Meccano Synchronous Electric Clock

THE Electric Clock shown in Fig. 1 is driven by a synchronous motor, and apart from the wire used for the motor field windings it is made entirely from Meccano parts. The clock operates from a Meccano 20-volt Transformer, and its accurate timekeeping and neat appearance make it an unusually interesting subject.

The framework for the clock mechanism is made by bolting two 7½″ Strips 1 across a 5½″×3½″ Flat Plate. Two further 7½″ Strips are connected to the Strips 1 by 1½″×½″ Double Angle Strips, and a 3½×1½″ Flat Plate 2 is bolted in position. Two 5½″ Strips 3 are connected to the 5½″×3½″ Flat Plate by 1½″×½″ Double Angle Strips, and the ends of the Strips are joined by 3½″ Strips. A 3½″×½″ Double Angle Strip 4 is bolted between 1½″ Angle Girders fixed to the 5½″×3½″ Flat Plate, and three 3½″ Strips 5 face-to-face are bolted across the Strips 3. Two 1½″ Flat Girders 6 are attached to 1½″×½″ Double Angle Strips fixed between the Strips 3 and the 5½″×3½″ Flat Plate. Two 3½″ Strips 7 face-to-face are bolted across the Strips 3.

The rotor consists of two Bush Wheels, each fitted with eight Rod and Strip Connectors arranged radially. It is very important to space the Rod and Strip Connectors accurately, so that the angles between them are exactly the same in each case. The Bush Wheels are fastened on a 2½″ Rod 8, which is supported in the 5½″×3½″ Flat Plate and the Flat Plate 2. The bearings for the Rod are strengthened by two 1½″ Strips bolted to each of the Flat Plates. The inner Bush Wheel is placed with its boss facing the 5½″×3½″ Flat Plate, and it is spaced from it by three Washers. The second Bush Wheel is then fixed so that its Rod and Strip Connectors just touch and are exactly parallel to those of the first Bush Wheel.

The reduction gearing to the minute hand has a ratio of 45000:1 and is arranged as follows. A ½″ Pinion is fixed to the inner end of the Rod 8, and it meshes with a 57-tooth Gear on a 2″ Rod that carries a ½″ Pinion 9. This meshes with a 57-tooth Gear on a 4″ Rod 10, which is fitted also with a Worm 11. Two 3½″ Strips bolted across the 5½″×3½″ Flat Plate strengthen the bearings for the 2″ Rod and Rod 10. The Worm engages a 50-tooth Gear on a 4″ Rod 12 supported in the Flat Girders 6. The slotted holes of the Flat Girders are used to adjust the mesh of the Worm and the 50-tooth Gear.

