Another Fine Meccano Clock

Driven and Controlled by Mains Current

THE great interest that Meccano model-builders have recently displayed in clocks of all types has prompted our expert model-building staff to design an electric clock to be driven by alternating mains current. The driving motor is of the type known as synchronous, which means that it keeps in step with the frequency, or rate of change of direction, of the alternating current supply used. Clocks fitted with motors of this kind cannot run fast or slow, need no winding and are practically noiseless in operation. For this reason they are very popular, especially in the form of small mantel clocks.

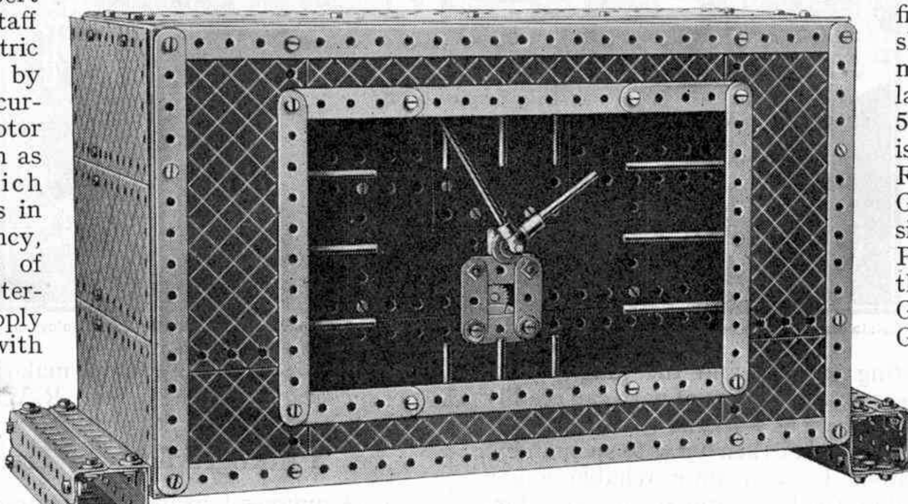

Fig. 1. The fine Meccano electric clock described in this article.

Commercial synchronous clocks are driven directly from alternating current mains, but the clock described in this article obtains the necessary current through a Meccano T6A, T6 or T6M Transformer. As will be seen from Fig. 1, the Meccano clock is artistic and thoroughly modern in appearance, an when properly adjusted it keeps accurate time.

The front and back o the model are not bolted in place but are held in position by the four $5\frac{1}{2}''$ Angle Girders forming the upper and lower corners of the case. Three $2\frac{1}{2}'' \times 2\frac{1}{2}''$ Strip Plates are bolted to the centre of the face as shown, and are so arranged that an opening $1\frac{1}{2}'' \times 1\frac{1}{2}''$ is left in the centre. Before this opening is partially filled up in the manner shown in Fig. 1, a Socket Coupling is added, after which the four $1\frac{1}{2}''$ Strips are bolted in place.

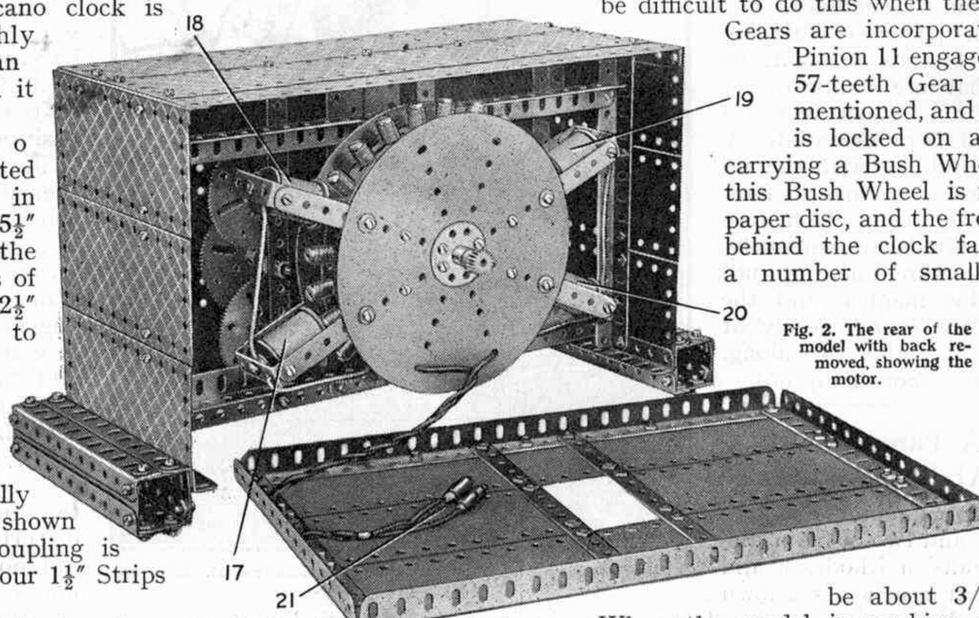

Fig. 2. The rear of the model with back removed, showing the motor.

