither of the actors in the scene being visible.

The right ascension of Mercury on the 1st is 3 h. 26 m., his declination is 16° 42′ north, his diameter is 6″.0, and he passes during the month through the constellation Taurus and nearly through Gemini.

Mercury rises on the 1st at 3 h. 35 m. A. M. On the 30th he sets at 8 h. 20 m. P. M.

URANUS

is evening star. The moon, four days after her first quarter, is in conjunction with Uranus on the 6th, at 9 h. 22 m. A. M., being 0° 53′ north. The resulting occultation is visible in China, but not in America. It is worthy of note that the moon's present path lies so near to where Uranus is now that the moon has occulted Uranus (when the June occultation has passed) in every month of the present year, one occultation only being visible here.

The right ascension of Uranus on the 1st is 14 h. 2 m., his declination is 11° 54′ south, his diameter is 3″.8, and he is in the constellation Virgo.

Uranus sets on the 1st at 2 h. 37 m. A. M. On the 30th he sets at 0 h. 41 m. A. M.

NEPTUNE

is morning star, a role he assumed on the 29th of May. He is, therefore, at the beginning of June, too close to the sun to be seen.

The right ascension of Neptune on the 1st is 4 h. 30 m., his declination is 20° 18′ north, his diameter is 2″.5, and he is in the constellation Taurus.

Neptune rises on the 1st at 4 h. 29 m. A. M. On the 30th he rises at 2 h. 39 m. A. M.

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

The Egg of Columbus.

BY DR. P. H. VANDER WEYDE.

When we carefully, with an unprejudiced mind, examine the traditional anecdote of the egg of Columbus, we are driven to the conclusion that there is even less truth in it than there is in that other traditional story that Newton discovered the theory of gravitation by accidentally seeing an apple fall from a tree. Gravitation was not discovered, neither must we ever speak of the "theory of gravitation," because gravitation is not a theory but a stubborn fact, which everybody understands by experience. Surely the apple was not the first thing which Newton ever observed to fall down. He discovered nothing new, but what he did was that, by his inventive genius, aided by his mathematical knowledge, he detected the link of connection between the amount of centrifugal force generated by the motion of the moon in its elliptical orbit around the earth with the amount of velocity which it would obtain by the earth's attraction when it were left to itself without revolving, and he found that these two forces balanced each other, so that the velocity of falling to the earth and the velocity of flying off from the earth generated by the centrifugal force were alike, and kept the moon at the same average distance.

The result of Newton's labors were as much invention as discovery. He first invented a mathematical theory, and when applying it to the motion of the moon he found it to be verified by the facts, and this was a discovery.

This leads me to call attention to the difference of the meaning of these two words, which are frequently confounded, as well in England as in our country. So I find, for instance, the London *Illustrated News* mentioning "the discovery of the sewing machine in America," as if the sewing machine had been lying loose in our Western States and had been discovered, like we discover coal mines or like De Soto discovered the Mississippi River.

The above reasoning will make it clear that an invention is to create a thought, theory or material object which was not known or did not exist before, while a discovery is to unveil to the world something which existed, but was unknown to mankind.

Applying these truths to what Columbus did, we find that he *discovered* a new world, and, considering the results, he did, in fact, more than was done by any man who ever lived. Comparing this with the stupid anecdote of the egg, it is clear that this had nothing to do with his grand discovery, as it was no discovery at all. It was a mere trifling invention, in fact a trick; and it is surprising that intelligent men have for so many years thoughtlessly been believing and repeating such nonsense. For my part, I cannot believe that Columbus did ever lower himself so far as to compare his grand discovery to a trick. Surely it was no trick by which he discovered a new world, but it was the result of his earnest philosophical convictions that our earth is a globe floating in space, and it could be circumnavigated by sailing westward, which most likely would lead to the discovery of new lands in the (before him) utterly unknown hemisphere beyond the western expanse of the great and boisterous Atlantic Ocean; while thus far no navigator ever had the courage to sail toward its then utterly unknown, apparently limitless, western expanse.

Columbus is the most illustrious example which the world ever saw of faith in his own philosophical deductions, and of perseverance in his attempts to verify that which he had faith in, and all mankind must glory in his triumph, in the same sense as that which our illustrious poet Whittier describes in his poem entitled "My Triumph."

But suppose that the most undeniable evidence were forthcoming that it really happened that Columbus illustrated his method of the discovery of a new world by the smashing of the point of a hard-boiled egg, I will say that his comparison was a most unfortunate one, considering the obstacles in the way of his grand discovery, obstacles which his perseverance did overcome, such as hardships by stress of weather, privations, and even mutiny of the crew on board of his ship—all these and many more he had to vanquish; and when we compare the ultimate results of his discovery with that of crushing the shell of a hard-boiled egg, the only reasonable explanation I can find is that Columbus was an old sailor, and cracked the egg shell after a dinner party.

Shade Plants.

In addressing the Association of American Cemetery Superintendents at Chicago last autumn, Mr. Eurich, of Toledo, Ohio, said, with regard to plants that can be used to cover the ground beneath trees where grass will not grow, that he had experimented successfully with two "sod-forming" plants, Herniaria glabra and Veronica repens. The first named, he explained, "is a moss-like, creeping plant which covers the ground in a very short time, and surpasses a grass sward in beauty. A strip of ground was planted in April with one hundred such plants set apart, and in less than two months the entire surface was covered closely. The plants were thinned out, so that we obtained more than twice the original number, and an adjoining new piece was planted with the same result. This procedure was repeated in August, and before winter set in we had a beautiful greensward of Herniaria growing. A very cold winter followed, and the plants were tinged slightly brown, but by April were again charmingly green. H. glabra will thrive in any soil in the open sun or in the shade." Veronica repens, the speaker, said, "has somewhat larger leaves of shining green and generally the same characteristics as Herniaria glabra. A grave mound planted with it in August was completely covered by fall, and with a slight protection during the winter was brighter and fresher than the mounds covered with myrtle (Vinca) and ivy. The special feature of this plant is that in May it is completely covered with very light blue flowers as low as the plant itself."

Satisfactory Test of New Armor Plates.

A satisfactory test of 14 inch nickel-steel armor was held at the Indian Head proving ground on the 21st ult. This is the thickest armor plate yet tested by the Naval Ordnance Bureau.

The plate came from the Bethlehem Works, in Pennsylvania, where the armor for the battle ships is being manufactured under contract. The present plate was the first, the test plate, of the 800 tons of 14 inch diagonal armor intended for the Massachusetts, Indiana, and Oregon. The usual severe conditions which surround the acceptance tests of armor obtained at the trial, and, after the firing, an order was sent to Bethlehem by Commodore Folger, the Chief of Ordnance, to complete the order and deliver the material.

Three shots were fired at the plate. There was not a crack anywhere visible after the shots, nor a perforation. It is said this is the best showing made by any armor in any recorded test.

Aluminum in the Galvanizing Process.

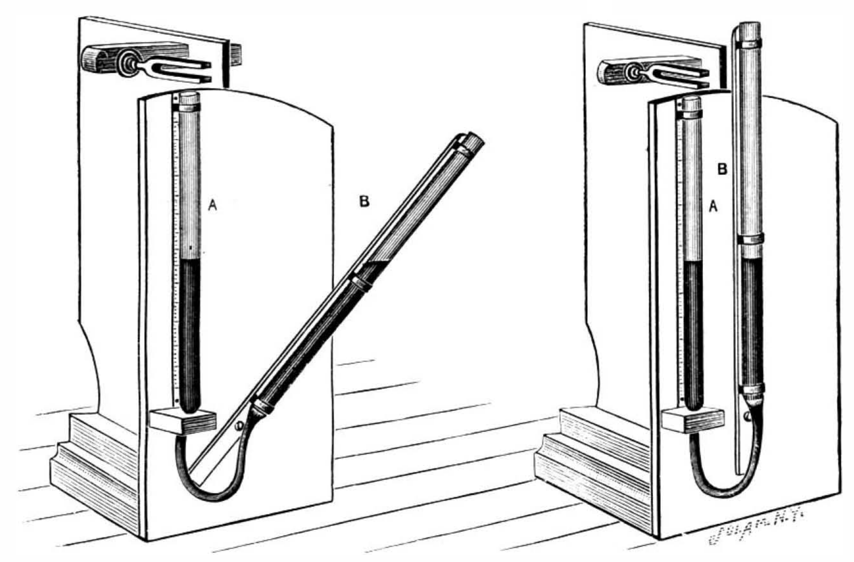
According to Mr. J. W. Richards, the addition of a mere trace (0·08 oz.) of aluminum to a ton of zinc makes a galvanizing base which insures a highly crystalline and permanently brilliant and adhesive coating.

A CONVENIENT FORM OF RESONANCE TUBE FOR DETERMINING THE VELOCITY OF SOUND.

One of the essentials for securing fullness of tone in a musical instrument is that there should be as large a volume of air put in vibration by the sounding body as is possible. The difference between putting a small amount of air into vibration and a large amount may be readily shown by playing a common toy musical box, first when holding it in the hand, and again when resting it upon a suitable box.

In the first instance the result is a delicate tinkling produced by the vibration of the steel comb alone, while in the second this tone is enriched and rounded out by the vibrations of the air in the supporting box.

In studying this subject by the use of a tuning fork



A CONVENIENT FORM OF RESONANCE TUBE FOR DETERMINING THE VELOCITY OF SOUND.

for the vibrating body and a glass or pasteboard tube for the resonator, it is found that the column of air in a tube of a fixed length will be put into vibration by a fork of a certain pitch, and, also, that the higher the pitch of the fork—and consequently the greater the rapidity of its vibration—the shorter must be the tube to produce resonance.

This fact being established, the possibility of using the tuning fork and its resonance tube to determine the velocity of sound in air at once suggests itself.

The air space around any sounding body is thrown into alternate condensations and rarefactions, the condensations being separated by the length of the sound wave produced by the sounding body. Then if N represents the number of vibrations made by a tuning fork, L the wave length, and V the velocity of sound in air, the velocity will be given by the formula $V = N L$.

Now, in order that a tube may be a resonator for a certain fork, it must be of such a length that the pulse of the sound wave, which is put in motion when the fork starts on its path toward the tube, shall pass to the closed end of the tube, be reflected, and reach the fork just as it is beginning its movement in the opposite direction. In order to do this, the pulse of air must pass through twice the length of the tube while the fork is making half of a complete vibration, and hence must pass through four times the length of the tube for each vibration of the fork.

From this, if l represents the length of the tube, the velocity will be given by the formula $V = 4 N l$.

It is found, however, by experimenting with tubes of different diameters, that a connection must be made for the open end of the tube; in other words, that to obtain a correct result, a certain fractional part of the diameter must be added to the value of l.

Lord Rayleigh gives this value as one-half, so that the formula will now read :

$V = 4 N (l + r)$, in which r is the radius of the tube.

It is better to use the formula $V = 4 N (l + k d)$, in which k is the constant required, and then determine its value at 0° experimentally. In one tube used this value was 0·56.

A form of tube by which this method of measurement can not only be readily demonstrated for class use, but the value of V accurately determined, is shown in the accompanying figures.

In Fig. 1, A is the resonance tube of 11 mm. internal diameter. This is drawn out at the lower end and connected by flexible rubber tubing to a similar glass tube which is fastened to a wooden arm, B. This arm is movable about a point at the lower end, the pivot being formed of a bolt passing through the vertical support.

Back of the tube, A, is a paper scale graduated in mm. with the scale division numbered from the position of the fork.

At a right angle to the main vertical support is another, which is so arranged that forks of different lengths may be held in position.

By filling the tubes with water to a convenient height, the length of the air column can be varied by moving the arm, B, from its vertical position as in Fig. 2, and, on putting the fork in vibration, a position can readily be found in which the resonance is a maximum.

Knowing, then, the vibration frequency of the fork, finding the value of d by measurement and the value of l by the experiment, a substitution in the above formula for V will, on reduction, give the velocity of sound in air at the temperature of the room in which the experiment was made. GEO. A. HOADLEY.

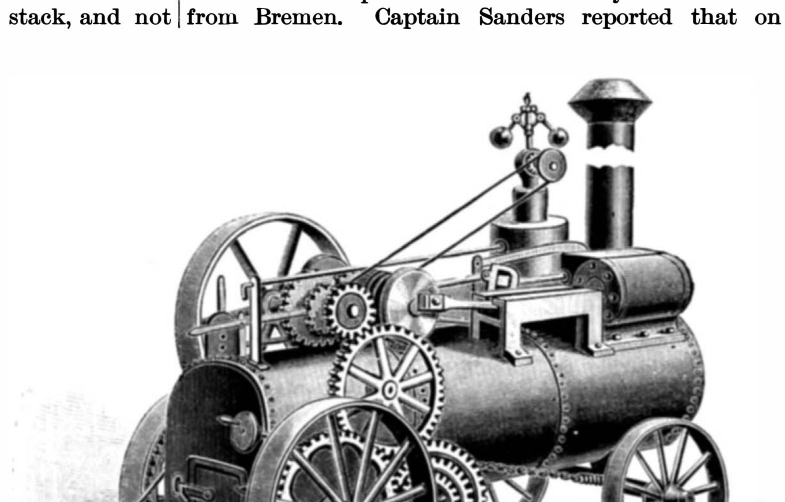
Physical Laboratory of Swarthmore College.

Photographs in Colors.

The method adopted by Mr. Ives for photographing in colors is, says the *British Architect*, another instance of American ingenuity. Acting on Helmholtz's theory that the nerves of the eye respond to wave vibrations corresponding to light of red, green, and bluish violet, and that all tints are made up of combinations of these light waves, he takes three photographs of a scene or object, screening off from the first sensitized plate all but the red rays, from the second all but the green rays, and from the third all but the blue-violet rays. Then he places the photographs on celluloid obtained from these negatives in a three-lens lantern, and projects these so that they coincide in one picture, screening his lenses with glass of red, green, and blue-violet color. The result is a large photograph in all the actual colors of nature, both landscapes, photographs of pictures or of flowers. A still more striking effect is produced by placing the treble-celluloid positives in a kind of stereoscope lantern with prisms, when the photograph of a geranium or other flower stands out with the vivid colors of nature. Of course Mr. Ives' results are very different from the colored photographs often put forward as examples of actinic power, but in which all colors but one are produced mechanically. It is remarkable that M. Lippmann, one of the professors at the Sorbonne, has also succeeded in photographing colors. At the last meeting of the French Academie des Sciences he exhibited several examples of plates from colored objects, one being taken from the national flag.

AN IMPROVED TRACTION ENGINE.

The engine shown in the illustration, while being a compact and efficient machine, is designed to travel without difficulty over uneven roads, to be run with a relatively small amount of fuel and carry a heavy load, and is also provided with means for changing its speed without changing the stroke of the engine. It has been patented by Mr. John R. Hatch, of Sugar Lake, Mo. The cylinders, supported on a suitable framework, are arranged at slightly different angles, so that there will be no dead center, and receive direct steam by a pipe leading through the smoke stack, and not exposed to the air. The valves, of the common slide valve form, are operated through a link pivoted at its ends to connecting rods extending rearward and terminating in eccentrics on a countershaft over the boiler. The link is also centrally pivoted to a rod pivoted to an elbow lever on a shaft in front of the dome, the two links being similarly connected to a lever on each end of the shaft, the shaft being also connected by a rearwardly extending rod with a lever in convenient reach of the operator, for changing or reversing the stroke in the ordinary way. The upper end of the main supply pipe in the dome has a common throttle valve, a rod from which terminates in a handle within convenient reach. On the countershaft over the boiler are disks which have a crank connection with pitman rods pivoted to the crossheads, and near the center of this shaft are different sized gear wheels meshing with similar gear wheels on a parallel shaft just to the rear, in hangers on the top of the boiler, the latter gear wheels being keyed to the shaft but adapted to slide thereon, so that, by means of a lever, the different sized wheels of the two shafts may be brought into mesh with each other to change the speed of the machine, causing it to run slowly, with increased power, as may be desired, in going up a hill, or with greater speed when the pull is less. On the rear shaft is the usual fly wheel, from which power may be taken by a belt in the ordinary way, the shaft being likewise connected with the governor, and on one end is a gear wheel meshing with a lower pivoted gear wheel at the side of the boiler, the latter wheel meshing with a compound gear wheel on a shaft below the boiler. This shaft has at each end a gear connection with the rear wheels of the machine, the axle resting in socketed heads in which are spiral springs to prevent jar, and beneath the center of the boiler in front is a depending socketed head, in which is a strong spring, and through which a king bolt extends, passing through the front axle. Each end of this axle is connected by a chain in which is a spring with a steering shaft in front of the firebox, the shaft having on one end a worm wheel meshing with a worm on a shaft extending diagonally upward and carrying a crank disk, by revolving which the front axle is turned as desired to steer the machine.



