IMPROVED WIMSHURST STATIC ELECTRICAL MACHINE.

The former construction of the Wimshurst machine is shown by working drawings in SCIENTIFIC AMERICAN SUPPLEMENT, No. 548. The present is a simple improvement by which peculiar results are obtained. It is described by *Engineering* as follows:

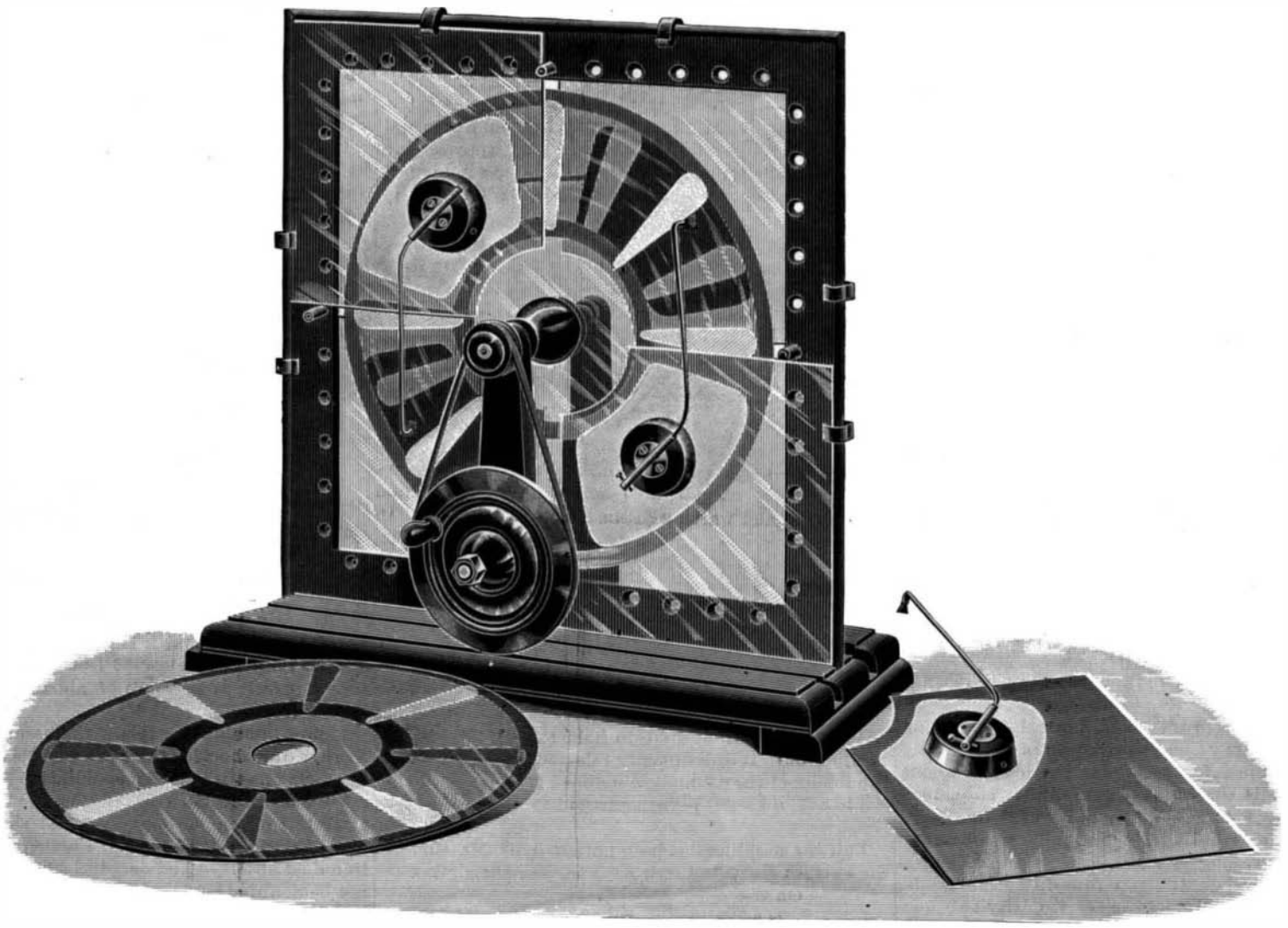
Among the various machines which have been constructed for the generation of statical or so-called frictional electricity, none can be compared with that of Mr. James Wimshurst, of the consultative staff of the Board of Trade, London, either for simplicity, reliability, or efficiency. These merits of the Wimshurst influence machine are known to a very wide circle of electricians and physicists; consequently the news that the inventor has brought out another, having very curious and unlooked for qualities, will be received with interest and expectation in many laboratories, schools, and homes, and will secure for it an attentive reception, which its remarkable features fully justify. The new apparatus was lately exhibited for the first time before the Physical Society.

A remarkable feature of the new machine is that while it gives an abundance of sparks, it is impossible to charge a Leyden jar, or similar contrivance, from it. After the electricity has been apparently flowing for minutes into the jar in rapid sparks, the latter is found to be free from all charge. Neither spark nor shock can be obtained from it, and delicate tests fail to reveal the presence of electricity in it. It is as if one had been pumping water into a bucket with no bottom; the stream is plainly to be seen, but nothing accumulates. It is, however, easy to demonstrate the integrity of the jar, and its capacity to hold a charge when filled from an ordinary machine. The conclusion is therefore forced upon us that the current of sparks is really the oscillation of a small charge, which flows backward and forward with great rapidity between the machine and the jar. The electricity that is developed is alternately positive and negative, and the normal condition of the jar is not upset.

