scale, with one battery. It consists of 88 pairs, each of which is composed of a plate of rolled zinc, 9 inches wide and 12 long, inserted in copper cases, open at top and bot­tom. These elements are suspended in groups of 11 pairs, or 8 sets in all ; and each of the 8 troughs which are raised up to the elements, are divided into 11 cells by wooden partitions coated with cement

An electric apparatus, in which the phenomena were sup­posed to be independent of chemical action, was invented by J. A. de Luc, in 1809. It consists of a great number of alternations of small discs of zinc, and silvered paper, about an inch in diameter. These discs succeed each other in the following order : zinc, silver, paper ; zinc, sil­ver, paper. When from 500 to 1000 discs are enclosed in a dry glass tube, and the plates are pressed together by a brass cap and screw at each end, the pile will produce dis­tinct electrical effects. When the columns of 1000 series each, are fitted up as in fig. 41, and placed vertically in a glass receiver, a brass ball, suspended by a thread of raw silk, will, by the action of the two piles, continually strike the two bells placed at the lower end of the piles. Mr B. M. Forster suc­ceeded in making an apparatus analogous to the preceding, which rung continually for five months. Mr Singer made one, which rung continually for 14 months, and De Luc had a pendulum which kept vibrating for more than two years.

Mr Singer found that when the paper was perfectly dry, the pile lost all its power, and that it was deteriorated when too much moisture was present. M. Jaeger, however, observed, that when the paper, after being dried to excess, was heated by exposing the pile to a temperature of from 104° to 140°, the pile began to act as powerfully as before. When the paper is in its driest natural state, the pile is ac­tive, and it loses its activity only when the paper is sub­jected to a degree of heat capableof scorching it. By means of a pile of 20,000 groups of silver, zinc, and double discs of writing paper, a series of distinct sparks were obtained. A jar, having a coated disc of 50 square inches, was charged in 1.0 minutes, and gave a disagreeable shock in the elbows and shoulders. The charge of this jar fused one inch of platina wire, the five-thousandth of an inch in diameter. This pile, though exhibiting such power, did not exercise the slightest chemical action.

The two ends of the electric pile are in opposite electric states, the *zinc* extremity being *positive,* and the *silver* ex­tremity *negative,* the middle part being in a neutral state.

M. de Luc and Μ. Hausman observed that the rays of the sun increased the power of the column, an effect which they thought was not due to heat. Mr Singer, however, found that his column was always more powerful in summer than in winter, and in a room with a fire than in one without it.

M. De Luc has shown how the dry pile may be used in determining the conducting power of bodies, and also their insulating qualities, and he has likewise employed it as an aerial electroscope for indicating the electrical changes which take place in the atmosphere.@@'

In 1812, Professor Zamboni of Verona made a consider­able improvement on the pile of De Luc. He dispenses en­tirely with the discs of zinc, and employs only discs of paper, one of whose surfaces is silvered, or rather *tinned,* and the other covered with a thin film of the peroxide of manganese pulverised in a mixture of milk and flour. The faces of tin are placed in contact with those of manganese, the *tin* being *the positive,* and *the peroxide* the negative element. M. Zamboni has been endeavouring during the last 20 years, to produce by this pile a *perpetual* or long-continued motion ; but the motion, though often long-continued, frequently ceases for a while, and sometimes altogether, when the elec­tric force of the apparatus has been enfeebled.

Chemists and natural philosophers had in vain endeavour­ed to produce chemical effects by means of the dry pile ; but M. Gassiot has very recently@@2 succeeded in exhibiting its chemical power. Having constructed a pile of 10,000 series of discs of laminated zinc, paper, and oxide of man­ganese, each about one inch in diameter, he divided it into separate piles of 1000 each. With this apparatus he suc­ceeded in obtaining sparks which passed through the space of 1/10 th of an inch. When the distance of the points was 1/50th of an inch, the stream of sparks was so powerful as to produce that peculiar phosphorescent odour which is always perceptible in the action of the electrical machine. With one of the piles of 1000 series, a spark passed through a space of the 12/5000dth of an inch ; but what was of more inte­rest, M. Gassiot succeeded, after many trials, in obtaining chemical decomposition of a solution of *iodide* of *potassium.* He fastened about two inches of platinum wire to each end of the pile of 10,000 series, the two points of his micrometer electrometer being brought parallel to each other, so as to be about a quarter of an inch apart. A piece of bibulous paper saturated with a solution of iodide of potassium was placed on a slip of glass, and then brought into contact with the ends of the wires from each extremity of the pile. The iodine then appeared invariably on the end of the wire at­tached to the end of the pile, which terminated with the oxide of manganese.

The dry pile has been applied with much success by Μ. Bohnenberg, in constructing an electroscope of great deli­cacy. Having suspended between the two opposite poles of two piles a single strip of gold leaf, he found that this leaf, however slightly it was electrified, was drawn to one or other of the poles, according to the nature of the electricity with which it was influenced. In this way he obtained an instru­ment, not only sensible to small electrical influences, but ca­pable of indicating the kind of electricity which was pre­sent.@@3

Before concluding this part of the subject, we shall de­scribe some series of apparatus, which have been employed in the most recent researches, both in this country and on the continent, in conducting the important researches to which we shall afterwards refer, respecting the reduction of oxides and earths by *weak electric* currents. Μ. Becquerel employed only a single pair of plates, in connection with his decomposing cell. Having closed a glass tube at one end by a plug of moistened clay, he immersed it in a weak solution of common salt. The solution of the metallic salt to be de­composed, was then placed in this glass tube, and a com­pound metallic arc, formed of zinc and platinum, was placed in the solution in such a manner, that the platinum leg was immersed in the tube containing the metallic solution (the *negative tube* of Becquerel), while the zinc dips in the solu­tion of salt. Chemical decomposition then takes place, and in a few hours or more, sometimes a few weeks, the metal appears on the plate of platinum, in a form more or less crystallised.

Dr Golding Bird, in prosecuting similar researches, has contrived a simple form of the battery, which with Becque­rel’s cell, enables us to perform this class of experiments with facility and certainty. It consists of a large glass cy­linder A, (tig. 42,) 8 inches deep and 2 in diameter. With-

@@@, See Nicholson's Journal, vol. xxvii. p. 81, 161,241, and also vol. xxviii. p. 5 *Phil. Mag.* 1810, vol. xxxv., vi. and vii. and Singer's *Elements of Electricity.*

*@@@’ Phil. Trans.,* 1840, part i. p. 191, note.

@@@• See *Annales de Chim. et de Phys.* tom. Xvi. p. 91, and *Bibl Univ.* tom. xv. p. 163 Gilbert’s Annalen der Physik, vol. xlix.