SCIENTIFIC AMERICAN

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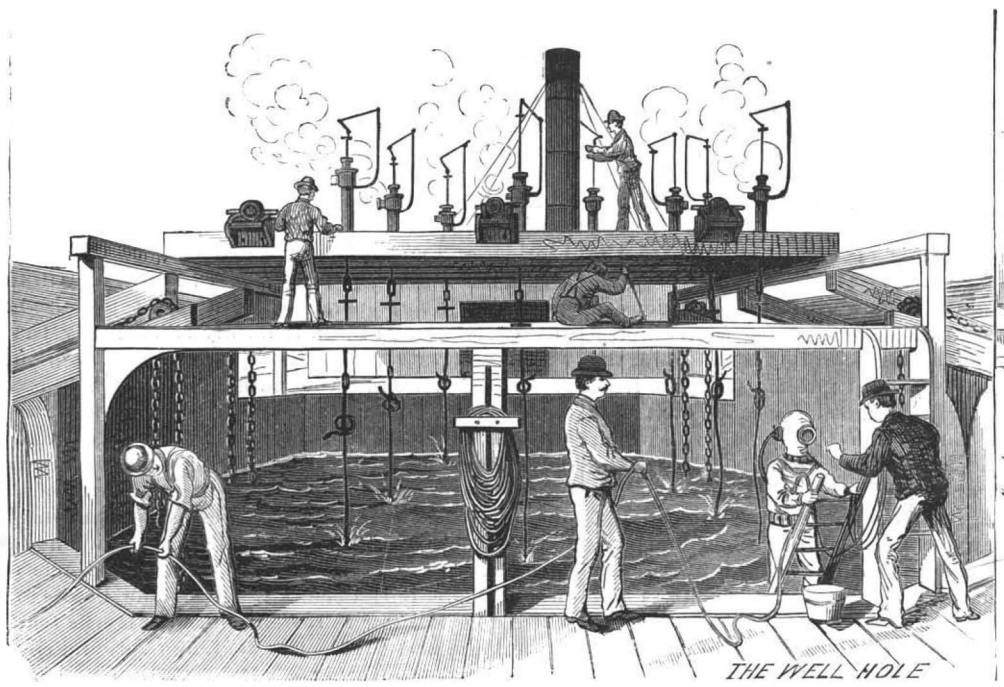

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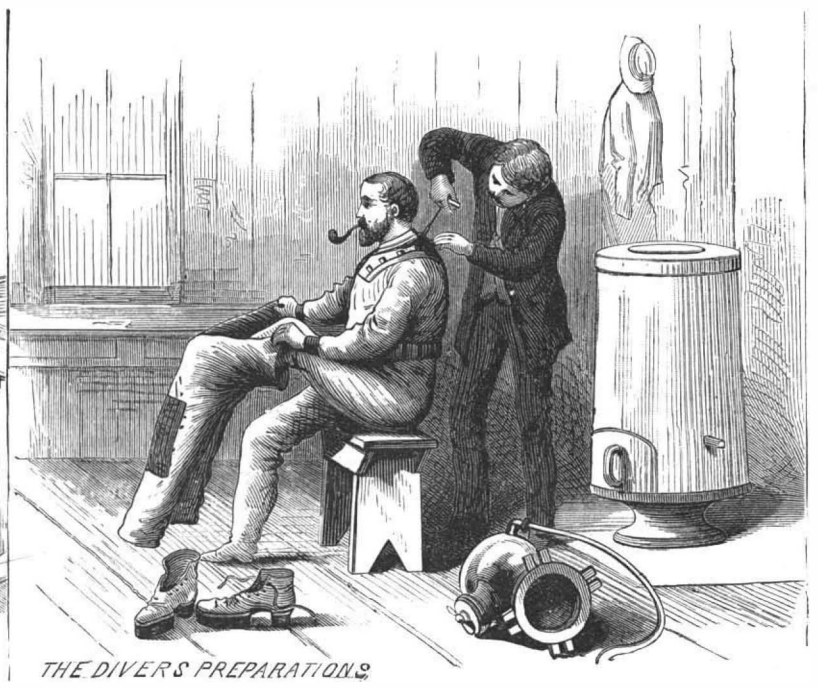
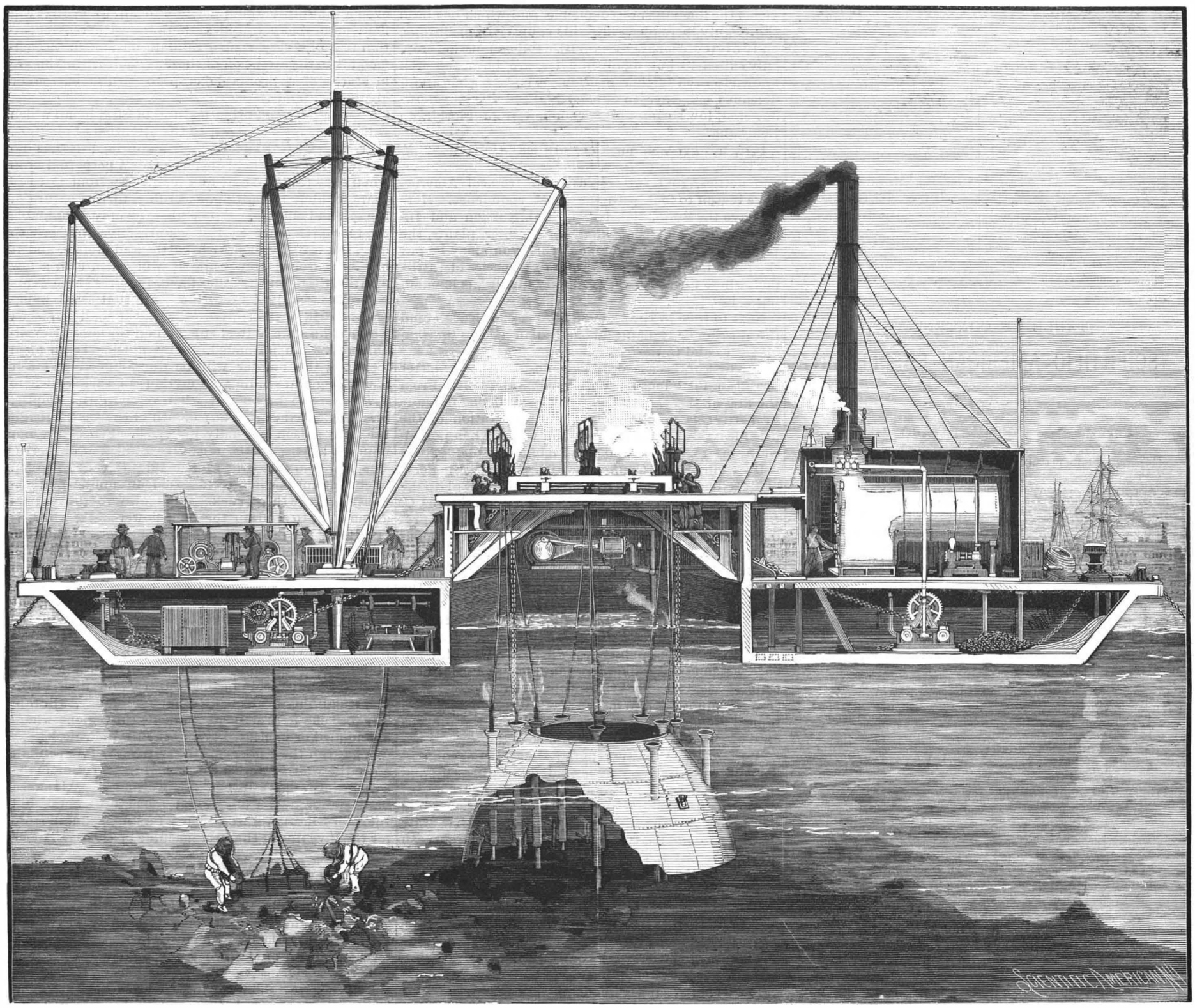


THE DIVER'S PREPARATIONS



THE UNITED STATES DRILLING SCOW GENERAL NEWTON, AT WORK ON DIAMOND REEF, NEW YORK HARBOR.—[See page 70.]

Scientific American.

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NEW YORK, SATURDAY, AUGUST 1, 1891.

Contents.

(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 813.

For the Week Ending August 1, 1891.

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FIBERS AND FIBER CULTURE.

The natural orders of the plants from which the vegetable fibers now in most general use are derived are botanically widely differentiated, and the methods used for fiber extraction are therefore somewhat dissimilar. Such widely separated families as the nettles and hemps (*Urticaceæ*), Spanish daggers (*Liliaceæ*), palms (*Palmaceæ*), peas (*Leguminosæ*), flaxes (*Linaceæ*), aloes or century plants (*Amaryllidaceæ*), and jute (*Tiliaceæ*), furnish the principal fibers for which there are at present good and fairly steady markets. The decortication of a number of these is well understood and provided for by well tried and excellent mechanisms. But in the case of some of the more recently discovered fibers much remains to be invented.

A display of the greatest industrial value was made by Messrs. Ide & Christie, of London, England, at the recent Jamaica exhibition. This firm, who are large handlers of all fibers, displayed samples of at least twenty-five different sorts in the different conditions in which they reach the London markets. To the West Indian, Mexican and Central American resident this exhibit was of great interest and of considerable educational value; and some of the facts gleaned therefrom yielded matter of equal interest to the citizens of our own country.

Under the Palms there were exhibited specimens of fibers from the Dwarf Fan, resembling coarse horsehair; Piassava, from Madagascar, Bahia and Para, the former the finest and strongest; Raffia (*Rhafia*), from brackish swamps and only good for mats, etc.; Coir fiber, from the Cocoanut Palm (*Cocos nucifera*), which is very durable and always in great demand in the English market; and the Hat Palmetto (*Chamærops humilis*), which is hardly a true fiber producer, but which yields an excellent and durable leaf for hats, matting, etc. Of these the Coir (cocoanut) fiber seems to be the most adaptable and valuable, but is not likely to be successfully cultivated in the United States unless a limited area yet to be reclaimed in the Everglades of Florida shall prove to be suited thereto.

Flax (*Linum usitatissimum*) the strong bark of which yields the linen fiber of commerce, and which has been thoroughly introduced into this country from Europe, and Jute (*Corchorus capsularis*), a soil-exhausting crop, only suited to hot, damp climates, are both too well known to need further mention. The latter has an indigenous congener in *Corchorus siliquosus*, a yellow-flowered, low shrub, not uncommon from Florida to Louisiana.

It is, however, among the so-called hemps, found in the three widely distinct families of the peas, aloes, and nettles, that sub-tropical and tropical America have reason to look with the most confidence. Here we have the Sunn, Sausiveria, Sisal, Russian and Indian hemps, and that king among fiber plants, the Ramie fiber. Least valuable in this group may be put the Sunn hemp (*Crotalaria juncea*), a species of rattlepod, whose fiber is of very ordinary quality, commanding a low price.

Next to this in the scale of fibrous excellence stand the Russian or Italian and the Indian hemps (*Cannabis sativa* and *C. indica*).

The first of these is an indigenous growth; the latter has been introduced as an ornamental plant. From the first of these, both being nettles of strong narcotic properties, is made "gunjah," a preparation of the dried leaves which is smoked, and which when pounded in water is drunk under the name of "bhang." It is the resin of this *Cannabis* which produces the nervous excitement, and increasing doses of it lead to delirium, catalepsy, and finally end in insanity. *C. indica*, the Indian hemp, is well known from its product, "hasheesh," a most virulent narcotic, very popular in the East. Both of the plants yield fair fibers, but the demand for them is decreasing.

This same family (*Urticaceæ*) furnishes us with the genus *Bœhmeria*, the false nettles, from which we derive the Ramie fiber (*Bœhmeria nivea*), which is now universally acknowledged by experts to be the best of all fiber-producing plants known to agricultural science. Ramie or Rhamia has long been known to the Chinese as an excellent substitute for or adulterant of silk. To quote Mr. Wm. Fawcett, director of the Botanical Department of Jamaica, it "has the appearance of silk and the strength of flax."

Messrs. Ide & Christie report Ramie fiber as in great demand, with but very little available at present, and the same report comes from New York. The State of Vera Cruz probably produces over one-half now being sent to market, and it was at a hacienda in that State that the recent trials were made for the large cash prize offered by the Mexican government. These tests, it is understood, were far from being regarded as final. Ramie can be grown from Central America to New Jersey, the crops under the most favorable circumstances in the former averaging seven per year, while two or three may be taken off the land in the pine barrens of the latter. Its congener (*Bœhmeria cylindrica*) is not uncommon in swamp lands, from Florida to the region around Philadelphia.

At present it is the need of proper decorticating and other special machinery which seems to stand most in the way of the development of both Sisal and Ramie fiber cultivation. There are large areas in the United States, notably in Florida, along the Gulf coast, and in Texas and New Mexico, where both of these fibers could be cultivated to a remarkably successful extent. This is especially true of Ramie, and this is fortunately so, for, as already said, this plant produces a beautiful fiber of silk-like quality and of very great strength, which needs but to be seen and compared with any of its rivals to commend itself as the most desirable for cultivation. It is quite safe to say, indeed, that when the inventive faculties of our American mechanics shall have produced superior fiber-extracting machinery, Ramie is destined to drive from the market many other fibers now used for cordage or spun goods. This plant should yield four crops per year along the Gulf coast of the United States.

Sisal hemp, the fiber extracted from the American aloe or century plant (*Agave Americana*), and its near ally the Spanish dagger (*Yucca aloefolia*) are both well known plants in our Northern hot houses. The latter is indigenous to this country as far north as the coast of North Carolina, and the former has a well established congener, *Agave rigida*, which grows in south Florida, and which I believe will be found to produce a valuable fiber. Spanish dagger (*Yucca*) may in time yield a fair fiber, though with the great promise held out by Ramie and Sisal, it hardly seems likely that it will be cultivated. Sisal hemp has been much more largely advertised in the public prints, and it is undoubtedly at present the best known and most favorably considered of the American fiber products. Perhaps its remarkable aptitude for growing in the most barren places—on honeycomb rock and in arid sands—has rightfully earned it its present reputation. Be that as it may, it is the plant which has awakened the dormant energies of Yucatan, yielding handsome revenues where only deficits were possible before, and which now bids fair to revolutionize the sterile reaches of the Bahamas, thanks to the judgment and energy of their former governor, Sir Henry Arthur Blake, now governor of Jamaica. A plant that will grow where even a sandpiper would hesitate to alight, or that will flourish on rocky hillsides where the withered vegetation tells of a very sparse rainfall, has much to commend it to the attention of those agriculturists who are in search of a profitable crop to utilize barren or abandoned lands.

There are certain other features of Sisal hemp which will at once recommend it to the attention of planters. It requires no plowing nor manuring; it has no insect nor other animal enemies; it is a perpetual crop when once ready to cut; and it will last from 15 to 25 years without replanting, according to the nature of the soil and climate. Ramie fiber, its only formidable rival for preference in this country, does not last so long, is a favorite food with cattle and horses, and it has its seasons. But while it will mature in a few months, Sisal, on the other hand, requires three years before it is ready for cutting. All that Sisal hemp seems to ask of the cultivator is that it shall be placed where shines the hottest sun, and on the poorest available soil. An unshaded, rocky hillside is an ideal location; the planter will be dumfounded to see it flourishing and sending out myriads of suckers where there seems to be no soil whatever. In the tropics, Sisal is planted during any month of the year, though the rainy season is usually preferred. Fences are not required; hogs, cattle, etc., give Sisal a wide berth. The principal care called for, besides that to be taken in cutting for market, is to avoid an undue and exhausting growth of suckers, and also to prevent its attempting to send up the long flower-stalk, which is invariably the precursor of death, no matter what the age of the plant. But these are items of simplest details, easily mastered by the most indifferent farm hand.

As has already been said, nothing is now lacking but the application of American inventive skill to the problem of fiber extracting. When this shall have reached a reasonable solution, many thousands of acres of land now looked upon as useless will come under profitable cultivation in this country, and fiber growing, if suitably protected during its infancy, will rapidly become a prominent industry in regions where abandoned or uncleared lands are now the rule.

What can the readers of the SCIENTIFIC AMERICAN offer the waiting agriculturist in this direction of decorticating apparatus? The government of Jamaica has a standing offer of £200 ($1,000) as a premium, and the fiber-consuming world has a far larger sum in store for the inventor of the best machine of this sort.

Valuable Discovery of Silica.

At Friedensville, Pa., five miles from Allentown, according to the Philadelphia *Ledger*, there have been discovered practically inexhaustible deposits of silica. Over fifty acres are known to be underlaid with that mineral, the veins varying in thickness. Samples of the silica were submitted to pottery experts at Trenton, who pronounced them admirably adapted for chinaware.

POSITION OF THE PLANETS IN AUGUST.

JUPITER

is morning star, according to astronomical classification, which ordains that planets when on the western side of the sun are morning stars, and when on the eastern side, evening stars. The natural classification would make him evening star, for he rises at 9 o'clock at the beginning of the month and at 7 o'clock when it closes.

Words fail to picture the splendid appearance of this princely planet as he makes the circuit of the skies on August nights. He is at his best, for his opposition occurs on September 5, and the month before and the month after opposition include the most brilliant portion of his course. He is retrograding or moving westward, increasing in size and luster as he approaches the earth, rising earlier every night, and traveling north, which lengthens his stay above the horizon, as observers can see for themselves.

The moon is in conjunction with Jupiter on the 20th, the day after the full, at 7 h. 25 m. P. M., being 3° 44′ south. The conjunction takes place very near the time when the moon and planet appear above the horizon.

The right ascension of Jupiter on the 1st is 23 h. 18 m., his declination is 5° 53′ south, his diameter is 41″.6, and he is in the constellation Aquarius.

Jupiter rises on the 1st at 8 h. 51 m. P. M. On the 31st he rises at 6 h. 47 m. P. M.

MERCURY

is evening star. He reaches his greatest eastern elongation on the 16th, at 7 h. P. M., when he is 27° 25′ east of the sun. He sets then about an hour after the sun, but is 12° south of the sunset point, the moon is near the full and the summer twilight lingers long. These conditions make it difficult to find him, although he is nearly at his maximum distance from the sun. Mercury moving eastward from the sun meets Saturn moving westward toward the sun. The conjunction takes place on the 13th, at 8 h. 8 m. P. M., Mercury being 3° 36′ south. The planets set on that evening about the time of the conjunction. Observers endowed with good visual power may have a glimpse of our celestial neighbors in the west soon after sunset, if the sky is cloudless and the atmosphere serene. A marine glass will be a valuable assistant in the search.

The right ascension of Mercury on the 1st is 10 h. 17 m., his declination is 11° 11′ north, his diameter is 6″.0, and he is in the constellation Leo.

Mercury sets on the 1st at 8 h. 12 m. P. M. On the 31st he sets at 6 h. 55 m. P. M.

