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ELECTRICAL INDICATOR FOR SHOWING THE ROTATION OF THE EARTH.

BY GEORGE M. HOPKINS.

Although the apparent displacement of the plane of vibration of the pendulum had long been noticed, it was not until the year 1852 that the fact was coupled with the diurnal rotation of the earth. In September of that year M. Foucault, a distinguished French physicist, suspended a ball, by means of a fine wire, from the dome of the Pantheon at Paris, and for the first time in the history of the world made visible the rotation of the earth. The pendulum thus formed, after receiving an impulse, vibrated for many hours, and preserved its plane of vibration while the earth slowly turned under it. This splendid experiment was subsequently repeated at the Capitol at Washington, and at other places, and is now about to be again performed in Paris.

Soon after the pendulum experiment, Foucault, to illustrate the same thing, constructed a gyroscope which was a modification of Bohnenberger's machine. This gyroscope received a rotating impulse from the hand of the operator, and the momentum of the disk was depended on to continue the rotation for a sufficient length of time to exhibit the movement of the earth.

The duration of the rotary movement thus produced must have been short, and the result unsatisfactory.

Recognizing the desirability of a more practicable means of making visible the diurnal movement of the earth, I have made the action of the gyroscope continuous by applying electricity as a propelling power.

In the first engraving (which represents the machine arranged for the purpose named) the rectangular frame which contains the wheel is supported by a fine and very hard steel point, which rests upon an agate step in the bottom of a small iron cup at the end of the arm that is supported by the standard.

The wheel spindle turns on carefully made steel points, and upon it are placed two cams—one at each end—which operate the current-breaking springs.

The horizontal sides of the frame are of brass, and the vertical sides are iron. To the vertical sides are attached the cores of the electro-magnets. There are two helices and two cores on each side of the wheel, and the wheel has attached to it two armatures—one on each side—which are arranged at right angles to each other. The two magnets are oppositely arranged in respect to polarity, to render the instrument astatic.

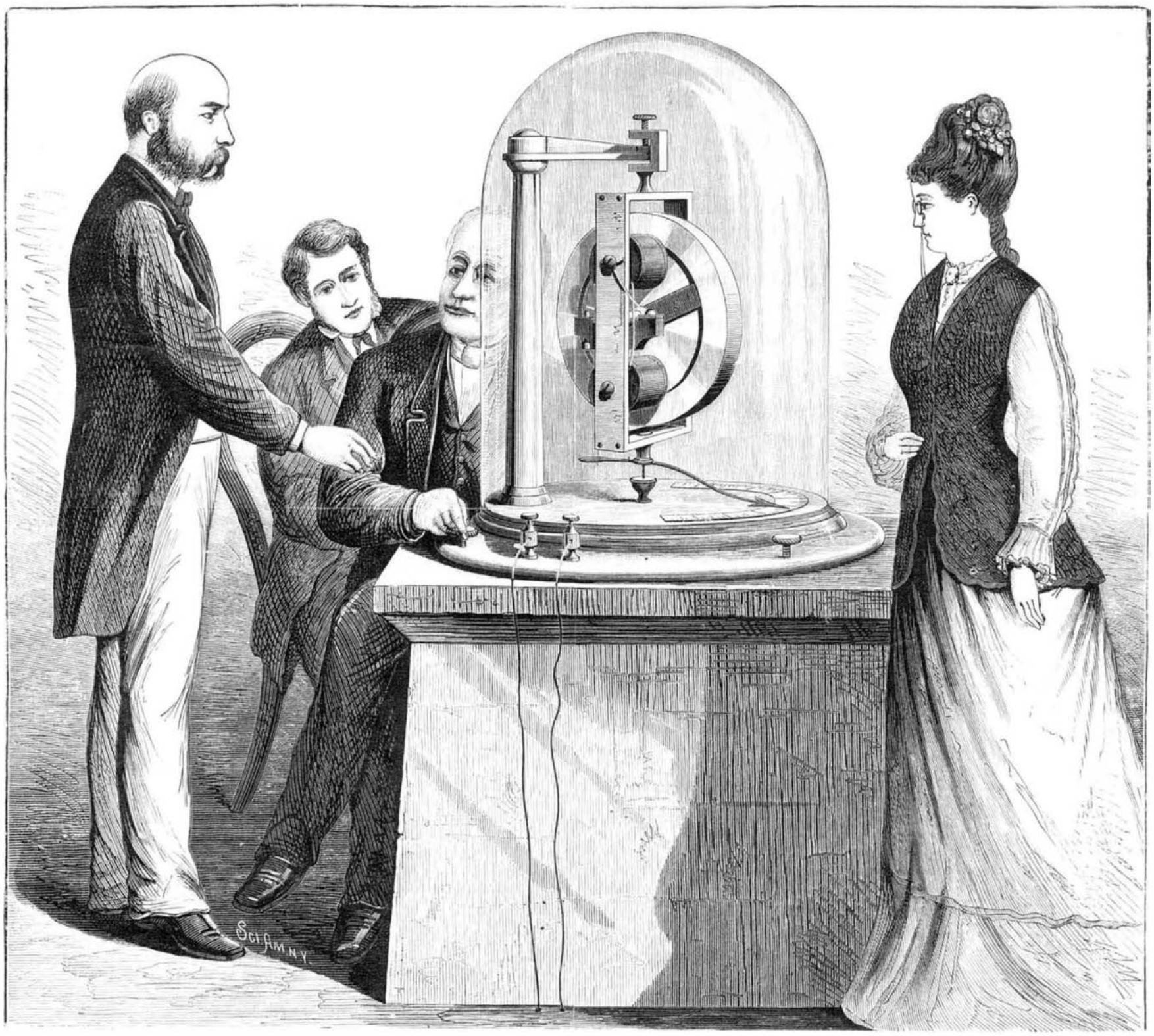
An insulated stud projects from the middle of the lower end of the frame to receive an index that extends nearly to the periphery of the circular base piece and moves over a graduated semi-circular scale. An iron point projects from the insulated stud into a mercury cup in the center of the base piece, and is in electrical communication with the platinum pointed screws of the current breakers. The current-breaking springs are connected with the terminals of the magnet wires, and the magnets are in electrical communication with the wheel supporting frame.