HATCH'S TRACTION ENGINE.

Electroplating with Silver Alloys.

The alloy now deposited is one of cadmium and silver, or of zinc, cadmium and silver. The percentage of cadmium used is from 25 to 35 per cent, although for common work a much larger proportion of the cheaper metal may be employed. The bath is made by dissolving cadmium cyanide in a solution of potassium cyanide, and adding a small quantity of the double cyanide of potassium and silver. The anode consists of an alloy of cadmium and silver of about the same composition as the deposit required. The bath is worked cold, and the electrodes are kept in motion, in order to prevent the formation of layers in solution of different densities. For this purpose the plates are carried on a frame, to which motion is communicated from a shaft running parallel to the end of the bath, by means of a rod and eccentric, and at the same time a vertical movement is obtained by causing the frame to ride up short inclined planes placed at the side of the bath. The alloy can be deposited on such metals as form a suitable substratum for silver plating, either direct upon white metal alloys, or on a previously coppered surface in the case of iron. A weight of an ounce to a square foot gives a good coating, and, like the original alloy, there is said to be less tendency to tarnish than when silver alone is used. Greater current density can also be adopted, so that a given tank will turn out about twice as much work as when silver plating is being done. A curious phenomenon has been noticed in rolling the metal for anodes. When the proportion for cadmium slightly exceeds 35 per cent, the plate shows a tendency to split longitudinally into strips of triangular section, the bases and apices of which alternate on each side of the plate. No explanation, as far as we know, has been advanced to account for this effect, which certainly merits investigation. The process as a whole is chiefly interesting from the fact that it adds another to the scanty list of those in which an alloy is successfully deposited. It may be that in time alloys will hold as useful a position in commercial electrolysis as they already do in other industrial arts.

Iceberg Bears.

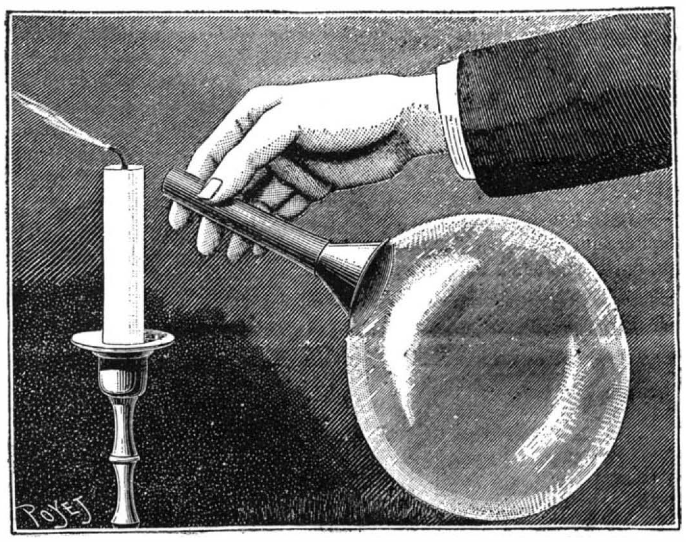
The steamship Ems arrived recently at New York from Bremen. Captain Sanders reported that on May 21, just to leeward, a large iceberg was sighted about sunset. Such a sight is not often witnessed by passengers, and every one crowded to the bulwarks.

After watching some minutes, all agreed they saw human beings on the ice, and the steamer's course was changed so as to bear closer on. It was then discovered that two large polar bears were pilots of the iceberg, which was traveling to warmer seas. No attempt was made to rescue the adventurous voyagers.

EXPERIMENTS WITH SOAP BUBBLES.

The air confined in a soap bubble is often submitted to pressure which, let us say in passing, is proportional to the bubble's curve, that is to say, inversely proportional to its radius, when it is spherical. Such pressure has been frequently measured, but its exact determination requires apparatus and a certain amount of skill. In return, it is very easy to demonstrate its existence and render it visible to an assemblage. To this effect, it suffices to blow a bubble upon a small funnel having a wide neck, like the mouthpiece of a cornet-a-piston, and then to direct the current of air issuing from the orifice against the flame of a candle. The flame will then take a horizontal position and may even be extinguished at the moment at which the bubble, before entering wholly into the funnel, exerts its maximum pressure. The annexed figure, reproduced from a photograph kindly sent us by Mr. C. V. Boys, member of the Royal Society of London, shows the arrangement of the experiment.

We shall describe another, which also is due to Mr. Boys. The phenomena of the diffusion of gases through membranes are rarely demonstrated in elementary lecture courses, although it can be done very simply. Pour into a bell glass, whose mouth is directed upward, a few drops of ether. These will volatilize and fill the bell with a heavy vapor. We can, in the first place, render the existence of this vapor evident by allowing a soap bubble to descend into the bell glass. The bubble will stop and float at a certain level. Then, after having bursted the bubble, let another be blown and plunged into the vapor. On taking this out after about half a minute, it will be remarked that it has lost its graceful form and hangs placidly beneath the funnel. If, now, a candle be placed near the latter's neck, a flame several centimeters in length will be observed to burst forth and burn as long as it is fed by the mixture of air and ether contained in the bubble. In preparing for this experiment, the bottle of ether must be immediately recorked, and only the quantity of liquid necessary to produce the effect required should be poured out. The candle should be at a level higher than that of the rim of the beli glass. Were these precautions neglected, there might an explosion occur that would offer a certain amount of danger.—*La Nature.*



EXPERIMENT ON THE INTERNAL PRESSURE OF SOAP BUBBLES.

A SIXTY HORSE POWER GAS ENGINE.

We give an illustration of a 60 horse power nominal Otto gas engine designed and made by Messrs. Crossley Brothers, Limited, Manchester. This, says *Engineering*, is one of the largest gas engines yet constructed. Even when the success of the Otto gas engine of sizes up to 20 indicated horse power had been insured a few years ago, the makers themselves would scarcely have ventured to predict that in the short time that has since elapsed engines indicating 85 horse power with a single cylinder would be commercially successful, and supplanting fairly good steam engines, even when using ordinary gas. The engine illustrated is what the makers call a "twin 30 horse power" or 60 horse power nominal, and indicates 170 horse power with ordinary town's gas and 160 horse power with Dowson gas. The consumption with ordinary coal gas is, we are informed, as low as 16 cubic feet per indicated horse power per hour, and with Dowson gas the consumption of fuel is only 1 pound of anthracite per indicated horse power per hour. These engines are substantially built, with ample strength and large bearing surfaces, and are the result of over twenty years' experience by the makers in gas engine construction. The general design is very compact and simple, and the engine occupies a very small space when compared with that required for a steam engine of equal power, with its boilers, flues, and chimney shaft.

The ignition of the gaseous mixture inside the cylinder is effected by a glowing tube, the tube being made of a metal which can be depended upon to last over twelve months. A timing valve is used to insure the igniting of the mixture exactly at the right moment, and at the same time to avoid the risk of the engine reversing and turning the wrong way in starting. These large "twin" engines are started in a very simple manner, by a small auxiliary gas engine placed alongside.

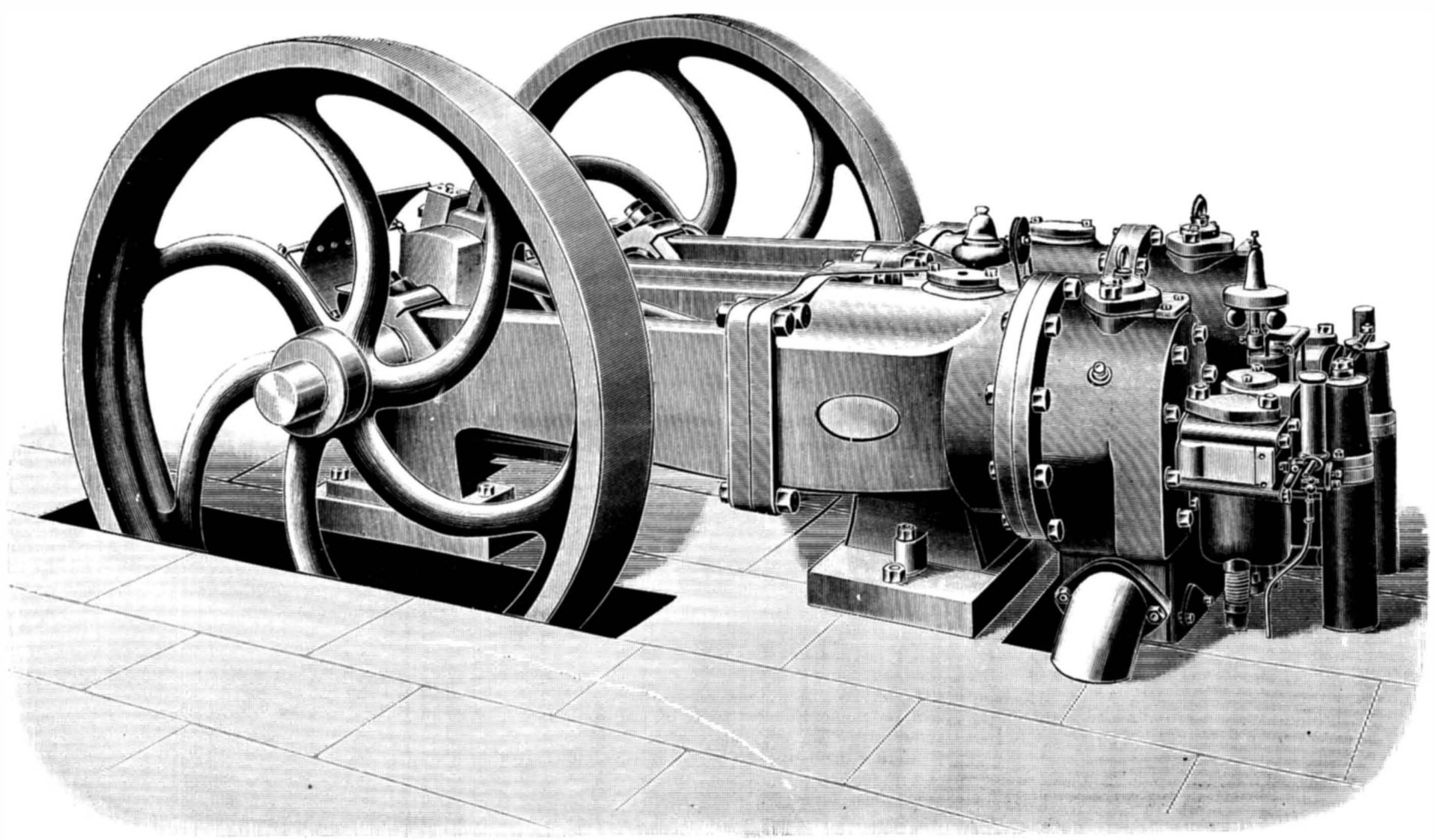
Color in Plant Life.

Those familiar with the growth of flowers know how essential light is to the creation of color. The most gaudy blooms and the most brilliant foliage if kept in the dark or overshaded will become pale and almost white. This fact (according to the *Horticultural Times*) shows the presence in the plant of some chemical agent which is acted upon by the actinic rays. To some extent this chemistry of nature is understood by florists, who, by the use of chemical manures and other means, strive to take the greatest advantage of it. For instance, it is a common practice to mix alum and iron filings with the soil in which certain plants are grown in order to bring out special colors. The bluish-tinted hydrangea is the result of such treatment. Salts of iron, or sodium phosphate, added to the soil turns the crimson of the peony to violet and produces blue hortensias. According to Dr. Hansen, who has studied the subject very closely for many years, there are only three distinct pigments to be found in flowers—setting aside the chlorophyl, which forms the green coloring matter in all plants. These colors are yellows, reds, and blues. The yellows are mostly in combination with the plasmic sap, while the others exist chiefly in solution in the cell sap. The yellow pigment forms an insoluble compound with fatty matters, and is termed lipochrome. Orange is formed by a denser deposit of the yellow, and the color in the rind of an orange is identical with that found in many flowers. The red in flowers is a single pigment soluble in water, and decolorized by alcohol, but capable of being restored by the addition of acids. Lipochrome combined with this red pigment produces the scarlets and reds of poppies and of the hips of hawthorns, but the varying intensity of reds in roses, carnations, peonies and other flowers depends on the presence of a greater or lesser quantity of acids. The blue and violet colors are also decolorized by alcohol, but reddened by acids. Florists have already succeeded in producing a very large scale of unusual colors in flowers, and there seems to be very good grounds for believing that it is possible so to manipulate nature that she will produce blossoms of every conceivable tint and hue.

A Complicated Instrument.

The beak of the mosquito is simply a tool box, wherein the mosquito keeps six miniature surgical instruments in perfect working order. Two of these instruments are exact counterparts of the surgeon's lance, one is a spear with a double-barbed head, the fourth is a needle of exquisite fineness, a saw and a pump going to make up the complement. The spear is the largest of the six tools, and is used for making the initial puncture; next the lances or knives are brought into play to cause the blood to flow more freely. In case this last operation fails of having the desired effect, the saw and the needle are carefully and feelingly inserted in a lateral direction in the victim's flesh. The pump, the most delicate of all six of the instruments, is used in transferring the blood to the insect's "stomach."—*Discovery.*

A RECENT census bulletin states that the national debt of the United States at the close of 1890 was $891,960,000. The State and local debt of the United States was $1,135,110,000. The aggregate national debts of foreign countries, $26,621,223,000.



IMPROVED SIXTY HORSE POWER GAS ENGINE.

PHOTOGRAPHIC NOTES.

Photographing on Wood.—The new process by W. J. Rawlings is highly spoken of, and is as follows: Whiten the face of the block by means of a mixture of albumen and zinc white. Next coat the dried block with collodion containing nitrate of silver. Dry it by heat. Dissolve off the coating with ether and alcohol. Apply a second coating of the collodion, dry and remove it as before. Dry and expose under the negative. Bring out the print and fix in hypo; wash and dry.

New Developers.—Two more substances are to be added to the already extensive list of developing agents. Herr Schmidt has, according to the *Photographische Correspondenz*, discovered the developing properties of methyle-para-amidophenol-meta-kresol and para-oxyphenyl-glycin. Life is short, says the *Photographic News*, and it is, therefore, a matter of congratulation that these substances are to be called methol and glycin respectively.

Red Printing Process.—In the *Revue Photographique*, M. Letellier gives the following process, by means of which prints of a red tone can be obtained: In a small quantity of water mix 72 grammes of nitrate of uranium and 20 grammes of nitrate of copper, the solution being neutralized with a little carbonate of soda. It is then made up with water to a liter. Paper sized with gelatine or arrowroot is floated on the solution for a minute or two, and dried in the dark. Printing is carried out beneath the negative until the image is fairly visible. It is then developed with an 8 per cent solution of potassium ferrocyanide, until the required density is obtained. Fixing is accomplished by well washing in plain water. If sepia tones are required, the uranium copper solution is neutralized with ammonia, and the developing solution made up to 2 per cent only.

Rewards for New Processes.—The Administrative Council of the *Societe Francaise de Photographie* have decided to offer the following prizes: First, a silver medal to the inventor of a simple and sure process of obtaining positives direct in the camera; second, a silver medal to the inventor of a process of artificial lighting which will permit of instantaneous photographs being made in the studio. The system must be free from danger, without smoke or odors, and without complicated apparatus. All communications to be made to the society before the 31st of December next, at their address, 76 Rue des Petits Champs à Paris.