The clock face is bolted at each corner to a $5\frac{1}{2}''$ Angle Girder, the connection being made three holes from the front end of the Girder. Two extra $7\frac{1}{2}''$ Strips 1 and 2 are fitted to the back of the clock face, the first forming a bearing for three of the gear train axles. Immediately behind the $12\frac{1}{2}''$ Angle Girders of the face two similar Angle Girders are fitted, one of which is shown at 3, near the bottom of Fig. 3.

The arrangement of the main gear train is shown in Fig. 3. A $\frac{3}{4}''$ Pinion, fitted on the armature shaft of the induction motor as described later, meshes with a 50-teeth Gear 5. This is mounted on a $1\frac{1}{2}''$ Rod that carries a $1''$ Gear meshing with a similar Gear. The $\frac{1}{2}''$ Pinion 6, driven by the last mentioned $1''$ Gear, rotates a $2\frac{1}{2}''$ Gear 7 secured on the same Rod as another $\frac{1}{2}''$ Pinion, which drives a $2\frac{1}{2}''$ Gear 8 through the medium of two further $\frac{1}{2}''$ Pinions and two $2\frac{1}{2}''$ Gears. This arrangement is shown in Fig. 3.

The Rod supporting the last $2\frac{1}{2}''$ Gear of this section of the gear train carries also a 57-teeth Gear 9 and a $\frac{3}{4}''$ Pinion, the Pinion being in mesh with a 50-teeth Gear on the $1\frac{1}{2}''$ Rod 10.

At this stage the indicator should be fitted, as it will be difficult to do this when the remaining Gears are incorporated. A $\frac{1}{2}''$ Pinion 11 engages with the 57-teeth Gear 9, already mentioned, and this Pinion is locked on a $1\frac{1}{2}''$ Rod carrying a Bush Wheel 12. On this Bush Wheel is fastened a paper disc, and the front, visible behind the clock face, carries a number of small lines or triangles as shown in Fig. 1. These are drawn in with Indian ink, and they should be about $3/16''$ apart.

When the model is working this paper disc rotates in a clockwise direction, and looked at from the front of the clock the upper portion of the disc is seen moving.

Continuing with the main gear-train, the 50-teeth Gear is secured on the Rod 10, together with a $\frac{3}{4}''$ Pinion that drives a second 50-teeth Gear on the $1\frac{1}{2}''$ Rod 13.

A ½″ Pinion is also mounted on this Rod, and this is in mesh with a 57-teeth Gear on the minute hand shaft. In addition to this Gear, a ¾″ Pinion and a second 57-teeth Gear are carried by the minute hand shaft. This 57-teeth Gear is free to rotate, but is clamped by its boss in one end of the Socket Coupling mentioned earlier. The Socket Coupling, which has a Collar in its opposite end, carries in one of its threaded holes a Rod Socket the plain hole of which is inserted in a 1½″ Rod forming the hour hand. The minute hand consists of a 2½″ Rod attached to its appropriate Rod by means of a Handrail Coupling.

The ¾″ Pinion carried on the minute hand axle is in engagement with a 50-teeth Gear 14, and this is secured on a 1″ Rod together with a further ¾″ Pinion. This meshes with a 50-teeth Gear on the Rod 15, which is also fitted with a 1″ Gear driving a second similar part on the Rod 16. A ½″ Pinion on this latter Rod engages with the 57-teeth Gear, already mentioned, that is coupled to the hour hand by the Socket Coupling.

This completes the gear transmission, and when all the bearings have been lined up and the Rods made to work freely, the construction of the motor is commenced. Great care must be taken in building this section of the model, the two main points to be remembered being the balance of the rotor and the freedom with which it rotates.

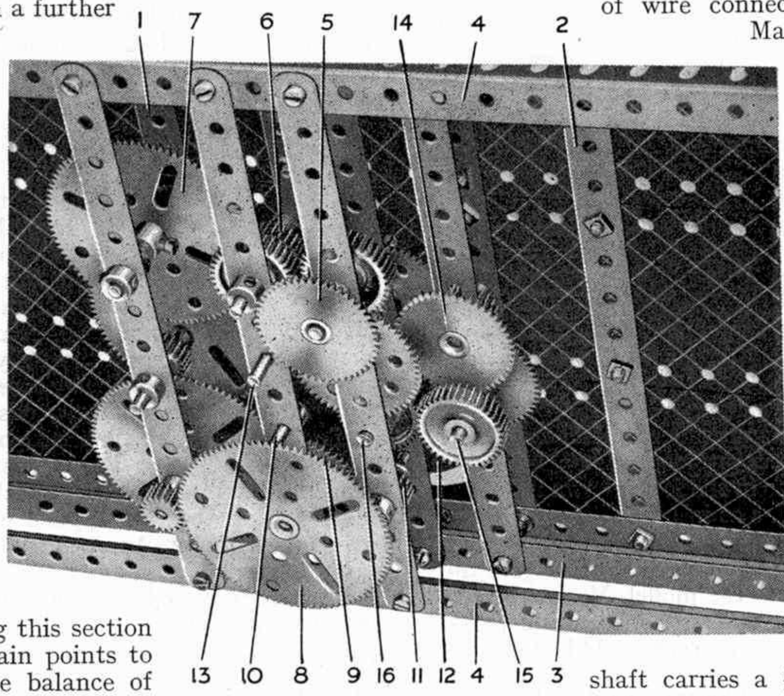

Fig. 3. The compact 15,000 : 1 gear train that is incorporated in the clock.

