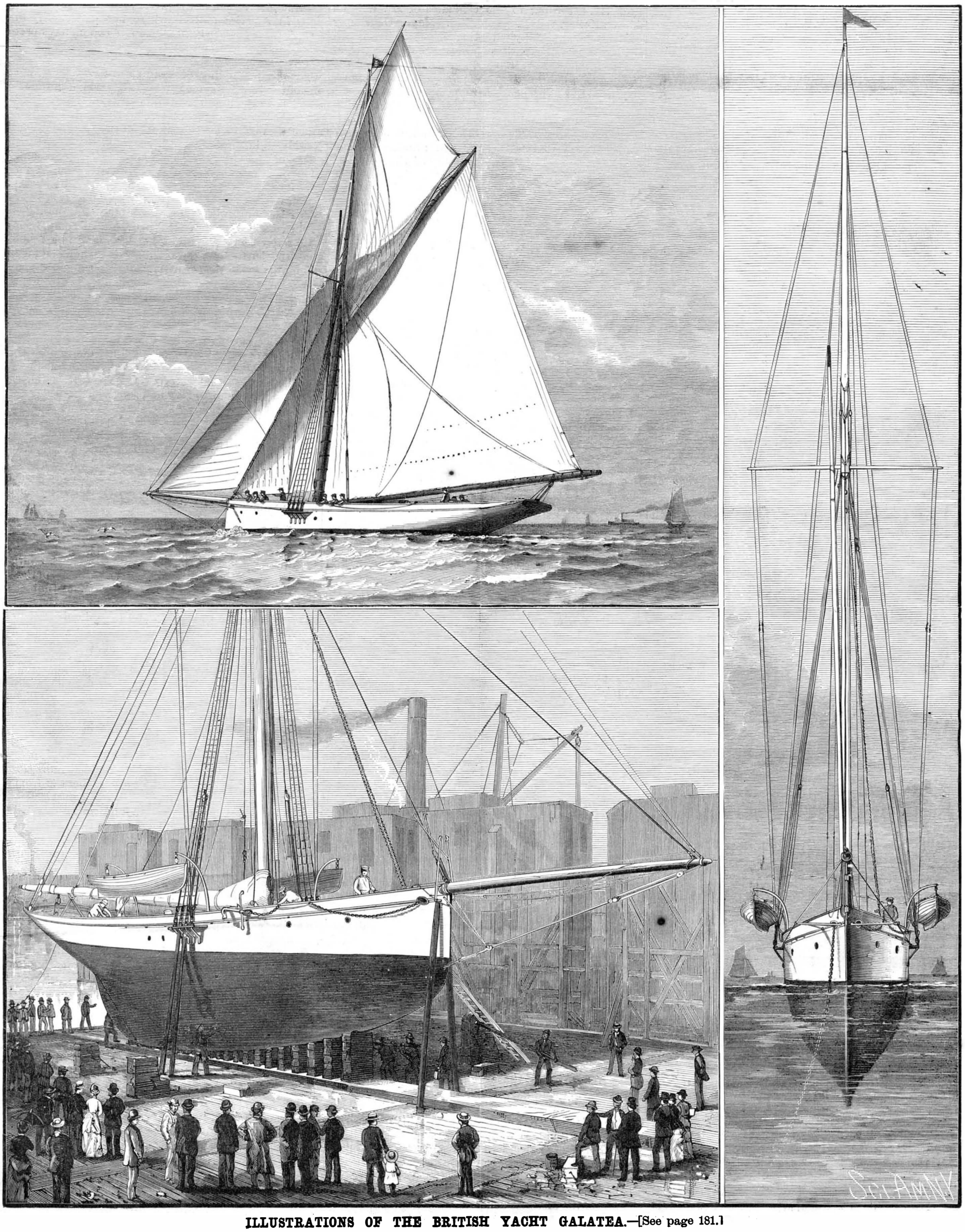
SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LV.—No. 12. [NEW SERIES.] NEW YORK, SEPTEMBER 18, 1886. [Price 10 Cents. $3.00 per Year.



ILLUSTRATIONS OF THE BRITISH YACHT GALATEA.—[See page 181.]

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

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NEW YORK, SATURDAY, SEPTEMBER 18, 1886.

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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 559.

For the Week Ending September 18, 1886.

Price 10 cents. For sale by all newsdealers.

THE GREAT EARTHQUAKE.

Day by day, for the last week, earthquake shocks of gradually decreasing intensity have disturbed Charleston, and at last it seems as if the earth has approached its condition of repose. The total number of disturbances has been very large, but the great damage was done by the first one. Mayor Courtenay, of Charleston, returning from Europe, received from the pilot that boarded the Etruria his first news of the disaster that had befallen his city. The loss has been estimated very differently by different authorities. The general consensus places it in advance of the figures given by us last week; $5,000,000 is the amount of damage to buildings and $500,000 to furniture and personal property, according to the estimates of Mr. William Aitken Kelley, the City Appraiser. Mayor Courtenay coincides substantially with this estimate. The death list has not been greatly changed; several additional deaths from exposure have slightly increased it. According to all authorities, no more shocks of any severity need be apprehended. The latter disturbances bear somewhat the same relation to the original that the last ripple caused by a passing steamer bears to the first violent waves. The first shock indicated the progress of the earth toward settlement; and subsequent shocks have marked the dying away of the agitation. From the above comparison, it must not be surmised that each movement represents a wave of the same series. All we know is that, as a rule, the first or an early shock is the worst. No tidal wave at this late date is at all to be anticipated.

The present dread is of rain; the need is for shelter. Tents are in great demand and seem to be hard to obtain. The return of confidence is rapidly doing away with this necessity. Buildings are being repaired, and masons and carpenters are hard at work everywhere. Soon the houses will be reoccupied. Recurrence of rain is, however, greatly to be feared, as it will cause great suffering among those who are without shelter, or who have only tents to live in.

The fact having been established that the earth movement was not of sufficient intensity to quite destroy the majority of houses, many have suggested that the proper course to pursue in an earthquake is to remain within doors, and take shelter in an inner doorway, so as to be secure from falling plaster. As it is merely a question of degree how far the destruction will go, it is to be doubted if this is good advice.

Naturally, the greatest damage was done to brick buildings. Their inelasticity caused them to be cracked and overturned. Brick chimneys, in falling, were also a source of loss and damage. Hitherto, a statute has forbidden the erection of wooden houses. A movement now is impending to petition the legislature to do away with this restriction. The demand upon the real estate agents is for wooden houses, people fearing to establish themselves in brick buildings. The fire of August 31 seems to be forgotten by those who advocate this plan. Had the houses of Charleston been built of wood, there would be little left of the city, in all probability, to-day. The fire that destroyed so many buildings, if wood had been the prevailing material of construction, would have spread everywhere unchecked, as no efficient work could have been anticipated from the fire department during the scenes of panic.

Even the animals were affected, and, in some cases, were more frightened, to all appearances, than were human beings. The horses from one of the engine houses ran away in the wildest terror, and were not found again until the next morning. The surrounding country has furnished similar accounts of the behavior of domesticated animals.

A sensible departure in rebuilding the city, is suggested in the substitution of terra cotta for brick in the construction of chimneys. These would be more resistant, and, if destroyed, would do less damage in falling.

One of the difficulties of the situation has been to determine which houses could be reoccupied, and which ones required demolition. To meet this need, a committee including W. E. Speir, architect and inspector of public buildings, United States Treasury Department; Captain W. H. Bixby and Lieutenant F. V. Abbott, United States Engineers' Department; Louis J. Barbour, City Engineer; and John Devereaux, architect and superintendent of the United States Custom House wharf, Charleston, has been appointed chiefly to examine and condemn dangerous houses and property.

As was to have been expected, contributions are pouring in from all sides, and with her natural resources and manufacturing industries the city will soon be on the road toward a recuperation of her losses. The city has shown great increase in prosperity recently. From 1880 to 1883, manufacturing capital increased from $1,718,300 to over $6,000,000, while production and hands employed nearly quadrupled in amount and number. Charleston rock, the great natural phosphate of this country, was the basis of this advance, most of the factories being devoted to the production of superphosphates and other artificial fertilizers. The city is fortunate in having her own deposits of phosphate to draw upon, being thus a producer as well as a manufacturer of her great staples.

On the evening of Wednesday, September 1, Prof. Dawson, Principal of McGill College, Montreal, read a paper touching on earthquakes before the British Association for the Advancement of Science, then in session in Birmingham, England. It consisted of an exhaustive review of the geological formation of the bed of the Atlantic, with especial reference to its bearing upon the question of earthquakes. The paper was highly praised and regarded as a valuable contribution to the discussion, but within a day came the full account of the Charleston upheaval, and Prof. Dawson immediately made the following confession:

"The phenomena of the present earthquake convulsions in America and elsewhere, but particularly in America, are extremely puzzling, and completely upset some of the conclusions set forth in the address I read last evening."

The high standing of Prof. Dawson, recognized as one of the leading geologists of the world, and the retraction, in the light of natural events, of his views expressed a few hours before, forcibly illustrate our ignorance as regards earthquakes. If they could only be considered in the correct light, as infinitesimal disturbances of the earth's surface, speculation concerning their origin would be less freely indulged in. A depression of the land enough to have submerged Charleston into the sea would only have involved a lowering of surface equal to about one three-hundred-thousandth of the earth's diameter. Making the same comparison with reference to what did take place, it will be found that the surface was agitated far less than one fifty-millionth part of the diameter. A proportional dimension on a twenty inch globe would be about one-fifteenth or one-twentieth the thickness of a piece of gold leaf, or, referred to a sheet of paper, a thousandth of the above fraction.

In other words, regarded as cosmical disturbances, earthquakes are almost too small to be intelligently theorized about. Their disastrous effects on humanity may be very great; but referred to the earth's dimensions, they amount to very little at the present day.

From general reports and the observations of the Government scientists, Director Powell concludes that the earthquake had its center in North and South Carolina, to the northeast of Charleston. The land area of the earthquake was one-third of the total area of the United States, and the maps which have been prepared show that the shock traversed this distance in fifteen minutes.

RARE MONKEYS.

Five new members of the monkey collection were placed on exhibition last week in the Museum of Natural History in the New York Central Park. All of these are rare, as may be judged from the fact that the Rochester agency, which contracted to furnish specimens of each known variety, and is paid only as it delivers them, has been four years getting the curious group of the family *Simiadæ* now for the first time on exhibition here.

The ring-tailed lemur (*Lemur catta*) is from Madagascar. It has thick gray fur, slightly shaded with brown along the shoulders and flanks, and mostly white on lower surface The tail is two feet long, prehensile, heavily furred, and spotted with white. The specimen is two feet exclusive of tail, and has a rather pointed, fox-like nose.

No. 2 embraces a group of very variable lemurs (*Propithecus verreaux*). The coloring of these is from a pure white to a deep red.

No. 3 is a black monkey with a brown head (*Semnopithecus johnii*), three feet long, tail slender and as long as body. It is from India, and was captured by Taxidermist Hornaday, of the National Museum at Washington.

Nos. 4 and 5 are rare specimens of the little marmoset or quircal monkey of Brazil.

Those unfamiliar with the monkey family, who are sufficiently interested to visit this collection, will discover that while none of the Old World monkeys have short tails, American members of the family are not thus restricted to the one fashion, some wearing long and some short tails.

They will observe, further, that the Old World monkeys have cheek pouches for the temporary storage of food, and callosities on either side of them, while those of the New World have neither the pouches nor the callosities, but are characterized by the width between their nostrils.

Peroxide of Hydrogen.

The use of peroxide of hydrogen, commonly called oxygenated water, is extending for bleaching purposes. It will be remembered that some years ago the fair sex rendered this product somewhat popular by partially bleaching their hair with it, but the product has now emerged from this fashionable employment into the more common and perhaps more useful application for industrial purposes, being now employed for the bleaching of feathers and also of tussah silks, for which it is admirably adapted.

Inland Navigation.

Canals, so long relegated to the background, appear now in a fair way of coming to the front again, additional interest having been lent to the subject by the passing of the Manchester Ship Canal Bill, and by the subsequent permission to pay interest out of capital. At a congress on inland navigation, held last summer in Brussels, the Belgian Minister of Agriculture, Industry, and Public Works observed that canals had been too long neglected, and that public attention was now being turned to them, not with that impetuosity which, fifty years ago, created an immense iron network, but with a wise maturity which augured well for their future. In a paper on the eventual prospects of the canal, M. Van Drunen, one of the secretaries of the congress, and engineer to the Societe Generale des Chemins de Fer Economiques, came to the conclusion that the true transport arrangements of a country should include both railways and canals, each taking its share of the traffic according to its aptitude, to the great advantage of trade and manufacture. The canal would not take from the railway either passengers or goods sent by *grande vitesse* in small quantities, while the water transports would comprise substances forwarded in large quantities at low tariffs, and on which the profit is insignificant. The canal would thus free the railway from a clog upon its action, and enable it the better to organize its fast passenger service, to its own profit and the public advantage. Reduction in the cost of transport is the remedy suggested for the present stagnation in trade, it being indispensable that the transport of raw materials be cheapened both for industry and agriculture. Ship canals only enable the capital of a country to engage in commercial operations, because capital is not so easily displaced for commerce as it is for industry. A canal system of moderate section should be supplemented by a few ship canals of sufficient depth, where the probable traffic warranted the outlay.

The economical side of the question was well brought out by Mr. Daniel Adamson, who energetically pleaded the cause of the Manchester Ship Canal and others in a similar case. Cotton imported from India to London cost less for ship transit over 4,000 miles than by railway from London to Manchester, a distance of 200 miles; and manufactured goods, sent by through rate from Manchester to Bombay, paid 12s. 6d. for the 40 miles by rail to Liverpool, and only 10s. for the remaining 4,000 miles. Water carriage was the carriage of the future for heavy and not necessarily fast traffic; and the legitimate province of the railways, with their handmaids, the telegraph and telephone, was for quick speed and light weight. The railways should be content to carry passengers, 14 to the ton, at 14 pence per mile, rather than minerals and other heavy goods at 1d. per ton per mile, including the loading and unloading. Mr. E. Leader Williams, C.E., engineer for the Manchester Ship Canal, wished it to be put on record that it was he who first suggested the idea of lifting vessels vertically by hydraulic power, having argued that, if there had been no difficulty with a vertical, there need be none with a horizontal water joint. The late Mr. Mulvaney, formerly Commissioner for Public Works in Ireland, insisted on the advisability of taking the sea as far into the interior of a country as possible; and the Antwerp delegate complimented the English for carrying out public works by private enterprise instead of courting the favor of government.

Three important ship canals, the Suez Canal, the Cronstadt and Petersburg navigation, and the canalized River Main between Mentz and Frankfort, to be opened on October 1 next, formed the subject of several interesting communications.

THE SUEZ CANAL.

M. Dirks, engineer to the Dutch Waterstaat, and member of the Suez Canal International Committee, gave the results of the inquiry that had been conducted as to the deepening and widening of the canal, the captains having, on an average, voted for a width of 85 meters and the pilots for 76 meters, with a depth, respectively, of 3 feet and 3½ feet under the keel; while four captains estimated the speed that could be attained under the improved circumstances at 8 knots an hour, one at 9, two at 10, and two sailing full speed. The Committee had unanimously declared for enlarging the existing canal, with a provisional depth of 8½ meters, and a final depth of 9 meters. This would permit of a speed of 8 knots an hour, so that steamers could pass through in a single day, or half the time now required. For protecting the banks, masonry facing was recommended.

Commander Di Gioia, delegate of the Italian Government, and also a member of the Suez Canal International Committee, considered that planting the banks down to the water's edge constituted the best and most economical protection. The action of the waves was felt 2 meters below the water line, and not more than 1 meter above it, so that the banks must be protected for a vertical height of 3 meters.

ST. PETERSBURG CANAL.

M. Tcharnomsky, engineer, of St. Petersburg, gave some particulars of the Cronstadt and Petersburg ship canal, 28 kilom. or 17 miles long, generally 84 meters or 275 feet wide, and 22 feet deep, which cost £1,200,000, and will, by saving the transshipment of goods, prevent a loss of about £800,000 per annum on a traffic of 2,700,000 tons. The Goutonieff dock, 365 meters long by 214 meters wide, and the two supplementary docks have a total area of 174 hectares, or 430 acres. The foundations of the quay walls, laid in treacherous ground, consist of caissons, formed of fir logs, about 10½ inches in diameter, and filled with sea pebbles, on which is a layer, about 3 feet high, of concrete, carrying the granite faced masonry, and braced together by half logs and tie bolts. The timber is always under water, so that it is not liable to decay; and there are no teredos in the Baltic.

THE RIVER MAIN CANAL.

Herr Dusing, engineer in chief for the canalization of the Main between Mentz and Frankfort, contributed some information concerning that work, which is being carried out by the Prussian Government at a cost of £275,000, and will permit the largest vessels—1,000 tons burden—that navigate the Rhine to get up to Frankfort. The depth of the Main will be increased from 0·9 meter to 2 meters, while the locks, etc., are being constructed for an ultimate depth of 2½ meters. The distance to be regulated is 36 kilom., or 22 miles; and the total fall is 10 meters, or 33 feet. There are five weirs with locks, dividing the length into five reaches. The needle weirs are in the middle of the stream, the masonry sill being at low water level, excepting the central opening, where it is 0·6 meter lower, to allow boats to pass freely when the weir is down. The locks on the left bank are 80 meters, or 262 feet, long by 10½ meters, or 34 feet, wide; and the raft passes on the right bank are 12 meters, or 39 feet, wide, the shoot having an inclination of 1 in 200. Particulars of the works at Frankfort were added by Herr Stahl, delegated by the Municipality in the absence of Mr. Lindley, engineer in chief. The works, which were begun in 1884, and are to be completed at the end of the present year, are being carried out by the Frankfort Municipality at a cost of £200,000. The harbor of refuge, 570 by 70 meters=1,870×230 feet, and 2·8 meters=9 feet deep on the right bank, is formed and protected by an outer dam parallel with the shore line, and will also be fitted out for loading and unloading goods. Besides this harbor of ten acres area, which will be capable of receiving fifty of the largest Rhine boats (of 1,000 tons), the commercial harbor on both sides of the river between the Main-Neckar Railway and the State Railway bridges will have an area of thirty acres. There will also be 5 kilom., or 3 miles, of quay above the Main-Neckar Railway bridge along the reach of the river dammed by the Frankfort weir. Sidings will run from the goods stations all along the quays, so as to facilitate the direct transfer of goods from water to rail, and *vice versa*. It is intended to erect hydraulic cranes and lifts supplied from a central hydraulic station, utilizing the fall of 2·7 meters=8 feet 10 inches at the needle weir to drive turbines giving out from 280 to 500 horse power.