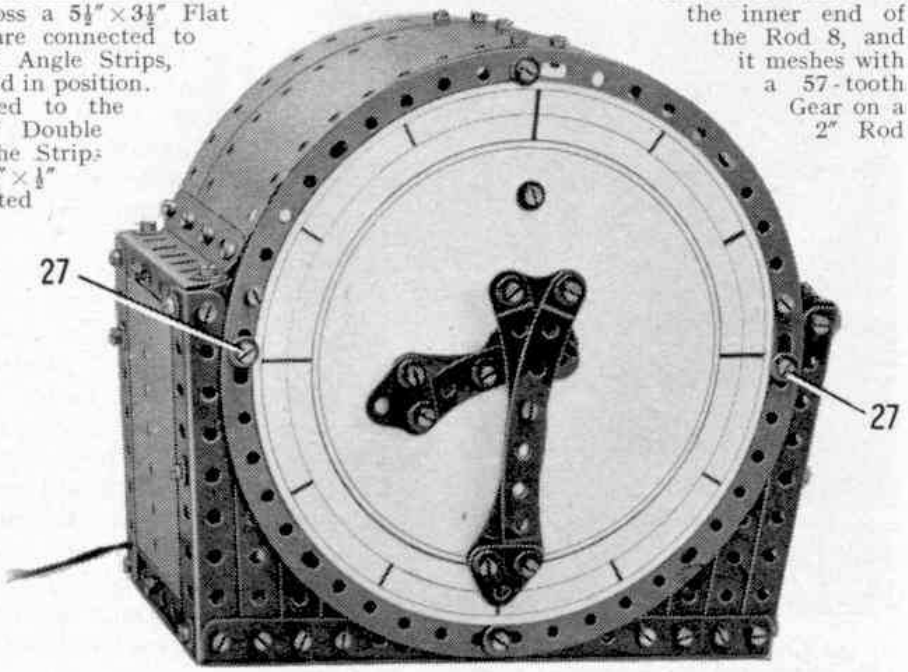

Fig. 1. This fine Electric Clock is operated by an easy-to-make synchronous motor, and is a good subject for the more experienced model-builder.

Rod 12 carries a Worm 13, and this drives a 50-tooth Gear 14 on a 1½″ Rod mounted in the 5½″×3½″ Flat Plate and in the Strips 5. A ¾″ Pinion is fixed on the 1½″ Rod, and this engages a 50-tooth Gear 15 that is loosely mounted on a 2″ Rod supported in a 1½″ Flat Girder 16, the Double Angle Strip 4 and the 5½″×3½″ Flat Plate. A 1″ Pulley fitted with a Rubber Ring is pressed against the Gear 15 to provide a light friction drive. This allows the hands to be turned without affecting the drive from the motor. A 1″ Gear 17 is fixed on the same Rod as the Gear 15, between the Double Angle Strip 4 and the Flat Plate. The Gear 17 drives a similar Gear on a 4½″ Rod 18, which carries the minute hand.

The drive to the hour hand is taken from a ¾″ Pinion 19, fixed on the same Rod as the Gear 15. Pinion 19 drives a 50-tooth Gear on a 2″ Rod supported in the 5½″×3½″ Flat Plate and in the Strips 7. The Rod carries also a ¾″ Pinion 20, which is meshed with a 50-tooth Gear 21 on a 2″ Rod. A ½″ Pinion on the same Rod engages a 57-tooth

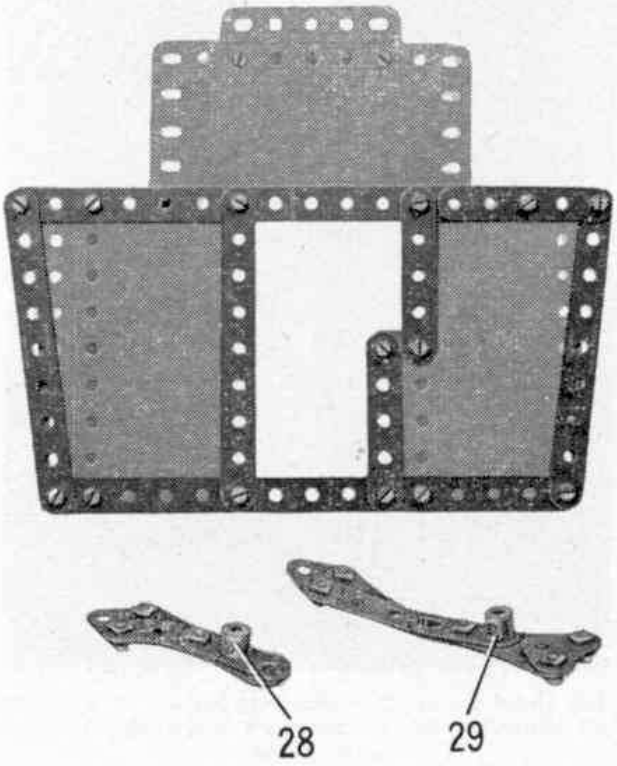

Fig. 2. The removable back of the clock case and the hands are shown clearly in this view.

