

Japanese made the face of the mirrors convex, hitherto unknown to foreigners, consisted in scratching the face while cold with a distorting rod. During the operation the mirrors became visibly concave, but spring back and became convex when the pressure of the rod is removed. The thicker part yields less and becomes less concave under the rod and less convex when it is removed. This explained Professor Atkinson's discovery, in 1877, that a small scratch on the back of a mirror made with a blunt nail, although producing apparently no effect on the other side, appeared as a bright line on the screen when a light was reflected from the mirror. In concluding, the professor said that while the Japanese were generally ignorant of the so-called magic quality of their mirror, the priests made use of a device for producing in the mirror, by the use of acids, figures which can only be seen by looking sideways, of which an example was exhibited.

AN ECONOMICAL ARRANGEMENT OF THE CALLAUD BATTERY.

By JOHN MORGAN.

I PREPARED two sets of Callaud Locals (two cells to each) with sawdust, in this manner: I placed the copper disk in its place, then filled the interstices with blue vitriol, pounded tolerably fine, level with the top of the copper. This required 2 lbs. and 2 ozs. of the vitriol for each cell. On the vitriol a pasteboard disk was placed fitting neatly. On this pasteboard disk I packed dry sawdust as tightly as I could, to a height of nearly three inches. Above this sawdust was placed another pasteboard disk, and above the latter the zinc. The cells were then filled with water to their proper line, and the next day placed in circuit on two of our sounders, on local wires, where a great portion of our business is transmitted. These cells worked just as strong and far more regular than those prepared in the usual way.

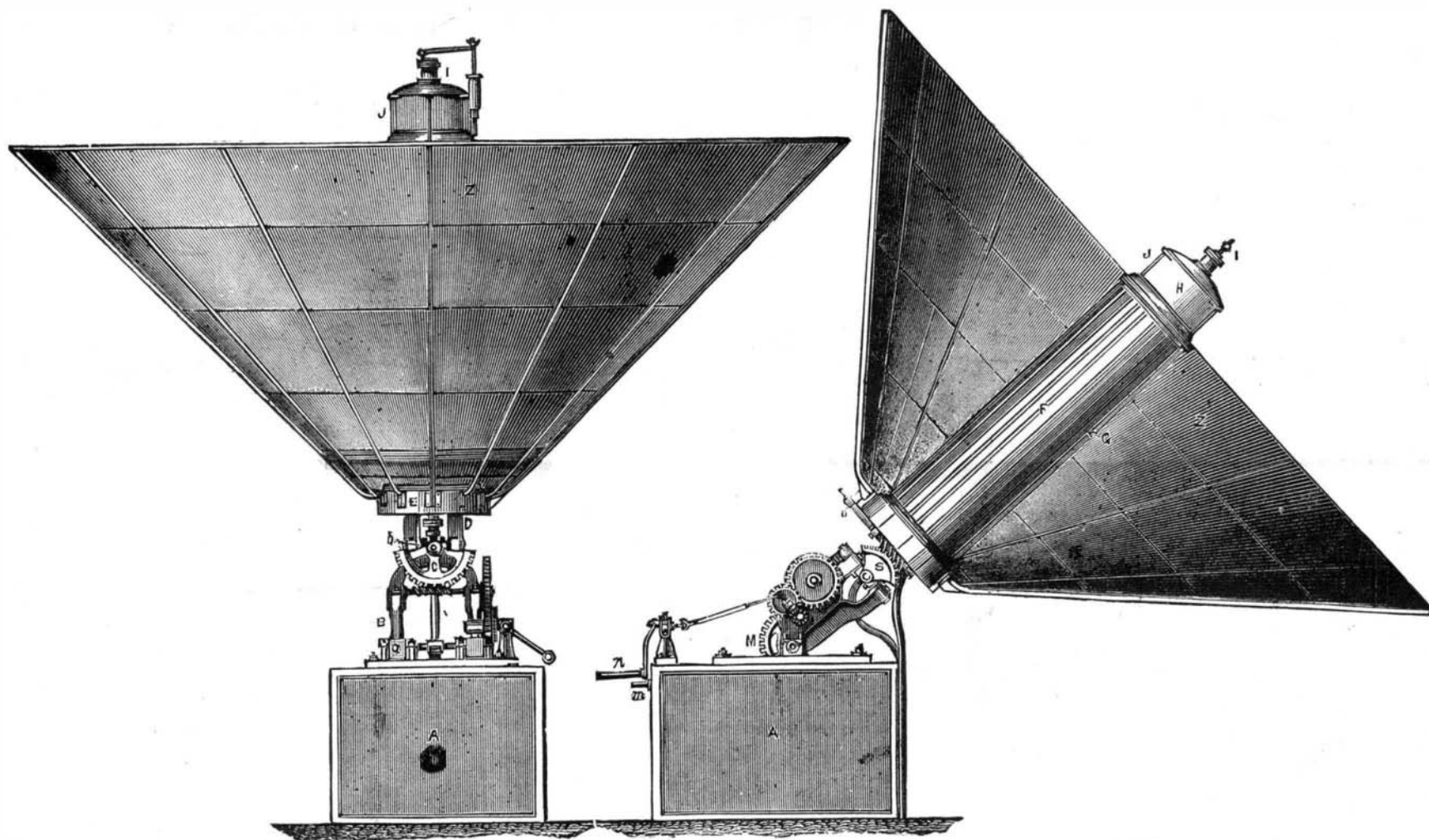
SUN ENGINE.

