SCIENTIFIC AMERICAN

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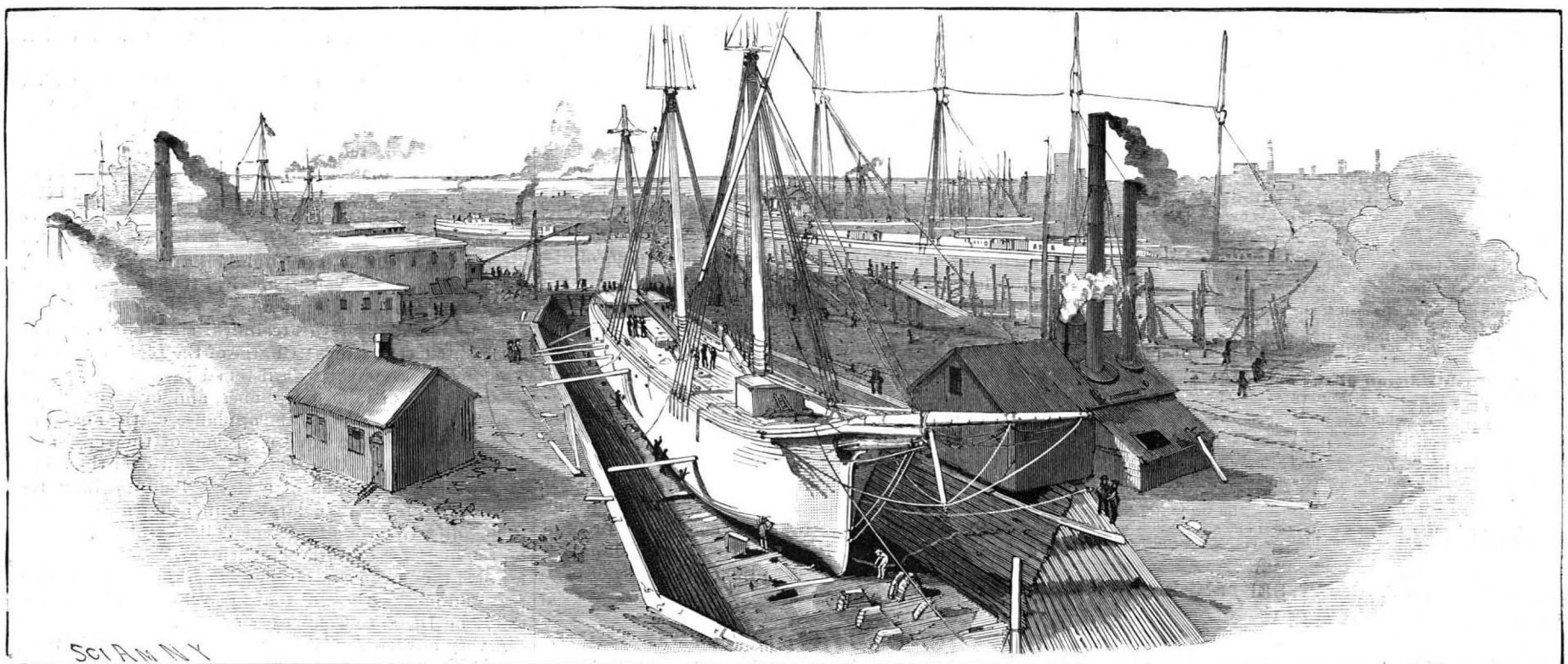

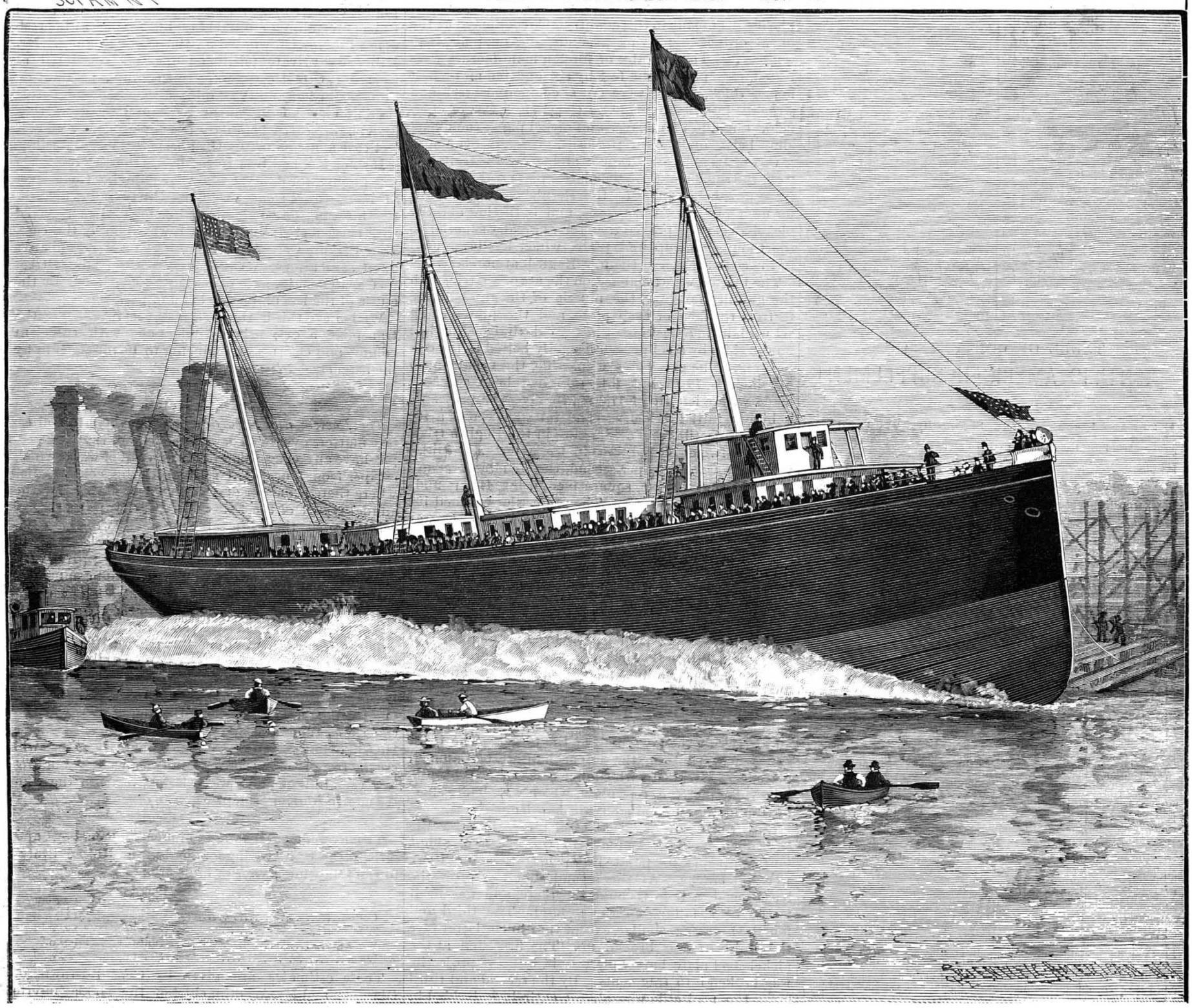

SHIPBUILDING ON THE GREAT LAKES—SIDE LAUNCH OF 3,000 TON STEAMER NORMAN, AT CLEVELAND, OHIO.—[See page 197.]

Scientific American.

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NEW YORK, SATURDAY, SEPTEMBER 27, 1890.

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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 769.

For the Week Ending September 27, 1890.

Price 10 cents. For sale by all newsdealers.

AN EVENING ELECTRICAL SCHOOL.

A contemporary has made the suggestion that there is need of a place in this city where instruction in electricity and the kindred sciences could be obtained in the evenings. Many young men enter the service of the electrical companies and are thrown entirely upon their own resources as regards future advancement in technical knowledge. We are in constant receipt of inquiries as to the best means of obtaining a knowledge of electrical engineering. Many who are anxious to become electrical engineers cannot afford the time and expense incurred by pursuing a college course. For such aspirants an evening school of electrical science would have an incalculable value. The equipments and general laboratory appliances should be of the best. The instructors should be thoroughly competent. It is not going too far to say that such an institution could be filled with the most earnest class of students at once. There are many young men who are obliged to be self-supporting, yet who by every intellectual qualification are well fitted to take the highest standing if they could but obtain an education.

The lesson of the day in this city seems to be that our electrical systems are not properly cared for. The numerous deaths that have occurred show the need of intelligence in administering electrical systems of distribution. There is no doubt that there is room for a better class of men in the electrical profession than have hitherto filled its ranks. It is also safe to say that there are a very large number in those ranks who long for technical instruction and who are in a position to profit by it. Occupied during the daytime with practical electrical work, without facilities for investigating its theory, they inevitably become empirics. This they become in the face of the fact that they are the best material for our future electrical engineers. It is not right that advancement should be denied to any one really worthy of it. No more convincing proof of such worthiness could be given than the willingness with which young men accept the lower grade of positions in electrical works.

TESTING ARMOR PLATES FOR OUR WAR VESSELS.

One of the most thorough trials of heavy armor plating ever made in this country was conducted at the naval ordnance proving grounds, at Annapolis, September 18. Three plates of foreign manufacture were tested, each plate eight feet by six, and ten and a half inches thick. They were (1) a compound steel and wrought iron plate, made by Cammell & Co., of Sheffield, England; (2) a steel and nickel plate, the nickel alloy being about four per cent, made by Schneider & Co., of La Creusot, France; and (3) an all-steel plate from the same makers. The latter plate was similar to those now being made at the Bethlehem Iron Works for use on our new war vessels, and both that and the nickel-steel plate proved themselves greatly superior to the Cammell compound plate, which has been used in the construction of the new English armorclads.

The targets were arranged on the arc of a circle, with the gun in the center, the muzzle of the gun being 28 ft. from the face of each plate, and the plates being set upright in a backing of heavy oak timbers, flanked on the sides by steel posts, all solidly bolted to the oak backing. The gun was a 6 in. rifle, the usual length of which is 16 ft., but this gun had been specially made with a length of 17½ ft., to give the projectile a higher initial velocity. The initial speed of a 100 pound projectile from a 6 in. gun in the English trials was 1,976 ft. per second, but in these tests the initial velocity was 2,075 ft. per second, the chamber pressure being 15 tons to the square inch, using 44¼ pounds of powder to the charge. The projectiles weighed 100 pounds each, and were made by Holtzer & Co., at Unieux, France; they were of forged steel, with points of chrome steel, and each 17 in. long.

Four shots were fired at each plate, striking respectively in order near the right and left hand corners at the bottom and top. At the first shot on the Cammell compound plate there were many flying fragments, and the projectile went entirely through the plate and eleven inches into the backing, the metal around the hole being crushed into many small pieces, and the plate being considerably cracked. The second shot also pierced the plate and increased the size and number of the cracks, scaling off the steel face in places and wrecking the lower half of the target. The third and fourth shots on the upper half of the Cammell plate were attended with similar results, the projectile each time piercing the plate, which was badly shattered and almost completely dismantled.

In the first shot at the all-steel plate, the projectile embedded itself in the plate to the depth of about fourteen inches, its point just penetrating, but there were no cracks. At the second shot the projectile barely made a hole through the plate, and was itself forced back, falling on the ground. The third and fourth shots were similar, except that in the latter case the projectile was broken up. The first shot at the nickel-steel plate barely pierced it, but the projectile was broken into fragments. By the second and third shots the projectile was almost entirely embedded in the plate, but did not go through it, and by the fourth shot the projectile was broken up, its point having just pierced the plate, in which, however, no cracks were made.

Although further tests are to be made of the all-steel and nickel-steel plates, using an eight-inch gun, the compound plate was so badly damaged that it was decided not to risk another trial of it hereafter. The trial described was conducted under the direction of a board of officers, with Rear-Admiral Kimberly as president, and Secretary Tracy was present, giving it his personal attention.

Dancing to Music from Afar Off.

An interesting and really notable musical and vocal entertainment was given recently from New York to a very large audience assembled at the Grand Union Hotel, Saratoga.

As our readers will conjecture, the audience, which numbered at times no less than 800 people, was brought *en rapport* with the performers by means of a "long distance" telephone circuit running a distance of 180 miles from 18 Cortlandt Street, New York, to Saratoga. From Cortlandt Street a circuit had been run to the Madison Square Garden, and the concert being given by the Strauss orchestra was taken in alternation with the other numbers of the programme, which comprised selections by the long distance orchestra, flute and cornet solos, a whistling song, and glees by members of the technical staff, one of whom also recited Tennyson's "Charge of the Light Brigade." The orchestral music was listened to at Saratoga by means of sets of hand telephones, and every note was heard distinctly, even to the applause of the audience gathered at Madison Square. Some of the songs and solos and the recitation were heard all over the room at Saratoga by means of a single loud-speaking receiver provided with a large funnel-shaped resonator to magnify the sound. Great delight was expressed by the audience at Saratoga with the evening's entertainment, and the exhibition was considered one of the best and most successful that has yet been given over the Long Distance Company's system.

A very novel and striking use was made of this telephonic concert by Mr. A. S. Hibbard, who happened to be entertaining a number of his friends at his residence in Morristown, N. J., the same evening. Mr. Hibbard's private telephone line was connected at Cortlandt Street with the circuit running to Madison Square Garden, and the strains of the famous orchestra were heard so plainly in the house at Morristown that dancing was carried on to the accompaniment with perfect ease and comfort by the guests there assembled.

If some one had told Herr Strauss that his orchestra was playing for dancers who were enjoying themselves at Morristown, some twenty or thirty miles distant, the information would probably have been received with sheer incredulity, yet such was actually the case. Two Strauss waltzes were enjoyed by Mr. Hibbard's guests, and afterward the orchestra at Cortlandt Street was switched in, and dancing was continued by the music of the less ambitious band of performers.

We believe this is the first instance recorded of the transmission of music by telephone with sufficient volume and clearness for dancing to be indulged in by the listeners.—*Electrical Engineer.*

Waste of Water.

The Review and Record, a paper devoted to real estate matters over in Brooklyn, concludes that few people have any conception of the amount of water which escapes from faucets left running during cold weather where there is danger of freezing over night. In the annual report of the Zanesville, Ohio, water works, recently issued, there is a table published which is sufficient to astonish the unthinking who indulge freely in the water waste business. The table given gives various sizes and pipes, head and pressure, and commences with an aperture the diameter of which is one sixty-fourth part of an inch, equivalent to that of a cambric needle. Under a head—we will say of 150 feet—equivalent to a pressure of almost 65 pounds to the square inch, the quantity of water which would escape during the year, if always open, would reach 26,280 gallons, or through an orifice the size of a pin, equal to one thirty-second of an inch, the quantity escaping in the same time and under the same pressure will be 115 632 gallons. Where so large a quantity as that will escape from a small orifice it is only a question of figures to ascertain how much water is lost through the winter months during the prevalence of frost.

THE average yearly wages of men, women, boys, and girls in the United Kingdom and in the United States in the following classes of mills are:

	United States.	Great Britain.
Cotton	$329.33	$179.50
Woolen	364.34	165.00
Worsted	361.99	151.00
Linen	305.44	126.00

These estimates are given by Consul Brown, of Glasgow, and Mr. Wadlin, chief of the Massachusetts Bureau of Labor Statistics, in his latest report.

POSITION OF THE PLANETS IN OCTOBER.

VENUS

is evening star. The distinguishing feature of the month is her arrival at her period of greatest brilliancy. This event occurs on the 29th, at 8 h. A. M., 36 days before her inferior conjunction. She is now passing through the phase of the moon in her last quarter. Before the 29th, her increasing diameter as she approaches the earth more than counterbalances the decrease in her illumined disk, and her luster increases. After the 29th the still increasing diameter fails to counterbalance the decrease in her illumined disk, which has become a rapidly narrowing crescent, and her luster decreases. Observers are fortunate who command a view of the southwestern horizon, and can watch this peerless star as night after night she moves with charming grace, low in the south, and disappears in the west almost before the twilight fades.

Venus sets on the 1st at 7 h. 15 m. P. M. On the 31st she sets at 6 h. 26 m. P. M. Her diameter on the 1st is 27″.6, and she is in the constellation Libra.

JUPITER

is evening star. He passes, during the month, an interesting epoch in his course, his quadrature with the sun. This event occurs on the 26th, at 9 h. P. M. He is then 90° east of the sun, is on the meridian at sunset, and is in fine position for observation. Jupiter on the meridian, and Venus near her greatest brilliancy at the same time, form a combination that lovers of the stars will greatly enjoy.

Jupiter sets on the 1st at 0 h. 17 m. A. M. On the 31st he sets at 10 h. 29 m. P. M. His diameter on the 1st is 41″.2, and he is in the constellation Capricornus.

MARS

is evening star. He is advancing on his eastward course, and approaching Jupiter, the space between them rapidly lessening. At the close of the month the two planets are about 8° apart. Mars will be near the moon on the evening of the 19th, though the conjunction occurs on the morning of the 20th, when moon and planet are only 33′ apart. Venus, the moon the day before the first quarter, Mars and Jupiter will then form a celestial picture of exceeding beauty.

Mars sets on the 1st at 9 h. 57 m. P. M. On the 31st he sets at 9 h. 42 m. P. M. His diameter on the 1st is 10″.0, and he is in the constellation Sagittarius.

MERCURY

is morning star. He reaches his greatest western elongation on the 15th, at 1 h. A. M., when he is 18° 10′ west of the sun, and may be easily found by keen-eyed observers. He rises at that time an hour and a half before the sun, and is 9° north of the sunrise point.

Mercury rises on the 1st at 5 h. 31 m. A. M. On the 31st he rises at 5 h. 40 m. A. M. His diameter on the 1st is 9″.8, and he is in the constellation Virgo.

URANUS

is evening star until the 20th, when he becomes morning star. He is in conjunction with the sun on the 20th, when, passing to the sun's western side, he commences his course as morning star.

Uranus sets on the 1st at 6 h. 18 m. P. M. On the 31st he rises at 5 h. 30 m. A. M. His diameter on the 1st is 3″.4, and he is in the constellation Virgo.

SATURN

is morning star. He is a conspicuous object in the morning sky, rising about 2 h. A. M. when the month closes.

Saturn rises on the 1st at 3 h. 33 m. A. M. On the 31st he rises at 1 h. 52 m. A. M. His diameter on the 1st is 15″.4, and he is in the constellation Leo.

NEPTUNE

is morning star. He rises on the 1st at 8 h. 22 m. P. M. On the 31st he rises at 6 h. 18 m. P. M. His diameter on the 1st is 2″.6, and he is in the constellation Taurus.

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

THE HORSE HAIR SNAKE.

BY NICOLAS PIKE.

Much has been written of late in relation to the so-called horse hair snake, the *Gordius aquaticus*. One of the New York journals has recently published a very remarkable account from Ansonia, Conn. The question is asked, "Will a hair from a horse's mane or tail develop into a snake if placed in water?"