VENUS

is morning star. She is close to the sun and invisible, but an incident occurs in her August course that, under other conditions, would attract great attention. She is in conjunction with Mars on the 22d at 3 h. 4 m. A. M., being 1′ north. One minute of arc is a very small piece of sky, and the planets are so near together that they will seem to touch, or make an appulse. They are, however, below the horizon at conjunction and no human eye can witness the rare phenomenon that comes near being an occultation of Mars by Venus.

The moon, the day before her change, is in conjunction with Venus on the 3d, at 8 h. 12 m. A. M., being 3° 34′ north.

The right ascension of Venus on the 1st is 7 h. 58 m., her declination is 21° 17′ north, her diameter is 10″.2, and she is in the constellation Cancer.

Venus rises on the 1st at 3 h. 51 m. A. M. On the 30th she rises at 5 h. A. M.

MARS

is morning star. His meeting with Venus has already been referred to. He has advanced so far on his course westward from the sun that he rises nearly an hour before the great luminary when the month closes.

The right ascension of Mars on the 1st is 8 h. 44 m., his declination is 19° 19′ north, his diameter is 3″.8, and he is in the constellation Cancer.

Mars sets on the 1st at 7 h. 11 m. P. M. On the 31st he rises at 4 h. 29 m. A. M.

SATURN

is evening star. He sets on the 1st about an hour and a half later than the sun, and may be found about 16° east of Regulus and slowly receding from the bright star. His conjunction with Mercury on the 13th has been referred to.

The moon, when three days old, is in conjunction with Saturn on the 7th, at 5 h. 21 m. A. M., being 3° 16′ north.

The right ascension of Saturn on the 1st is 11 h. 9 m., his declination is 7° 34′ north, his diameter is 15″.2, and he is in the constellation Leo.

Saturn sets on the 1st at 8 h. 51 m. P. M. On the 31st he sets at 6 h. 47 m. P. M.

URANUS

is evening star. Keen-eyed observers will find him 6° east of Spica. His right ascension on the 1st is 13 h. 43 m., his declination is 10° 9′ south, his diameter is 3″.6, and he is in the constellation Virgo.

Uranus sets on the 1st at 10 h. 23 m. P. M. On the 31st he sets at 8 h. 25 m. P. M.

NEPTUNE

is morning star. His right ascension on the 1st is 4 h. 29 m., his declination is 20° 12′ north, his diameter is 2″.6, and he is in the constellation Taurus.

Neptune rises on the 1st at 0 h. 27 m. A. M. On the 31st he rises at 10 h. 31 m. P. M.

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

Death of Two Noted Entomologists.

BY C. V. RILEY.

Henry Edwards.—Probably no entomologist who has died in recent years will be more sincerely mourned by a larger circle of friends than Henry Edwards, who died June 9, at his home in New York City. Mr. Edwards was a man of the most engaging qualities, was a well-known actor, and was one of the foremost entomologists of this country, where he has resided for many years. His collection of lepidoptera is almost unsurpassed, and he possessed, also, very large series in other orders. His collection was not strictly American, but included many thousands of specimens from other parts of the world, principally from Australia, where he lived for a number of years. He was not only a systematist of some note, but also a keen observer of the habits of insects, and a most enthusiastic lover of the biological phase of the science. His kindly nature and his great generosity were two of his most prominent characteristics.

Mr. Edwards was sixty years of age at the time of his death, having been born at Ross, Herefordshire, England, August 27, 1830. His early manhood was spent in London, where he became an amateur actor and subsequently a professional. He began the study of entomology while in London, and when, in 1853, he sailed for Australia, it was probably the entomological novelties to be collected in that then almost unknown country which attracted him quite as much as the chance of professional success. He remained in Australia twelve years, and then moved to California, where for twelve years more he was an actor and stage manager in the California theaters. During that period he collected as industriously as ever, and made one or more trips to Mexico, as described in a charming book of sketches published in 1878 under the title of "A Mingled Yarn." During his stay in California he was for some years president of the celebrated Bohemian Club, in San Francisco. He removed to Boston in 1878, and in 1879 to New York, where for a number of years he was connected with Wallack's theater. During this time he was president of the New York Entomological Club, and one of the founders and first editor of *Papilio*. In the summer of 1889 he went to Australia to fill a professional engagement, and returned to this country last fall. His death was due to the grip, followed by pneumonia and Bright's disease. Entomologists of the present generation will cherish his memory both for his lovable personality and for what he did as a scientific man. Those of future times will know him from his descriptive papers in lepidopterology. Perhaps the most useful work he has left behind him is his excellent catalogue of the described transformations of North American lepidoptera, which is indispensable to every student of North American insects.

I had the pleasure of meeting him only a few weeks ago with the Daly company at Washington. His appearance then greatly shocked me, and showed the severe illness which he had passed through. He was, in fact, at that time, unfit to be on the stage; yet he was hopeful and genial and pleasant as ever. The last article which he probably penned was published in the last number of *Insect Life* (vol. iii., pp. 384 to 386), on the early stages of *Cryptophasa unipunctata*. So far as I can learn, he left no will, and made no particular disposition of his magnificent collection. I also regret to learn that, as is so often the case with men of his generosity and devotion to art and science, he left little of this world's goods, so that his widow depends chiefly upon the insect collection which for so many years was at once his chief care and pleasure. It is of great scientific value, and its money value may be judged from the fact that for many years Mr. Edwards carried upon it an insurance of $17,000. I hope and trust that it will remain in this country. There are few, if any, institutions as capable financially of paying its true value as the new Leland Stanford, Jr., University, and in no institution would it rest more appropriately, so large a number of the specimens having been collected in that State. I regret exceedingly that the National Museum has no funds wherewith to secure collections thus offered. The trustees of the Central Park Museum were thinking a few years ago of securing the collection, and Mr. Edwards offered it on favorable terms; but whether it remain in New York or go to California, the friends of the deceased will be glad to know that it remains in the country, and should do all they can to secure it here.

Jules Kunckel d'Herculais.—Most of your readers have already seen the announcement of the death of M. Kunckel d'Herculais, formerly president of the Entomological Society of France, who is said to have died under the most distressing circumstances near the village of Sideriel, Algiers, while engaged in the investigation of the European migratory locust, early in May. The shocking report that he was attacked by a swarm of locusts while sleeping and destroyed by them, after desperate struggles to escape, is probably not warranted by the facts, although we have yet no definite information on the subject. The probabilities are that he was overcome by the heat, or died from heart disease or some other sudden and unexplained cause, and that subsequently the locusts alighted upon his body and devoured the exposed portions and parts of his clothing. It is a well known fact that when locusts are swarming in such enormous numbers they depart from their usual food habits and become more or less carnivorous. They have also been known, under these circumstances, to eat woolen cloth, and even to alight on the backs of sheep and eat the wool. D'Herculais was a very prominent entomologist and had done much good work. His selection by the French government to investigate the cause of the locust plague in Algiers was an eminently fitting one, and he had already published a preliminary report on the subject. He was a personal friend of the writer, who was his guest at dinner in the fall of 1887, when the locust question in Algeria was discussed in the light of the mission with which he was subsequently intrusted. How little either dreamt that it would end for him so tragically!

The Storage Battery Patent.

On July 23, an important decision in this matter was made by Judge Coxe, in the United States Circuit Court, New York, by which the Brush patents for the manufacture of storage batteries in the United States are made valid. The decision was filed in the case of the Brush Electric Company against the Electrical Accumulator Company.

The contest between the companies has been bitterly waged.

The Julien Electric Traction Company was sued for infringement by the Electrical Accumulator and the Brush Electric companies, and, in addition, the Brush Company also brought an action against the Accumulator Company. The first suit heard was that between the Electrical Accumulator and the Julien companies, and in that a decision was given in favor of the former. Immediately, however, the cause of the Brush against the Julien Company came on for hearing, and a decision was given whereby the defendant was enjoined from the use of its storage battery.

The Consolidated Electric Storage Company, successors of the Julien Company, bought the exclusive license in the United States for the Brush storage battery patents, and the cause of the Brush Company against the Electrical Accumulator Company was pushed. The decision of Judge Coxe awards to the Brush Company the exclusive right for the manufacture and sale of every type of modern storage batteries. In his decision the judge says: "Mr. Brush was the first in this country to make the broad invention. He is entitled to the fruits of his invention. It is the policy of the law to reward him."

The managers of the Fourth Avenue Railroad say they will immediately restore the storage battery cars to their Fourth and Madison Avenue lines. It is claimed that these cars have not, as yet, been run as cheaply as horse cars, on account of the cost and rapid deterioration of the batteries; but additional improvements are looked for, and it is thought economies will be effected in running to more than make the account even.

Coal Deposits in Westphalia.

During the annual meeting of the Society of Gas and Water Engineers, recently held in Strassburg, Herr Grassmann, mining assessor, of Saarbrück, read a paper on the production and consumption of Saar coal. He stated that the length of the district was 32¼ miles and its breadth 9¼ miles. The richness in coal was estimated at 565,000,000 square meters, and the quantity of coal was reckoned at 14,000,000,000 tons. The yearly production was 6,000,000 tons, so that if the present rate only was maintained, the deposits would last over 2,000 years. Dr. Brookmann, of Bochum, then read a paper descriptive of the Rhenish Westphalian coal deposits from a geological point of view. He said that 130,000 miners produced 36,000,000 tons of coal per annum in the Ruhr district. Although considerable beds lay in the ground, he was of opinion that they could not be worked at a greater depth than 1,000 meters, or say 3,250 ft., owing to the great danger. The thickness of the 138 layers in the Ruhr district was from ½ to 2 meters, but in case of three strata they were about 3 meters.

A GOOD recipe for making waterproof cement, to be used in constructing aquarium, is to take 25 parts gutta percha in shreds and melt it carefully. Add 75 parts ground pumice stone, and then mix in 150 parts Burgundy pitch and melt well together.

EDISON DYNAMO AND MOTOR.*

The steel armature shaft is 16½ inches long and ½ inch in diameter at the journals, and $1\frac{1}{16}$ inch in diameter between the journals. The larger part of the shaft is 9½ inches long. Sufficient end chase is allowed in the armature journals to cause the surfaces to wear smoothly.

On the central portion of the armature shaft is placed a wooden sleeve, $1\frac{1}{16}$ inch in diameter; on this are mounted the thin sheet iron disks forming the armature core. These disks are 2⅛ inches in diameter. They are arranged in series of five, with tissue paper between the disks, and between the series of five are placed several thicknesses of paper. Enough disks are clamped together on the shaft to make this portion of the core 3½ inches long. The cast iron disks between which the sheet iron disks are placed are ¼ inch in thickness and 2⅛ inches in diameter. One of them is fixed on the shaft, the other being held in place by a hexagonal nut screwed on the shaft. The cast iron disks have their outer corners rounded, and in the edge of each are formed thirty-two equidistant radial slits $\frac{1}{32}$ inch wide. In these slits are inserted slips of vulcanized fiber for separating the different pairs of coils during the operation of winding.

It is impossible to describe the Edison winding without depending mainly on the diagrams, Figs. 1 and 2. There are two series of coils; that is to say, there are two coils in each division of the armature. There are thirty-two bars in the commutator, which are numbered consecutively from 1 to 32.

The armature core and shaft are thoroughly insulated by means of paper coated with an adhesive varnish. Jute string ribbon is wound on the face of the core as a further protection.

The wire used on the armature is No. 21 copper wire, double covered; the inner covering being of silk, the outer of cotton.

Leaving an end out for connection with the commutator coil, No. 1 is begun at 1 and wound in four layers, with six convolutions in each layer, the outer terminal coming out at 1′. These ends are marked respectively 1 and 1′ in such a manner as to avoid any possibility of the detachment of the marks. If this caution is observed, much trouble may be avoided. A good way to mark them is to place a tag of parchment, or parchment paper, on each end of the wire, with the number marked on.

After winding coil No. 1 the armature is turned half way over and coil No. 2 is wound and marked in the same way, with 2 on the inner end of the coil and 2′ on the outer end. The coil is then reversed and coil No. 3 is wound and its ends are marked in the same way, and so on until the first series of coils is finished, the last coil of the series being marked 16 and 16′.

The first coil of the outer series is No. 17–17′. This wound on the top of coil No. 1. The armature is turned over and No. 18 is wound on the top of No. 2, and so on until all of the outer coils are in place.

Before winding, the inner end of each wire is wrapped

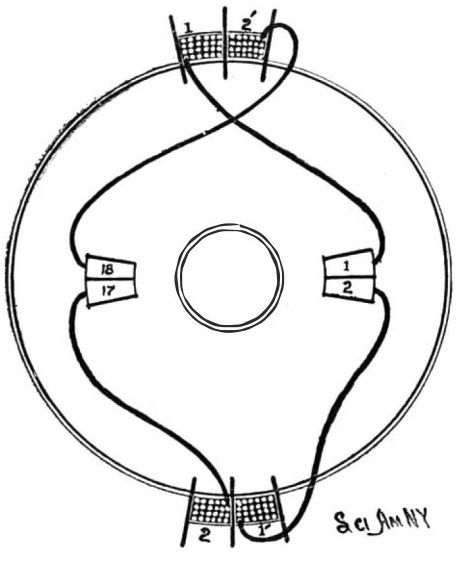


Fig. 2.—THE FIRST TWO COILS AND COMMUTATOR CONNECTIONS.

in jute string ribbon to a point within the end of the armature core, and it is further protected by a wrapping of thin adhesive tape. The outer end of the coil is covered in the same way.

About three pounds of No. 21 wire are required for the armature. The length of wire in the first inner coil is 26 feet 6 inches. The length of wire in the last outer coil is 35 feet.

The commutator cylinder† is formed of 32 bronze bars having beveled ends and radial arms for receiving the wires. These bars are clamped in position on a sleeve having an under-cut flange, by a countersunk washer and a nut screwed on the sleeve. Mica is inserted between the commutator bars, between the bars and the sleeve, and between the ends of the bars and the flange and the washer. The radial arms extending from the commutator bars each have a slot in the end for receiving the terminals of the coils.

The coil terminals are arranged in groups of 16, the wires of each group being parallel. The terminals are carried around and attached to commutator bars which are about 45° from the planes of the coils to which they belong, thus making the winding more symmetrical and at the same time permitting of a better arrangement of the brushes.

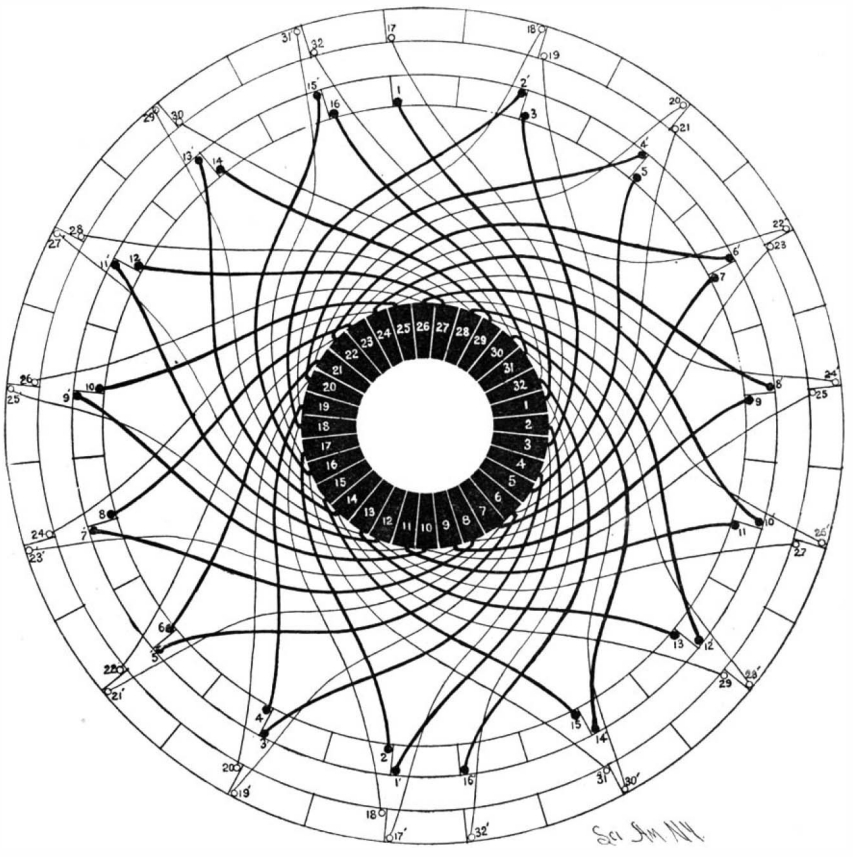


Fig. 1.—DIAGRAM OF WINDING OF EDISON ARMATURE.

The coil terminals are inserted in the slots of the arms of the commutator bars and soldered with soft solder, the connections being made in accordance with the diagram, Fig. 1.

The wires, where they cross at the back and front end of the armature, are separated by sheets of mica. Where the winding crosses at the rear end of the armature the wires are spread out so that they are only one layer deep.

When the winding of a coil is finished, the terminal is fastened by stout threads inserted in the coil before winding the last three convolutions, and tied after the coil is complete.

A vulcanized fiber collar, a little larger in diameter than the commutator, is slipped over the commutator bars and placed against the radial arms of the bars as shown. The edge of the collar is grooved and a canvas cover is fastened to the collar by tying it in the groove. It is then drawn over the terminals and fastened by the first ring of binding wire on the armature. At the opposite end of the armature a similar collar and cover is provided.

Before covering the terminals with the canvas they are wound with twine, to give the end of the armature a symmetrical shape. The winding is varnished with shellac before its cover is applied, and the cover is varnished after it is secured in place.

The binding rings are formed of brass wire, wound tightly over a layer of mica interposed between the wire and the binding. The binding wire is secured by clips and soft soldering.

The brush yoke is provided with wooden handle by which it may be moved and a binding screw by which it is clamped in the position of use. In mortises in the ends of the yoke are placed insulating blocks, in which are inserted the brush-holding studs. These studs are each provided with a nut for clamping the brush holder cables which communicate with the leads at the side of the pole pieces.

On each brush-holding stud is placed a sleeve fastened with a set screw, also a loose sleeve connected with the fast sleeve by a spiral spring concealed within it. The loose sleeve is furnished with a brush clamp for holding the brush, which bears on the commutator cylinder with a yielding pressure. The brushes are formed of spring copper wires fastened together at their outer ends with soft solder.

A jig goes with each machine for clamping the brush and guiding the file while renewing the brush ends.

The speed of the motor on a 125 volt circuit is 2,400 revolutions per minute. The speed at which the armature is to be driven in order to generate a current having an E. M. F. of 125 volts is 2,730 revolutions per minute.

Since the first part of this article appeared in our issue of July 25, we have received a letter from the Edison General Electric Company, stating that the machine here described, according to the new rating, which went into effect June 15, is a 0·5 kilowatt machine, which, when used as a generator for supplying lights, will generate sufficient current to bring to full candle power nine 16 C. P. 112 volt lamps, and when used for power it is a ½ H. P. motor at a rated volt. It is guaranteed to give 0·47 H. P. at ⅞ of its rated volts.

We are also reminded by this letter of the fact we neglected to state in our former article, which is that this form of machine is a type which was brought out in 1885, and is known as the Standard Edison machine, which is made in several sizes. Each size is identical, in its general construction, with the machine described, and any of the machines can be used either as a dynamo or motor.