OBSERVATIONS CONCERNING CANALS.

M. De Saint-Hubert, of Namur, advocated the making of canal locks as uniform as possible, so that the governments of adjacent countries might agree upon a system of through working, as was the case on railways. He also expressed the opinion that the service should not be interrupted during the night, and to this end he would utilize the fall of water over the weirs to generate electric current for lighting the locks and shores. He gave an outline of his scheme for connecting all the large rivers of Central Europe, the Elbe, the Rhine, the Danube, the Oder, and the Weser, thus forming one vast system of waterways, connecting the North, Black, and Baltic seas, and making Berlin and Vienna seaports. There would be a length of 1,000 kilom., or 621 miles, of canal to cut, at an estimated cost of £11,000,000, requiring a capital of £14,025,000; but he estimates the traffic at 2,400,000 tons per kilometer (0·62 mile). Taking only half of this to begin with, and putting the dues at half a kreutzer per kilometer, there would be an immediate revenue of £600,000, yielding more than 5 per cent on the capital.

The quays of the Ghent docks, which were visited, have two lines of way in front and four behind the warehouses, which are to have cellars and an upper story. The hydraulic principle has been chosen for the traveling cranes, which will run on the first line of way. These additional works are estimated to cost 12,000,000f., or £480,000, which has already been raised by loan. There is a scheme for making Bruges a seaport, by cutting a ship canal to the nearest point on the coast, a distance of 7½ miles, and making a deep-sea harbor inclosed by piers at Heyst, and docks at Bruges. An English company offered to carry out the work for a 99 years' concession, if the Belgian Government would guarantee 3 per cent on the outlay.

During the deliberations on the technical portion of the programme of questions, M. Casse gave it as his opinion that in cutting a canal, the *debris* should be put on the banks in as direct a manner and with as little intermediate mechanism as possible; and he described an excavator that he had devised for effecting this object. It consists of a hollow jib, movable along the bottom by chains and pulleys, carrying at one end a revolving cutter, giving blows like those of a pickax, and at the other an exhausting fan. The *debris* is drawn through the hollow jib and delivered by tubes on to the banks, with a great saving in cost.

M. A. Huet, of Delft, gave particulars of his water locomotive, by means of which he feels warranted, by trials on a small scale, in expecting as great speed on the water as is now attained on railways. The vessel's keel is fitted with plain drums of sheet zinc, steel, or iron, caused to revolve at a great speed by a pitch chain and belt from the pulley of a motor. The speed is to be increased by immersing a greater number of drums, or more of their surface, or by increasing the speed of the motor. In support of his project, M. Huet cited the experiments made by M. Bazin at Paris in 1874, when disks made to revolve at a great velocity presented the remarkable phenomenon of a richochet motion directly they touched the surface of the water.

Sig. J. Rigoni contributed a paper dealing with the various methods of traction on canals, in which he referred to the system of towing vessels by an endless cable, constantly running, supported on pulleys in the tops of posts, placed on the banks in a somewhat inclined position toward the stream. The advantages of this system are high speed, regularity of traffic, optional starting and stopping, prevention of injuring the banks, and great economy in a canal where the traffic is great. The cost of installation is put at between 6,000f to 7,000f. per kilometer, and the working expenses at about 1,000f. per kilometer per annum. —*The Engineer.*

Progress of Locomotive Building.

The Baldwin Locomotive Works recently completed and shipped engine numbered 8,000. The first locomotive built at these works was turned out in December, 1832, and it took 20 years—until November, 1852—to build 500 engines. The second 500 engines were built in 8 years, number 1,000 being finished in February, 1860. The next 6 years saw the third 500 built, number 1,500 leaving the shop in July, 1866. The fourth 500 were built in 3 years, by October 30, 1869; the fifth 500 in 2 years; and the sixth and seventh 500 each in 1 year, engine number 3,500 leaving November 20, 1873. Business then slackened, 3 years being required to build the next 500, and two years the following 500, engine number 4,500 leaving December 17, 1878. Then trade improved, 500 engines being built in 15 months, and 1,000 more engines in 22 months, while 500 more engines were finished in 10 months, number 6,500 leaving December 6, 1882, and marking a half century for the works. The next 8 months saw 500 more built, and before the close of 1884, number 7,500 was turned out. Work again slackened, and 19 months were required for the final 500 locomotives, number 8,000 having just left the establishment. It is noteworthy that one-half the whole number, and these by far the heaviest and most elaborate engines that have been built, were turned out within the last 10 years, the first 4,000 requiring 44 years to build.—*Philadelphia Ledger.*

A Bullet Post.

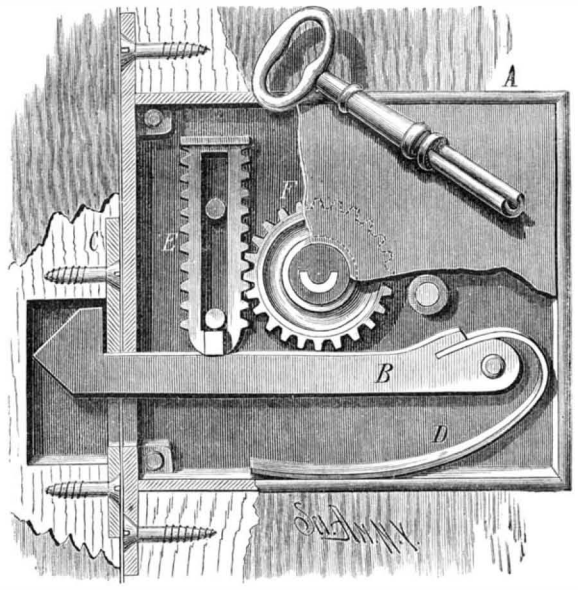
The Museum of the Berlin General Post Office received a few days since an interesting addition to its treasures. This is a parchment letter found in the city archives of Cologne, and which had been inclosed in a hollow bullet and fired out from the beleaguered town of Neuss in 1475, to let the friendly forces of Cologne know of the terrible plight to which the citizens were reduced. Charles the Bold of Burgundy was carrying on war against the town of Cologne and other Rhenish confederated cities, and had hemmed in Neuss so closely that the inhabitants were brought to the last extremity.

An army of observation of the confederates, posted beyond the Rhine, watched Charles' operations, hoping to get an opportunity of relieving the town. The letter is from the commander, the Landgrave Hermann of Hesse, who describes how the besieged are destitute of food and ammunition, and have only stones for weapons and water to live upon. They have no medicines or surgical appliances, and so the sick and wounded die without assistance. Some are for a surrender, and he fears that traitors may betray the place. They had a few days before lost 100 men in repulsing an assault of the Burgundians. The letter mentions that the besieged had previously fired off several other letters, some of which had fallen into the Rhine; and they were expending their last powder in firing off this one.

IN the description of the drawer check and support in our issue of August 21, the name of the inventor was spelled S. J. Frazer; it should have been S. J. Fraser.

SPRING LOCK.

The simple spring lock herewith illustrated is the invention of Mr. Frank O. Phelps, of Blue Island Ill. One end of the bolt, B, is pivoted to the casing and the other end projects through a slot, being provided with a suitable catch to engage the face plate. The lower, rounded end of a double rack, E, slotted longitudinally to engage guide pins in the casing, bears on the bolt, whose free end is pressed upward by a spring, D, arranged as shown. Meshing with the teeth of the rack is a toothed wheel, F, whose hub is extended on each side and journaled in apertures in the casing. Extending through the hub is an irregular slot to receive the key,



PHELPS' SPRING LOCK.

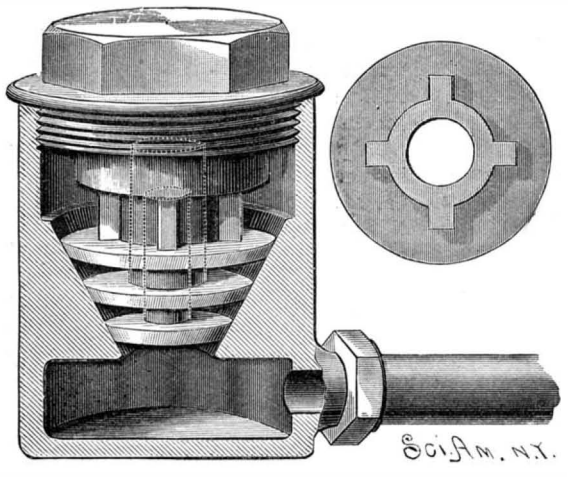
so that the lock can be operated from either side. Although here shown in a lock of the mortise pattern, this arrangement is equally applicable to many other styles. The key may be dispensed with, and handles used instead.

The key being inserted and turned causes the toothed wheel to carry forward the rack, and thereby drive the bolt back to an open position. Upon releasing the key, the lock springs back to a closed position.

LOCOMOTIVE BOILER CHECK VALVE.

The accompanying engraving represents a check valve adapted to stop the back pressure of steam or fluids, but particularly useful in feeding steam boilers when injectors or inspirators are used. The engraving shows the invention in the shape of a boiler check with the inlet pipe near the bottom, the outlet being near the top and at right angles with the inlet. The shape of the body or case of the valve is clearly shown. In the top is fitted a screw cap which gives access to the interior. About at the center, the wall of the chamber is made tapering, preferably at an angle of about 35 deg., to form a seat upon which close the three check disks of the valve. The bored step of the upper disk is provided with longitudinally ranging exterior ribs, which fit within a bore of the cap and guide the disks in the cap. The bored stem of the middle disk fits in the bore of the stem of the upper one, and the solid stem of the lower disk fits in the bore of the stem of the middle one.

When water, steam, or other fluid is admitted at the inlet, the lower disk will open about one-eighth of an



GLACE'S LOCOMOTIVE BOILER CHECK VALVE.

inch, and then will strike the next disk and raise it to a like distance to the upper disk, which will then open for any required distance to pass the fluid to the outlet, whence it escapes. When the feed is shut off, the back pressure will be held by the upper disk closing, when the other disks will seat themselves by gravity. Should the upper disk happen to be held from a tight closure by dirt or other matter, the middle disk would tightly close the valve; and should that be prevented from seating perfectly, there would be another chance of a tight closure of the valve by the perfect seating of the bottom disk; consequently, a practically perfect closure of this check valve may at all times be depended upon. This construction not only makes the valve more reliable, but its adds most materially to its durability by preventing the wear that takes place when a fluid passes through an imperfectly seated valve. One of the valves has been working upon a locomotive for some time, and it is now in as good condition as when first applied; this leads to the belief that these valves will work for an indefinite period without requiring any attention whatever.

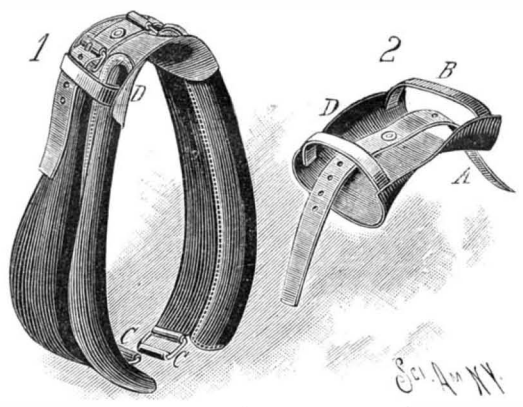
This invention has been patented by Mr. A. D. Glace, of Rocklin, Cal.

Volcanic Ejections.

The quantity of matter ejected by the New Zealand volcanoes lately is probably very great. The Melbourne *Argus* of June 29 writes: "Latest accounts as to the New Zealand volcanic convulsions state that an area of 2,000 square miles is said to be covered with 3 in. and more of dust. About 20 miles square is covered mostly to the depth of 3 ft. and more. For 400 square miles at the outside the country is totally destroyed, and 1,600 square miles is much damaged, the result depending on the problem of the fertilizing qualities of the deposit." Although 20 miles square is here mentioned, 20 square miles is probably more nearly the area covered 3 ft. in depth with the ejecta. Even that quantity represents about 1,400 millions of cubic feet, which will allow a good deal of contraction of the earth to take place, but the estimate is probably too much; but in any case the amount extruded here and by Krakatoa must make room for a good deal of secular cooling and contraction.

HORSE COLLAR.

The accompanying cut represents an improved horse collar, which has been patented by Mr. Patrick Sheehan, of Monroe, Wis. The collar is formed of two similar parts, having pads like those ordinarily employed, and provided with rolls forming, together with the pads, grooves for receiving the hames. The neck shield, D, is placed under the upper ends of the collar, and provided with straps, B, and the longitudinal strap, A, riveted to the center of the neck shield and



SHEEHAN'S HORSE COLLAR.

received in buckles secured to the upper ends of the halves of the collar. The hames are provided with straps which extend through the rectangular loops, C, attached to the lower ends of the pads, and are buckled together. Arranged in this way, the collar may be expanded or contracted to fit horses of different sizes. The lower ends of the halves of the collar being disconnected are free to move independently and in accordance with the motion of the horse's shoulders. The shield permits of adjusting the collar for different horses, and the great flexibility of the collar insures a perfect fit.

A New Discovery of Natural Gas in Michigan.

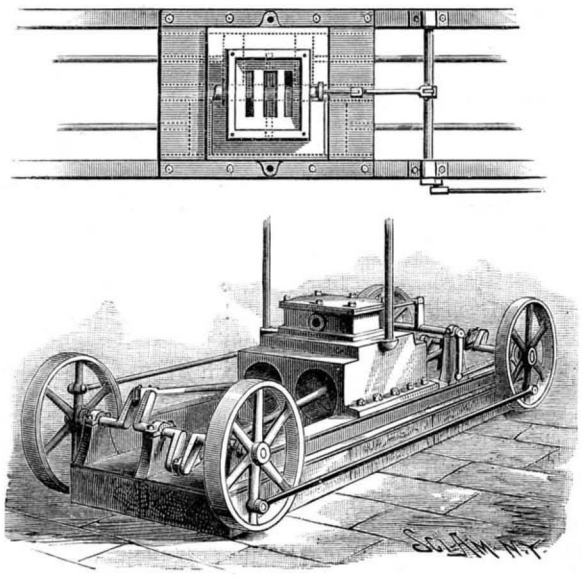
Another natural gas field has been recently discovered, and partially developed, at the foot of Lake Huron, within the precincts of the city of Port Huron. Mr. Charles Bailey, while "boring for oil" in June last, struck an immense flow of gas, at a depth of little more than five hundred feet; and two wells sunk subsequently give like results, exhibiting a pressure of 180 pounds to the square inch. This would appear to afford the one solution necessary to the manufacture of salt in this region, viz., cheap fuel. A magnificent vein of rock salt, several feet in depth, is known to underlie the whole region between Lake St. Clair and Lake Huron, extending west and north to the Saginaws and Muskegon, at a depth varying from 800 to 1,600 feet; in the northern counties, along Saginaw Bay, this is utilized in the form of brine, and also at Marine City, on the St. Clair River.

Though a new find, gas is not wholly unknown to the region, having frequently been found at depths varying from 80 to 150 feet, but never in definite quantities. A well on the stock farm of Hon. John P. Sanborn was abandoned some years since because of its eructations of gas; a similar well on the dairy farm of Mr. George Tawse, adjoining, has been utilized for years as a means of light and fuel.

While the wells have decisively proved that oil can be had in this region in paying quantities, the gas settles a more pertinent question, and is deemed the more valuable. Steps have already been taken to furnish the gas to residents of Port Huron, for both fuel and light. The facilities for shipment by either water or rail, at Port Huron, leave little doubt that valuable manufacturing interests will be added to the region, in view of this new and remarkable development of natural fuel.

STEAM ENGINE.

To the center of the frame is fastened a casting, provided with cylinders, placed alongside of each other,



RUSH'S STEAM ENGINE.

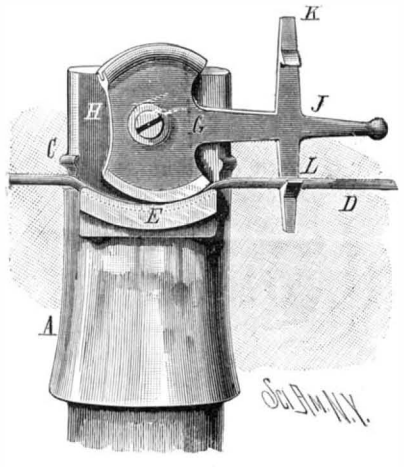
and each having two pistons. Each pair of pistons is connected by pitmen with crank arms, on a shaft mounted in bearings on the end of the frame. The shafts are provided with additional crank arms or pulleys, which are connected with each other by rods. The steam chest is placed centrally on top of the casting; the arrangement of the ports is clearly shown in the upper view. A common slide valve is operated from one of the shafts in the usual manner.

When the engine is in operation, the pistons in one cylinder recede from each other, while those in the other cylinder advance toward each other, by means of the relative positions of the pitmen and their respective crank shafts. One slide valve controls the admission and exhaust of steam from both of the cylinders, thereby lessening the number of parts in the engine and increasing the efficiency, when compared with similarly arranged engines having each cylinder provided with a separate steam chest.

This invention has been patented by Mr. Peter S. Rush, of Atlanta, Texas.

INSULATOR FOR ELECTRIC WIRES.

One side of the insulator is cut away and provided with a concave laterally projecting lip, having a transverse groove adapted to receive the wire. To the plane face of the insulator is pivoted a lever, formed with two oppositely arranged cam segments, having grooves in their peripheries to receive the wire. The lever is provided with an arm having a cross arm, made with hooks on its ends. The wire is placed in the concave lip when the arm is in a vertical position, and the wire is clamped between one of the



LEONARDSON'S INSULATOR FOR ELECTRIC WIRES.

cams and the concave lip, by turning the arm into a horizontal position, when the arm is held by the hook being brought into engagement with the wire. With this construction, the wires may be readily strung and securely fastened; and when it is desirable to remove them, they may be readily disengaged by releasing the lever and turning it to a vertical position. The body of the insulator has a circumferential groove, which permits of applying the usual binding wire, if desirable.

This invention has been patented by Mr. John M. Leonardson, of Ludington, Michigan.

MICHEL EUGENE CHEVREUL.

On the 31st of August, 1786—a century ago—at eight o'clock at night, came into the world, at number 11 Deux-Haies Street, Angers, he whose centenary has just been celebrated, Michel Eugene Chevreul.