One of the binding posts is connected by a wire with the mercury in the cup, and the other is connected with the standard. A drop of mercury is placed in the cup that contains the agate step to form an electrical connection between the iron cup and the pointed screw. The instrument is covered with a glass shade to exclude air currents, and the base piece is provided with leveling screws.

The current breaker is contrived to make and break the current at the proper instant, so that the full effect of the magnets is realized, and when the binding posts are connected with four or six Bunsen cells the wheel rotates at a high velocity.

The wheel will maintain its plane of rotation, and when it is brought into the plane of the meridian the index will appear to move slowly over the scale in a direction contrary to the earth's rotation, but in reality the earth and the scale with it move from west to east, while the index remains stationary, or nearly so.

[*Continued on page* 4.]



ELECTRICAL INDICATOR FOR SHOWING THE ROTATION OF THE EARTH.

HORIZONTAL CONDENSING ENGINE AT THE PARIS EXHIBITION.

We illustrate in the annexed engraving a new horizontal engine of peculiar construction, exhibited at the Paris Exhibition by La Société Anonyme des Usines St. Maurice, Lille. The framing is of cast iron, really in four pieces, but so well put together, and so clean in the joints, that it is not easy to believe that it has not been cast in two pieces, one at each side. The piston rod head is guided by a vertical parallel motion, the joints of which are made with straps and cotters on solid blocks forged in one with the rods. The upper levers of this motion are keyed on a cross shaft turning in bearings on the side frames, and on each end of this shaft is keyed a double horizontal lever. That on the right hand of the engine looking toward the fly wheel from the cylinder works two single acting vertical air pumps drawing from the jet condenser, which is seen right beneath the cylinder. The lever at the other side works two ordinary plunger pumps. On the parallel motion horizontal shaft, just noticed, are two sleeves; one of these carries a lever, which is connected with the main slide valve on the one hand, and with a crank on the other. The crank is made in a horizontal shaft, carried in bearings in two castings, one of which supports the governor. This crank shaft is driven by spur gearing from the main shaft.

Above the main slide is a gridiron expansion valve, actuated by an arm on a vertical shaft, shown at the side of the governor. On the lower end of the governor rod is a sleeve fitted with two cams. The sleeve rises and falls with the governor, the weight of which is partially balanced by the two balls supported on arms seen in the elevation of the engine. The position of the cam sleeve is controlled by the governor, and so determines the point of cut off in a way that will be readily understood. The cut off valve is worked by a second lever and sleeve rocking on the horizontal parallel motion shaft.