Protection against Lightning.

Prof. Henry A. Rowland, of the Johns Hopkins University, is reported as follows in the Baltimore *Sun*, in an interview on the subject of protecting buildings against lightning.

"Recent scientific study has swept away some of the old notions about conductors. The method now considered the best for the protection of buildings is to provide a metal roof, with an ample number of metal conductors leading to the ground, which will receive and carry off the electric bolts from the clouds. Copper is the best material, but tin or iron will answer the purpose, and I always suggest the placing of the conductors at the corners of a building, so that all parts will be equally protected.

"Though rods may be used, rain spouts will answer the purpose equally well. The physical laboratory of the Johns Hopkins University is protected from lightning by the roof and spouting. You can safely class all patented lightning rods as being of little value beyond conducting rods that any man can put up himself, because the simple principle underlying all is that the lightning will follow the best conductor. The idea so largely adopted in the erection of lightning rods, that a small band of glass will prevent the electric current from passing to a better adjacent conductor, seems playful. While it is true that lightning is attracted to an elevated point or angle, when you cast your eyes over a city like Baltimore and see the large number of such points and angles, the use of pointed rods fades into insignificance as compared with the method of roofing with a good conductor. This was well illustrated by the incident of lightning striking the great monument in Washington several years ago.

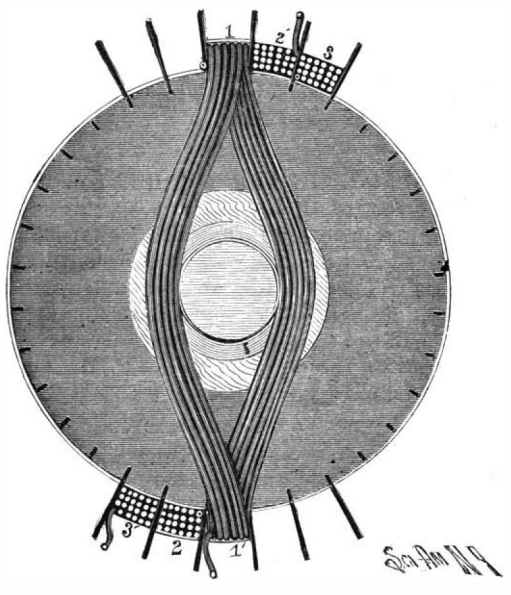


Fig. 3.—ARRANGEMENT OF THE LAYERS AT END OF ARMATURE CORE.

The monument is capped with a piece of aluminum, which has metallic connection with the ground by means of the ironwork of the interior, but the lightning did not strike the top of the cap. It descended to some copper fixed in the side of the pyramidal top, some distance from the apex, burst a portion of the stone, and, running along the copper into the interior, leaped without any metallic connection to the iron framework and passed to the ground. A framework of copper rods covering the angles and crossing the sides of the immense cap was recommended by me at that time for the future protection of the monument, and

* Continued from page 54.

† For further points on commutators see SUPPLEMENT, 690.

has probably been constructed. The ground connection was to be through the internal ironwork spoken of. Somewhat similar to these methods is that of the Peabody library. The iron shelving connected with the metallic roof, and resting on a stone foundation which might be shattered by a stroke of lightning, has been connected with the ground by metal conductors, and no danger from lightning is apprehended.

"Lightning has no fixed portion of a building to strike. The stroke may fall at the center of a roof, and while it runs along the surface of a body, the body may be broken or crushed by the enormous pressure brought to bear upon it, in the same manner that an explosion of dynamite or nitro-glycerine would cause a fracture. I have some fragments of a church spire struck by lightning which are bound together in their former relative positions, but exhibiting all the fractures produced by the concussion. There is a vast difference between the quantity of electricity and what is known as electrical pressure. This is illustrated in a simple manner by the compression of air. A small quantity of air can be compressed to the same degree to obtain as great an expansive force as a large quantity. The quantity of electricity in a stroke of lightning is not nearly as much as passes along almost any electric wire on the street, but the voltage or electrical pressure of the street wire is rarely 3,000. A volt is the basis on which the pressure is estimated. The voltage of the lightning stroke is roughly estimated at 6,000,000,000 volts. In addition to this appalling difference it may be said that the current of the wire is constant and continuing, while the lightning dart is delivered in the one two-hundredth part of a second. Such an astounding force is capable of doing many strange things."

In speaking of places of safety during an electrical storm, Dr. Rowland said that probably as safe a place as any other would be an iron bedstead, provided the

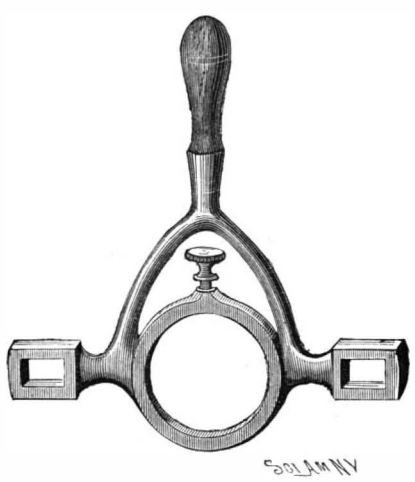


Fig. 6.—THE BRUSH YOKE.

ground connection is perfect, this being in line with the above theory, that the lightning would follow the best conductor.

The Prince Edward Island Tunnel.

The greatest public work the Canadian government has now in contemplation is the construction of a railroad tunnel under the Straits of Northumberland, connecting the shores of New Brunswick with those of Prince Edward Island. At the request of the Dominion government Sir Douglas Fox has made a report on the cost and feasibility of the work, of which the following is a brief summary:

The greatest depth of water is 96 ft. at high water, with a rise of tides of 6 ft. at springs and 3 ft. at neaps, and the speed of the current does not exceed three knots, with two hours of slack water at each tide. The distance from shore to shore is given at about 13,200 yds., or say from shaft to shaft 13,500 yds., exclusive of land approaches on either side, of which about 2,000 yds. would be in the tunnel. The shores on either coast are well adapted for railroad approaches, varying from 15 to 35 ft. in height above high watermark, with a mean altitude of 25 ft., the soil being largely red clay. The higher land on the Prince Edward Island shore falls away toward the interior, which will shorten the approach on that side. It is considered that about 5½ miles of railroad, including some 2,000 yards of tunnel, as before mentioned, will be necessary beyond the shafts to connect the tunnel with the respective systems of railroad, which, however, are of a different gauge, viz., 4 ft. 8½ in. in New Brunswick and the Dominion generally and 3 ft. 6 in. in Prince Edward Island.

From the above it will be seen that the length of tunnel from shaft to shaft would be 7·67 miles, while, with the connections to the present railroad on each side, the whole tunneling required would be over 9 miles.

The estimates are as follows:

In the dry portions of the work, a tunnel of brickwork, in cement, averaging 1 ft. 6 in. in thickness (the

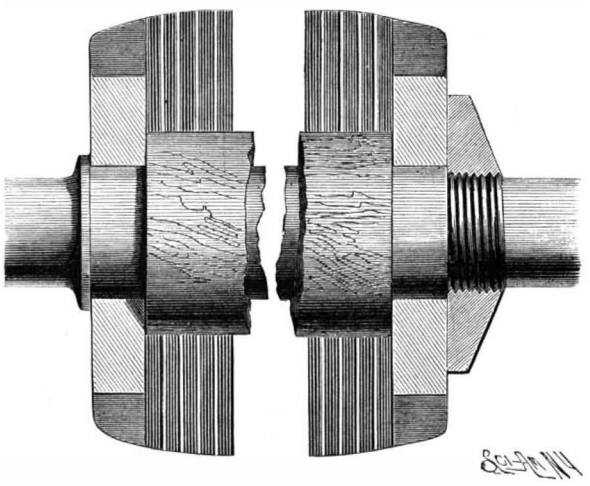


Fig. 4.—THE ENDS OF THE ARMATURE CORE.

bricks being of local manufacture), and where feeders occur, with cast iron casing 1¼ in. in thickness, with 6 in. flanges, laid with steel rails weighing 50 lb. to the yard, is estimated to cost £66 10s., nearly, per lineal yard, or say £897,500 from shaft to shaft, or with the land tunnel and contingencies a total sum of £1,075,200.

Should it be decided that the tunnel must be of sufficient dimensions for a railroad of the 4-8½ gauge, and that the railroads of the island shall be altered to that gauge, a tunnel of 16 ft. in diameter would appear to just accommodate passenger and freight cars of the normal Canadian and American type, but not drawing room and sleeping cars, nor some of the cars running upon the Intercolonial railroad. This size does not allow of a very satisfactory permanent way, nor does it provide proper space for the platelayers. Such a tunnel constructed in the shale, of brickwork in cement, 1 ft. 10½ in. in thickness, and where feeders occur with cast iron casing, 15 in. in thickness, with 9 in. flanges, and laid with steel rails weighing 70 lb. to the lineal yard, is estimated to cost £122 10s., nearly, per lineal yard, or say £1,652,500 from shaft to shaft, or with the land tunnel and contingencies a total sum of £1,971,800.

Sir Douglas Fox is of opinion that to properly accommodate the Canadian and American rolling stock the tunnel should have an internal diameter of not less than 18 ft. Such a tunnel, constructed as specified for the 16 ft. tunnel, is estimated to cost £140 per lineal yard, or say £1,890,000 from shaft to shaft, or with land tunnel and contingencies a total sum of £2,225,500.

It is recommended that, before inviting tenders for the main work, a shaft placed at Carleton Point, so as to be afterward available for permanent pumping and ventilating purposes, should be sunk well into the red clay shale, which lies above the carboniferous sandstone. Borings similar to those taken at the Sarnia tunnel (viz., from a vessel or platform through 16 in. wrought iron pipes, so as to insure cores of sufficient size and undamaged being brought to the surface) should be made across the straits and down to the carboniferous bedrock. With this information obtained, much closer tenders may be expected for the construction of the tunnel.

When the work is resolved upon, immediate steps should be taken: 1st. To connect the existing railroads with the tunnel work.

2d. To establish brickyards at the nearest available site where good clay free from lime is to be found. The quantity of bricks required will vary from 30 to 60 millions, according to the size of the tunnel.

3d. To erect dwellings, stores, etc., for the staff and workmen.

4th. To put down the permanent pumps and provide the necessary plant for temporary purposes.

5th. To install the necessary electric plants and motors.

6th. To provide and fix the compressed air machinery. —*Railroad Gazette.*

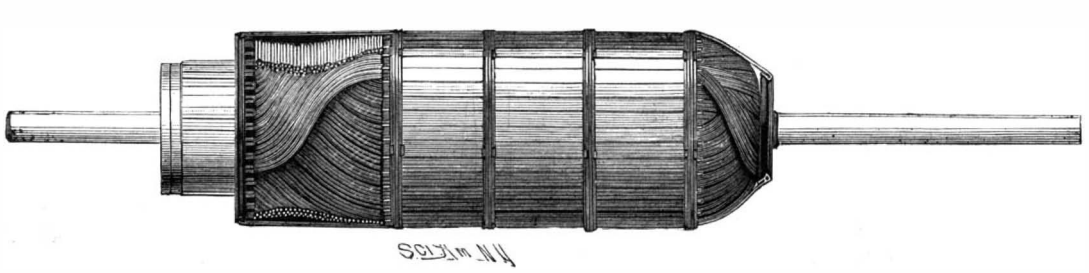


Fig. 5.—THE ARMATURE WITH PARTS BROKEN AWAY.

Canaigre, a New Tanning Material.

Canaigre, a tanning material which has recently been introduced, forms the subject of an article by Von W. Eitner, in *Der Gerber*. It appears that this product is the root stock of a polygonaceous plant which grows extensively on the shores of the Rio Grande, and covers large plains in Texas and New Mexico. The stem and branches of the shrub are annual, but the root is perennial, and in the second and third years attains a thickness of 1½ inches; at this stage of its growth it is richest in tanning material (28 per cent), while in the fourth year it begins to deteriorate. The fresh roots contain some 57 per cent of water and have to be dried before they are exported, so that they appear in the European markets either split up into slices or as thin whole roots, of which the tegument is brown and more or less furrowed. The external layers of the flesh of the root are red-brown in color, while the interior are bright yellow. Besides tannin, a considerable quantity of starch and some other extractive matters are contained in the roots, which can be easily powdered and rapidly exhausted.

According to the author's experiments, canaigre appears to be a valuable tanning agent; it is said to tan as quickly as japonica, at the same time imparting a fine, pure orange color to the goods, not to be imitated by any other tan stuff. The resulting leather is plump, but not unduly swelled; the grain remains soft and at the same time tough. This tanning agent is said to be especially valuable for upper leather, also for saddlery and fancy leathers, making, in fact, a leather well adapted for stuffing and finishing; as a substitute for sumac, and for mixing with bark (on account of its color), it is again very useful. It is best adapted for use when coarsely ground.

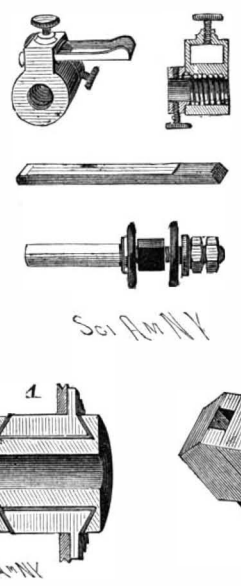


Fig. 7.—DETAILS OF THE BRUSH HOLDERS, THE COMMUTATOR CYLINDER, AND BRUSH HOLDING JIG.

The present price of canaigre is £18 per ton, in Vienna; this will not be prohibitive if the claims of the author as to its capabilities be substantiated. For it contains some 22 per cent of easily extracted tanning stuff, and one ton of canaigre will play the part of four tons of oak bark and four and a half tons of pine bark in tanning upper leather.

The cultivation of canaigre is very similar to that of the potato. The harvest can be taken every two or three years, and the plant thrives in sandy soils, which are practically useless for other purposes.

Trade Schools Useful.

The editor of the *Builder and Wood Worker* believes in trade schools. It gives a young man, in a few months, he says, instruction that it would take him the same number of years to "pick up" haphazard in a shop, and accompanies this instruction with a technical and scientific teaching of the whys and wherefores of his work that the shop seldom or never furnishes. At the same time, it enables him to reach the stage at which he attains a value as a mechanic that much earlier than if he went into a shop as a boy. He can commence with the trade schools in his seventeenth or eighteenth year, and would be just as far as the shop boy of completing his trade school course, with the incalculable advantage, if he has wisely used his time, of possessing the foundation for an education that will ever help him.

To make tin foil labels adhere to tin collapsible tubes, use a mixture of the best fish glue and gum arabic dissolved in water. A little glycerin may be added to advantage.

Ruins of the Panama Canal.

A correspondent of *Engineering News* reports as follows:

The bulk of our observations were made from the rear platform of a rapidly moving train; but the facts were had from Mr. Lefevre, the general agent of the Pacific Mail Steamship Company, a man who has spent years upon the Isthmus and was familiar with every foot of the way.

The first signs of the artistic work and extravagance of the French canal builders were met with in coming into Panama Bay, past the famous Sanitarium of Toboga. There a city of hospitals has been built, with bright red-tiled roofs and massive retaining walls peeping out of park-like grounds threaded with walks and drives for the director-general and his subordinates. A costly roadway connects this sanitarium with Panama. As the latter city is approached, another hospital, or a mass of hospital buildings, looms in sight, situated on the high ground back of the town, and built and adorned even more elaborately than those at Toboga. By an oversight of the engineers they were planned and constructed before any arrangement had been made for carrying the sewage through the city of Panama, which lies between the hospitals and the bay. When this time came, the citizens, who seem to believe in keeping their own sewage within the city limits, grew virtuously indignant at the proposition of the hospital authorities to carry the sewage through the town; and they had goodly reason. The tide at Panama is over 20 feet, and when this goes out it leaves exposed broad flats of mud that now cry out to the high heavens in their foulness.

Almost immediately upon leaving the city on the Panama Railroad you come in sight of the canal works. The towers of Belgian and French dredges appear above the trees in now detached and partly filled-up channels that were once sections of the sea level canal. A little further east, and you come to an almost continuous line of villages for laborers that were never occupied, storehouses, sidings filled literally with miles of dump cars, locomotives, and other machinery, past stacks of Decauville railway track and the small iron dump cars to fit them, and the endless variety of material that went to make up the plant of the most extravagantly equipped public work the world ever saw. Near Tavernilla we saw a line of steam cranes, almost buried in the jungle, that we have undoubted authority for saying have occupied this same siding for years; they were never used. On another siding we saw about 60 clumsy locomotive boiler steam drilling machines, with the drill frames rigidly attached alongside the boiler. These too had been there for years, and had never been fired up, for the proper reason that they were utterly worthless for work on the Panama Canal.

All of the machinery in sight was well cared for, and outwardly looked well enough with black paint and white-leaded bright work. They had been put in this condition just previous to the visit of the last French commission, and it is said that $20,000 per month is now being spent in keeping them in a presentable shape. Yet a mechanical engineer, who examined some of this machinery with a view of possible purchase, informed us that when he attempted to open the doors to look into a boiler, these fell off, a thin shell of rust covered with paint. Inside, the boiler was so scaled with rust that he thought that a good blow with the fist would have punched a hole through the plates almost anywhere. When Mr. Lefevre was asked why this plant was not gathered up and shipped out of this moist, iron-destroying climate, the reply was that we evidently knew little of Panama Railway freight rates. The transportation charges would have eaten up all the profits, even if the machinery were bought at old-iron prices.

The buildings along the line of the canal number thousands, though comparatively few seem to have been occupied. These houses are constructed of wood, with corrugated iron roofs; but cheap as some of them looked otherwise, they were generally propped up on pillars of stone masonry laid in cement mortar, that cost more money at times than the building they supported.

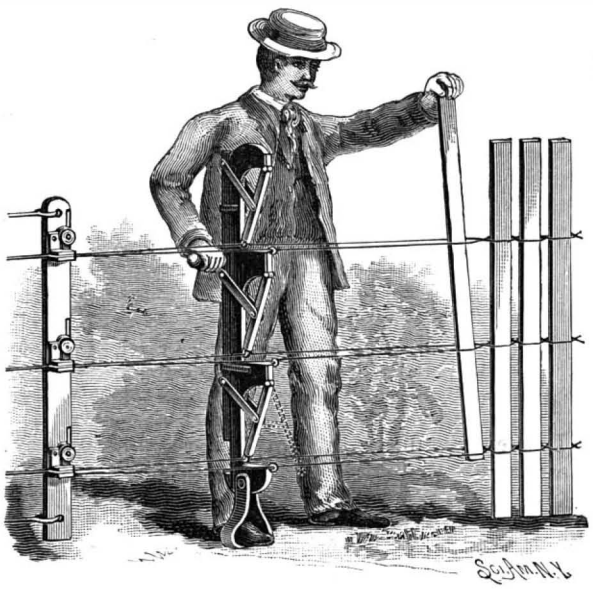
On the line of the canal a large amount of work has undoubtedly been done, and some of the cuts are deep and wide and the spoil banks are high. But it is just as evident that an immense amount of work yet remains to be done before even a lock canal can be built.