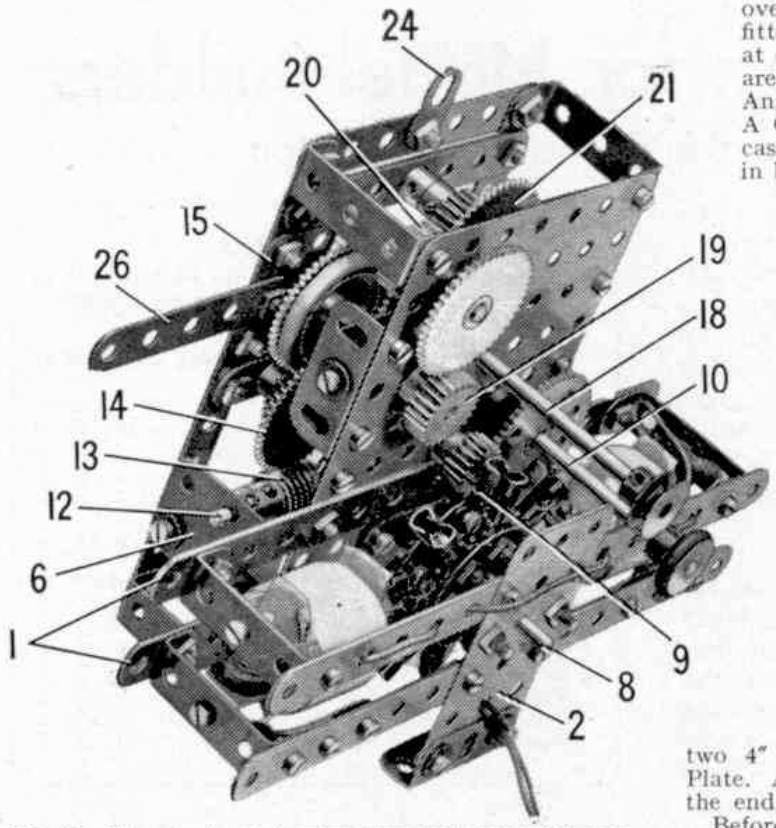

Fig. 3. The clock mechanism removed from its case, showing details of the field coil mountings and the rotor of the synchronous motor.

Gear 22. This Gear is gripped in a Socket Coupling 23 that is free to turn on Rod 18.

The Rods used in the mechanism are held in position by Collars where necessary, and Washers are used to space the Gears and Pinions so that they engage accurately. It is essential to make sure that all the moving parts of the mechanism are perfectly free running.

Each of the two field coils consists of twelve 2" Strips connected by $\frac{3}{4}$" Bolts, which serve also to secure two Angle Brackets at one end and two Double Brackets at the other end. The 2" Strips and the Brackets are insulated by a layer of paper. Each coil is wound evenly with approximately 65 yards of 36 S.W.G. Double Cotton Covered Wire. The completed coils are attached by the free lugs of the Double Brackets to the $1\frac{1}{2}$" × $\frac{1}{2}$" Double Angle Strips bolted between the $7\frac{1}{2}$" Strips, so that their inner ends are as close as possible to the rotor.

The coils are wired in series; that is, the inner end of one coil is connected to the outer end of the other coil. The two remaining ends of the coils are attached to a length of light flex, which is used to connect the clock to a 20-volt Transformer. The joins should be covered with insulating tape.

The base of the clock case consists of two $5\frac{1}{2}$" × $3\frac{1}{2}$" Flat Plates overlapped seven holes. The Flat Plates are fitted at the front with a $7\frac{1}{2}$" Angle Girder, and at each side with a $3\frac{1}{2}$" Angle Girder. The sides are $4\frac{1}{2}$" × $2\frac{1}{2}$" Flexible Plates, edged by $4\frac{1}{2}$" Angle Girders, $4\frac{1}{2}$" Strips and $3\frac{1}{2}$" Angle Girders. A Circular Strip is attached to the front of the case as shown, and the lower corners are filled in by $2\frac{1}{2}$" and $1\frac{1}{2}$" Strips and 1" Corner Brackets.