Detection of Crime by Photography.—Once again photography has played an important part in the detection of fraud. It would appear that in France gold articles are marked by being stamped with tiny marks representing horses' heads, insects, etc., according to the parts of France where the articles are made. The genuineness of some gold rings manufactured at Havre, and which were stamped with a mark representing some kind of insect, was doubted, and in order to detect the fraud, and convince a French jury, M. Londe—a gentleman well known in French photographic circles—undertook to make photomicrographic reproductions of the doubtful marks, and also of genuine marks. This done, it required but a comparatively small magnification to entirely remove all doubt as to the difference that existed.

The New Concentric Lens.—The new lens is intended for landscape, architecture, and copying purposes. Open a pair of compasses to about three inches, and draw a curved line two inches in length; now close the compasses sufficiently to draw another curved line half an inch within the other. Between the two curved lines draw a straight one, and the result will be the representation of a convexo-plano lens combined with a plano-concavo lens. Imagine two such lenses set in a mount with their concave surfaces opposed to one another, and you have a correct picture of Messrs. Ross' new concentric lens.

We see at once that the instrument has a novelty of form; for achromatic lenses generally, which have flat or other contact surfaces, and which give a positive image, have the radius of their convex surface shorter than the other; here it is necessarily longer, for the curves are concentric, and the convex is the outer one. The convexo-plano, or outside lens, is made of glass having a high refractive power and relatively low dispersive power; while the plano-concavo, or inner lens, which is cemented to it, is constructed of glass having a lower refractive power than its fellow, while at the same time it is of the same or higher dispersive power.

Among the advantages claimed for the new lens are the following: It will give uniformly perfect definition over a flat field of a circle of about seventy-five degrees in diameter; it is free from astigmatism, distortion, and glare; its illuminating power is wonderfully uniform over the entire field; it has more depth of focus than other lenses of the same aperture; it does not require to be stopped down in order to gain marginal definition, and it differs in other ways from all lenses hitherto constructed.

It may be asked why, seeing that this lens was conceived about four years ago, it has been so long in the hands of its makers. The answer is that lenses are not like boxes of pills or bottles of patent medicine, which can be filled by children and placed upon the market at a few hours' notice. Their construction requires skilled labor and personal supervision at every stage of the process, and Messrs. Ross have been wise to make no public mention of the lenses until they could report that the special glass of which they are made is permanent in its good qualities, and until they had accumulated sufficient stock to meet the demand which is sure to arise for them.

We recently had an opportunity of seeing this lens tried against many others, and have no hesitation in saying that the claims made for it are justified. Focusing a view on the ground glass of a large camera with this lens, and employing a large stop, it was quite startling to find the whole screen brilliantly illuminated, while, at the same time, the details of brickwork and slates were as sharply defined at the extreme margins as they were in the center of the field. The volume of light seemed strange to one who was accustomed to identify such sharpness of definition with the use of a very small stop.—*Photo. News.*

Petroleum.

Dr. William Anderson, in his recent presidential address before the Institution of Mechanical Engineers, gave the following:

One more subject which is attracting great attention, and which seems to open up a field for the inventive faculties of mechanical engineers, is the use of petroleum or mineral oil. As a source of power, petroleum is rapidly gaining ground, especially where motors of moderate size are needed. The records of the Royal Agricultural Society show that for many years past efforts have been made to produce petroleum engines, but never, until quite recently, with any practical success, chiefly, he thought, because oils of low flashing point, or petroleum spirit, were used. The dangerous nature of these would alone have condemned any engine, however efficient, for general use, except, indeed, in the form advocated by Mr. Yarrow, in which petroleum spirit acts only as the working substance or agent for the conversion of heat into work, and is therefore not expended, except by way of leakage, so that the difficulty of supply does not arise. It was not till the show at Nottingham in 1888 that Messrs. Priestman brought out their engine working with heavy oil having a high flashing temperature. That engine was tested by Lord Kelvin and by himself independently, and gave an efficiency of one brake horse power to 1·73 pounds of oil. At the next year's show the consumption fell to 1·42 pounds; at the next in 1890 to 1·243 pounds; and Professor Unwin this year reports that a brake horse power has been obtained by the combustion of 0·946 pound. It is proved by experience that these engines do not need any special attendants; neither boiler nor chimney is required; the fuel is much more cleanly, and the engine can be got to work in a few minutes; it is certain therefore that they will increase greatly in favor with the public, and will prove formidable competitors to gas engines. Naturally, also, Messrs. Priestman's success has stimulated the inventive spirit, and already more than one successful form of motor is in the field, the tendency being to simplify the details and to render them less delicate in adjustment. But much still remains to be done. The useful work on the brake is under 14 per cent of the energy latent in the fuel; while the heat carried off by the water jacket round the cylinder and by the exhaust is equivalent to 75 per cent of the total thermal capacity of the oil. This loss surely constitutes a storehouse from which we may hope to appropriate a good deal. He thought that probably a combination of the direct combustion engine with the spirit engine of the Yarrow type would give the best results, especially if a more advantageous cycle than that of the Otto gas engine can be adopted.

As a lubricant also petroleum is taking a prominent place. The circumstance that it is devoid of fatty acids makes it peculiarly fitted for use with steam machinery, and for work which it is desired to protect from rust or verdigris. It can be obtained also of any degree of fluidity, from the most mobile of liquids to the consistency of jelly, while its cheapness serves to recommend it to every consumer.

ORIGIN OF PETROLEUM.

It is commonly assumed, without any good reason however, that petroleum is of the nature of coal, and has been formed like it out of the *debris* of primeval forests or out of the remains of marine animals, and that, like coal, the deposit will be exhausted in time. But it seems not unlikely, as the distinguished Russian chemist Dr. Mendeleeff has suggested, that petroleum is constantly being formed by the action of water on metallic deposits in the heated interior of the earth; and that there is good hope, therefore, not only that rock oil can never be exhausted, but that it will be found in most parts of the earth if borings sufficiently deep be made; and it should be borne in mind that the depth of a boring adds very little to the cost of getting, because the oil usually rises naturally to the surface, or very nearly to it.

Petroleum is an almost pure hydro-carbon, the American variety having a composition homologous with marsh gas or fire damp, $C\,H_4$, that is, composed according to the general formula $C_nH_{2n}+_{2n}$ ranging in value from 1 to 15. The Caucasian oil has the general formula C_nH_{2n}; and olefiant oil gas or ethylene, C_2H_4, appears to be the lowest of the series, n rising in value to 15. When exposed to heat—either in the ordinary process of distillation or when, by working under pressure, the temperature is raised above that due to the atmospheric boiling point—the crude oil "cracks," as it is termed, and the vapors of different boiling points, but still preserving a homologous chemical composition, are given off in succession, and in varying proportions; indeed, in some districts rock oil issues from the ground in the form of gas, even at ordinary temperatures and pressures.

Petroleum, in a form not to be distinguished from the natural product, has been produced artificially by the action of steam at high temperature and pressure upon the carbides of metals, more especially on those of iron; the water is decomposed, the oxygen combining with the metal, and the hydrogen, in part, at least, with the carbon. This circumstance, among others, led Dr. Mendeleeff in 1877 to propound a theory, which he would sketch very briefly, because if correct it gives an assurance of inexhaustible supplies of oil, and also indicates the probability of its occurring in every part of the world, quite irrespective of the age of geological formations; and so holds out motives to engineers to perfect the means of penetrating much deeper into the heart of the earth.

Laplace's theory of the origin of the planetary system is generally accepted as correct; and according to it the earth must be composed of the same materials as the sun. This view has in latter days received striking confirmation from the spectroscope, by means of which it has been demonstrated that there exist in the sun many of our metals, and especially iron, in the state of vapor, while meteoric stones, which belong to the same order of substances as the planets, have been found by actual analysis to be largely composed of iron and its carbides. The law of the diffusion of gases would lead us to expect that on the condensation of the metallic vapors the substances of higher specific gravity or greater atomic weight would collect chiefly nearer the center of the future globe, while the lighter matters would tend to aggregate on the surface. The mean specific gravity of the earth is about 5, while that of its superficial deposits ranges from only 2½ to 4, so that it is evident that the interior of the globe must be composed of substances having high specific weights—such as iron, for example, which ranges between 7 and 8. Moreover it is certain that the rocks at a comparatively short distance down from the surface exist in a highly heated if not in a molten condition; and that the solid crust covering them is relatively thin and easily fissured, as is abundantly proved by the upheaval of the land in geological and even in modern times, and by the earthquake disturbances which prevail more or less over the whole world even now.

Dr. Mendeleeff points out that the oil-bearing regions generally lie parallel to mountain ranges, such as the Caucasus in Russia, the Alleghanies in America, and the Andes in Peru; and that petroleum does not appear to belong to any particular geological formation, inasmuch as it occurs in Europe usually in rocks of the tertiary period, while in the United States it is found in the Devonian and Silurian strata, which are so nearly devoid of animal and vegetable remains. He also points out that, on account of the volatile nature of rock oil, it could not have been borne from a distance like many other deposits, but must have been formed very near the spot where it is found.

The fissuring of the earth's crust by the upheaval of mountain chains and by other disturbances allows surface waters to penetrate into the heated internal portions of the earth; and there, coming in contact with the glowing metals and their carbides, they give rise to the chemical reactions which result in the formation of petroleum in the state of vapor, and in the evolution of steam. These vapors penetrate through the fissured crust into the upper and cooler regions, where they are either wholly or partially condensed, forming deposits of petroleum very commonly associated with water; and the gases which cannot be condensed by cold escape to the surface. The precise compounds which are formed depend upon the temperature and pressure met with; and hence we find associated every grade of product—gas, oil, mineral pitch, ozokerit, and other substances. The extraordinary average persistence of the oil wells leads to the conviction that the substance must be forming as fast almost as it is removed; and he had very little doubt that improved boring appliances will enable engineers to penetrate to depths not even dreamed of now; so that, by the time that our coal resources come to an end, from the exhaustion of the mineral, or from the condition of perpetual strike to which we seem tending, oil springs will be tapped which will have the priceless advantage of yielding their riches without the agency of underground labor.

A HINT TO INVENTORS.—An elastic stove pipe coupling would do more good than seven long sermons.—*Texas Siftings.*

Extinct or Nearly Extinct Vertebrates.

Mr. A. F. Lucas has a readable article upon the animals which are recently extinct or threatened with extinction as represented in the National Museum.* The West Indian seal (*Monachus tropicalis*) is uncertainly placed in this category, for but little is known of it, and its habits and habitat seem favorable for its perpetuation. The California sea elephant (*Macrorhinus angustirostris*) is possibly entirely extinct, none having been recorded since fifteen were sent in 1884 to the National Museum. The walruses, too, are threatened with extinction, the Pacific species, *Odobœnus obesus*, being in greater danger than the Atlantic, *O. rosmarus*. The source of danger lies in the whalers, who capture the animals for oil and ivory. Between 1879 and 1880 there was brought to market 1,996,000 gallons of walrus oil and 398,868 pounds of walrus ivory. In 1879 the ivory was worth 45 cents a pound; in 1880, $1.00 to $1.25; and in 1883, $4.00 to $4.50. The European bison (*Bison bonasus*), which is at present restricted to Lithuania and the Caucasus, is protected in both localities. In 1880 the Lithuanian herds numbered but 600, and the number is smaller at present. The Arctic sea cow (*Rytina gigas*), the history of which has already been given in our pages,† was exterminated in 1767 or 1768.

Three species of birds from the Hawaiian Islands are probably extinct. The last ornithological collector who returned from these islands found no specimens of the mamo (*Drepanis pacifica*), and but about half a dozen specimens represent the species in museums of the world. It was probably exterminated in obtaining feathers to make the yellow war cloaks of the Sandwich Island kings. The Hawaiian *Chætoptila augustipluma* is represented but by two specimens, and the small tailless rail (*Pennula ecaudata*) of the same archipelago is nearly as rare. It would appear that nearly all the native birds of the islands are also threatened with extermination.

The California vulture (*Pseudogryphus californianus*) is now extremely rare, and largely restricted to Southern California. "The free use of strychnine in ridding the cattle ranches of wolves and coyotes has caused the disappearance of this bird, which has been poisoned by feeding on the carcasses prepared for the four-footed scavengers." The dodo (*Didus ineptus*) of Mauritius, and the solitaire (*Pezohaps solitaria*) of Rodriguez, have a history too well known to be recounted here. They are represented in the National Museum by a few bones.

So, too, the fate of the Labrador duck (*Camptolæmus labradorius*) and of the great auk (*Alca impennis*) has often been told. Of the former but thirty-six specimens are in existence. Two of these in the National Museum were collected by Daniel Webster. The last specimen was taken in 1878. Specimens of the great auk are not so rare, and yet they command enormous prices. The last skeleton sold brought $600, the last skin $650, and an egg brought $1,500. The great auk was probably exterminated in 1840.

Pallas' cormorant (*Phalacrocorax perspicillatus*) of the region around Kamschatka has a brief history. It was killed by man for food. In 1741 it was "frequentissimi" on Bering Island. About a hundred years later it was extinct, and is represented to-day by four stuffed specimens and twenty-three bones in all the museums of the world.

Of the lower vertebrates Mr. True refers to the great Galapagos tortoises and their relatives of the Mascarene Islands, and the tile fish. The former have already formed the subject of a paper by Dr. Baur in this journal,‡ and it is only necessary to say that probably they are exterminated from another of the Galapagos group. The giant tortoises of the Mascarene Islands were extremely abundant in the seventeenth and eighteenth centuries, but their use as food caused their extinction at the beginning of the present century. "Save the few bones rescued from the marshes of Mauritius and the caves of Rodriguez, nothing is left to show that these large and formerly abundant tortoises ever existed."

The history of the tile fish (*Lopholatilus chamæleonticeps*) is among the strangest known. So far as we have any information, no one, fisherman or naturalist, ever saw a tile fish (the common name is an abbreviation of the generic) until March, 1879, when a Gloucester fishing schooner took about 6,000 pounds. In the following years 1880 and 1881 a few were taken by the U. S. Fish Commission steamer. In March and April, 1882, vessels arriving in American ports reported passing through large numbers of dead and dying fish off the southern coast of New England and Long Island. Vessels reported sailing for forty to sixty miles through floating fish (in one instance through 150 miles), so that it became evident that a vast destruction had taken place. Captain Collins estimates from these reports that an area of 5,000 to 7,000 square statute miles were so thickly covered that the total numbers must have exceeded a billion. The next fall the Fish Commission searched in vain for these fish on the ground where they were formerly so abundant; and no one has since reported a specimen.

* Report National Museum for 1888-89, p. 609, 1891.

† L. Stejneger, Am. Nat., xxi., p. 1047, 1887.

‡ Am. Nat., xxiii., p. 1039, 1889.

A Cold.

BY J. J. WALLER, M.D., OLIVER SPRINGS, TENN.

In dealing with the above subject we, of course, are aware of the fact that it has never as yet been clearly defined. Most or very nearly all text books consider it merely as a cause of a number of different pathological conditions, or sometimes the *morbus* at hand is considered a phase or manifestation of what is so familiar among us—"taking cold."

Dismissing further speculation along the line as not germane to the object now in view, I wish to call especial attention to the mechanism by which the effects of taking cold are brought about; and as theories and facts make up the bulk of our medical information, probably to theorize on this subject and draw a corollary of facts from the result would be the proper manner of procedure.

Any portion or the whole of the body exposed to a cold draught for a varied length of time of course suffers from irritation, and immediately wires the ganglion or center most intimately connected with that region, through the afferent nerves, and makes known the disturbance there. If the irritation is great (which we will assume to be a fact now) and the whole nervous system has to take cognizance of it, the disturbance is appreciated as an insult, and revenge is at once sought by sending out orders to have the secretions and excretions of the skin locked until peace is made. When the glands of the skin surrender their function, the ramparts of the citadel are taken, the skin becomes in a measure dry and chaffy, and loses its usual pliancy which is so essential to health. With the periphery thus in a state of blockade, it is not known by the economy at what time some of the more vital internal organs will suffer; so the nervous system trembles with fear, and we have a form of nervousness as a concomitant symptom of cold. The nervous system, still trembling with fear and maddened by the insult of irritation, resolves to carry on the secretions and excretions by precipitating a double duty on the internal mucous membranes or serous membranes, as the case may be. So when the nervous system orders a mucous or serous membrane on double duty it revolts at the idea of having a vicarious function to perform, and even refuses to carry on its normal function. It is now that we have the dry stage of cold. When the nervous system locked the secretions and excretions, it seemed to not realize the fact that it was at the same time locking in some of the venomous products of destructive metamorphosis which, so to speak, in a state of stagnation, undergo a sort of change and become irritating to the brain and nervous system, thus causing the dull lethargic feeling and indifference to mental and physical exertion, and the aching pains in the limbs.