The whole engine is self contained in the sense that little or no excavation is required; and abnormal as the engine appears, the *Engineer*, from which we take our engraving, states that it runs exceedingly well, and compares favorably with many other engines in the Exhibition.

The admission of steam which corresponds with an effective duty of 100 horse power is stated to be one tenth of the stroke of the piston. The principal dimensions are as follows: Diameter of cylinder, 23·6 inches; stroke of piston, 3 feet 8 inches; number of revolutions per minute, 46; diameter of air pumps, 13·6 inches; length of stroke of buckets, 10·8 inches; proportion of steam cylinder to air pump, 12 to 1; diameter of fly wheel, 16 feet 9 inches; width of fly wheel, 25·6 inches.

A CORRESPONDENT suggests the construction of projectiles on the principle of the boomerang, for reaching an enemy behind earthworks or embankments. The usual way of surmounting obstacles of this sort is to make the balls ricochet or bounce over the parapet after first striking the ground.

ELECTRICAL INDICATOR FOR SHOWING THE ROTATION OF THE EARTH.

[*Continued from first page.*]

If the index were absolutely motionless the scale would move under it at the rate of 15° an hour, but owing to friction the motion of the scale or apparent motion of the index is less.

It makes no difference whether the index points northward or southward, its apparent motion is always westward, thus affording visible evidence that the earth rotates.

The instrument I have thus described may be easily modified, so as to illustrate other interesting phenomena of rotary motion.

By removing the index and point from the insulated stud at the lower part of the frame and unscrewing the support-

Fig. 2

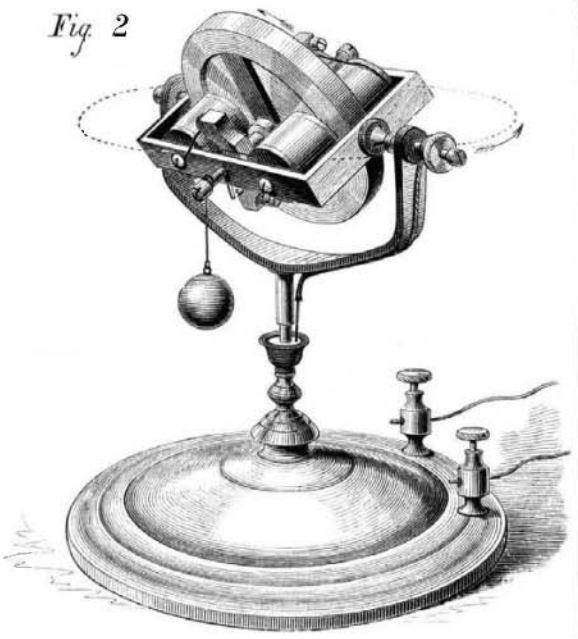


Fig. 2.—ELECTRICAL INDICATOR.

Fig. 2.—ELECTRICAL INDICATOR.

ing piece from the top of the frame, the frame may be suspended in a horizontal position upon pointed screws in a fork which is supported upon a vertical pivot, as shown in the second engraving.

The pointed screw that enters the insulated stud is insulated, and communicates, by an insulated wire, with mercury contained in an annular vulcanite cup on the fork supporting pivot. One of the binding posts is connected with the pivot of the fork and the other communicates with the mercury in the vulcanite cup.

When the instrument is connected with a battery the wheel revolves rapidly, and if undisturbed will remain in the position in which it was started. If a small weight, such as a key, be hung upon one of the pivot screws of the wheel spindle, the frame containing the wheel does not turn quickly on its pivots as might be expected, or as it would if the wheel were not revolving, but the entire apparatus immediately begins to revolve slowly on the vertical pivot, while the weighted side of the frame descends almost imperceptibly. Transfer the weight to the opposite pivot, and while the wheel still revolves in the same direction the apparatus will revolve on the vertical pivot in the opposite direction. The rotary movement on the vertical pivot is in opposition to the friction of the wheel, that is, the apparatus if rotated on the vertical pivot by the friction of the wheel on its pivots would be in the opposite direction.

