per wire, 1/12th inch in diameter, covered with cotton thread. The two ends of the wire are connected with *p,p',* by means of binding screws. Over this primary coil is wound a second insulated copper wire, 1/80th inch in dia­meter, and about 1500 feet long, and the two ends of this wire are connected with *s*, *s',* by means of binding screws. From the law of electro-dynamic induction. It is evident

that, if the ends *p,p,* of the thick coil are connected with a single pair of voltaic ele­ments, as at *a*, a current of electricity is set in motion in the thin coil, and, in breaking contact, a second current in another direction traverses the same coil, sufficiently intense to give a powerful shock, by grasping the handles *d, d,* communicating with the extremities *s, s', of* the thin coil. The intensity of the second­ary or reduced current is greatly increased, by inserting a bar *i*, of soft wire, or what is better, a bundle of soft iron wires in the hollow axis of the steel, which becomes mag­netic.

The ingenious method of breaking contact in this arrange­ment, which we owe to Dr Golding Bird, though shewn in fig. 81, is more distinctly re­presented in fig. 82. It con­sists of a base of wood, eight inches long and three broad, having at both ends a piece of hard wood, A, B, each piece having two holes excavated in it to hold mercury. The holes in A communicate with those in B, by thick copper wires D, D. A piece of soft iron wire EF, five inches long, and one- eighth inch diameter, supported with screws with milled heads, moves in a vertical plane upon the upright stem C. Round the wire EF are wound two helices of thin insu­lated copper wire in the same direction from right to left, so that the two ends of one helix may terminate in the copper points G, H, and those of the other in the points KNL. The small horse-shoe *permanent* magnets, shewn in fig. 82, are fixed on proper supports, near the ends of the bar EF, so that in depressing the end F of the bar. It may be opposite one, suppose the *south* pole of one magnet, and consequently the end E will be opposite the other, the *north* pole of the second magnet. On raising the end F, the contrary will take place, and to effect this the similar poles of the magnet should be in the same direction. Up­on connecting the mercury cups in A or B, as shewn in fig. 81, with the small voltaic battery at *a,* the wire EF will become a temporary magnet, if the ends of either helix are allowed to dip in the mercury ; and if connection with the battery is properly made, the ends or poles of the tem­porary magnet will be repelled by the poles of the per­manent magnet to which they are opposed ; the bar EF will therefore move, and make the ends of the second he­lix dip in the other cups of mercury,—repulsion will again take place, and so on ;—in this way, about 300 oscillatione of EF can be obtained in a minute. Upon connecting the ends *p,p,* of the thick helix with a single voltaic pair, by means of this contact-breaker, a series of powerful induced currents will be obtained from the extremities *s, s’,* of the larger helix. This connection is best made, as in fig. 82, where R is a section of the reel, S one end of the short helix, connected with a cup of mercury in the piece B, Z the other end of the short helix, connected with one plate of the battery, while the wire C connects the other cup of mercury in B with the other plate of the voltaic pair. When the points G, H, K, L, leave the mercury, very brilliant sparks are produced. A loud snapping noise ac­companies them, and a vivid combustion of the mercury, clouds of the oxide of mercury being largely evolved. If the ends P, R, fig. 82, or *s*, *s'*, fig.81, have platinum points, and are immersed in water, acidulated with sulphuric acid, torrents of minute bubbles of oxygen and hydrogen are evolved; and if, instead of water, the points are pressed upon paper, moistened with iodide of potassium, iodine and oxide of potassium are separated. Solutions of sulphate of potash and soap, chloride of potassium, sodium, antimo­ny, and copper, are also rapidly decomposed. Dr Page was the first person who suggested the application of per­manent magnets for the purpose of breaking contact, though Dr Bird afterwards, and without knowing this, made the same application.@@1

We shall now conclude this chapter with a brief notice of some very recent investigations of Dr Draper of New York, on the electromotive power of heat. The apparatus which he employed is shewn in fig. 83, where AA is a glass vessel about three inches in diameter, with a neck wide enough to receive a mercurial thermometer *b,* and the extremity of a pair of thermo-electric wires about a foot long, and the 1/16th of an inch in diameter, soldered at *s* with hard solder. The free extremities of these wires dip into the glass cups *d, d,* filled with mercury, and immersed in a trough *e,* containing water and pounded ice. By means of the copper wires *f, f,* 1/6th of an inch in diameter, the apparatus is connected with the mercury cups of the galvanometer, the coil of which is of copper wire, 1/8th of an inch thick, and making only twelve turns round the ar- tatic needles, whose deviations are determined by the tor­sion of a glass thread, as invented by Dr Ritchie. When a copper and iron wire are used, they indicate temperatures with a promptitude and accuracy quite surprising. In

@@@’ See Lond. and Edin. Pbil. Mag., Jan. 1838, vol. xii. p. 18; Noad’s Lectures, p 364; and Dr Golding Bird's Elements of Nat. Phil. chap. xvii.