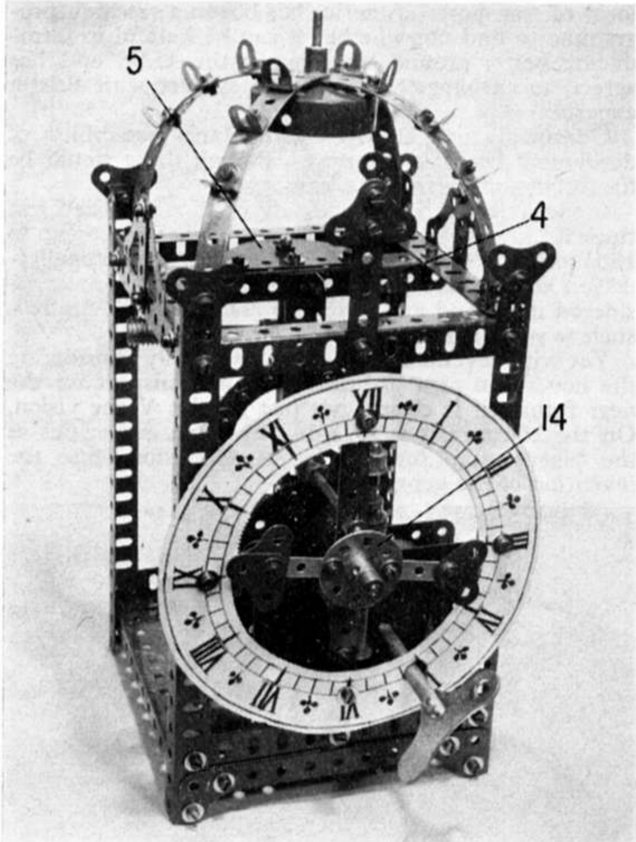
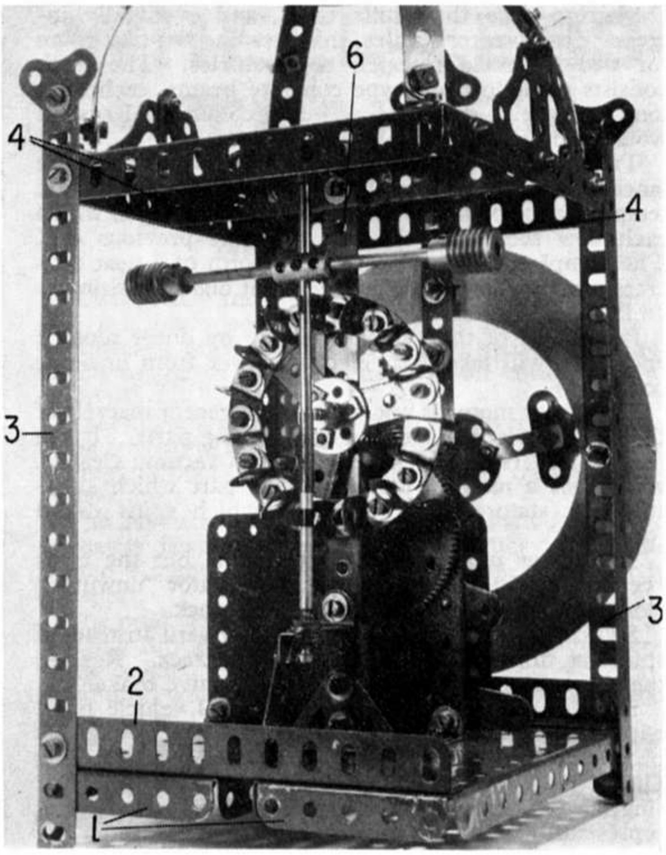




Nuremburg Clock

An historical timepiece built in Meccano by Pat Briggs

ANOTHER first by one of our regular clock makers! Established readers need no introduction to Pat Briggs and his fine Meccano clocks which have appeared in various Meccano publications. This time he pulls off another 'first' by building an historical clock complete with a fully working replica, all in standard parts, of the original Nuremburg 16th Century clock Foliot, Verge and Crownwheel escapement. As usual with Pat's clocks, this one is simple to build, reliable and long running.