After a while the mad internal membrane yields to its higher authority, the nervous system, and being overburdened by hyper-secretion and hyper-excretion, soon ceases to do its work physiologically and passes into a pathological state, and a catarrh is the result. Thus we may have coryza, pharyngitis, laryngitis, bronchitis, enteritis, etc., if a mucous membrane be involved; pleurisy, pericarditis, etc., if it falls on a serous membrane. Other troubles besides diseases of mucous and serous membranes are brought about by cold, but it is not our purpose to go minutely into them now.

In treating a cold, just bear in mind the mechanism by which it was brought about. The nervous system is willing to compromise on almost any plan which includes removal of the offending locked-up excretions. Diaphoretics propose to do that, and on their administration and promise the nervous system unlocks the pores of the skin, and equilibrium is restored.—*Southern Medical Record.*

How to Drink Milk.

Terpsichore gives a few practical hints about digestion as follows:

Do not swallow milk fast and in such big gulps. Sip it slowly. Take four minutes at least to finish that glassful, and do not take more than a good teaspoonful at one sip.

When milk goes into your stomach, it is instantly curdled. If you drink a large quantity at once, it is curdled into one big mass, on the outside of which only the juices of the stomach can work. If you drink it in little sips, each little sip is curled up by itself, and the whole glassful finally finds itself in a loose lump made up of little lumps, through, around, and among which the stomach's juices may percolate and dissolve the whole speedily and simultaneously.

Many people who like milk and know its value as a strength-giver think they cannot use it because it gives them indigestion. Most of them could use it freely if they would only drink it in the way we have described, or if they would, better still, drink it hot. Hot milk seems to lose a good deal of its density, and one would almost think it had been watered, and it also seems to lose much of its sweetness, which is cloying to some appetites.

Varieties and Uses of Mica.

George P. Merrill contributes to *Stone* some useful information on the varieties of mica.

There are several distinct varieties of mica, all characterized alike by a very perfect basal cleavage whereby they split readily into thin sheets, but differing in color, elasticity and composition. The most prominent varieties are (1) the white colorless variety, muscovite; (2) the white to yellowish brown or brownish red variety, phlogophite; (3) the black and frequently opaque varieties, biotite and lepidomelane; and (4) the pink lilac or rose colored lepidolite. Of these only the white variety muscovite is, excepting as a rock constituent, of economic importance, and need be described here.

Occurrence.—The micas are among the most common and widely disseminated of minerals, occurring in irregular shreds or six-sided tablets in rocks of all kinds and of all ages. They are particularly characteristic of the acid crystalline rocks, both eruptive and metamorphic.

The white variety is, however, much the more restricted in its distribution, and it is believed is confined wholly to the older acid rocks of the granitic or gneissic groups.

The prevailing form of the micas is that of small irregular flecks, from a mere point to a fourth of an inch in diameter, disseminated throughout the mass of a rock. In the younger eruptives, in limestones, and in granitic veins it not infrequently shows good crystallographic forms hexagonal in outline, which are easily recognized as mica from their property of splitting readily into six-sided thin sheets.

The white mica, or muscovite (sometimes called isinglass) of commerce, is derived wholly from pegmatitic or other coarse granitic veins in granite and gneiss. Besides mica, the chief constituents of the veins are quartz and feldspar, though there not infrequently occurs a pleasing variety of minerals, as beryl, tourmaline, apatite, cassiterite, etc. Indeed, such veins are the mineralogist's most fruitful fields, both as regards abundance and variety as well as perfection of crystalline form.

Properties.—The distinguishing characteristic of muscovite, and that which gives it its chief value, is its property of splitting readily into thin, transparent, tough and elastic sheets. It is but little acted on by heat, though gradually becoming brittle on prolonged exposure to high temperatures.

Uses.—The chief use of mica is in the form of thin sheets for stoves and furnaces. For this purpose it must be clear and free from bad spots, cracks, or blemishes of any kind. The most desirable color is stated to be wine red. Of late years there has arisen a considerable demand for mica in the form of strips some eight inches long by one inch wide for insulating purposes in the manufacture of electrical apparatus. The qualities essential for these purposes are toughness and freedom from iron. There is a considerable and increasing demand for ground mica, which allows of the utilization of the scraps, which must otherwise go to waste. At present eight grades are prepared, the coarsest being used to give a spangled effect to fancy grades of wall paper, while the finest is used in producing a uniform metallic white surface on the same. The intermediate varieties are used mainly in the manufacture of lubricants for heavy machinery.

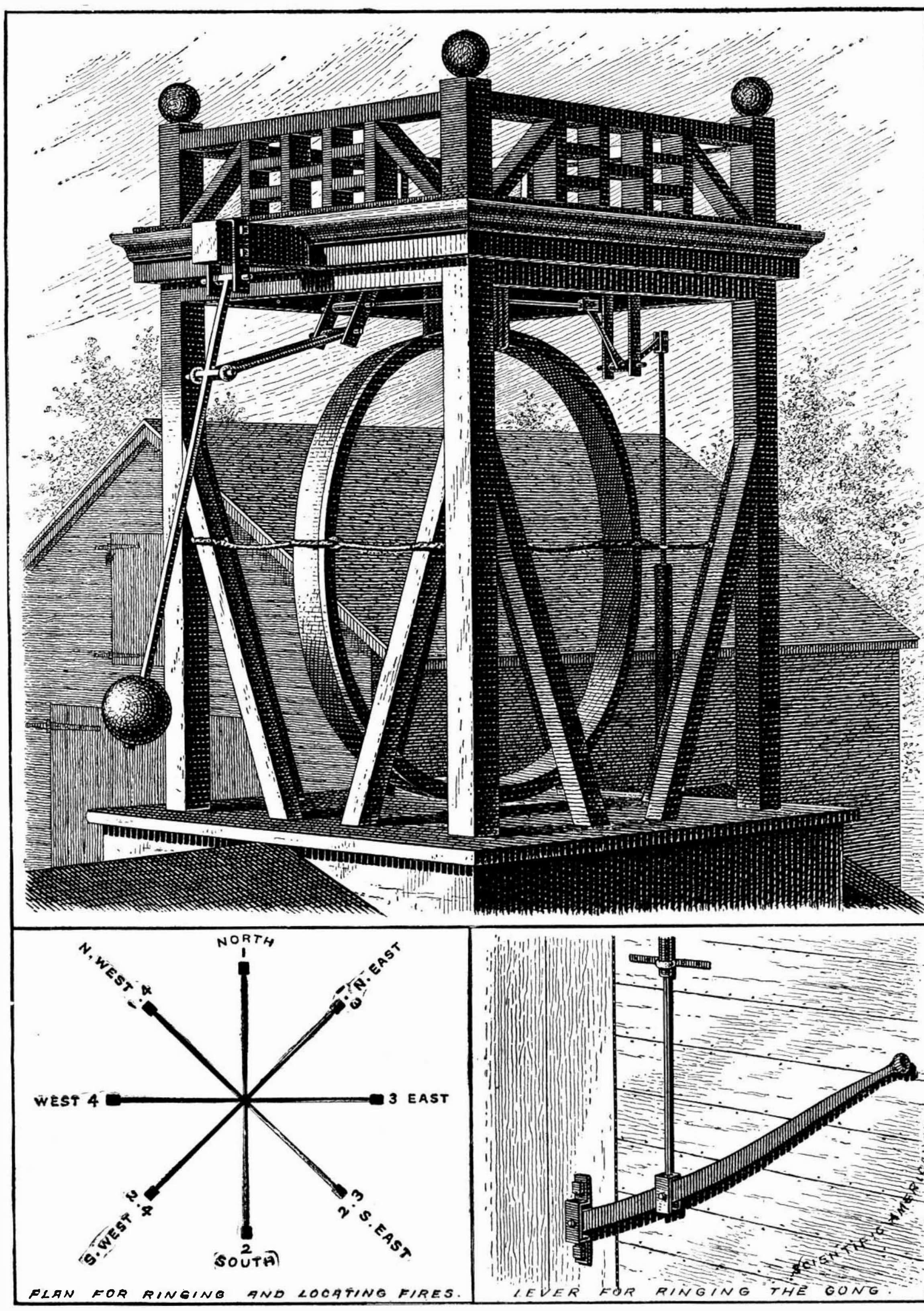
Preparation.—Mica occurs in sheets of all sizes up to two or more feet in diameter and from the fraction of one to several inches thick. The larger sheets are utilized mainly for sheet mica, and for this purpose the blocks, after being taken from the quarry, are freed from all gangue material, split to such thinness as to trim readily, and, by aid of patterns, cut to standard sizes, the value of the cut sheets increasing very rapidly in proportion to their size. There is a great amount of waste in this process, and it is stated not above eight or ten per cent of sheet mica is obtained from the block mica thus treated. The waste material or scrap from the trimming, and, in some cases, the entire product, if sufficiently clean and free from gritty substances, is ground. This process, owing to the toughness and fissility of the mineral, is one of considerable difficulty, and at date of writing not more than two or three firms in the entire country are prepared to do the work.

Sources.—More or less mica has from time to time been produced by nearly every State bordering along the Appalachians, though the mining is nearly always more or less spasmodic and intermittent. Frequently mica forms a product of the feldspar and quartz mines, though the amount thus obtained is comparatively small. New Hampshire and North Carolina are at present the chief sources in the United States. From forty to fifty tons are annually produced, valued at from ten cents to five dollars a pound, according to quality. The chief foreign sources of mica are Canada and India.

SOME one has said that a man never realizes how much valuable advice his neighbors have to give away until he announces his intention to build a house.

AN ECONOMICAL FIRE ALARM.

The present illustration is taken from the fire alarm at Boiling Springs, opposite Rutherford, N. J. The machinery for striking the gong or ring was made by a blacksmith of the town. The gong is held up in place by means of a ⅝ inch wire rope which goes around the gong and over a heavy piece of timber at the top of the tower. The striking apparatus with bearings are also connected to this piece of timber. These bearings are made of 2×½ bar iron and the striking material mostly of ⅝ inch round iron. The L shaped bell crank with shaft is forged in one piece. The lower section of bell crank and the lever below are joined together by means of a piece of ⅝ inch round iron with a forked connection at the top and bottom. This piece of iron runs through a piece of gas pipe which is bolted to the floor as a support. One end of the lever works inside of a yoke which is bolted to the side of building. To throw the clapper or ball back the lever is drawn upward, which throws the upright part of crank with forked connection backward, which in turn forces back the clapper. By pushing the lever down the clapper strikes the gong. The gong is a 6 foot tire of a driving wheel of a locomotive, is 1¾ inches in thickness, 6 inches in width and weighs 500 pounds. It yields a deep tone like a bell. On a still night it can be heard about two miles. The clapper weighs about forty pounds. A plan has been adopted for locating the direction of fires by strokes of the gong. One stroke indicates that the fire is in the northern section of the town. Two strokes, south. Three strokes east. Four strokes, west. One stroke and a pause and then three strokes, indicates a fire in the northeast. Two and three strokes, southeast. One and four strokes, northwest. Two and four strokes southwest. This fire alarm has been very satisfactory, costing, with gong and machinery, with labor, the small sum of $25.



LOCOMOTIVE TIRE USED AS A FIRE ALARM BELL.

Distillation of Wood.

At a recent meeting of the Society of Chemical Industry, London, Prof. Ramsey read a paper by himself and Mr. J. C. Chorley on "The Distillation of Wood." The communication being one which dealt with a number of tabulated details rather than general conclusions, was wisely given in abstract form. Prof. Ramsey remarked that although wood had been distilled for at least 100 years, yet but little had been done to investigate the precise character of the reactions which went on, and the nature of the products which were obtained. Of the main products of distillation, which were water, acetic acid, methyl alcohol, and wood creosote, and charcoal left as a residue in the retort, the first was of course valueless, the next two largely utilized, while the creosote, with the exception of a little which was purified for dentists' use, was not generally considered of much account; the utilization of the charcoal depended upon the kind of wood that had been employed. That from oak and beech was consumed in the foundry, while charcoal from willow and alder was preferred for the manufacture of gunpowder. After recounting the numerous substances which accompanied the main products, Prof. Ramsey pointed out that our knowledge of what was going on in the interior of the retort was necessarily very limited, as the temperature could not be accurately ascertained. In order to investigate the phenomena of distillation more closely, a small-size apparatus had been devised, consisting of a flask in which the wood was distilled, surrounded by a triple air jacket and provided with a thermometer, connected with condensing and receiving vessels, the further end of which was coupled to a gas holder. A connection was made to a water pump, so that at the beginning of the experiment a fair vacuum could be obtained throughout the apparatus, and thus the true amount of permanent gases yielded by the wood determined. The method adopted for estimating the methyl alcohol, though confessedly crude, was in the authors' opinion the best that was applicable under the circumstances. It consisted essentially in oxidizing that portion of the distillate containing the alcohol with potassium bichromate and sulphuric acid, and determining the carbonic acid given off. Some light was thrown on the degree of reliability of this method by the fact that the amount of methyl alcohol recorded as being obtained from different woods varied enormously, a result which was not confirmed by the yield on the large scale, the variations under manufacturing conditions being, it is true, in the same direction as those in the laboratory apparatus, but showing smaller and less violent fluctuations. Strictly speaking, therefore, it was necessary to consider the results obtained by this method as indicating the amount of "oxidizable matter calculated as methyl alcohol," rather than to assume that they represented methyl alcohol itself. The change that went on during the distillation of wood became exothermic at a certain point, the stage being marked by a sudden evolution of gas, without additional or more vigorous firing. On account of the occurrence of this exothermic change, the authors ventured on the somewhat paradoxical course of regarding wood as an explosive. The yield of acetic acid was remarkably constant even with different woods, and its evolution might be taken to start from the time when the wood, in the authors' phrase, "begins to explode" and to cease with the explosion. Furfural was similarly a product of "explosion." The products from the distillation of wood varied not only with the nature of the wood, but with its place of origin and state of seasoning. A smaller yield of acetic acid was obtained with wet wood. In the discussion which followed, Mr. Blount took exception to the use of the word "explosion" for a change of this character, and characterized it as an abuse of terms. Mr. C. F. Cross spoke of analogous changes such as occur in the formation of ensilage from grass, and pointed out that the distillation of cellulose itself from various sources would be likely to give suggestive results. Mr. Watson Smith, speaking as an old wood distiller, said that it did not appear that any severe rise of temperature took place during distillation. It was true that when the charcoal was drawn it might take fire, but this might well be due to the condensation of air in its pores. Mr. A. G. Green pointed out that a more satisfactory method of estimating methyl alcohol than that described might easily have been used. Mr. Biggs complained of the attitude of the inland revenue authorities toward the producers of methyl alcohol. One at least was induced to experiment in order to obtain a pure product, and when success had been attained, was confronted with the fact that the full duty would be levied upon the spirit because of its potability. Professor Ramsey, in reply, defended the use of the term "explosive," and intimated that he was prepared to denote many substances and reactions not usually thus included by that term.—*Chem. Tr. Jour.*

The University of Chicago.

The University of Chicago will soon be one of the greatest educational establishments in the country. Mr. John D. Rockefeller of New York, in addition to large contributions to this institution previously made, has lately added the munificent sum of $2,000,000; and other large amounts by other contributors have been made, so that the institution will have a splendid endowment, the total being nearly $5,000,000. The ground occupied by the University has an area of some 24 acres. It is situated between the two great parks—Jackson Park and Washington Park. Three buildings now under way are the Divinity Dormitory, the University Dormitory, and the Recitation Building or Lecture Hall.