Parts of the canal once excavated at great cost are almost completely filled up again, and in other places the banks have washed in and the channel is obstructed. Nearer Colon, channels that once admitted vessels of 14 feet draught 14 or 15 miles inland are so blocked up in places that a canoe alone could navigate them. On the eastern or swampy side there appears to be a quagmire of unknown depth, and it is little wonder that the deposit from the conveyer pipes of the dredges forced up the soil in the line of the canal being excavated.

FOR a good recipe that will stick muslin to bunting, boil together 2 parts shellac, 1 part borax, and 16 parts of water. The surface must not be greasy.

A LIGHT AND SIMPLE FENCE MACHINE.

An easily operated device, patented by Mr. E. S. Lafferty, by which fence wires are quickly crossed after the insertion of each picket, the wires being, at the same time, held under proper tension, is represented in the accompanying illustration. A movable post has at its lower end a stirrup, for convenience in holding the post in proper position, and at the outer edges of lugs or projections, one above another, at one side of the post, are eyes, through each of which passes one of each set of wires for holding the pickets in position, the other wire of each set passing through corresponding eyes on levers fulcrumed to the lugs. The levers are adapted to swing transversely across the fixed eyes



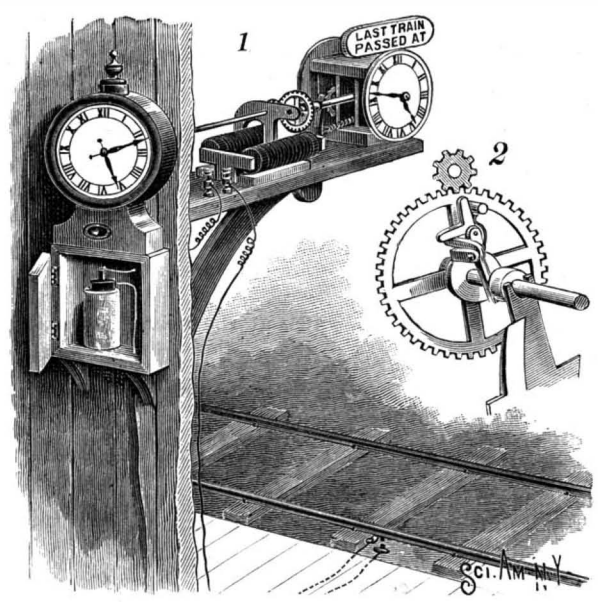
LAFFERTY'S MACHINE TO WIRE FENCE PICKETS.

on the lugs of the post, the wires carried by the levers being thus moved alternately from one side to the opposite side of the other wires. Each of the levers is pivotally connected by a link with a bar having a handle and sliding vertically in keepers on the front side of the post. A stop limits the downward movement of the bar and the outward swing of the levers, the inward motion of the latter being limited by the eyes striking against the edge of the post. To hold the several sets of wires at a proper tension, they are passed from the reels through tension devices held on a board connected by ropes with a post or other fixed support. The tension device has a fixed lower jaw, on which presses a movable jaw actuated by a cam fulcrumed on a stud projecting from the back plate of the device, a suitable handle being provided for operating the cam.

Further information relative to this invention may be obtained of Mr. L. H. Slagle, East Brady, Pa.

A RAILWAY TRAIN TIME REGISTER.

A register which shows positively to the engineer of an approaching train the exact time at which the preceding train passed over the track is herewith illustrated. It has been patented by Messrs. Joshua C. Dickover and Walter Scott, of Hot Springs, South Dakota.



DICKOVER & SCOTT'S RAILWAY TIME SIGNAL.

The minute hand arbor of the clock within the station projects through the back of the clock case, and to it is attached one end of a spindle which carries at its opposite end a pinion engaging a spur wheel of a mechanism for connecting the time movement with a spring-actuated dial mechanism at the side of the track. This mechanism is in a double frame exposing opposite clock dials, and minute hand arbors in the frame impart motion to the hour hands through dial wheels in the usual way. These arbors have crown pinions engaged by a spur wheel on an arbor of the connecting mechanism, and one of the crown pinions is engaged by a spur wheel on a mainspring arbor to which is attached one end of a clock spring, the other end being attached to the frame. A stud projects from the spur wheel of the connecting mechanism, shown in Fig. 2, and upon its arbor is an angled arm to which is pivoted a right-angled lever, a sleeve mounted on the arbor being in the path of the longer arm of the lever. Beneath this mechanism, on the base of the instrument, is mounted an electro-magnet, the armature lever of which is divided into two arms, one of which engages the sleeve on the arbor while the other engages a toothed wheel of the dial mechanism, a retractile spring attached to the armature lever and to the frame normally holding the lever away from the magnet. Under one of the track rails is placed a bow spring carrying a contact point electrically connected through a battery cell with one terminal of the magnet, and below the movable contact point of the spring is a stationary contact point electrically connected with the other terminal of the magnet. On the passing of a train the spring beneath the track rail is depressed, bringing the contact points together and closing the circuit with the magnet, when the latter attracts the two-armed armature lever, whereby the sleeve is moved on the arbor of the connecting mechanism and a toothed wheel of the spring-actuated dial mechanism is released, whereby the hands on the dials are carried forward to indicate the time shown by the clock at the moment the contact points touch. When the train has passed the circuit is broken, the retractile spring then withdrawing the armature lever, and the indicating mechanism remains quiet, but the spur wheel of the connecting mechanism is constantly carried forward by the clock, the stud on this wheel limiting the movement of the indicating mechanism when the latter is again started by the passing of a following train.

The Chemistry of the Ocean.

The study of the 685 densities of the water of the sea made during the expedition of the Challenger, and the report of 108 series, of which each extended from the bottom of the ocean to the surface, the discussion of the results of the deep soundings obtained by Pola in 1890, the various theories relative to the chalk formations by chemical action, with the necessary intervention of living creatures, and, finally, the different observations of oceanic analysis with which M. J. Thoulet has been occupied for several years past, relative to the existence at the bottom of the ocean of two belts of water, one in repose, and the other in motion, are all in accordance with the following hypothesis:

The surface of the ocean, submitted to climacteric changes, is in a state of heating and evaporation more or less intense. The variations which result in the real density and in the chemical composition of the waters, joined to the mechanical action exercised by the wind, give in the place of horizontal marine currents those more or less vertical, which cross between these where they overlie each other, with extreme quickness and in different directions. These together constitute oceanic circulation, which is effected almost entirely in a very shallow belt, about 500 fathoms in depth. The substances, only slightly soluble, contained in the waters of the seas, and brought to the ocean by the fresh waters which are far more dissolvent, attain at a certain depth their limit of solubility and form precipitates. Becoming solid, they descend vertically, penetrate into the still belt, and at last reach the soil at the bottom. Surrounded by immovable water, they dissolve and increase the proportion of salt contained in the deepest stratum of the water, and that immediately in contact with the soil. They then spread, and with extreme slowness, increase the saline quality of the adjacent waters, and at the same time extend to the stratum next to the soil which is not saturated, and consequently continues to dissolve the new material which arrives without cessation. The submarine soil is then a kind of center of chemical activity, fed by fresh material from the surface, and radiating slowly toward the surface.—*Public Opinion, Revue Scientifique.*

American Exhibitors at the International Electrical Exhibition at Frankfort-on-the-Main, Germany.

The United States are represented at the Frankfort Electrical Exhibition by a number of leading firms. The Thomson-Houston Company, Lynn, Mass., exhibits its dynamos, electromotors, and mining machines. The Edison Company, on account of having transferred its patents to the Berliner Allgemeine Elektrizitats Company, is not directly represented, but through the last mentioned firm. The phonograph is shown by the Edsion United Phonograph Company, of New York. The Westinghouse Company exhibits its well known steam engines, and another type of American engines is shown by the one belonging to the Thomson-Houston Company, and manufactured by McIntosh, Seymour & Co., Auburn, N. Y. Instruments are represented by the Weston Electrical Company, New York, and electrical elevators by the American Otis Elevator Company, New York.

Correspondence.

Early History of Reissues of Patents.

To the Editor of the Scientific American:

I herewith submit copies of a correspondence on file in the Department of State, relating to the early history and practice of granting reissues of patents. The correspondence has never been published, and involves, so far as I can ascertain, the first issue ever raised between the Patent Office and an applicant for the reissue of a patent. The correspondence can not but be deemed interesting, if not instructive, as adding an item to the history of that unique feature of the American patent system—the reissue of patents. A brief explanation of the circumstances attending the correspondence will, perhaps, tend to its better understanding. The patent law of 1793 provided that upon application made to the Secretary of State for a patent for any new and useful invention or improvement thereof, he should cause a patent to be made out for the same for a term of fourteen years, but that before the patent should issue, the patentee should deliver, to be filed in the Department of State, a description of his invention. The decisions of the courts were that a patent was void if the description was defective or insufficient. In 1802, one William Thornton was appointed to have charge of the matter of issuing patents. He held that the object of the law, being to promote the progress of useful arts by rewarding inventors, was not accomplished when the public refused to correct a defective or insufficient description, innocently made, and that if the patent did not secure the invention to the patentee, by reason of such defect or insufficiency, it was within the spirit of the law to issue another and corrected patent therefor, for the unexpired part of the term of the original patent. This practice of Thornton's was first called in question in one phase in the subjoined correspondence; other phases affecting its correct administration subsequently formed the subjects of several opinions of the Attorney-General of the United States. The legality of the practice itself was not controverted until the notable case of Grant *v.* Raymond, U. S. S. C., January Term, 1832, and it was thereby confirmed. On July 3, following, the first statutory provision was made for reissues of patents.

LEVIN H. CAMPBELL, *Asst. Exam.*,
Washington, D. C., June, 1891. U. S. Pat. Office.

DEPARTMENT OF STATE.
PATENT OFFICE, Nov. 27, 1817.

Sir: I have received from George Sullivan, Esq., of Boston, an application for a renewal of your patent, under a declaration that the former one is deemed by the Hon. Judge Story insufficiently described in the specification, and therefore void. If I were to admit this, it might lead to dangerous consequences, for I must aver that the specification contains the principles in a manner sufficiently clear to enable any shoemaker to make a shoe or boot containing the principle, though it may perhaps deviate in some particulars from any specific mode; but if the principle be not new, then indeed the honorable judge is right, and you will be held to a *specific mode* of performing what is only an *improvement* or a variation in the execution. Your patent therefore will be issued as an *improvement* on the mode formerly described.

WILLIAM THORNTON.

To JOHN BEDFORD,
Philadelphia, Pa.

BOSTON, Dec. 30, 1817.

Dear Sir: By advices from Mr. Bedford, it appears that the patent he applies for is considered disallowable; because his specification shows an improvement only, and his patent should be only for this. The fact is, that at a recent trial for an infringement of Bedford's former patent for making shoes with metal nails, it was considered by Judge Story that the specification thereof described nothing which from the evidence it appeared was Bedford's invention. It was too general, insufficient and therefore void. Now, Bedford applies for a patent for the thing he *did invent*, which is now sufficiently described in the specification I had the honor to transmit, and the thing described therein is, in Judge Story's opinion, distinctly and legally different from the invention attempted to be described in the former specification. Then as his invention has never been protected by the former patent, that is entirely void, and his application for a patent on the specification now presented is therefore to be regarded as if none had ever before been granted. The Hon. Mr. Webster, who is of counsel with me in this case, and I have consulted upon your suggestion; and having the opinion of Judge Story with us on the subject, we feel no hesitancy in taking the risk of a patent in the form proposed. We think it will be sustained by the courts, and presume therefore that you will have no objection to issue it accordingly; the more especially, as your suggestion was advisatory and given probably without full knowledge of all the circumstances, of which, however, I take myself to blame of not more fully informing you. GEORGE SULLIVAN.

To WM. THORNTON, Esq.

Mr. Thornton still declining to issue the patent as requested, an appeal was taken to the Secretary of State, who directed Mr. Thornton to explain to him why the reissue was denied.

DEPARTMENT OF STATE.
PATENT OFFICE, Jan. 6, 1818.

Sir: A patent was issued on the 16th day of July, 1806, to John Bedford, of Philadelphia, in the usual form, containing the specification of his invention in his own words. After enjoying the benefit of his patent for these twelve years past nearly, Judge Story, one of the supreme judges, acting in this case as a circuit judge, pronounces that the specification is not *sufficiently* specific, and that there ought to be a new patent issued. This was made known to me by George Sullivan, of Boston, counsel of Mr. Bedford. I sent to Mr. Bedford an answer, a copy of which is inclosed (letter, ante, Nov. 27, 1817), and since received the letter from Mr. Sullivan, who still urges a patent upon the general principle, which I must in duty decline to issue upon this plea: If a patent were really imperfectly issued by an official irregularity, or for the want of legal forms, dependent on the office, even then the demand of a patent would be a doubtful one, provided the patent had run for some years and the patentee had obtained the full benefit of the patent till arrested by a determination against him in law, from a want of validity in his patent. But it would be proper in this case to correct the patent, from the time of such legal arrest, to give validity for the remainder of the term, which I am even willing to do in this case without a new treasury fee, though the incorrectness was not the fault of the office, but of the patentee himself. But to give a new patent for the general principle when the patent has nearly expired, and the patentee till now has enjoyed the profit thereof, would be to rob the public of the benefit acquired by the fulfillment of the engagement virtually entered into by them and the patentee, which would open a door to unceasing deception and fraud, and would really be a *stultitiam premium*. If, therefore, Mr. Bedford wish a patent upon the general principle of his invention (which, however, I firmly believe is not his, having been in use in Ireland for many years, and the army of England has long been furnished with boots and shoes on this principle), I will grant it till the expiration of the first term of fourteen years, without any additional fee, as a correction of his erroneous specification, though this is not an official duty, nor could he of right demand it. Or if he wish a patent for any *specific* mode, as an *improvement* on the general principle, I will grant him a patent for fourteen years, according to the second section of the patent law, in the usual forms, and on his paying the fee, as a mere improvement, but not on the general principle, unless directed to do so by the Hon. the Secretary of State, who will please to decide on this, or submit it to the Hon. the Attorney-General; for it is a case that may hereafter be considered as a precedent. WILLIAM THORNTON.

To the Hon. JOHN Q. ADAMS,
Secretary of State.

WASHINGTON, Feb. 3, 1818.

Sir: In relation to the patent claimed for John Bedford for the full term of fourteen years, I am of opinion, on the statement of the case as made by Dr. Thornton, that the claim is not warranted by our law.

WILLIAM WIRT,
Attorney-General.

To the Hon. J. Q. ADAMS,
Secretary of State.

WASHINGTON, Aug. 26, 1818.

Sir: I have reconsidered very deliberately the opinion which I had the honor to give you formerly on the construction of the patent law, and I see no cause to change it. Dr. Thornton's answer to Mr. Sullivan is, I think, a very proper one, and his exposition of the law a very sound one. If the former defective patent had been a nullity *ab initio*, I should concur with Mr. Sullivan; but so far from having been a nullity, I understand, from the facts, that it has completely protected the invention of the patentee for half the legal term; and, having derived this practical benefit from it, they ought not, I think, to be permitted by a legal fiction to regard it as a nullity. The power to issue a patent for a less term than fourteen years has, I also think, been placed on its true ground by Dr. Thornton—the restriction is on the *maximum* only, not on the *minimum*. WILLIAM WIRT.

To Hon. J. Q. ADAMS,
Secretary of State.

Hydraulic Mining in California.

To the Editor of the Scientific American:

In reading several back numbers of your journal, on my return from an absence of several weeks, I encountered an article in the paper of May 16, 1891, headed "Hydraulic Monitors," copied from the San Francisco *Chronicle*, which is so grossly wrong that I take it for granted you will gladly correct it, whether the *Chronicle* would do it or not. Hence I take the liberty of calling your attention to one gross misstatement. The statement I desire you to correct is the closing paragraph, where it is stated that there was "in use from the Feather, Yuba, Bear, and American Rivers, Butte Creek, and the two dry creeks, a total of 10,650,505 miner's inches of water each twenty-four hours. At an average of 3½ cubic yards of gravel to the inch, there was thus washed away daily 36,600,000 yards of material. This is a low estimate. As an actual fact much more was carried away. But the amount stated represents a mass of earth 500 yards long, 386 yards wide, and 200 yards high. With such a tremendous quantity washed away every twenty-four hours, it can be readily understood that no great length of time need elapse literally to remove mountains and cast them into the sea."

I have no mode of ascertaining who the Munchausen is who imposed such a statement upon the *Chronicle*. But it could only have emanated from some member of an association known as the Anti-Debris Association, as there has emanated before this statement, from that association, others worse if possible.

Now, if the reader of the paragraph referred to will divide each result by 365, he will come somewhat near the truth. And when the Munchausen states his figures "as a low estimate," and that "as an actual fact much more was carried away," he must have known that he either lied or did not know what he was writing about.

The actual fact was that from all the numerous streams on the west slope of the Sierra Nevada Mountains, for a distance of over 400 miles in length by about 120 miles in width, there was used, during the palmy days of hydraulic mining, not exceeding 10,000,000 miner's inches per year, which mined out not exceeding 30,000,000 cubic yards per year (not per day), turning out about $12,000,000 in gold. This gold yield is now at an end, as nearly all these great mines are closed by injunction caused by statements similar to the one herein referred to. Very respectfully,

L. L. ROBINSON,
Prest. Miners' Association.

Los Medanos, California, July 7, 1891.

Results from an Invention.

Dr. Lardner, writing of the steam engine, said: "To enumerate its present effects would be to count almost every comfort and every luxury of life. It has increased the sum of human happiness, not only by calling new pleasures into existence, but by so cheapening former enjoyments as to render them attainable by those who before could never have hoped to share them. The surface of the land and the face of the waters are traversed with equal facility by its power; and by thus stimulating and facilitating the intercourse of nation with nation, and the commerce of people with people, it has knit together remote countries by bonds of amity not likely to be broken. Streams of knowledge and information are kept flowing between distant centers of population, those more advanced diffusing civilization and improvement among those that are more backward. The press itself, to which mankind owes, in so large a degree, the rapidity of its improvement in modern times, has had its power and influence increased in a manifold ratio by its union with the steam engine. It is thus that literature is cheapened, and, by being cheapened, diffused; it is thus that reason has taken the place of force and the pen has superseded the sword; it is thus that war has almost ceased upon the earth, and that the differences which inevitably arise between people and people are for the most part adjusted by peaceful negotiation."

A Lost River.