By removing the weight from the pivot screw and turning the apparatus on the vertical pivot the converse of what has just been described will result; that is, the wheel besides revolving on its own axis will turn in a plane parallel with its axis.

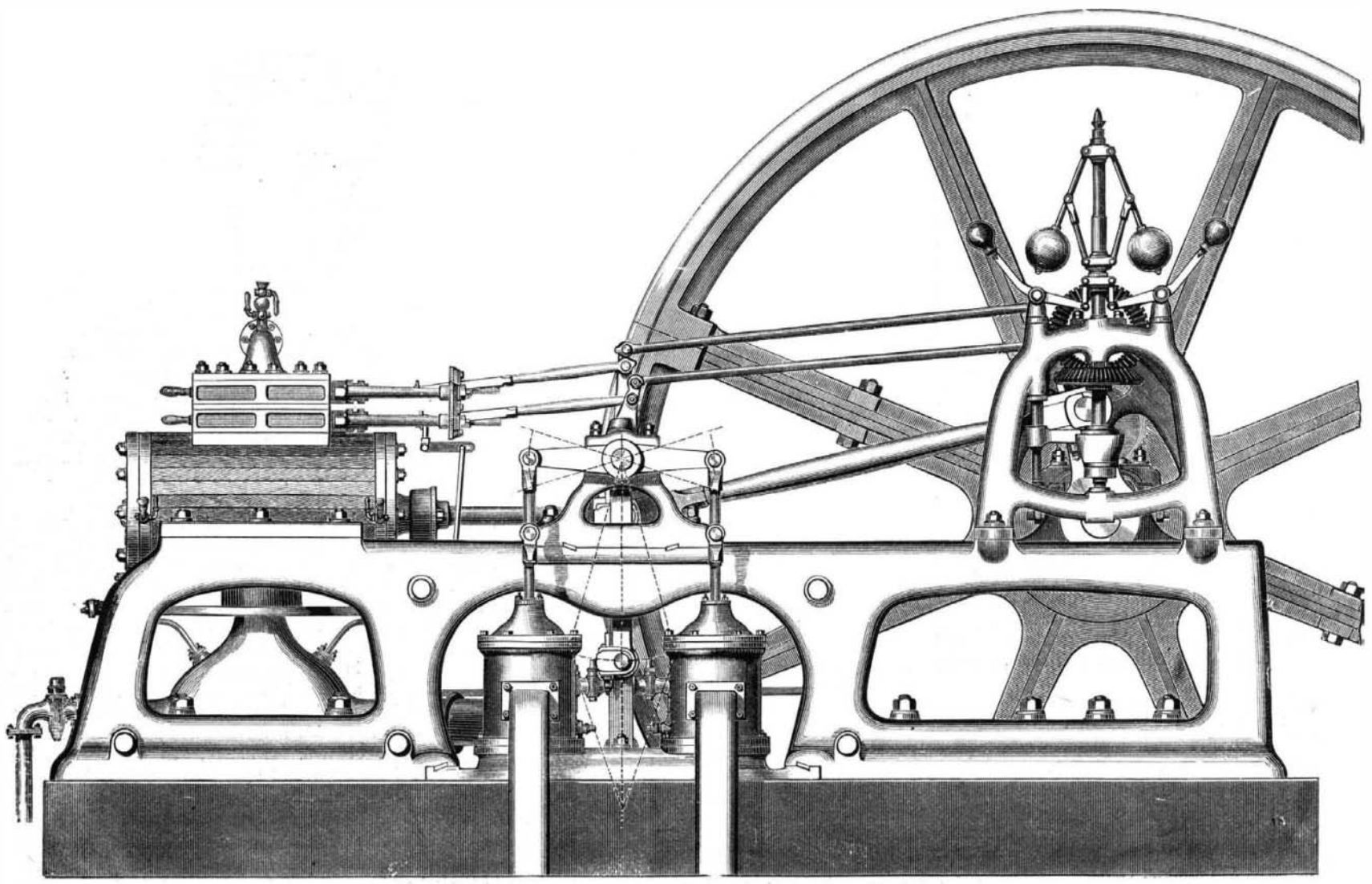
If the apparatus be turned on the vertical pivot in the opposite direction the rotation of the wheel on its new axis will be reversed, and by oscillating the apparatus on the vertical pivot the wheel and frame will revolve rapidly on the pointed screws that support the frame.