Professor William Rainey Harper, of Yale University, has been chosen president. He is a young man, 37 years old. He is professor of the Semitic languages and literature. Dr. E. G. Robinson, late President of Brown University, and J. H. Tufts have charge of the Department of Philosophy. Professor J. Lawrence Laughlin, late of Cornell University, is the head of the Department of Political Economy and Finance. He is assisted by Professor Adolph C. Miller. Dr. Hermann Eduard Von Holst, of Freiburg, Germany, also takes a professorship. He will be assisted by a number of distinguished and able professors. The Department of Physical Culture is to be under charge of Professor A. A. Stagg. William C. Wilkinson is Professor of Rhetoric. E. H. Moore, Professor of Mathematics. The Library is in charge of Mrs. Zella A. Dixon and Miss Julia Bulkley. The University is to be open to both sexes.

A STEEL rail lasts, with average wear, about eighteen years.

THE PYTHONS OF THE PHILIPPINE ISLANDS.

To the Editor of the Scientific American:

In your issue of August 29, 1891, we notice an article on boa constrictors in which mention is made of the pythons of this region. Thinking that some additional facts might be of interest, we submit the following:

Pythons are abundant in the Philippines, the species being identical with that found in Borneo. During our stay of eighteen months in these islands we have heard many accounts of the enormous size attained by these snakes and recently have obtained three fine specimens. The smallest of these measured nineteen feet eleven and one-half inches in length and eighteen inches in greatest circumference. It had evidently been without food for some time and was in an emaciated condition, but was still a heavy load for two men. The next in size measured twenty-two feet six inches in length and twenty-four inches in greatest circumference. The head was six inches wide at the angle of the jaws and the mouth opened thirteen inches without any of the stretching of the skin or displacement of the bones of which it is capable. The third specimen measured twenty-two feet and eight inches in length, and twenty-two inches in greatest circumference. The gape was the same as in the second specimen. In each case the stomach was entirely empty, and one familiar with such animals can easily form an idea of the enormous increase in size that would take place if gorged with food.

Above the length of nineteen or twenty feet, these snakes increase greatly in bulk for every foot in length, so that a snake nineteen feet long looks small beside one twenty-two feet long. It is difficult to estimate the weight of an animal of this kind, and we had no means of determining it accurately. A quarter of it was a heavy lift for a strong man, and it was all that two men could do to drag it a few feet along the ground, one man being unable to do so. The second specimen displayed its enormous strength by snapping in two by a steady pull one of its fastenings a rattan between one-half and three-quarters of an inch in diameter. The snake being securely fastened by rattans around the neck, two men and a boy who attempted to hold it by the tail were powerless to do so.

From the log in which the third specimen was caught, eighty-nine eggs were taken. They were white and nearly round, about the size of an ordinary base ball, and were covered with a soft leathery shell or skin. They adhered to each other, forming a large mass, which had to be literally torn apart to separate them. So far as observed, all were fertile, each specimen examined containing a living embryo about four inches in length. When discovered the snake was coiled upon its eggs, apparently incubating. Upon being removed from the log the eggs dried up rapidly. As the temperature within the log was noticeably above that of the atmosphere, it is probable that the close coils of the snake prevented evaporation.

A snake of this size could bring down a medium sized buffalo, and could crush out the life of a man in a fraction of a minute; and we have no hesitation in expressing the opinion that it could swallow him. We know of the case of a snake of about this size swallowing a full-grown buck with antlers, a male deer of this species being larger around the belly than is a man around the shoulders.

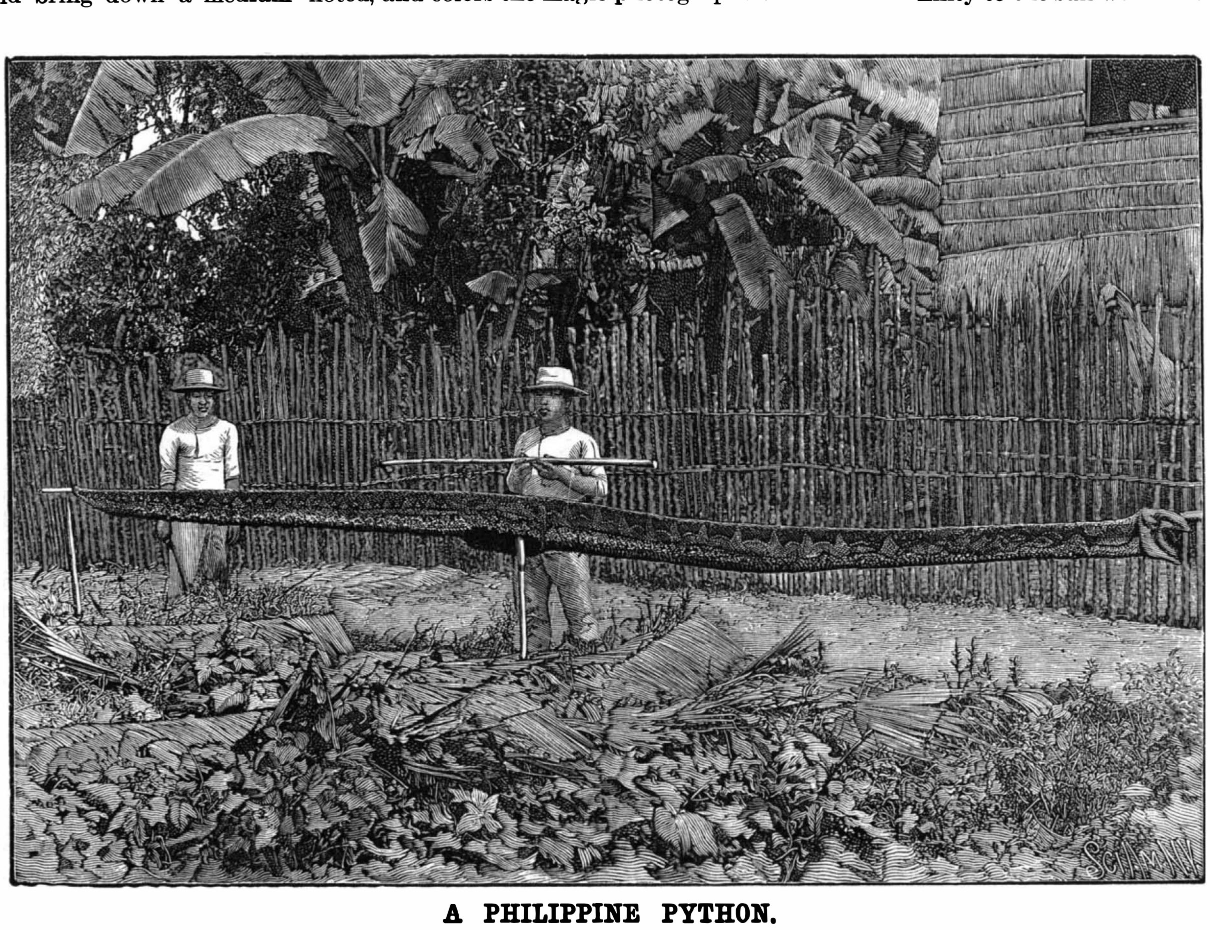
If the stories told here about large snakes can be believed, the specimens described are small indeed in comparison with really large snakes, but we find that such snakes decrease greatly in size when brought in contact with the deadly foot rule. An intelligent half caste recently told us that his brother-in-law had killed, measured, and skinned a snake forty-four feet long. We did not wish to question the man's veracity, but heartily sympathized with the remark of a Spanish gentleman, that forty-four feet were a great many feet.

We inclose a photograph of the skin of the second specimen. The tail does not show distinctly, as it is not extended. The stick held by the man behind is just five feet long, and is held parallel to the skin and near to it.

The specimens described will be shipped to the Minnesota Academy of Natural Sciences at Minneapolis.

D. C. WORCESTER,
F. S. BOURNS,
Menage Scientific Expedition.

Manila, Philippine Islands, March 2, 1892.



A PHILIPPINE PYTHON.

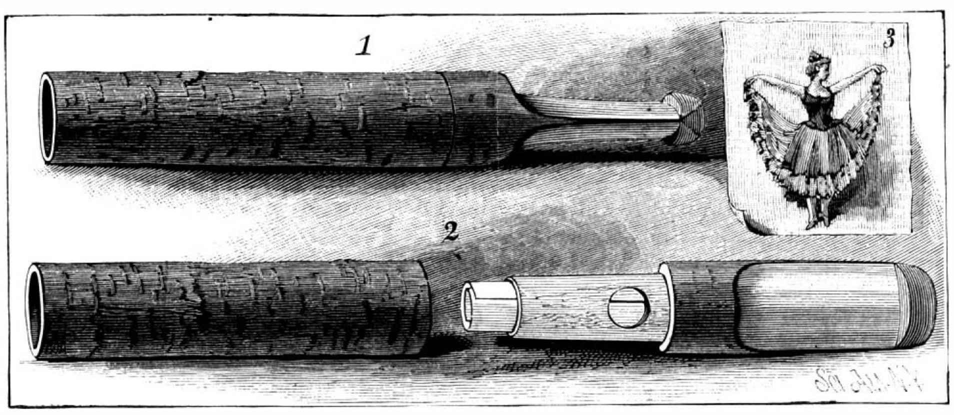
Skin 22 ft. 6 in. long, 2 ft. circumference. From a photograph sent from Manila to the SCIENTIFIC AMERICAN by Messrs. D. C. Worcester and F. S. Bourns, of the Menage Scientific Expedition.

MAGIC PHOTOGRAPHS DEVELOPED BY SMOKE.

Among the novelties recently introduced here, we find a curious thing in photography. It consists of a cigar or cigarette holder, accompanied with a small package of plain white photographic papers about the size of a postage stamp. If one of these papers be placed in the interior of the holder, before an orifice arranged for the purpose, the tobacco smoke will come in contact with it, and develop thereon a portrait or other object.

Fig. 4.—DEVELOPING THE PHOTO.

The process employed is very simple, and consists in preparing a small photograph on chloride of silver paper, and dipping it into a solution of bichloride of mercury, so as to bleach it and cause it to disappear.



PHOTOGRAPHIC CIGAR HOLDER.

It is necessary to prepare the photographs without gold. The bichloride of mercury changes the photograph partly into white chloride of silver and partly into protochloride of mercury (which is also white), and thus renders it invisible on the white paper.

The image may afterward be made to appear by the action of hypochlorite of soda, or by that of ammoniacal vapors. Tobacco smoke, which contains vapors of ammonia, succeeds very well, as we have above noted, and colors the magic photographs black.

In the annexed cut, Fig. 1 represents the cigarette holder closed; Fig. 2 shows it open, exhibiting the orifice and showing one of the small plain papers inserted in the holder, and Fig. 3 shows the paper after the image has been developed upon it.

An Electrolytic Experiment.

In *La Lumiere Electrique* for March 19 the following electrolytic experiment is described; it is due to Herr Arons, and was shown by him to the Berlin Physical Society. If we place a hollow copper cylinder between the electrodes of a sulphate of copper voltameter, copper will be deposited on the cylinder where the current enters it and dissolved where it leaves. If the cylinder is free to turn about a horizontal axis, it will commence to rotate as soon as the current passes, owing to the surface next the anode becoming weighted. It is possible to arrange matters so that the specific gravity of the cylinder is only a trifle greater than that of the solution, and hence the pressure of its axis upon the supports may be indefinitely reduced. The containing vessel used by Herr Arons was a glass box. The copper cylinder, which occupied nearly the entire width of the containing vessel, was 4·5 cm. long and 10 cm. in diameter, and the walls were about 1·8 mm. thick. The spindle was formed by a glass rod 1 mm. in diameter, secured to ebonite plugs fixed into the cylinder; the spindle rested on ebonite supports, attached to the walls of the containing vessel. The cylinder turned slowly and continuously under the influence of currents varying from 0·1 to 1 ampere. Experiments showed that the speed of rotation was very nearly proportional to the current.

The Solar Heat.

An interesting paper on "Solar Heat" is given in a recently issued volume of the "Transactions" of the Astronomical and Physical Society of Toronto by Dr. Joseph Morrison. Two theories have been advanced to account for the source and maintenance of the heat of the sun. One ascribes the heat to the energy of meteoritic matter falling on the sun, the other asserts that the supply of heat is kept up by the slow contraction of the sun's bulk. Taking the "solar constant" as twenty-five calories per square meter per minute, Dr. Morrison calculates that the linear contraction of the radius of the sun which is requisite to keep up the present rate of radiation is 0·000004972 feet in one second, or 156·9 feet in a year, or 29,716 miles in a thousand years. "Now 450 miles of the sun's diameter subtends at the earth an angle of one second, and therefore it would require 7,575 years for the sun's angular diameter to be reduced by one second of arc, which is the smallest angle that can be accurately measured on the solar disk." With regard to the meteoritic theory of solar energy, a calculation shows that a quantity of matter which weighs one pound falling freely from infinity to the sun would develop by its kinetic energy 82,340,000 units of heat. From this it can be found that the heat radiated could be developed by the annual impact on the sun of a quantity of meteoritic matter a trifle greater than 1-100th of the earth's mass, and having a velocity of 382·6 miles per second.

Water Dearer than Fuel.

In Balakany, near Baku, the center of the Russian petroleum industry, is witnessed the anomaly of the water used for the steam boilers in the several establishments costing more than the fuel. As a matter of fact, the water is bad and dear, costing about half a crown per ton; while a ton of astatki, that is the residuum of the distillation of the crude naphtha, which is the combustible naturally utilized, is sold at a price equivalent to eighteen pence per ton of coal.

AN alloy of 78 per cent gold and 22 per cent aluminum is the most brilliant known.

The Management of Cemeteries.

It seems to be a pretty general belief that in almost every field of human effort demand precedes supply. But in matters where a refined public taste is concerned, the supply of good work precedes and creates the demand. For many years the best pictures produced by American artists have not been those which sold the best, and, of course, those which sell the best most truthfully represent the condition of the public taste. Again, our appreciation of the best foreign works of our time has been largely due to dealers who imported the pictures of such men as Corot, Rousseau, and Daubigny, before we even knew their names, and long before we could understand and properly estimate their art. It is true that in the long run dealers may have profited by this experiment, but the public has profited by it far more, and it is just that we should feel grateful to them as to unselfish benefactors. What we wish to do now, however, is to call attention to another illustration of this truth which has been suggested by the published report of the *Proceedings of the Convention of the Association of American Cemetery Superintendents*, which was held last autumn in Chicago.

To some eyes there may seem no hint of artistic things or questions in this title. But our readers are aware that we consider the right treatment of the rural cemetery, an institution which is almost peculiar to America, rests on important and interesting artistic principles. And yet it is evident from this report that the greatest obstacle in the way of such treatment is the persistent bad taste of the public. We might suppose that our cemeteries are not more beautiful because it is hard to find people to make them beautiful. But the case is really the reverse of this. Many at least among the persons who are employed to care for them know what aspect they ought to wear, and are eager to give them this aspect, but their employers bar the path. If the bad taste of the committee or trustees who control a cemetery is not to blame, then it is usually the bad taste of the majority of individual lot owners.

Of course, we should not assert this simply on such statements as that "the superintendents of cemeteries have to bear with many things that they do not like in catering to the public." If no explanations with regard to points of difference were given, we might conclude that the superintendents rather than their patrons need an education in good taste. But the various addresses given at length in this report bear such clear witness to the correctness of the views of prominent cemetery superintendents, and to the conflicting views of their patrons, that one cannot help feeling confident as to the source from which improvement may be expected.

For example, Mr. G. H. Scott, of Rose Hill Cemetery, Chicago, in discussing how large a part nature should play in the cemetery, said: "What may be considered natural in a cemetery? In the first place, grass and trees. There should be an abundance of grass and a sufficiency of trees and shrubs, with as few pathways as possible, and no more driveways than are absolutely necessary. A cemetery lot with mounds or graves not higher than three inches above grade of plain sod, well clipped and trimmed, gives that appearance of neatness, simplicity, quiet, and beauty which every such lot should have. The prevailing anxiety on the part of lot owners to surpass each other in the erection of costly monuments, vaults, and stonework generally, is detrimental to the natural appearance of a cemetery. Another encroachment upon the natural appearance of a cemetery is carpet bedding. To take the natural and well trimmed sod from a grave and cover it with a carpet bedding of plants and flowers, giving it the appearance of a patchwork crazy quilt, is, to say the least, absurd, and certainly not in keeping with the natural appearance of a cemetery representing the peaceful resting place of the dead. Not so with plants of wild flowers and hardy herbaceous perennials. They are things of nature. This class of plants are inexpensive, will live over winter, flourish without care, become larger in size and increase in beauty every year, and should be dispersed over the ground so as to give them a natural appearance. A cemetery should be a place for meditation, a place where the living, pleased and satisfied with its natural appearance of peace and quiet, and free from the busy hum of human toil and artistic dazzle, may anticipate the time when they, too, must succumb to the inevitable, not mournfully, but cheerfully. Besides, if cemeteries generally were kept more natural in appearance, their cost of maintenance would be less."