According to the Los Angeles *Herald*, the Southern Pacific Railroad Company has lost a river, and in consequence has a bridge whose occupation is gone. The Whitewater river has flowed from the Sierre Madre mountains across the sands of the region just this side of Seven Palms as long as any one can remember. The station of Whitewater was located where the river crosses the railway and was supplied with water from its current. During the last heavy rains the Whitewater rose in its might and devastated the whole country round about, washing out the bridge and the roadbed and playing the mischief generally. Soon the rains and the river stopped simultaneously, and the river has not been found since. It appeared to become ashamed of itself for doing so much arm, and has apparently slunk away in disgust and sorrow. It is entirely gone. At no point does it cross the railroad, as it would have to do were it still in existence in some new course. The railroad company, in order to secure water for its station at Whitewater, has been obliged to build a pipe line away up to the mountains, at considerable expense. All last summer, during the hottest, driest weather, the river ran placidly along—in fact, it has never failed until after its "jag" of this winter. Now it forms one of the mysteries of that mysterious region, the Colorado river desert, and perhaps is flowing by the Pegleg mine, and possibly rippling beside the treasure-laden Spanish galleon which lies somewhere in that region buried in sand.

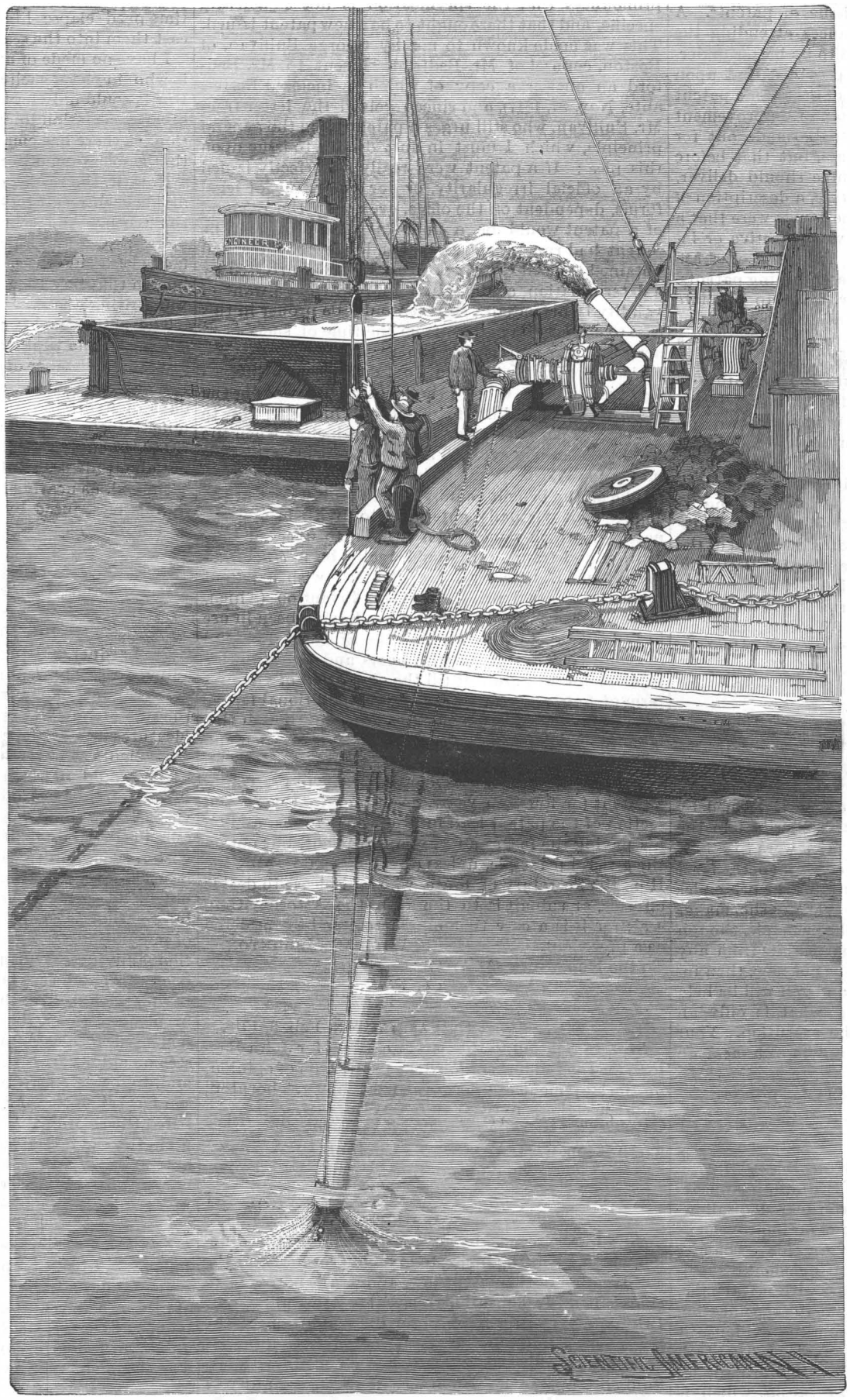
THE UNITED STATES DRILLING SCOW GENERAL NEWTON AND THE REMOVAL OF DIAMOND REEF, NEW YORK HARBOR.

Diamond Reef in the harbor of New York for many years was known as a dangerous shoal. It was situated at the mouth of the East River between the lower end of New York City and Brooklyn. Its limits were supposed to be known until about two years ago a vessel came in contact at a depth of nineteen feet with a rock hitherto unknown to any one. This lay a short distance to the east of the original shoal. It is by no means the first instance of such accidental discovery of rocks in the much traversed waters of this vicinity. Within the last few years two other rocks but a few miles from Diamond Reef have been discovered by vessels striking them.

Upon the discovery of the new Diamond Reef obstruction, it was surveyed and found to all appearances to consist of a rock of small area surrounded by a gravel shoal. It was supposed that a couple of months' blasting would be required to remove it. On attacking it, the conditions were found to be different than supposed. The apparent bed of gravel was only a thin deposit overlying a massive rock formation. It is only to-day, after twelve months' blasting, that the work is on the verge of completion.

The drilling scow used for executing the work, and which is illustrated in the present issue, was built during Gen. John Newton's administration for work upon the reefs of the harbor. For over twenty years it has been at work, and has proved the most successful machine for its own class of operations yet constructed. It is the property of the United States government.

As it is designed to work in exposed situations where there may be risk of collision with passing vessels, the leading idea in its construction of hull was to make it so strong that no ordinary impact would hurt it. It has a hull, rectangular in plan, 128 ft. long and 56 ft. broad. It is designed to perform two principal offices, to drill blast holes and to hoist the debris from blasting. The first function is accomplished by a dome which is lowered upon the bottom of the channel. Through the center of the hull of the scow an octagonal well hole thirty-two feet in diameter is constructed. Around this are arranged several catheads, short beams carrying grooved sheaves at their end, over which chain tackles work. These catheads are arranged in radial planes, pointing toward the center of the well hole. The dome is a portion of a hemisphere. It is made of boiler plate. The top is cut off, the truncated shell having a large central aperture. This dome is suspended from the catheads by the chain tackles mentioned above.



SAND PUMPS IN OPERATION REMOVING SAND AND GRAVEL.

By windlass power it is raised and lowered as desired. Around its lower rim are a number of pointed leveling bars. These are 4½ inches square and have a drop of four feet. They are arranged with self-acting cams, so that they can be held in any desired position, and trip lines for the cams are worked from the surface by lines or chains, if desired. Around the dome, arranged upon a circle of 23 ft. 6 in. diameter, are a number of 6 in. tubes. These reach nearly to the bottom plane of the dome. At the top they carry funnel-shaped openings of 21 in. diameter. An inner set of similar tubes is arranged upon a circle 11 ft. 6 in. in diameter. Besides this, provision is made for tubes to be set at any point of the large central opening in the top of the dome.

In operation the dome is brought over the place to be attacked. It is lowered by the tackles in a horizontal position As it nears the bottom the pointed leveling legs strike the rock and are pushed up one by one until all attain a bearing. When all is satisfactory the legs are clamped fast. Drill bars are now lowered from the scow and introduced into the tubes best placed for the work to be done. All this detail is determined by divers. The drill bars are connected to jars at their tops and are worked by ropes from drilling engines on the upper deck of the scow. They accomplish their work by their own impact, exactly as in drilling an artesian well, the tubes acting as guides.

In this way holes of any desired size are rapidly bored. Cartridges charged with dynamite or other explosive are placed in the holes and exploded by electrical detonators after the scow has been withdrawn a sufficient distance. The charges are placed in the holes by a diver.

The explosion being effected, the derricks seen upon the scow's deck are brought into use. Divers are sent down, who load the rock upon platforms, whence it is hoisted to the surface and dumped into a scow, to be removed. Finally the ground has to be definitely proved free of all dangerous projections. This is done by the use of a peculiar sounding apparatus worked from the scow. Two iron bars are dropped from its rear corners, worked by tackle, so as to be maintained vertically and so as to be kept at any desired depth. A third bar is attached to their lower ends so as to be horizontal. The rods are lowered to the determined minimum depth, in the case of Diamond Reef 26 ft. at low water. By paying out and taking in the four anchor chains the ground is swept with this sounding bar. It is accompanied in its progress by divers. If it strikes any obstacle, the diver signals to the surface. He examines the locality, and places one or more charges of explosive, as seems best, to remove the projections by surface blasting. They are exploded. If satisfactory, the sounding is continued, and the surface blasting is repeated wherever needed.

To remove the softer materials that may form part of the reefs and shoals operated upon, a centrifugal pump with long suction pipe is provided. Through this a stream of water mixed with sand and bowlders is driven, rapidly removing all such matter from the vicinity. Thus the scow really is used in a four-fold capacity, drilling, hoisting, sounding, and sand pumping. The test of its long service of twenty-one years has gone to prove its excellent qualities. Its construction adapts it for use in varying tides. The drill connections of rope are paid out or taken in, as necessary, according to the rise and fall of the tides. The connection of dome and scow is only by chain tackle, so that this is also independent of hourly variation in depth of water. Finally, the hemispherical shape of the dome, acted on by the horizontal sweep of the tides, revolves their thrust-in part into a downward or radial component that anchors the dome more firmly in place.

As work progresses, the position of the dome is constantly determined by triangulation from the shore.

Within the hull of the scow is a small machine shop, a blacksmith's shop, and air compressors for the divers, while a complete electric plant is installed for lighting its interior. Experiments have been conducted also with the light under water in the diver's hands.

The work now in progress in different parts of the harbor of New York is in charge of Lieut.-Col. G. L. Gillespie, to whom our thanks are due for courtesies received in connection with this article.

Action of Oils on Metals.

A series of tests, lasting some twelve months, on the action of various oils on metals in contact with them, recently carried out, gave the following results: In the case of iron, seal oil acted the least on it, and tallow the most. Bronze was not attacked at all by colza oil, and but very slightly by olive oil; it was, on the other hand, vigorously eroded by linseed oil. In the case of lead, the most deleterious lubricant was whale oil; the best, olive oil. Whale, lard, and sperm oils were about equally erosive. Zinc seemed to be but little attacked by mineral lubricant oils; the best oil was lard, and the worst sperm. Copper was not attacked by any of the mineral oils; sperm oil had the least and tallow the most action on it. Generally speaking, mineral oil attacked the metals under test the least; and sperm oil attacked them the most. In conducting the experiments, the metals were first thoroughly cleaned in ether and then dried. They were next carefully weighed and placed in closed vessels filled with oil, which were kept for a year at a uniform temperature in summer of 80° Fah. and in winter of about 50° Fah.

JOHN P. HAINES, president of the Society for the Prevention of Cruelty to Animals, recommends to persons who own horses subject to fits of blind staggers to supply themselves with spirits of ammonia, and when the animal exhibits evidence of an attack coming on to saturate a sponge or cloth with the ammonia and apply it to the horse's nostrils, and it will have as good effect as bleeding in the mouth, which is not always easily accomplished.

FOSSIL PATENTS.

BY T. GRAHAM GRIBBLE.

The origin of patents was a royal grant conveying a monopoly. The word patent or open now exactly expresses the stipulation on the part of the government in guaranteeing protection to an inventor, but it did not originally convey that idea. Now the inventor discloses all his secret, even to the most minute detail, so that "any one skilled in the art" may be able to manufacture or operate the same from the model drawing and specification If he can be proved to have designedly withheld any essential feature, his patent is void.

In the first patents, on the other hand, we find no detailed specification, and for a long while after specifications were made there were no drawings. The inventor was at first protected as fully as now, but was also able to preserve to a great extent his secret. The patents were monopolies bestowed upon royal favorites for a consideration, and sometimes were possessed of scarcely any original features.

The term letters patent is more ancient than the patent system. Letters of nobility were also granted under letters patent. These open letters were in contradistinction to "*lettres de cachet*" or "*lettres closes*." Both were royal mandates, but the latter were usually given to ambassadors, generals, governors, and such like, to convey instructions for their guidance when arriving at their destination. Letters patent, on the contrary, were capable of being produced at any time and exhibited anywhere as royal authority for the enforcement of claims, the protection of rights, and so forth. There was always in olden time an element of uncertainty about "*lettres de cachet*" from the fickleness of princes. Despite the high honor of receiving them, there were many cases on record of the bearers of the secret letters finding out on arrival at their destination that they contained subject matter of an unexpected nature, such as the curtailment of their stature at its most effective extremity. Consequently letters patent were more popular under despotic governments. It is a curious survival of ancient customs that letters of introduction are still left open in order that the bearer may assure himself of fair play.

Patents themselves originated in royal perquisites, but *patent law* arose out of a parliamentary protest to the abuse of the prerogative. King James the First was remarkable for initiating many things which turned out of much greater value than he had any idea of. He was the first to grant patents, and he did it as a kind of very mild boodle. He carried on the first patent bureau to the mutual satisfaction of his royal self and his ingenious lieges until the people were so squeezed by it that they forced a law out of him, declaring all such patents as were "grevious and inconvenient to the subject to be void," with the exception of those granted for the "sole working or making of any manner of new manufactures," and which were not "contrary to law or mischievous to the state." This is the pith and marrow of patent law.

The first patent of which there is any record bears date "the eleaventh daie of March, 1617." It is granted by "James, by the grace of God Kinge of Englande, Scotland, France and Irelande, Defender of the Faith, etc., to his lovinge subiecte, Aron Rathborne, gentleman, practicioner in the mathematiques," and conveyed to him the exclusive right to make "a perfecte survaie as well of the said cittie of London as of divers other places within this our Kingdome of England hereafter mentioned, and to make such exacte plotte, mappes, and descripcions thereof as hath not been hitherto performed by anie." The royal mind had been stirred to emulation by the rumor that "amongste forraine nations there are faire curious and artificiall descriptions, plotte and mappes made and sett forth of their principall citties and townes of greatest noat, which beinge exactlie drawne out in metall and printed of, are dispersed and sent abroad into all partes to the greate honor and renowne of those princes in whose domynions they are, whereas in our cittie of London, being the chiefe and principall in this our Kingdome of England, there hath never been made or taken any true or perfecte description, but false and meane draughts cutt out in wood and soe dispersed abroade to the greate disparagement and disgrace of soe famous and worthie a state."

This "royall licence and priviledge" granted to Rathborne power to forcibly restrain any other person or disobedience in breakinge and contemninge our comaundment and prerogative royall."

The royal benefit from this transaction was not in cash, but in kind. Half the proceeds of the loot upon the illicit mapmakers was to go to majesty and the other half to the "lovinge subiecte."

Rathborne's survey is not extant with his name attached, though in all probability it is represented by the map in the illustration. The oldest description, termed a survey, but unaccompanied by a map, is a large work entitled "The Survey of London, contayning the originall increase, modern estate and government of that city, methodically set down, begonne first by the paines and industry of Johnston in the yeare 1598. Afterwards inlarged by the care and diligence of A. M. in the yeare 1618. And now completely finished by the study and labour of A. M. H. D. and others, this present yeare 1633.

It is nothing more than a detailed description or guide to the city. The labors of Rathborne and Burgess protected by royal decree doubtless produced the first survey of London, although rough perspectives of much more ancient date exist. It is a strange commentary on the schemes of princes that this first patent of King James should be the means of producing a map by which 25 years afterward a revolted parliament should make fortifications to keep his son Charles out of London.

These fortifications were ordered by Act of Parliament of 7th March, 1642, and were very rapidly constructed by means of a general tax.

Besides paying a lump sum of sixpence if their house rent reached the yearly rental of five pounds, the whole city—men, women and children—turned out with pick and shovel to make earthen ramparts, and did so in an amazingly short time.

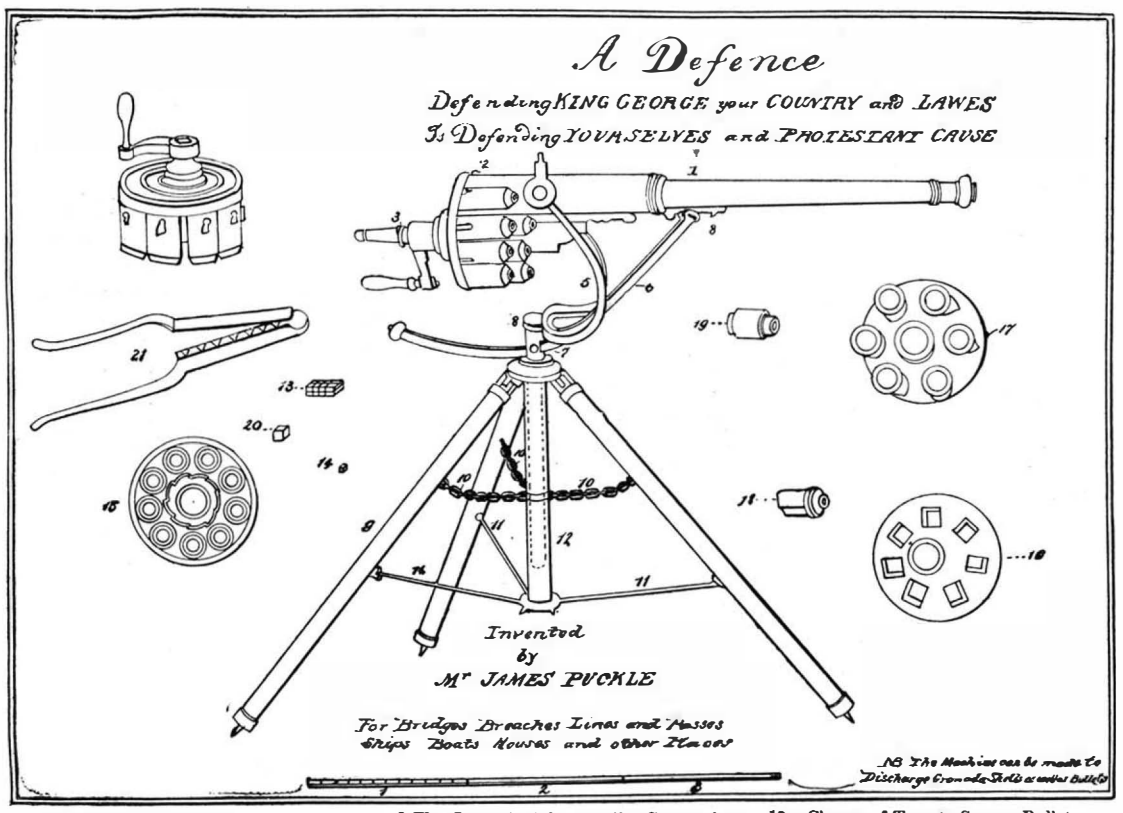
The second patent granted by King James was a protection of his royal dignity against caricaturists. It was granted to his "well-beloved servaunt, Nicholas Hillyard, Gent.," for the modest "yearely rent or some of thirteene shillings and fower pence of lawfull (?) money to be paide to Vs, our heires and successors att the Exchequer, at the Feast of Saint Michael the Archangell, or within forty days after." Whether the picture of the king, when padded out dagger-proof to go hunting, was a production of Mr. Hillyard's or one of those caricatures which the patent was meant to discourage, we are unfortunately unable to now ascertain.