If we investigate the action of the machine more minutely by the aid of an electroscope of an exceedingly delicate construction, we find confirmation of the hypothesis that positive and negative electricity is produced alternately. Commencing to turn the disk exceedingly slowly, say at the rate of three or four revolutions per minute, the leaves of the electroscope suddenly diverge, being repelled from each other. They remain apart quite steadily until the disk has made rather more than three-quarters of a revolution, when they suddenly approach and cling together, showing that the sign of their charge has changed. They remain thus for an instant, and during another three-quarters of a revolution they again separate, and so on. But if the disk be turned rapidly the leaves are no longer able to respond in this way to the changes of charge. Such light appliances, with their large surfaces exposed to the air, are incapable of rapidly approaching and receding through a considerable distance under the small stresses brought to bear upon them. They consequently take up a mean position between the extreme ends of the range, and show the alternate attractions and repulsions to which they are subject, by a quick fluttering or tremor. It is abundantly evident that they are subject to varying stresses, which the retarding effect of the atmosphere will not allow them to completely obey.

The appearance of the machine is clearly shown in the engraving. A central spindle carries a glass disk 16 in. in diameter. This is varnished, and has affixed to it a number of sectors of tinfoil. The sectors measure 4 in. radially, while in breadth they may vary from ¼ in. to 5½ in. Usually the sectors on one side of the disk are arranged to break joint with those on the other side, but this is not essential. Indeed, in many respects the construction of the machine is very elastic, and many modifications are introduced. For instance, the number of tinfoil sectors may vary from 2 to 16 or more, on each side, and as we have said, their relative positions on the two surfaces of the disks are not important. The disk itself is mounted in the center of and in the same plane as a wooden frame 20 in. square. This frame carries four inductors of the shape shown in the detached view; they are 9¾ in. square, with one corner cut away to admit the spindle and boss of the disk. Two of the inductors are mounted on each side of the frame, at opposite diagonal corners; those at the side of the machine nearest the spectator are, say, at the upper left hand and the lower right hand corners. At the opposite side the inductors are at the upper right hand and the lower left hand corners. Upon each inductor plate is a tinfoil patch of the shape shown, measuring 4 in. radially and 7 in. circumferentially. Other inductors are provided, having upon them the smallest tinfoil patch practicable. Cemented over each patch is a wooden disk which on its face carries a bearing in which there rides a bent brass rod, having a plume of fine wires at its end, touching the glass disks at a point 90 deg. remote from the inductor, and opposite one of the inductors at the other side of the plate. The disk is thus touched on both sides in two places. It is driven by a cord from a small handwheel below, and revolves in the direction of the hands of a clock. To further vary the capabilities of the machine a bar of insulating material is made to carry two metal wire plumes at its ends, these having metallic connection with two terminals; this device takes the place of two of the inductors and by its use a constant flow of electricity may be maintained.

The machine which we illustrate has been constructed with the view of being most readily used for the purpose of demonstration and experiment. It is provided with several disks, having different arrangements of sectors, and all the parts are made interchangeable. By withdrawing the rear bearing the nut on the spindle can be screwed off at once, when half the boss comes away and the disk can be withdrawn and be replaced by another in a few moments. The inductors lie on pegs on the square frame, and are held by light steel clips; provision is made by a number of holes in the frame for the use of inductors of different sizes. To couple one inductor to another, if such an arrangement should be desired, holes are bored in the wooden disks carrying the brush holders, and into these holders the ends of wires can be inserted, the wires being bent in such a way to join any pair of inductors. The parts of the machine are beautifully finished, and all the ends are attained by the simplest devices. The method of action of this instrument is not very easy to follow, and indeed no theory has yet been put forward in explanation of the results which flow from it.



THE WIMSHURST ALTERNATING INFLUENCE MACHINE.

Curious Electrical Phenomenon.

Some remarkable electrical phenomena accompanying the production upon a large scale of solid carbon dioxide are described, says *Nature*, by Dr. Haussknecht, of Berlin, in the current number of the *Berichte* of the German Chemical Society. In order to obtain large quantities of solid carbonic acid, it is found most convenient in practice to allow the liquid stored in the usual form of iron cylinder to escape into a stout canvas bag. The liquid issues at pressures varying from 60 to 80 atmospheres, and a compact snow-like mass of solid carbon dioxide is formed in the canvas receiver. When the experiment is performed in the dark, the canvas receiver is seen to be illuminated within by a pale greenish violet light, and Dr. Haussknecht states that electric sparks 10 to 20 cm. long dart out from the pores of the cloth. Dr. Haussknecht further states that the phenomenon is very noticeable in the dark, whenever there is a leakage in any portion of the compressing apparatus or the manometers connected therewith. The reason assigned for this development of statical electricity is similar in principle to that usually accepted in explanation of the hydro-electric machine of Sir William Armstrong. As the liquid carbonic acid is issuing from the valve, it becomes partly converted into gas, which is violently forced through every pore of the canvas. Moreover, carried along with this stream of gas are great quantities of minute globules of liquid, which are brought in forcible contact with the solid particles already deposited. Dr. Haussknecht, therefore, considers that the electrical excitation is due mainly to the violent friction between these liquid globules and the solid snow. It is very essential for the successful reproduction of these electrical phenomena that the carbon dioxide should be absolutely free from admixed air; that prepared artificially yielding much finer results than that obtained from natural waters, which latter contains considerable quantities of air. The luminosity is not generally developed in the interior of the receiver until a crust of solid carbonic acid 0·5 to 1 cm. thick has been deposited, which renders the probability of the correctness of the above theory all the greater.