mous in the opinion that the inner part of the embankment should be the most impervious, and that if it cannot be homogeneous in structure, the materials should be so placed that the imperviousness of the inner part should change gradually to the porosity of the outer. In following this practice it would be impossible in all well executed structures for the full head, or any head of water, to be exerted against a centre wall.

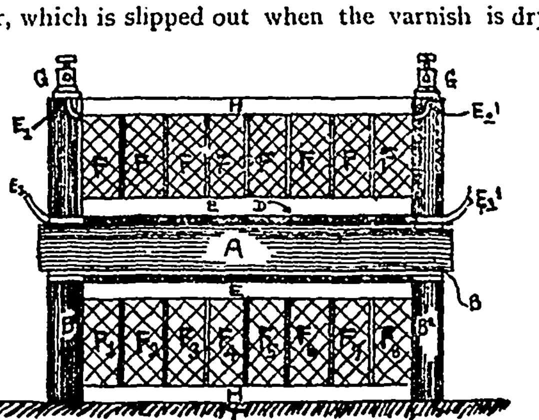
If the intention is to place all the impervious material near the centre and next to the core wall, the design is one of the worst that can be conceived. In such an embankment there is a porous mass of earth next to the water, through which the latter can readily seep or percolate, then a heart wall encased in clay puddle much too weak to sustain the hydrostatic pressure, and back of this a second porous mass of earth too weak in itself to retain the impounded water. This method of retaining water reminds the writer of the city engineer of a Western city who built a stand pipe of brick, and, to be doubly safe, lined its exterior with thin sheet-iron plates. When the water was first turned in it never rose to the full head, but burst the brick and afterwards the thin sheet-iron. In impounding water one must depend wholly upon one particular class of material to sustain the pressure and prevent seepage and percolation.

AN INDUCTION COIL.

J. B. HALL, E.E.

The construction of an induction coil to give a 4 inch spark, to be used for producing X rays with vacuum tubes.

The core A is composed of No. 22 B. & S. gauge iron wire in pieces 10 inches long, the tube B being filled with them. The tube B is made of paper, stuck together with shellac varnish, formed on a round rod 1 inch diameter, which is slipped out when the varnish is dry.



Scale in inches 1 2 3

FIG. 1. INDUCTION COIL IN SECTION.

The end blocks C are of vulcanite or red fibre and are $\frac{3}{4}$ inch thick by 7 inches square, drilled to permit the terminals of the primary ($E1$ & $E1^1$) and secondary ($E2$ & $E2^1$) coils to pass out, also drilled and tapped to receive screws to hold the coil to base. The primary coil D is composed of 64 wires of No. 14 B. & S. gauge double cotton-covered copper wire, with terminals, taped or enclosed in a rubber tube, emitting from the end blocks ($B1$ & $B2$) and connected to binding posts. Upon completion of the primary coil, it is well wrapped with paper until cover E is $\frac{3}{8}$ inch thick, shellacking the layers to cause them to stick together. When the shellac is dry, the secondary coils are to be slipped over. The secondary coils F are composed of No. 31 double cotton-covered, B. and S. gauge copper wire. They are wound on a former (Fig. 2), the former first having a strip of presser unsized cardboard wound on it to act as a stiffener or base for the coils. The coils F are

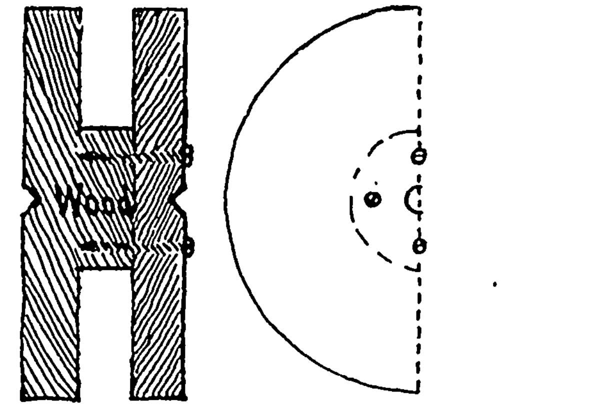
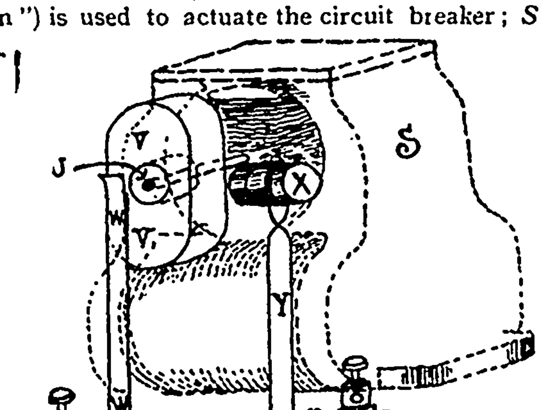


FIG 2.
FORM FOR SECONDARY COIL.
Scale in inches 1 2 3

eight in number, and each when completed is removed from the former with the cardboard attached, and taped with two thicknesses of best quality adhesive tape. They are then slipped on the coil over tube E, care being taken that they are all turned in the same direction, the end of No. 1 joining the beginning of No. 2. (It is better to mark the terminals so that no mistake will happen.) Lead the terminals $E2$ and $E2^1$ (enclosed in rubber tubes) out, as shown, to the binding posts, GG^1, from whence connection may be made to the vacuum tube. Complete the coil by wrapping it with varnished paper to $\frac{3}{8}$-inch thick, H, sticking it with shellac, after which it may be screwed to its base I, and the connections made to circuit breaker. The circuit breaker is a novel one. Owing to the large current and voltage being used, the ordinary make and break contact is unworkable, so the following method is substituted. A toy electric motor (such as a "Franklin") is used to actuate the circuit breaker; S is the



Scale in inches. VIEW OF CIRCUIT BREAKER.
FIG. 3.

motor on whose shaft is fastened a fibre washer U, on which fibre washer is fastened a carbon block, elliptic shape, V, of carbon $\frac{1}{4}$-inch thick, against the side of which continually presses a contact of spring brass, W, $\frac{1}{2}$ inch wide by $\frac{1}{32}$ thick, on which is a binding post. The edge of the elliptical carbon is in contact twice, apart of each revolution, with a piece of $\frac{1}{2}$ inch electric light carbon, X, held by a spring clip on a spring contact, Y, to which is screwed a binding post. The circuit is broken with the usual spark and heating, but the carbon is easily replaced and answers all the requirements that platinum fulfils in the same place, besides being much cheaper. The motor is run by taking off the current from one storage battery of the number used to excite the primary coil.