In the days of its forebears, clocks of this nature were almost invariably weight-driven as the art of the spring-maker was expensive and still in the process of development. However, the standard Meccano No. 1 Clockwork Motor, which features in many of Pat's clocks, is once again pressed into service with very pleasing results. In fact, the whole mechanism is literally and metaphorically based on the Motor, the remnants of the clock frame being almost superfluous!

Fig. 1. shows the general view of the Nuremburg Clock which reveals its basic simplicity. Generally speaking, our ancestors were quite happy to know the passing of the hour, hence the provision of the hour hand movement only. (Readers who might insist on a minute hand can add their own by using a 12:1 reduction gearing as standard practice). Since it was Pat's intention to reproduce the original in form and movement, the simple form is described here, Bert Love providing the pictures and write-up based on Pat's notes. The clock dial was made very quickly from a ring of white cardboard which was inscribed with a common felt-tipped pen. A winding hole of about ¼ in. diameter is provided on the 'quarter' ring at about the 5 o'clock position.

Construction of the clock case could hardly be simpler, consisting of just two 5½ × 2½ in. Flanged Plates 1 joined by a pair of 5½ in. Angle Girders 2, with four 9½ in. Angle Girders 3 serving as corner posts. Even when one of the latter is removed, as in Fig. 2, to show the escapement, the clock still stands and functions perfectly. Five 5½ in. Angle Girders 4 complete the top of the clock case, four of them in a square with the fifth one bolted across the square top by its end slotted holes, five holes in from the rear of the clock frame. This cross-member carried a 2½ in. Semi-circular Plate 5 at its centre, the curvature to the rear holding an electrical Pivot Bolt by two lock-nuts to form the upper journal for the foliot shaft (See Fig. 1). A 7½ in. Angle Girder 6 is attached centrally to the 5½ in. Angle Girder and runs down to the base of the clock where it is secured in a Trunnion straddling the gap between the two Flanged Plates forming the base (see Figs 2 and 3). The Trunnion is raised by Washers, or suitable packing, to permit the escape wheel shaft ½ in. Pinion 7 to mesh comfortably with the 2½ in. Gear Wheel 8 mounted directly on the Motor drive spindle.

A pedestal bearing for the lower end of the foliot shaft is shown in Fig. 3 and is constructed from a 1 × ½ in. Angle Bracket mounted four holes up from the bottom of Angle Girder 6, but spaced from the Girder by three or four Washers on the fixing $\frac{7}{8}$ in. Bolt. A second electrical Pivot Bolt is set in the slotted hole of the Angle Bracket, at the same time securing a $\frac{1}{2}$ in. $\times$ $\frac{1}{2}$ in. Angle Bracket on the Pivot Bolt with the two locking nuts being *finger tight*, only. The spare lug of the $\frac{1}{2}$ in. Angle Bracket is then connected to the base of the clock by means of a $1\frac{1}{2}$ in. Perforated Strip 9 and a second $\frac{1}{2}$ in. Angle Bracket, as shown.

Fitting the Basic Gearing

In fitting the basic gearing, a $1\frac{1}{2}$ in. Corner Bracket 10 is secured to the top right-hand corner of the Clockwork Motor, as shown in Fig. 3, using two Nuts and Bolts and leaving the Nuts set square in line. The normal motor output shaft is replaced by a $2\frac{1}{2}$ in. Rod, the $2\frac{1}{2}$ in. Gear Wheel 8 being mounted on this Rod at the rear, with a Worm 11 on the Rod at the front. The Motor is then secured on the base plates with four $\frac{1}{2}$ in. Angle Brackets.

