MODEL OF THE MONTH

Vertical Milling Machine

THERE are few more attractive and interesting subjects for keen Meccano model-builders than the many different kinds of machine tools used in modern workshops. Drilling machines, lathes, milling machines and many others provide splendid scope for Meccano model-builders to display their skill and ingenuity in reproducing the mechanisms required to carry out the essential movements, and for our latest "Model of the Month" subject we have chosen one of the most fascinating of these machine tools, a vertical milling machine. The model is based on a large type of vertical miller used for general machining operations of many kinds in engineering workshops.

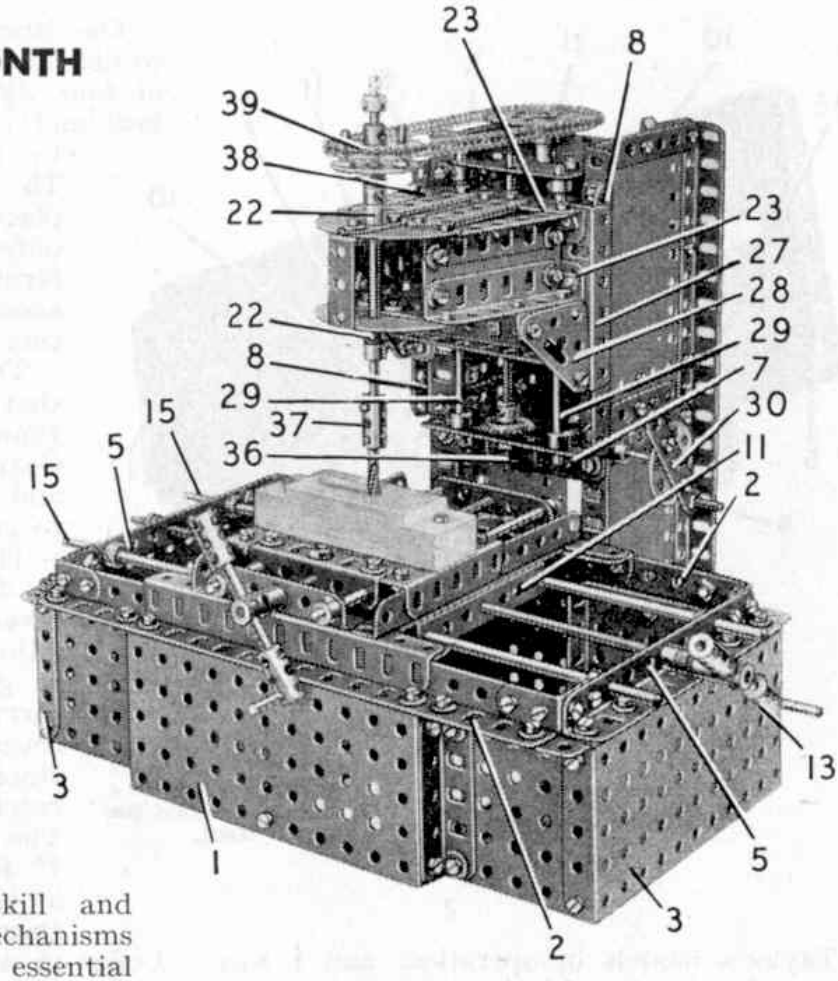

Fig. 1. The Meccano Milling Machine in its completed state.

The actual machining operation is carried out by a special milling tool driven at high speed by an electric motor. The head carrying the tool can be raised and lowered to vary the depth of cut in the metal to be machined. The metal is clamped to an adjustable work table that can be moved as required to bring it underneath the tool.

Our model is operated by an E20R(S) Electric Motor that drives the milling tool through Chain and Sprockets arranged to provide a step up ratio. A special slide arrangement