Science says not; but Mr. T. H. Pierce, of Mount Pleasant, Derby, says: "Scientific men don't know everything." Then follows the astounding statement that Mr. Pierce claims under certain conditions he can and has produced from horse hairs perfectly formed snakes!

The heads were perfectly developed, with eyes and mouth, the reptile having life and motion and progressed in length and thickness. He has at present three in process of evolution, with which he expects to silence doubts as to his statement. Mr. Pierce has exhibited two horse hair snakes, as he calls them, and those who saw them are divided in opinion as to whether they are a species of water snake or really produced from a horse hair! The gentleman says it takes about three months to develop the snakes! Oh, shade of Darwin! is evolution come to this?

I will give a slight *resume* of the life history of the horse hair snake, which is the *Gordius aquaticus* or hair worm, a true entozoon. It is common in most of our fresh ponds and rivulets, being well known to nearly every farmer's boy in the country, and they mostly believe in its development from a horse hair. These worms are, when full grown, from 5 to 7 inches long, and about as large round as a coarse cotton thread, and have a golden stripe down both sides of the body. It has no jointed skeleton internally, but a jointed coverings, as in insects, and the male is distinguished from the female by having the tail bifid.

Nothing is known of their reproductive powers. The eggs are found, but whether they are vivified before or after passing the female is not known. The ova are deposited in strings like a chain on the sides of shallow ponds or creeks, and they are greedily swallowed by various aquatic insects. Thus from the time the egg is hatched, the first part of the worm's life is spent as a parasite, absorbing nutriment from the body of its unlucky host. For a long time it was supposed these creatures had no mouths, but science at length decides that they have not only one, but a minute circular mouth or sucker on each side of the head. From each of these a cone-shaped tube extends toward and at its base joins the alimentary canal. At times the whole body seems filled with ova, and under the microscope they have been found to contain from a few scores to thousands.

The large water beetles, the *Dytiscus marginalis* and *D. niger*, are very subject to these parasites. They have been found in a cricket (*Gryllus sp.*), and once when dissecting a large water snake, the *Tropidonatus sipedon*, between the outer and inner epidermis lay some of these worms. They are graceful swimmers, but when taken from the water it irritates them so much that they twist themselves into such an intricate knot that it is almost impossible to unloose it. These worms are aptly named from Gordius, that old Phrygian king who tied the world-famous knot on which the empire of Asia depended. I can only say if it possessed the complications the bodies of the *G. aquaticus* are thrown into, I do not wonder at that choleric young conqueror Alexander solving the puzzle by cutting it in pieces with his sword.

When the ponds dry up in the long droughts of summer, such as we had a few years ago, all the usual inhabitants of such places totally disappear, and the clayey bottoms become so parched and dry they can be walked over. I was once digging in a dried-up pond, for I was curious to see if I could find any of the abundant animal life that had so recently swarmed there in the muddy water. Among other things I found quite a number of the Gordius worms stiff and dry in the clay. They were carefully removed and carried home in a box by themselves, that they might not be injured. My intention was to dissect and examine them microscopically at my leisure, and they were laid away for some days, as I had no time then to attend to them. When at last I thought about them, I was going to soak them in a weak alcoholic preparation I keep for such purposes, before dissecting them. I found my bottle empty, so laid the worms in a bowl of water, and left them overnight. To my surprise, in the morning they were alive, and swimming about in a very lively fashion. I took one out, when the furious knotting process began, and I placed it on a plate in the broad sunlight, and left it for two days, when it was again dried up, but on putting it in water it was all activity again in a few hours. Thus it will be seen how tenacious of life the creature is. I only know of one species of Gordius inhabiting the United States, but it is possible there may be another worm here of a closely allied genus, the *Mermis*.

In England both genera exist, and they so closely resemble each other, only an expert who has studied both can determine them. The ova of the *Gordius* worms are found in water or mud, and those of *Mermis* in damp earth, and even on low plants. Both are developed in the intestines of insects who swallow the ova—to their own utter destruction.

A curious case was told me by a friend that led me to suspect the presence here of both genera. He was breeding a number of the larvæ of the large Cecropia moth in a cage. All throve but one, that looked sick and turned dark. The others completed their cocoons, but the sick one lay dead at the bottom of the cage, with some small white worms around it, and on examination the whole body was found to be filled with them. Some were sent to an authority on the subject, and they were determined as *Gordius aquaticus*. It was difficult to account for their presence, as the Cecropia larva was hardly likely to go to water. Now it occurred to me that they might be worms of a *Mermis*, and the larva had swallowed the minute ova when devouring the leaves of some low-lying plant, in its early stages. I leave the question for experts to decide.

Both, as far as I know, are innocuous to man, but there is a species of Gordius, the *mediensis*, very common in the East Indies and Africa, often measuring several feet in length, yet not larger round than our *aquaticus*. We may rejoice that it is not here, for it is very dangerous to man, frequently producing ulcers, gangrene, and even death, when it enters the human body. It usually inserts itself when very small in some part of the lower extremities, often just above the ankle, and the flesh closes rapidly over it. Indians who stand long in fresh water pools, fishing, frequently get them.

During my sojourn in the East I met with several severe cases, and on one occasion extracted a worm from a Malabar's leg. It had entered near the foot and worked its way up the leg to the trunk of the body, rapidly increasing in length, and would doubtless have killed him in time. He had been strong and healthy, and that, with youth on his side, had enabled him to battle against the terrible scourge. It was, however, beginning to tell upon him, when I told him I could cure him if he would consent to an operation. He was informed that certain death was before him unless the worm was extracted, and he even expressed a willingness to lose his leg if he could be cured, but that was needless.

I made a small incision and secured the end of the worm, which I carefully fastened with a thread to a piece of pine wood some inches long, as large round as a pen holder. After the end of the worm was safely fixed, I began to turn the stick till the tension of the worm was all it could bear without breaking. This operation was done carefully many times for about eleven days, when success crowned my efforts, and the worm was taken whole from the man. It was a work of considerable patience on both our parts, and the agony of mind the man endured every time I turned the stick lest the worm should break was very great. Had a small piece of it been left in the flesh, it would have grown again, and as it was approaching vital parts, it would have been worse than ever, and all the trouble for nothing. He, however, stood it well, and though greatly emaciated when it was all over, with a little care he was soon well and strong again. The worm is now in the Museum of Comparative Zoology, at Cambridge, Mass., as I sent it in one of my *envois* to the late Professor Louis Agassiz, with a full description of its habits.

I have no doubt that one reason why the idea of the horse hair snake has been propagated is from ignorant persons who have had various aquatic insects in clear water, watching them for study or curiosity. Knowing they put in only certain live creatures, and some day finding these live worms, they were astonished, but they must be accounted for in some way. The chances are they developed from a pet beetle that in its native pond made a feast of some ova of the Gordius, to be paid dearly for later when they were hatched. The watchers little knew, when the beetle lay dead, it had given life to these worms that had fed on its vitals—but so it is, in this as in all creation, in the midst of life we are in death, and from death still comes life.

Electricity in the Printing Office.

A new use for electricity has been found at the Cook publishing house. In the office of the superintendent ten electric lamps are arranged in separate compartments of a frame or box, somewhat similar in appearance to the annunciators seen in hotel offices. The lamps are concealed from view, apertures in front of the compartments being covered with colored glass, each having its distinguishing color. The lamps are connected by means of electric wires with the automatic counting machines on the ten large printing presses located in an adjoining building. When the presses are in operation, the electric circuit is opened and closed by the working of the counting machines, causing quick flashes of light in the lamps. Thus every sheet of paper printed in the establishment telegraphs its record to the office, where the operation of each machine can be seen and its speed or delays noted.

In this connection it may be interesting to note that the speed of the large perfecting press is so great that it was found necessary to record each two sheets printed instead of single sheets, and even then the flashes of its lamp are almost continuous in appearance, showing that while the press is not quite as quick as lightning, it is too fast for the eye to follow.

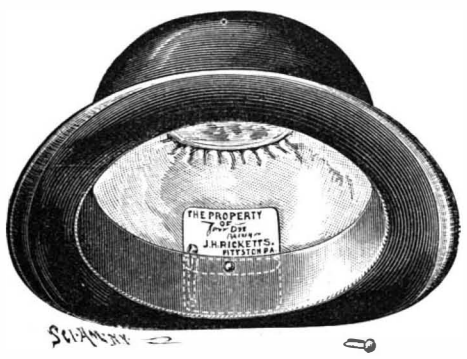
It is believed that this is the first application of electricity to purposes of this kind, and may serve as a valuable hint to managers of large establishments who wish to be enabled to see the operation of their machinery while working at their desks.—*Elgin, Ill., Daily News.*

Progressive Knowledge.

Some one says: At ten years of age a boy thinks his father knows a great deal, at fifteen he knows as much as his father, at twenty he knows twice as much, at thirty he is willing to take his advice, at forty he begins to think his father knows something, after all, at fifty he begins to seek his advice, and at sixty—after his father is dead—he thinks he was the smartest man that ever lived.

AN IMPROVED HAT TAG.

The illustration represents a very neat and simple form of tag, adapted for attachment to the sweat band of a hat or cap, and designed to bear the wearer's name and residence, or other desired information. On the reverse side is space for lot, number, size, price, brim, crown, dimensions, and block, a feature which hatters and wearers will appreciate. It is a patented invention of Mr. John H. Ricketts, corner of Main and Water



RICKETTS' HAT TAG.

Streets, Pittston, Pa. The tag is preferably made of celluloid, zylonite, rubber, or other waterproof material, with rounded corners, and has near the center of one side an eyeleted opening for the reception of a pivot pin by which the tag may be fastened to the sweat band. The pin consists of a head and two pliable members extending therefrom, to be bent in opposite directions upon the inner surface. The tag, thus secured, may be turned downward beneath the sweat band, as shown in dotted lines. Messrs. C. W. Findley & Co., Philadelphia, are agents for this tag.

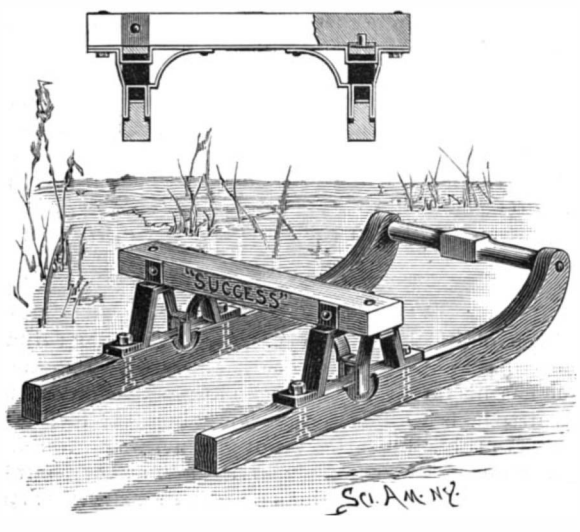
A Premium on Population.

At the last session of the legislature of the province of Quebec a bill was passed authorizing the government to offer a reward of one hundred acres of crown lands to the fathers of all families of twelve or more living children. The prolific character of the French Canadian *habitant* of the rural districts is proverbial, and no sooner was the bill passed than applications for the one hundred acres came pouring in with alarming rapidity. Up to date no fewer than 1,250 fathers whose quivers are full have presented their claims, and the Premier has been obliged to establish a special office in connection with the department of agriculture, with a superintendent whose duty it is to investigate the claims, which must be supported by the *cure*, the mayor, and the doctor of the place. The cause of this high birth rate among the agricultural classes of Lower Canada lies in the fact that early marriages are the rule; added to this the people lead a healthy life, morally and physically, and, though ready money is scarce, wholesome food is plentiful. This bill, which has now become law, will tend to keep the members of large families at the work of agriculture, and while it will act as an *encouragement des autres*, will powerfully assist in the population of the unsettled districts.—*N. Y. Med. Jour.*

THE "SUCCESS" BOB SLEIGH.

In the sleigh shown herewith, styled by the inventor the "Success," the runners are designed to be flexible and free to move to conform to uneven surfaces, while two bearings are furnished upon the sleigh runner, one on either side of the central point. The knees bear on the tops of the runners at two points, and each knee has on its flat upper surface a stud entering a hole in the beam through an apertured plate secured thereon. To the under surface of the beam is secured a cast or forged double standard, as shown in the sectional view, which extends centrally under each knee, and has downwardly projecting forked arms adapted to embrace the upper portion of the runners and prevent them from moving laterally. The sides of the runners are recessed so that the outer faces of the forks lie flush with the inner and outer sides of the runners. Arranged in this way, each runner is free to move independently of the other, and the load is so distributed as to admit of a light and strong construction. When the standards are to be cast they are preferably made in two pieces, but when of wrought metal they are formed as one double standard.

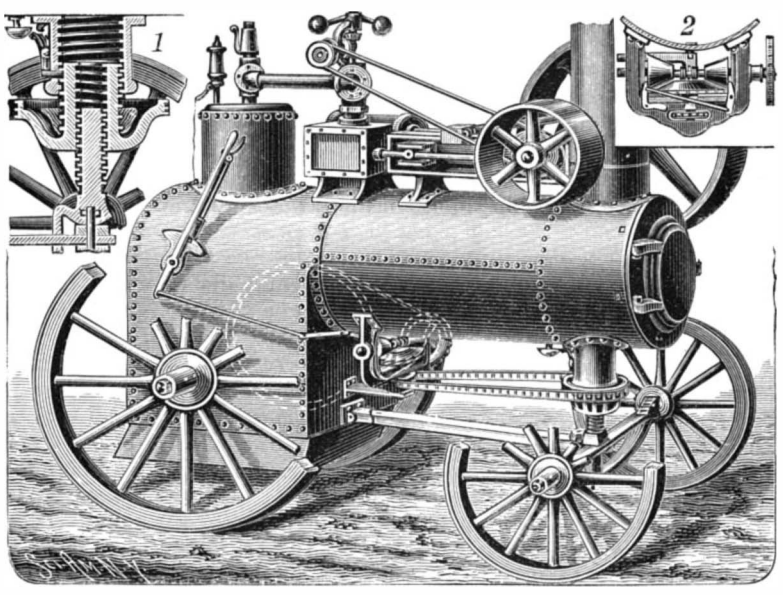
For further information relative to this invention address Mr. C. Nichols, the patentee, Helena, or Messrs. A. J. Davidson & Co., Helena and Bozeman, Montana.



NICHOLS' BOB SLEIGH.

A LEVELER FOR TRACTION ENGINES.

The illustration represents a construction whereby the boiler of a traction engine may be easily leveled when resting upon or traveling over uneven ground. It forms the subject of a patent issued to Mr. Frank Saxon, of Worthington, Minn. Bolted to the under side of the boiler, near its forward end, is an internally threaded drum, fitting within which is the screw-threaded hollow hub of a sprocket wheel, the hub being also internally threaded to fit a vertical screw-threaded support held by a king bolt on the forward axle, as shown in Fig. 1. The arrangement is such that the sprocket wheel will have a double action, screwing the hub into the drum and screwing the support into the drum—or the opposite—thus raising or lowering the boiler. Upon the hub are notches adapted to engage a bell pawl pivoted on the rear of the drum, whereby the bell will be sounded when the boiler reaches a level position, or either extreme in its up and down movement. In a depending bracket secured to the under side of the boiler at its rear is a short vertical shaft carrying on its upper end a beveled friction wheel or pulley, as shown in Fig. 2, the shaft also having a sprocket wheel connected by a chain with the forward sprocket wheel. Mounted in the rear bracket, above



SAXON'S BOILER LEVELING DEVICE FOR ROAD ENGINES.

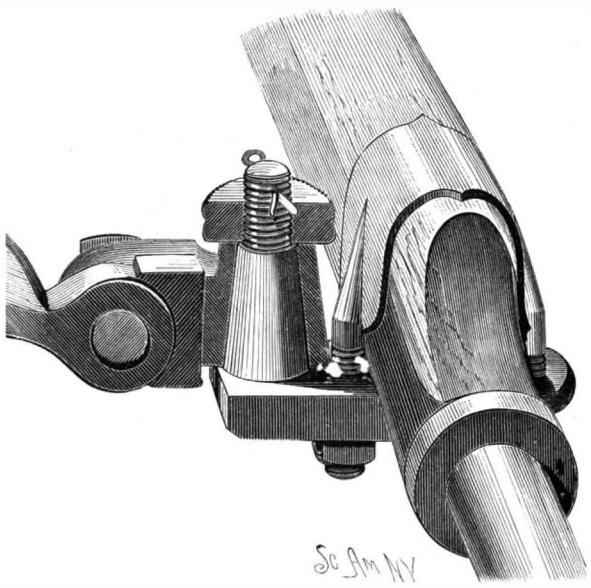
the beveled friction pulley, is a horizontal shaft, longitudinally movable in its bearings, on which are arranged conical friction pulleys, adapted to bear against the opposite sides of the beveled face of the friction wheel, so that when one of the cone pulleys is brought into engagement therewith it will turn in one direction, the engagement of the other cone pulley turning it in the other direction. The shaft has on one end a sprocket wheel, to which power is transmitted by a suitable chain from the engine fly wheel, as shown in dotted lines in the main view, and centrally on the shaft are collars between which fit the bifurcated ends of a bell crank lever, pivoted to the boiler, and connected by a rod with a lever pivoted in easy reach of the engineer. Pivoted to the sides of the bracket are dogs to prevent the engagement of the friction and cone pulleys without the movement of the lever, adjacent to which is a rack with a central notch to hold the lever in position. By moving the lever forward one of the cone pulleys is made to engage the friction wheel, a backward movement of the lever moving the opposite cone pulley into engagement with the friction wheel, thus communicating motion to the forward sprocket wheel to raise or lower the boiler.

Indian Mounds in the Capon Valley.

A region very rich in Indian remains, whence quantities of stone arrowheads and other products of aboriginal manufacture have been collected, is found in the Capon Valley, West Va. Dr. J. H. Porter has reported very rich finds, and it seems as if the region were worthy of special attention from American anthropologists. One of the mounds, a regular ellipse, nearly 200 feet long, is described, but has not yet been excavated. Dr. Porter's work will be the subject of a report by himself to the Smithsonian Institution.

AN IMPROVED THILL COUPLING.

The device represented in the accompanying illustration is simple and durable in construction, and is designed to permit of quickly changing the shafts for



GOSNEY & JONES' THILL COUPLING.