The following is the register of his birth, which was drawn up the next day:

St. Peter's Parish.—On Friday, Sept. 1, 1786, we, the undersigned curate of St. Julien, baptized Michel Eugene (who was born last night at eight o'clock), the son of H. H.* Michel Chevreul, Master of Surgery and Doctor of Medicine of this city, and of Lady Magdeliene Bachelier, his wife, a native of the said parish of St. Maurille. The following were sponsors: H. H.* Gilles Chevreul, Master of Surgery, great-uncle of the child, and Lady Etiennette Delmont Delisle, wife of Mr. Claude Bachelier, also Master of Surgery, and grandfather of the child, all of this parish, the father and all the undersigned present.

Etiennette Delmont Delisle Bachelier; G. Chevreul; Chevreul, physician and surgeon; Renée Delmont Delisle; Claude Bachelier, master of surgery; J. Paviot; Robin, Curate of St. Peter's; Lemay, vicar of St. Peter's; Huchelou-Desroches, curate of St. Julien's.

The father and mother of the new-born were both persons of distinction, and very much esteemed in the city of Angers. The father was a physician and emeritus practitioner, a professor, a prolific writer, and a man of great intelligence and of excellent health. He died at the age of 91 years. The mother was a woman of sense and virtue. The nonagenarian companion of her husband, she survived him for some time, and died peacefully at Angers at the age of 93 years.

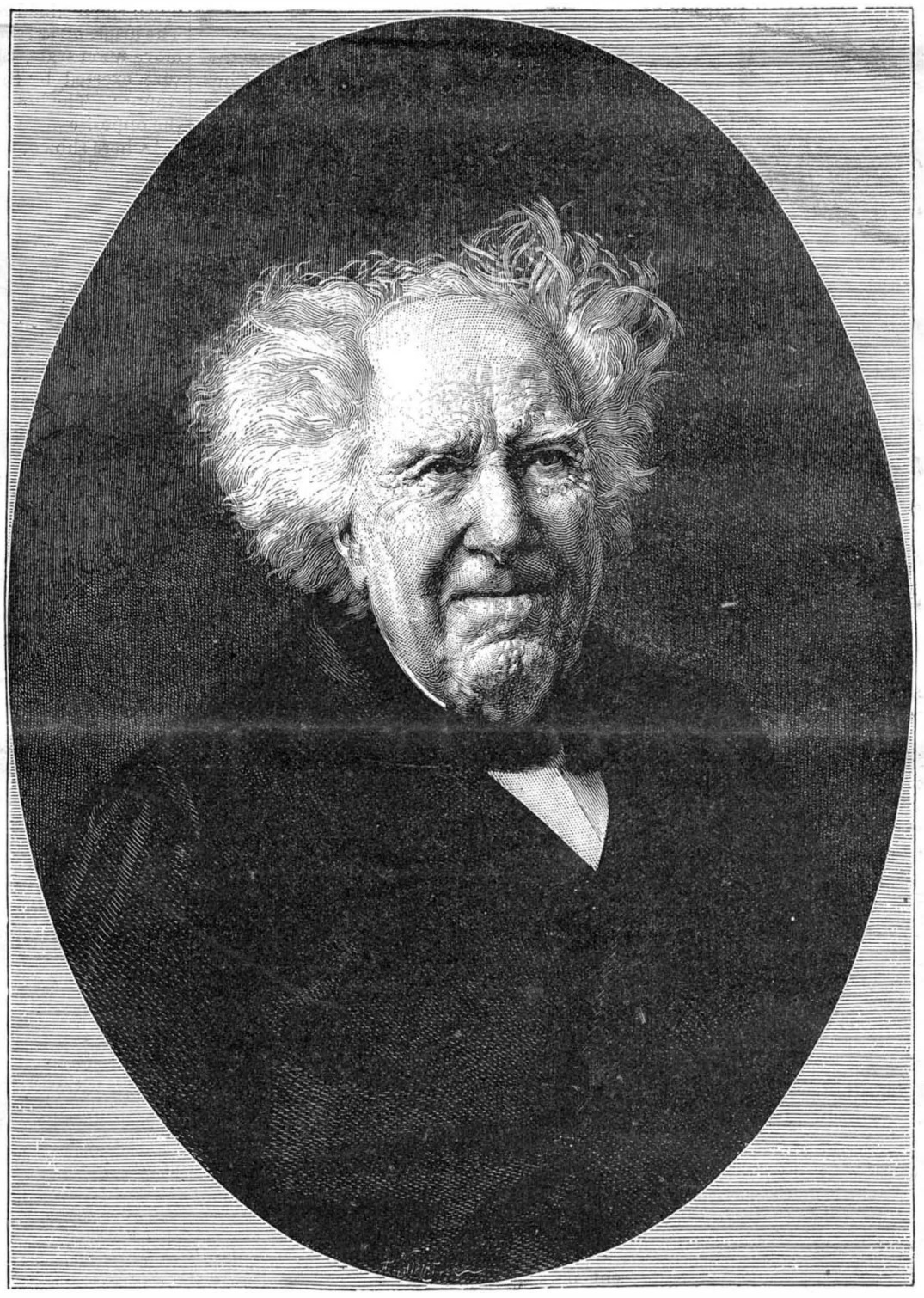
The son was destined to follow the example of his parents, and to inherit from them a remarkable health and vigor, which, from his very birth, ought to have allowed a centenarian to be foreseen in him.

Mr. Chevreul passed his early youth in the center of old Angers, and it is thither that he loves to carry himself back in memory. He still sometimes tells that upon Ralliement Place, while hidden behind a window to which curiosity had attracted him, he in 1793 (when he was but seven years old) witnessed the guillotining of two young girls who had been accused of hiding some refractory priests. His family also owned a country seat in the village of Murs, near the banks of the Loire, and the centenarian still takes pleasure in describing it. Here the child was witness of the bloody battle of Murs Rock, fought between the Vendeans and Republicans.

Such terrible dramas make Mr. Chevreul forget neither the happy hours nor the pleasant pictures. "It was at Murs," said the illustrious scientist recently, "that I passed the pleasantest days of my youth, and it is there that I should like to rest forever in the green cemetery."

Mr. Chevreul's youth was one of toil. After the revolution, the old University of Angers disappeared, and was replaced in the year IV. by a central school, in which the lecture courses were divided into three groups. Here the young scholar studied from the age of twelve to seventeen. His first professor of chemistry was a man named Heron, who, according to his pupils, possessed a genuine talent for making things clear. Heron, who died at an advanced age at Angers, while academical inspector, had the happiness to applaud the success of his pupil and to extol his already brilliant reputation.

When Chevreul left the college in which he had made his brilliant studies, his passion for knowing persons and things directed his attention to Paris. The capital was then shining with particular brilliancy, and the sciences were being cultivated and taught there by eminent masters. Fourcroy had devoted all his efforts to the restoration of advanced studies. He was teaching at the Museum, and had confided his chair at the College of France to his old preparator Vauquelin, of whom Dumas has said that he "was all chemist, chemist every day of his life, and chemist all day long." His laboratory superintendent was Thenard, who was then 26 years old. It was at the door of such a school that young Chevreul came to knock. He was admitted in 1797 to Vauquelin's laboratory, wherein Thenard was already helping, and through which successively passed Orfila, Payen, Bouchardat, and Fremy, as well as other young men of merit, who formed a brilliant galaxy of chemists and scientists, above which Chevreul was to rise to the highest summit.



E. CHEVREUL.

From his very entrance into the laboratory, the young manipulator made himself remarked by his fellow workers and his master. He was scarcely twenty years of age when Vauquelin gave him the direction of his laboratory. At the same time, Chevreul was giving instruction in Charlemagne College. Four years afterward, he became preparator at the Museum, and at the age of thirty was appointed director of the dye works and special professor of chemistry at the Gobelins.

It is not our intention to give a complete account of Mr. Chevreul's scientific work in this place, but before speaking of his immortal studies upon colors and their applications to the industrial arts, we must recall the none the less fecund discovery of the stearine candle. In 1814, the skillful chemist demonstrated that oils and fats, which up till then had been considered as pure immediate principles, were formed of a mixture of several peculiar principles, among which were margarine, oleine, and stearine. It was this latter substance that, by furnishing stearic acid, was to give rise to that manufacture of stearine candles which is now so extensive and prosperous. Mr. Chevreul's labors upon fatty bodies and his theory of saponification (1823) have not only created new industries, but have opened up immense horizons to the theories of organic chemistry, and secured to inventors of the future quite a series of studies and discoveries. Next to his studies upon fatty bodies must be mentioned his labors upon colors.

"How can one fail to remember," says Dr. Farge, in an excellent biography of the great chemist, "by what a sure and clear analysis Chevreul was enabled to reduce the delicate question of the alliance of colors to exact scientific laws? In following that fertile line of research which the great chemist has himself named the philosophy of natural phenomena, we see him from 1828 to 1864 pursuing with sure step, and by degrees, that law of simultaneous contrast which produces harmonies. Prepared by the memoirs of 1828, 1831, 1839, and 1848, it in 1864 ended in a book in which science reaches poetry through the easy style and the abundance of images. With magisterial sureness, the author traces the rules of those undulatory and fugitive effects that will be produced by the colors of walls, furniture, wood, fabrics, and clothing even, upon the flesh-color of man or woman, and as far as to the distribution of flowers or ornamental plants in gardens."

Apropos of the memoir of 1858 upon the Theory of the Optical Effects that Silk Fabrics exhibit, he loves to recall a typical anecdote: "A visit was once being paid me by young Madam Paul Delaroche and her mother, Madam Horace Vernet. With these two wives of illustrious painters I felt at ease to speak of colors, their relations, and their harmonies. Taking an example, I said to Madam Delaroche: 'Why is it that you, a blonde, wear a white cloak? You lose all the tints that a color would have lent to your delicate flesh-color.' 'See,' said she at once to Madam Vernet, 'I told you that white did not become me, and that a bright-colored cloak would have been more suitable.' I was delighted with this confirmation of science by the delicate taste of a woman."

This discovery reaches still further yet; we find in it not only a guide to the taste. Chevreul's genius has shown that the harmonies of colors are submitted to immutable laws, which he has revealed, and the certainty and fruitfulness of which is demonstrated by calculation.

The great chemist has been enabled to discover the laws of the simultaneous or successive contrasts of colors, the theory of colored shadows, and the art of defining, by means of a chromatic circle, every shade by a figure, and to reproduce in America, and without seeing them, the tones of a fabric or the tints of a picture painted in Europe, and that, too, with fidelity.

Mr. Chevreul was not forty when the results of his new invention found an echo throughout the entire scientific world. The chemist Proust had just died, and left a place vacant in the chemical section of the Academy of Sciences, and this, in 1826, Chevreul was elected to fill. The venerable academician, then, along with the centenary of his birth, celebrates the sixtieth anniversary of his entering the Institute. None of his contemporaries of that epoch is now alive, and, during this long space of time, several vacancies have occurred in the same chair.

In 1830, Mr. Chevreul was appointed director of the Museum, where he was already a professor, and the progress of which he helped along for more than forty years.

"Remembrances crowd each other," says a biographer, "in the presence of this great man—the last vestige of the galaxy of scientists who rendered illustrious the end of the last century and the first half of the present, such as Guyton de Morveau, Lavoisier, Berthollet, Fourcroy, Gay-Lussac, Thenard, Dumas, Berzelius, Woehler, Liebig, Laurent, Pelouze, Ebelmen, Saint-Claire Deville, Wurtz, the Cuviers, Arago, Ampere, Biot, Fresnel, Cousin, Pouillet, Regnault, and others. Aside from his direction of the Gobelins dye works for sixty years, which turned his attention to the extraction, fixation, and observation of colors, he

* Honorable homme.

has occupied the highest positions in science. While examiner for many years at the Polytechnic School, all the celebrities in the sciences and the higher administration passed before him, and remained his admirers. He has always been president of the National Agricultural Society. After presiding over the Museum for a long time, he was about being superseded by Prince Bonaparte of Canino (as the administration was then desirous of changing the oligarchical management of this celebrated establishment), when the death of the Prince, who had made him change his apartments, caused him to resume direction, and it was not till 1883 that he gave up the place to Mr. Fremy.

MR. CHEVREUL. (FROM A LITHOGRAPH OF 1836.)

All the scientific bodies in the world have done themselves the honor to include him among their foreign members, such as the Royal Society of London, and scientific societies of Copenhagen, Stockholm, Berlin, Moscow, Philadelphia, and others.

Up to 1855 he had been a member of the jury of every French exhibition. A member of the Legion of Honor, commander in 1844, grand officer in 1865, grand cross in 1875, he has all the grades that any scientist could be covetous of. The foreign decorations that he has received would cover his entire breast. But honors have never elated the indefatigable worker, who is ever studying, and who remains more than ever, at the age of one hundred, the dean of the students of France and of the entire world. The life of the centenarian has been passed between the Museum of Natural History, the Gobelins, and the Institute of France. Mr. Chevreul never fails to be present at the Monday sessions of the Academy.

The number of memoirs that he has presented to his colleagues is incalculable, so to speak. He has never been desirous of being a politician, but has preferred to remain a great man and a great patriot. During the Franco-Prussian war (1870–71), at the age of eighty-six, he willingly endured the privations of the siege, and did not leave the confines of Paris. He lived at the Museum, while more than eighty Prussian bombs

MEDALLION STRUCK IN 1839.

were shattering the galleries and breaking the cases. More than one of these projectiles burst in the vicinity of the laboratory where the noble old man was at work.

Let us reproduce just here the indignant protest that he caused to be entered in the proceedings of the Academy on the 9th of January, 1871 :

"ACADEMY OF SCIENCES.

"*Session of Jan.* 9, 1871.

BOMBARDMENT OF THE MUSEUM OF NATURAL HISTORY.

"*Declaration.*

"The garden of medicinal plants founded at Paris by an edict of Louis XIII., in the month of January, 1626,

"Became the Museum of Natural History, by a decree of the Convention, June 10, 1793,

"Was bombarded

"Under the reign of William I., King of Prussia, Count Bismarck, Chancellor,

"By the Prussian army on the night of Jan. 8–9, 1871,

"Up till when it had been respected by all parties, and by all national and foreign powers.

"E. CHEVREUL, *Director.*

"Paris, Jan. 9, 1871."

It was in the train of this declaration that Mr. Chevreul had occasion to write a letter to Abbot Lamazou, in which he styled himself the dean of students. We reproduce the last sentence of this touching epistle: "Let the expression of such sympathy be permitted, not to the scientist, but to him who can call himself the dean of French students, since it has been allowed him to uninterruptedly continue upon the banks of the Seine studies that were begun at the end of the last century in the beautiful country of Anjou."

Mr. Chevreul has a large library at the Museum, which has kept constantly increasing by the addition of valuable books, part of which have been discovered by his son, who also is a book-lover. His grand life has been absorbed by thought and concentrated in study, and from thence have been evolved his useful discoveries. He has been rendered happy by work and moderation. His wife (*née* Braccini), his devoted companion during her entire married life, always foresaw his wants, and up to her death (a long time ago) paid him that devotion that superior minds know how to offer to those that surround them. Mr. Chevreul's only son lives at Dijon. The illustrious veteran lives alone, then, having for his sole companions certain old books, through which he can converse with his brothers, the great men of the world.

When he is not among his books, he is at his laboratory at the Gobelins, where he is still pursuing his researches with a juvenile lightness of hand.

Mr. Chevreul has a large fortune, which his life as a scientist is yearly increasing. His life is therefore passing along peacefully, and he has the happiness of receiving ovation after ovation as the end of his career approaches. He has been present at the advent of all the scientific discoveries of our era, and at the wonderful spectacle of the development of the modern industries.

Mr. Chevreul is tall and straight, elegant in manner, and of matchless affability, and it is rarely the case that in approaching a person he has not a smile upon his countenance. He has a splendid head, with a wide and powerful forehead and white hair. He is a man of humor as well as one of genius. Upon recently employing a new preparator, he exclaimed: "You must have courage in order to accept a situation as my curator; I have already killed four."

One might say to Mr. Chevreul what Voltaire said to Madam Lullin, who reached a hundred years: "Par votre esprit vous plaisez à cent ans," and desire Mr. Chevreul, as the patriarch of Ferney also desired his centenarian lady, to survive for a long time for Fontenelle. But Mr. Chevreul has what the author of the Plurality of the Worlds did not always have, and that is goodness and sensibility of heart. Fontenelle, who died at the age of ninety-nine years and eleven months, had said of himself: "I have failed to love." Madam de Tencin one day uttered this cruel apostrophe:

"It is not a heart that you have there, but brains like those of the head."

However this may be, Mr. Chevreul has the privilege of being not less amiable than the great writer.

Up to a few years ago, he still attended the winter balls of the Elysée, and we remember having seen him there at midnight, fresh and smiling, and surrounded by ladies whom he was entertaining with exquisite and charming grace.

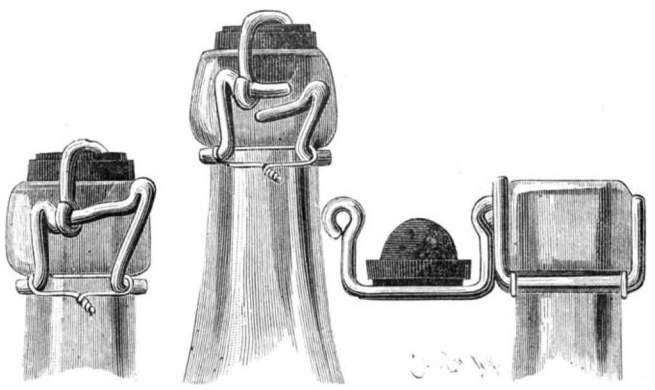
Mr. Chevreul is very temperate. He drinks nothing but water or beer; but it is certainly not to this regimen alone that he owes his longevity, but to his strong constitution and his virtuous, regular, and industrious life. The birthday of such a man, who honors to such a degree the science to which he has devoted himself and the country to which he belongs, is a memorable event that cannot be celebrated with too much *eclat.*

Our centenarian offers a grand and beautiful spectacle, like that of an old oak sheltering under its shade continuously renewed generations. Deaf to the noises of the world, he delights in remaining isolated in his laboratory, where his ever active intelligence is being attracted without cease to the irradiations of eternal truths.—*La Nature.*

STOPPER FASTENER.

Extending across the top of the stopper, the form of which is clearly shown in the right hand view, is a bar bent to form arms terminating in eyes. This bar is so attached to the stopper that when the latter is pressed down in closing the bottle, the bar may be turned without carrying the stopper around with it. Encircling the neck of the bottle is a stout wire, bent as plainly shown in the two left hand views. The upward extensions of the neck band are on opposite sides of the bottle, and the inclination of the fastening rods, upon which slide the eyes formed in the arms of the stopper bar, is in opposite directions on the two sides. To close the bottle, the stopper is turned down on the mouth, and the eye on the free end of the bar is brought opposite the extremity of the inclined fastening rod. The bar is then turned so as to make its eyes move down the inclined rods, forcing the stopper to its seat. The arms, after reaching the lower part of the inclines, move upon seats, which then receive the upward pressure exerted by the contents of the bottle upon the stopper. The bottle is opened by moving the arms in the opposite direction.

