

## ELECTROMAGNETIC INDUCTION IN CONDUCTORS OF DIFFERENT MATERIALS AND IN ELECTROLYTES.

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This investigation was undertaken for the purpose of determining whether or not the character of a conductor has any effect upon the electro-motive force generated in it when it is made to cut magnetic lines of force.

Is the e. m. f. generated in a copper wire of given length exactly equal to the e. m. f. generated in a silver wire of the same length when both cut lines of force at the same rate? And is this e. m. f. equal to that generated in a nonconducting tube of length  $l$ , filled with an electrolyte, when the electrolyte is made to cut lines of force at the above rate? Electrolytic conduction and metallic conduction appear to be very different processes, why then should one expect metals and electrolytes to give identical results from electromagnetic induction?

It is evident that many difficulties and sources of error will be avoided if the two conductors to be tested can be placed together and made to cut the same field in such a manner that the resultant e. m. f. generated is zero, provided that electromagnetic induction is independent of the substance of the conductor. Also, the direction of the e. m. f. must be constant if a sensitive galvanometer is to be used to detect it.

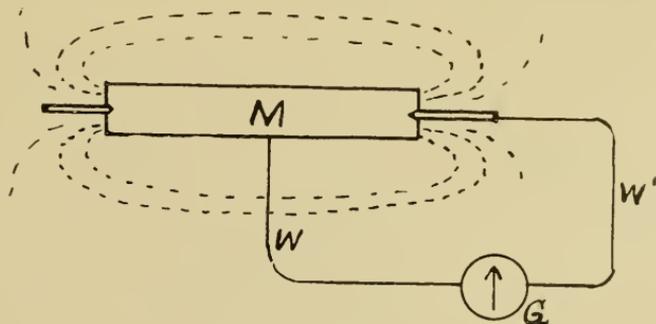


Fig. 1.

Let  $M$  (Fig. 1) be a cylindrical magnet mounted to revolve about its axis, and let  $w$  and  $w'$  be wires in contact respectively with the middle of the magnet and the center of the end, and connected, as shown, to a gal-

vanometer,  $G$ . Suppose the magnet to be revolved at a high speed. Few lines of force cut  $w^1$ , as it is parallel with the axis of the magnet.  $W$  is cut by the lines passing from pole to pole and if the pole strength is sufficiently great and the magnet is revolved rapidly, the galvanometer will indicate a current—and therefore an induced e. m. f. If  $w$  and  $w^1$  are led from the magnet as in Fig 2, it is evident that the resultant e. m. f. generated is zero, since that generated in  $w$  opposes that generated in  $w^1$ . But suppose that  $w$  is of one metal and  $w^1$  of another, if the e. m. f. generated in each is not the same, the galvanometer, if sufficiently sensitive, will indicate a current. The wire  $w^1$  may be replaced with a tube containing an electrolyte and the electromagnetic induction in the electrolyte measured. To increase the sensitiveness of the apparatus there may be a number of  $w$ 's and  $w^1$ 's connected as shown in Fig. 3.

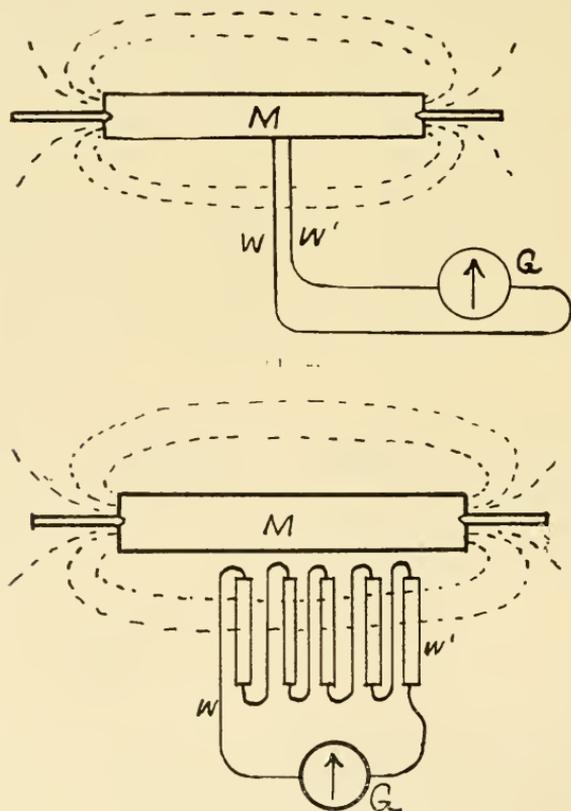


Fig. 3.

Although considerable work has been done, it has been entirely of a preliminary character. With a magnet of pole-strength 415, making 4,000 revolutions per minute, with 100 copper wires ( $w$ ) and 100 German silver wires ( $w^1$ ), the junior author of this paper found that no current was indicated by a galvanometer whose constant was  $1.1 \times 10^{-9}$ . The magnet was rotated by an electric motor and the galvanometer was placed on a pier in an adjoining room some thirty feet distant. Work with electrolytes is now in progress.

The senior author is arranging to make the apparatus more sensitive by using an electromagnetic field and a more delicate galvanometer. Results will be given in a future paper.