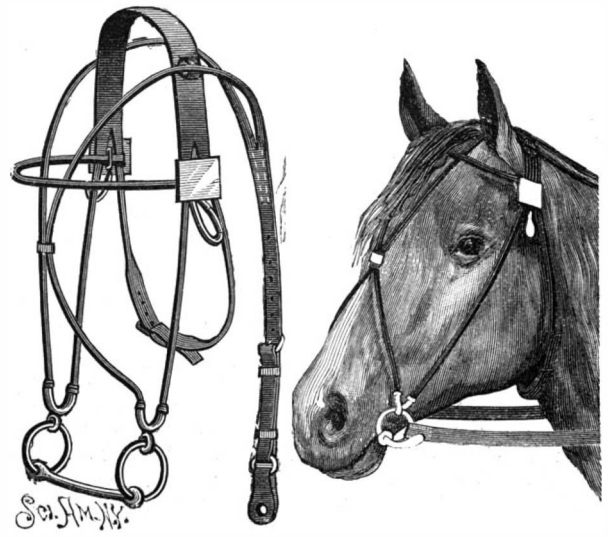
single or double teams, without disturbing the relative positions and connection of the shafts with the shaft box. It has been patented by Messrs. John Gosney and David B. Jones, of Wilmington, Delaware. The clip is attached in the usual manner to the front axle, and on the front projecting end of the clip plate is secured a substantial pin or stud on which is fitted to turn a shaft box, our views representing the shaft box partly cut away to show the pin. This shaft box is held in place on the pin by a nut, the latter being locked in position by a split key passing through the threaded upper end of the pin on top of the nut. The shaft box has the usual fork in which is held the bolt forming the pivot for the eye of the shafts, and in such fork is held a block of rubber to act as an anti-rattler. With this construction the shafts can readily be detached from the clip plate without removing the bolt, by taking out the split key and unscrewing the nut, when the shaft box lifts off the pin and another shaft box can be placed thereon and similarly locked in place.

For further information relative to this invention, address Mr. D. B. Jones, 841 Market Street, Wilmington, Delaware.

AN IMPROVED BRIDLE.

The bridle herewith represented is simple and comparatively inexpensive, and forms a combined bridle and check device, readily convertible for service with either an overdraw checkrein or a side checkrein. It is also adjustable to fit animals' heads of different sizes, making an elegant, light, and very substantial bridle and check. It has been patented by Mr. John H. Rafferty, of No. 12 Green St., Worcester, Mass. Except its metal trimmings and bit, and the brow band, this bridle may be made practically of one continuous leather strap, the checkrein strap being made partly of the leather straps forming the bridle, and stitched fast to the bridle straps. The cheek and face pieces of each side are formed as continuous straps connected at one end to the crown strap, and extending rearward at the other ends to form a checkrein.

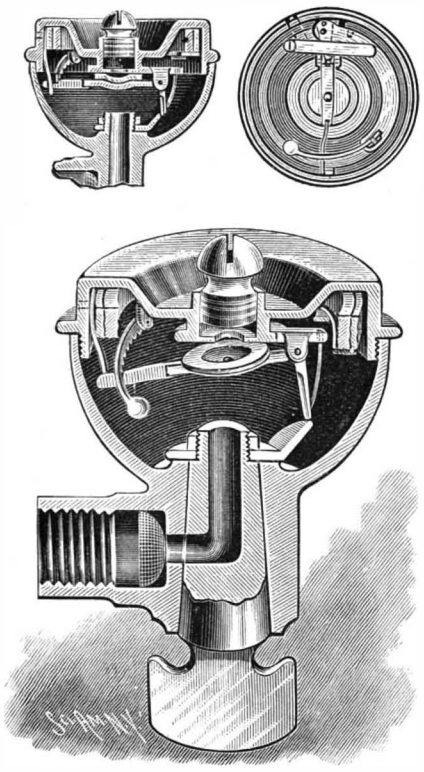
W. G. of Ill.—The publication of the ARCHITECT AND BUILDERS EDITION of the SCIENTIFIC AMERICAN was commenced November, 1885. We can furnish you all the numbers from that date for $12. If you order bound copies, they will cost more.



RAFFERTY'S BRIDLE.

AN IMPROVED GAS BURNER.

The illustration represents a burner from which the gas is automatically shut off when the flame is extinguished while the pressure of gas continues. It has been patented by Messrs. Athanase P. Frechette and



FRECHETTE & DUPUIS SAFETY GAS BURNER.

Peter M. Dupuis, of Carson City, Nev. The larger view represents a longitudinal section of the burner with interior parts adjusted to permit the flow of gas, one of the smaller views showing the parts adjusted to shut off the gas, and the other being an inverted plan view, the safety valve being closed. The burner body or shell has a cap screwing into its top, the central part of the cap being depressed and having a cylindrical flanged aperture above which the burner tip projects. Below this aperture a disk valve is held, on the upper edge of a swinging bar pivoted at one end between depending ears, and there is integral with the pivoted end of the bar a downwardly projecting arm adapted to engage a toe projecting upward from a washer clamped on the end of the plug, so that when the washer is revolved, as in opening the plug valve, the bar will be swung downwardly, opening the disk valve. A strong plate spring returns the arm when free to vertical position, thus closing the valve. Within the walls of the cap piece are seated two rings, an inner and heavier ring of brass, and an outer ring of steel, the rings being severed and held closely to the side of the cap by a screw near one end. Two dowel pins are laterally inserted in the rings near their ends on each side of the cuts, and when the rings are differentially expanded by heat from the burner they separate at the ends, so that upwardly projecting small pins on their opposed ends will be thrown out of line. Fitting on these pins, and conforming to the curvature of the inner brass ring, on which it freely works, is a curved bar, lightly held in place by a finger spring, the free end of this bar having a ratchet-cut curved extension, on the outer end of which is a ball weight. From the inner side of the cap a post projects downward, in line with the swinging bar on which is the disk valve, and on the outer end of this bar is attached a thin steel plate laterally elastic but edgewise rigid, this extension of the bar being adapted to rest on the lower end of the post when the bar is swung downward by opening the plug valve. The latter valve is always turned far enough to disengage the toe on its washer from the arm on the pivoted end of the bar carrying the disk valve, so that after the plug valve is opened the disk valve is held open by the extension of the bar on which it rests being engaged by the opposite post. The heating of the differentially expanding rings then causes the ratchet teeth on the extension of the curved bar connected therewith to slip over the plate extending from the disk valve under the post, but should the gas be extinguished without the cutting off of its flow, the ratchet teeth would be drawn the other way by the cooling of the shell and rings, and would dislodge the plate from its engagement with the post, when the plate spring bearing on the pivotal end of the bar carrying the disk valve would close the latter. The turning of the plug valve to light the gas resets the disk valve in open adjustment.

Living by Rule.

Oliver Wendell Holmes thinks that he owes his good health and the retention of his mental vigor, in his eighty-first year, to the extreme care he has long taken of himself. Never robust, he was still wiry in his earlier and maturer life, but since he reached eighty his hygienic vigilance is unceasing. The rooms that he daily occupies are equipped with barometers, thermometers, aerometers, every kind of instruments, in short, to prevent his incurring the slightest risk of taking cold. He knows that pneumonia is the most formidable foe of old age, and he is determined to keep it at a distance if possible. He never gets up until he knows the exact temperature, during winter, or takes his bath without having the water accurately tested. He lives by rule, and the rule is inflexible. His time is scrupulously divided, so much allotted to reading, so much to writing, so much to exercise, so much to recreation. His meals are studies of prudence and digestion. He understands the specific qualities of all ordinary foods, and never departs from the severest discretion in eating.

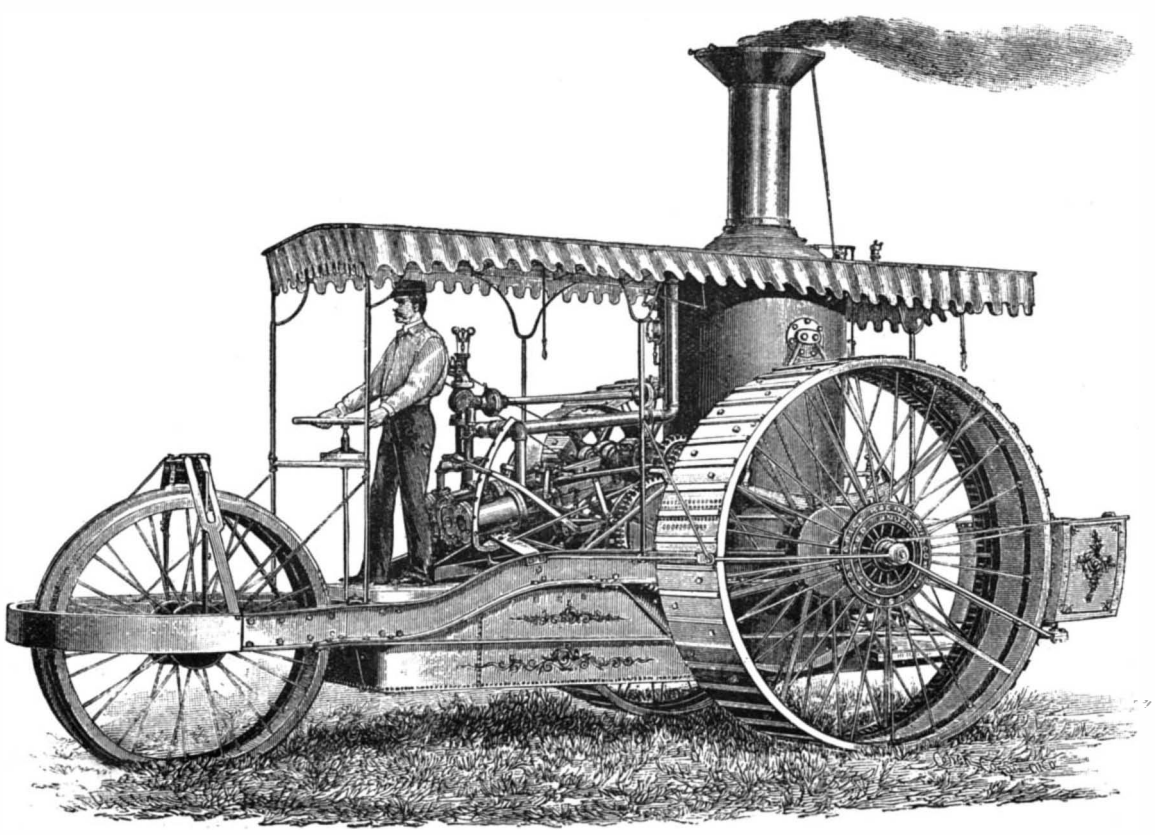
One might think that it would be a serious infliction to keep up existence by such precise, unvarying methods. But the little doctor enjoys them, having settled firmly in these habits years ago. Philosophic as he is about death, he has an eager curiosity to see how long he can live by following the laws he has rigorously prescribed for himself. He has long had various theories on the subject of health and longevity, and he relishes experimenting upon himself. He thinks sometimes that he may attain one hundred, which he would dearly like, if he could retain, as he has retained thus far, the full possession of all his faculties. —*Chicago Mail.*

IMPROVED FIELD LOCOMOTIVE.

Among the latest machines designed for use on large farms is the new field locomotive of Jacob Price, of Racine, Wisconsin, illustrated herewith. It is said that this machine pulled, near San Leandro, an outfit of twelve 11-inch plows in a dry, adobe soil, traveling at the rate of over four miles per hour in doing so, and maintaining the steam pressure at 130 pounds, without difficulty.

It is of about 100 horse power—as horse power is commonly figured; or, to express it in another manner, it will pull as much as 40 or 50 horses, besides propelling itself. Its weight is only 8½ tons. The carrying wheels are about 8 feet high and 26 inches wide. The steering wheel is 5 feet high and 14 inches wide. The boiler is an enlarged fire engine boiler of the most approved type, and is made strong enough to carry 200 pounds working pressure with safety. Its fire surface is 200 feet and its other heating surface (flues) 200 more, making a total heating surface of 400 feet. The main gears are steel rollers working on oiled steel pins.

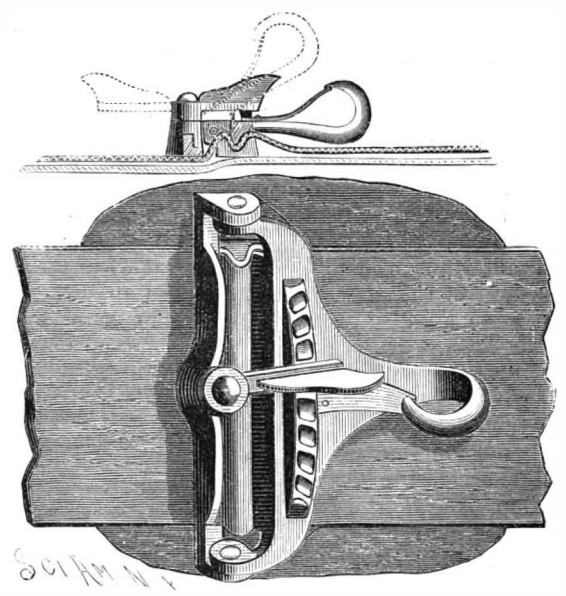
The entire machine is mounted on long, easy, elliptic springs in a manner that utterly obviates any interference with the working of the gears, a result, according to Mr. Price, never accomplished before. The machine has twin engines, piston valves, and link motion. It is adapted for plowing, running combined harvesters, freighting with wagons, hauling saw logs, or pulling of almost any kind, and is suitable for any stationary work, such as running thrashing machines, sawmills, etc.—*Min. and Sci. Press.*



IMPROVED FIELD LOCOMOTIVE.

AN IMPROVED BACK BAND BUCKLE.

The buckle shown in the illustration is designed to be quickly adjusted to place, and its clamping member is free from sharp or abrading surfaces, thereby preserving the band from mutilation. It has been patented by Mr. William D. Mitchell, of McComb City, Miss. Our engraving shows the buckle applied, and also a transverse section. In the upper surface of the base portion of the buckle are two parallel longitudinal ribs, in front of a longitudinal slot, and at the back is an offset having a central bore to receive a pin carrying a locking button, having a vertical wing to facilitate its manipulation. The hinge member of the buckle has on its under surface a longitudinal rib adapted to enter the space between the parallel ribs of the base, forcing a portion of the strap downward therein, and on its upper surface is a longitudinal ridge having a series of cavities or depressions, the ridge being higher at one end than at the other. The strap is passed upward through the slot of the base and over the two ribs, when it is locked in position by carrying the hinge member downward and moving the button to enter a convenient cavity in the ridge on top of the hinge member.



MITCHELL'S BACK BAND BUCKLE.

Magazine Rifle Firing at Bisley, England.

The report of the chief umpire of the brigade field firing with the new magazine rifle on August 16 has been issued. The troops engaged were the 1st Royal Rifles, Royal Scots, and Devon Regiment, with squadrons of cavalry and a battery of artillery. The umpire in chief remarks that the weather was stormy, with heavy showers, the atmosphere clear, and the wind strong and gusty. Firing was carried out with steadiness, and words of command were given intelligently and with decision by section commanders. The accuracy of range finders was fairly good, and the sights of rifles were properly adjusted. In the first phase of attack the percentage of hits was 14·64. In the second phase, when only marksmen and first-class shots fired, the distance being 1,100 yards, the percentage rose to 22 6, and in the third phase, when two battalions of mixed shots fired, the percentage was 14·86. This is the first time field firing has been practiced with the new rifle by a large body of troops.

IN the case of George Westinghouse, Jr., of the Philadelphia Natural Gas Company, against the Chartiers Natural Gas Company, for infringement of patent on the double safety in-vent pipe, Judge Acheson, of the United States court, decided that the defendant company had not infringed upon the patents of the plaintiff, and, furthermore, that the invention was not patentable. The suit involved vast sums of money.

Subterranean Gas in Indiana.

BY H. C. HOVEY.

The terrific explosion at Waldron, while justly regarded as due to local causes and altogether an exceptional occurrence, has served to intensify the interest already taken in the Indiana gas field and its various problems. In company with several hundred scientists, we recently visited the general region, and a fortnight later went over the ground more at our leisure. Nothing seems to delight the Hoosiers more than to play with fire. They had given us some pretty exhibitions of it at Indianapolis, to which the gas is piped from Anderson. We had become used to the flambeaux in front of the Dennison House and on the capitol grounds. And when, on alighting from the cars at Noblesville, we were taken to the vicinity of a plain iron tube about ten feet high and three inches in diameter, from whose top floated a lambent flame, we were interested, of course, and exchanged opinions and surmises as to the resources and possibilities of the subterranean agent exhibited. But when the man in charge of the show suddenly opened the valve, letting loose a pillar of fire eighty feet high, roaring so as to be heard for miles around, and making the earth tremble, every scientist remembered Waldron and fled! That rejoiced the natives. The man calmly closed the valve, shutting the genie into his box again; and presently our courage revived sufficiently to enable us to call for an encore. At each stopping place, Kokomo, Marion, Alexandria, Muncie, and Anderson, the performance was repeated with variations, until we began to feel like experts instead of novices, and fully competent to give any quantity of sound advice to our generous entertainers. The grandest display of all was aquatic and nocturnal. The citizens of Anderson "set the river on fire," and many thousands besides ourselves witnessed the feat. Through two great pipes laid to White River, at points on the bank half a mile apart, gas was played for an hour or more, sometimes along the surface of the water, and frequently under it, with an incessant change of beautiful colors; now a broadside of flame, and anon a fountain of fire, and yet again breaking from the steaming surface in myriads of burning bubbles. All this magnificent display of natural pyrotechnics amid the blackness of a cloudy night produced an indescribable and magical effect never to be forgotten. As our special train moved along on its return to Indianapolis, we had a farewell salute of flames from every well and jet in town and country. No wonder that Prof. Goodale, the president of the A. A. A. S., felt it his duty, in his parting address, to warn the citizens against a wicked waste of their gaseous heritage!

WHAT IS NATURAL GAS?

We conversed not only with the intelligent officers of the various corporations, but also with those whose notions, though crude, were often very interesting. The ingenious but fanciful theories advanced by Berthelot and other European chemists find numerous advocates. More than one person assured me that the gas was stored in a vast cavern or series of caves, into which it was constantly flowing as the result of the action of salt water on the melted metals existing in the interior of the earth. In keeping with this theory I was gravely told that the flow of the gas wells varied with the ebb and flow of the tides; that when the great explosion took place at Hell Gate, the shock was felt at Kokomo; and that there was undoubtedly an arm of the Atlantic reaching westward under Ohio and Indiana. This may account, in part, for the popular conviction that the stupendous chemistry of nature works constantly to replenish the wasted supply, and that the heaviest draughts made on the subterranean reservoir cannot, therefore, exhaust its contents.

"It is practically inexhaustible" is the phrase that has met my eye again and again in the enterprising dailies of the region, and there are scientists as well as boomers who echo the saying. We shall revert to the topic presently. But, as to the nature and origin of natural gas, a theory is held by the geologists that is far more tenable than that of the chemists just mentioned. Knowing that marsh gas and natural gas are nearly identical, each being a light carbureted hydrogen, the fair inference is that they share a similar origin. Stir the sediment at the bottom of a marsh and inflammable bubbles arise. The gas they contain comes from decayed vegetable matter. So it is with the larger accumulations in the beds of lakes and seas. The Mississippi "mud lumps" are examples, being mounds rising for several yards above the water, and emitting from their tops great quantities of carbureted hydrogen gas. The Spanish navigators found what still excites the wonder of voyagers across the Atlantic, namely, an area equal to continental Europe filled with an enormous mass of seaweed, single specimens being hundreds of feet long, and their stems huge vegetable cables a foot in diameter. Imagine some ancient Sargasso Sea to have had its mass of algæ caught in a bed of calcareous mud where it underwent slow decomposition. What a measureless quantity of gas would have been manufactured and afterward imprisoned in the surrounding limestone formed from the mud! The time would plainly come when, the work of decomposition being finished, no more gas could be made; but what had been created would stay there until in some way released. It might be called fossil marsh gas. Gas, petroleum, and coal are but three distinct results of the decomposition of ancient vegetable life.