As here shown, both the extensions carrying the fastening rods and the neck band are of one piece of wire, the arms being turned to the sides to form the neck band, and smaller wires being used to connect the arms. The rod shown below the inclined fastening rod is designed to guide the free eye upon the fastening rod.



HAZARD'S STOPPER FASTENER.

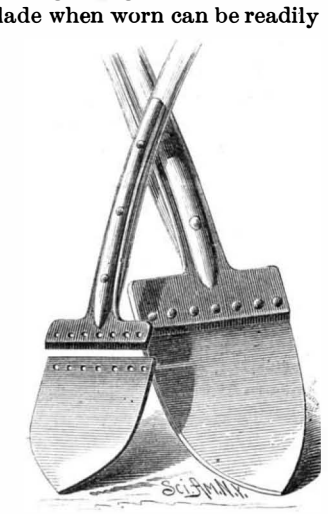
This invention has been patented by Mr. Robert H. Hazard, whose address is care of the Firemen's Insurance Co., of Washington, D. C.

Artificial Respiration.

Mr. J. A. Francis describes the following method of artificial respiration in the *British Medical Journal.* The body of the patient is laid on the back, with clothes loosened, and the mouth and nose wiped; two bystanders pass their right hands under the body at the level of the waist, and grasp each other's hands, then raise the body until the tips of the fingers and the toes of the subject alone touch the ground; count fifteen rapidly; then lower the body flat to the ground, and press the elbows to the side hard; count fifteen again; then raise the body again for the same length of time; and so on, alternately raising and lowering. The head, arms, and legs are to be allowed to dangle down quite freely when the body is raised. The author alleges that this method is most successful, and it is so simple that any one can perform it without any teaching.—*London Medical Record, June* 15, 1886.

IMPROVED SHOVEL.

The shovel shown in the engraving is constructed in such a manner that the blade when worn can be readily replaced by a new one. Upon the lower end of the socket strap, to which the handle is secured in the usual way, is formed a plate similar to the upper part of a shovel blade, and which has a row of holes near its lower edge. The upper part of the blade also has a row of holes along its edge, and is lapped upon the rear side of the plate, so that the rows of rivet holes will coincide. The plate and blade are then riveted together. The edges of the plate and blade are beveled to prevent the substance being shoveled from lodging against them. When the blade becomes worn, the rivets can be punched out and the worn plate replaced by a new one at a trifling cost, thereby saving the expense of an entire new shovel every time a blade wears out.



All further particulars regarding this invention can be had from the patentee, Mr. Wm. C. Gregg, of Golconda, Nevada.

Correspondence.

Effect of the Sun's Action on Iron.

To the Editor of the Scientific American:

I noticed recently a published statement that if a plumb-bob were suspended from the center of the dome of the Capitol at Washington, it would move 4½ inches east in the morning and 9 inches west in the afternoon. As the writer does not state whether he makes the assertion from a practical observation or a scientific calculation, I will be a little slow in contradicting the article, but I think it will bear looking into. In a latitude where the thermometer ranges from say 25° below to 125° above zero, iron will expand, under action of the sun, an inch or more to the 100 feet, and marble about the same. This being the case, how can the sun's action on the dome move it *east* in the morning and *west* in the afternoon? J. N. HUSTON.

Meridian, Miss., July 15, 1886.

[Tall, slim towers have a small movement to the *west*, *north*, and *east* during the day, because the base is small. The dome of the Capitol at Washington can have but a *very* small movement, from the abruptness of its lower part in the heavy walls of the building, and from its large proportional base.—ED.]

Cause of the Charleston Earthquake.

To the Editor of the Scientific American:

In connection with the recent earthquake, I venture to suggest a line of investigation which may develop something interesting touching the cause of the same. Major Powell, of the Geological Survey, says that there is a line of weakness in the crust of the earth beginning somewhere south of Raleigh, N. C., and extending in a line along the tide water past Richmond, Washington, Baltimore, and Troy, N. Y.; and that this line of weakness is marked by a displacement. In some places, this displacement is a flexure in the rocks; in other places, a fault; and in the neighborhood of this displacement are found the principal waterfalls which constitute the water powers of the Atlantic slope. "It will be interesting," he adds, "to discover the relations of the point of origin of the earthquake to this line of displacement or weakness."

I suggest the idea that the escape of the vast volumes of petroleum and natural gas from the wells sunk into the bowels of the earth may furnish a cause for the earthquake in this region. It is well known that this oil and gas issues at enormous pressures, varying according to location. The pressure at which they issue proves that these fluid materials are pressed upon by the crust of the earth, which in consequence is partly supported thereby. When a sufficient vent is found for these cushions for the earth's crust, the latter drops from gravity, and the shake is most manifest at the line of greatest amplitude of movement, which, in the present case, is nearly coincident with the line of weakness indicated by Prof. Powell, and the path of the earthquake.

The ventage which volcanoes afford seems to bear some close relation to earthquakes, and why not the ventage of the enormous volumes of natural gas and petroleum, which of late years has progressed to such extensive proportions? If there is any such connection in the relation of cause and effect, it is probable that our recent earthquake has had some disturbing influence on the petroleum and gas wells of the country, probably increasing, by the collapse, the flow and pressure at some points, and reducing it, by opening new cavities, at other points.

I suggest that the oil and gas regions be called upon for data on this subject. If the robbing of the earth of her hidden stores of oil and gas within is to be followed by such results, we cannot know it too soon, and laws restricting production should, for the sake of posterity, be promptly enacted. EDWARD W. BYRN.

Washington, D. C., Sept. 1, 1886.

Theosophy Explained.

The *Boston Record* describes in the following brief manner the belief of that curious sect in Burmah calling themselves Theosophists, of which Madam Blavatsky, of Russia, and Col. Olcott, of our own country, both residing in Bombay, are prominent converts.

Publications containing the writings of both of these persons are sent to this country by each departing Bombay mail, and it is said that they are creating some interest among a class of original thinkers in Boston.

"Taking the broad fact of mind and matter having been adjudged separate entities or states of being, the theosophists proceed to build upon this stated fact. They claim that while the body lies sleeping, or inert through trance, the soul, by which they mean the mind, or will, is capable of traveling to distant places, noting the events, holding converse, ere she, the soul, returns to her waiting and unconscious body. A theosophist speaks of his 'astral body,' of its power to visit those places which his soul, or mind, or will, has previously determined upon visiting.

"To mention the conditions first, theosophists state that an 'aura' surrounds them, not only theosophists in particular, but all people. 'Aura' is a species of atmosphere, impregnated with the electrical essences, animal magnetism, or chemical gases that our bodies are constantly discharging; this, encountering the ordinary air, is not dispelled or disseminated, as might be naturally expected; but, to call it human essence for the sake of illustration, this discharged human essence gathers to itself a certain portion of the ordinary air that surrounds us, which it permeates with our own desires and vitality. Therefore it will be seen that this aura is always with us, and ready for all emergencies.

"The way that transference is effected is that a theosophist wishing to appear in a distant city or foreign land seeks seclusion, and then bends the whole force of his mind upon the desire to reach that place. Finally, he either falls asleep or succumbs to a self-induced trance. During the sleep or trance the body lends a portion of its vitality, or more correctly a certain portion having been ejected by the will, the soul is enabled to clothe herself in the waiting aura, and thus become an astral body, an exact counterpart of the sleeping one, and then proceed upon her aerial journey."

THE GALATEA AND MAYFLOWER.

The International Queen's Cup, won thirty-five years ago by the schooner yacht America, has again, after so long a sojourn in this country, become a subject of contest. The Galatea, an English keel boat, having had her challenge of 1885 extended so as to allow of her racing under it this year, has met the American centerboard yacht Mayflower for a series of inside and outside course races to decide the future holding of the trophy.

The competitors are illustrated both under sail and as they lay in the drydocks. To show more accurately the general model, the bilge blocks have been omitted, the latter views thus exposing the whole side. They are nearly of the same length, the Mayflower being two feet the shorter. In breadth and depth they differ widely; the Mayflower is much wider and shallower. Being wider, she carries more sail than the Galatea, and is handicapped, having to allow the Galatea 38 seconds over the inside course.

In the Galatea's model will be recognized the convex lines of the conventional cutter. Her sheer is quite pronounced, an end elevation of the hull showing a sharp rise in the bow that is missing in the Mayflower.

In the comparative side views of the two yachts as they lay in the drydocks, further differences will be noticed. The Galatea has a strongly rocking or curved keel. This is an important factor in her turning when tacking. In conjunction with her high momentum, due to her heavy ballasting, it enables her to go about very rapidly, the rudder not having time to check her speed. She is reported to have shown herself eight seconds quicker in stays than the Mayflower. Minor features in the rigging of the two vessels are also to be noticed in the different views. The Galatea's masthead spreaders are so wide that they actually cause the topmast shrouds to overhang the hull, being wider than the hull itself. The use of a block and fall on the Galatea's bobstay, necessary with a shifting bowsprit, seems clumsy. Her bowsprit is considerably shorter in proportion to her length than is that of the American vessel. In both vessels, however, the bowsprit is far longer than in American yachts of thirty or forty years ago. In those days, a mast far back and short bowsprit was the rule. This feature is shown very strikingly in old pictures of the Black Maria, the first of our largest size racing sloops.

In the Mayflower, it will be noticed that her bilge is but slightly hollow, very little more than is that of her competitor. Accepting the sloop and cutter subdivisions as of any moment, her model, especially in this feature, indicates an approach of the American sloop to the English cutter.

The theory has long held, and has been justified in practice, that a deep vessel was better in a seaway than a shallow one. There is no question that for rough weather, the old American shallow draught racing boats were defective. The foundering in the Gulf Stream of the Black Maria was a sad proof of this. But having overcome this wrong tendency, the point has been to stop when sufficient depth was reached. There is every probability that this has been done in the Mayflower. A broader vessel plunges less, and having a higher center of gravity rolls less, and careens less under sail, than does a narrow one. In these important respects, as affecting comfort, she is the superior. If it can be shown that this width is not inconsistent with speed, it may be considered that one valuable result has been attained.

The Genesta and Puritan, who competed last year for the international trophy, were somewhat smaller than the present competitors, but were large enough to represent the largest type of single-masted vessels. The general result of recent yachting trials has developed the fact that greater speed is to be looked for from the single-masted vessel than from the schooner. This is, to an extent, unfortunate, as the schooner is far the more practical type. In our river and sound commerce for the last few years, nothing is more striking than the disappearance of sloops and increase in number of schooners. In old times, sloops have been engaged in ocean traffic to a certain extent, but now that rig is being abandoned except for the smallest class of vessel.

We give the table of dimensions of both vessels below. The interesting features are the relative displacement and lead ballast carried. The Galatea, it will be seen, is really 50 per cent larger than the Mayflower, and carries nearly twice as much ballast. Yet by the generous N. Y. Y. C. rules she receives a few seconds time allowance from the Mayflower. The exorbitant amount of outside lead ballast and large displacement certainly tend to make her more nearly a racing machine than is her competitor.

	Galatea. ft. in.	*Mayflower.* ft. in.
Length over all	102 6	100 0
Length on load water line	87 0	85 7
Extreme beam	15 0	23 5
Depth of hold	13 3	8 6
Draught of water	13 5	9 0
Length of mast	79 0	83 0
Length of topmast	47 0	46 0
Bowsprit outboard	36 5	38 0
Main boom	73 0	80 0
Main gaff	45 0	50 0
Spinaker boom	65 5	74 0
Area of sail, per N. Y. Y. C. rule, in square feet	7,146	9,000
Tonnage, O. M.	171 14-95	171 74-95
Displacement, in tons	157·63	110·0
Ballast, in tons	81·50	48·0
Amount on keel, in tons	81·50	42·0

The Galatea is built of steel, and was modeled by Mr. J. Beavor-Webb, a native of Kinsale, County Cork, Ireland. The Mayflower is of wood, and was modeled by Mr. Edward Burgess, of Boston, Mass.

The first race was sailed over the N. Y. Y. C. course. Starting in the Narrows, the yachts sailed down and through the outer bay of New York to and around the lightship that lies about eight miles from the bar, out at sea, a total distance of thirty-eight miles. The Mayflower won by 12 minutes and 2 seconds corrected time; the elapsed time was:

Mayflower	5 h.	26 m.	41 sec.
Galatea	5 h.	38 m.	43 sec.

The second race was sailed on Saturday, September 11, over the outside course upon the ocean, twenty miles out from the lightship at the entrance to New York Bay and back. It was won by the Mayflower by 29 min. 9 sec. corrected time; the elapsed time was:

Mayflower	6 h.	49 m.	00 sec.
Galatea	7 h.	18 m.	48 sec.

The winner of two races out of three takes the cup, subject to future challenge.

A challenge designed to settle the question of relative superiority of the English and American vessels in heavy weather has been given to Lieut. Henn, of the Galatea, by Gen. Paine, of the Mayflower. He offers to lie by the Galatea's side off Marblehead and await the equinoctial gale, and be ready to start for a race during the worst of the gale at any time that Lieut. Henn may select. It is stated that Lieut. Henn has been called home peremptorily, and will not be able to remain long enough in this country to accept the challenge.

Continued Decay of the Egyptian Obelisk in Central Park.

A recent examination shows that the obelisk in the Central Park is not so thoroughly protected as many supposed it would be by the hot paraffine treatment last fall. This process was fully described in the SCIENTIFIC AMERICAN of December 5 last, and consisted in heating the stone and applying a mixture of paraffine, creosote, and turpentine. Previous to this the stone had been carefully gone over, and pieces supposed to be loose, on testing with a hammer, or where there were cracks, were removed. It now appears that the stone is again in some places flaking off, or showing slight signs of slow disintegration, although such action is only perceptible on careful examination. It is said to be the result of an insufficient trimming off of the surface of the stone, to remove imperfections before the paraffine was applied; others attribute the result to the application of heat to the stone before putting on the paraffine. It has been decided best to do nothing further in the matter at present, until it is shown to what degree the preservative process will be actually effective for a longer period, although in the end it may be necessary to inclose the stone by building a light glass structure around it.

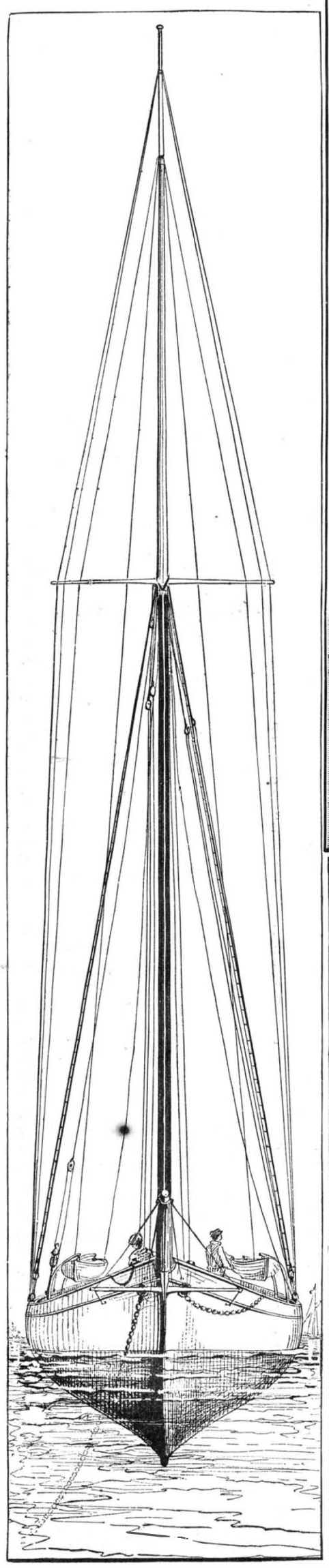
Minnesota Opium.

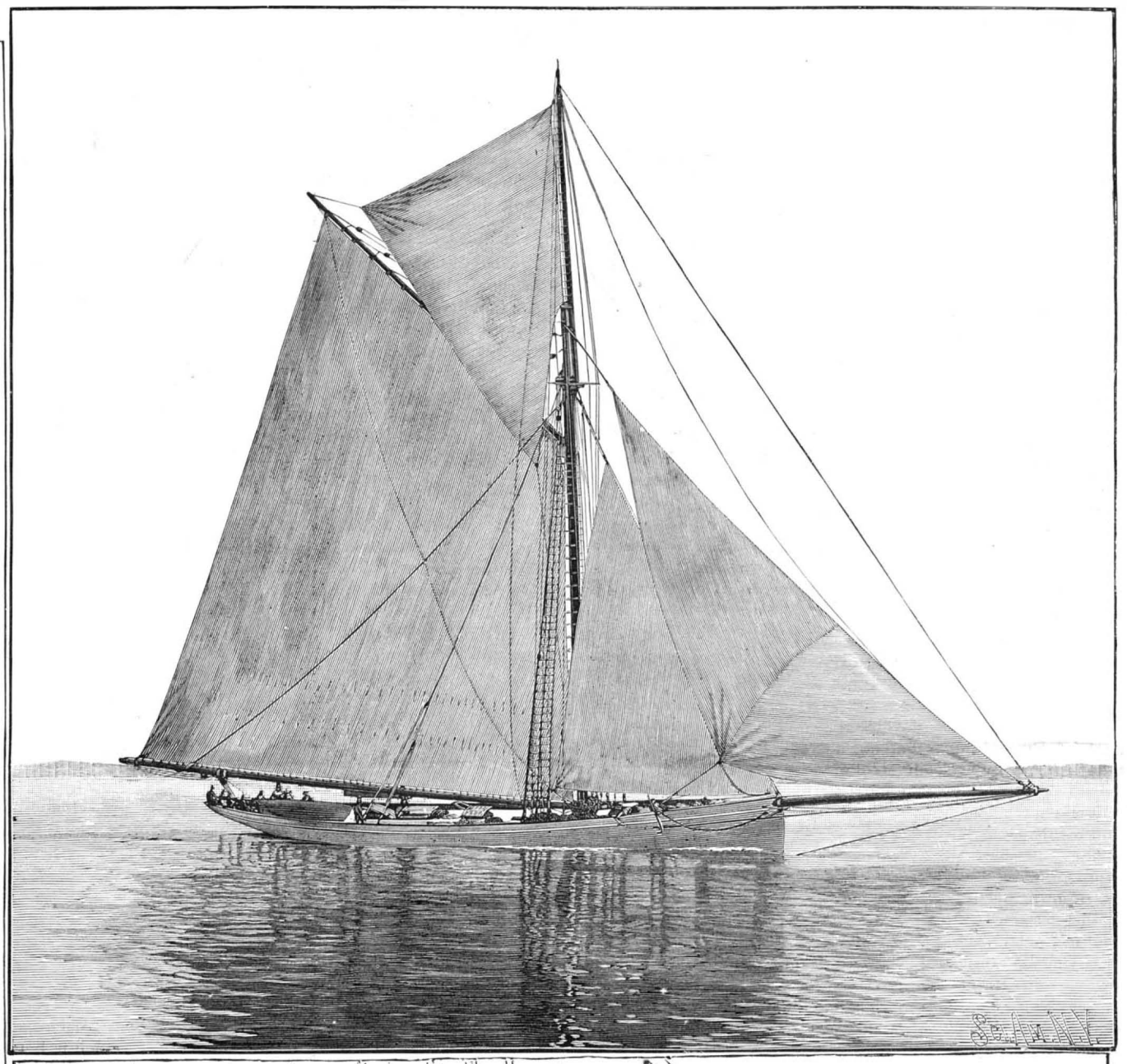
During the year 1885, Emil Weschcke experimented on the cultivation of different species of *Papaver* at New Ulm, Minn., and from the unripe capsules of *P. somniferum* prepared a quantity of opium which, in the air dry condition, contained 2·8 per cent of moisture, and, after drying, yielded 15·230 per cent of morphine, 0·325 per cent of narcotine, 0:416 of codeine, and 3·500 per cent of meconic acid. The author does not believe that the cultivation of the poppy for the production of opium in this country would be attended with profit.—*Contrib. Dep. Phar., Univ. Wisc.*, 1886.

