

ELECTRIC CLOCKS AND HOW TO MAKE THEM

BY

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CHAPTER III

A HIPPI CLOCK WITH A HALF-SECONDS PENDULUM

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THIS clock is pendulum-driven, that is to say the pendulum drives the wheels instead of the wheelwork and the escapement driving the pendulum. When the pendulum gets tired and loses its swing, it is boosted by an electro-magnet.

The clock was invented by Mathias Hipp, of Reutlingen, over 100 years ago, and is known as Hipp's butterfly escapement. The charm of this invention lies in the human touch which gives life to a dead piece of mechanism. It endows a pendulum with intelligence, or shall we say, an instinct which tells it when it wants help and gives it the ability to get it.

You will see in Fig. 6 the little steel vane, lightly pivoted on the pendulum, which trails over a block with a V-shaped notch in it. As the arc of the pendulum dies down, there comes a time when the vane fails to clear the notch and lodges in it. The pendulum, then, with all its latent energy and immense leverage, forces the block and the spring on which it is mounted, down, and makes a firm electrical contact, in response to which an electro-magnet attracts an armature fixed on the pendulum just above the coils.

Several examples of a Hipp clock appeared in the first edition of this book. This one has been selected for many reasons, among which the following will be appreciated : The fascinating action of the butterfly escapement is in full view immediately below the dial. Only one small round dry cell is required and it will last from three and a half to four years. It is accommodated at the bottom of the case, which is only 18 in. long overall.

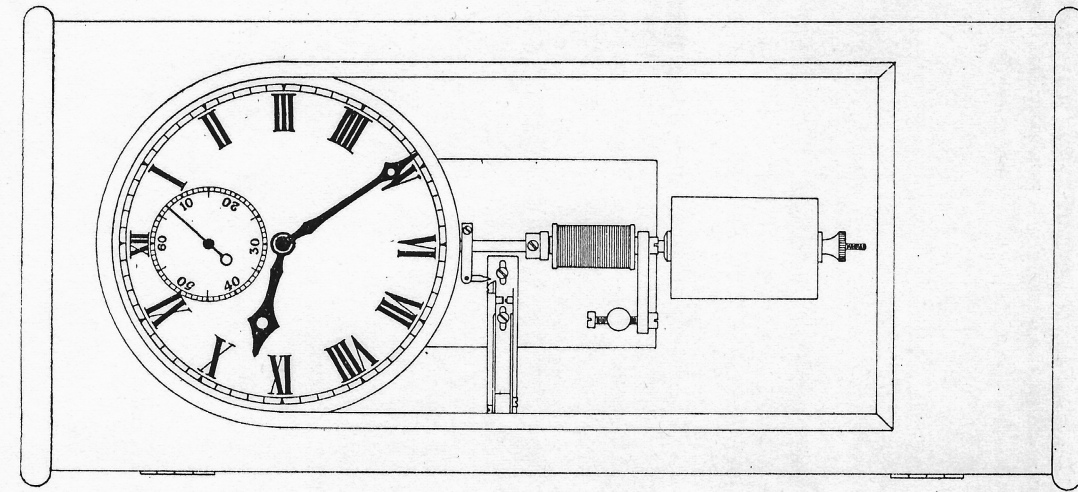


Fig. 1. Front view of completed clock.

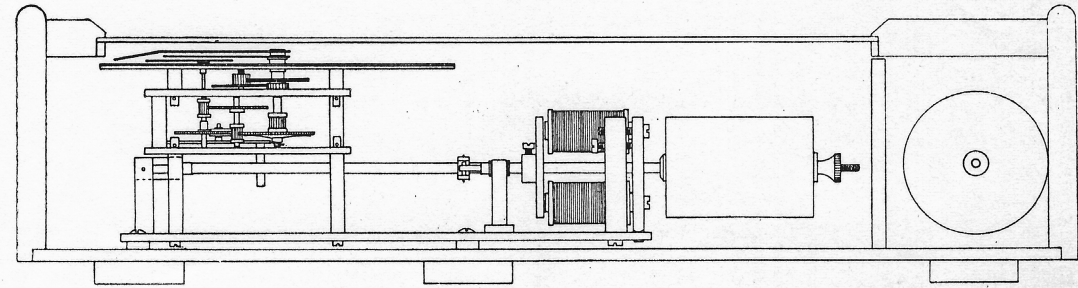


Fig. 2. Side view.

The dial has a dead-beat seconds hand of the distinguished type known as inset seconds. It is in the most convenient position for noting the frequency of the escapement action. When the dry cell is new the electro-magnet boost will take place at intervals of about 30 seconds. In course of time the interval becomes less and less and thus gives a clear indication of the condition of the battery and its expectation of life. Its timekeeping is very good and, thanks to the centre-seconds hand, when the time signals come through it "shows off." It has been known to keep within the six dot-seconds for months at a time, and you will be proud of it.

The drawings being to scale and clearly dimensional, little instruction is needed, but the following constructional notes will be useful:—

The baseplate may be of mild steel or brass and measures 9 in. $\times$ 3 in. $\times$ $\frac{1}{8}$ in. thick.

The pendulum is of $\frac{3}{16}$ -in. rod. It should be of "Invar," an alloy of 66 per cent. steel and 34 per cent. nickel. Its original maker in this country was G. P. Wall, of Sheffield, but if you should experience

difficulty in getting it, don't hesitate to use steel.

Pendulum suspension. A French double-suspension spring is recommended with the usual hook screwed on to the end of the rod.