THE TRENTON LIMESTONE.

The fact is at first hard to comprehend that natural gas, instead of being collected in a cavernous reservoir, is stored up in what appears to be solid limestone of the Trenton period. But this is true throughout the Ohio and Indiana gas fields. In the latter the Niagara limestone is always the surface rock, being about 400 ft. thick. Next below come nearly 600 ft. of Hudson River and Utica bituminous shales, that appear to roof over and confine the true gas bed. The sandstone found in the Pennsylvania field is wanting in Indiana. The Trenton limestone is next to the shale, and yields gas almost as soon as it is struck, although the custom is to drill into it for from ten to forty feet—never more than sixty. Very little petroleum has yet been found in Indiana. A peculiar stickiness observable in the rock brought up by the drill is taken as a sign that the boring approaches salt water, of which it is impossible to get rid when once it invades a well. The attempt has been made by great artificial pressure to force the water back and give the gas a chance, but without success. Microscopic examination proves all gas rock to be porous, no matter how solid it may seem to be. As nine-tenths of the Trenton limestone is non-porous, an observation of this one fact might have saved thousands of dollars wasted in drilling dry rock barren of what was sought. The elevation of the stratum above sea level is another important indication. At Muncie and Anderson it lies entirely above, and therefore there is no danger from salt water. At Kokomo, Marion, and Noblesville the stratum varies from sea level to 100 ft. below, and yet by due caution the salt water may be shunned. But where it lies from 200 to 700 ft. below, no gas is to be had. This partly explains the fact that, although the Trenton underlies perhaps fifty counties in the State, the productive gas region as thus far developed is limited to six or eight of them, namely: Delaware, Blackford, Madison, Grant, Hamilton, Howard, Tipton and Shelby. The average cost of a well in these counties being only about $1.200, many wells have been opened. Farmers have clubbed together for a neighborhood well merely for domestic purposes. Small factories have been started here and there in rural places. But the main borings have been in the vicinity of the larger towns.

THE USE AND ABUSE OF A GREAT TRUST.

When the first successful gas well was opened at Kokomo, in October, 1886, people simply stared at it for sixty days as one of the wonders of the world before putting it to any form of useful service. Lavish displays have been in order ever since on the slightest provocation. The rivalry between Kokomo, Marion, Muncie, and Anderson has led each to vie with the others in holding out alluring inducements to settlers and manufacturers, "free land and free fuel" being the watchword. The reward has been a very rapid growth, until each of the cities named claims from 10,000 to 12,000 inhabitants, while the smaller towns have increased proportionally. In some instances heavy municipal indebtedness has been incurred, while in others it has been avoided. Cities outside the gas belt have not only been allowed but encouraged to pipe the gas away. This was, doubtless, excusable concerning Indianapolis, as being the State capital; but what possible advantage can accrue to the favored region from permitting the two lines of eight-inch pipe that are now being laid as rapidly as possible from Kokomo to Chicago? It seems foolish for the people to allow themselves to be robbed of this precious gift of Nature, and wicked for them to waste it themselves, as so many persist in doing. Flambeaux, in country and town, have been burned by day and night. The illuminating and heating of dwellings and public buildings have been with little regard to economy. This homely virtue has been almost despised as unworthy of consideration by people to whom kind Providence has generously given "an inexhaustible supply." But the fact ought not to be concealed that the leading men of enterprise by whom the resources of the region are being developed are wisely anxious. Millions of dollars have been invested in glass works, paper mills, rolling mills, pulp works, straw board factories, and numerous other industries, and those concerned have a right to look ahead and ask how long this marvelous fuel is going to last.

I had the opportunity of sounding the officers of several natural gas companies, and every one of them felt that the time had come to call a halt on the reckless abuse of a great trust. Some of the largest consumers have very sensibly laid their plans on the theory that the natural gas will presently fail, in which event they expect to make use of ordinary fuel gas. It has been stated that certain wells which have failed have revived after being closed awhile, and have even been stronger than before, the plain inference being a continuous generation of gas. But I found no such instances in Indiana. On the contrary, the universal testimony was that when a well failed it was never resuscitated. Professor Orton's note of alarm has been sounded none too loud. Warning should be taken from the experience at Findlay and other Ohio towns. In 1886 the rock pressure at Findlay was 380 pounds to the square inch, but now in the original field it is but 170 pounds. The Natural Gas Company, of Lima, O., reported at the August meeting of the city council that within a single year the rock pressure had been reduced 120 pounds, with a prospect that the supply would wholly run out within two years! Meanwhile farms in that vicinity that were rented at $20 per acre yield at present only $10 or $15 per acre, leaving the lessees in a constantly increasing arrearage. In Indiana the rock pressure has likewise shrunk in four years from 340 pounds to 300, and in certain wells to 200, or even to 150, at which point the salt water begins to flow and the wells are worthless. At this rate the supply cannot last beyond five years. In new wells the pressure usually falls from 30 to 40 pounds soon after being drilled in, then it is stationary for several months, after which it fails rapidly, the rate being greatly augmented when it falls below 275 pounds. The fact should also be noted that new wells draw away from old ones if located too near them, the distance varying from a quarter of a mile to a mile and a half.

Practical men complain not only of the foolish waste of gas, but that scientific writers give them little definite information on matters so vitally important to thousands of people. They also complain because their own conservative measures are not suitably backed up by public sentiment and timely legislation. We are told that rock gas has been burning for ages along the shores of the Caspian Sea and amid the salt mines of China; but the consumers have practiced the proverbial Oriental economy. In Madison County alone seventy-five wells are reported, and it is claimed that each well yields an average of 8,000,000 cubic feet of gas per day. Of course but a very small per cent of this immense quantity can be used under existing circumstances. The attempt is being made to pack and anchor such wells as are not in immediate demand, holding their contents in reserve. The plan is a wise one. The Diamond Plate Glass Works at Kokomo own twenty wells, besides many acres of gas land; and yet they actually use but about 5,000,000 cubic feet of gas per diem. The remainder is held in reserve. Let this idea gain prevalence, let it be emphasized by men in authority, let it be enforced as far as possible by sound legislation, and while speculators and charlatans come to grief, the subterranean resources of Indiana may yet be husbanded till another generation enters the arena.

Wool Production of the World.

ESTIMATED BY THE LONDON BOARD OF TRADE.

Countries.	1860	1870	1880	1889
	Pounds.	Pounds.	Pounds.	Pounds.
United Kingdom.....	140,000,000	150,000,000	149,000,000	134,000,000
Continent of Europe..	500,000,000	485,000,000	450 000,000	450 000,000
North America.....	110,000,000	176,000,000	270,000,000	330 000,000
Australasia	60,000,000	175,000,000	308,000,000	450,000,000
Cape of Good Hope...	26,000,000	43,000,000	60,000,000	70,000,000
River Plate...	43,000,000	97,000,000	256,000,000	360,000,000
Other countries..... ..	76,000,000	69,000,000	133,000,000	156,000,000
Grand totals.....	995,000,000	1,295,000,000	1,626,000,000	1,950,000,000

The Acme Automatic Safety Engines.

These engines, manufactured by the Rochester Machine Tool Works, of Rochester, N. Y., and arranged for using either natural gas or kerosene oil, as ordered, are said to be in greater demand this season than ever before. They are made in sizes of one, two, three, and four horse power, and are exceedingly well adapted for use for almost an infinite variety of purposes. There has been an especial call for these engines for use with natural gas in Buffalo and Pittsburg, where they have been largely employed for driving ventilating fans in restaurants and for furnishing electric lights. One of these engines, of three horse power, in Buffalo, is said to have a record of running, for several weeks, thirty sixteen-candle power lamps on a fuel consumption of 120 cubic feet of natural gas per hour, delivered under a four-ounce pressure. The engine has a fourteen-inch band wheel, and runs 450 revolutions per minute under a boiler pressure of 110 pounds. During the day time the outfit is otherwise employed.

An Ocean Flume to a Fresh Water Lake.

Mr. James F. Milligan writes us that Virginia Beach, Princess Anne County, Va., has a recently constructed ocean flume, from the low water line, and supplied with water at high tide, which empties into Lake Holly, 800 feet from the shore, making the lake salt instead of fresh, as heretofore. The construction has been simple and inexpensive, the mouth of the flume being Y-shaped and strongly backed with piling to withstand the heavy surf. The work has been done upon the plans of Mr. J. J. Powers, a Brooklyn, N. Y., sanitary engineer, Mr. P. W. Van Houghton, of Hackensack, N. J., having been the superintendent and contractor.

SHIP BUILDING ON THE GREAT LAKES.

The launch which affords the subject of our first page illustration, besides being rather unusual to Eastern eyes in that the vessel slides off the ways in a sidewise position, is remarkable in the fact that it represents the building of the ninth steel screw propeller of this class by one firm in a little over eight months, with an aggregate carrying capacity of over 26,000 tons. The builders, the Globe Iron Works Company, of Cleveland, Ohio, claim that this not only exceeds the amount of tonnage in iron and steel ships produced for a corresponding time by any shipbuilding firm in America, but believe that it surpasses the work of any European ship yard for a similar period. The launch was in every way a success, the vessel sliding smoothly into the water, and rolling but little before settling into her natural position.

The Norman is a staunch steel steamer, of the same style as her eight predecessors, with a length of keel of 296 ft. 5½ in.; length over all, 312 ft. 5½ in.; beam, 40 ft.; moulded depth, 24 ft. 7 in.; draught, 15½ ft. Her engines are triple expansion, with cylinders 24, 38, and 61 in. diameter, respectively, and a 42 in. stroke. She will have an independent air pump condenser. Her wheel is sectional and 14 ft. in diameter with a lead of 17 ft. She has two boilers of the Scotch type, each 14 ft. in diameter and 12½ ft. long, with three furnaces, the boilers being designed for 160 pounds pressure to the inch. She has eight loading and two fueling hatches, with steam windlass and capstan forward, steam capstan aft, and steam steering apparatus. She will have three pole spars with standing gaffs, but no canvas.

The importance of the commerce of the great lakes on our northern border, and the great shipbuilding industry necessarily developed thereby, are matters which people on the seaboard are too likely to underestimate. The growth of shipbuilding on the lakes has been particularly marked within the past three or four years, the vessels being mostly large freight carriers of iron and steel. Chicago has just entered this field, the keels of her first two steel ships having been laid in July. The material for them is being brought from Cleveland, but it is expected soon to use steel plates rolled at South Chicago. Last year the tonnage put afloat by lake builders was almost exactly equal to that built at all the Atlantic, Gulf of Mexico, and Pacific ship yards combined.

Lake navigation is very materially interrupted by ice during the winter months, but during 234 days of last year tonnage was passed through the Detroit River to the amount of 10,000,000 tons, which is more than the entries and clearances of all the seaports of the United States, and 3,000,000 tons more than the combined foreign and coastwise shipping of Liverpool and London.

Profit Sharing by a Coal Company.

Three years ago the Campbell's Creek Coal Company, in the Kanawha Valley, commenced the sharing of profits with its men, and on the first occasion divided something over $6,000. Last year the amount was much less, because the profits were smaller. The result this year is shown in the announcement that on September 20 the company will divide $4,500 among the men. The money is given out in proportion to the amount of wages the men earn, and the next distribution will give each man an average of about $60. Besides sharing the profits, the company does a sort of insurance business among the miners in a novel and commendable manner. In that district the miner is "docked," or forfeits a certain amount of his wages when the coal he turns out has over a fixed percentage of slate. The company mentioned takes the dockage according to the general custom, but that amount, instead of going to the company, is put into a fund for the benefit of the men. From this fund the men are entitled to draw $4 per week when sick. On several occasions, when through numerous demands this fund has become exhausted, the firm replenished it temporarily. In another way this company and its employes have moved together for the common good. In that locality the public schools are open only about four months in the year. To continue the schools for nine months each year, the miners pay each twenty cents per month into a private school fund. The effect of this plan of sharing profits, and the mutual good feeling between the men and their employers, is plainly apparent. The men are contented and steady; they have improved morally and physically.—*American Manufacturer.*

A New Antidote to Cholera.

According to the *British Medical Journal*, M. Roux has tried to cultivate the cholera microbe of Koch in an infusion made from the refuse of malted barley left after extraction in the brewing of beer. It is a liquid in which nearly all other microbes grow well, except the one above mentioned. This not only will not thrive in it, but when immersed in it is quickly killed. He has therefore suggested to the *Societe des Sciences Medicales*, of Lyons, that the infusion might be of use in the treatment and prophylaxis of cholera.

Correspondence.

Work of Amateur Electricians.

To the Editor of the Scientific American:

I am a subscriber to SCIENTIFIC AMERICAN and SUPPLEMENT, and right here I would like to state one thing in reference to my views on the question of amateurs and others making electrical apparatus according to instructions given in these papers, and that is this: That if any person wants to make any success, let him follow out the instructions religiously. In making the simple electric motor, from the very start I made only slight deviations from the instructions, and every time I had to commence right from the start, and when I did so everything came out as promised. I have not finished my motor yet, but from my experience I can assure you I shall keep strictly to your instructions.

I merely mention this, as in my own experience I have found others who have given up a motor half finished, because they had not enough common sense to do as they were told.

The "army" you referred to in your original notice is indeed a mighty one, possibly greater than you have any idea of. E. MAYER.

Beaver Falls, Pa.

The Cube Root—Easy Method for its Extraction.

To the Editor of the Scientific American:

The following is a quick method of extracting cube root, when root is a whole number, from 1 to 1,000. For larger roots I prefer method published in SCIENTIFIC AMERICAN SUPPLEMENT of September 6, 1890. In illustration the following eight examples were done in twelve minutes, without the slightest knowledge of the roots. The last four were calculated mentally.

Find cube root of following:

Example 1.—	918,330,048.	Answer—	972.
" 2.—	741,217,625.	"	905.
" 3.—	188,132,517.	"	573.
" 4.—	7,345,373.	"	197.
" 5.—	493,039.	"	79.
" 6.—	175,616.	"	56.
" 7.—	42,875.	"	35.
" 8.—	512.	"	8.

In extracting the cube root of numbers of three periods it is not difficult to find the largest cube in first period mentally, and by two or three trials to get the largest cube in first and second periods; but to get the last figure of root requires many trials by old methods. But by this method the last, or unit, figure of root is the easiest to obtain, provided the root is a whole number. If it is not a whole number, this method is so rapid that it is quicker to use it, and cube the root found afterward by way of proof. By use of following table, which can be easily committed to memory, it is surprising how rapidly you can extract cube root of any number a perfect power up to 1,000,000,000.

All cubes ending in—

1—	its root will end in	1.
2—	" "	8.
3—	" "	7.
4—	" "	4.
5—	" "	5.
6—	" "	6.
7—	" "	3.
8—	" "	2.
9—	" "	9.

This is easily committed to memory. The first and last numbers, 1 and 9, and center numbers, 4, 5, and 6, are always the same in unit column, in cube and root.

When cube ends in	2,	root will end in	8;	added	= 10.
" "	3,	" "	7;	"	= 10.
" "	7,	" "	3;	"	= 10.
" "	8,	" "	2;	"	= 10.

Example—What is cube root of 343? If it is a whole number, it must be 7, as 10 − 3 (the unit figure) = 7 = cube root. If you doubt it, how quickly you can multiply 7 × 7 = 49 × 7 = 343.

Referring to example 1, what is cube root of 918,330,048? We know that 9 is largest cube contained in 918. 9 × 9 = 81 × 9 = 729. We now want the second figure of root. As 918 is nearer 1,000 than 729, we take it for granted our trial root should be nearer 100 than 90. So will try 98 for trial root and find it too large. Try 97, and find it the largest cube root contained in the first two periods, 918,330. To get the last or unit figure of root—by reference to table that can be remembered easily, as cube ends in 8, root must end in 2, making answer 972. As it takes but two or three minutes to get this result, it will pay to use this rule always, as you can cube the root found, and if it proves to be right, which is always the case when cube is a perfect power, it saves a much longer method. Examples 1, 2, 3, and 4 are all done in the same way. Examples 5, 6, 7, and 8 are so easy they are done mentally.

Example 5.—What is cube root of 493,039? The largest cube root in 493 is 7 × 7 = 49 × 7 = 343. Cannot be 8, as 8 × 8 = 64 × 8 = 512. Having found root of first period = 7, second period, referring to table, is 9. Answer, 79.

Example 7.—What is cube root of 42,875? The largest cube root in 42 is 3 × 3 × 3 = 27. 4 is too large. The root of second period, per table, is 5. Answer, 35.

Brooklyn, N. Y. E. G. TREMAINE.

Quenching Fires on Steamships.

The fire which burned for an hour or more among cotton bales in the hold of the White Star line steamer Majestic, at her New York pier the other night, suggests again the query why the owners of the large steamship lines do not make some effort to adopt a system for fire extinguishment by means of carbonic acid gas, which has been shown to be so effective and economical a quencher of flames in confined spaces. In this case considerable damage was done, mainly by water, before the fire was put out, while when the steamer Mentone put into Plymouth the other day with her cargo on fire her hold had to be entirely flooded, to the ruination, probably, of her whole lading; and so it is, and must naturally be, in every instance of the kind where water is employed. Upon the other hand, *Fire and Water* sensibly adds, many cases are upon record where by the injection of carbonic acid gas into the hold fires have been smothered and the damage entirely confined to that by burning.

As a case in question may be cited that of the bark Whistler, mentioned by C. T. Hopkins in the *Commercial News*, of San Francisco. Every effort to put out a fire on this vessel by the usual methods had failed, when the injection of carbonic acid gas was tried and the flames extinguished, and when the underwriters appraised her cargo, it is said that "not the least particle of damage attributable to gas was discovered." Again, last December, the bark Beltana put into Lyttleton, N. Z., with a six days' old fire in her cargo, which, however, was put out in four days by fifty-two charges of carbonic acid gas forced into the hold through holes in the deck and sides.

In commenting upon those facts an insurance contemporary remarks: "It does seem strange that this effective safeguard, which requires for its generation only a few barrels of marble dust and twenty or thirty gallons of hydrochloric acid, with a little simple machinery in the way of hogsheads for the confinement of the gas and hose for its injection, is not universally required for the preservation of life and property on the high seas, especially as in the hold of a vessel, which can be tightly closed, the principle of chemical extinguishment can be applied with almost certain success." And this reflection would appear to apply more particularly to the great Atlantic liners, in which the addition of such apparatus to the existing machinery and equipments would be so simple a matter; while there is so much reason to believe that the adoption of the system would result not only in the saving of property, but might at any time prove the means of averting loss of life.