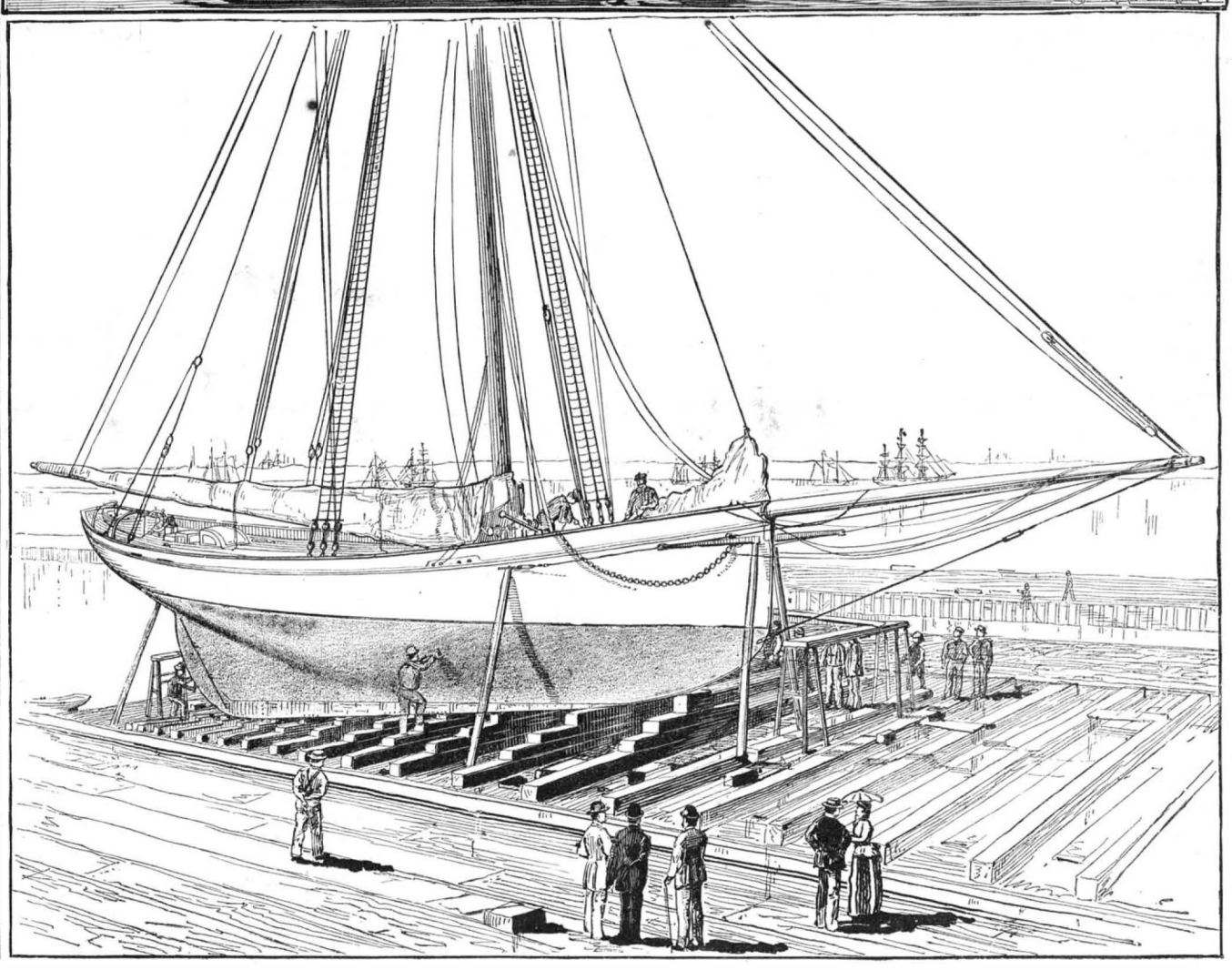
Corrosion of Tea Chest Lead.

A late number of the *Journal* of the Asiatic Society, of Bengal, contains a short memorandum by Professor Pedler, of the Presidency College, Calcutta, on certain experiments which he has made on the corrosion of the lead linings of Indian tea chests. His conclusions are that tea properly manufactured in the ordinary way has no power to corrode lead; but if unseasoned and damp wood is used for the boxes, corrosion of the lead is almost certain, some varieties of wood acting more violently than others. Even with seasoned wood, if it becomes saturated with water, and be then placed in favorable circumstances of heat and moisture, corrosion takes place. The active agent, he thinks, does not exist ready formed in unseasoned wood, but is produced by a secondary action from the constituents of the wood. The corrosion is not due usually to contact action between the lead and the wood, but a volatile substance is gradually produced from the unseasoned wood. The corroding agent is usually acetic acid in the presence of moist air and carbonic acid, but other acids of the same series are sometimes produced and also act on the lead; and in the case of butyric and valeric acids the incrustation is of a greenish yellow, while that from acetic acid is whitish or yellowish. The lead being corroded by these acids, which are produced by the decomposition of substances known to be present in the woods, the tea takes up the disagreeable odor of the latter after they have undergone the change in which acetic, butyric, and the other acids are formed, and will thus become deteriorated.

UMBRELLAS, when wet, should be placed with the handle downward to drain. The moisture thus concentrates at the tips and falls from the edge, instead of gathering into the folds of the umbrella, and thus dries quicker and the fabric is better preserved.







ILLUSTRATIONS OF THE AMERICAN YACHT MAYFLOWER.—[See page 181.]

THE ACME AUTOMATIC SAFETY ENGINE.

The engine herewith illustrated is adapted to all purposes where a small power is required, is noiseless in operation, easy to manage, and safe. The parts are so designed and arranged as to insure economy, efficiency, and durability.

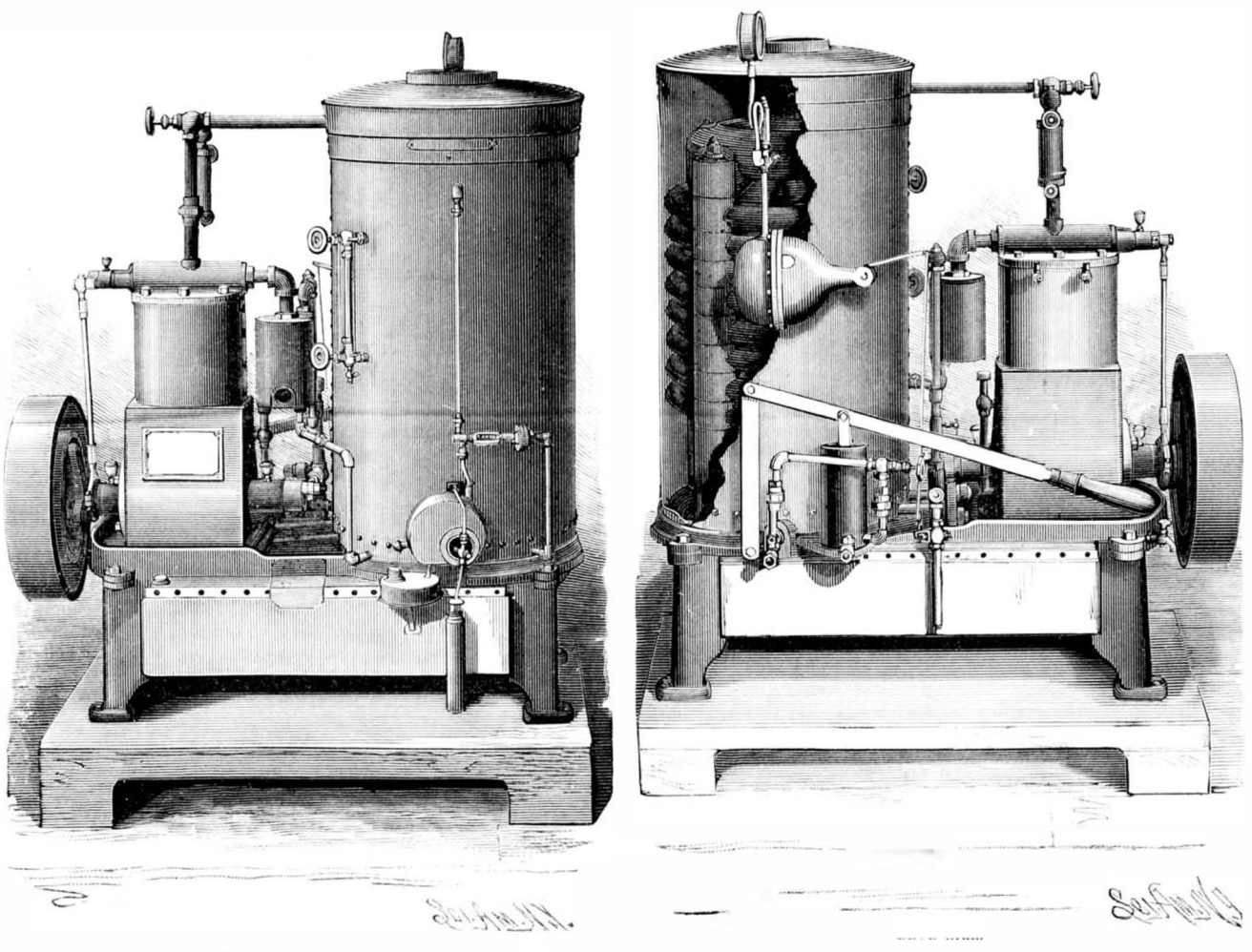
There are two single-acting cylinders, the pistons in which, being one and one-half times the stroke in length, form their own guides. The cylinders are directly over the center of the shaft, so that the engine may be run either way as may be required. The steel cranks are placed 180° to each other, and are of large size, both in diameter and length. The valve is of the balanced rocking type, has extra large and long bearing surfaces, and is placed on top of the cylinder, the valve case forming the cylinder head; this allows long ports, that give quick admission and release, and make the action of the cut-off governor sensitive to the slightest change in speed or load. Within the periphery of the flywheel is the automatic governor, which regulates the admission of steam to suit the varying loads by changing the throw of the eccentric.

The eccentric rod strap and bearing, and the outer bearing of the valve stem, are the only bearings not constantly flooded with oil while the engine is running. This important characteristic is accomplished by carrying in the crank case a mixture of oil and water, into which the cranks dip at every revolution, thereby not only flooding themselves, but throwing the oil to every part of the inside of the case, the wrist pins and lower part of the cylinders getting a plentiful supply at each stroke. As this oil cannot escape, it is used over and over, and the oil furnished to the main bearings is all caught and returned to the crank case at last.

The boiler is a quick and economical steam generator, and has a very rapid circulation—increased in its rapidity by the intensity of the fire; and all sediment is deposited in the water space below the fire, where it can be readily removed or blown out. The construction of the boiler will be understood from the accompanying engraving. The water is carried in a series of rings connected by inclined tubes that break joints, so that the fire is compelled to reach every part in its passage through them. On top of the boiler is a ring or dome for insuring an ample supply of well dried steam. A double jacket prevents loss of heat by radiation. A pump, worked directly from the main shaft, forces the water through a coil heater, where it is subjected to the effect of the exhaust steam before entering the water leg of the boiler; by this means the water is heated to near or above the boiling point before being introduced into the boiler, without in the least choking the exhaust. The supply of water is regulated by a ball float, attached to the boiler, which by means of levers controls the amount delivered at each revolution of the engine, and may be adjusted to maintain the desired water level under all conditions.

The fuel is kerosene oil, which is atomized by a steam jet and controlled by an automatic fire regulator that reduces or cuts off entirely the supply of fuel when the steam pressure reaches the limit at which the regulator is adjusted. This fire gives a most intense heat, is easily controlled, and makes an even and constant supply of steam. No dust or smoke is produced when the fire is properly adjusted, and this fuel is cheaper than coal.

At the present time, two sizes of these engines—for which great success in incandescent electric lighting is claimed—are manufactured by the Rochester Machine Tool Works (Limited), of Rochester, N. Y. The one horse power has cylinders 2⅛ in. bore by 2½ in. stroke, makes 500 revolutions per minute, and the boiler is tested to 500 pounds hydraulic pressure and the regulator is set to carry 110 to 120 pounds steam. The second size is two horse power, having cylinders 3 in. bore by 3½ in. stroke and making 400 revolutions per minute. The engines are capable of a higher power than their rated duty, as the nominal power is computed on a basis of 70 pounds steam pressure.



THE ACME AUTOMATIC SAFETY ENGINE, WITH BRYANT'S PATENT BOILER.

A NEW LONG DISTANCE TELEPHONE SYSTEM.

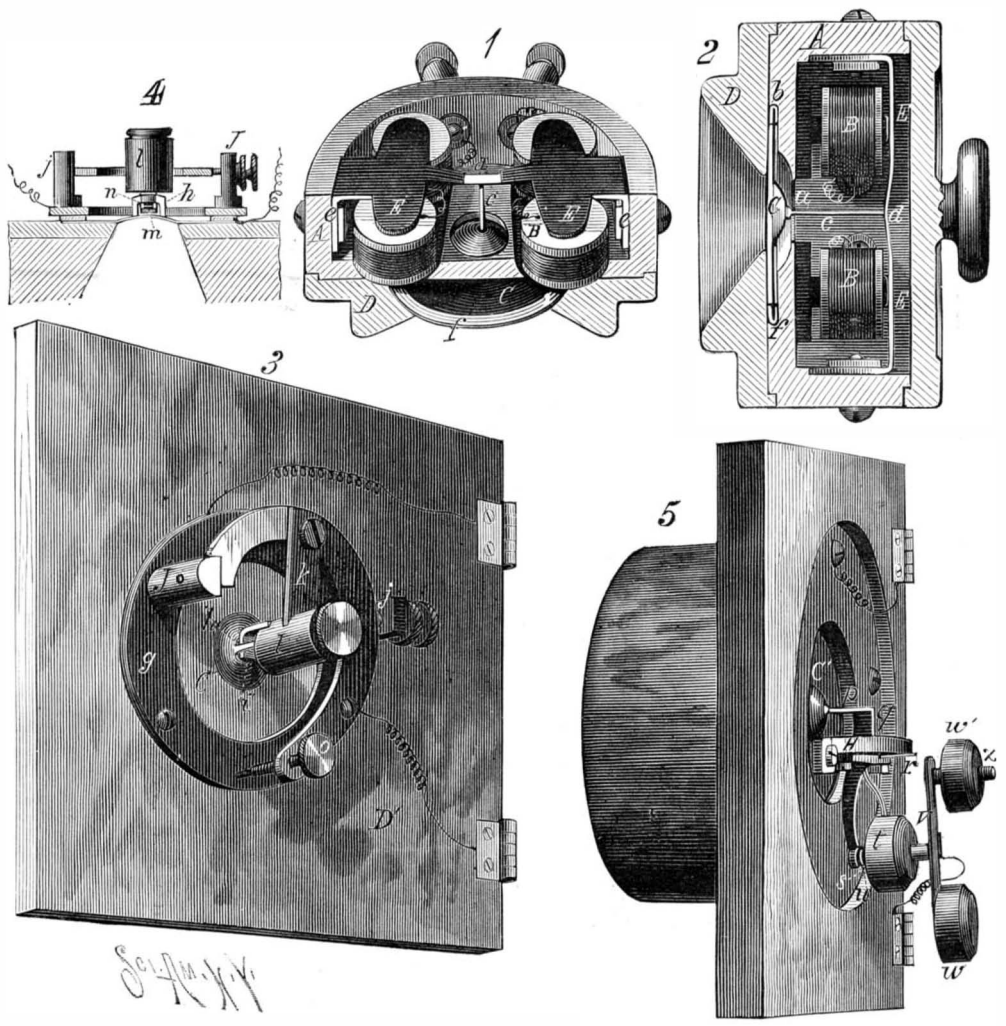
The transmission of articulate speech by means of broken electric currents has been considered impossible by telephone experts, and, as is well known, it has been disclaimed by Bell in his patent.

The transmission of articulate speech by means of interrupted or pulsatory electric currents has been a matter of great difficulty, so great, indeed, that it is supposed by many electricians to be impossible to secure any practical results by means of such currents; but, on the other hand, it is admitted that the nearer the transmitter can approach to interrupting the current, the more distinct will be the articulation, and the greater the volume of sound.

Proceeding on the supposition that a properly manipulated interrupted current would prove far more efficient in the transmission of speech than an undulatory current, Messrs. Dann & Lapp, of Honeoye Falls, N. Y., have devised a telephone system consisting of a transmitter and a receiver, which they claim is a refinement of the Reis system, and in which the intermittent currents are produced and used successfully in the transmission of articulate speech.

Fig. 1 is a perspective, sectional view of the receiving instrument; Fig. 2 is a diametrical section of the receiving instrument; Fig. 3 is a rear view of one form of the transmitter; Fig. 4 is a transverse section; and Fig. 5 is a perspective view of another form of the transmitter.

These various members of the telephone system are detached from their supports, and arranged to show their working parts as clearly as possible.



DANN & LAPP'S LONG DISTANCE TELEPHONE.