The description of the exclusive right to portray the royal presence, and the pains and penalties to be visited upon lawless limners, is extremely lengthy, verbose and tedious.

There are no patents by Cromwell, but during the Commonwealth the New England colonists availed themselves of the temporarily free institutions to grant protection to inventors without, however, extorting "a consideration." The first American patent is almost synchronous with the Commonwealth. A much later but very quaint patent is that of Dame Sybilla Masters, of Philadelphia, for corn shelling and preserving. She writes in German text, hard to decipher and very antiquated for that period.

It is granted by King George the 1st, and the official entry in Roman text is as follows: "Letters patent to Thomas Masters, of Pensilvania, Planter, his Execrs., Amrs. and Assignees, of the sole Vse and Benefit of 'A new Invention found out by Sybilla, his wife, for cleaning and curing the Indian Corn growing in the severall Colonies of America, within England, Wales and Town of Berwick upon Tweed, and the Colonies in America.'"

The accompanying drawing was enrolled instead of a specification, so that it is difficult to fully do justice



No. 1 The Barrel of the Gun
2 The Sett of Chambers Charg'd put on ready for Firing
3 The Screw upon which every Sett of Chambers play off and on
4 a Sett of Chambers ready charged to be Slip'd on when the first Sett are pull'd off to be recharg'd
5 The Crane to rise fall and Turn the Gun round
6 The Curb to Level and fix the Guns
7 The Screw to rise and fall it
8 The Screw to take out the Crane when the Gun with the Trepeid is to be folded up
9 The Trepied whereon it plays
10 The Chain to prevent the Trepieds extending too far out
11 The hooks to fix the Trepied and Unhook when the same is folded up in order to be carried with the Gun upon a Man's Shoulder
12 The Tube wherein the Pivot of the Crane turns
13 a Charge of Twenty Square Bullets
14 a single Bullet
15 The front of the Chambers of a Gun for a Boat
16 The plate of the Chambers of the Gun for a Ship shooting Square Bullets against Turks
17 For Round Bullets against Christians
18 a Single Square Chamber
19 a Single round Chamber
20 a single Bullet for a Boat
21 The Mould for Casting Single Bullets

Whereas our Soveraign Lord King George by his Letters patents bearing date the Fifteenth day of May in the Fourth Year of his Majesties Reign was Graciously pleased to Give & Grant unto me James Puckle of London Gent my Exors Admors & Assignes the Sole priviledge & Authority to Make Exercise Work & use a Portable Gun or Machine (by me Lately Invented called a Defence in that part of his Majesties Kingdom of Great Brittain called England his Dominion of Wales, Town of Berwick upon Tweed and his Majesties Kingdom of Ireland in such manner & with such Materials as Should be Ascertained to be the Sd New Invention by writing under my Hand & Seal and Inrolled in the High court of Chancery within Three Calendar Monthes from the date of the Sd patent as in & by his Majs Letters Patents Relacon being thereunto had Doth & may amongst other things more fully & at large appear NOW I the said James Puckle Do hereby Declare that the Materials whereof the Sd Machine is Made are Steel Iron & Brass and that the Trepied whereon it Stands is Wood & Iron And that in the above print (to which I hereby Refer) the said Gun or Machine by me Invented is Delineated & Described July the 25th 1718./

4B2180

Jas Puckle

BREECH-LOADING MAGAZINE GUN PATENTED BY MR. JAMES PUCKLE IN 1718.

to the lady's scheme. Her inscription is as follows: "Phila., the 2nd mo. called August, 1716, Pursuant to his Majesty's grant for cleaning, curing and preparing the indian train [a clerical error for grain] fit for transportation, the which was never before done, these the draughts of part of the engine I carry on my projection with the witness my hand and seal.

"Certio die Novem. Annon, Georg ii."

The two upper illustrations show the cleaning and the lower the curing. The top view represents the sheller, worked by animal power, probably a donkey (*Asinus vulgaris*). The gearing and shaft are of wood, and a reciprocating motion is produced by a series of detents upon a revolving cylinder something after the manner of a musical box.

In the middle view the reciprocating motion is also present, but the motive power is from a stream acting upon an undershot wheel.

The lower view represents the shelled corn laid out to bake upon wooden trays.

It is to be feared that Dame Sybilla's invention did not attain to as wide a field of application as was covered by the letters patent. It is more than probable that the obtuse agriculturist continued to shell corn sitting on a pine plank with a spade edge to scrape them off by, in spite of the "paines and industrie" of the dame.

Another patent of King George's, two years later than Mrs. Masters', is both amusing and highly suggestive. It is for the first breech-loading magazine machine gun, and is 173 years old. The drawing is self-explanatory, but a few words of comment may be added.

The magazine contained chambers which were loaded, in the usual manner of the period, with powder and ball, cartridges not being then invented. The magazine was detached from the gun for the purpose of loading, two or more being supplied with each gun. The inventor does not seem to have troubled his head much about the question of recoil, but, in view of the date, we must not be too critical.

The name alone of "Defense" is suggestive in the extreme. Did Puckle foresee the peculiar advantage of his gun to defensive rather than to aggressive warfare?

The year 1521 is generally accepted as the date of the introduction of matchlocks into regular warfare, when they were used at the siege of Berwick. Fifty years previously Edward IV. imported 300 Flemings armed with hand guns into England, but it was not until the middle of the 16th century that the small firearm became the recognized weapon for the foot soldier. The close of the 16th century also saw the first attempts at a magazine flintlock and a breech-loading cannon, which we illustrate. They were crude attempts, and the smooth-bore muzzle loader remained the only weapon in regular use until the beginning of the present century. It is the extent to which the inventions were prophetic which makes them more or less interesting, and among them all Puckle's breech-loading machine gun, with removable magazine, is one of the most suggestive and entertaining. We are not aware whether Messrs. Gatling, Nordenfelt, Maxim & Co. have ever dipped their flag to Mr. Jacobus Puckle, but we offer them the opportunity by a very brief description of the "Defense."

The old idea of defense for warriors had recently changed when Puckle invented his weapon, and the defense of fortresses was on the eve of change. In the time of King James I. knights still clad themselves in coat of mail, but the disadvantages of it were naively stated by that pusillanimous monarch when endeavoring to recommend it. He said that heavy armor afforded "a double protection, preventing the wearer at the same time from being injured and from injuring others." This was true, because, as projectiles were made heavier, armor was made thicker, until an unhorsed knight could not possibly regain his feet, but lay like a lobster that could only be got at for killing by breaking him up with a battle ax. Finally the armor became so weighty that the horses could not stand it, and it, was entirely abandoned for the principle of quick firing and quick maneuvers.

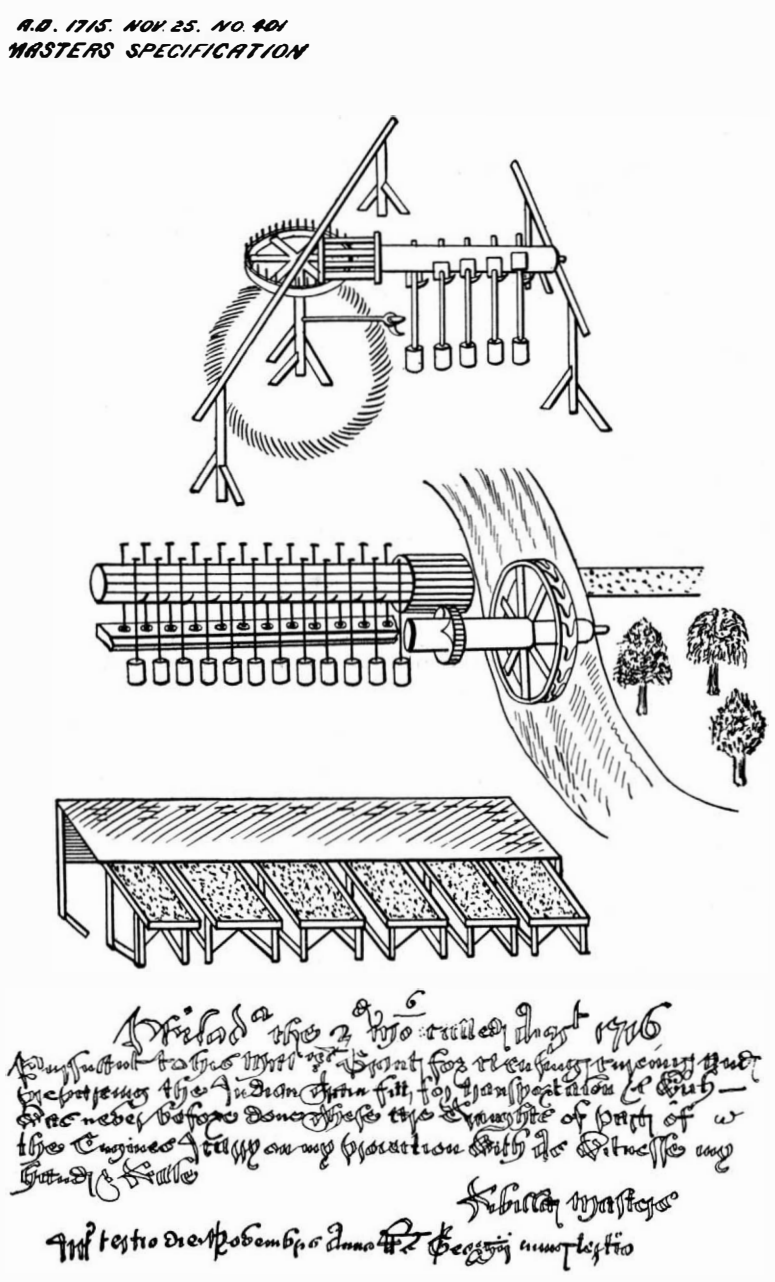
Similarly as regards fortress defense, it is the perfection of the magazine rifle which has displaced the massive towers of masonry and wide moats, because it has rendered the most hastily constructed defenses impregnable when manned by a handful of steady troops. The "unprotected zone," which has always been the crux of the besieging force, is not now represented by moats or outworks. It is simply the range of the besieged combatant's rifle. The martello towers of England are all going to decay, even the more modern fortifications of America's seaboard are more or less antiquated. The highest modern authorities are raising the question, not of the class of the fortification, but as to whether to build or not to build. The machine gun has, however, gone on in its development until it is the acknowledged arbiter of the fate of nations.

The religious aspect of "The Defense" is one of its quaintest features. Brer. Puckle no doubt intended his square bullet as a holy terror to the Turk, but modern science would have told him that he was really harder on his fellow Christian than on the Moslem. The round bullet will travel much farther under similar conditions than the square one. Sentiment no longer guides the designer of projectiles. First of all, electricity enables him to measure the velocity at any position of the flight by means of metallic screens which, when placed in an electrical circuit, are successively pierced by the shot which breaks the circuit and stops the recorder. The interval of time is measured by the vibrations of a tuning fork, the fall of metallic rods, the movements of a pendulum, the rotation of a cylinder with a smoked surface and otherwise. Col. Noble, of Woolwich Arsenal, Messrs. Schultz, of Germany, Le Boulange, of France, and Vignettie, of Italy, have all produced chronoscopes of more or less efficiency, but some of them actually register to the one-millionth part of a second. Next comes photography and makes a picture, not only of the bullet in its flight, but, which is more important, of the minute cloud of condensed air created by atmospheric resistance. It is from the configuration of this cloud that the section of least resistance is determined and the relative effect of different methods of rifling. The resistance of the air to an elongated bullet from a smooth bore always causes it to travel irregularly, because the air pressure acts unequally upon ii. Rifling a gun produces a rotation round the longer axis which steadies the bullet just as spinning does a top, and gives rise to its technical name of "polar projectile."

The ferocious intention of inflicting prolonged agony by the construction of the projectile is much older than Mr. Puckle. From the poisoned or barbed arrow head of the savage, or the cruciform arrow head of the Aztec, to the spreading or chain shot of more modern times, and so down to the present weapons of wholesale slaughter, the transition has been from the essentially cruel desire to produce suffering to the more humane object of putting an end to an inevitable struggle as rapidly as possible.

The loyalty and religious zeal displayed by Puckle in his weapon are quaint in the extreme, but it is even a more curious fact to record that one of the greatest modern designers of heavy artillery, himself a very devout man, always prays that he may get a sound casting when a monster gun is under construction.

Will the American of A. D. 2000 look upon the "Whitehead torpedo" or the "dynamite gun" and all other killing tools as objects of as much archaic interest as we now regard the "Defense" of Brother Puckle?



ROYAL PATENT GRANTED THOMAS MASTERS OF PHILADELPHIA IN 1716, FOR CLEANING AND CURING CORN.

Electric Welding.

According to Professor Elihu Thomson, it is not the extra resistance at the break that gives rise to the heating in electric welding. The imperfect contact there no doubt hastens the heating at the joint, but a solid bar placed between the clamps of an electric welding machine can also be raised to the welding temperature, and the bar may be upset there. The real cause of the concentration of the heating between the clamps is the relatively greater conductivity of other portions of the welding circuit, which is usually composed of massive copper conductors kept cool in the case of large work by the circulation of water. By keeping the conductors cool in this way their resistance is maintained constant, and there follows an accentuation of heating effect at the joint where the rise in temperature increases the resistance. In large works it has been found that hydraulic power can be advantageously employed both for clamping and making contact with the pieces to be welded or worked. In dealing with metals such as lead, tin, and zinc, the temperature required for welding is so low that the metal never glows, and the progress of the breaking cannot be watched with the eye. By properly shaping the ends leaden water pipes can easily be welded together end to end. The meeting edges should be thinned so as to reduce the surface of contact below the area of the pipe wall. Joints thus made are very good and sound. Most metals can be welded without the use of a flux, but for good work a flux is often desirable.

Electrical and Chemical Energy.

Of the various transmutations of energy, that of *chemical separation* into *electricity in motion* in the voltaic battery, and of the latter into the former in the case of decomposition by a battery, are among the most interesting. In the first case, the sources of electrical excitement are the points of contact, say the zinc and platinum when we have electrical separation produced; but this would not produce a current *per se*, for an electric current implies very considerable energy and must be fed by something. The supply is kept up and really produced by the oxidation and dissolution of the zinc, and the chemical separation of the metallic zinc is transmuted into the energy of the current. In the second case the energy of electricity in motion is transmuted into that of chemical separation when a current of electricity is made to decompose a compound substance; as, for example, when a battery is used to decompose water. Heat apparently disappears during this operation, but it is given back when the mixed gases, oxygen and hydrogen, which result from the decomposition, are exploded in a eudiometer.

Recently this interesting subject has been placed under investigation by E. Levay; he specially gave his attention to the study of the relation between electrical and chemical energy in galvanic cells, and the object of his experiments was to determine for certain of these cells the heat generated chemically and the heat equivalent of the current, so that he might be able to obtain an exact measure of the difference between the two.

The heat evolved in the cell was determined calorimetrically, and that of the circuit in like manner by means of a silver voltameter placed within the calorimeter along with the cell.

Two cells were examined, namely, the Daniell and the De la Rue, and three calorimetric determinations were made with each cell.

In the case of the Daniell cell, the heat equivalent of the current appears to be greater than that which is generated chemically, so that the net result is that the cell works with an absorption of heat.

The reverse is true in the case of the De la Rue cell; but in this case Levay observed that the relative amount of electrical energy increases with the concentration of the solution in the cell.

The results show a close agreement with those obtained formerly by Jahn. The original paper appeared in the *Ann. Chem. Phys.* [2], xlvii. 103.

FISH will drown if the action of their gills is disturbed or interfered with.

Obeah Poisons and Poisoners.

BY EUGENE MURRAY AARON, PH.D.

In a recent lecture before the London Institute, reported in the SCIENTIFIC AMERICAN of May 30, 1891, Dr. Tidy, in his attractive way, discusses the subject of poisons, and ends by claiming that science has done and is continuing to do much to check those forms of crude poisoning so prevalent a few decades ago. There is probably no locality where Anglo-Saxon civilization is now waging so active a warfare in this direction as in the British West Indies. There the colonial governments are brought face to face with the Obeahman, whose skill with native poisons is supplemented by a certain rude acquaintance with the pharmacopœia, and whose sway over his debased followers is practically absolute.

In Jamaica, the largest of these colonies, the greater extent of the interior affords ampler refuge for these impostors, who naturally desire to secrete themselves far from the ken of the police inspection. To offset this immunity from detection the officers of the law are necessarily more constant in their vigilance, and the good offices of an "island chemist" and his assistants are constantly before the public. The very presence of such an official, whose main duty it is to aid in the conviction of suspected poisoners, cannot fail of having a deterrent effect on those who have recourse to the poison cup and the envenomed poniard. Mr. John J. Bowrey, F.C.S., who has filled the position of chemist in chief for over twenty years, has made a special study of the ways of Obeah and the Obiman, and to him the science of toxicology is indebted for important discoveries.

Obeah, the worship and propitiation of the eternal snake as an emblem of evil, long ago degenerated into a series of obscene orgies among its West Indian followers. The original office of the priest of this superstition was the simple protection of his followers from evil. It afterward came to include the perpetration of secret crimes against the property and lives of their enemies. The poisoning of implements of warfare seems to have been the first step in this direction, as Dr. Tidy has pointed out. Following this came the poisoning of streams used by hostile tribes. From these collective forms of savagery it was an easy step to the use of poisons in individual cases. The earlier expedients probably are still in vogue in the tribal warfare of Africa, but in the West Indies the skill of the Obiman is only invoked to enable a follower to wreak his vengeance on the flocks, the family, or the person of a hated rival or secret foe. The Obiman is an acknowledged adept in the use of poisons, and while his skill may awaken suspicion, it too frequently defies detection, even with the aid of accurate chemical analysis.

The Spanish and French West Indies afford a greater proportionate number of cases of these crimes among the negroes. In Haiti, especially, the practice undoubtedly reaches its highest development and is practiced with the greatest impunity. But as these countries do not employ official toxicologists to aid in the identification of such cases, we must still look to the British West Indies, and especially to Jamaica, for the best opportunities to study Obeah poisons and poisoners. This fact is well illustrated by the criminal statistics of the past decade. While in Barbadoes the convictions were about 5 per cent of the inhabitants, and in Trinidad over 6 per cent, they were only 1·65 per cent in Jamaica. On the other hand, the convictions ought to have borne a larger proportion in the last named island, because it is well known that the two former are under much better control of their white rulers. During the same period the arrests made for all crimes in Jamaica numbered 179,663, and the failures to establish a case 85,622, or over 47 per cent of the whole. It is well known that a very considerable number of these cases originate in Obeah practices, and that many of them have to do with actual or attempted poisoning.