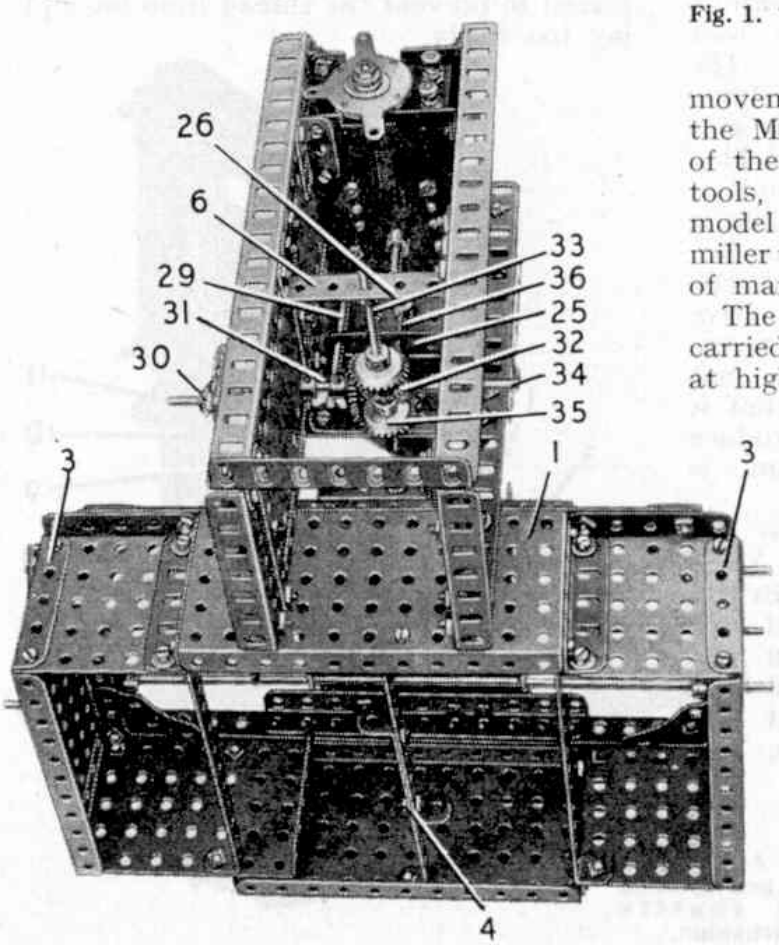

Fig. 2. A rear view of the Milling Machine.

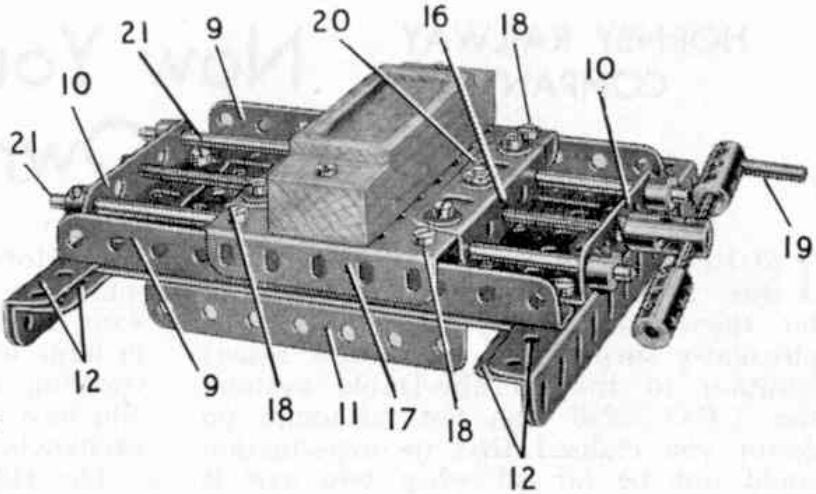

Fig. 3. The work table, showing the construction of the slides.

incorporated in the drive permits the tool head to be raised or lowered without interfering with the drive. The work table is provided with longitudinal and transverse adjustments. These movements and the milling head adjustments are screw operated and give very fine control over the machining operation.

In the model the milling tool can be represented by a short $\frac{5}{32}''$ high speed twist drill. The model is capable of operating with a block of wood as the work to be machined, and the block should be bolted securely to the work table as shown in the picture.

Full instructions and a list of the parts required to build the Milling Machine can be obtained by writing to the Editor, enclosing a 2d. stamp for postage. Readers in Canada, Australia, New Zealand, South Africa and Ceylon can obtain instructions for the *current* "Model of the Month" by writing to the main Meccano Agents for those countries, enclosing suitable stamps for return postage.