The telephone receiver shown in Figs. 1 and 2 is provided with a casing, A, which incloses two electro-magnets, B, arranged parallel with each other on opposite sides of the center of the casing, and with their yokes secured in front of the casing. In the front of the casing there is an opening, *a*, also a recess, *b*, for receiving the diaphragm, C. The diaphragm is clamped in place by a mouth piece, D, of the usual form. The central portion of the diaphragm, C, is made inwardly convex, and connected by a wire, *c*, and elastic cross piece, *d*, with the spring armatures, E. Each armature is provided with an arm, *e*, which is bent at right angles and bolted to the side of the casing, A. It will thus be seen that the poles of the electro-magnets, B, are not in proximity to the diaphragm, as in other forms of receiver, the diaphragm being arranged to receive its motion through the wire, *c*, from the spring armatures, E. By making the central portion of the diaphragm convex, it is rendered rigid, so that the vibrations transmitted by the wire, *c*, are distributed over a greater surface, thus insuring superior results. To render the action of the diaphragm free, its edges are inclosed in an elastic band, *f*. The receiver is connected with the line, so that the current passes through the two magnets in series.

The transmitters shown in Figs. 3, 4, and 5 are substantially alike in principle, but different in form. That shown in Figs. 3 and 4 is provided with a diaphragm, C', which is made and mounted

in substantially the same way as the diaphragm of the receiver, being held in place by a ring, *g*, which clamps the diaphragm to the mouth piece, D′. To the center of the diaphragm is secured a U-shaped bar, *h*, carrying on the side next to the diaphragm a contact point, *i*. To the ring, *g*, are secured posts, *j j′*, between which is pivoted the segment, G, of a ring which carries a spring, *k*, to the end of which is secured a weight, *l*. This weight carries a right angled finger, *m*, which is provided with a contact point, *n*, supported opposite the contact point, *i*. A screw, *o*, serves to adjust the electrodes by tilting the ring, G. The ring, G, and the weight, *l*, supported thereby are insulated from the diaphragm, and the current employed in the transmitter is taken through the diaphragm through the contact points, *i*, *m*, through the rings, G, *g*, and the instrument is connected up in the local circuit in the usual way. The action of this transmitter is such as to cause the contact point carried by the diaphragm to separate from the contact point carried by the pendulous weight, when the diaphragm is pushed backward by the impact of a sound wave.

The instrument shown in Fig. 5 is provided with a diaphragm, C′, having a concavo-convex center, as in the other cases, and is connected by a wire, *p*, with the short arm of the lever, *q*, which is connected by a spring, *r*, with a bridge, H, extending over the diaphragm. The lever, *q*, carries at the end of its longer arm the contact point, *s*. The spring, *r*, which supports the lever, *q*, is bent at an approximately right angle, and prolonged downward and attached to a weight, *t*, carrying at its center a contact point, *u*, directly opposite the contact point, *s*.

On a stud projecting from the back of the weight, *t*, is mounted a cross arm, *v*, carrying at its lower end a fixed weight, *w*, and provided at its upper end with a screw-threaded stud, *x*, on which is adjustably mounted the weight, *w′*. By turning the weight, *w′*, on the stud, *x*, the relation of the weights will be changed, so as to vary the pressure of the contact point, *u*, on the contact point, *s*. In this form of transmitter the motion of the diaphragm, C′, due to the impact of a sound wave, causes the contact point, *s*, to retreat from the contact point, *u*, and the contact point, *u*, by virtue of the inertia of the weights, *t*, *w*, *w′*, is unable to follow the contact point, *s*, consequently the current is interrupted. On the return movement of the diaphragm, C′, the circuit is again established, and so with every complete vibration of the diaphragm the current is interrupted at the contact points.

It is claimed that by means of this system, articulate speech can be transmitted over a five hundred mile line distinctly and clearly, that the articulation is perfect with a battery of one cell Leclanche, and farther if more battery is used.

On an experimental line the transmitted speech may be heard ten feet from the receiving instrument. It is claimed that, owing to the make and break of the current, the sound from the receiving instrument, when speech is being transmitted, is as great in volume as the noise made by the receiver, when the current is made and broken, by similar electrodes, as rapidly in any other manner.

With these instruments the circuit is not only broken, but the current also. If a spark should cross the gap made by the parting of the electrodes, the transmission is very much injured thereby.

Messrs. Dann & Lapp have an electrode which takes the place of carbon; in this electrode it is claimed that the molecular action of iron is used to effect a separation of the electrodes. It is equally as efficient in an undulatory current transmitter as in a make and break. To protect the iron from corrosion, it is plated with platinum. It is said to be as good as carbon, if not better. We are informed that, while speech is being transmitted, the electrodes vibrate and separate, and the noise made by this motion can be heard several feet.

Causes that Produce Unrest and Strange Nocturnal Visions.

Wundt regards most dream representations as really representations, since they emanate from sensorial impressions, which, though weak, continue during sleep. An inconvenient position during sleep causes the representation of painful work, perilous ascent of a mountain, etc.

A slight intercostal pain becomes the point of an enemy's dagger or the bite of an enraged dog.

Difficulty in respiration is fearful agony caused by nightmare, the nightmare seeming to be a weight rolled upon the chest or a horrible monster which threatens to stifle the sleeper.

An involuntary extension of the foot is a fall from the dizzy height of a tower.

Flying is suggested by the rhythmic movements of respiration.

Further, "those subjective visual and auditory sensations which are represented in a waking state as a luminous chaos of an obscure visual field, by humming and roaring in the ears, and especially subjective retinal sensations, have an essential role," according to Wundt. "There are shown to us innumerable birds, butterflies, fish, multicolored pears, flowers, etc. But if there be some cutaneous irritation, these visions are usually changed into caterpillars or beetles, crawling over the skin of the sleeper."

The sleeper sometimes dreams of his appearing on the street or in society only half dressed; the innocent cause is found in some of the bedclothes having fallen off.

An inconvenient position of the sleeper, a slight hinderance to respiration, or interference with the action of the heart may be the cause of dreams where one seeks an object without being able to find it, or has forgotten something in starting on a journey. The movements of respiration may suggest to the sleeper, as previously mentioned, flying, but this flight may be objective, and instead of himself flying he sees an angel descending from the heavens or a luminous chaos where birds are swiftly moving.

The representation of dreams having sensorial origin may have mingled with them those which arise solely from the reproduction of past memories. Parents and friends cut off in the flower of life ordinarily appear in dreams, because of the profound impression which their death or burial has made, "hence the general opinion that the dead continue during the night their intercourse with the living."

The Atlantic and Pacific Ship Railway.

The following able statement is by Mr. E. L. Corthell, chief engineer, presented to remove any misapprehensions that may exist in reference to the ship railway proposed between the Gulf of Mexico and the Pacific for the transportation of ocean vessels:

1. The commercial and political history of the world, for 3,000 years, exhibits the importance of Pacific markets. The history of the last 300 years records the efforts to reach them by crossing the American isthmus.

2. The following statesmen, among many, have urgently advocated the encouragement and protection by the United States government of an isthmian transitway: Clay, Jackson, Buchanan, Webster, Fillmore, Cass, Seward, Hayes, Windom, Blaine, Arthur, Edmunds, Bayard, Cleveland.

3. The commerce, industry, and general welfare of our country imperatively demand the construction of the isthmian ship railway, that we may thus unite our Atlantic and Pacific coasts by a maritime route, open to our Atlantic ports the important markets of the Pacific countries, and bring the markets of Europe 8,000 miles nearer to our western coast.

4. The Tehuantepec isthmus, in Mexico, has great advantages over Panama and Nicaragua, being 1,200 miles nearer to the United States than the former and 800 miles nearer than the latter.

The climate is healthy.

The winds and ocean currents are favorable.

The harbors are deep and capacious, and their approaches can be easily defended by a navy, and the railroads can promptly transport an army to the isthmus.

Mexico and the United States can hold this isthmus against the world, and control it as an American route.

5. The ship railway is entirely feasible, and is so asserted by a large number of practical experts of national and international reputation—naval constructors, navigators, civil engineers, and railway managers.

6. Economy in construction, maintenance, and operation, speed and safety in transportation, are its distinguishing features, and it surpasses, in these respects, a canal at Panama or Nicaragua. The entire cost of the ship railway will be less than $100,000,000—that of the Panama Canal at least $500,000,000, and the Nicaragua Canal $260,000,000, if adequate channels are provided.

7. If the ship railway is completed in 1890, a traffic of 5,000,000 tons is estimated to await its opening.

8. The concession from Mexico, granting the right to build and operate the railway, is very liberal.

It grants to the company 2,700,000 acres of public lands—an area half as large as the State of New Jersey—in addition to a right of way half a mile wide.

Exemption, for ninety-nine years, from all taxes, State and Federal, and from all duties on imports.

The right to establish coaling stations at each terminus.

A guarantee of $1,250,000 per annum for fifteen years, as one-third of the net revenue.

The defense of the railway by the army and navy of Mexico.

9. What is asked of the United States government? A national charter by a company of American citizens.

A guarantee that, when the railway is completed, solely at the expense of the company, and tested to the satisfaction of the government, by transporting over it vessels weighing, with their cargoes, 6,000 tons, two-thirds of the net revenue, during the first five years, shall amount annually to $3,500,000; the government to be liable for the payment of $2,500,000 the first year, $1,500,000 the second and third years, and $1,000,000 the fourth and fifth years, or a total possible liability of $7,500,000.

This liability of the government is conditional upon the railway being kept in order for transporting ship weighing 6,000 tons the first year, and 7,000 tons the remaining four years.

10. What is offered to the United States government?

Repayment, within ten years, of the amounts loaned.

Security for repayment in the bonded obligations of the company and the receipts of the railway.

The bonds, with 10 per cent interest added thereto, if not paid within ten years, may be used in payment of tolls on American vessels.

The right, with Mexico, of a representation of four-ninths in the board of directors.

The power to reduce the tolls whenever the net revenue (one-half of the gross receipts) exceeds ten per cent on $100,000,000—the limited capital of the company.

A rebate of 25 per cent on all coastwise commerce of the United States and on American vessels bound for foreign ports loaded with American products, and on American vessels returning with cargoes for consumption in the United States. This rebate is to continue fifteen years; estimated total amount of rebates, $35,000,000.

Transportation, during ten years, of government vessels, property, and mails and the transmission of telegraphic messages for 75 per cent of the rate charged to other governments, except Mexico.

The right to enforce its claims against the company in the United States and in Mexican courts.

Unnoticed Dangers.

Mr. Le Roy F. Griffin, in the *Chicago Current*, comments very sensibly on household dangers as follows:

"Far too many houses, both in city and country, are positively dangerous. Many city houses stand on made land, or at least that which was formerly swampy. The foundation walls, when there any—for houses often stand on posts alone—are built of solid masonry, but with no cement either outside or in. Such walls are porous, and soak up water nearly as rapidly as a sponge. Then it slowly trickles down the inside, emitting malaria, forming a fine soil in which all manner of fungoid growths flourish. The rooms over such places are first-class disease breeders, and every home should be frequently examined to see that this source of danger does not exist.

"Then, drain pipes often leak in the cellar and basement. This adds to the danger to the rooms above. The two fiends, stagnant water from the sewers and the water filtering slowly in through the walls, work in concert to sap the life of the little ones, and to fit them to yield to the first disease.

"The walls of the rooms themselves, in far too many houses, are disease breeders. A neat and tasty paper upon the wall makes a room inviting and adds to the home comfort. But, unfortunately, even when the paper is made free from poison—and good paper can be so made—the paste with which it is attached is just the home for the minute organisms which produce certain diseases. This is bad enough where there is only a single layer of paper; but when, as is often the case, several layers of paper and paste are spread upon the same wall, outside of one another, the danger is multiplied many times. Such walls are really masses of festering filth. The best wall is, undoubtedly, the plain plastered wall.

"All cases like these demand caution. Those who are responsible for the homes cannot be too careful. The health, often the life, of loved ones, children particularly, depends upon rigid exclusion of all these lurking places of disease and breeders of death. Beauty should be, and is, consistent with perfect safety in the home."

Railroading in Mexico.

The expenses of railroading in this hot climate are great. Wooden ties have but a short life, cracking in the dry season, and rotting during the rainy months; bridge timbers and piles also wear out rapidly. Freight cars must be painted frequently to prevent drying and cracking, and even the substantial Pullman cars shrivel under this exposure. Fuel constitutes a large item of outlay. Mesquit roots are burned on the Central road; pine cut along its route is used on the Interoceanic; and the Vera Cruz Company feed their engines coal blocks that are brought from Wales as ballast. The decay of ties will in time necessitate a serious outlay on the Central road, for wooden sleepers cost here $1 each. It is evident that iron ties are a necessity in Mexico, and they are just coming into use. The climate tends to preserve the rails and iron bridges—provided the latter escape the torrents of the rainy season. Engineers command better wages here than they do in the United States, for only that inducement brings them here. The general staffs of the roads are also well paid, but the section hands, who are peons, work for small wages. The natural and proper tendency on all the roads is to employ Mexicans when the right men can be obtained. This policy helps to protect the property of outside corporations doing business here.—*Springfield (Mass) Republican.*

AN INEXPENSIVE AIR PUMP.

BY GEO. M. HOPKINS.

A brass air pump gleaming with polished and lacquered surfaces, mounted on the conventional mahogany base, and furnished with accessories for convenient experimentation, is desirable and useful, beside being ornamental; but how many of those interested in the study of pneumatics have free access to such a machine, or, indeed, any other apparatus which will enable them to investigate practically and individually the interesting phenomena of the air and gases? It may be safely said that the number is comparatively small. The engraving illustrates an efficient air pump for both exhaustion and compression, which may be made from materials costing one dollar and fifty cents, and with the expenditure of not more than two or three hours' labor.

With this pump, the entire range of ordinary vacuum and plenum experiments may readily be performed by the aid of a few well known and inexpensive articles, such as lamp chimneys, fish globes, a tumbler or so, and pieces of sheet rubber, bladder, etc.

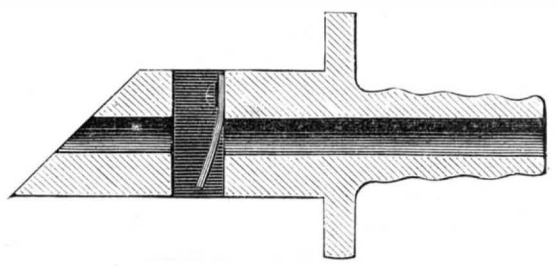
In the present article, only the pump will be described, the experiments and accessory apparatus being reserved for a future article.

Fig. 1 illustrates the manner of using the pump. Figs. 2 to 5 inclusive are sectional views of the pump and its valves. Fig. 6 shows a form of valve for the compression pump, and Fig. 7 shows the application of a foot pedal to the pump.

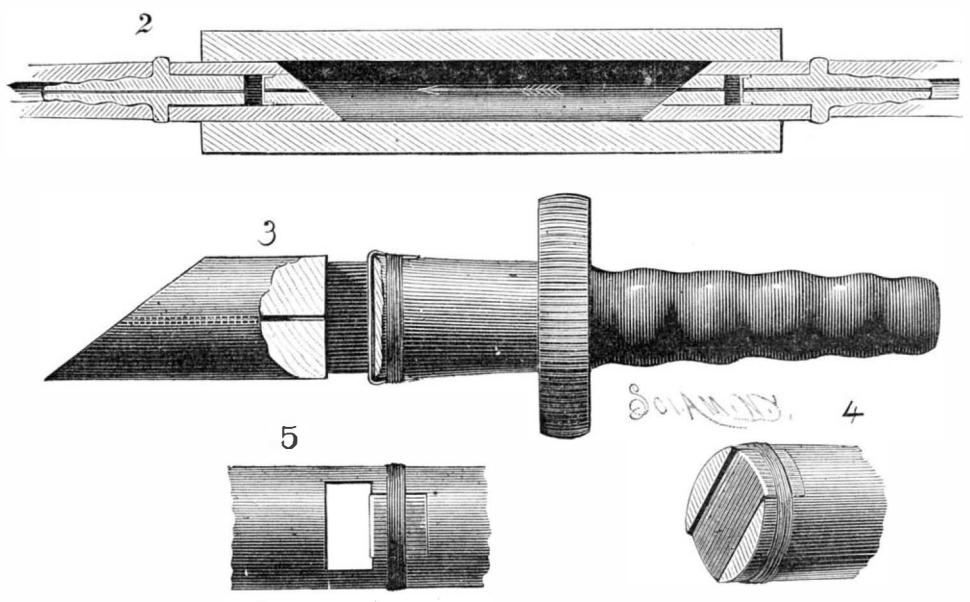
The materials required are as follows: A piece of so-called pure rubber tubing 1¾ inches external diameter, 1 inch internal diameter, and 9 inches long; a piece of pure rubber tubing 1 inch external diameter, ⅝ inch internal diameter, and 5 inches long; a piece of heavy pure rubber tubing ⅝ inch external diameter, and 4 feet long; two wooden valve casings (shown in Fig. 3); a strip of the best oiled silk, ⅜ inch wide and 8 or 10 inches long; and some stout thread.

The piece of 1 inch rubber tube is cut diagonally at an angle of about 30°, so as to divide it into two similar pieces. The wooden valve casing is pierced longitudinally with a one-sixteenth inch hole and transversely with a hole ½ inch square, and thoroughly shellacked or soaked in melted paraffine to render it impervious to air. The longitudinal hole is cleared out, and the walls of the square transverse hole are smoothed. One of the walls of the square hole into which the one-sixteenth hole enters forms one valve seat, and the other forms the other valve seat. The valves each consist of two thicknesses of the oiled silk strip stretched loosely over the valve seat, and secured by the thread wound around the wooden valve casing. It will of course be understood that when the valve casings are placed in the 1 inch rubber tubing, and the 1 inch tubes are placed in the ends of the larger tube, as shown in Fig. 2, the valves must both be capable of opening in the same direction, so that the air may pass through the pump as indicated by the arrow, entering by one valve and escaping by the other.

The pieces of rubber tube inclose the valve casings, so that each valve has a little air-tight chamber of its own to work in. The beveled ends of the rubber tube



6.—VALVE FOR COMPRESSION PUMP.