A $9\frac{1}{2}$ in. Strip 12 is now attached centrally to the front of the clock frame and lined up to match with the top hole of Corner Bracket 10 on the Motor, after which the hour-hand shaft is passed through. This shaft is a 3 in. Axle Rod which passes through the eighth hole up of the $9\frac{1}{2}$ in. Strip. It carries a Collar and a 19-teeth Pinion 13, as shown in Fig. 3. The hour hand itself is made from a $3\frac{1}{2}$ in. Narrow Strip bolted to a Bush Wheel 14 which is free to revolve on the shaft, being held in place by a frontal Collar against which the Bush Wheel is kept in fairly tight contact by a Compression Spring behind it. This arrangement keeps the hour hand rotating with the clock movement, but allows it to be set to the correct time when starting the clock. Two 1 in. Corner Brackets make a pointer for the hour hand and a third Corner Bracket forms the tail, the latter being counterbalanced by four Washers on a $\frac{3}{8}$ in. Bolt.

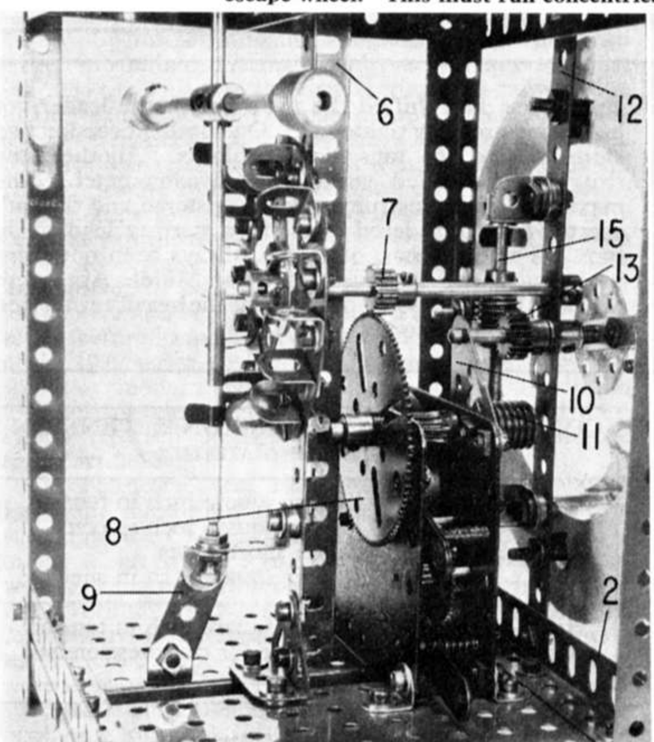
Drive to the hour-hand shaft is via Worm and Pinion reduction on a vertical 4 in. Axle Rod 15, this rod journalled in a pair of Corner Angle Brackets stood off from Strip 12 by three Washers on $\frac{3}{4}$ in. Bolts. Extra backing-up Washers are used to hold the slotted holes of the Corner Angle Brackets securely. The Rod is held in place by a Collar and a Spring Clip at the top end and the lower 19-teeth Pinion (not shown in the illustration) is set to mesh with Worm 11 on the Motor Shaft.