The law controlling these movements is as follows: "Where a body is acted upon by two systems of forces, tending to produce rotations about two separate axes lying in the same plane, the resultant motion will be rotation about a new axis situated in the same plane between the directions of the other two."

By means of this continuously operating gyroscope Dr. Magnus' experiments showing some of the causes of deviation of projectiles may be nicely exhibited.

Deep Boring.

A deep artesian well is being bored at Pesth, and has reached a depth of nearly 1,000 meters, over 3,300 feet. The work is undertaken by the Brothers Zsigmondy, partially at the expense of the city, which has granted £40,000 for the purpose, with the intention of obtaining an unlimited supply of warm water for the municipal establishments and public baths. A temperature of 161° Fah. is shown by the water at present issuing from the well, and the work will be prosecuted until water of 178° is obtained. About 175,000 gallons of warm water stream out daily, rising to a height of 35 feet. This amount will not only supply all the wants of the city, but converts the surrounding region into a tropical garden. Since last June the boring had penetrated through 200 feet of dolomite. The preceding strata have supplied a number of interesting facts to the geologist, which have been recorded from time to time in the Hungarian Academy of Sciences. Among some of the ingenious engineering devices invented during the course of the borings are especially noteworthy the arrangements for driving in nails at the enormous depth mentioned above, for pulling them out, for cutting off and pulling up broken tubes, and a mechanical apparatus by means of which the water rising from the well is used as a motive power for driving the drills.



HORIZONTAL CONDENSING ENGINE AT THE PARIS EXHIBITION.

Whitening Positives.

Bichloride of mercury and other things have been suggested and tried in the process of whitening a dark positive picture, but with no good and satisfactory result. We have found a very simple and pure method by which an ambrotype or ferreotype may be whitened in the shortest time and give excellent results. The first trial was with a much under-exposed picture, which was entirely too dark. After it had been fixed and dried, we ran a stream of water over it again, in order to soften the film; we next prepared a mixture from one part of the usual developer (consisting of protosulphate of iron and acetic acid) with half a part of the silver bath, which was entirely neutral. This mixture we flowed over the picture, and after the lapse of four seconds the picture became nicely white, the half-tones appeared white, while the blacks of the darkest shades remained perfectly uninjured. The solution was now thrown off, and as a number of gray, dirty looking specks appeared on the picture, the usual fixing solution was applied to it again, by which means the picture appeared faultless, the whites being intense and of a brilliant white.

Since that time we have made the same trials with a different developer and an acid silver solution, and obtained the same excellent results. We have carried this redeveloping process further, and in the course of one minute changed a good positive into an excellent negative, which printed very good. We have tried this method with pictures which were more than half under-exposed in the camera, and did not fail in a single instance.—*Practical Photographer.*

MR. THOMAS A. EDISON.

Many of our readers will recognize in the engraving the face of Mr. Thomas A. Edison, and others, who are not familiar with his appearance, may form a good idea of how the great inventor looks. Every one is acquainted with his telephone, phonograph, and other remarkable inventions, therefore we shall not notice them here.

Mr. Edison is above the medium height, and although he is only thirty-one years old, his iron gray hair and thoughtful eye show the effects of continued study. He is genial, liberal, and entirely unostentatious. His mind, day and night, is on his projects; and even while eating his thoughts dwell on his inventions. His table conversation consists of occasional ejaculations regarding some new point in whatever project he may have in hand. He is at home in his laboratory, which is very large and complete in all of its appointments. He has a number of assistants, who are competent and quick to carry out his wishes, and they are often engaged on several widely different subjects at the same time. The experimental apparatus which is completed during the day is often tried at night when all is quiet and no visitors are present.

Notwithstanding his great mental labor, he avers that his health is good, and that as his occupation is pleasurable it does not tire him.