2.—LONGITUDINAL SECTION OF SIMPLE AIR PUMP. 3.—VALVE CASING PARTLY IN SECTION.
4.—TRANSVERSE SECTION SHOWING VALVE IN PERSPECTIVE. 5.—PLAN VIEW OF VALVE.

are arranged as shown in the engraving, and the inner ends of the wooden valve casings are beveled to correspond, so that when the large rubber tube is placed on the floor and pressed by the foot, there will be very little air space left in the pump. The four foot rubber tube is attached to one end of the pump for vacuum experiments, and to the opposite end for plenum experiments. To avoid any possibility of the sticking of the valves, the valve seats are rubbed over with a very soft lead pencil, thus imparting to them a slight coating of plumbago, to which the oiled silk will not adhere. As an elastic rubber pump barrel, of the kind described, requires considerable pressure of the foot to insure the successful operation of the pump, it is advisable to construct a treadle like that shown in Fig. 7. It consists of two short boards hinged together, the lower one having a shallow groove for the reception of the middle part of the pump. The edges of the upper board are beveled at about the same angle as the ends of 1¼ inch rubber tube. The width of the hinged boards should be somewhat less than the length of the chamber in the pump. A mark is made on the side of the larger tube at one end to indicate the top, the proper position for the pump being that shown in Fig. 2.

1.—TESTING SIMPLE AIR PUMP.

The pressure of the foot on the side of the pump barrel expels the air through the discharge valve, and when the barrel is released, its own elasticity causes it to expand, and while regaining its normal shape it draws the air from any vessel communicating with the suction valve.

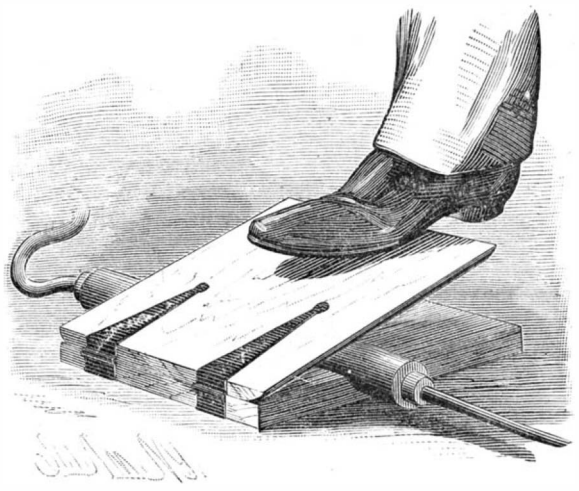
A vacuum sufficient for most of the ordinary experimental work may be produced by means of this pump in a short time. A gauge may be improvised by attaching the suction pipe to a piece of barometer tube about 30 inches long, and dipping the end of the tube in mercury, using a yard measure as a scale, as shown in Fig. 1. The pump will be found to compare favorably with piston pumps.

When it is desired to construct a pump of this kind for compressing air or for a low vacuum, the elastic tube forming the pump barrel may be larger and thinner, and the hole through the wooden valve casing may be made larger, as shown in Fig. 6, and the oiled silk valve may be replaced by a simple rubber flap valve, held in place by a single tack.

To dissolve old rubber so as to form a kind of rubber paint for cloth, use coal tar benzole.

Drying Up of Great Lakes.

The rapid drying up of lakes in the Aral-Caspian depression, in so far as it appears from surveys made during the last hundred years, is the subject of a very interesting and important paper contributed by M. Yadrintseff to the last issue of the *Izvestia* of the St. Petersburg Geographical Society. Two maps, which will be most welcome to physical geographers, accompany the paper. One of them represents the group of lakes Sumy, Abyshkan, Moloki, and Tchany, in the Governments of Tobolsk and Tomsk, according to a survey made in 1784. The other represents the same lakes according to three different surveys made during our century, in 1813 to 1820, in 1850 to 1860, and finally in 1880, and it shows thus the rapid progress of drying up of these lakes. There are also earlier maps of Lake Tchany, which represent it as having very many islands (Pallas estimated their number at seventy), but they are not reliable. As to the map of 1784, no cartographer, accustomed to distinguish "nature true" maps from fancy ones, would hesitate in recognizing it as quite reliable as to its general features. It is also fully confirmed by the ulterior detailed surveys dating from the beginning of our century. It appears from this series of four maps, dating from different periods, that the drying up has gone on at a speed which will surely appear astonishing to geographers. The groups of lakes consisted of three large lakes, Sumy, Abyshkan, and Tchany, with a smaller lake, Moloki, between the two latter. Lake Tchany (the largest of the three) has much diminished in size, especially in its eastern and southern parts, but the greatest changes have gone on in the other lakes. Whole villages have grown on the site formerly occupied by Lake Moloki, which had a length of twenty miles at the end of last century, and now is hardly three miles wide. Of Lake Abyshkan, which had a length of forty miles from north to south, and a width of seventeen miles, in the earlier years of this century, and whose surface was estimated at 530 square miles, only three small ponds have remained, the largest of them being hardly one mile and a half wide. The drying up has been going on with remarkable rapidity. Even twenty-five years ago there were several lakes ten and eight miles long and wide where there are now but little ponds. Lake Tchebakly, which was represented in 1784 as an oval forty miles long and thirty miles wide, has an elongated irregular shape on the map of the beginning of our century. It measures, however, still forty miles in length, and its width varies from seven to twenty miles; while several small lakes to the east of it show its former extension. Thirty years later we find in the same place but a few small lakes, the largest of which hardly has a length and width of three miles; and now three small ponds, the largest of them having a width of less than two miles, are all that remain of a lake which covered about 350 square miles a hundred years ago. The same process is going on throughout the lakes of West Siberia, and throughout the Aral-Caspian depression. No geologist doubted upon, but we cannot but heartily thank M. Yadrintseff for having published documents which permit us to estimate the rapidity of the process.—*P. K.*, *Nature.*



7.—TREADLE FOR AIR PUMP.

Bromidia.

In the decline of life, when exhausted nature habitually repels the restorative influence of sleep, there is nothing so suitable to induce healthful repose as one-half to one teaspoonful of bromidia, at bedtime. It may be taken for years, in the same dose, with the same effect and without detriment.—*Amer. Med. Jour.*

ENGINEERING INVENTIONS.

A boiler cleaner has been patented by Messrs. James Millar and George Feeny, of Amabel, Ont., Canada. It is a brush formed of steel wire mounted in a head hinged to a block, on one end of a manipulating bar or rod, which passes loosely through the block, and upon either side carries two arms or lugs, which project at right angles from the rod.

A steam plow has been patented by Mr. William Lay, of Omaha, Texas. A steam boiler and engine suitably mounted on a frame revolve a shaft on which are disks carrying several pairs of shovels, which are forced into the ground vertically and drawn out in an inclined position, loosening and raising the ground, and at the same time propelling the plow forward.

A safety attachment for locomotive tenders has been patented by Mr. Charles W. Dikeman, of Racine, Wis. It is intended to facilitate the escape of the engineer or fireman foreseeing a collision or other accident, and consists of an arm made to swing out some sixteen feet from the tender, bearing a man with it, upon the man standing upon a step which controls the swinging arm.

A car coupling has been patented by Mr. Albert M. Gregory, of Newton Factory, Ga. Combined with a drawhead, pin, and weighted pivoted block, is a cord secured to the upper portion of the stop block and extended thence rearwardly, whereby the block may be operated to release the pin, there being sufficient play to enable the proper coupling of drawheads of different heights.

A flue broom has been patented by Messrs. Peter Light and John Luscher, of Frankfort, Ky. It is an expansible broom, in which the broom sections are adjustably supported by radially slotted disks secured to the ends of a tubular shaft, with means for guiding the broom sections at the periphery of the disk, whereby a single broom may be adapted to flues of different sizes, or readily adjusted to compensate for wear.

AGRICULTURAL INVENTIONS.

A check row corn planter has been patented by Mr. John K. Voorhees, of Pella, Iowa. It has a combined pulverizing and marking wheel, with seed dropping mechanism, such that the seed will be dropped at the proper time to be in line with the marks made by indicating knives, and the arrangement being such that the depth to which the knives enter the ground can be readily regulated.

A hand corn planter has been patented by Messrs. William A. Esterly and Ebenezer W. Poe, of Bowling Green, Ohio. Combined with a stock, to one side of which is attached a seed box, is a seed dropping slide, which passes through openings in the stock, together with hinged side jaws and an operating mechanism, whereby the seed will be properly divided before being discharged into the ground.

MISCELLANEOUS INVENTIONS.

A lap robe holder for vehicles has been patented by Mr. Fitz Hugh Littlejohn, of Broadalbin, N. Y. It consists of a spring hook and spring clamp and flexible connection between them, the holders to be made of such length as to hold the lap robe with the necessary closeness to the body of the rider.

A buckle has been patented by Mr. Isaiah H. Osborn, of Wilmington, O. It is a rectangular frame with a back plate and a spur for receiving a strap, a spring arm being attached to the front for holding the strap on the spur, the buckle being more especially adapted for the hip strap of a harness.

A nut lock has been patented by Mr. Mannasseh W. Farber, of El Dorado, Kan. The bolt and nut are grooved, and there is a locking key to fit these registering grooves, the key being made of spring wire, bent at several angles, to adapt it to its functions, and one end bent laterally to form a claw.

A bolt has been patented by Mr. Joseph A. Coultaus, of Brooklyn, N. Y. It is made with a bevel faced feather, the bevel of which extends from the face of the bolt shank to the inner face of the head, the bolt being especially designed for mounting caster rollers within the forked arms of the body of the caster.

An automatic fire alarm has been patented by Mr. Thomas H. Prescott, of Sackville, N. B., Canada. It is a signal tripping device, in which the signal is tripped by a rise in temperature, and in which an easily pliable material is employed, by the partial fusing of which the signal tripping devices are released.

A movable threshold has been patented by Mr. Eugene Schmidt, of Stillwater, Minn. It is a construction arranged to be carried by and applicable for use in connection with any door, being designed to do away with permanently mounted thresholds, and leave the floor level beneath the lower edge of the door.

A nut lock has been patented by Mr. Isaac R. Ritter, of Reading, Pa. This invention consists principally in a novel combination of notched nuts, with a notched retaining plate and springs arranged to lock the nuts upon the bolts, the device being designed for use on raliway joints and in other places.

A strap ear for well buckets has been patented by Mr. William H. Parrish, of Richmond, Va. It is composed of a single metal strap formed at its upper end with an eye having a hook-shaped lower end, and so made as to prevent the hoops of a bucket from coming off, while the shape of its lower end will prevent it from being pulled off of the bucket.

A thill coupling has been patented by Messrs. Percy J. Hindmarsh and William H. Gwinn, of Centralia, Kan. The coupling is arranged to be used in connection with a novel form of attachment designed to prevent the rattling of the shackle, bolt, and thill eye, to effect which a novel construction and combination of parts is provided.

An automatic candy shaping machine has been patented by Mr. Gustavus C. Snyder, of New York city. It consists of a sizing device, a series of interchangeable rollers, one having a rotary cutter, a device for automatically opening and closing the hopper and the series of rollers, and another for keeping the candy in motion until it has cooled off.

A lamp burner has been patented by Mr. Shipley W. Spooner, of Astoria, Ore. The invention covers a special construction of burner, match carrier, and igniter, the match carrying mechanism being readily removable to allow the parts to be cleaned, and the lighter being applicable to burners for any kind of oil, burning fluid, or gas.

A lamp chimney cleaner has been patented by Mr. William J. Webb, of Harbor au Bouche, Nova Scotia, Canada. It has a series of flat or plate springs, attached to work with a suitable handle, so that they may be expanded inside a cover of suitable fabric, the device being applicable for lamp chimneys of different sizes.

A lead-corroding pot has been patented by Mr. Peter H. Decker, of Ellenville, N. Y. It is made of glass, with its lower part of smaller internal diameter than the upper part, and with a shoulder upon the inside, so that the acid for corroding may be placed in the bottom of the pot, and the metallic lead placed in the pot to rest upon the shoulder, with other novel features.

An egg carrier has been patented by Mr. John Shibley, of New York city. This invention relates to egg carriers made with pockets or cells to hold the eggs, such as are usually made of pasteboard, and provides for constructing the carrier to permit the cells to yield to the weight of the eggs, while strengthening the carrier.

A sheet holder for marine vessels has been patented by Mr. Eben F. Enos, of Magnolia, Mass. It is a post with a foot or flange for attachment to the deck of a vessel, a shaft being journaled in the post with drum and ratchet, the ratchet being engaged by a pawl pivoted in the post, by means of which the sheet is held as it is hauled in the manipulation of the sails.

An anchor has been patented by Mr. Robert R. Spedden, of Astoria, Ore. It is made of separable parts, so that it can be readily taken to pieces for storage or shipment, the shaft having hooked pivots, so that no screw threading and nuts are required, and a triangular fluke is used, with fins to prevent the cable from being caught on the upper angular corners.

A road cart has been patented by Mr. Frank Becht, of Colona, Ill. It has body supporting side bars, provided with lengthwise slots and made adjustable at their front ends, combined with pivotal supports attached to the axle, the construction being intended to render such vehicles more comfortable, alike for the occupant and the horse.

A stock muzzle has been patented by Mr. Abner Wesson, of Memphis, Tenn. It is made with hinged jaws, which open automatically when a portion of the muzzle is pressed on the ground, and close when the animal raises its head, thus allowing stock muzzled with it to feed on grass or shrubs, but preventing the biting of trees or plants of high growth.

A sash lock has been patented by Mr. Thomas A. L. Moore, of New Orleans, La. It consists of a locking dog in a case which can be secured to a window jamb, with an aperture to be engaged by a spindle, the latter having a knob and arranged in connection with a spring, which is inclosed within a case formed in connection with an escutcheon.

A spring for baby carriages has been patented by Mr. Jay F. Butler, of New York city. It is a bent spring connecting the axle with the body part of the carriage, with a tension block secured to the axle, and a clamp to fasten the spring to the tension block, in order to regulate the tension according to the weight in the carriage.

An exercising device for musicians has been patented by Mr. Julius Caesar, of New York city. It is a combination of a plate and attachable additional plates with a wristband and clamping bar, to fit a player's wrist and weighted to suit, in order to develop superior flexibility and strength in the muscles of the hand and forearm of the player.

A folding lamp shelf for pianos has been patented by Mr. Reinhard Prause, of Bastrop, Tex. An arm carrying a shelf is pivoted to the back of the music rack, the arm being arranged to swing outward into a horizontal position, and the shelf being connected with the end of the arm by a pivotal connection, whereby a lamp may be held near the music.

A gate for hens' nests has been patented by Mr. William S. Spaulding, of Paintersville, Pa. It has central bars so arranged that the hen can, by putting her head through an opening and pushing against the bars with her shoulders, easily open or close the gate, but the design is such as to prevent animals from disturbing the nest or eggs.

A tack driver and carpet stretcher has been patented by Mr. Patrick J. O'Connor, of Seymour, Ind. Combined with a slotted tube having spring jaws is a tapered hammer rod, connected to a sliding block arranged upon the outside of the tube, the tack or staple holding jaws being adjustable, and the claw serving jointly as a stretcher and a tack extractor or puller.

An atomizer has been patented by Mr. Anaximander B. Tutton, of Sioux Falls, Dakota Ter. It has an elastic bulb, with an opening to be distended over the neck of any bottle, inlet and outlet orifices, a valved tube, compressor, and pendent tube, for the production of a continuous flow of spray, through the discharge tube, of any liquid contained in the bottle.

A mechanical detecter has been patented by Mr. George H. Gaskins, of the Division of Steam Engineering, U. S. Steamship Lehigh, City Point, Va. It consists of a contact rod or bar and a conductor for conveying the vibration of the contact part to the ear, to aid in detecting when machinery is running untrue, whether a watch sounds properly, or whether working mechanical parts are in proper order.

A catch basin inlet and cover for sewers has been patented by Mr. Hiram W. McDonald, of Bucyrus, O. It has an opening in the top and receiving mouth in the side, with vertical guide ribs at the inside edges of the mouth, between which fits a detachable grate, with other novel features, and adapted to conform to the sidewalk material, and make a desirable finish and secure anchorage.

An apparatus for dyeing has been patented by Mr. Eugene Rau, of Philadelphia, Pa. Combined with a vat are rollers at the top and bottom, pressing rollers, an apron below them, a roller around which the dyed fabric is passed, and a roller on which the fabric is wound, the apparatus being especially designed for dyeing fabrics with aniline color dissolved in hydrocarbons.

A knockdown bed bottom has been patented by Mr. Reuel W. Woodman, of Bar Mills, Me. It has simple and efficient irons or fixtures, adapted to join the side rails and end bars of the bottom frame, so it can easily be knocked down for storage or shipment, and readily set up, while the springs or other flexible mattress support of the bottom may be strained up tightly at any time.

A washing machine has been patented by Mr. William M. Egan, of Salt Lake City, Utah Ter. The suds box has a close fitting cover and a false concave bottom of parallel bars, the clothes presser being a perforated board with fingers that enter and work in the grooves of the bottom, so that when the presser is vibrated it raises the clothes out of the water, squeezes, and then allows them to fall back into the suds.

A churn has been patented by Messrs. Samuel E. Foreman and Frank T. Walls, of Randolph, Kan. It has a twisted vertical shaft carrying a dasher, a block carrying an apertured plate, through which the shaft passes, and dasher blades carried by the block, in such manner that currents will be produced in four directions, to agitate the cream, the construction being very simple.

A two wheeled vehicle has been patented by Mr. Mortimer L. Knowles, of Union City, Mich. A pair of springs is rigidly fastened to the bends of the shafts near the axle, a rearwardly projecting seat bar having its forward ends loosely connected to the shafts, so as to oscillate, with clips connected to the springs by hinge joints, and other novel details, to make an easy riding vehicle, without "horse motion" to the seat.

A wood moulding machine has been patented by Mr. Walter J. Smith, of Philadelphia, Pa. It has an elastic rest, adapted to be attached to an arm adjacent to the spindle, and moulding knives, combined with an adjusting screw working in a fixture and carrying a follower or block connected to the rest, for changing the curvature of the rest, with other novel features.

A bicycle pedal has been patented by Mr. Thomas J. Strickland, of Randolph, Mass. It is formed of two end pieces, between which two U-shaped pieces of sheet metal are held by tongues formed on the end edges and passed through slots in the end pieces, whereby the pedal is made light, but strong, and so the rider's foot cannot slip, and the sole of the foot will rest only on the flat side of the pedal.

A grinding mill has been patented by Mr. Henry Cutler, of North Wilbraham, Mass. It is a vertical disk grinding mill, in which the mill case has trunnions and is provided with arms, brackets, and bearings, combined with the driving shaft, its pulley and adjusting devices, whereby the mill case and its connections are tilted, and in which the running stone may be nicely held to its work, but will give should unyielding substances get between the surfaces of the stones.

A cigar tip has been patented by Mr. Arno S. Rosenbaum, of New York city. It may be made of metal, rubber, celluloid, or other suitable material, and attached in the manufacture or by the consumer, being of suitable shape and so perforated with numerous small holes as to permit the passage of the smoke, while preventing the nicotine from entering the mouth, the tip holding a small cup with an absorbent of cotton, sponge, or other suitable material.