We have taken these sentences out of their context and massed them so as to show, as briefly as possible, Mr. Scott's idea of what the treatment of a rural burial ground should be. And from the speech of Mr. Higgins, of Woodmere Cemetery, Detroit, we may take a few more sentences with a similar purpose. "What," he asks, "are the essentials of a perfect cemetery? Beauty and harmony. Harmony, as I here use it, should not be considered as flatness or want of variety, but as a lack of elements of discord which it is difficult to overcome. Thus a small Niagara would not be desirable in the proposed site for a burying ground, neither beetling cliffs nor wild gorges. Picturesqueness may occasionally be properly sought after in the improvement of parks or private grounds, but is scarcely productive of that air of quiet repose which should be one of the main characteristics of the last resting place of man. . . . The two crying evils of all cemeteries are our present great ugly headstones and our unsightly grave mounds. It seems to me, however, that in some cemeteries which are working toward the lawn plan, they lay too much stress on prettiness and bring with it the puerilities, polish and showiness of highly kept front yards or showy lawns, and that too much money is expended in ornamentation and display. Now, neatness is one thing, display an entirely different thing. I believe that the nearer we keep to nature in our methods of cemetery improvement, the better results we shall obtain and the more economical will be our management of affairs. We must bear in mind that cemeteries are designed for burying places for the poor as well as for the rich, and that extravagance in ornamentation or wasteful methods of care defeat the very purpose for which they were intended."

Surely these ideas are sound. They are the truly artistic because the truly fitting principles in accordance with which rural burial grounds should be designed and maintained. It is pleasant to know that persons holding executive positions in our cemeteries entertain such ideas, and we should be glad to know that they were less frequently hindered from acting upon them by their employers.—*Garden and Forest.*

The Chemical and Physical Properties of Rosin Oil.

Until recently it was generally believed that the use of rosin oil was almost entirely confined to the manufacture of printing inks and cart grease and the adulteration of other and more expensive oils. Although large quantities of it were manufactured, but little found its way into the retail market, at least under its own name. There is now, however, some probability of an increased consumption taking place owing to the rediscovery of its properties as an insulator; and it will not, therefore, be out of place to say something concerning its nature and properties, if only to dispel the vague atmosphere with which the subject has been surrounded and to show how completely any dogmatic statements that have been made, or may be made, must be modified by a consideration of the quality of the oil referred to.

In the first place, rosin oil is so called because it is the heavier part of the products of the destructive distillation of rosin, which, in its turn, is the residue left by distilling crude turpentine, spirits of turpentine being the volatile portion. The ordinary vitreous body, varying in color from light yellow to almost black, known as rosin consists of a mixture of abietic acid and abietic anhydride, together with a small quantity of sylvic acid. When distilled, these bodies are broken up, yielding a mixture of hydrocarbons, accompanied by a larger or smaller proportion of unchanged rosin acids and anhydrides. The relative amount of these constituents is determined by the design of the stills and the manner in which the distillation is conducted. The more carefully prepared and refined the oil is, the lower is the proportion of rosin acids, and in the laboratory rosin oil may be obtained with but a few per cent of substances other than hydrocarbons. The specific gravity of rosin oil of commercial quality may vary from 0·98 to 1·10, while its power of rotating a beam of polarized light is similarly variable, being generally dextro-rotatory, but sometimes lævo-rotatory, or nearly absent. These facts are sufficient to indicate the variable character of commercial rosin oil, and the futility of discussing its electrical properties without defining the character of the sample used is tolerably apparent. In the various communications which have lately been made concerning rosin oil insulation, this necessity has not been sufficiently kept in sight. The only satisfactory method for settling once for all the kind of oil best fitted for this purpose would be to examine the insulating capabilities of numerous samples, and simultaneously determine their composition by analysis. If this were done, and it were ultimately found that rosin oil could be as advantageously used as some of its advocates appear to think, there would be afterward no difficulty in obtaining supplies of precisely the same quality as those which had been found efficient. The maker would be given a definite standard to work to, and could, by the aid of his chemist, match that standard as nearly as would be necessary.

In dealing with rosin oil, one of the most noteworthy qualities that are apparent on inspection is its great viscidity. It is to this, and to its immiscibility with water, that its applicability for the purposes of insulation is chiefly due. It is, therefore, plain that in addition to a purely chemical examination, the determination of the important physical property of viscosity would have to be undertaken. Thanks to the advances that have been made in the methods of examining lubricating oils, there is no difficulty in effecting this. Besides determining the viscosity at ordinary temperatures, it would be very desirable to do so at higher temperatures, as it by no means follows that oils of the same viscosity at any given temperature have the same coefficient of decrease as the temperature is raised. There is a further point which seems to have been also overlooked. Rosin oil when exposed to air undergoes change. How noteworthy that change may be has been opportunely illustrated by some figures given in a paper by Mr. F. H. Leeds, which was recently read before the Society of Chemical Industry. The results of three of the samples examined are given below:

No. of Sample.	Original oil. Rosin acids.	Original oil. Hydro-carbons.	Oil after exposure to air. Rosin acids.	Oil after exposure to air. Hydro-carbons.
A	31·07	68·93	24·90	75·10
B	22·20	77·80	16·09	83·91
C	9·72	90·28	4·29	95·79

The results show that a considerable amount of alteration has taken place. There is an apparent decrease under the column headed rosin acids (which strictly means total saponifiable matter, including probably anhydrides and esters) and an increase under the head of hydrocarbons. It is unlikely, on purely chemical grounds, that a conversion of the former into the latter takes place. Probably the explanation of the change is to be sought in the volatilization of the lighter acid constituents, and the consequent enrichment of the mass in heavy non-volatile hydrocarbons. In the paper in which these results appear, other differences are recorded and discussed, but, being at present still unsettled, do not immediately concern us. One deduction is, however, plain, namely, that an oil may undergo profound alteration by exposure, and may well alter in character to such an extent as to become more or less useful in tangible degree. It can, therefore, never be safe to assume that, because a specimen of oil has at one time given certain results, it will necessarily possess identical properties after the lapse of time, particularly if the conditions under which it has been kept have involved its exposure to the atmosphere. This again opens up a field for investigation, in that not only do all kinds of rosin oil change, but that the tendency of oils of different qualities to alter by exposure varies greatly. It is probable that samples consisting almost wholly of hydrocarbons would prove the most resistent, and, if found to be also high in insulating power, would be preferable on that account. Direct experiment is, however, much needed.

Wonders of Electricity.

At the Crystal Palace, London, a private view lately took place of some new electrical experiments illustrating recent discoveries of Professor Elihu Thomson. The demonstrator was Dr. J. A. Fleming (Professor of Electrical Engineering at University College). As a preliminary to the experiments Dr. Fleming made a few remarks, in the course of which he informed his hearers that he was about to deal with an alternating current which changed its direction of flow 125 times a second. The original current, a continuous one, was generated a mile and a half away from the palace, and was on arrival changed into one of alternating character, and was used to excite an electric magnet which stood on his lecture table. The current was now switched on, and the lecturer held a copper ring over the pole of the magnet. A strong and perceptible repulsion was the result—so much so, that directly Dr. Fleming released the ring it flew several feet upward into the air. Lighter rings, he explained, could be held captive by short cords, and would then float in the air above the magnet which repelled them in this wonderful way against the force of gravity. The next experiment was a very beautiful one. A glass jar of water was placed on the pole of the magnet, and in the water was set floating an incandescent lamp, in circuit with a coil of wire, which, with the help of cork, formed a kind of round boat below it. This arrangement sank to the bottom of the jar, but directly the current was applied to the magnet it rose up to the surface, while at the same time the little lamp burst into radiance. If, while this experiment was in progress, a copper shield were placed between the magnet and the vessel of water, all action ceased, for the copper acted as a screen. Many other curious experiments were shown, including one which plainly indicated that this form of magnet would differentiate between a good and a spurious coin. The metal of the former being pure, or nearly so, formed a good conductor, and was, therefore, held between the poles of the magnet; but a bad coin, not possessing that necessary qualification, immediately fell down when placed in position.

A REDUCTION in some of the fees for British patents has been passed by the English government. The reduction takes effect upon the taxes that accrue during the latter part of the term for which the patent is granted, but does not lessen the cost of making the application.

RECENTLY PATENTED INVENTIONS.

Engineering.

ROTARY ENGINE.—Stephen H. Bloomer, East Portland, Oregon. This engine has a ring-shaped steam chamber in which operates a piston connected with and arranged to travel concentric with the main shaft, the peripheral edge of the piston having transverse sockets for packing, while around its edge is held a packing ring, whereby the positive operation of the piston is effected without danger of loss of power by undue leakage. By a novel arrangement of several cam disks which operate the cut-off valve and gate, the cut-off may be made when the piston is near the end of its stroke or at any point which may be desired.

STEAM ENGINE GOVERNOR.—Richard H. Payne, Aquone, N. C. In this governor the governor stem is controlled by balls and connected with a pivoted arm carrying the valve stem. A bell crank lever carries at one end a pulley resting on the driving belt, the other arm of the lever being adapted to engage an arm held on a rocking shaft controlling a spring supporting the governor stem. This improved construction is simple and durable, while it is very effective in operation, being arranged to actuate the valve at the slightest variation of speed, according to an increasing or diminishing load or steam pressure.

Railway Appliances.

CAR COUPLING.—John La Burt, New York City. In this coupling the drawhead has a horizontal recess from which a recess leads through the upper side of the drawhead, a locking arm being pivoted at its angle or being in the front corner of the horizontal recess to swing horizontally, a pivoted tumbler of novel form co-operating with the rear end of the locking arm and a rearwardly projecting handle. The device is of simple and inexpensive construction, and provides for the automatic coupling of the cars, while it is so made that it cannot possibly uncouple by accident and may be uncoupled by the brakeman without danger.

CAR COUPLING. — Robert Reardon, Savannah, Ga. This invention provides an improvement in automatic couplings in which coupling knuckles or hooks are used, and which frequently get out of repairs on account of the breaking of the hooks. For this purpose it provides a double or reversible locking hook or knuckle which may be quickly changed, so that either end may be used, also providing a positive locking mechanism which will hold the coupling hook in such a position that it cannot accidentally be displaced. A lever mechanism is employed by means of which the coupling may be unlocked without going between the cars.

TRAMWAY BRAKE. — Friedrich Adler, Prague, Austria-Hungary. This invention relates to a style of brake which is automatically applied to the wheels when the forward pull on the car lessens, while the momentum lost by the car in stopping is stored and applied to lessen the power necessary for starting. For this purpose a sliding drawbar is provided with a rack engaging a gear wheel mounted loosely on the axle, there being a mechanism for locking the gear wheel to the axle when the drawbar is pulled out in the act of starting the car, whereby the wheels of the car will be revolved by the engagement of the teeth of the rack with the gear wheel.

RAILWAY SIGNAL.—Colon M. Stanley, Montezuma, Ga. This is an improvement in that class of signals in which the signal arm is secured to a post at the side of the track, and provides means for easily raising and lowering the arm so that the lantern may be filled without difficulty. A crank-operated drum is mounted on the post, on which the arm is held to move vertically, and a weighted lever pivoted in the arm has at one end a brad to engage the post, a cable extending over guide pulleys on the top of the post connecting the drum and weighted lever. The construction is such that the arm cannot be accidentally dropped.

Mechanical Appliances.

BORING AND TENONING MACHINE.—Abel B. Sharp, Durango, Col. This machine is especially designed to form the tenons on spokes and bore the tenon apertures in fellies. A bracket held on a supporting beam has a bearing in which slides and turns a feed screw, a nut on the bearing being movable into and out of engagement with the screw, in which turns a shaft on which is held a tool-holding socket. A keeper held vertically adjustable in the beam is adapted to support the spoke in line with the shaft, and a collar held adjustably on the feed screw is adapted to regulate the depth of the tenon to be formed on the spoke.

STAVE TRIMMING AND JOINTING MACHINE.—William J. Wright, Cooperstown, Pa. By this machine the billet is first trimmed to the proper size, after which it is automatically fed into the machine through the various stages necessary to complete it, the stave in passing automatically controlling and setting the bevel-cutting and bilge-forming devices in exact proportions relative to the different widths. The invention is an improvement on a formerly patented invention of the same inventor, all of the machine operating automatically after the stave is fed to the trimmer saws, the several parts serving to give the proper bilge and bevel to all staves, irrespective of their thickness, length or width.

Miscellaneous.

PRESSURE REGULATING VALVE. — August Heithecker, Long Island City, N. Y. This is an improved valve adapted to be connected with a high pressure gas main, causing the gas to flow therefrom at a reduced and uniform pressure. The pressure of gas in the valve, in which is a horizontal diaphragm, is regulated by the resistance of a spring, which is increased or diminished, according to the gas pressure desired, by adjusting a collar by turning handles upon a nut. The valve is of very simple construction, and may be nicely and positively adjusted so that the gas will flow at the exact pressure desired, while the valve will not easily clog up and get out of repair.

ELECTRIC LOCK. — Frederick Morgenthaler, Brooklyn, N. Y. An attachment by means of which a door may be locked in either an open or closed position is provided by this invention, the device being electrically operated and controlled by push buttons arranged in different parts of the building. The invention relates more particularly to the mechanism for holding the door open and for releasing the door, providing a positive means for effecting these objects, and simplifying the construction covered by a former patented invention for the same purpose. In a store equipped with this improvement the escape of a thief might sometimes be prevented, the attendant being able to close and lock the door by pressing a button.

HAY RICKER.—Maxon Chase, Lucerne, Mo. Combined with a suitable base and upright frames, arms, and fork, is a revoluble shaft, with elevating ropes, operating rope, pawl, and automatic locking and unlocking devices, the several parts being simply constructed and assembled and requiring but little power to operate them. The mechanism dispenses with weights and is safe at all times.

OIL CAN. — Noah G. Pomeroy, New Haven, Conn. This can is designed to be safely carried in the pocket without spilling any of its contents. Its nozzle has a loosely fitted piston or cleansing rod, adapted to clean oil apertures from any dust or dirt before the oil is supplied, and the device is especially adapted for use in oiling the bearings of bicycles and similar machines.

AXLE LUBRICATOR.—James S. Patten, Baltimore, Md. This is an improvement in axles having a reservoir for oil, and constructed to feed oil from the reservoir to the spindle or bearing for the wheel, the reservoir having a novel cover. The axle is chambered to form an oil reservoir, there being along the chambered portion external threads, while the cover consists of a band having internal threads meshing with those of the axle and provided with an opening movable into and out of register with the reservoir.

COTTON BALING APPARATUS. — Edmund M. Ivens, New Orleans, La. This invention relates to that class of baling machines which bale the cotton by what is known as the "roller process." Combined with a continuously operated folder or lapping device and a compressing platen is a rotatable press box having dual chambers arranged to alternately receive the cotton from the lapper and carry it over the compressing platen, with means for temporarily receiving the cotton from the folder when the cotton box is not under it, the oscillating lapper and folder frame being formed with extensible side sections.

ROPE CLAMP AND STOPPER.—Thomas P. Inglesby, St. Louis, Mo., and Thomas J. Davis, Richmond, Va. This device is adapted to clamp and hold different sized cords and ropes subjected to longitudinal load strain, preferably for holding a hoisting rope to permit its release from the drum of a hoisting machine so that another similar rope may be applied to the drum while the clamping rope is held with its load suspended. It consists principally of two longitudinally grooved grip blocks, with means to anchor one block to a staple object, while a bail clamp is loosely secured to the other block and adapted to slide endwise upon and removably hook fast to the anchored block, an adjusting screw engaging the clamp and one of the grip blocks.