Another feature in the government of Jamaica which does much to foster Obeah pharmacy is the mismanagement, as it appears to be to the disinterested onlooker, of what is termed the Island Medical Department. With eight heads of departments, drawing fat salaries, and a force of forty-one district medical officers, with a good salary guaranteed in each case, the patronage of the department has become of great value. Without going into particulars which would not interest the reader, it suffices to say that the result is to bring into great demand the services of "bush doctors," as those uneducated charlatans are called who brew simples from the wild herbs at hand. This is not to be wondered at when we find that there is but one educated physician to every 12,300 of inhabitants, by far the greatest proportion of whom are spread over stretches of wilderness, and what wonder that "bush physic" is all that these ignorant, neglected negroes ever receive?

In one parish, in which Obeah has a larger following than in any other, with a total population of over 35,000, only 4,500 of whom can read and write, scattered over an area of 280 square miles, there are but two medical officers and no non-official regularly qualified practitioners. Many in that parish live fifteen and more miles from a doctor and ten miles from the nearest drug shop, but in every little community may be found the bush doctor, usually also a priest of Obeah, who is coining money from his dupes.

Of over 14,000 deaths reported for the last fiscal year (an average of over 180 to each practitioner) in less than one-half is the cause of death known. Five days are allowed after burial before the death need be reported to the local register's office, but it is notorious that many deaths occur of which no report is ever made.

With these facts before us it is hardly necessary to go back, as Dr. Tidy does, to "ancient times" to find witchcraft "bound up with the practice of medicine and poisoning." It is quite safe to venture the opinion that some form of witchcraft requiring the use of poisons is called for as often as the more legitimate branch of bush pharmacy. The unlicensed black dispenser of medicines is too often a sorcerer and a poisoner, the latter perhaps through ignorance oftener than through intention.

Nature in the tropics lends herself readily to the uses of the poisoner. On every hand abound vegetable products from which the deadliest poisons may be extracted by easy processes. Lobelia, nux vomica, belladonna, prussic and oxalic acids, urichitine, manchioneal, and many other less well-known substances are all abundant. In the animal kingdom the potency of putrid blood, the venom of tarantulas, scorpions, centipedes, and more rarely serpents, are well understood. Although no poisonous snakes are now found in Jamaica, their venom is sometimes procured from elsewhere. Pere Labat is of the opinion that it is serpent venom which renders the scratch of the finger nail so deadly. But other poisons are employed in this way. A case of this kind came to my personal knowledge. The victim, on shaking hands with a supposed friend afterward found to be a rival, was slightly scratched by a sharply pointed finger nail. Death ensued within a few hours, and it was proved that the poison employed was of vegetable origin.

Cases in which a scorpion has been found to have been boiled in coffee or other beverages are not infrequent. Yet scorpions are so commonly found secreting themselves in household utensils that death from this cause is seldom attributed to anything but accident. Among the many forms of animal putridity employed by poisoners none is more highly prized than that taken from the intestines of the gecko lizard. This creature, stuffed, is a rare charm; its saliva forms an ingredient in many love potions, and its claws, worn on a string next to the skin, are reputed to ward off leprosy, syphilis, and other like ills.

Among the vegetable poisons a dilute prussic acid is obtained from the kernel of the rose apple, oxalic acid from various species of *Oxalis;* and the manchioneal poison, crudely distilled from the tree of that name, is one of the most deadly, both as a stomach and blood poison. Nux vomica and belladonna are well known to the Obeah pharmacists, and they are also familar with antidotes to these and other rapid poisons.

Urichitine, a potent toxic agent, extracted from the very common yellow Savannah weed, *Lobelia*, was recently discovered by Mr. Bowrey, and by him made known to science through the medium of the Royal Chemical Society of England. Yet there is reason to believe that this poison has long been employed by the Obimen. For some years the students of this science have been convinced that the Obiman was in possession of some cumulative poison whereby the death of a victim could be so timed as to take place after any stated interval—a poison the administration of which practically defied detection. In urichitine such a poison has at last been found. Mr. Bowrey's experiments therewith have been most thorough. A cat given but one one-thousandth of a grain per day regularly for six weeks, at the end of that time suddenly died in the most violent manner. The chances of detecting such an infinitesimal dose either by taste or sight are *nil;* the opportunities for the administration of such a dose in coffee, cocoa, or soup are legion. The chances that the chemist has for bringing the users of such a subtile poison to justice are almost too slight to be worthy of consideration. Its very action is described as least likely to awaken suspicion.

A typical case, one that will be at once recognized as typical by all West Indians, may be related in conclusion. A mistress discovered that her well favored quadroon waitress was exerting an undue influence over the eldest heir to the paternal acres, and reproved her therefor. Reproof not sufficing, a case of *flagrante delictu* was punished by a whipping with a strap—unfortunately not applied to the youth but to the plump shoulders of the girl. The punishment was taken in grim silence, and at its termination some threat, indistinctly heard by others, was made in which "Obiman" and "work de Obeah" were phrases. The next morning the mistress and her daughter, who took breakfast alone together, were seized with convulsions, and before medical aid could arrive were dead. Here was quite enough of the circumstantial to warrant the arrest of the girl; but further than that the case never went. No very definite results came from the chemical analyses, no one knew of the girl having visited an Obiman or having held communication with any one between the time of her punishment and the death of her mistress, and no poison was to be found in the house. Finally the suspected servant had to be set free, and on every hand she was hailed by her ignorant fellow servants as possessed with great powers, and her "cuss-cuss" (imprecations) were sought by all who had vengeance to wreak. Thus she abruptly graduated from the regions of servantdom to the higher realms of Obi priestess. How had she won her triumph? What "bush" had been brought in to her aid? Even the keen insight of a Bowrey or the wide knowledge of a Tidy would fail to unravel her secret. The West Indies afford scores of such mysteries every year.

A Static Electro-motor.

The static electric machine usually consists of one or more glass disks, by rotation of which an electric current of small quantity but great intensity is produced. The form of machine of which Mr. James Wimshurst, of England, is the author is one of the latest and best of the static or influence machines. It was last illustrated in the SCIENTIFIC AMERICAN of June 20, 1891.

Mr. Wimshurst has lately produced a new static electro-motor, which he exhibited a few days ago at the evening *soirée* of the Royal Society, London. It is said to be the first motor ever operated by static electricity.

This motor is simplicity itself; it consists of a glass disk, mounted on a vertical spindle, and carrying on one face a number of tinfoil sectors. The upper face of the disk is touched at two places by brushes connected by wires to the poles of the influence machine, while at right angles to the diameter joining these brushes there are two other brushes connected by an equalizing rod. Below the rotating disk is a stationary one, having upon it two sectors of tinfoil extending about 90°. These sectors are also in communication with the poles of the influence machine. As soon as the latter is put in motion, the glass disk begins to rotate and rapidly attains a very considerable speed, turning with an amount of force which is quite remarkable. A similar effect is produced, but to a less extent, by presenting the knob of a Leyden jar to one pole of the motor. We believe that this is the first motor that has ever been constructed to be operated by static electricity, and it attracted a very large amount of attention. Mr. Wimshurst also showed some very pretty effects with Leyden jars. In these the outer coating of tinfoil only extended about an inch from the bottom, while the inside of the jar was blackened. At each sparking the outer surface was covered with mimic streaks of lightning, which showed exceedingly distinct on the dark background.

The Japanese Fan.

One of the necessities of life in Japan consists of the fan, of which there are two kinds, the folding and the non-folding fan. Paper enters largely into their composition. Bamboo forms a material very handy for the framework of the cheaper kinds. The paper is either decorated with paintings in all the different styles of Japanese art or else brightly colored and sprinkled over with silver and gold leaves. These fans are manufactured of all possible qualities and prices, the richest and largest being used for ceremonial dances, where they form accessories of great importance.

The place most noted for its production in fans is Nagoya, and superior ones are made at Kiyoto, while the inferior descriptions come from Fushimi and Tokio. Several millions of fans are exported annually from Japan to America and Europe.

The fan is an inseparable part of the Japanese dress. A native is rarely without a fan. It is his shelter from the sun, his notebook, and his plaything. The varieties of these paper fans would form a curious collection in respect to form as well as quality. The highest priced fan that was used in the days of seclusion from the outer world was not more than 5 yen, or 15s.; but now they have been made to order for foreigners as dear as £2 to £3. The general prices of ordinary fans range from 2s. to guineas per 100. There are many curious uses for fans in Japan. The umpire at wrestling and fencing matches uses a heavy one, shaped like a huge butterfly, the handle being the body, and rendered imposing by heavy cords of silk. The various motions of the fan constitute a language, which the wrestlers fully understand and appreciate. Formerly, in time of war, the Japanese commander used a large fan, having a frame of iron covered with thick paper. In case of danger it could be shut, and a blow from its iron bones was no light affair. One notable variety of fan is made of waterproof paper, which can be dipped in water, and creates great coolness by evaporation, without wetting the clothes. The flat fan made of rough paper is often used as a grain winnow, to blow the charcoal fires and as a dust pan. The Japanese gentleman of the old school, who never wears a hat, uses his fan to shield his eyes from the sun. His head, bare from childhood, hardly needs shade, and when it does he spreads an umbrella, and with his fan he directs his servants and saves talking.—*Paper Mill.*

RECENTLY PATENTED INVENTIONS.

Railway Appliances.

LOCOMOTIVE SAND BOX. — John McDonald, Tokio, Japan. A steam chest made preferably in the form of a hollow disk is, by this invention, arranged on the under side of the sand receptacle, a pipe passing through the steam chest connecting at its lower end with the sand pipe leading to the rails, while a valve slides on the top of the steam chest to establish communication between the sand box and the pipe, an agitator secured on the valve extending into the sand receptacle. The construction is simple and durable, and the arrangement is such as to perfectly dry the sand, preventing its caking and insuring a continuous flow, at the same time permitting of placing the sand receptacle below or at the side of the boiler, instead of on top, as is now done.

TRAIN ORDER HOLDER.—Clarence E. Biddison, Goodland, Kansas. This is an improvement on a former patented invention of the same inventor, whereby the holder is rendered more simple and durable, and providing for them orc expeditious and convenient inserting of the order and holding it in place, the device also displaying train orders or notices of any description. Combined with a receiving frame, from side to side of which a pintle extends, is a door frame holding a glass pane and having outward projecting loops sliding and turning on the pintle, around which are coiled springs bearing on the receiving and door frames, the door being normally held closed by the springs, which are compressed when the door is lifted up.

Mechanical Appliances.

TUBE SEAMING MACHINE.—Albert D. Prentice, New York City. This is a device for forming a secure double-folded locked seam on the adjacent edges of a blank of sheet metal as it is being formed into a cylindrical or other shaped tube. It consists of a composite die having a base piece on which is a converging channel die to commence the bending, a contracting die in which is a tongue shaping and flanging the tube, two flanging dies and a finishing die, all arranged to receive the blank consecutively, while a mandrel is longitudinally extended through the several dies.

PUMP. — Joseph Darling, Karns City, Pa. This pump is intended especially for use in deep wells, whether oil or water. Connection is provided with a trap valve at the bottom of the well, whereby the valve may be positively opened when the standing valve of the pump is inserted, being held open so long as such valve support remains in operative position, and closed on the removal of the standing valve. As such insertion and removal of the standing valve only occurs in some instances at intervals of about thirty days, there is practically no wear on the trap valve, which, when once inserted, will wear a long time without needing repairs.

SUCKER ROD LIFTER.—Lewis Vaughan, Summit City, Pa. The block or base plate of this device has a seat for the rod, a slot leading thereto, while a hanger is pivoted to the plate, and a latch having its shaft portion journaled to the base plate has a crank arm at its front end extending across the slot, a handle extending from a crank arm at its opposite end, whereby the latch may be released by the hand grasping the hanger. The device is especially intended for lifting the sucker rods of deep wells, and in practice two of the implements are used, one being engaged with the head of one sucker rod section, and the whole being lifted by suitable hoisting devices, to bring the head of the next lower section above the well tube, when the next lifter is applied.

PLIERS.— Walter J. Monteith, Albany, Oregon. This tool is composed of pivoted jaw levers having shanks curved inwardly in opposite directions and pivoted lever handles whose shorter arms are curved outwardly and oppositely and pivoted to the shanks of the jaw levers, the implement working on the principle of a toggle lever, the power becoming greater and the grip of the jaws more powerful as the jaws are brought together.

BEVEL. — Peter J. Mabye, Brooklyn, N. Y. This is a simple and inexpensive tool that may be used either as a square or a bevel. It has a bifurcated handle, with a transverse screw provided with a thumb nut at its outer end, and a segmental groove concentric with the screw, while a blade in the handle has a projection to enter the groove, the screw passing through a small aperture to permit the blade to swing, but prevent longitudinal movement, it being clamped in the desired position for a square or bevel by the screw and nut.

Agricultural.

PLANTER. — William W. Jones, Granada, Col. An auxiliary beam is pivoted at one end to the plow beam and has at its other end a drive wheel, the auxiliary beam carrying a seed box in which is a spring-pressed slide, there being a flexible connection between the slide and the axle of the drive wheel. The implement is designed to be simple, durable and inexpensive in construction, and adapted for quick and easy attachment to the beam of a double or a single plow, the construction of the seed box being such that any kind of seed may be dropped therefrom without portions of the seed adhering to the drop slide.

PLANTER. — John A. Handeland, Palouse City, Washington. Combined with a main frame having an axle on which revolves a supporting wheel journaled in its forward end, is an auxiliary frame pivoted in the main frame and carrying a seed-dropping mechanism. The implement is designed to be especially adapted for garden use, and is so constructed that it may be utilized for planting seed or for cultivating young plants, and when the planting mechanism is removed, the implement may be used as a wheelbarrow.

Miscellaneous.

ARTIFICIAL STONE.—Walter Näf, New York City. This invention relates to what are known as "doublets," composed partly of strass or other artificial material and partly of genuine stone, the design being to minimize the color effects of the genuine stone and better preserve the color of the artificial body, while protecting it. Garnet is most largely employed for the facing, as it readily fuses with the artificial stones, and by this invention the genuine facing is made to cover the stone above the girdle, the major part of the covering being of uniform thickness and corresponding with the contour of the artificial body above the girdle.

ILLUMINATING TILE. — Charles W. Mark, New York City. Two patents have been granted this inventor for improvements in vault lights such as are used in sidewalks, roofs, etc., the inventions providing lenses for the tile which will not become easily obscured by dirt, which will be capable of diffusing a great amount of light, and by means of which the light may be thrown to one side as well as immediately beneath the lens. The lenses are secured in a frame in any of the common ways, and, according to one patent, a bull's eye is produced centrally on the under portion of the lens, while depending lips or lugs with inclined inner sides and vertical outer sides are arranged at right angles to the bull's eye, the lugs being cut away at the corners to provide for a greater diffusion of light. According to the other patent the lugs are of dissimilar lengths, and depend from a flat under surface, the lugs being arranged in rows according to the direction in which the light is to be reflected.

HAND STAMP TYPE HOLDER.—Taylor S. Buck, Brooklyn, N. Y. This holder is designed principally for India rubber type of a flat form with edge flanges, the holder consisting of a casing of tin or other suitable material open at the bottom and having side edge flanges. Within the casing is a spring-pressed follower to which the handle is centrally attached, the spring clamping the follower on the flanges of the type. The follower is readily moved back with one hand, for putting in or removing type from the holder, leaving the other hand free to handle the type.

SPIRIT LEVEL. — Reginald Forwood, New York City. This level consists of a four-armed casing having a cruciform slot, a four-armed or cruciform spirit glass being held in the casing, and having rounded corners at the points of intersection of the arms. True level indicators are provided above the center of the glass, the indicator consisting of wires or threads extending across the center of the opening of the casing, or the indicator may be formed of marks or lines made directly upon the center of the spirit glass. This device is designed to indicate the true level in every direction of a camera box or other object to which it may be applied.

BANJO.—Frederick Gretsch, Brooklyn, N. Y. This invention provides a means whereby the brackets usually employed on a banjo head may be dispensed with and the neck may be secured to the head in such a manner as not to weaken but to strengthen the head, with the object of lessening the cost and improving the quality of the tone. A sounding plate with a central opening constitutes the bottom of the head, to the under surface of which the neck is secured, while a clamping band encircles the body band, resting on the sounding plate, the clips engaging the clamping band being passed through the sounding plate and being provided with adjusting or locking devices.

BERTH SAFE.—John A. Brittain, New York City. This is a safe or locker especially adapted for use in connection with sleeping car berths or steamer or ship berths, and is adapted to be quickly and conveniently attached in any desirable position to virtually constitute a portion of the berth. The casing is preferably cylindrical, and a drawer properly partitioned to receive money, valuables, etc., is held to slide in it, a stop device limiting longitudinal movement, while guides prevent transverse movement, while means are provided for securely locking the drawer in the casing.

SWEAT PAD.—Harry Ryburn, Bloomington, Ill. This is a combined sweat and collar pad, which may be a stuffed cushion pad, or made of felt or other suitable material, but having at its center, or portion which rests on top of the neck, an opening, leaving narrow side strips connecting the pad sections on opposite sides. The opening is of a size to fit over an ordinary sore, allowing the ready application of a medicament, and is closed by flaps extending from opposite sides, the flaps being made tapering and held to close the opening by means of strings.

DOOR LATCH. — Ambrose H. Applegate, Phillipsburg, N. J. Combined with a casing provided with studs is a reversible frame engaged by the studs, a reversible latch having trunnions fulcrumed in the reversible frame, and a bar pivotally connected with the latch and actuated from the knob spindle. The device is simple and durable, and permits of an easy closing of the door, while it can be used on right and left hand doors without turning the lock upside down.

FENCE. — George P. Ruhle, Swengel, Pa. This fence is composed of a series of independent panels, constructed in the form of trestles, each separately anchored. Each panel is composed of three pairs of crossed posts having a rider rail in the top crotches and a lower crotch rail, both secured to the posts, two rails being secured to the posts near the ground parallel with the lower crotch rail, diagonal braces and base poles being provided, while an anchor stake driven into the ground is connected by a detachable wire link with the lower crotch rail.

WORK HORSE DRIVER. — Oscar M. Bryan, Wilson County, near Chanute, Kansas. A spring-pressed crank rod having its outer end bent at a right angle is provided with a cross bar carrying prods, a sliding rod mounted in a support being connected with the crank of the crank rod, a lever mechanism being provided for moving the sliding rod, forming a device applicable to all kinds of horse powers on which work horses are used. By its means the horses may be urged without a special driver, and the device may be adjusted so that, as applied to a pair of horses, if one horse is slow or lazy and the other quick and irritable, the slow horse may be urged without exciting the other.

CHIMNEY CONSTRUCTION. — Adolph Boettcher, South Stillwater, Minn. An inner tubular plate is adapted to fixedly encircle a chimney and has an annular outwardly and downwardly extending flange in combination with an outer tubular roof plate disconnected therefrom and extending under the flange, so that when the plates are secured in place the inner plate may move downward on the settling of a chimney without affecting the outer or roof plate. These attachments are designed to protect the adjacent woodwork, and permit the chimney to settle without breaking or cracking, thus maintaining it in a fireproof condition.