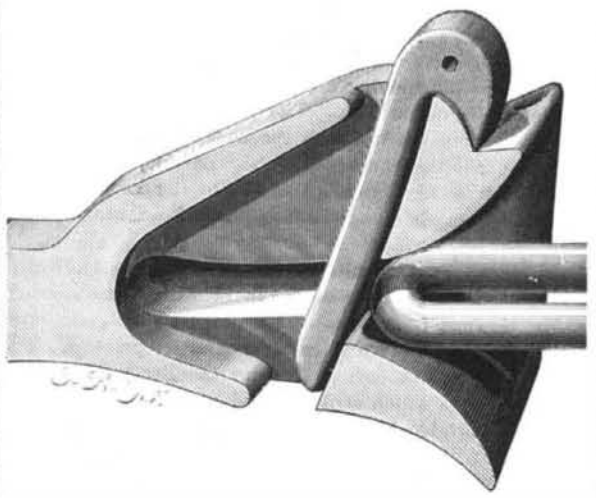
His residence and laboratory at Menlo Park are beautifully situated upon the brow of a hill that overlooks a picturesque valley. The beautiful landscape and the mountain air—Nature's best restoratives for the brain-weary—he has without the seeking.

Mr. Edison may well pride himself as to his position in the world of science, standing, as he does, first among the inventors of the day; and having, by his own energy and persistence, secured an income that enables him to carry forward on a grand scale such experiments as his prolific mind may suggest.

We publish in another column a detailed account of Mr. Edison's researches in telephony.

PATTESON'S IMPROVED CAR COUPLING.

The annexed engraving represents a new and very simple form of automatic car coupling. It will be observed that there are no more parts in the device than in the common coupling now in use, and that the operation is positive and



PATTESON'S CAR COUPLING.

can hardly fail. The shape of the interior of the drawhead is evident from the illustration. The pin hooks over a projection on top and passes down through to a slot beneath. The entering link pushes the pin back, causing it to swing on the point of the hooked portion. The lower end of the pin is thus lifted as the link passes under it, and allowed to fall back into the link opening, thus effecting the coupling by the simple action of gravitation.

Practical railway men will at once see the great simplicity and utility of this coupler as a life-saving apparatus to brakemen. The drawhead will be from 15 to 20 pounds lighter than the old one, and much thicker and stronger in front. Cars can be run closer together, as no one goes between them to couple, and shortening the length of the train will cause a more compact and less jarring pull. When coupled, the link is not cramped, and can work in every direction. The pin fits plumb in the lower part of the drawhead, and is sufficiently inclined to make the pull steady, and against the upper and thicker part of the drawhead, and cannot bounce up or be jolted out of place. An asbestos rope is put in the head of the pin and hooked to the top of a freight car, so that the brakeman can uncouple from the top of the car, or at the side of the track, without going between the cars, and can pass from car to car more easily, as the boxes will be nearer. The drawheads can be used nearly touching, by cutting the hole for the pin more to the front and correspondingly reducing the rear space and link; the front of the drawhead to be blaring and very strong, especially the upper half, which will withstand the main pull.