The top of the case consists of four $5\frac{1}{2}$" × $2\frac{1}{2}$" Flexible Plates. These are attached to the sides and to the Circular Strip by Angle Brackets. The dial is made from cardboard, and is bolted to a Fishplate 24 and a 2" Strip 25 fixed to the front of the clock mechanism. When the mechanism is inserted in the case the end holes of $2\frac{1}{2}$" Strips 26 are passed over the shanks of $\frac{1}{4}$" Bolts 27. These Bolts are passed through the Circular Strip, and each is fitted with four Washers and a nut. Further nuts are tightened on the Bolts when the Strips 26 are in place. The back is fastened in place by bolts screwed into Threaded Bosses attached to the sides of the clock case.

The hour and minute hands are shown separately in Fig. 2. The hour hand consists of two $2\frac{1}{2}$" Curved Strips bolted to a 1" Triangular Plate, and fitted with a Double Arm Crank 28. The boss of this Crank is gripped in the Socket Coupling 23. The minute hand is made by bolting two 4" Stepped Curved Strips to a 1" Triangular Plate. A Crank 29 attached to the hand is fixed on the end of Rod 18.

Before starting the motor a drop or two of good quality light machine oil should be applied to the bearings and to each moving part.

To start the clock the rotor must be spun at almost exactly its normal running speed, which is 750 r.p.m. With practice the speed can be gauged quite accurately, however, and once it is started the clock will run indefinitely and keep excellent time.

A list of the parts required to build this model will be supplied by the Editor on request.

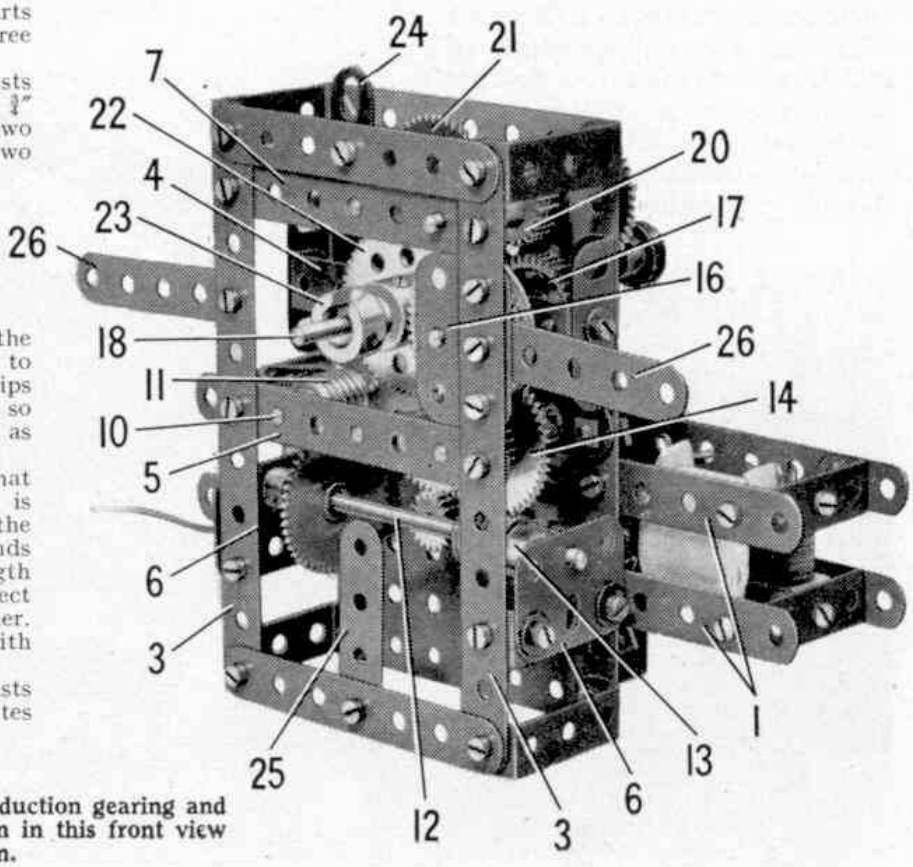

Fig. 4. The arrangement of the reduction gearing and the drive to the hands can be seen in this front view of the mechanism.