PNEUMATIC TIRE.—William R. Foster, London, England. This invention relates to tires of bicycles, etc., in which air is forced into the hollow rubber tire, under sufficient pressure to form a cushion that is more or less elastic, the invention providing therefor a novel form of valve to effectually close the orifice at which the air is forced in, in combination with a circumferential re-enforcing or constricting elastic band, the valve being such as to admit of being slightly opened to relieve the internal pressure, to suit the requirements or fancy of the rider, should the inflation be deemed excessive.

THILL COUPLING. — John Cook, No. 1008 South Clinton Avenue, Trenton, N. J. The coupling piece provided by this invention consists of a plate having a rib at one end and a projecting flange at the other, the coupling bolt extending from the flange parallel with the axle and terminating in a laterally projecting lug. The thills have transverse holes in the ends to fit the coupling plates, the holes having recesses in one side to fit the lugs of the bolts, which are engaged by cams on the thills. The coupling is designed to be strong, durable and inexpensive, and easily attached or removed, while it also prevents the thills from rattling, and may be so used as to hold the thills in elevated position when the vehicle to which it is applied is to be stored.

ROAD CART. — States D. Palmer, Marshalltown, Iowa. A pair of bars connected at their rear ends to the axle and at their front ends to the body of a vehicle have at an intermediate point a spring connection with the shafts, made adjustable along the length of the bars. A plate attached to the vehicle body has a long bearing, and a bolt or rod extends through the plate and also through the ends of the bars, elastic washers or cushions being arranged about the bolt on each side of the bars. The improvement is more especially designed to relieve the body of a two-wheeled cart from horse motion, but may also be applied on four-wheeled vehicles.

TONGUE SUPPORT. — Thomas C. Churchman, Sacramento, Cal. A rod, the ends of which are secured to the hounds, is located above the pivot pin of the tongue, while a spring rod is bent upon itself to form two coils extending around the pivot pin of the tongue and the rod above the pivot, an upwardly inclined forward U-shaped member of the spring rod engaging with the lower face of the tongue while a forked rear member engages with the lower face of the axle. The device may be applied to any vehicle, and is designed to cushion the tongue, rendering its movement easy to the horses when the vehicle is passing over rough ground, while also practically relieving them of the direct weight of the tongue.

MOVING LIVE STOCK FROM BARNS.—William Jones, Osceola, Neb. This invention provides an apparatus designed to facilitate the removal of live stock, especially horses, from barns, in case of fire or other emergency. The improvement consists mainly in hinging the stall partitions at their rear ends, so that their front ends can move laterally, latch devices being provided to hold them in normal position, while a chain or wire rope or cable is supported to move longitudinally in guides, the chain having rings or loops to which the horses are secured and being also connected with the latches of the stall partitions. At the ends of the barn are locks to prevent the endwise movement of the chain until it is designedly released, when it may be drawn upon to lead the string of horses out of the barn.

TEACHING ADDITION. — Arthur L. Gillis, Mount Pleasant, Iowa. This invention provides a casing with upper and lower shutters and vertically adjustable strips, with numbers of greater value alternated by numbers of less value for exposure through openings, to facilitate the work of an instructor in teaching mathematics. The device is designed to afford answers to every combination of numbers, the answers to be concealed from the pupils by a transverse slide until after the work is done, when, to test their correctness, the slide is moved and the answer exposed to view. The device saves the annoyance and unhealthfulness attending the use of chalk, and is calculated to interest and command the attention of young learners.

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

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Notes & Queries

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

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

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(3191) J. B. asks: Does a lightning rod attract lightning? "A" says it attracts first and then conducts. "B" says it does not attract, but only conducts? A. It is supposed that the main function of a pointed lightning rod is to diffuse the earth's charge and thus prevent the violent union of the electricity of the clouds and the earth. The rod when struck conducts the charge to the earth.

(3192) C. M. N. asks for a receipt for making solution of copper that will, with a battery, make a deposit on iron sufficient for a base for a silver plate. A. To a solution of pure copper sulphate add slowly a solution of potassium cyanide until no more precipitate is formed. Wash the precipitate and collect. Dissolve two pounds of potassium cyanide in a gallon of water, then add as much of the cyanide of copper as the cyanide solution will dissolve. Finally, add about four ounces of potassium cyanide. The solution should be used warm. Care should be taken in handling the solution, and the fumes from it should be avoided.

(3193) D. W. asks (1) for the best way to cover a canoe. I would prefer using canvas, but do not know how to make it water tight. A. The following is recommended for waterproofing canvas: Boil 1¼ lb. of castile soap (shaved up) in 15 gallons of water. In another vessel dissolve 1¾ lb. of alum in 15 gallons of water. Have both solutions nearly boiling. Immerse the canvas in the soap solution until it is completely saturated. Allow it to drain off, then run it several times through the alum solution. Allow the canvas to dry in the open air. Also you may use paraffine wax melted in with a hot iron. 2. Can I keep a gravity battery in a closed circuit continually with a burglar alarm? A. You can keep a gravity battery on a closed circuit, provided the resistance of the circuit is the same as that of the battery.

(3194) P. K. asks: 1. Can you tell me what kind of battery is best for a closed circuit or which kind is least apt to polarize? Is the cause of polarization faulty construction or bad management? Is the Minotto and its modification suited for a closed circuit? A. The gravity or Daniell's battery is best. Polarization is generally due to the collection of hydrogen on the negative element. It may be due to either con-

struction or management. The Minotto battery is practically the same as Daniell's. 2. Which is the positive pole—the earth or the cloud? A. The earth is always negative. The clouds are sometimes positive and sometimes negative. 3. Why is it that a 10 cell battery used in galvanic belt will not operate a sounder? Although the positive pole when set on the forehead and the other on the tongue will burn the skin, the current is not felt in other, even if silver is laid between the skin and the pole. A. A galvanic belt generates a very weak current, which is insufficient for operating a sounder. 4. Can I use old newspaper in dry battery instead of sawdust? A. We think old newspapers packed tightly would lack porosity. 5. Can you give me the address of any who could give me description of the writing telegraph now tried or used in Chicago? A. Write the inventor, Professor Elisha Gray, of Chicago.

(3195) C. L. asks (1) how to reverse a small electric motor? A. Reverse the current in the field magnet or armature, but not in both. 2. What is the formula for dry battery paste? A. Dr. Gassner's formula is as follows: Zinc oxide 1 part by weight, sal ammoniac 1 part, plaster of Paris 3 parts, zinc chloride 1 part, water 2 parts. 3. Is there anything that can be used instead of alum in the hypo bath in photography? Alum leaves a white sediment on the plate. A. You will have no trouble of the kind mentioned if you will use the alum in a separate solution by itself, after the hypo has been washed out. 4. Please give formula for bichromate of potash solution for batteries. A. Make a saturated solution of bichromate of potash in water. Add slowly one-fifth its bulk commercial sulphuric acid. 5. Is there any way of preventing a Leclanche battery from running down when used on a motor? A. No. This battery is not adapted to running motors.

(3196) W. B. H. asks: I contend with a friend of mine that the changes going on in a cell of battery are by virtue of the current, that they are caused by the current, while he claims that the changes are causing the current. Which is correct? A. Chemical action starts the current, and the current increases the chemical action.

(3197) C. W. writes: 1. I have a cell of chromic acid battery with 2 carbons and 1 zinc plate, each 3×6 inches, separated ¼ inch, and immersed in the solution to a height of 5 inches. Please let me know what is the resistance, the electromotive force, and the current of this battery at its terminals, the solution being kept in circulation? A. A working battery acts as an electrolytic conductor and is in practice of higher resistance than the measurement. The ohmic resistance would be but a small fraction of an ohm if measured when not in action. When in use it would quickly increase as the acid became exhausted. How great this increase would be may be estimated from the fact that zinc sulphate solutions have from 24 times and upward the resistance of sulphuric acid and water. Assuming the battery to be charged with sulphuric acid of 1·080 sp. gr., the resistance would be but 0·004 ohms. Polarization and exhaustion would quickly deteriorate this constant. The E. M. F. of such a battery is nearly 2 volts. 2. How many 25 volt 30 candle power lamps could be lighted with a battery of 12 such cells, the lamps being connected in parallel on a circuit having one ohm resistance? A. The resistance of the battery might be taken in practice at 0·05 ohm. For a single lamp 14 cells would be required, arranged in series. 3. What is the rule for computing the resistance and current of a battery cell of this description? A. Multiply the specific resistance of the solution to be used in the battery by the distance from zinc plate to carbon, and divide the product by the facing area of the plates. All dimensions must be reduced to centimeters. 4. In SCIENTIFIC AMERICAN SUPPLEMENT, No. 792, you state that the large plunge battery described furnishes 4 amperes of current, is this correct? A. Yes; under the limitations indicated in the first answer. 5. Please give numbers (if any) of SUPPLEMENTS containing articles on domestic electric lighting? A. See SCIENTIFIC AMERICAN, No. 18, vol. 61, No. 19, vol. 62, SUPPLEMENT, Nos. 603, 699. For general electrical calculations we refer you to "The Arithmetic of Electricity," which we can supply by mail for $1. The general idea of supplying a lamp from a battery is this. The voltage of the battery must exceed to some extent that of the lamp. Its resistance should be equal to that of the lamp for the minimum number of cells. With this resistance it must deliver four times the watts required by the lamp. With less resistance less watts are required and a higher efficiency will be attained, but more cells will be required.

(3198) Reader asks: Can you tell me where I can find a description of the process of preparing canvas or cotton cloth so that it is soft and pliable, and after being decorated can be applied to the wall by means of paste or white lead? I have known of several ceilings which have been treated and decorated abroad, rolled up, and sent over here to be put up, but so far have been unable to find out by what process the canvas retains its flexibility after being decorated. A. According to one method the canvas is dyed in imitation of tapestry. This is accomplished by rubbing the dye into the fabric by means of brushes. Effects secured in this way are said to rival those of real tapestry. According to another method the work is done on canvas or some other fabric in oil colors thinned with turpentine. The painting is also done on the canvas by oil colors in the regular way, with the exception of the use of an oil that does not dry hard, such as poppy oil or some of the drying oils with a very slight admixture of fixed oil.

(3199) W. H. B. asks: What is the difference between a modified choke shot gun and a straight bored, also what is the difference between a modified and full choke, also what difference would there be in their shooting qualities? A. Straight bore is what its name means, a perfectly straight and cylindrical gauge in the bore. A modified choke bore has the muzzle slightly drawn in on a taper to prevent scattering of the shot. A full choke is only a little more so, or the extreme amount of choke that is allowable. Choke boring of any degree is made to control the scattering of the shot by impacting it at the moment of leaving the gun.

(3200) G. W. R. asks: 1. What can I mix with powdered black oxide of copper (commercial) to form it into cakes for battery purposes, and how is it solidified? A. Powdered black oxide of copper is usually solidified by heavy pressure. 2. How can I make a good conducting cement for electrical purposes? A. Electrical soldering. Lead, soft solder, and carbon are used as conducting electrical cements. 3. I saw a Bulinger receiver, and the helix on the outside was wound with bare copper wire. What advantage is this? A. The copper wire referred to is insulated by collodion or some kind of varnish. 4. What is the Gower-Bell telephone, and how constructed? How are receivers constructed to bring out sound for audiences on long distance? What is the Edison megaphone and how constructed? A. The loud-speaking and Gower-Bell telephones are described in Prescott's work on the telephone. Edison's megaphone is simply a combination of large speaking trumpets and ear trumpets.

(3201) F. C. M. asks: 1. Which is the best material with which to construct a 6 foot sewer 1¼ miles long, tunneled under a hill 200 feet from the surface, cement, concrete, or brick, and which is used the most? Cement is worth $4 per barrel, here in Seattle, and sand and gravel in abundance. Sewer brick are worth $10 per M delivered on the work. Which is considered by men of experience in that business to be the most practical, a cement or brick sewer? A. For a sewer of dimensions you state, brick set with cement mortar is best. 2. Can you refer me to any cities which have constructed cement sewers? A. New York, Brooklyn, and nearly all the large cities. If the tunnel you mention is to go through earth, the work might be easily executed by means of the Beach pneumatic shield.

(3202) N. N. asks: Will an auxiliary magneto-electric or extension bell work on a line 1½ miles long, having perfect connections all around, without the aid of the regular magneto? I desire to use one if I can, on account of their less cost. What is difference in the winding of the cores of a 5 ohm and a 40 ohm? How can I tell them apart? A. By the use of a relay and battery you can ring your auxiliary bell. A 5 ohm magnet is wound with coarse wire, while a 40 ohm magnet is wound with fine wire. The safest way to distinguish the magnets is by the maker's mark or by actual measurement.

(3203) E. B. N. asks (1) if it will hurt geological specimens to wash them in soap and water to take off the dirt. I didn't know whether the soap would affect their color or not. A. As a rule it will not. 2. Will you tell me of some inexpensive but good solution to erase writing ink, and which will not hurt the paper? A. Equal parts oxalic and tartaric acids dissolved in water. Javelle water may be used also.

(3204) R. F. writes: I desire to ask a few questions relative to the tang. galvanometer and set of coils described in "Experimental Science:" 1. Would it be at all advisable to use a 2 inch needle with a 5 inch pointer? A. The length of the needle depends upon the diameter of the galvanometer coil. It should not be longer than one-twelfth the diameter of the coil. 2. What sizes of German silver wire should be used for coils? I desire to make a set running from one-half to one thousand ohms. If you have not the data, where can I get it? A. German silver wire has a resistance ten times greater than that of copper. You can readily determine its approximate resistance by comparing it with copper.

(3205) D. M. D. writes: Will you tell me if there is any such serpent as a hoop snake? We have had quite an argument about it, but I can find no such snake in my dictionary. Also please tell me the motion it has in propelling itself forward. A. The hoop snake is a myth. The common milk snake progresses by forming a series of long loops which sometimes bear some resemblance to a hoop. It never takes its tail in its mouth and rolls, as some believe. See Col. Pike's article on "Hoop Snakes," SCIENTIFIC AMERICAN, vol. 61, page 344.

(3206) H. D. A. writes: I have constructed an electric motor as described in SUPPLEMENT, No. 767, but find instructions do not say how wires should be connected, and I am unable on that account to complete. How should the connections be made between poles of field magnet and to armature and commutator? A. Connect one terminal of the field magnet with the battery, connect the other with one of the commutator brushes, and connect the remaining commutator brush with the battery. If the field magnet is wound with fine wire it may be placed in a shunt, *i. e.*, its terminals may be connected with the brushes and the brushes with the battery.

(3207) E. B. H. asks: How are bricks enameled, and what kind of enameling is used? What coloring matter is used to variegate the colors? A. Enamel for bricks is composed of powdered flint glass 260 parts, carbonate of soda 41 parts, boracic acid 12 parts. The face of the brick is sized with glue size, the enamel is then applied in solution, and fused in an oven. The enamel is colored with the metallic oxides. We refer you for further information to "Bricks, Tiles, and Terra Cotta," by C. T. Davis, which we can mail you for $5.

(3208) F. B. asks: I would like to build a vehicle of some kind, and I would like to put some power to it. Can a motor about one horse power or a little more be run by a storage battery? If so, how much room would it take up, and what would it cost to run? A. It requires about 8 cells of storage battery for a horse power, and this power is hardly sufficient for running a vehicle on an ordinary road. Such vehicles have been used experimentally, but none, so far as we know, have been in practical use. Better use steam. It is cheaper and better in every way.

(3209) W. M. writes: I would like very much to know if there is a way of finding the voltage and amperage of a battery, without using the expensive instrument called the voltmeter, etc.? A. You can ascertain the voltage by comparing one of your cells with a cell of gravity or Daniell using a high resistance galvanometer. The amperage is determined by dividing the electro motive force by the resistance.

(3210) H. M. S. writes: In your number of July 11, 1891, in Notes and Queries, No. 3135, M. S. S. wants to know what will prevent the trouble of lime being deposited in a copper tea kettle, when lime water is used. Tell him to put an oyster or a mussel shell into the clean kettle, and the lime will prefer the shell to the copper. When the shell is loaded, take it out and break off the lime, or put in a fresh one. That is an easy way.

NEW BOOKS AND PUBLICATIONS.

Hay Fever and Rose Colds.—The July number of "Wood's Medical and Surgical Monographs," price $1 a number, published by William Wood & Co., of New York city, has an interesting treatise of eighty pages by Sir Morell Mackenzie on hay fever and its treatment, with a chapter on rose colds, from which it appears that the cause of this disease is the entrance into the eyes and air channels of those predisposed to the ailment of minute particles of vegetable matter from grasses and plants in flower. Some of the grasses the pollen of which is most productive of hay fever are illustrated in the article. Although, it is said, hay fever too often excites ridicule rather than sympathy, the distress it occasions is declared to be very real, although the sufferers are "almost exclusively persons of cultivation, the male sex being more liable than the female, in the ratio of about three to one." Two other elaborate papers are included in this number of the Monographs, one on "Tuberculosis of the Bones and Joints," by Dr. Fedor Krause, of the University of Halle, and "A Study of Malignant Disease of the Upper Air Tract," by Dr. F. H. Bosworth, of the New York Bellevue Hospital Medical College.

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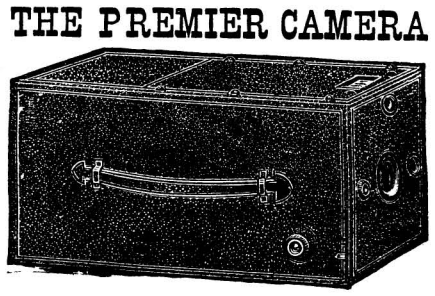

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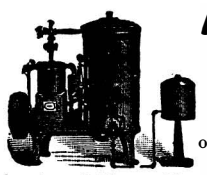

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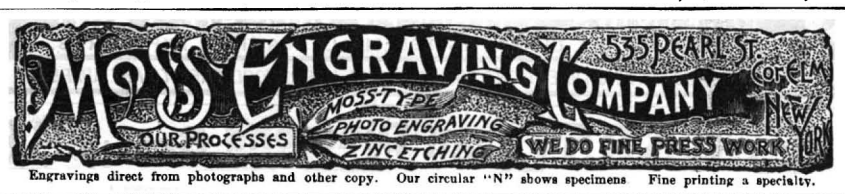

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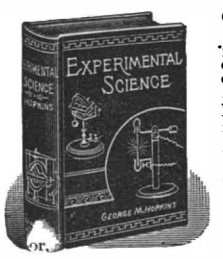

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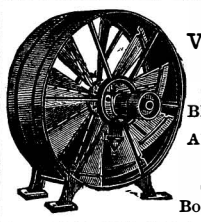

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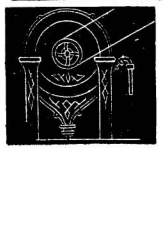

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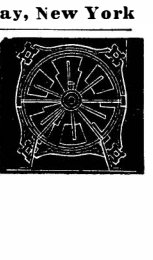

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