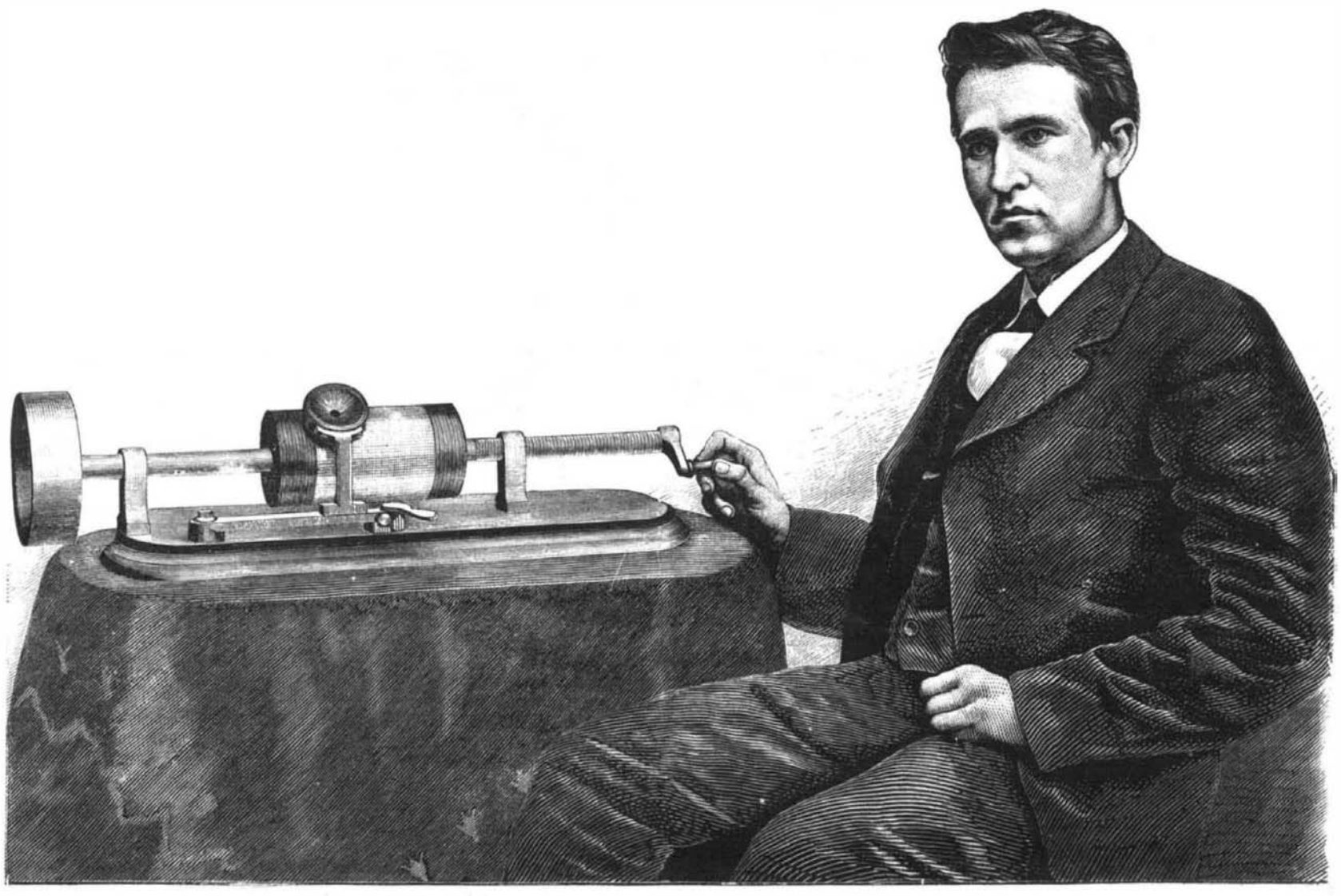
This simple automatic coupler has no springs, bolts, bars, or screws to rust, break, or get out of order, and is pronounced by many railway experts the most perfect yet invented. Patented February 26, 1878. For particulars touching its introduction, sale, etc., address E. M. Drane, Frankfort, Ky.

Project for Increasing the Water Power of Pennsylvania.

The head waters of the Pennsylvania streams are not very much higher nor are they far distant from the rapids at Niagara Falls, and the suggestion of increasing the water power of the State of Pennsylvania to an almost unlimited extent by using the power of the Niagara Falls to force a supply from the head of the rapids across to the head waters of that State is believed to be feasible. The water power which could thus be thrown into the head waters of the Ohio and Susquehanna to be used a hundred times over would be of incalculable value to that great industrial State, while its cost would be but a trifle compared with steam, more especially now that the dams and water wheels already exist. The same principle of supplying power to other streams, but by steam power, it is believed will be found feasible, especially where the stream is so rapid and the dams so numerous as to completely use the water when furnished. The water leaving the Connecticut at Holyoke, Mass., turns the water wheels for mills located upon six different terraces, so that the same water is used six times over in a distance of less than two miles.

A Japanese Built Ironclad.

A Japanese ironclad, the Li-ki, five guns, is now on her way to England, making a call at all the principal Asiatic and European ports *en route*. Unlike most of the vessels belonging to the Japanese navy, the Li-ki was built in Japan, under the superintendence and from the designs of M. Chiboudier, a French gentleman employed in the Imperial Arsenal of Yokoska. It will be remembered that the English Government lately made overtures for the purchase of three or four gunboats built in that country for Japan, but were unsuccessful in their bids for the vessels. The visit of a native-built ironclad to Portsmouth is therefore looked forward to with considerable interest. The Li-ki was built in 1874. Her length is 191 feet; breadth, 22 feet; draught forward, 11 feet; and aft, 13 feet. She has two decks, the upper one carrying five guns. The state cabin, ward-room, etc., are handsomely fitted, and the whole arrangements of the vessel are said to be very complete. Her officers are nearly all native Japanese.



THE PHONOGRAPH AND ITS INVENTOR, MR. THOMAS A. EDISON.