time that magnetic contact was made, the convulsive effect increasing with the suddenness with which the contact was broken and restored.

Dr Faraday, as we have now seen, was the first person who obtained, in November 1831, the electric spark from a magnet. The spark which he obtained was got from a soft iron magnet, made by the influence of a voltaic current. Professor Nobili@@1 and Antinori afterwards obtained the elec­tric spark from a soft iron magnet, made by the influence of a common artificial magnet ; and Professor Forbes (March 1832) obtained the electric spark from a soft iron magnet, made by the influence of a natural loadstone.@@1 The method adopted by Professor Forbes is shewn in fig. 76, where A is a suspended natural magnet. A cylindrical keeper or arma­ture, *ab,* has a helix, *c,* coiled round it, about 7½ inches long, and consisting of about 150 feet of copper wire, about 1-20th of an inch in diameter; the helix consisted of four layers in thickness, separated by insulating partitions of cloth and sealing wax. The branch *bde* of the wire terminates in the bottom of the glass tube *h,* containing mercury, with a pure surface. The other branch *f* of the helix communicates by means of the mercury cup *i*, with the iron wire *g,* the fine point of which is brought by the hand into contact with the surface of the mercury in *h.* and is separated from it the in­stant the keeper *ab* is brought into contact with the poles of the magnet ; the spark is then produced in the tube *h*.@@5

That the action of magneto-electricity is the converse of that of electro-magnetism, is well shown in the rotatory ap­paratus in fig. 77. It consists of a copper disc C, re­volving round a horizontal axis by means of the han­dle H. A power­ful horse-shoe magnet, AB, is so placed that the edge of the disc C, can revolve be­tween its poles

*n, s.* Two conducting wires *w, w,,* are so placed, that two of their extremities terminate in the mercury cups of a gal­vanometer *g,* while the other end of the first is kept in perfect metallic contact with the axis, and the other end of the second is in contact with the circumference of the disc at the point between the poles *n* and *s* of the magnet. When this disc revolves from right to left, an electric current proceeding from the centre to the circumference of the disc, is generated in the direction of the curves, and the needle of the galvanometer is deflected. If the disc revolve from left to right, the electric current moves in the opposite direction.

For further information on the subject of magneto-elec­tric induction, see Mr Faraday’s recent papers in the *An­nales de Chimie et de Physique,* tom. li. p. 404, &c., *Lond. and Ed. Phil. Mag.* October and November 1840, vol. xvii. p. 281 and 356, and Dr Golding Bird’s *Elements of Natu­ral Philosophy,* Lond. 1839, p. 243.

*Description of Magneto-Electric Apparatus.*

After Dr Faraday’s great discovery of *magneto-electric* and *volta-electric induction,* various machines were con­structed for experimental investigation and exhibition. M. Hippolyte Pixii of Paris exhibited to the Academy of Sciences in 1832, his *magneto-electric* machine. A power­ful magnet was made to revolve with great rapidity before its keeper or armature, which had round it a coil of copper wire about three thousand feet long. By this means sparks and severe shocks were obtained, a feeble charge was ac­cumulated in a Leyden phial, the gold leaves of an electro­meter were made to diverge, and water was decomposed.

A very ingenious and complete machine was exhibited by Mr Saxton, at the meeting of the British Association in June 1833, as shewn in fig. 78. The magnet A is a horse-shoe one of great power, composed of many steel plates, closely applied to each other, or it may be a soft iron electro magnet of the same shape. A keeper, CD, of the purest soft iron, has each of its ends bent in­to a right angle, and is so mounted that the surfaces of their ends are exactly oppo­site and close to the poles of the magnet. In this position the keeper CD may be made to revolve round the horizon­tal axis EF, by means of the wheels C and E, and band GE fixed to the upright pillar B. Round each end, C, D, of the keeper, are coiled two series of copper wires, cover­ed with sdk, so as to form compound helices. The ends of these wires, which have the same direction, are joined together, and are likewise connected with a circular disc, revolving with the keeper in a cup of mercury, with which in every position of the disc it is in metallic communica­tion. The other ends of the wires are joined, and passing together without metallic contact through the spindle EF, terminate in a slip of copper, with two opposite points, as at *i*, at right angles to the axis. These points alternately dip into, and rise above the mercury, in another cup, K, which may be connected with the first by means of a cop­per wire. Now, whenever the ends of the keeper are op­posite the poles of the magnet, the keeper becomes a tem­porary magnet, and it ceases to be so when the line joining them is at right angles to the line joining the two poles. The instantaneous generation and extinction of the mag­netic force, which takes an opposite direction in the keeper according as its opposite ends are close to the same poles, and induce corresponding opposite electric currents in the copper wire, provided the circuit is complete by the immer­sion of the points at *i.* The arrangement of the points at *i* is such, that they just rise from the mercury as the ends of the keeper come opposite to the poles of the magnet ; and hence the sudden breach of the circuit makes the current pass in the form of a brilliant spark. If a fine platinum wire, instead of the dipping points, forms the communication between the revolving disc and spindle. It may be kept at a red heat. Its light slightly intermitting from the alterna­tion of the currents. If a communication is formed be-

@@@1 Ann. de Chim. December 1831, and Antologia, November 1831.

@@@, See Phil. Mug. June 1832, p. 401, and Lond. and Ed. Phil. Mag. November 1834.

@@@\* Edin. Trans, vol. xii.