Trade Schools.

The Philadelphia *Telegraph* thinks Secretary Wallace struck the keynote of the discussion before the United Typothetæ, in Boston, recently, when he offered the mechanical trade schools as the true solution of the problems connected with the education of skilled labor. The apprentice system, which formerly afforded the means of trade education, has been abandoned, and is now hardly anywhere in practical use. It is futile to discuss the merits and demerits of that system in view of the facts. Whether good, bad, or indifferent, our people have departed from it, and there is every reason to believe they will never return to it. We may regret it—and some of our conservative mechanics doubtless do regret it—but that does not alter the case in the least. The fact is that apprenticeship is a thing of the past, a bygone institution so far as America is concerned. We could not revive it if we wanted to, and it is, therefore, incumbent upon us to provide other means whereby our youth can acquire mastery of the handicrafts by which the work of the community is carried on. The means best adapted to this use in this country is the trade school.

Success of Vaccination in Germany.

Under the law of Germany making vaccination compulsory and providing for revaccination at stated periods of life, says the *Sanitary Inspector*, small pox is almost completely disappearing from the German empire. A late official report states that in 1888 only 110 deaths from small pox occurred in the whole empire, and that this number is 58 fewer than occurred in 1887, and 87 fewer than in 1886. Of the 110 deaths, 88, or about four fifths of the whole number, occurred in those parts of the empire immediately bordering other countries not well protected by vaccination, and in which there is constant intercourse between the vaccinated and the unvaccinated sides of the boundary. More than one-third of all the deaths occurred in the Prussian province of Posen. Comparing the small pox death rate of the large cities of other countries with that of the larger cities of Germany, it was 136 times as great in the cities of Austria, 30 times as great in those of Hungary, 16 times as great in those of England, 24 times as great in those of Belgium, and twice as great in those of Switzerland as in the German cities.

SEAMLESS TUBES FROM SOLID BLOCKS OF METAL.*

In our age of great inventions a new discovery must be very remarkable to excite the interest of a large circle, and still the wonder of which we are about to speak has rendered the technical world, which is accustomed to strange phenomena, speechless with surprise. It has long been possible to mould iron and steel like wax under the steam hammers of our factories, but it would seem incredible to even the modern engineer that these substances could be as easily handled as they are now, thanks to this new invention. What was Vulcan's forge compared with the art of the present day?

REINHARD MANNESMANN.

Heretofore, when tubes were to be produced, the glowing metal was rolled into sheets between two hard rollers which worked parallel to one another, and then these sheets were riveted or soldered. If special strength was desired, the tubes could be bored or rendered more durable by being galvanized. Several years ago it was rumored that tubes had been successfully rolled from the block, and that tubes made in this manner had a resistance five or six times as great as that of tubes made in the ordinary way. This rumor was received with great incredulity, which was strengthened by the fact that the article did not appear on the market. Now the inventors, the Mannesmann brothers, have come before the public with their perfected method, and at one blow the technical possibilities of construction have been greatly increased.

In the Mannesmann machine the rollers are provided with spiral grooves and ridges and are placed at angles to each other. Their movement is in different directions, causing shoving and turning of the red hot metal bar placed between them, and when these impulses are thwarted, the surface of the bar is carried along, leaving the center or core stationary. The "skin" of the bar is literally "drawn over its ears," and thus the tube is formed. It is possible to make tubes which are closed at both ends, and it has been ascertained that such tubes contain a gas formed of a mixture of hydrogen and one per cent of nitrogen, which must have been pressed out of the iron.

The structure of the Mannesmann tubes is very peculiar, and the metal is treated in such a manner as to greatly increase the cohesion of every part. After repeated experiments it has been calculated that this new material will stand a pressure of 4,000 atmospheres, that is, each square centimeter of the tube can sustain a pressure of 4,000 kilogrammes (about 8,000 pounds). The machine operates with crushing strength. The inventors have succeeded in constructing fly wheels which store up from 8,000 to 10,000 horse power, which, when the brakes are applied, is given off again in 30 seconds, this being sufficient time for the completion of a 2 inch tube 4 meters long. The metal is kneaded like a soft mass, and there is no form that it cannot be made to assume.

The applications of the Mannesmann material are very numerous, and will make many changes in present technical methods, for it will be apparent to even the laity that these light tubes, to which any desired form can be given, and which retain the strength of a bar of metal, will admit of constructions which formerly seemed impossible. Thus an entirely new field is opened to bridge builders, who have found it difficult to obtain material which was sufficiently light, and at the same time had the requisite strength, for long spans. The new method will also be a great aid to progress in the manufacture of weapons. We rejoice that this discovery is the work of Germans, for we are often classed among the dreamers, and here is a truly practical invention.—*Ueber Land und Meer.*

Two minutes 8¼ seconds for a mile's trot was the wonderful time made by the four year old stallion Alabasteo, at Independence, Iowa, August 29.

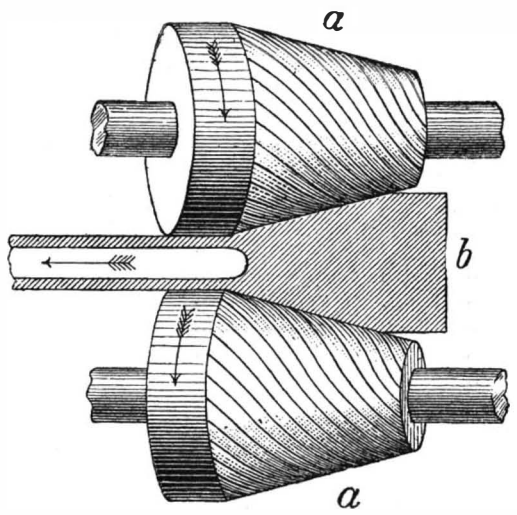
* For more full description of this method of making seamless tubes, with illustrations, see SCIENTIFIC AMERICAN SUPPLEMENT, No. 671.

Quick Ship Building.

The rapidity with which iron steam vessels may nowadays be constructed, when proper tools, machinery, and materials are at hand, is well exemplified by some of the English ship builders.

W. Doxford & Sons launched from their yard at Pallion, on August 16, a cargo steamer named Faizilka, built to the order of the British India Steam Navigation Company, Limited, of London, Glasgow, etc. This vessel is of steel, with cellular bottom fore and aft, and teak upper deck and poop bridge and forecastle, to Lloyd's 100 A 1 class. Her dimensions are: Length, 380 feet; breadth, 48 feet; depth, 29 feet 3 inches. The engines are the ordinary triple-expansion three-crank type, by Messrs. Doxford, the cylinders being 28 inches, 46 inches, and 74 inches, by 51 inches stroke, supplied with high pressure steam from three large boilers, capable of driving the vessel 11 knots loaded with 6,000 tons on a remarkably light draught of 23½ feet. She is for the East Africa trade. Her keel was laid on the 12th of May, so that she has been built in the space of three months and four days.

The Rangatira, lately built by W. Gray & Co., Limited, is nearly 400 feet in length, breadth 47 feet, depth 29 feet 4 inches, and is built to the highest class at Lloyd's. This vessel is the largest yet built at the port of the Hartlepools, and has a carrying capacity of about 6,250 tons. She has been fitted by Messrs. Shaw, Savill & Co. with two complete sets of the Haslam Foundry and Engineering Company's refrigerating machinery,



THE MANNESMANN PROCESS.
a a, the rollers; *b*, the block of metal.

the holds being lined all over with a non-conducting material, so as to entirely insulate them from the ordinary atmosphere. When fully loaded this vessel will carry over 70,000 carcasses. The main engines for driving the vessel have been supplied by the Central Marine Engine Works of Messrs. W. Gray & Co., Limited, and are of the triple-expansion type, working on three cranks. The cylinders are 27 inches, 43 inches, and 72 inches in diameter, with a piston stroke of 45 inches. Steam is supplied by three large double-ended boilers, containing in all twelve furnaces, all of which lead into one funnel, 10 feet in diameter. The working pressure of the steam is 160 pounds a square inch. On the measured mile the average speed on four runs was 11½ knots per hour.

MAX MANNESMANN.

Harland & Wolff, Belfast, have launched the steamship Georgian, 441 feet long, 45 feet beam, by 34½ feet deep, and is the largest cargo boat afloat, being capable of carrying nearly 7,000 tons dead weight. She is fitted for carrying cattle to the number of 1,000. Her holds are fitted up with refrigerating chambers for carrying dead meat, the system adopted for cooling being the Kilbourn Refrigerating Machine Company's.

A steel screw steamer named the Parkmore was launched recently by Charles J. Biggar, Londonderry. Length between perpendiculars, 340 feet; breadth moulded, 42 feet 4 inches; depth of hold, 28 feet 3 inches; gross tonnage, 3,500 tons; dead weight capacity, 5,000 tons on a mean draught of 24 feet. She has been specially constructed for trade between Liverpool and Boston and Baltimore, accommodation being provided for about 1,000 head.

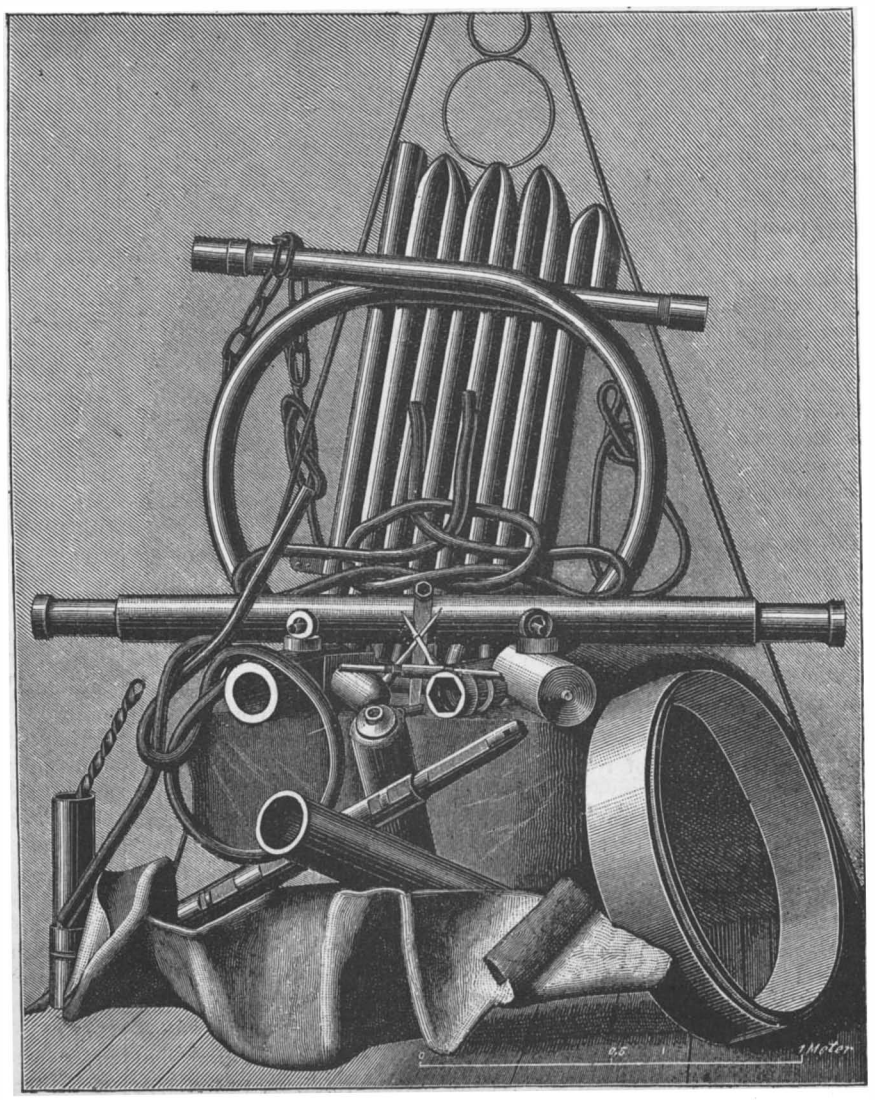
Can Consumption be Cured?

Among the subjects that came before the recent Medical Convention at Berlin, for consideration, was that of the treatment of pulmonary complaints. The question as to whether consumption can be cured, or whether it can be prevented among persons who inherit weak lungs, is one that has for generations excited the liveliest interest among medical men. Two reports were made to the Berlin convention on this subject.

Dr. Paul Gibier, of the Pasteur Institute in this city, who was a member of the Berlin convention, was asked by a *Sun* reporter what he thought the probable outcome would be of the reported recent discoveries relating to the treatment of consumption.

"I have received a copy," he replied, "of an elaborate report by Prof. Grancher, of the Pasteur Institute, Paris, that has just been made to the French Academy of Medicine, giving the results of experiments in preventing consumption by vaccination. The animals operated upon were rabbits. Briefly it may be said that the object aimed at by Professor Grancher is to make the rabbits consumptive proof. The virus is prepared from tuberculosis bacillus (the germ of consumption) and is of ten grades of strength. The inoculations were made at intervals of ten days, care being taken to see that the animals were in a perfectly healthy condition. After being subjected to this treatment the rabbits were inoculated with virulent virus, but no development of tuberculosis followed. The efficacy of the treatment was illustrated by inoculating other healthy rabbits, which had not been treated according to the new discovery, with the virulent virus. In all these cases tuberculosis was quickly developed, and the animals died. None of the consumptive-proof rabbits were affected. It will be seen that the treatment thus far is a preventive of the disease, but further experiments are being made with the hope of being able to apply the treatment, or one somewhat similar, to patients in which tuberculosis has been fully developed."

DANIEL QUICK, living near Atwood, Platt County, Ill., while digging recently a tile ditch on his farm, unearthed the remains of a gigantic mastodon. The tusks measure 12 ft. long and are 10 in. in diameter. Taking the tusks as a basis, the *Mastodon giganteus* was 12 ft. in height and over 18 ft. long. The skeleton would measure 17 ft. 5 in. in circumference. The skeleton was only three feet below the surface of the ground. This is one of the largest specimens of this species ever discovered.



SPECIMENS OF WORK DONE BY THE MANNESMANN PROCESS.

The Dangers of Electricity.

At the recent meeting of the National Electric Association, Cape May, President Dr. Henry Morton, President of the Stevens Institute, gave an interesting paper on the dangers of electricity. Among other things he says:

The Employers' Liability Assurance Corporation, after collecting a mass of material from a great variety of sources, has formulated a series of rules for the protection of those employed in erecting and operating electric apparatus involving the use of powerful and therefore dangerous currents. These rules have been examined and approved by several of the managers of prominent electric companies, and so far it would appear as if no accidents have resulted from the use of electric currents where these rules have been followed, and that most if not all the accidents which have occurred would have been prevented had these rules been followed and obeyed. As the author had something to do with the framing of these rules, his chief object in presenting the paper was to secure their criticism by those best able to perceive their imperfections, and such suggestions as may lead to their beneficial modification or extension. The rules are as follows:

1. Do not touch or handle any electric wire or apparatus of any sort while standing on the ground, or while in contact with any iron work, gas or water pipe, or stone or brick work, unless your hands are covered with rubber gloves, and you are provided with such properly insulated tools as have been declared to be safe and in good order by the electrician or other competent officer of this company.

If it is at any time necessary to stand on the ground, or on any surface not insulated from the ground, while handling electric wires and apparatus, rubber boots or an insulated stool should be used.

In moving wires hanging on or lying over electric light wires, lamps or fixtures, use a dry hand line.

2. Never handle any electric wire or apparatus with both hands at once when this can be avoided, and if it is necessary to do so, be sure that no current is present, or that one or both hands are protected by rubber gloves or other efficient insulation.

3. When handling line wires, treat each and every wire as if it carried a dangerous current, and under no circumstances allow yourself to make contact between two or more wires at the same time.

4. Never open a circuit which has been in use without giving notice to the superintendent, or whoever is in charge, of your intention to do so, and at the same time request that the same line be opened at the main station, and kept open until you have given notice that your work on that line is complete.

5. In the dynamo room never go near the belts or dynamos, nor touch any apparatus unless you are fully informed and instructed how to do so.

Tools used by linemen should be provided with insulating handles of hard rubber or other equally good insulator. It is the duty of each lineman to look after his own tools and see that they are in good order, especially as to their insulation.

6. Lamp trimmers and others engaged in the care of lamps must see that the switch putting the lamp in circuit is turned off before they handle the lamp in any way.

7. In construction work, a space of at least 20 inches must be left between the holes for pins on the cross arms, so that a lineman may get to the top of the pole and work without danger.

The same insurance association has collected the authentic records of a number of so-called "electric accidents" or accidents happening to the employes of electric companies. I have now before me the abstracts of 91 such cases.

Dr. Morton concludes as follows: "Of course I do not mean to imply by this that these rules are perfect or complete, but only that they seem to be in the right direction, and to furnish a starting point from which further developments may proceed.

"No one having even an elementary knowledge of electricity as it existed ten years ago needed or needs to be convinced of its power to do harm where all safeguards are removed; and the occasional declarations of its harmless character which have been uttered can only be accounted for by reference to that combative disposition which impels some minds always to take a view in opposition to any which may be expressed, and gives birth now and then to a book or pamphlet disproving the law of gravitation or the solar origin of light and heat. To say this is, however, far from agreeing with the other extremists who would banish electricity from our daily walks and occupations, or place it under restrictions which *might* render it harmless, but which *certainly would* render it relatively useless for the countless purposes in which its efficiency demands its full development.

"The true opinion is that which is supported by past experience, and which advocates the fullest developments of power to which this agency can attain, combined with the use of all the means of protection by which human intelligence can protect itself while using to the utmost this potent and, therefore, dangerous weapon in our victorious contest with the inimically destructive forces of nature."

A LADY SLIPPER ORCHID.

Hybridists are as diligent as ever in their operations among the lady slipper orchids, and one of their most recent additions is the handsome plant shown in our illustration. It was raised in the nurseries of Messrs. Sander & Co., St. Albans, England, from *C. superbiens* and *C. Roebeleni*, the latter being the pollen parent. At the meeting of the Royal Horticultural Society in the Drill Hall, July 8, it was exhibited and generally admired, receiving an award of merit as a recognition of its value.

C. Youngianum may be said to be intermediate between its two parents, as certain characteristics of each of them is at once noticeable to a practiced eye. The leaves are light green, having the upper surface traversed by longitudinal darker green lines, which are connected by means of dark bars. The strong, dull purple pubescent scape of the plant in question bore two large flowers, and, curiously enough, besides the usual bract at the base of the ovary, it also had another in the shape of a young leaf about a third of the way up. But this was probably an abnormal state of affairs, which is unlikely to occur when the plant blooms again. The upper sepal is creamy white, tinged with green at the base, and handsomely marked with dark madder brown stripes, while each of the intervening spaces is decorated with a row of spots of the same color. The lower sepal is not so large; it is white, with pale green stripes. The petals remind one very much of those of *C. Morganiæ*, but they are not so long nor so broad as in that fine hybrid. They are also white flushed with rose at the margins, which are fringed with dark grizzly hairs, and heavily spotted with madder brown on the front surface. The blunt, oblong pouch is of a soft olive brown color in front, passing into pale green behind, while the inflexed basal lobes are sparsely studded with small, reddish brown warts, and the surface of the pale green roundish staminode is marked with dark green reticulations. On the whole, notwithstanding its lateness in the field, *C. Youngianum* may be considered a success, and will no doubt take its place among first-class hybrid lady's slippers.—*J. W., in Gardeners' Magazine.*

A LADY SLIPPER ORCHID—CYPRIPEDIUM YOUNGIANUM.
[From a drawing by Mr. John Weathers.]