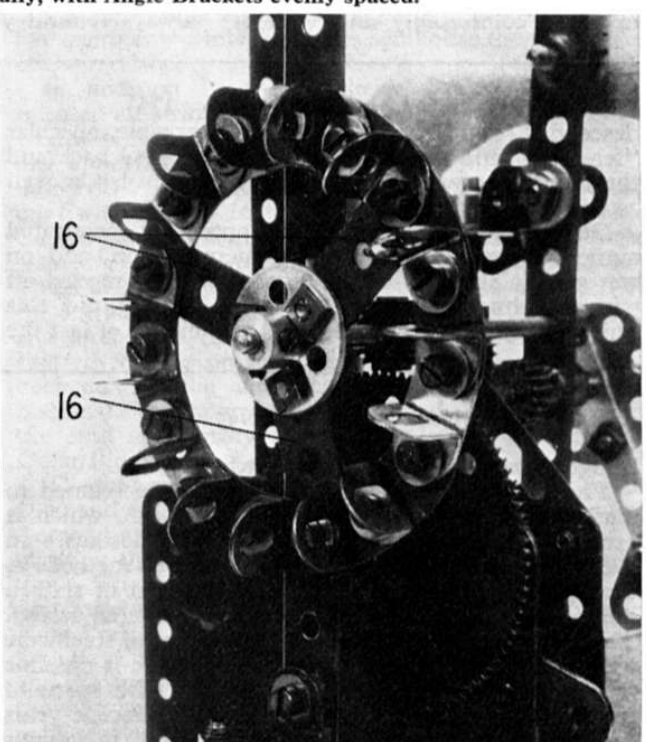
Building the Escape Wheel

The most critical part of the assembly is the escape wheel, and care must be taken with its construction. Verge escapements demand an odd number of teeth in the escapement, or 'crown' wheel, so this has to be a made-up job. Fig. 4 shows the unit in detail.

Three $2\frac{1}{2}$ in. Stepped Curved Strips are joined in a 'circle' by using three Fishplates. At the same time $\frac{1}{2}$ in. Angle Brackets are bolted to every available hole in the ring and three $1\frac{1}{2}$ in. Strips 16 are attached to the centre holes of the three Curved Strips to form the wheel spokes. These are then bolted to a 1 in. electrical Bush Wheel. Choose your parts carefully for this part of the clock; they do not need to be brand new but they do need to be in good condition. Be patient in setting up this escape wheel and make sure of the following points as far as possible: (1) that the crown wheel

(Opposite page Left) Fig. 1. A general view of the Nuremburg Clock, built in Meccano by Pat Briggs. No minute hands were provided on these comparatively simple units. (Right) Fig. 2. The Foliot verge and crown wheel escapement of the historical Clock. An odd number of teeth on the escape wheel is essential. (Below left) Fig. 3. A general view of the simple mechanism of the Clock, grouped around the Meccano No. 1 Clockwork Motor. (Below right) Fig. 4. A close-up view of the escape wheel. This must run concentrically, with Angle Brackets evenly spaced.





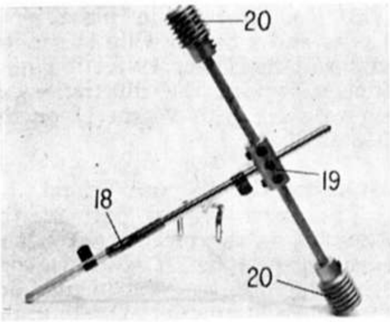


Fig. 5. The Foliot verge which makes use of the special Pivot Rods from the range of Meccano Electrical Parts Note the Spring Clips which engage with the Angle Brackets on the escape wheel.

does not wobble; (2) that it is as concentric as possible; (3) that all 15 Angle Brackets are set squarely in radial line with the shaft centre and that their tips stand off from the wheel rim at the same distance in each case. Thin Brass Washers from the Meccano Electrical Parts range are strongly recommended for setting up any discrepancies in levels in this, or any other part of the clock assembly. Remember that patience here pays handsome dividends!

When you are satisfied that it is running true, the completed escape wheel is mounted on a 4 in. Axle Rod which is passed through the central 7½ in. Angle Girder 6. The 19-teeth Pinion 7 is fixed on the shaft to mesh comfortably and without binding with 2½ in. Gear Wheel 8 on the Motor shaft. The shaft is held in place by Collars and Washers. At this stage a preliminary wind up of the Clockwork Motor should set the hour hand spinning and there will be no doubt about whether the escape wheel is running true!