A rotary water meter has been patented by Mr. Franklin T. Gilbert, of Walla Walla, Washington Ter. It is an improved arrangement of rotating wheel in a case, with wings mounted upon radial axes and adapted to act like pistons to take the pressure of water coming in through an inlet pipe to turn the wheel, the wings gradually turning upon their axes into a horizontal plane in passing over an incline bed as they move toward the outlet pipe.

A bridge guard has been patented by Mr. William C. Newman, of Charlevoix, Mich. The guards consist of from one to three rods or rails extending across the bridge approach, and slide with their ends in vertical guide grooves, being adapted to be lowered by the bridge itself into deep narrow recesses as the latter is closed, and to rise automatically into an operative position as the bridge is swung open for the passage of a vessel.

A telephone transmitter has been patented by Messrs. John E. Dann and John Lapp, of Honeoye Falls, N. Y. Combined with a diaphragm having a bracket or arm carrying an electrode apart from the diaphragm, is a second electrode, which projects between the other and the diaphragm, a weight being attached to the second electrode, and a spring which supports and tends to hold it normally in light contact with the electrode attached to the diaphragm, with other novel features.

A switch and a cut-out for electric circuits form the subject of two patents issued to Messrs. John M. Fairchild and James O'Connor, of Portland, Oregon. The first invention covers a peculiar construction and combination of parts, whereby an electric current may be switched from one circuit to another, or which may serve as a cut-out for the lamps of an electric light circuit, while the cut-out is more particularly adapted for electric light circuits, whereby the lights of a building may be cut-out by the police or firemen without affecting the main line.

Business and Personal.

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

Notes & Queries

HINTS TO CORRESPONDENTS.

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

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

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

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

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

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(1) E. B. asks how to copper small pieces of sheet iron. A. Clean the article thoroughly by treatment in a bath of muriatic acid 1 part, water 4 parts, to remove all scale. Wash in hot water and tumble in sawdust wet with a solution of sulphate of copper in water, to which add as much sulphuric acid as is equal to the weight of the dry sulphate of copper. Use about 2 ounces of each to a gallon of water. You may also copper work that cannot be easily tumbled by dipping in the above solution hot. The work must be cleanand free from grease.

(2) J. F. L. asks how to remove stains made on piece of linen by paraffine varnish, or coal tar such as used in roofing, etc. A. Paraffine is soluble in alcohol and ether. You will succeed best with a warm solvent. We would also suggest a trial with coal tar benzol. Moisten the cloth with the liquid all around the spot, and so work up to it. Do not pour directly upon it.

(3) E. L. C. V. desires (1) a recipe for a furniture (walnut and ebonized) polish not varnish. A. Mix thoroughly olive oil 1 pound, refined oil of amber 1 pound, and tincture of henna 1 ounce. Keepthe mixture in a well stoppered glass bottle. Apply with a tuft of raw cotton and rub dry with a cotton rag. 2. What can be used to clean fly specks from lacquered brass work (chandeliers) without injury to the luster? A. Old ale is a good thing to wash any gilding with, as it acts at once on the fly dirt. Apply it with a soft rag.

(4) A. J. M.—When the minerals or rocks to be polished have been trimmed off as near to the desired shape as possible by means of a small steel hammer, the faces are first roughly ground on metal plates with the addition of coarse emery powder and water. When a smooth surface has thus been obtained, the final polish is effected by grinding on plates of glass with fine emery or rouge. This method is of course very slow, and is used only where occasional specimens are treated. Where any number are to be polished, a lathe is employed. The laps or wheels rotate horizontally, and are made of cast iron, copper, or lead, according to the hardness of the mineral under treatment. Where slices or large sections are to be made, a steel diamond saw is used. Lathes for amateur use are now manufactured, and cost from $50 to $250. The slicing apparatus costs from about $35 upward. If you only care to polish an occasional specimen, or make a few rock sections for examination under the microscope, a cast iron plate, 6 inches in diameter, a plate of thick glass about the same size, cut preferably square, and an assortment of different grades of emery powder, will constitute the necessary outfit.

(5) C. S. L. asks: 1. Can a vacuum be held in a glass jar or any other kind of jar? A. It can be so held, and is in incandescent electric lamp bulbs. 2. After pumping the air out, how can it be kept out? A. It can be kept out by hermetically sealing the jar. 3. How can you tell when the air is all expelled? A. By a pressure gauge attached to the tube, through which the air is pumped out.

(6) T. H. asks (1) a formula for the volume in cubic feet per minute escaping from a gas well, the pressure and opening being given. A. Assuming pressure of gas to be given in pounds per square inch within a few inches of the opening of the pipe, we have:

$$Q = 9{\cdot}8\,A\sqrt{\frac{h}{d}}$$

Q=cubic feet per second, A=area of cross section of pipe in square inches, h=pressure of gas, d=pressure of air which may be taken at 15 pounds per square inch. 2. The length of pipe and pressure given, a formula for volume discharged in cubic feet per minute. A. Assuming pressure of gas to be given in pounds per square inch at beginning of pipe:

$$Q = 9\,A\sqrt{\frac{\frac{h}{b}}{1{\cdot}18+\left(0{\cdot}025\,\frac{l}{d}-1\right)}}$$

Q=cubic feet per second, A=area of cross section of pipe in square inches, h=pressure of gas in pounds per square inch, b pressure of air which may be taken at 15 pounds, l=length of pipe in feet, d=diameter of pipe in feet or fraction thereof.

(7) L. W. asks: 1. What is meant by a 10 per cent solution, 5 per cent solution, etc.? A. A ten per cent solution means ten parts of substance in one hundred of solution, and the same for other percentages. 2. In formulæ giving a certain number of "parts" of a salt, and a certain number of parts of water or other liquid, how are these parts taken, by weight or by volume? A. The term "parts" in formula generally means parts by weight, whether referring to liquids or solids.

(8) A. S.—The plant, from your brief description, is undoubtedly a tall form of *Aralia hispida*, which is the only species shrubby at the base. Its leaves are merely bipinnate, while those of the shrubby *A. spinosa* are tripinnate. The other species of *Aralia* are herbaceous and unarmed.

(9) W. N. asks: What effect has common salt and water on steel in hardening, no matter how heavy or light the brine? A. The addition of salt to water raises the boiling point and makes it a more efficient and rapid cooler of the metal. Hence it is liable to crack heavy pieces, and tends to make the hardening penetrate deeper.

(10) C. P.—Indian red is made by calcining iron sulphate. It is a more or less pure iron peroxide.

(11) A. E. S.—We can send you "Fur, Fin, and Feather," with game laws of each State, for fifty cents. The following is an excellent harness liquid blacking: Dissolve by heat 4 ounces glue or gelatine and 3 ounces gum arabic in ¾ pint water; add 7 ounces molasses and 5 ounces ivory black in fine powder; gently evaporate over a water bath until of a proper consistence, stirring all the time. Keep in corked bottles.

(12) E. N. asks how to produce cold in a small ice chest without the use of ice. A. Use one of the numerous freezing mixtures, such as equal parts of ammonium nitrate and water; or, eight parts of sodium sulphate with five parts of hydrochloric acid.

(13) J. T. P. asks how to cleanse and whiten harness lines made of Russia leather. A. Sponge the leather with dilute solution of oxalic acid, and then dress well with oil. The acid must be used sparingly, as it never benefits the texture of leather.

(14) W. S. A.—Gelatin, starch, and Irish moss soaked in warm water are among the substances generally used in making ice cream bricks. Ice mixed with the former requires a greater degree of heat to cause it to melt, and hence bricks of ice cream thns made stay hard longer on exposure than will ordinary ice cream.

(15) W. asks what curd soap is. A. Curd soaps contain no resin, and are generally made from tallow or lard, in about the proportions, fat 9 parts, alkali 1 part, and from 5 to 8 parts of water.

(16) E. P. E. asks: 1. What is the glue or liquid used for sticking fringe and plush on card for New Year? A. A good quality of glue dissolved in hot water is generally used. 2. Also the liquid used to gilt the edges of cards. A A composition consisting of four parts of Armenian bole, and one of candied sugar, ground together with water to a proper consistence, and laid on by a brush with the white of an egg. This coating, when nearly dry, is smoothed by the burnisher. It is then slightly moistened by a sponge dipped in clean water and squeezed in the hand, after which gold leaf is applied. 3. The mixture to bronze gas fixtures? A. Mix vinegar or dilute sulphuric acid (1 acid, 12 water) with powdered black lead in a saucer or open vessel; apply this to the brass with a soft plate brush by gentle brushing. This will soon assume a polish, and is fit for lacquering. The brass must be made slightly warmer than for lacquering only. A little practice will enable the operator to bronze and lacquer with once heating. The color, black or green, varies with the thickness of black lead.

(17) A. O. R. desires a recipe of a compound that would harden wood, so that an article made of maple or any other wood, and in general of a shell-like form, would be capable of enduring considerable rough treatment. A. It has been found that wood acquires a remarkable hardness and toughness when it is placed in tanks and covered with quicklime, which is gradually slaked with water. Wood, such as is used in mines, takes about a week to become thoroughly impregnated.

(18) G. S. H. asks how to laundry shirts to give the fine gloss to the bosoms. A. Take of white wax 1 ounce, spermaceti 2 ounces, melt them together with a gentle heat. When you have prepared a sufficient amount of starch, in the usual way, for a dozen pieces, put into it a piece of the polish about the size of a large pea, using more or less, according to large or small washings. Or thick gum solution (made by pouring boiling water upon gum arabic) may be used. One tablespoon to a pint of starch gives clothes a beautiful gloss.

(19) E. C. N. writes: I have a white chip hat which is slightly sunburned. The local bleachery says it cannot be bleached. Is there not some way of making it white again? A. Straw hats and bonnets are bleached by putting them, previously washed in pure water, and still moist, into a box with burning sulphur; the fumes which arise unite with the water on the bonnets, and the sulphurous acid thus formed bleaches them.

(20) G. W. C. asks how to make water containing carbonate of lime soft and fit to drink. A. Boil it, and allow to settle and pour off. See "How to Soften Hard Water," contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 270. See also the articles on this subject in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 280, 348, and 392.

(21) E. R. asks what to use to polish cows' horns. A. Having scraped the work perfectly smooth and level, rub it with very fine sand paper, repeat the rubbing with a bit of felt dipped in finely powdered charcoal with water; and lastly, with rotten stone or putty powder and finish with a piece of soft wash leather, damped with a little sweet oil; or still better, rub it with subnitrate of bismuth by the palm of the hand.

(22) A. W. asks: 1. How can I remove paints from the floor of a room that has been used for a store room for the sale of paints? A. Take 1 pound American pearlash, 3 pounds quick stone lime, slake the lime in water, then add the pearlash, and make the whole about the consistence of paint. Lay the mixture over the whole body of the work which is required to be cleaned, with an old brush; let it remain for 12 or 14 hours, when the paint can be easily scraped off.

(23) N. B. asks: 1. Does the gradual, instead of instantaneous, disappearance of a fixed star behind a planet prove that the planet has an atmosphere? A. Not wholly. The condition of our atmosphere, the declination from the zenith, and the diameter of the telescopic aperture may have some influence in graduating the occultation. 2. Is it necessary that the star should change its color? A. If the light was affected by a planetary atmosphere, there would probably be a slight change in color. Diffraction may also have a share in the visible phenomena. 3. Mention a good work on taxidermy. A. Maynard's Manual of Taxidermy, which we can furnish for $1.50.

(24) J. M. E. asks: An armature is running 1,200 revolutions per minute, carrying a load of 1,200 lamps. Will it require more power to run it 1,800 revolutions, carrying the same load, with the lamps at the same intensity, leaving bearing friction out of consideration? A. In general terms, a higher speed increases intensity of current and hence involves increased mechanical resistance. The lamps would also give more light at the higher speed. The friction of the air would increase at a higher speed. If the dynamo was of such construction that the lamps gave the same light at 1,800 as 1,200 revolutions, then the resistance to rotation, apart from that offered by the air and bearings, would be the same.

(25) A. J. M. asks an easy and simple means for cutting and polishing all kinds of ores, minerals, etc. A. A grindstone to cut to shape, a leathered board, with fine flour of emery to finish, and another leathered board, with crocus for polishing, is the most simple arrangement that we know of.

(26) H. M. asks (1) the best method to enlarge eye of an emery wheel from ¼ to 1 inch. A. Chuck the wheel in a lathe and turn out the eye with a hard tool or, better, a diamond tool, with a very slow motion. 2. What is best to apply to gum belting that is glossy and begins to scale off or crack? A. We know of no restoration for gum or rubber belting that scales off or cracks. If it is new, it is of poor quality. If it is old, there is no help for it but renewal.

(27) S. H. J. writes: I have 6 inch reflecting telescope, mounted equatorially. How shall I set it relative to the north pole, so that the star-following motion will always keep the star in field of view? A. You should have some means of moving the frame of the polar axis in azimuth and altitude, sufficient for the last adjustment. Then observe Polaris in its east or west position of mean altitude with the declination axis horizontal. Get the star in the center of the field, clamp the declination axis, and turn the telescope 180° on its polar axis. The difference in position in altitude is double the distance of correction required. When Polaris is on the meridian, the horizontal difference in the field is twice the correction required in azimuth. 2. In looking at the sun, I have hitherto used smoked glass as a protection for the eye, but it is very easily spoiled by a touch, rubbing off the carbon film. Where can I buy black glass that may be ground to a thin plate and used in lieu of smoked glass? A. You can buy colored glass for eye pieces at any optical establishment. A solar eye piece composed of 2 prisms cemented together is the best. The dark blue colored glass is the best.

(28) B. M. R. asks how to clean a white goat skin rug. I am afraid warm soap suds may injure the skin, though it is just what the long white hair needs. A. One washing with warm (not hot) suds will not materially hurt the skin itself. The skin may not seem quite so soft after the washing, but if the washing is done quickly, the skin well rinsed in cold water, and dried with only moderate warmth, being frequently turned and shaken, the difference will hardly be perceptible.

(29) S. R. D. writes: I have a gold solution for plating. I wish to separate the gold from the cyanide of potassium. A. Acidify in open air with excess of hydrochloric acid, add protosulphate of iron, heat, filter out precipitated gold, wash, dry, and ignite. Be careful not to inhale evolved gases.

(30) H. J. C. desires (1) a receipt for frost-proof ink. A. Aniline black 1 drachm, rub with a mixture of concentrated hydrochloric acid 1 drachm, pure alcohol 10 ounces. The deep blue solution obtained is diluted with a hot solution of concentrated glycerin 1½ drachms, in 4 ounces of water. This ink does not injure steel pens, is unaffected by concentrated mineral acids or strong alkalies, and will not freeze at a temperature of 22 or 24 degrees below zero. 2. A receipt for liquid glue made without acid. A. An excellent liquid glue is made thus: Take of best white glue 16 ounces, white lead dry, 4 ounces, rain water 2 pints, alcohol 4 ounces. With constant stirring dissolve the glue and mix the lead in the water by means of a water bath. Add the alcohol, and continue the heat for a few minutes. Lastly pour into bottles while it is still hot.

(31) J. W. V. asks what material potters use to give a gloss or polish to their wares, something in the shape of a powder placed in their furnaces. A. Doubtless you refer to the salt glaze, which consists simply in throwing dry salt into the furnace while the articles are being baked. Other glazes are produced by dipping the articles into a specially prepared mixture, substantially glass ground into fine powder and suspended in water, receipts for which can be found in any of the works on pottery.

(32) C. W. S. desires a recipe for making lithographic ink. A. Melt 10 ounces of wax, 8 ounces of shellac, 5 ounces of mastic, 4 ounces each of pure tallow and hard tallow soap, ½ ounce Venetian turpentine. Mix with these 2½ ounces of lampblack. This ink is rubbed up with water like water-colors, and forms an emulsion. You will find numerous receipts given in the "Techno-chemical Receipt Book," which we can send you, postpaid, for $2.

(33) C. L. G. asks how to produce the harder grades of lithograph crayons. Several of the published formulas result in a good crayon for rough work, but not hard enough for fine work. A. We would advise the following: Pure wax 4 parts, dry white tallow soap 2 parts, white tallow 2 parts, gum lac 2 parts, lampblack enough to give a dark tint; occasionally, copal varnish 1 part. Concerning the details of preparation, see the article on Lithography, in Ure's Dictionary. For white wax we would recommend beeswax.

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

J. M. U.—The sample of ore sent does not contain copper or any other valuable metallic ingredient.—W. G.—The specimen appears to be infusorial earth, and is of value as a polishing powder.—J. S. L.—The specimen is calcite, or crystallized carbonate of lime. It is of no value.

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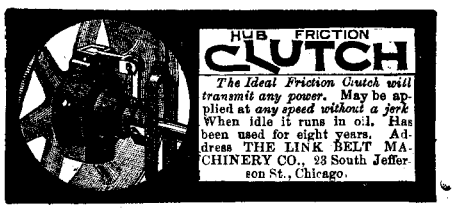

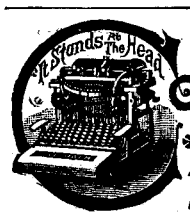

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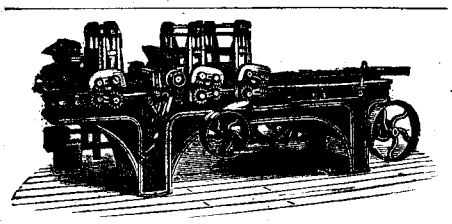

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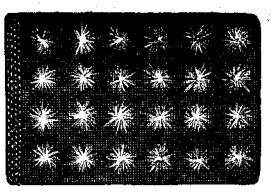

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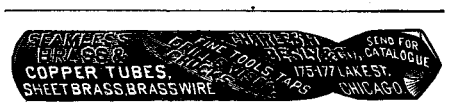

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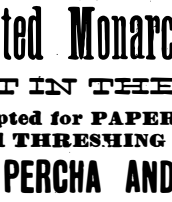

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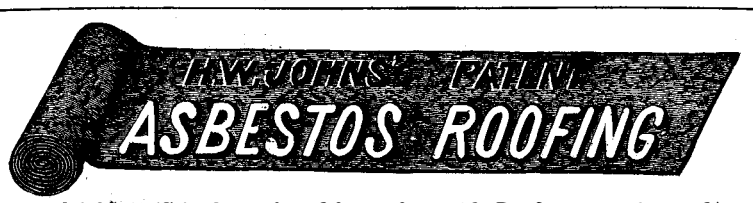

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