STIRRUP. — Alain J. De Lotbiniere, Quebec, Canada. This stirrup has a yielding foot rest, the lower ends of the members of the bow section being provided with collars, and the foot rest having at its ends sleeves sliding upon such lower ends, a spring secured at the ends of each of the members bearing against the under side of the middle portion of the foot rest. By this means the weight thrown upon the stirrups, instead of being transmitted directly to the back of the horse, is taken up gradually by the foot rest, saving the horse from shock. The foot will also be readily released in case the rider is thrown, and the upward pressure of the spring causes the stirrup to be felt at all times, so there is no danger of losing it.

ARTIFICIAL TOOTH. — David B. McHenry, Grenada, Miss. This invention provides a means of securely fastening a partial plate of artificial teeth in the mouth. The plate is formed of rubber or similar material fitted to the general contour of the jaw, and studs, pins or screws are inserted in the natural teeth, or in permanently mounted artificial crowns, and projecting a short distance therefrom, while also removed from the gums a sufficient distance to admit of slipping the edge of the plate under the fastenings, the ends of the plate being adapted to spring inwardly.

PORTABLE OVEN.—William O. Silvey, Middleport, Ohio. This is a simple and cheap construction adapted to be heated by an ordinary lamp burning oil or gasoline, and especially adapted for raising any kind of bread, or for keeping articles warm. The oven is also provided with means for heating an inner chamber either by steam or hot air, which may be kept warm for a long time, and which has thermostatic means for regulating the amount of heat to maintain the exact temperature desired.

CALCULATOR. — Jose H. y Bolado, Aguas Calientes, Mexico. A series of cylinders fitted one upon another and each provided with an enlarged portion having apertures, and a reduced portion having a set of numerals appearing through the apertures of the next following cylinder, form the principal feature of this invention. The device has the general appearance of a lead pencil, to be readily carried in the pocket, and carries movable leads, while it can be arranged to perform mechanically a variety of arithmetical and mathematical calculations, as multiplication, division, extraction of roots, and other problems treating of relative proportions.

WINDOW SHADE FIXTURE. — William W. Wythe, Orange, N. J. Two adjustably connected brackets are adapted to hold the shade roller, a guiding cord extending over pulleys secured to the brackets, the cord being secured at opposite sides of the window frame at points above and below the brackets, while an adjustable suspending cord is secured to one of the brackets and to the window frame. The fixture is adapted to conveniently suspend a window shade in front of a window to admit light at the top or any other part of the window, and it may be readily adjusted to suit the width of any shade.

LADDER. — Francis S. Sprague, Coldwater, Mich. This is a step ladder which is light, strong and inexpensive, and of which the side pieces, legs, and steps may be readily taken apart and packed in small space for carriage. The construction and connection of the steps is such, also, that the improvement may be employed in forming other ladders without legs. The steps are held in connection with the side pieces by means of swinging stirrup-like straps or loops, the steps having pins or projections on their under sides to engage with the free or swinging lower ends or portion of the straps or loops.

GATE LATCH. — Charles J. Ericson, Salt Lake City, Utah. This is a simple and inexpensive device for attachment to gates of all kinds, either single or double acting, but more especially designed for garden or front gates swinging both ways. It consists of an angled and curved bolt attached to or formed integrally with a rock shaft having at its ends hand levers for operating the bolt, an adjusting screw passing through the bolt for limiting its drop, and a metallic plate for holding the rock shaft in place on the gate, guiding the bolt, and covering the opening in the gate stile containing the bolt. The bolt is balanced to close perfectly from either side by its own gravity, and the gate will close when left only partially open.

GATE HINGE.—The same inventor has likewise obtained a patent for a double-acting gate hinge, preferably made from sheet metal, although it may be made of cast or malleable iron, brass, or bronze. It consists of two rectangular tubular parts formed alike and oppositely arranged with respect to each other, each having at one end a pair of perforated ears, while a link is pivoted between the ears. The two parts are applied, respectively, to the lower part of the gate post and the stile of the gate, the upper part of the gate having an eye which turns on an angled hook projecting from the post.

MEASURING FAUCET. — Herman M. Nye, Avoca, Neb. This is an improvement on a formerly patented invention of the same inventor, to cheapen and simplify the construction of measuring faucets for air-tight barrels or receptacles, providing a faucet by means of which any liquid may be quickly drawn and accurately measured. The improvement also adapts the faucet for use in connection with highly combustible or explosive liquids, and provides a suitable air vent in the liquid receptacle, and means for straining the liquid as it is drawn.

FOUNTAIN. — Fridolin Pascalar, Rochester, N. Y. This fountain is especially adapted for use in churches and other places to hold holy water for distribution. A lower open vase of any approved form constitutes its lower portion, and supported against the wall just above is a water storage receptacle on the plan of an inverted bottle whose mouth is held below the level of the water in the vase. By this means, as the water in the vase portion or fountain is used the supply is constantly replenished, so that it does not get below the level of the mouth of the reservoir until all the water in the latter has been used up, thus preventing waste and obviating the necessity of frequent renewals. The reservoir portion, being filled, is readily moved to place with the hand upon its mouth, the vase first having been sufficiently filled.

KITCHEN CABINET. — Albert C. Carr, Middlesborough, Ky. This is a simple and inexpensive construction comprising an upper compartment, a central drawer compartment, and a lower bin compartment, there being a cupboard in the upper compartment and hinged bins at each end of the cupboard, there being also a detachable board or cover adapted for use as a shelf, and a bin formed with a series of compartments.

THEATRICAL APPLIANCE.—Frederick Wohlgemuth, Philadelphia, Pa. This invention provides a device to aid in producing the illusory effect of a bicycle race on the stage. It consists in a bicycle mounted to have its wheels free from contact with the surface on which it appears to run, its front and rear wheels geared together, and its pedals free to be operated by the rider, the supports of the machine being secured to and projected up from a carriage adapted to be moved over the stage. The carriage carries suitably arranged dust-making devices, operated by the motion of the bicycle wheels, whereby the illusory effect of the race is rendered more effective.

LAWN TENNIS COURT MARKER.—Herman Reichwein, Spring Lake, N. J. The casing of this device is open at its base and carries a dust-reciprocating box with a perforated bottom, any suitable white powder being carried in the box. The device has a forward supporting wheel, and is pushed over the ground by means of handle bars, when the powder is evenly sifted in a continuous line as the marker is pushed by the operator.

TRAP.—Hubbard S. Goff, Arch Beach, Cal. This is a trap for taking fish or game of any description. Its body consists principally of two bow frame jaws, upon the outer rounded portion of which are hooks, a spring normally drawing the jaws to engagement. The trap may be conveniently set or baited without danger to the manipulator, and it may be placed in a horizontal or suspended in a vertical position, according to the use to be made of it.

WATER CLOSET DEVICE. — Walter R. Webster, Pine Grove, Cal. This is a device for automatically closing the covers of closets or other receptacles. It operates by the combined action of a metallic or other spring and air-cushioning cylinder and piston devices, through the intervention of suitable levers and connections. It effects the gradual closing of the cover, without noise or bang.

CATAMENIAL BANDAGE.—Anna Chapman, Jersey City, N. J. This invention covers a novel construction and combination of parts whereby the improved appliance is adapted for quick adjustment and removal of parts, affords comfort in use, and facilitates the renovation of portions requiring it.

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

NEW BOOKS AND PUBLICATIONS.

PHILOSOPHICAL NOTES ON BOTANICAL SUBJECTS. By E. Bonavia, M.D. With 160 illustrations. London: Eyre & Spottiswoode. 1892. Pp. ii, 368.

The author presents the subject of botany from the standpoint of evolution and very graphically treats on plant structure and life.

A HISTORY OF WATCHES AND OTHER TIMEKEEPERS. By James Francis Kendal. London: Crosby Lockwood & Son. 1892. Pp. ii, 252. Price $1.

By numerous illustrations, personal, historical and archaeological references, this work is rendered of great interest to the ordinary as well as to the professional reader. The author, a member of the firm of Kendal & Dent, is evidently qualified from study and literary taste, as well as from his trade knowledge, for the work has undertaken. The work appears to us to be one of great interest, and is presented in the most attractive manner.

L'ANNEE ELECTRIQUE OU EXPOSE ANNUEL DES TRAVAUX SCIENTIFIQUES, DES INVENTIONS, ET DES PRINCIPALES APPLICATIONS DE L'ELECTRICITE A L'INDUSTRIE ET AUX ARTS. Par Ph. Delahaye. Paris: Baudry et Cie. 1892. Pp. vii, 347.

The title of this work tells its own story. The entire field of electricity, from electric light to medical electricity, is treated. It discloses the wonderful activity of workers in the science, and forms an excellent compendium of a year's progress. While it has excellent and clear illustrations, we think that a more liberal use of the artist's pencil would have been advisable.

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 the following week's issue

Notes & Queries

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

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

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

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Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(4370) T. R. asks: In a dynamo made of the field magnet of Parkhurst motor and drum armature 4½ inches long, 1½ inches diameter, would 250 feet of wire give 25 volts? By winding it with 6 layers of No. 21 wire 350 feet could be wound on; allowing 10 feet wire to a volt it would give 35 volts, and with low external resistance 10 amperes. This would give 350 watts and require about ½ horse power to run it, if my calculations are correct. Is there danger of getting too much wire on and requiring too much power to run it? Could not resistance be introduced and thus decrease the power required? How many ampere turns does this field magnet need to magnetize it fully? A. [T. R.'s query was referred to Lieut. Parkhurst, who has kindly furnished the reply, given below. Although an abstract of the reply would probably answer the purpose, we print it in full to show that it is not always an easy matter to furnish a reply to an apparently simple question.—ED.] Referring to your correspondent's query, I would say that I have worked out the winding with No. 21 wire for the dynamo in question, and I have not the time now for a complete solution of the question. But I can say at once that even granted that No. 21 wire can be wound so as to give 35 volts E. M. F., the carrying capacity of the wire entirely precludes the idea of ever taking out more than 4 amperes as a maximum current. Even this is beyond limit of ordinary safety, and anything more would probably heat the wire of the armature so much as to burn it up, or at least destroy the insulation completely. The most I can figure as possible to put upon the armature is 8 turns per layer per coil, with 12 coils, each 3 layers deep (and it would be a tight squeeze to get on 3 layers per coil on core 1⅛ inch diameter and not exceed 1½ inch for diameter of finished armature); this would give 288 turns of wire upon armature, and this would come somewhere between 300 and 350 feet of wire, the uncertain factor of waste length in the heads not being readily determined except by winding. Of this length of wire, whatever it might be, there would only be about 225 feet not connecting the heads, and of this there would only be about 75 per cent active, or about 170 feet of active wire, or about 85 feet active in each half of the armature. By driving it fast enough this might and probably would penetrate 35 volts E. M. F. The armature with 350 feet No. 21 wire would have a resistance of something over one ohm. The field winding would also, if series wound, have from ⅝ ohm to 1 ohm, so that the lowest resistance allowable in external circuit would be—

$$R_{es} = \frac{35-8}{4} = \frac{27}{4} = 6{\cdot}75 \text{ ohms.}$$

This comes from $C = \frac{E}{\Sigma R}$

$C=4 \quad E=35 \quad \Sigma R = R = R_{es} + R_a + R_f$

$R_a = 1+ \quad R_f = 1$

$$\therefore 4 = \frac{35}{R_{es}+2}$$

This would only give 140 watts; and assuming that the dynamo is working at 70 per cent efficiency—as high a rate as can be assumed—this would call for about 200 watts as the actual work expended, or something over ¼ horse power. The armature is small in diameter and is pretty stiff. Mechanically, it probably can stand 6,000 revolutions per minute, and it would have to turn at something like that rate to generate 35 volts E. M. F. The area of magnet limb is only about 2 square inches. Allowing 40,000 lines of force per square inch, and not deducting for leakage, 80,000 lines of force for each magnet is all that can be counted on, or 160,000 lines of force for the field (with no leakage). To generate 35 volts E. M. F. 35×10^8 lines of force must be cut per minute, and since there are about 225 active turns of wire, and 160,000 lines of force, in the field, there will be 225 × 160,000 lines of force cut in each revolution, or the armature must rotate $\frac{3500000000}{36000000}$ per second or 97 + times per second, or 5820 revolutions per minute, to generate 35 volts E. M. F. This is only about 40 feet per minute for the outside wire of the armature, a speed not unusual, in fact general, in large machines. No. 16 wire for the field can carry 4 amperes of current safely. Allowing 25 per cent for insulation and slack winding, 34 turns should be got upon each magnet limb; 5 layers would therefore give 170 turns per limb, or 680 turns for the 4 limbs, and with 4 amperes we would have 680 ampere turns per limb, or 2720 ampere turns in all, which would probably be enough for the purpose. This would probably give rather higher resistance for the field winding than called for, but not enough to make very much difference. The above calculations are only roughly approximate, for as I said above, I have not time to go into the matter in all its detail. They may serve however to show that the machine in question could not under any very probable circumstances ever run up to more than ¼ horse power, and if it ran to much over ⅛ horse power, I would be rather surprised. C. D. PARKHURST, Lieut. 4th Arty.

(4371) N. W. B. asks: 1. An electric motor that takes 110 volts 3 amperes current to run at its full capacity is run as a dynamo; will it have the same output? A. Nearly. 2. How much wire will it take to make an induction coil to get one thousand volts, No. 32 wire, worked by 2 cells Bunsen battery? A. Consult SUPPLEMENT, No. 160, for this information. 3. In winding an induction coil does it make any difference if the wire is not wound in even layers near the primary coil? A. The wire should be wound as compactly as possible. 4. Is it essential that you should be good at mathematics to be a good electrician? A. Yes. 5. In asking you questions in regard to patents, if they are worth patenting or not, do you charge anything for the desired information? If so, how much? A. We give our opinion free of charge. 6. I was testing an electric bell iron frame. If I took hold of the bell with one hand, and the screw that makes the connections with the other one, I received a shock. What was the cause of it? Had about 4 volts, 2 cells plunging battery. A. The shock was due to the induced or extra current generated during the discharge of the bell magnet. 7. Which is the cheapest—to buy an induction coil, say 1,000 volts, or to make one? A. It is probably cheaper to purchase. 8. In making induction coils with more than one electrode, how do you do it—by winding as many wires on it as you want electrodes? A. The binding posts are connected with the winding at different points, so as to include different lengths of the secondary wire. 9. If you choke an electric motor, is there any danger of burning the armature out—100 volts 3 amperes? A. Yes, there is danger of burning out the armature unless the wire is of sufficient size to carry the current.

(4372) E. B. A. asks: 1. What is formula of the solution in the porous cup in the Bunsen cell? A. Make a saturated solution of bichromate potash and water. To this slowly add one-fifth its weight of commercial sulphuric acid. 2. What is the internal resistance of the Daniell cell? A. About 3 ohms. 3. Is there any local action in either of the above cells when not in use? How strong a current will each of these cells give? Is the number of SUPPLEMENT named giving the directions to make an induction coil for medical purposes? A. There is very little local action in a Daniell battery, more in the Bunsen battery. The Daniell battery has an electromotive force of 1·07 volts, and the Bunsen about 2 volts. The current from either is determined by the resistance. The electromotive force divided by the resistance equals the current. $\frac{E}{R} = C$. Induction coil is described in SUPPLEMENT, No. 569.

(4373) C. W. O. asks: 1. How can I get mercury from the stuff on looking glasses? A. Scrape off and boil with a little hydrochloric acid and water. If the mirror is coated with amalgam, this will remove the tin. 2. If I make a Trouve battery such as is described in Notes and Queries No. 3395 (September 26, 1891), with plates 3 inches in diameter, how many such pairs will be required to give 90 watts through zero external resistance? A. We have no exact figures, but a very large number would be needed. The battery is not adapted for high power currents. 3. Is copper 1-100 inch thick, thick enough? A. Yes. 4. Which wears out—zinc or copper? A. The zinc. 5. What is the resistance of motor described in SUPPLEMENT, No. 641? A. About 3 ohms. 6. What number of feet of copper wire will it take to give a resistance of 1 ohm of each size given? 12, 13, 14, 15, 25, 26, 27, 28, 29, 31, 33, 34, 35, A. W. G. A. 615, 488, 386, 306, 30, 24, 19, 15, 12, 7·5, 4·7, 3·74, 2·97.