The *pendulum bob* consists of a brass tube $2\frac{1}{2}$ in. long $\times$ $1\frac{3}{4}$ in. diameter, $\frac{1}{16}$ in. thick, with brass end-caps. A brass tube is fitted through the centre with $\frac{1}{4}$ in. diameter hole. The bob is filled with molten lead and weighs about $2\frac{1}{2}$ lb.

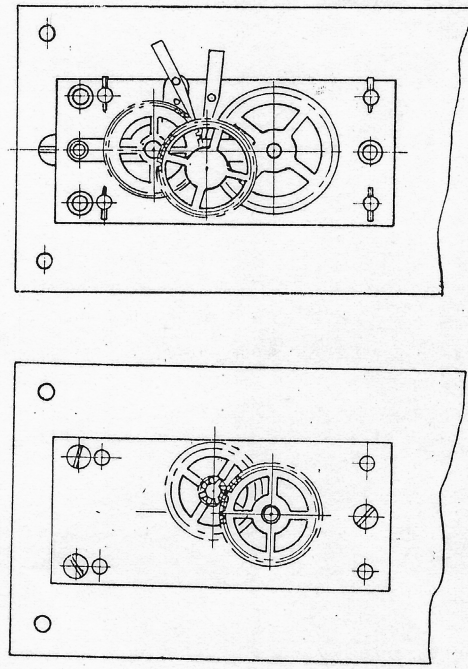


Fig. 3. Front view of movement showing motion wheels. Movement with front plate removed showing the arrangement of the wheel work, propelling and back-stop action.

Collars or washers are fitted to each end of the bob, the top one having a $\frac{3}{16}$ in. diameter hole to take the rod, the bottom one drilled with a $\frac{1}{8}$ -in. hole to take the 5-B.A. rating thread.

The *wheel work* suitable for the job will be found in any old 5-in. alarm clock, but a 60 tooth wheel will be required. It should be 1 in. diameter and $\frac{1}{16}$ in. thick.

The *trailer vane* is $\frac{3}{8}$ in. long from its arbor centre to its tip and is made of steel hardened and tempered. It must be

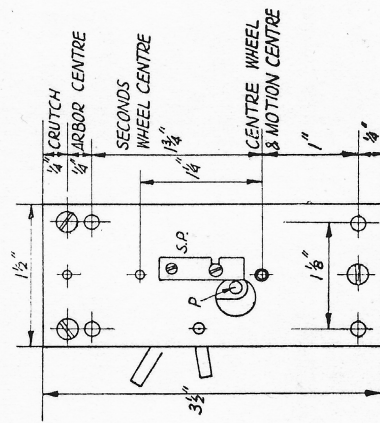


Fig. 4. Back view of movement showing crutch pin (P) resting against an adjustable stop-plate (SP).

finely pivoted in the bracket provided for it. A diameter of 0.02 in. is suggested for the pivots.

The *trailer V block* is made of agate and was purchased

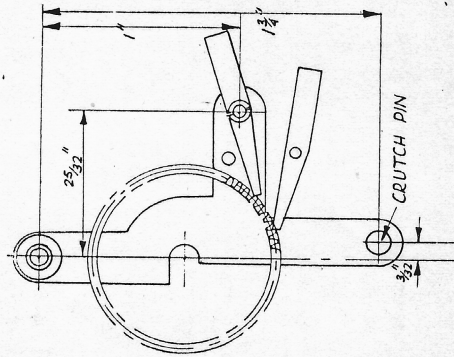


Fig. 5. Propelling and backstop action.

from T. G. Wood, St. John Street, Clerkenwell. The contacts are made of silver.

The magnet poles are $1\frac{1}{2}$ in. long from the bottom shoulder to the top and are made of soft iron rod of $\frac{1}{16}$ in. diameter. Ebonite or bakelite end-caps of $\frac{3}{4}$ in. diameter and $\frac{3}{32}$ in. thick are drilled so that they are a driving fit on to the poles.

Winding. The poles are wound with 30-s.w.g. enamelled copper wire up to the level of the end-caps. Before beginning [to wind, two turns of a good quality paper should be wound round the poles. The resistance of the coils is 10 ohms each. They are joined in series making a total resistance of 20 ohms, which at 1.5 volts produces 75 milliamps. The duration of each impulse is about 0.2 second.

The *magnet yoke* is also made of soft iron; it carries the poles which are securely fitted into it. It has a U-shaped recess cut out of it to allow the pendulum to swing to the left. The yoke is fixed to the base-plate by two 6-B.A. screws, but gets its firm support from the $\frac{3}{8}$ -in. brass pillar

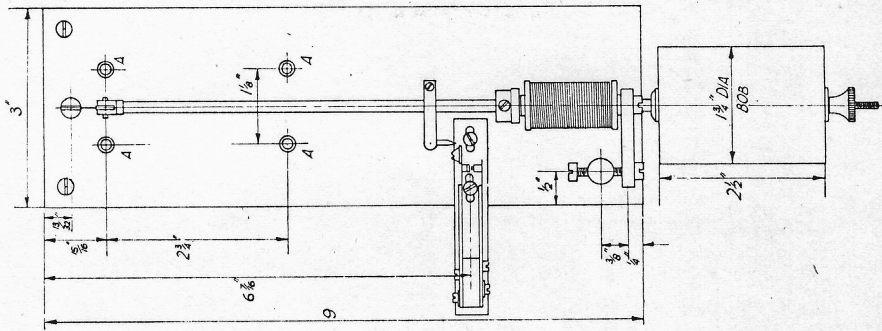


Fig. 6. Baseplate with complete Hipp action fitted. Also pillars (A.A.A.A.) for movement mounting.