BRICKS boiled in coal tar are rendered hard and durable, and machine-made brick, if boiled for a long period, say twenty-four hours, become waterproof. Bricks thus treated are well adapted for sewers, cesspools, and the foundations of buildings.

Gas Service Pipes.

Progressive Age, referring to gas pipes in our streets, states most truthfully that services are commonly made of a material that under conditions of moisture and atmospheric contact deteriorates rapidly. Under the frequently occurring conditions of moisture and the contact of soil containing salts, iron worksrefuse, ashes or manure, or subject to seepage of uric acid, wrought iron will rust out in a few years or months. Easy to lay and strong to resist crushing or cutting strain, it is, except for susceptibility to corrosive action, the ideal small diameter gas conduit. Steel pipe, which is stronger, has an advantage in its greater resistance to rupture while in the lathe or under the tongs; but aside from this it is practically the same as wrought iron as far as adaptability to service work is concerned. Where the corrosive action of the soil on iron is particularly bad, lead pipe is sometimes used for services. Except its resistance to corrosive action, everything is against it. First cost, ease of manipulation, strength, and resistance to cutting strains are all in favor of the iron or steel. If these could be adequately protected from the present ill effects of contact with corroding substances, little would be left to desire in the way of service materials.

Galvanizing or zinc coating naturally suggests itself. Against moisture and the oxidation due thereto this is a protection. But soil often contains corroding agents against which a zinc coating cannot protect an iron pipe. This fact is too well known to require proof. Something better is needed. Tar is extensively used. It helps somewhat, but it is, if ever only when used in quantity and with much care that it can be called a complete protection. Various compounds of tar, glue, rubber, etc., are used, and some with considerable success. They all require care in the preparation and application, add to the difficulties of laying pipe, and are easily removed by erosive action. It is not, perhaps, improbable that our successors in the next century will use a non-corrosive aluminum pipe for service work. It would be a near approach to perfection. But that is far in the future. At present the most encouraging prospect is in the direction of lead-coated pipe. We have seen, the writer states, samples to which the lead adhered so tightly that the abrading action of tongs and wrenches was not competent to remove it; and we have in our possession an iron nail, similarly coated with lead, which spent several months in a bath of corrosive acids without apparent damage. Evidently if this coating can be done at or near cost of galvanizing, lead-coated pipe is destined to have an extensive application to service work.

One fruitful cause of the destruction of service pipes the writer believes to be the grounding of telephone and telegraph wires over them. He has seen services honeycombed as the result of electrolytic action caused by the passage of small currents of electricity over them to damp ground.

He also believes that the question of tightness in a cast iron gas main is mainly one of joints; in a service, of the material of the conduit. To discover leaks in mains is comparatively simple. Bare down to the joints and you locate the smaller leaks. The large ones due to fractures ordinarily announce themselves. A service has almost the same liability to leakage at each point throughout its length, and the only thorough examination consists in stripping it. How important then it is that it should be properly laid, and of the most enduring material, which has the necessary strength to resist the strains which may ordinarily come upon it.

Locomotives for the St. Clair Tunnel.

The Baldwin Locomotive Works, Philadelphia, have the contract for building four decapod tank locomotives for service in the new railway tunnel under the St. Clair River between Port Huron, Mich., and Sarnia, Canada. These engines are to have cylinders 22 by 28 inches, five pairs of driving wheels 49 inches in diameter outside of tires, and will weigh in working order, including 1,800 gallons of water in the tank, about 180,000 pounds. They will have boilers 74 inches in diameter, carrying 160 pounds steam pressure. The firebox is 11 feet long by 3½ feet wide. There will be about 280 tubes, 2¼ inches in diameter and 13 feet 6 inches long. The cab is placed centrally over the boiler with foot plate and coal box at the rear of the boiler. The wheel base is 18 feet 3 inches. As the track through the tunnel is straight, the engines are not required to pass curves on the main line, and are only required to enter ordinary sidings. Additional play will be given the tires of the extreme driving wheels. The second and fourth pairs of driving wheels will be flanged with the usual play, and the distance between their centers is 8 feet 9 inches. The tires are to be secured by Mansell retaining rings, and each engine will be fitted with two sandboxes and two headlights, a Cooke steam bell ringer, and the Westinghouse automatic brake, with equalized driver brake fixtures acting on all the wheels. The fuel will be anthracite coal or coke. The load which these engines are intended to haul is about 760 tons, and the grades are 105·6 per mile. They are to be delivered in January.

[SAW-MILL GAZETTE.]

How to Manage a Steam Engine.

A PRIZE ARTICLE.

BY ECCENTRIC ROD.

(*Continued from page* 184.)

FIRING.

In firing to keep steady steam, and up to the proper pressure, I watch the steam gauge, and when the pointer ceases to move, I know the fire is about spent; then I put in more fuel, and by the time the fire is burning bright, the steam has fallen but little. I always avoid having any bare spots on the grate, as cold air going through these will hinder steam making.

The first boiler I ever fired, I had for fuel the screenings around the coal yard, and I had to use a fan blower under the grate to give draught. Sometimes the fire would go out in spots, and it will be found difficult to start it again in that place. I have succeeded in doing so with the aid of pieces of boiler plate ten or twelve inches square. I throw one of these on the dead spot, and work fire on it until it is thick, and burning good, then I carefully draw the plate out. If nearly the close of day, I leave it until fresh fire is started.

With good fuel I prefer using the ashpit door for regulating draught. I think it better than damper in chimney. To check the draught still more, and especially in cleaning the fire, I open the flue door so that no ashes will go in the tubes. In banking fire I use the flue door. By avoiding opening the furnace door as much as possible, cold air is kept away from boiler shell and tubes. Cold air and cold water in and around the boilers do more harm than long usage. I pay attention to the ashpit, and by keeping it clean I have no trouble with the grates. I ran one boiler that had some grate bars in for ten years. A boiler that has to be forced to make steam necessarily has to be run with thin fires, and the grates become pretty hot, but more are warped by not putting plenty of air under them. I keep all water away from every part of the boiler, and more particularly if burning wood, as water with ashes will make lye, and that will destroy iron rapidly.

Perhaps it may be thought that I would do wonderful things, but I have had charge of an engine and boiler in a sawmill (which is the worst place they are found, generally), and I had, in spite of sawdust, shavings, and twenty to thirty persons running in and out of boiler and engine room every hour in the day, as nice a rig as could be found in many miles. The engine ran smooth and still, I had no trouble with boiler, and joints all around were tight, so that by closing all valves Saturday night a vacuum would show plainly Monday morning.

For steady and economical boiler feeding, I prefer a plunger pump driver. I have used nearly every form of boiler feeders, but I will take the plunger pump, as these have only two valves to look after, and one stuffing box, and should it fail to work, I would open the air cock that is between pump and check valve near the heater. If air is in suction, this cock will show it. Next, I look at the stuffing around plunger. This, when the pump is working, should drip a very little, as it keeps the plunger lubricated. It is also a seal against air working down, so if there is an air leak the water will be gone. It is no trouble to take out the pump valves to remove anything that may get under them. It takes but little to stop a pump working, especially if the pump has to lift water over ten or twelve feet. I want a foot valve placed on the extreme end of the suction pipe. This keeps the pipe full of water all the time, so that the pump valve is relieved of the weight of water somewhat. If nothing is found under these valves, I will look throughout the entire length of the suction until I find the leak which I know exists if the valves and pump are all right. By having a foot valve on, it will keep pipe full, and this will help to locate the leak, but I want drips at the lowest point of suction to drain in cold weather. By having stop valve in the suction pipe, I regulate the flow and keep a steady supply in the boiler at all times.

I want three full gauges at quitting time, as steam is condensed in the pipes, taking that away from the water, and the water will contract in cooling.

For independent feed I prefer the inspiratoral injector, which is practically the same, as the water will go to the boiler warm. Any steam pump will send it in cold, but it has to go in.

THE ENGINE.

The engine has to receive some attention. I would have drip in the steam pipe near the throttle, so as to empty the pipe without running through steam chest and cylinder. I would start the engine by first opening all drips, and warm the cylinder well before giving steam enough to turn over, then by watching it a little while, I could tell if it was to suit me. If I thought the valve or the piston leaked, I would turn the wheel until the valve covered the three parts, which it should do just before the piston is at end of stroke, then I would open the throttle, and go where I could see the end of the exhaust pipe, and if steam showed there, it would indicate the valve was leaking, and if no steam showed, it was tight. So I would try the piston in this manner: Place crank half way between points of travel, put a stick in the fly wheel and against the pillow blocks. I would be sure that was placed so it could slip. If this was an engine over sixty or seventy-five horse power, I would not do this way, but I have found no trouble by opening wide cylinder drips and letting in steam very gently, and by standing at the throttle and having some one to watch the exhaust. I find in this way whether there is any leak or not. If the exhaust is big and short, I can tell by the sound about what shape the piston is in; the puffs should be distinct, with no blowing between them; if the valve and piston are tight, the engine indicator will show this, but for all they have been on the market so long, only few are used. The average engineer don't seem to feel able to put one hundred dollars into them, and I have never known an owner (excepting a manufacturer of engines) to own one. They are worth the price to any one that has an engine of any size.

I want to keep the piston in center of cylinder; this can be done by calipers. If necessary, put in pieces of sheet iron between ring and piston head. With the old way of making rings, set out by flat springs on a bolt with nut on either side, one could make flat springs hold the piston up; but many are made now with very light rings, either sprung over a solid piston or put on and held by a follower. The spring of the ring is all that holds it out to the cylinder. I can keep the crosshead up to its place by use of the level.

The guides are supposed to be parallel with the center line through the cylinder, and they will keep so, unless they are badly worn at the outer ends, and this would happen only by accident or neglect to oil. When the piston has been put in the center of cylinder, compare level on rod to guides, and correct the rods by guides, and it is pretty close to original position. I want the brasses in the straps to touch, no pieces of wood, or leather, or space between. If the edges touch, they will not work loose in straps. It pays to give particular attention to the packing around the piston rod and valve stem. I never use raw hemp unless I am obliged to. I think it is rougher than any other material on a rod. I tried some on a six horse engine, and I found that I could stop it under a pressure of eighty pounds steam. I have used hemp soaked with plumbago and tallow, and on one engine which I used twenty-two months, the rod was smooth and polished, but I think the plumbago and a very deep stuffing box was the chief reason. I oil the rods many times a day. A drop of oil is not wasted on the rods. Should the eccentric slip, I would turn the fly wheel in the direction the engine runs, until the crank was to the extreme end of the stroke, then I would open the cylinder drips, give little steam through throttle, and turn the eccentric on the shaft, until the cylinder drip nearest the piston should steam faster, and the eccentric is set.

There may be many rules in theory, but this, I know, will work, provided the valve is made properly. If the valve should slip on the stem, I would set it again equally by the steam ports, so that the opening would be the same on either end of the stroke. I turn the wheel so that the crank will be at the end of the stroke, and make a mark on the crosshead and corresponding ones on the guides. As the brasses near you bring the crosshead and crank pin nearer, but by always keeping these marks together (this can be done by putting in sheet iron between rod and brass), the clearance between the piston and cylinder heads will be the same. Hot boxes come from being out of line, too tight, or from dirt getting in, or from not being properly oiled.

The shaft should be level at all times. It may be necessary to put a thin piece of iron under the box to bring it to place. And to get the crank to travel straight with the cylinder, I take out the piston and crosshead, and the connecting off, and bolt a piece of wood on the flange of the eye that will reach to about the center of the whittle, this end down, then with the divider I can get the exact center of the counterbore; using the wood for one leg of dividers, I make a fine hole. I run a fine fish line through this hole, having a knot to hold the end of line, and run the other end out beyond the circle described by crank. Nail up a stick and draw the string taut on stick, and where the line goes through the stuffing box, center it on the stuffing box by moving the line on outer stick until it becomes central, then turn the wheel until the crank pin nearly touches the line. Mark carefully and turn the crank over to the other side. Notice how the mark compares with the line. If it does not show straight, the shaft must be moved at the outer end until the mark will touch the line on either side.

If the brasses get hot so as to get cut with grooves, I scrape them as smooth as I can with scraper, and put plenty of black lead in; this will fill up deep scratches and help to wear smooth. I never use sandpaper nor emery cloth around any part of engine, as it is hard to get out when once ground in.

I have used water on crank pins where they were too small and the load on the engine heavy. I attached a hose to the little pipe usually found in oil cups, and kept a stream of soapy water on; it made rather a nasty muss, but I could find nothing better, and by having a big pan, it caught nearly all the water.

(*To be continued.*)

The Execution by Electricity.

Capital murder was never more thoroughly discredited than in the late method of killing the unhappy culprit Kemmler by electrical discharge. What occurred was really worse than was prognosticated. The shocks administered were intense surface shocks, attended with extreme local action, but not affecting directly or immediately the respiratory centers. The idea seems to have been that an electric shock passed through the head would kill like the blow of a pole ax; an idea which a perusal of one of Benjamin Franklin's experiments, in last century, ought to have rectified. The doubts which have been expressed about the strength of the current and the faults of the apparatus are out of the record. The mistakes were physiological, not electrical. If the blood, which is the prime conductor of electrical vibration, had been made the conductor, a current of half the strength used would have sufficed. If the electrodes had been applied to the arms of the man, one electrode to each arm, with saline and damp sponges, the death would have been more determinate, and far more rapid. The man was really killed by a clumsy stun, for which a dexterous blow from a pole ax would have been an expeditious substitute. He died, as I described in commenting on the action of lightning stroke in 1868, by a kind of gaseous apoplexy from the tension of the gases of the blood, not by the direct action of the electricity on either the structure of the nervous system or on the muscles. At the same time, while condemning, in the strongest terms, the degradation and the rank immorality which has been committed in the name of science, it is fair and proper to state that the man Kemmler suffered nothing. The electrical stun is a stun too quickly applied to be painful. I can cite two evidences of this fact. In the course of one of my experimental researches, an assistant, from carelessness on his own part, was knocked over by an electrical discharge, and was, for a few moments, rendered quite insensible. He was lifted into a chair, and soon regained his consciousness. The strange part of the matter, to those who are not acquainted with the experiments of last century, is that he not only did not feel pain, but positively did not know that the accident had ever occurred, and thought that a joke was being played on him when he was told the facts that had been observed. This is the first bit of satisfactory evidence. The second is that during a stun of this character the body lies so insensible that a surgical operation can be carried out without the infliction of any sense of pain. Thus, in one instance in which a large dog was stricken insensible by a single discharge, I performed a surgical operation—the removal of a tumor from the animal—without causing the slightest indication of suffering. There have, likewise, been instances in which injuries inflicted, after lightning shock, on the human subject, have not been recognized by the subjects of them until recovery from the shock has taken place. We may be certain, therefore, that the unhappy Kemmler, who, whatever his previous faults may have been, comes out as the bravest figure of the tragical scene, was not really subjected to agony. To him the godlike power was more merciful than the powers who evoked it; as if, in the phraseology of a past day, "the heavenly might came to his aid, and seeing his fortitude, unchanged by the many deaths to which the savagery of his age had subjected him, gave him peace both of mind and body."

An ethical question is here opened. Ought the members of the great profession of medicine, who live to prevent pain, disease, death—ought they to lend themselves, under any circumstances, to the loathsome act of playing the part of public executioner? I, for one, answer emphatically, *no*. On the contrary, we ought one and all to strike at these barbarities, and show the world that, whatever insanity it may perform, we are no parties to it. It has been often and influentially suggested that a lethal chamber, such as I have constructed for the euthanasia of the lower creation, should be applied to the execution of criminals. I protest against the suggestion as subversive of the entire object of the invention; and I protest most strongly against any method of execution like electricity, or other, that shall call for the necessary aid of any man of science to carry it out. It is high time for our gaol surgeons to ask themselves whether they ought any longer to condescend to perform the miserable so-called duty of professionally witnessing capital murder. But to take the leading part in it, *never!*—*Dr. B. W. Richardson, the Asclepiad.*

NEARLY 3,000 persons now find employment in the Edison Electric Works at Schenectady, and this company is so extending its plant that many more will soon be employed. In the new power station now being built will be located monster dynamos, which will furnish electricity for the many motors which are to supplant the steam engines now in use.

The Etching of Glass.

In the opaque etching of glass it has hitherto been thought necessary to use certain expensive fluorine salts in the preparation of the etching solutions. It has quite recently been discovered by A. Lainer that comparatively cheap etching can be prepared. In Dingler's *Polytechnisches Journal* (*vide* t. cclxxii., p. 227) Lainer gives two recipes which obviate the use of the more expensive fluorine salts.

1. Two solutions are first prepared: (*a*) consisting of 10 grms. of soda in 20 grms. of warm water, (*b*) consisting of 10 grms. potassium carbonate in 20 grms. of warm water. Solutions (*a*) and (*b*) are now mixed, and to the mixture is added 20 grms. of concentrated hydrofluoric acid, and afterward a solution (*c*) consisting of 10 grms. of potassium sulphate in 10 grms. of water is added.

2. This recipe contains the following ingredients: 4 c.c. of water, 1⅓ grms. of potassium carbonate, 0·5 c.c. of dilute hydrofluoric acid, 0·5 c.c. of hydrochloric acid and 0·5 c.c. of potassium sulphate. This mixture is treated with hydrofluoric acid and carbonate of potassium until it produces the required degree of opacity on being tried upon a piece of glass.

Lainer considers that the addition of a small quantity of hydrofluoric acid to solution 1 brings about a fine granulated appearance on the surface that is treated with it. But it appears that there is a still simpler process than either of these; it was invented by Herr Kampmann, of Vienna. In preparing an opaque etching fluid Kampmann uses a wooden vessel, the iron fittings of which are protected from the corrosive action of the acid fumes by a layer of asphaltous material. This vessel is filled to about one-fifth of its contents with strong hydrofluoric acid, which is then partially neutralized by cautiously and gradually adding some crystals of soda; more soda is added, and the mixture is stirred with a small wooden rod. The point at which the neutralization of the acid should cease is indicated by the mixture frothing and becoming sufficiently viscid to adhere to the stirring rod. It is, perhaps, scarcely necessary to say that the acid fumes are highly injurious and that this process should be carried on in the open air, in order to allow the vapor to pass rapidly away. The most hygienic and satisfactory process of all would be to carry on the operation in a "draught cupboard."