THE utilization of the rays of the sun as a motor is by no means a novel idea; we will not say it is as old as the sun itself, but very early attempts have been made to convert the heat engendered by them into a substitute for fuel. Euclid, Archimedes, Hero of Alexandria, Solomon de Caus, Buffon, De Saussure, Ducarla, Pouillet, Franchot, Ericsson, and others, have added the results of their researches to the solution of the question in time past, and Ericsson in 1868 published analogous experiences in Philadelphia; but M. Mouchot, the well-known French *savant*, whose efforts commenced in 1861, has gone further than any one else in reducing the problem to a practical form in the large engine he exhibited near the aquarium in the Trocadéro grounds. In 1861 M. Mouchot gave the name of Heliopompe to his invention, and in 1865 he had several small engines of this description at work at Tours—Inde et Loire—and, without discussing the question of priority with reference to Ericsson's invention, we may here remark that, as a distinction of construction, M. Mouchot has avoided the use of parabolic mirrors and added a glass jacket to retain the heat. The engraving below will give a general idea of the principle of construction and the mode by which the rays of the sun are collected and utilized.

The apparatus is composed of a large conical mirror, Z, with rectilinear plates of silver-plated copper of very high reflecting power; of a tubular boiler, F, with blackened surfaces inclosed in a glass jacket, G, and of a special mechanism whereby the orientation, or setting to the east, of the apparatus, is made to follow the direction of the sun's rays. The mirror serves the double purpose of receiver and reflector. Instead of employing parabolic mirrors to concentrate the rays in one point, the conical mirror merely reflects them towards its own central axis. The boiler is placed in the focus of the mirror; the glass jacket permits the uninterrupted inward passage of the sun's rays, and prevents their

short time with a steam pressure of three atmospheres. The pressure has risen at times as high as seven and eight atmospheres; but, from our own observations, it was quite apparent that, owing either to the lateness of the season or to the imperfections of the boiler allowing steam to collect on the inner surface of the glass jacket and prevent the passage of the rays, to the leaky state of the pump, and consequent loss of power, or to whatever fortuitous circumstances it may be ascribed—although the initial pressure at starting was six and a half atmospheres—it sank so rapidly—viz., at about the rate of one atmosphere in every three minutes—that no reliance could be placed on the experiment as illustrating the practicability of the principle.

Whatever field may be open for the exploitation of sun engines in tropical and rainless countries where fuel is dear, we cannot look on the invention in its present state, and with existing results, as anything more than an ingenious toy. The hypothetical advantages claimed for it, by uniting several generators with a common steam reservoir, may possibly be realized and the effective power increased. The system proposed to raise sufficient water during the day to continue the night service of an engine may be possible, although scarcely feasible, or even the idea of accumulating heat for the evaporation of volatile compounds, such as ether, or decomposing water into its component gases by a combination with the solar-thermopile, and producing both heat and light, not beyond the pale of scientific research. Nevertheless, until more satisfactory practical results, over a longer space of time than the present engine has ever worked, have been obtained, we must abstain from sharing the sanguine expectations of the inventor. Too much haste had been shown in endeavoring to execute the work in time to show it before the close of the Exhibition, and whatever the causes of its imperfect success may be, it is neither advisable for the interests of the exhibitors, when seeking public recognition, to be obliged to apologize for and explain the reasons of its not fulfilling its expectations, nor to advertise its probable ex-



MOUCHOT'S ENGINE, WORKED BY THE HEAT OF THE SUN.

In fact, there was *no* change in their regularity. They are removed from the instruments at least fifty feet, as the wires run. Nothing whatever was done to them during their continuance, excepting the replacing of the evaporated water. Had oil been used, probably even this little attention would not have been required. These cells lasted until the latter part of January, 1879, a period of nearly 14 months. The zincs were entirely consumed, but at least one-fifth of the blue vitriol remained in the cells *unused*. The consumption of blue vitriol, counting it as all consumed, averages a little less than 2½ ozs. per cell per month. Placing the cost of the vitriol at ten cents per lb. the cost would average 1 3-5 cent per cell per month. The zincs also lasted much longer than when set up in the regular way.