(4374) W. W. asks: Which is the more economical for heating purposes, hot water or steam? Why and to what extent? Will boilers deteriorate more when idle, when full of water or when empty? Please name some good work on drawing machinery in perspective. A. Hot water circulation for heating buildings and dwellings is the most economical in fuel when the plans favor its proper arrangement. The economy consists in the grading of the fire in moderate weather so that all the pipe circulation may have any desired temperature below that of steam-heated pipes, while for heating by steam a constant and full fire must be kept up at all times or no steam is generated. This applies to low pressure heating. Boilers should always be laid up for summer, full of water that has been boiled by filling the boiler and drawing the fire. Empty boilers rust. We recommend "Drawing for Machinists and Engineers," by Davidson, $2; "Practical Perspective," by Davidson, $1.50; and "Orthographical and Isometrical Projection," by Davidson, $1, mailed.

(4375) J. G. S. asks: Will hay or straw when packed in large quantities and in a damp condition cause spontaneous combustion? A. Yes; heating and spontaneous combustion is one of the liabilities in massing large quantities of hay or straw in such a way that the air will feed the oxidation following the heat of fermentation. This does not apply to ensilage, which must be done in tanks or ground recesses that are airtight at the bottom and sides, so as to hold the carbonic acid gas generated by fermentation, which in turn remains in the tanks by its weight and which drives any air that may be left in the mass out at the top.

(4376) C. L. D. asks: 1. Could a yacht of 140 horse power, burning 3¼ pounds of coal per horse power per hour, be run any more economically by electricity? A. No. 2. How much room would be needed for the storage batteries necessary to supply the above amount of horse power for four days? A. It requires about 8 cells for a horse power, and for a continuous run one charge will last about 6 or 8 hours, working at full capacity. The cells will average about one-half of a cubic foot each. 3. Has coal ever been turned directly into electricity in a battery? A. The nearest approach to this is a thermo-electric or pyro-electric battery.

(4377) A. H. N. writes: 1. I have use for a number of permanent bar magnets. I have a coil of about No. 16 magnet wire; said coil is 5 inches long, 6 layers carefully wound in glue on a dry hardwood spool the shell of which is ⅛ thick, the end flanges or collars ¼ thick. Would it improve this coil as a magnetizer to wind on a pound or so of very fine wire? A. The fine wire would not improve a coil for this purpose, but more coarse wire would undoubtedly render it more efficient with a suitable current. 2. Would it answer for an induction coil, and by removing vibrator and core, and changing connections direct to terminals of primary coil, be suitable for making strong permanent magnets 6 or 8 inches long by ⅜ to ¾ size of hole? A. Six layers of wire is more than is necessary for the primary wire of an induction coil. However, if you were to construct your coil in the manner suggested, you could magnetize with it, but not as successfully as you could with a coil having a larger number of convolutions of No. 16 wire. 3. Is an induction coil and a coil for making permanent magnets practical as a combination? A. No.

(4378) E. N. asks how to make hydroquinone developer. A.

No. 1.

Hydroquinone	6 gr.
Sodium sulphite c. p.	24 "
Water	1 oz.

No. 2.

Carbonate soda	60 gr.
Water	1 oz.

For a developer take of

No. 1	1 oz.
No. 2	2 "
Water	1 "

Use less of No. 2 if it works too fast. 2. How can I give prints a black tone? A.

No. 1.

Powdered borax	100 gr.
Water	10 oz.

No. 2.

Chloride of gold	1 gr.
Water	10 oz.

Mix equal parts. 1 grain of gold will tone a sheet of paper 18×22 inches.

(4379) T. B. H. asks: Does a curved ball really change its course in the air or is it only a deception of the eye? A. Yes; there is no doubt as to a curve or deflection being made from the line of projection by the peculiar twirl given to the ball as it leaves the hand. See a full discussion of the subject, with illustrations, in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 402, 410, 423, on base ball science.

(4380) W. B. asks for a good formula for coating paper with a chloride gelatine emulsion for photographic printing, to take the place of albumen paper. A. SCIENTIFIC AMERICAN SUPPLEMENT, No. 276, for full directions. 2. Please name a good treatise on the manufacture of gun cotton or pyroxilin. A. See "Modern Explosives" by Eissler. Price $4.20.

(4381) Subscriber, Vernon, Texas.—The insect is one of the plant lice. It belongs to the genus Callipterus.

(4382) M. M. says: I was much interested in the question by L. W. A., why the injector works. When the injector (or inspirator) is in operation under high pressure of steam, and the overflow valve is opened, allowing part of water to enter boiler and part to return to well, why don't the water rush out with great force, as there is an opening to interior of boiler through check valve? In balancing a cylinder, how can I tell whether both ends are balanced alike? Is there any rotary steam engine in successful operation, and where? What is the greatest difficulty to overcome to make a rotary compete with a reciprocating steam engine? A. There is a slight contraction in the stream as it passes between the delivery nozzle and the receiving nozzle, and when they are exactly proportioned and adjusted to prevent scattering and overflow, except when starting; the stream not only enters the receiving nozzle intact, but carries a little air with it. The check valve shuts off all flow from the boiler and only opens when the impact from the jet becomes greater than the boiler pressure. In balancing revolving cylinders place one journal in a box held by easy springs, or in an easy-sliding box, or suspended box, and revolve the cylinder or drum by an attachment on the shaft at the solid box end. By revolving at about its proposed speed, the journal in the elastic box will wabble and a piece of chalk held against the end of the cylinder will mark the light side. When one end is balanced, reverse the cylinder and balance the other, and if fine work is required, repeat the operation. We know of very few rotary engines in use, and those not on a large scale. They suit many special wants, but have not yet been brought to match the economy and ease of repair and care of the best reciprocating engines.

(4383) J. S. McD. asks the best method of keeping, during summer months, the pipes and radiators of a hot water heating apparatus. Is it better to keep the pipes and radiators full of water, or should they be kept empty when not in use? Please give me the best plan to preserve pipes, radiators and heater or furnace when not in use. A. A hot water heating apparatus should be laid up for the summer full of water, the same that has been circulating, as such water contains no air, and the boiler and pipes will not rust in water from which all the air has been discharged. If the water has been long in use, and it is desirable to clean out by drawing off, the new water should be heated and a hot circulation made before laying up for the season. The fire chamber and flues should be thoroughly cleaned, and the draught entirely closed to prevent sweating by changes of weather during the summer. Empty boilers and pipes rust very fast, as the inside cannot be made thoroughly dry.

(4384) A. W. T. asks (1) how ordinary tack hammers are magnetized, so they will pick up tacks? A. By passing them through an excited helix; the hammers being made of hard iron, or case-hardened, retain the magnetism. 2. What kind of metal is most easily magnetized? A. Very soft wrought iron is most easily magnetized, but it does not retain its magnetism. You can permanently magnetize hardened steel or case-hardened cast iron. 3. I can magnetize the blades of my pocket knife with a horse shoe magnet, but I have a steel tack hammer that I cannot magnetize with the magnet. Why is it? A. Possibly your steel; tack hammer is too soft, or it may be too hard, or possibly your magnet is too small to charge the hammer to any perceptible degree.

(4385) T. H. B. writes: 1. In regard to storage battery described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 845, can it be formed with a gravity battery? A. Yes, by giving it plenty of time, say one month. 2. If so, how many cells of gravity battery (6 x 8) should be used for each cell of storage battery? A. 4 or 8 cells. 3. How should the gravity cells be connected—in series or parallel? A. They should be connected so as to give an E.M.F. of 2¼ volts. 4. How long should the current be allowed to flow before reversal? A. 8 or 10 hours.

(4386) W. H. asks: Can you inform me in what part of the country bird's eye maple grows? A. The "bird's eye" and "curled" maple are accidental growths of the sugar maple, *Acer saccharinum*. It is native through all the Northern States and West to Eastern Minnesota Nebraska and Kansas, and southerly along the Allegheny Mountains to Northern Alabama and Western Florida. It is slightly reduced in size toward the limits of growth; it reaches its greatest development in the States bordering the great lakes.

(4387) J. A. B. says: In making a siphon, I suck the air out. What starts it flowing, and what keeps it flowing? Again, I take the tube and fill it with water and start it flowing. What starts it, and what keeps it flowing? A. The principle of the action of a siphon is due to the fluid leverage of unequal columns of water which are sustained in the bent tube by the pressure of the atmosphere. In whatever way you deprive the siphon of its air the water follows, and when full will run by gravity toward the lowest level with the velocity due to the difference in level less the friction of the pipe. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 793, on siphons, illustrated.

(4388) A. H. S. asks: In what proportion should the ingredients of a tar and gravel roof be mixed? A. Use as little tar as will allow the gravel to be spread with the trowel when hot. Cannot give the parts, as gravel differs in kind and fineness. Use tar that is nearly hard when cold. The gravel should be made hot before mixing with the hot tar. The surface should be sanded as soon as the mixture is spread.

(4389) C. N. asks: Can a circle be described so as to make any three given points the termini of the radii from a common center? A. Yes; draw a line between each of the three points, exactly bisect each, and draw a line at right angles from each bisection. The point of meeting of the lines will be the common center of a circle passing through the three points.

(4390) A. M. asks: Where is the proper position for the steam dome on a horizontal boiler? Does it make any material difference where it is placed in regard to danger of explosion? A. The number of sheet sections in a boiler generally determines the position of the dome. The center of the boiler is the proper place, so that it may gather the steam with equal facility from both ends of the boiler. When there are three sections, the middle one should receive the dome, although there are exceptions to this in practice. With two sections the usual practice, and we think the proper one, is to put the dome on the front section.

(4391) G. T. R. asks: 1. Where do balloonists get the hydrogen to inflate the balloons, or how do they produce it? A. Street gas is generally used. Hydrogen can be made by passing steam over white-hot iron borings and scrap. 2. When petroleum is burned there is great smoke. Is there any material containing oxygen which, if burned with it, would result in consuming this smoke (or unconsumed carbon) or how could it be prevented? A. No such substance is known. Proper burners, atomizing, and strong draught are the proper lines to work on for smoke-consuming. 3. Would black manganese, if heated, evolve oxygen? A. Yes, if heated high enough.

(4392) L. H. D. asks: If a sheet iron armature core be used for simple motor, as in SUPPLEMENT, No. 641, would it give satisfactory results? A. Yes, if made of sheet iron disks or rings.

(4393) E. J. K. asks: 1. What is the exciting fluid used in the Crowfoot gravity battery with zinc and copper elements? A. The exciting fluid is saturated solution of copper sulphate. 2. I am making two cells of storage battery, each cell containing two lead plates 6×8 inches; can I form the cells and afterward charge them with Crowfoot gravity batteries? If not, could it be done by covering them with red lead paste? A. You can form your secondary plates and charge them with the gravity batteries. It is advantageous to apply to lead plates a paste of red lead. 3. Will the two cells run motor in SUPPLEMENT, No. 641? If not, how many will it take? A. The two cells of battery described by you will have a very small capacity, owing to the small number of plates. You should have 7 or 9 plates in each cell.

(4394) H. L. asks: 1. Is plaster of Paris, after being moulded and dried, porous, so as to allow air to penetrate it? A. Plaster of Paris is quite porous. 2. Is there a mixture (the nature of plaster of Paris) that after being dried no air can penetrate it? If there is, what is it? A. Probably the oxychloride of zinc cement would be very nearly if not absolutely impervious to air, but you can saturate the plaster with gelatine, shellac varnish or paraffine, thus rendering it nonporous. 3. Is a note collectable which reads: Ten days after death I promise to pay, etc., provided after death the estate is valued at or above the amount called for by the note? A. Yes.

(4395) J. T. D. writes: Please explain the action of the Bourdon tube, used by Trouve in his aviator, illustrated on page 105, current volume of the SCIENTIFIC AMERICAN. I cannot understand why its branches recede from or approach each other as the pressure of the contained gas is increased or decreased. A. The Bourdon tube has an elliptical cross section, so that pressure exerted within the tube causes it to tend to approach a figure of circular cross section; in so doing, the internal pressure forces it inwardly toward the center of curvature. As the inner wall of the tube is confined in the direction of its length by the outer wall, the pressure which renders the inner wall more convex in a transverse direction reduces its convexity or curvature in a longitudinal direction and thus tends to straighten the tube.

(4396) G. M. V. asks: How many volts, amperes, and ohms an eight inch French Grenet battery has? A. The E. M. F. of a Grenet battery is 2 volts. Its resistance depends upon the solution and the condition of the battery, from ¼ of an ohm upward. The current depends upon the resistance of the battery and of the external circuit. It is calculated according to Ohm's law, which is $\frac{E}{R} = C$.

(4397) Amateur asks for directions for making a dry battery, and how to charge same, or if chemicals charge it. A. For information in regard to Gassner's dry battery we refer you to SUPPLEMENT, No. 792.

(4398) C. L. asks: Is it a fact that lightning rods have the power, to any extent, of protecting houses from injury by lightning? A. A lightning rod properly put up and grounded is undoubtedly a protection against lightning.

(4399) M. T. asks: If a surveyor was running an old line, that the call was north, and the time had been long enough to require two degrees variation here in Southwestern Virginia which would be run N. 2 W. or N. 2 E. to hit the old line? Out here in this portion of Virginia does the needle of a compass vary to the east or west, and about how many years would it take to make one degree variation? Where does the line of no variation, as it is called, run, and does the end of needle pointing north, if it is east of said line of no variation, tend to travel to the west, and if west of it does it tend to the east? A. The variation of the magnetic needle in Scott Co., Va., was about 2° east in 1870, and has been decreasing at the rate of about 3 minutes per annum since that time. The predicted variation for 1892 for your county was four-tenths of a degree east. As the variation of the needle travels west, the amount of variation known since a former line was run must be added to the east reading and subtracted from the west reading from the north end of the needle for tracing the old line on northern courses, and the reverse for southern courses. The north end of the needle always travels to the west by the amount of variation, whether you are to the west or east of the line of no variation, which is now in or near your county, its amount there being somewhat uncertain from local influence due to mountain regions.

(4400) G. F. C., Plaquemine, La., asks: What is meant by the figures, the river is 35 feet, a rise of 0·2 of a foot, and stands 1·7 feet below the flood line of 1890, or the gauge reads 16·6 feet, or the rise is 0·15 of a foot? I read this daily in the river news columns of our newspapers, and will be very glad if you will explain how it reads in parts of feet or inches, as there is a dispute about it. A. The datum of river gauges is at low-water mark. The published readings of the height of water are in feet and tenths above low-water mark. The variations are also in tenths or hundredths of a foot. Thus: 0·2 is 2 inches and 4 tenths of an inch, and 1·7 is 1 foot 8$\frac{4}{10}$ inches. Also 0·15 is 1 inch and $\frac{8}{10}$ of an inch.

(4401) O. F. H. asks: 1. Which will do the most work according to weight, the steam engine or the electric motor, including with both all accessories? A. As the electric motor is not a prime motor, you will be obliged to include the weight of the prime mover in making your estimate. This being the case, of course a steam engine would weigh less than the electric motor with its prime mover. If the prime mover is disregarded, the electric motor would weigh much less than a steam engine of the same power. 2. Which will produce the most power in a given short time according to weight—the primary or the secondary battery? A. The secondary battery.

R. Bros. & Co. ask how to make ambergris extract.—C. T. L. asks for a receipt for rice soap.—R. N. C. wants to know the antidotes for the principal poisons.—H. W. J. asks how hair washes are made.—P. W. S. wants to know how to bend glass tubes.—E. C. W. asks how to make the powders for a gasogene.—B. D. L. asks how to renovate oil cloths.—F. U. G. asks how to make gelatine sheets.—J. C. O'B. wants to know how to repair books.—C. H. H. asks how to make the composition for carton pierre ornaments.—E. W. S. wants to know how to make resin for violin bows.—A. E. N. asks how to filter water for drinking purposes.—G. G. H. asks for information on core sand.—B. C. S. asks how sand blast engraving is done.

Answers to all of the above queries will be found in the "Scientific American Cyclopedia of Receipts, Notes and Queries," to which our correspondents are referred. The advertisement of this book is printed in another column.

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May 24, 1892.

AND EACH BEARING THAT DATE.

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