The contents of this wooden vessel now consist of sodium fluoride and the unneutralized hydrofluoric acid. This mixture is now transferred to a wooden tub and diluted with from five to ten times its volume of water, according to the degree of dilution that is desired. It is objectionable to use this mixture in a too highly concentrated condition, for then the etched surface of the glass is irregular, coarse grained, and apparently strewn with tiny crystals; if, on the other hand, the dilution be too extreme, the etched surfaces will be transparent instead of opaque. Either of these two conditions of the etching fluid can easily be remedied, for if it be too strong water must be added, and if too weak a small quantity of hydrofluoric acid partially neutralized with soda must be mixed in.

A good recipe for preparing a small quantity of this etching fluid is the following: 240 c.c. commercial hydrofluoric acid, 600 grms. powdered crystallized soda, 100 c.c. water.

These etching fluids are best used by taking the following precautions. The glass is first thoroughly cleansed from all impurities, and is then provided with a rim of wax composed of the following ingredients: Beeswax, tallow, colophony and powdered asphalt kneaded together. The rim prevents the acid from spreading over those parts of the surface which it is not desired to etch. The glass is now etched for a few minutes with an ordinary etching solution (H.F.—1:10), which is then poured off, the surface being afterward washed with water and wiped as dry as possible with a piece of sponge.

The surface is now ready for the opaque etching fluid, which is poured on till it forms a thick layer. The operation is allowed to progress for one hour, when the liquid is poured away and the surface washed with water. Water is further allowed to stand on the glass until a thin film of silicate is observed to form; this film is then brushed off and the surface finally cleansed with water and the wax removed.

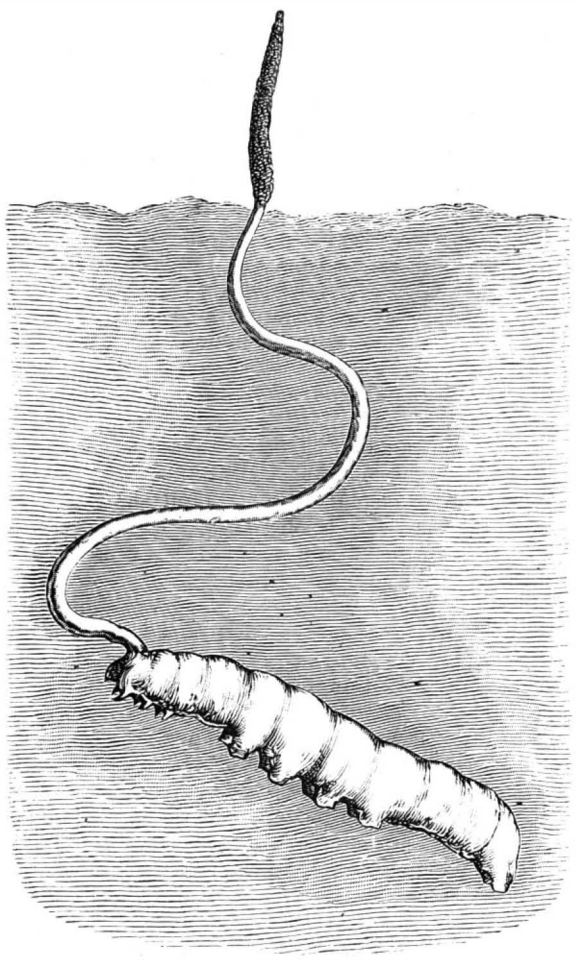
By varying the action of this opaque etching fluid or paste various degrees of opacity may be produced, and if the opacity be greater than that which is desired the surface can be cleared to any extent by using the etching solution of hydrofluoric acid.

Progress of Chilian Trade.

F. H. Haley, of Manitowoc, Wis., has been in Chicago the past ten days busily engaged in packing, marking, and shipping to Chili the enormous amount of machinery, furniture, implements, etc., recently purchased in this locality by J. Thompson Rei, the ambassador for the Chilian government. Mr. Rei, the Chilian representative, purchased fully $500,000 worth during his thirty days in the United States. His purchases consisted of carriages, wagons, thrashers, plows, wheelbarrows, trucks, reapers, mowers, fanning mills, iron bedsteads for hospitals, feed cutters, furnaces and heaters, mining machinery, and a general line of furniture. In Chili they are sparing no effort or expense to make their schools as good as any in the world. They are taking from America drawings and plans for school buildings, studying the many plans for heating, lighting, and ventilation, and the manner of laying out grounds, styles of fencing, material for substantial walks, the best methods of teaching, arrangements of recitation rooms, and in fact adopting daily all of the better methods of American ideas to produce the very highest results in education. Mr. Rei was constantly repeating that the sympathies of Chili were with the United States, and our methods, designs, and manufactured goods were far superior to any other he had yet studied.—*Carriage and Wagon Maker.*

GROWTH OF A WOODEN CATERPILLAR.

The oddest insect in existence—so odd that unless it were vouched for and explained scientifically would be considered a hoax—is the aweto. It is not easy to decide whether it ought to be classed under the fauna or flora of New Zealand, for it is as much vegetable as animal, and, in final stage, it is a vegetable, and nothing else. This is the vegetable caterpillar, called by naturalists *Hipialis virescens*. It is a perfect caterpillar, and a fine one also, growing to three and a half inches. Until it is full grown it conducts itself very much like any other insect, except that it is never



THE "AWETO," OR VEGETABLE CATERPILLAR.

found anywhere but in the neighborhood of the rata tree, a large scarlet-flowered myrtle, and that it habitually buries itself a few inches underground. Then, when the aweto is fully grown, it undergoes a wonderful change. For some inexplicable reason, the spore of a vegetable fungus, the *Sphæria Robertsii*, fixes itself directly on its neck, takes root, and grows, like a diminutive bulrush, from six to ten inches high, without leaves, and with a dark brown head. This stem penetrates the earth over the caterpillar, and stands up a few inches above the ground. The root grows simultaneously into the body of the caterpillar, which it exactly fills in every part, without altering its form in the slightest degree, but simply substituting a vegetable substance for an animal substance. As soon as this process is completed, both the caterpillar and fungus die, and become dry and hard, but without shriveling at all. The thing is then a wooden caterpillar, so to say, with a wooden bulrush standing up from its neck. *Papier mache*, perhaps, would better describe it than wood. It can be taken out of the ground entire, and preserved for any time. Where the aweto is found many specimens can be obtained. It is a light green when alive, and the Maoris eat it in its soft state, when it resembles marrow. When dry, they powder it for use as a flesh dye in tattooing.

It is certain that the caterpillar and fungus were made for each other, as the *Hipialis virescens* is never found without *Sphæria Robertsii* growing out of it, and *Sphæria Robertsii* is never found without this caterpillar with it. Our engraving was made from one by the London *Graphic* from a sketch by Major-General Robley, and the specimen is in the possession of Comte L. De Jouffroy d'Abbans, French consul at Zurich.

Compound Locomotives.

The Baldwin Locomotive Works has issued a pamphlet containing the results of the extended series of experiments made by Mr. George H. Barrus, of Boston, in April, May, and June, of this year, of the four-cylinder compound and a simple locomotive on the Baltimore & Ohio road.

The two locomotives were built for the Baltimore & Ohio, and are in regular service on that road. They are both comparatively new. Both are standard passenger engines, and are duplicates in every respect, except as to cylinders. They are eight wheel type, and have 66 in. driving wheels. The compound has 71,515 lb. on the drivers and 33,965 lb. on trucks; the standard engine has 72,460 lb. on drivers and 33,000 lb. on trucks. The engines have 58 in. wagon top boilers extending back through the cab, and the ordinary link motion, with reversing lever. They have extended smoke boxes fitted with screens, straight stacks and plain exhaust nozzles, one for each side of the engine. The fire box is fitted at the front end with a fire brick arch. The valves of the standard engine are ordinary D-valves, and are balanced by the introduction of packing strips along the four edges of the upper surface. The compound has four cylinders arranged in two independent sets, one on each side of the engine. On each side is one high pressure cylinder and one low pressure. The high pressure cylinder is placed vertically above the low pressure cylinder, and the two piston rods are attached to a crosshead common to both. One rod takes hold above the guides and the other at the same distance below the guides, and the guides are on a line with the centers of the driving wheels.

The average consumption of coal for four round trips between Philadelphia and Washington was 14·9 per cent less in the compound than in the standard engine; and the consumption of steam per horse power per hour during the selected periods of the runs which have been analyzed was 5·5 per cent less in the compound engine than in the standard.

The compound engine is more economical in the use of steam when running at slow speeds than at high speeds. The steam consumed when running at a speed of 257 revolutions per minute (50·4 miles per hour) was 25·69 lb. per indicated h. p. per hour, while that at a speed of 176 revolutions per minute (34·5 miles per hour) was 20·86 lb. per indicated h. p. per hour, a difference of 19 per cent.

The tests furnish ample reason to expect a saving of coal on freight trains, and on accommodation passenger trains making frequent stops, of not less than 30 per cent.

The compound steams freely, and without undue exertion on the part of the fireman. It starts from a state of rest quite as promptly as the standard engine. No difficulty is encountered in moving the fastest trains on schedule time, and in making up a reasonable amount of lost time.

Why Some Men do not Succeed.

Two of the most successful men on the North American continent were recently asked the question, "What are the causes of poverty?" One replied, "Ignorance and incapacity." The other said that the prevalent cause is "The number of young men who are wanting in decision and fixity of purpose. If they get into a good place at the start, they should stick to it, knowing that by perseverance, industry, and ability, they win promotion in due course as vacancies occur. But they see or hear of some one making a fortune in Wall Street, or in ranching, or in mining, and away they go to try their luck. When they lose, as they do in ninety nine cases out of a hundred, that is the end of them; they can never settle down to ordinary ways of earning a living after that, and their descent is rapid." This reason hits the nail square on the head. Go where we will, we will find men who commenced life under the most favorable circumstances, but who are such complete financial wrecks that there is but little hope for their reformation. They may be honest and temperate; they may even possess natural ability of a high order, but lacking in steadiness of purpose, they will never succeed. Had they sufficient will force to stick to one thing, no matter how disagreeable it might be at first, were they content to advance slowly, they would have no reason now to talk of the "luck" of those who have pushed forward into the front ranks.

Another cause of poverty is a lack of self-confidence. Many men seem to have no faith in themselves, consequently no assertiveness, no independence, no pluck, and no push. They are afraid to stand up and speak for themselves, preferring to lean on others. They are afraid to make an investment, because of the possibility of failure; they are afraid to tell what they can do, as they might make an error in doing it; they are cowards in every sense of the word. This is often the result of early training. A boy, naturally timid, is kept in the background so persistently, and his mistakes are so severely criticised, that he grows up into an entirely useless man. Push and fixity of purpose will always bring a measure of success.—*The St. Louis Miller.*

Regulations for Modern War Ships.

The following are among recent regulations issued by the Secretary of the Navy; fifty years ago the issuance of such orders would have been unintelligible and considered as evidence of lunacy:

I.—WATER-TIGHT DOORS AND VALVES.

1. The water-tight doors and valves in the engine and fire rooms and coal bunkers shall be under the charge of the senior engineer, and all others under the executive officer. These officers shall, under the captain, be responsible for the condition of the doors and valves, their freedom from all obstructions, and readiness at all times for immediate use; they shall personally examine and test them at least once a week, reporting the result for entry in the log.

2. It is the intention of the department to provide the shrieking or slide whistle for use as a signal to close water-tight doors on occasions of emergency. Should none have been provided, then some signal will be improvised for that purpose. Care shall be exercised that this signal is accessible to the officer of the deck, and kept in readiness at all times, day and night, at sea and in port: also that it can be readily and distinctly heard in all parts of the ship.

3. The captain shall, during an action or when at sea, in a fog, or at night, and at other times when a sudden collision may occur, have all practicable water-tight doors and valves closed, taking into consideration the necessities of the occasion and the requirements of the officers and crew. Even in action, certain communications in the engine and fire rooms, coal bunkers, magazines and ventilating conduits, will, of necessity, be kept open until the last moment.

4. He shall have men detailed, whose duty it shall be, upon the alarm of fire, or when the signal is given, to proceed with all possible speed to close the water-tight doors and valves, and then report them closed to the officer of the deck. There shall be a sufficient number of men so detailed to provide for all possible absentees from sickness or other causes.

5. He shall have frequent exercises, without previous warning, in order to practice the men so stationed at their duties, and enter in the log the time required to fully perform them.

6. He shall take precautions for the escape, by means of ladders through hatches, ventilators, and other openings, of those below in compartments; and shall require search to be made and warning to be given by those stationed to close the bulkhead doors.

7. He shall assure himself that the duty of examining and working all cocks, valves, slides, doors, outlets and hatches, in connection with the ventilating apparatus, pumps, and water-tight compartments, once a week, is faithfully performed.

II.—HULL AND DOUBLE BOTTOMS.

1. The captain of every iron or steel ship in commission shall appoint a permanent board of three officers, to be assisted by such other persons as may be necessary, for the purpose of examining and reporting upon the condition in respect to corrosion of the under-water outer hull each time it is accessible, and of all parts of the outer top sides, inner hull and double bottoms during the last week of each quarter. The reports will be made upon prescribed forms to the bureau of construction and repair.

2. In addition to these inspections a weekly examination of the ship for the same purpose shall be made by the executive officer and senior engineer, the result being entered in the log. The senior engineer will confine his examination to the engine rooms, fire rooms, coal bunkers and the double bottoms under them; the executive officer will examine the other parts of the ship.

3. Every ship not sheathed shall be docked, cleaned and painted at least once in six months when possible. Under no circumstances shall more than one year elapse without docking, except by authority of the Secretary of the Navy.

4. A sufficient quantity of cement, composition, and paint, such as is used on board to prevent corrosion, shall be kept on hand. The inspections and examinations provided for should be the means of detecting any places showing corrosion of a serious nature. When such places are discovered they must, at the first possible opportunity, be carefully scaled, dried and again coated with anti-corrosive material.

5. The report on the under-water outer hull shall include a statement as to the structural condition of all valves and ports, the rudder, propellers, shaft struts and tubes, torpedo tubes, bilge keels, and other fittings; also the date of the last cleaning and painting, the kind of paint or composition used and its condition.

III.—PRECAUTIONS.

1. An iron or steel unsheathed ship must never be attached to the moorings or chains used for a sheathed ship nor moored close alongside of the latter.

2. Great care must be observed that no articles of copper or bronze or filings of the same, or rust scale, are allowed to rest on the bottom in immediate contact with the iron or steel; and that the leaden pipes, strainers and other painted or varnished parts in the bilges are kept in good condition.

3. Bronze screw propellers must be coated with the same anti-corrosive paint or composition and in the same manner as the hull. Zinc protectors must be placed near them.

4. Whitewash must never be applied to any iron or steel parts of the ship.

5. An incandescent electric lamp of high power, with a portable connection, should be used for examining the condition of double bottoms, the interior of boilers, and other dark places.

6. When about to examine, clean, or paint double bottoms or boilers, the following cautionary measures must be adopted:

First.—They should be opened up and well ventilated, a connection being made to a fan system if possible.

Second.—This done, the purity of the air should be tested before entering by burning a candle on the bottom at least five minutes.

Third.—Working parties inside must always maintain communication with some one outside; they must also have with them a lighted candle, and withdraw should it begin to burn dimly.

7. No naked light is to be taken into a coal bunker until it is ascertained that no explosive gas is contained therein. Special precautions in this respect should be taken for some days after coaling. The ventilation of coal bunkers should receive careful and constant attention.

Quicksilver.

During the calendar year 1889, according to the statistics presented, California produced 26,464 flasks or 2,024,496 pounds. California has eleven mines in operation with 36 furnaces employing 937 hands, of whom 521 worked underground. The amount of cinnabar ore mined was 95,714 tons. The capital invested in the sixteen establishments is $1,333,114, of which $680,470 is represented by the mines and real estate, $222,300 in furnaces, houses, etc., and $146,150 in machinery, tools, etc. The total expenditure for the year was $845,911, of which $626,289 were for wages. The cost of producing the quicksilver per flask averaged $33.31 per flask of 76½ pounds, or 43½ cents per pound.

The price of quicksilver, which on January 1 was 69 to 71 cents per pound, is now 74 to 76 cents, according to quantity.

Its principal uses are in amalgams for recovering the precious metals, in making vermilion, fulminate of mercury for use in cartridges, in thermometers, steam gauges, and all kinds of mechanical instruments. In the form of corrosive sublimate it is not only an excellent disinfectant and antiseptic, but is employed to a considerable extent in the preservation of timber used in underground or underwater construction, as, for instance, says the *Commercial Bulletin*, by the Locks and Canal Co. at Lowell to preserve their bulkheads, gates, etc.

But in that industry which is popularly supposed to consume a great deal of quicksilver, viz., the making of looking glasses, very little is employed. Mirrors are now covered almost entirely with a solution of pure silver precipitated or sprayed on to the glass. After this is done the glass would be still transparent were the backs not painted over with a brown or other dark colored paint of a certain chemical composition, first introduced from Bohemia by a firm in this city just before the war.

In the old way of making mirrors the glass was covered with an amalgam of quicksilver and tinfoil, and whereas the silver-backed mirrors are ready for handling the next day, the quicksilver and tinfoil required two weeks before the amalgam was sufficiently hardened for handling. The quicksilver process makes the best and most enduring work, the painted backs of the silvered glasses being apt to change color in spots. The quicksilver method is, however, the most expensive, which largely explains the reason for its decadence.

The production of quicksilver throughout the world during the past ten years is put at 1,093,611 flasks, of which the United States produced 407,675, and Spain, Austria, and Italy 685,936 flasks.

What's in a Name?

The London *Electrician* calls attention to some curious coincidences between the names of inventors and mechanical appliances which have given rise to absurd mistakes. It was commonly supposed years ago that the Brush machine was so called on account of some special kind of brushes, and that the Lever arc lamp derived its name from two peculiar levers in its mechanism. "The Ball dynamo has no spherical armature, as might be supposed. The Short electric railway system is not specially adapted for lines of limited length. Bright shackles are never polished, and the Siemens galvanometer has nothing to do with the mariner's compass, with which beginners sometimes confound it. The Parsons engine is not a clerical device, and the Upward battery has nothing in common with Excelsior carbons. Such popular errors may be excused, however, when we find a recognized text book explaining the Daniell cell as being so called because of its constancy." In this country a large number of people have always thought that the Bell telephone was so called because of the bell that was attached to it, and so widespread was this belief, that the Long Distance Telephone Company made it serve a commercial purpose by adopting the bell as its trade mark.

New Aleutian Volcano.

Every vessel from the Aleutian Islands arriving at San Francisco nowadays reports the liveliest sort of doings along that volcanic chain. The subterranean energies that are incessantly seeking a means of escape to the surface have massed their forces along that line of volcanic vents, and are making a display of pyrotechnic brilliancy and awful energy that is seldom seen anywhere. It is now reserved for a very few spectators, most of whom are badly frightened by the exhibition.