I have never tried cells filled in this manner in a main battery as yet, but from the perfect manner in which they performed as *locals*, I can see no reason why they would not act just as well in a main. It certainly has proved to be a great economizer of vitriol, zinc and labor, and as such, I place the facts before you, in the hope that they will assist still farther in reducing the expenses of the company in the way of battery material.—*Jour. of Telegraph.*

METALLIC CHROMIUM.—M. H. Moisson has presented to the Académie des Sciences a memoir on the amalgams of chromium, manganese, iron, cobalt and manganese, and on a new means of obtaining metallic chromium. To prepare the amalgams, a protochloride of one of these metals, in solution, is treated with sodium amalgam, when chloride of sodium and an amalgam of the metal employed are obtained. By distilling the chromium amalgam in a current of hydrogen, metallic chromium is obtained. Ordinarily this metal can be produced only by means of very high temperatures and somewhat lengthy manipulations; by the new process it may be obtained in a few hours. Chromium is attacked by boiling hydrochloric acid, but resists the effects of sulphuric and nitric acids. It would appear that, unlike the other metals mentioned, chromium amalgam cannot be obtained electrolytically by means of a mercury cathode.

radiation after they have been converted into obscure heat, by their contact with the blackened tubes.

The relative inclination to the latitude of the spot on which the apparatus stands having been, once for all, determined, it is only necessary to turn the handle, *n*, Fig. 2, which works the sector, C, Fig. 1, to produce the diurnal movement of the reflector; this can also be effected automatically. Referring to the drawing, A represents a masonry pedestal; B, Fig. 1, a stirrup-shaped support in cast iron turning on the shaft, *a*, by which the apparatus is arranged relatively to the latitude of the spot on which it is erected; C, Fig. 1, is a sector fitted on the shaft, *b*, by which the apparatus is made to follow the diurnal moment of the sun; D, Fig. 1, represents the cast iron standards which support the boiler and the reflector; E, Fig. 1, the framework to which the boiler and the skeleton of the reflector are attached; F, Fig. 2, the tubular boiler of plate iron; G, Fig. 2, the glass jacket; H, Fig. 2, the steam dome; I, the safety valve; at J is the steam gauge; *m*, Fig. 2, the screw which works the sector, M, for giving the latitudinal inclination; *n*, Fig. 2, the handle by which, through a train of geared wheels, the diurnal movement of the sector, C, Fig. 1, is actuated; and S, the sector fitted on the shaft, *r*, Fig. 2, worked by the screw, O, to alter the position of the boiler and reflector, according to the different solstitial angles in summer and winter. The extreme diameter of the reflector is about 5 meters; the area of the opening, therefore, about 20 square meters. The boiler—nominally, 3-horse power (?)—weighs, with its accessories, 440 lbs., with an extreme length of 8-20 ft., and a capacity of 44 gallons, or 3-53 cubic feet, 1-059 cubic feet of which is steam space, and the remainder, or 2-471 cubic feet, water. The usual time required to get up steam varies, of course, with the intensity of the sun's rays, the state of the atmosphere, etc., and is generally 1½ hours for the first and 8 minutes for every succeeding 15 lbs. pressure; and adopting the data of September 22d as the result of mean autumnal influence, and as a fair criterion, we find that on that day a steam pump connected with the apparatus was lifting between 2,000 and 3,000 liters, or 4-600 gallons, per hour for a

tensive application, until it has achieved the limited purpose for which it was constructed. Far be it from our task to judge the matter hastily or to depreciate the laudable efforts of the inventors, but we must, nevertheless, looking to practical and not to theoretical results for guidance, withhold our acquiescence in the favorable verdict passed on the desultory experiments by a large body of French *savants* who appear to have been too much impressed with its ingenuity to appreciate the absence of practical application.—*The Engineer.*

THE WALLED LAKE IN IOWA.

ACCORDING to the Dubuque *Herald*, the greatest wonder in Iowa, and perhaps any other State, is what is known as the "Walled Lake," situated in Wright County, 150 miles west of Dubuque City. The lake is from two to three feet higher than the surface of the surrounding land. In some places the wall is ten feet high, fifteen feet wide at the bottom, and five feet wide on the top. Another remarkable thing is the size of the stones used in constructing the wall. Stones are abundant in Wright County, but surrounding the lake for a distance of five miles there are none. No one can conjecture as to the means that were employed to transport the stones, nor as to who constructed the wall. Around the entire lake there is a belt of woodland half a mile in length, and composed of oak trees; with this exception, the country is a rolling prairie. The trees must have been planted there at the time of the building of the wall. In the year 1856 there was a great storm; the ice on the lake broke the wall in several places, and the farmers in the vicinity were obliged to repair the breaches to prevent an inundation.

The lake occupies a ground surface of 2,800 acres, and has a depth of 25 feet. The water is clear and cold; the soil sandy and loamy. It is singular that no one has as yet been able to ascertain where the water, which is always clear and fresh, comes from, or where it goes.