Foliot Verge

Coming to the Foliot verge, this is simple by comparison with the escape wheel, as can be seen in Fig. 5, and it relies on electrical Pivot Rods for its success. A 3½ in. and a 2 in. Pivot Rod are joined by a Standard Rod Connector 18, a Coupling 19 being fixed towards the end of the longer Rod. A pair of 2½ in. Axle Rods, each fitted with a Worm 20, or similar weight bob, are fixed into the ends of the Coupling, then, finally a pair of Spring Clips are mounted on the composite pivot rod to align with the top and bottom of the escapement wheel.

It only remains now to set up the verge between the upper and lower Pivot Bolts and to screw them up gently, finally locking the Nuts when the escapement is working properly. Some adjustment of the Spring Clips will probably be required, both in height and rotation, until they are alternately caught and released by the escape wheel. The Foliot verge swings quite vigorously with a characteristic "thump, thump", so it will always remind you of its presence while it is working. This particular form of escapement, however, is notoriously less accurate than the pendulum and anchor escapement, so do not expect chronometer reliability! Nevertheless, the building of this clock is most instructive and results in a very acceptable form of antiquity!

Ornamentation

Clock ornamentation is purely a matter of constructor's choice. Fig. 1 shows the simple embellishments adopted by Pat Briggs, using four 5½ in. Perforated Strips, twelve Angle Brackets, a Boiler End, an Adaptor for Screwed Rod and some Corner Brackets. The result is extremely pleasing, but each individual builder is of course at perfect liberty to follow his own inclinations.

PARTS REQUIRED
BASIC CLOCK

1—1a	1—12b	52—37a	1—126
4—2	2—15b	40—37b	1—133
4—6a	4—16a	40—38	3—133a
4—8a	1—24	1—63	1—120b
1—8b	3—26	3—90a	2—154a
7—9	1—27c	4—111	1—213
3—10	4—32	3—111c	1—214
21—12	6—35	1—120b	1—235b

Electrical Parts

2—545	1—548	1—549	12—561

1 No. 1 Clockwork Motor

SIMPLE ORNAMENTATION

4—2	16—12	8—133a	1—173a
30—37	4—108	1—162a	

HORSE-POWER (*continued from page* 175)
descended from Shires. With his remarkable muscular "forearms" and quarters, short, well-coupled back and the immense power in his frame, the Shire has moved astonishing weights.

During official trials before a properly-constituted authority, two Shires, yoked tandem-fashion, and on wet granite setts (offering a poor foothold), moved off with the huge weight of 18½ tons. They did this quietly and without any fuss, and as a matter of fact the shaft horse had shifted the mass before the leader got his chains properly tightened. On another occasion two shires moved 16½ tons of wood blocks. Another time two Shires pulled against a dynamometer. The maximum of the instrument was registered and the pull exerted was considered equal to a starting load of 50 tons. The Shire has, of course, always been noted for its strength, and its ancestors of the Middle Ages were the only horses capable of carrying the heavily armoured knights of the period.

BRIDGES (*continued from page* 177)

bridge, illustrating the design principles.

The building of Sydney Harbour bridge seemed to mark the return to favour of the steel arch, which is probably still the most elegant of all bridge designs. In 1931 the Bayonne bridge, built by the same methods as the Sydney bridge, was completed at a cost of sixteen million dollars between New Jersey and Staten Island. The arch span is 1,652 feet and 16,000 tons of steel were used in its construction. Engineers believe it possible that we may yet see steel arch bridges with spans of from two to three thousand feet, and in recent years large steel arch bridges have been erected in various parts of the world. The largest steel arch span in Britain is the Widnes-Runcorn bridge in Cheshire, finished in 1961, with a span of 1082 feet.

COMPARATIVE COMPRESSION & TENSION
STRENGTHS OF MATERIALS

Mild Steel	18,000 lbs per square inch in tension 15,000 lbs per square inch in compression in short struts 13,500 lbs per square inch in sheer
High Tension Steel	20,000 lbs per square inch in tension with an increase for compression and sheer
Nickel Silicon & other alloy Steels	from 24,000 to 30,000 lbs per square inch in tension