

On a Method of Driving Tuning-Forks Electrically

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1888 Proc. Phys. Soc. London 10 288

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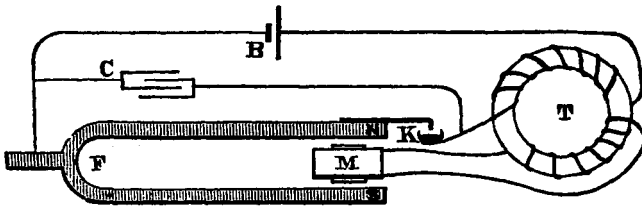
XXXVIII. *On a Method of Driving Tuning-Forks Electrically.* By W. G. GREGORY, M.A., *Demonstrator in Physics at the Royal Indian Engineering College, Coopers Hill**.

IN the ordinary method of driving tuning-forks by electricity, the battery circuit is completed just before the end of the stroke and broken again soon after the commencement of the return motion. Thus the fork receives its impulse at a most unfavourable moment, *i. e.* when it is stationary. The impulse can be considerably delayed by including in the battery circuit a solenoid into which a solid iron core is inserted more or less till the best result is obtained. This adjustment, however, varies with the amplitude of vibration and the alterations of the contact. The whole matter was discussed in a paper read before the Physical Society on June 26th, 1886, by Prof. S. P. Thompson†, who then suggested the employment of two similar forks which drove one another and settled down to a difference of phase of a quarter of a period. Each fork, therefore, received an impulse when moving at its greatest velocity in the middle of its stroke.

The method I now suggest accomplishes the same thing without the employment of a second fork, and moreover gives two impulses in each complete period instead of one.

The arrangement is shown in fig. 1.

Fig. 1.



F is a tuning-fork mounted in the usual way, and provided with a driving electromagnet M, and contact-maker K. But instead of taking the main battery-current directly through the electromagnet M, it is sent through the primary coil of a kind of transformer T, the secondary circuit of which is

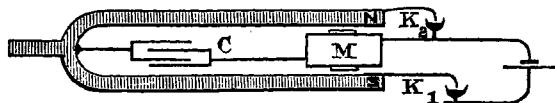
* Read November 1, 1880.

† Proc. Phys. Soc. viii. pt. ii. ; Phil. Mag. [5] xxii. p. 216.

connected to the electromagnet. Hence, at both make and break of the main circuit, momentary induced currents pass through the driving magnet alternately in opposite directions. By polarizing the fork so as to make it a horseshoe-magnet, the impulses are also made to act alternately as attractions and repulsions, and the fork receives two impulses for each complete vibration. By properly adjusting the contact when the fork is at rest, so as just to complete the circuit, the impulses will be given very approximately at the middle of the stroke, and are independent of the amplitude of vibration. The fork I tried made about 86 vibrations per second, and had prongs 20 cms. long and 1.8 cm. apart. The electromagnet M was formed by winding about 50 turns of no. 22 silk-covered copper wire round a core formed of a bundle of varnished iron wire. It was mounted on a wooden support capable of sliding between and parallel to the prongs. The transformer T consists of a core of cotton-covered iron bonnet-wire wound in the form of an anchor-ring having a mean diameter of 6 cms. and thickness 1 cm. Round this is wound the secondary coil of about 160 turns of no. 22 silk-covered copper wire, forming a single layer completely round, and outside this the primary of about 190 turns of similar wire. A condenser C of 4 microfarads capacity was connected across the mercury-break K to diminish the sparking. One small accumulator B sufficed to work the fork vigorously, the mean current consumed being about 2 amperes. By increasing the number of turns of wire, much less current would be required, but there would be a limit, since the lag must not be so great as to interfere with the proper timing of the impulses.

An alternative method, using far less current but requiring two contacts, is shown in fig. 2.

Fig. 2.



The contact K_1 charges the condenser C and K_2 discharges it. The currents of charge and discharge are both taken through the electromagnet M, and the action is the same as above, the fork being, of course, polarized. It would be