Each side of the motor consists of a 6″ Circular Plate, Fig. 2, fitted at its centre with a Bush Wheel and at its outer edge with four 3½″ Strips. These Strips are arranged as shown, and when the motor is ready for assembling they are fitted at their outer ends with 1½″ × ½″ Double Angle Strips.

The rotor is formed from a Hub Disc, mounted on a Bush Wheel at its centre. This Bush Wheel must be secured in place so that the Hub Disc rotates with perfect truth, and care must be taken to see that this is so. Another important point is that the Rod on which the rotor is mounted must be free from even the slightest bend. Each pole of the rotor is built up from a Pivot Bolt carrying on its shank nine Washers. It should be noted here that these Washers are not perfectly flat, but are slightly concave. Therefore, in order to ensure all poles being the same height, the concave sides of the Washers must face the same way. There are 24 poles on the rotor, and these must be spaced equally by means of a pair of dividers. When the rotor is complete and correctly balanced, the sides of the motor are passed over the two ends of the rotor axle.

The ends of the 3½″ Strip are now joined together by means of 1½″ × ½″ Double Angle Strips, and the Magnet Cores are secured in the centre holes of the Magnet Coils. Four Washers are used on the threaded portion of each Magnet Core for spacing purposes.

The electrical connections may now be made, and for this reference should be made to Fig. 2. One of the Plugs 21 is connected to the inner terminal of Magnet Coil 17, that is the terminal nearer the Magnet Core, and the remaining terminal of this Coil is connected to the inner terminal of Magnet Coil 18. Lengths of wire connect the outer terminal of Magnet Coil 18 to the outer terminal of Magnet Coil 19, and the inner terminal of the latter to the outer terminal of Magnet Coil 20. Finally the remaining terminal of Magnet Coil 20 is coupled to the second of the two Plugs 21.

The clearances between the Magnet Cores and the rotor poles must be adjusted when the wiring has been completed. They must be as fine as possible, and 1/32″ is the maximum allowable. The rear end of the rotor shaft is fitted with a ½″ Pinion for use in starting up, and the opposite end of this shaft carries a ¾″ Pinion, which engages with the 50-teeth Gear 5 when the motor is placed in position. 12½″ Angle Girders, secured to one side plate of the motor by 2½″ Angle Girders, are used for securing the driving unit.

The motor has been designed to run at a speed of 250 r.p.m. on alternating current of 50 cycles, that is current changing direction 50 times in a second. To start it, the Plugs 21 are connected to the Transformer and the rotor is spun in a clockwise direction, looking from the rear. It is necessary to spin the rotor at its correct speed of 250 r.p.m. before it will continue running, and a little practice may be necessary before this speed is found. In cases where the frequency of the supply is not 50 cycles the speed of the rotor must be found and the gearing altered accordingly. The speed of the rotor is obtained by multiplying the number of cycles by 120 and dividing the result by the number of poles.

The construction of the case and the fitting of the celluloid front cover are shown in Figs 1 and 2.

The Editor will be glad to help readers who find any difficulty in constructing this interesting clock.

Parts required to build the Clock:

2 of No. 1	12 of No. 8	12 of No. 17	5 of No. 27	4 of No. 48	1 of No. 136a	4 of No. 189	4′ 6″ Insulated Wire
13 „ „ 1b	8 „ „ 8b	3 „ „ 18a	3 „ „ 27a	20 „ „ 59	2 „ „ 146	3 „ „ 193	1 Piece of Celluloid 5½″ × 8½″
4 „ „ 2	12 „ „ 9	1 „ „ 18b	4 „ „ 27c	4 „ „ 63	24 „ „ 147b	14 „ „ 195	2 Plugs
4 „ „ 2a	2 „ „ 9d	1 „ „ 22a	4 „ „ 31	8 „ „ 103	1 „ „ 171	7 „ „ 197	
8 „ „ 3	6 „ „ 15b	4 „ „ 24	185 „ „ 37	8 „ „ 111	1 „ „ 179	4 „ „ 1538	
8 „ „ 5	5 „ „ 16a	5 „ „ 25	12 „ „ 37a	4 „ „ 111c	1 „ „ 186	4 „ „ 1583	
4 „ „ 6a	1 „ „ 16b	8 „ „ 26	312 „ „ 38	1 „ „ 118	2 „ „ 188	4 „ „ 1599	