Volcanoes that have not smoked for many years have suddenly become flaming chimneys, connecting with the molten regions beneath our feet. The grandest spectacles and the most remarkable phenomena are connected with New Bogoslov, which reared its head above the waters about eight years ago. At one end of Unalaska Island is the pass between the islands leading to the seal-breeding grounds of the Pribylov group. Bogoslov, a little mass of volcanic rock, is only about forty miles from this channel, and all vessels going to and from the sealery have a fine chance now to see the volcano in all its splendor.

Old Bogoslov was puffing away with other volcanoes when Levasheff discovered it 122 years ago; but ten years later, when Cook passed within seventeen miles of it, it was quiet. Two years after that time it was in a mild state of eruption, and in 1796 the island was reported to be rising from the sea.

The greatest changes at Bogoslov have occurred when no one was there to see. Big surprises have once or twice awaited vessels from the south that approached the island without knowing that momentous happenings had occurred. For the first fifteen years of this century Bogoslov kept gradually adding to his stature, but from 1815 until 1882 no eruptions are known to have occurred. In 1883, however, a most surprising discovery was made. A new Bogoslov had risen from the sea, probably in 1882, in front of the old volcano, with which it was connected by a gravel isthmus. The new island was 700 feet above the sea. It was a mass of flames and sulphuric vapors, and could not be inspected at close range until some officers of the cutter Corwin had the temerity, in 1884, to land on its smoking sides. It was nothing but a mass of ashes and volcanic debris, and down its slopes extended many crevices, from which stifling fumes and steam issued. These crevices were so hot that it was impossible to take the temperature, the mercury bursting the bulb in its surprise at the violent expansion. Once since then the new volcano has been ascended for a short distance, and in 1888 its height was still reported to be about 700 feet.

This new island had been thrown up by an eruption at the bottom of the ocean, which had gradually spread ashes over the ocean bed, covering a wide area, until they finally appeared above the surface and a new land was born. It was a splendid object lesson in the making of volcanic islands. But still greater wonders were in store for this neighborhood.

In February, this year, the new island with its little craters illumined the Arctic winter for many miles around. The night was almost as light as day, except when clouds of pumice dust filled the air. Several other little islands suddenly rose above the surface to join their elder sister. All of them had risen from profound depths. Their foundations are laid on the ocean bed three-fourths of a mile below the surface. It can be readily imagined, therefore, that a perfectly enormous quantity of ashes and debris have found exit through the crater or craters at the bottom of the ocean.

It is estimated that on February 22 the ashes from New Bogoslov rose to a height of about five miles, and the column of smoke, a dense black pillar, was computed to rise fifteen miles in the air. Such a sight as this is seldom witnessed in any part of the world. The natives of islands thirty or forty miles distant were terribly frightened, and thought they were going to be buried in the ashes that fell far and wide over that region. According to the most recent reports, when the new islands are not vomiting smoke and dust, steam jets often almost conceal them from view, and the hissing noise they make can be heard at a distance of several miles.

There is no telling where this new activity on our western borders will end. Other volcanoes in that neighborhood, which have long been inactive, are adding their lava, cinders, and ashes to the general commotion. Natives are moving to the parts of their islands most distant from the volcanoes. At night the scene is said to be most beautiful, for from one to another of these volcanoes stretching along the Aleutian Islands great tongues of flame shoot from craters, and rise toward the zenith like northern lights. It is a spectacle worth going far to see, but although it is adding some new islands to the domain of Uncle Sam, few will be able to see the process by which it is done. —*New York Sun.*

RECENTLY PATENTED INVENTIONS.

Electrical.

RAILROAD SIGNAL.—Edward M. Burt, Paris, Ill. Signal rails are arranged on each side of the track and connections therefrom are designed to operate through the wheels with an apparatus in the cab of the locomotive while the train is in motion, to notify the engineer directly of a misplaced switch, a bridge that is open, or of an approaching locomotive, etc.

WATCH DEMAGNETIZER. — Charles F. Berlin, of Berlin & Scott, 106 and 108 Liberty Street, New York City. A demagnetizing chamber, composed of or surrounded by a coil of insulated wire, is combined with a rheotrope acting in connection with plates or brushes, to reverse, in rapid succession, a current of electricity from any source, causing it to alternately pass in opposite directions through the coil while the watch is slowly passed through the chamber.

VALVE CONTROLLER. — Henry W. Deeds, Indianapolis, Ind. This is an electrically operated valve to be controlled by the pressure of the fluid, or its temperature, or the temperature of the air, an electro-magnet acting directly to open the valve of a combined valve and armature, while a permanent magnet connected with the core of the electro-magnet holds the valve until a reversal of the current, in combination with a battery, electrical connections, and a circuit closer.

LIGHTNING ARRESTER. — George D. Hoop, Jackson, Ohio. This is an attachment more especially for use in connection with electric lighting circuits, an insulated serrated disk having a fusible line wire connection and a contact point being combined with an insulated plate having an aperture receiving the disk and a contact point, a switch having a ground connection being adapted to swing from one of the contact points to the other.

Mechanical.

SUBMARINE MINING MACHINE.—John A. Mathews and Hiram T. Scurry, Vancouver, British Columbia, Canada. This invention covers an apparatus embracing a vertically adjustable dredging mechanism worked by steam power in connection with an ore washer and separator, for operation from floats in the beds of rivers having deposits of the precious metals.

EXCELSIOR MACHINE. — Ambrose L. and George D. Moore, New Orleans, La. This is a machine for cutting a series of shavings of a regulated thickness from blocks of wood, the machine cutting on both the forward and backward strokes of the knife head, and being simple and durable in construction.

Agricultural.

SEED DROPPER. — James S. Hickman, Hickman, Ill. As the machine is drawn the dropping devices are operated by a rope or wire stretched across the field, having knots which cause the seed to drop at measured intervals, this planter being adapted to plant two, three, four, or more rows at one crossing of the field, thus saving time and labor.

HARVESTER ATTACHMENT. — Ross B. Walmer, Millbank, South Dakota. This is a device adapted for application to any header or harvester, and by the use of which the driver can sit down and guide or steer the machine perfectly with his feet.

PLANTER. — Elisha P. Ferriss, Stevens Point, Wis. This invention provides an implement capable of use as a planter and drill, to which a marker attachment may be applied, and also a hoe, scraper, and cultivator attachment, when desired, the construction being simple and durable.

PLOW. — Ernst J. Swiedom, Giddings, Texas. The plow beam has a downwardly extending projection at its rear end, in front of which a plow standard is pivoted to the beam, a vertically sliding plate connecting the standard and extension, with an adjusting screw for operating the plate, whereby the plow may be easily and quickly adjusted while running to increase or diminish the cut, according to the nature of the ground.

Miscellaneous.

SHUTTER FASTENER. — Richeard Conner and Robert Wallbillich, New Orleans, La. This invention covers an arrangement for so connecting the various shutters of a house that all of them may be simultaneously locked or unlocked, if desired, or either shutter may be opened singly.

FIRE ESCAPE.—Charles G. Wheeland, Brush Creek, Iowa. A structure adapted to be erected either within or without a dwelling or other edifice is provided by this invention, and so arranged that any number of persons may be carried down from any floor or the roof, the escape being always in readiness for service, and having an automatic brake whereby the rapidity of descent may be regulated.

BRACE. — William H. Henderson and Louis H. Porter, Rockdale, Texas. This brace is composed of a number of plates forming a plurality of segmental sections, and is designed especially for hollow structures in which lightness of material is necessary with capacity for resisting inward pressure, such as metallic cisterns, well curbing, underground cylinders, piers, etc.

GATE. — Joseph Albers, Corvallis, Oregon. This invention relates to swinging gates, and particularly to a formerly patented invention of the same inventor, and provides improvements whereby the operator can open and close the gates from the same side.

MECHANICAL PUZZLE. — John F. Deeves and Richard U. J. Gauthreaux, New Orleans, La. This is designed to be a neat, compact, and attractive advertising puzzle of the permutation type, having parts connected with a case and aligning collars all marked with letters promiscuously placed to conceal the key word or sentence opening the connected parts of the puzzle, such word or sentence indicating the business advertised.

GAME. — David McCloskey, Wilmington, Del. This invention provides a game board representing the banks of a river and spaces for the battle field of opposing armies, to represent an imitation of a skirmish or engagement between military forces, the board being marked to represent the theater of action.

GAME APPARATUS. — Reinhold F. De Grain, Washington, D. C. An improved controlling wheel for such apparatus is provided by this invention, having a rim plate suitably supported and perforated to form seats for the weight ball by which the position of the wheel is controlled, the invention relating particularly to an improved raffle box.

FOLDING TYPE CASE STAND.—Daniel B. Bush, Jr., Pittsfield, Ill. This stand is formed of hinged side bars and cross bars combined with a skeleton frame adapted to be detachably held upon the cross bars and flexed laterally, to produce a simple and light folding stand which may be readily opened and compactly closed, and when in use will hold the type cases in convenient position for a standing or sitting compositor.

RESERVOIR GATE AND WATER WAY.—Thomas B. Craycroft, Panoche, Cal. This invention covers a novel construction of water way, with gate controlling it, in combination with a reservoir, with valve movable with the gate and arranged to be released by the rise of water above a certain height, for supplying clear water to the reservoir and separating the mud and sand from the water.

RIVET CATCHER FOR PUMPS.—Joseph Darling, Baldwin, Pa. This is a device for use in pumps employed in the oil regions, and is made to fit around the pump rod and rest down against the check valve cage, or in or on the top of the working barrel, in the manner of the ordinary rivet catcher, but this device is made flexible or yielding, and with such elasticity or spring that it will, when it strikes the upper tube, spring down and glance therein.

FLUID PRESSURE REGULATOR.—Ira J. Griffin, Sing Sing, N. Y. This is a device for regulating the flow of fluids through pipes, to always maintain a uniform pressure in the receiving pipe, and to reduce the pressure therein to any desired degree, the invention covering a novel construction and combination of parts.

REEFING ATTACHMENT FOR SAILS. — Joel N. Furman, Blue Point, N. Y. By this invention the sail is provided on each side with metal eyes attached to its seams, and a lace line is used in connection therewith in such manner that the sail may be quickly and easily reefed, so it will not chafe, while the reef may be instantly shaken out and released.

INSULATING PACKING. — Josiah C. Firth, Auckland, New Zealand. This invention covers a non-conductor of heat and protector against wet and damp, and an insulator also adapted for fire-proofing purposes, consisting in a packing composed of pieces of pumice stone reduced to lumps of regulated sizes packed together and held in fixed relation with a filling of granular pumice stone.

WATER HEATER.—Alfred P. Monnier, Greenfield, Mich. This invention consists of a water inlet pipe with a spring-pressed regulating valve, a diaphragm controlled by the water in the pipe and a nozzle, a steam pipe leading to the nozzle and having a valve controlled by the diaphragm, the apparatus being specially designed for use in greenhouses to heat water to 75° or 80° F. for sprinkling flowers in the winter time.

A ROPE OR TWINE HOOK.—James K. Miller, Emporia, Kansas. This is essentially a combination of two hooks, with an eye in the end of a single shank, and hooks arranged at right angles with each other at different heights upon the shank, by means of which ropes in use with pulley blocks or carrying weights may be quickly fastened or released, etc.

VEHICLE HUB.—John A. Lee and William H. Barrows, Brooklyn, N. Y. This invention is designed to provide a hub of simple construction that will be strong and light running, having a large bearing surface that may be easily oiled, dust being thoroughly excluded therefrom, while the axle has means for oiling without removing the hub.

VEHICLE GEAR. — George W. A. Robertson, Charlottetown, Prince Edward Island, Canada. This invention consists in a mechanism for imparting to the body of a two-wheeled vehicle a swinging or rocking motion, to so hang the body as to impart to it great delicacy of balance without inconveniencing the driver, the springs being so made and located as to overcome "horse motion."

BUCKLE.—Anthony Biesen, Hull, Iowa. This is a buckle for use in connection with any kind of brush that is held by a hand strap, but is especially intended for application to horse brushes and the like, to enable the adjustment of the strap of such brushes to fit large or small hands.

EXTENSION TABLE.—Lewis G. Smith, Dallas, Texas. This is an improvement in center tables, a construction being provided which can be easily extended or contracted, by which the objectionable center leg can be dispensed with, while the main or center portion will be firmly supported at all times.

EASEL ALBUM. — Thomas Kelly, New York City. This album projects upwardly from a base, to which the back is secured, and has two exposed covers, the rear one being fixed and the front one hinged, the front cover and leaves being swung down at right angles to the fixed back, while a secret drawer is provided for storing pictures and other articles.

ENVELOPE OPENER.—Martin Prosinger, Canon City, Col. This is a blade or cutter secured in a groove in a metal holder, and thus protected from contact with other objects, while adapted for its special function of opening envelopes, cutting leaves of books, etc.

Business and Personal.

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

Notes & Queries

HINTS TO CORRESPONDENTS.

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

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

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

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

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

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(2436) R. K. B. asks: Can you answer the following in your Notes and Queries column? 1. An explanation of the principle involved in the toy recently in the market, called "Uncle Sam, or the Mystery," consisting of a tube with flaring end, and a small sphere, such that blowing through the tube caused the ball to remain in the end of the tube. A. See our SUPPLEMENT, Nos. 37, 47, 51, and 76, for articles on this phenomenon. 2. Is the statement on page 12045 of the SUPPLEMENT, first column (in the article entitled "Sunheat and Sunlight"), that at an elevation of three miles the spectroscope shows only one color—yellow—and none of Fraunhofer's lines, correct? and if so, how is it explained on any other theory than the one there given? A. We cannot vouch for any statements in the article in question. You might address the author. 3. Describe the process by which photogravures are made. A. See our SUPPLEMENT, No. 418 and others. 4. What chemical reaction takes place in the simplest form of *fixing* a negative and *toning* a print? A. *Fixing* is simply dissolving out the unaffected silver salt. *Toning* is precipitating gold or other metal on the reduced portions of the silver salts forming the picture. 5. What is the composition of the paper from which ordinary blue prints are made? A. See our SUPPLEMENT, Nos. 61, 95, 421, 585, 574, 741.

(2437) Magician asks for a receipt for making white soft rubber, such as is used in making artificial fingers as used by magicians. The name of such rubber, and the mode used in forming it into different shapes or articles. A. Hoffman says such fingers are made of cork covered with wax. You may for a soft finger use white glue dissolved in water with enough white sirup added to give proper consistence on cooling. There is no such rubber as you call for. You may try the following: Cover white glue with water, and until it softens to a jelly, heat in a water bath and add an equal volume of glycerine; continue heating until of proper consistence. More glue will make it harder, and more glycerine softer. Color with a very little cochineal solution.

(2438) T. R. asks: 1. What will make paint dry? The doors have been painted two years, but are sticky in damp weather? A. The best remedy is to wash it off with caustic soda, or to burn it off and repaint. 2. I have wire screens in my windows and doors, but the mosquitoes get in when the doors are open. Can you tell me how to destroy what get in my house? A. We cannot. Try pyrethrum or buhach. See our SUPPLEMENT, Nos. 247, 299. 3. Explain a simple rotary electric motor; how the rotary motion is brought about. A. See our SUPPLEMENT, Nos. 641 and 761.

(2439) E. M. asks: A mixture is made one half and one-half by weight of borax and flint (almost pure silica) and fused in a porcelain kiln; is the resulting glass soluble in water? Is this glass a chemical compound or a mechanical mixture? If a chemical compound, what is its name? What difference would it make if boracic acid was used in place of borax? A. The resulting glasses would be more than mechanical mixtures, but it would not be possible to assign them a definite chemical status. They would represent rather solutions than combinations, and might be put on the border line between chemical and physical combinations. In no case where a glass is produced could it be termed a "mechanical mixture."

Replies to Enquiries.

The following replies relate to enquiries recently published in SCIENTIFIC AMERICAN, and to the numbers therein given:

Croton Bugs.—In reference to the answer to query No. 2402. At different times I have occupied four dwellings where the Croton water bugs appeared. I invariably caused their disappearance (and of small roaches as well) by sprinkling small quantities of perfectly fresh powdered borax on shelves and ledges. In one case where they were very numerous, I finely powdered the borax in a mortar and, by means of an insect powder gun, shot it into cracks, holes, and about water pipes, both horizontal and vertical.—I. HARMANUS FISHER.

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September 16, 1890.

AND EACH BEARING THAT DATE.

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Proposals for Lock Construction.—ENGINEER OFFICE, U. S. ARMY, Nashville, Tennessee, August 18, 1890.—Sealed proposals, in triplicate, will be received at this office until 3 P. M., Tuesday, September 23, 1890, for part construction and completion of Lock No. 1, Cumberland River, near Nashville, Tennessee. Bidders are invited to be present at opening of the bids. The United States reserves the right to reject any and all proposals. The attention of bidders is invited to the Acts of Congress, approved February 26, 1885, and February 23, 1887, vol. 23, page 332, and vol. 24, page 414, Statutes at Large. Specifications and blank forms for proposals will be furnished on application at this office.
J. W. BARLOW, *Lieut.-Col. of Engineers.*

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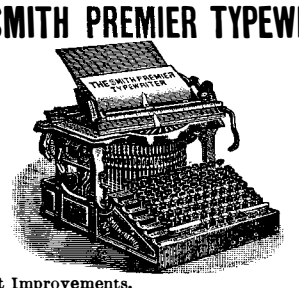

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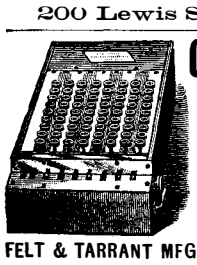

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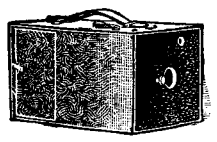

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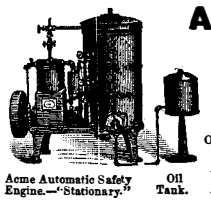

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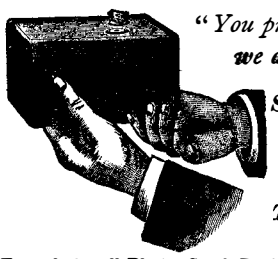

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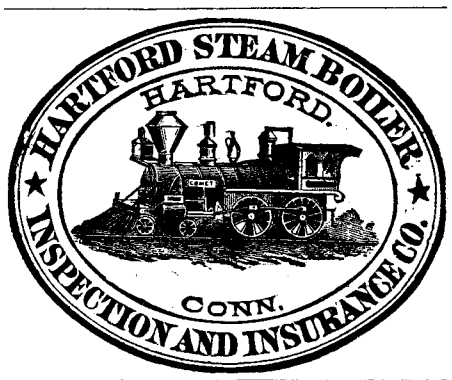

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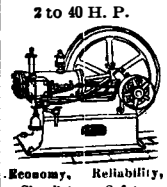

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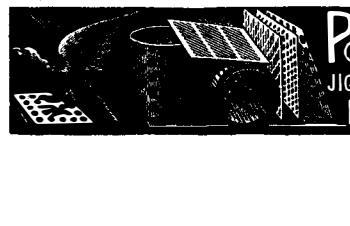

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