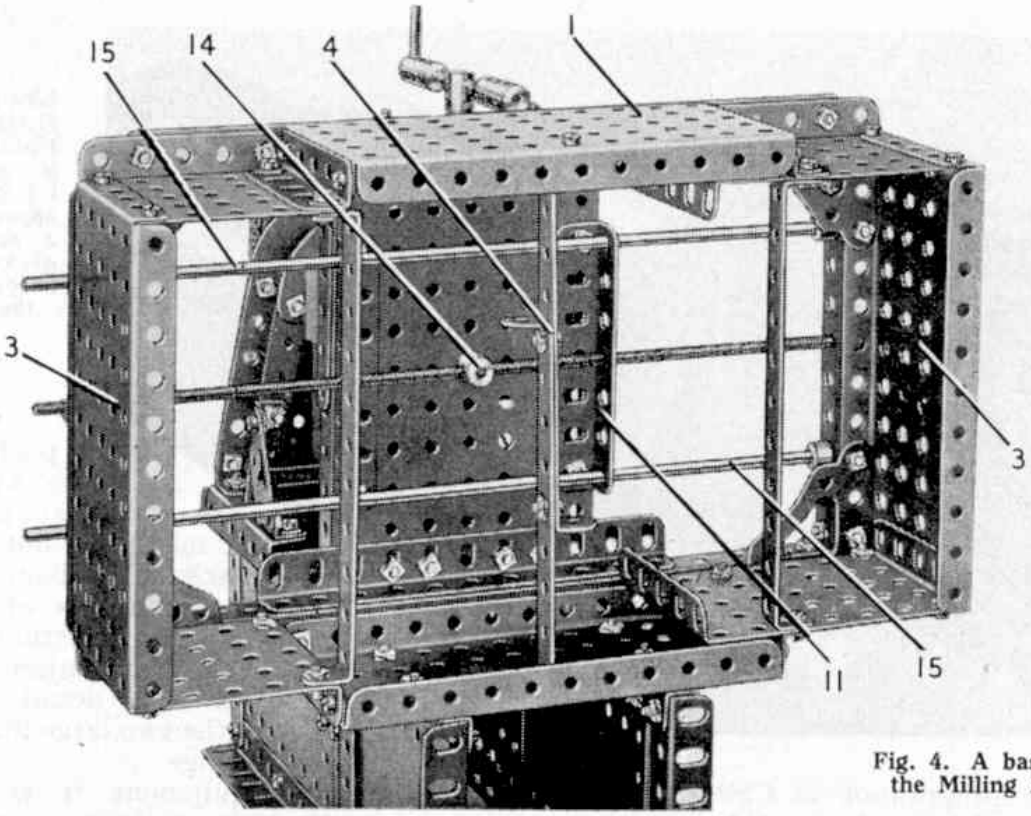

Fig. 4. A base view of the Milling Machine.

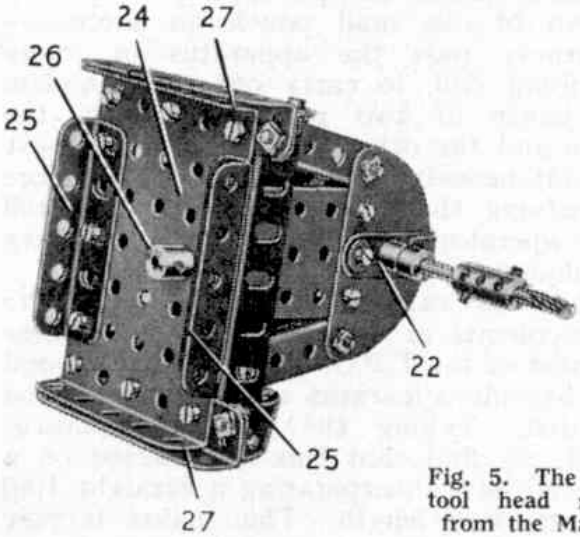

Fig. 5. The milling tool head removed from the Machine.

MODEL OF THE MONTH

VERTICAL MILLING MACHINE

Illustrated in the March 1957 issue of the "Meccano Magazine"

Construction of the Machine Frame

Each side of the base consists of a $5\frac{1}{2}$" x $2\frac{1}{2}$" Flanged Plate 1, a $3\frac{1}{2}$" x $2\frac{1}{2}$" Flanged Plate and a $2\frac{1}{2}$" x $2\frac{1}{2}$" Flat Plate joined together as shown by means of two $2\frac{1}{2}$" Angle Girders. A $9\frac{1}{2}$" Angle Girder 2 is attached to the upper edge of each side by two $2\frac{1}{2}$" Angle Girders. The sides are connected by two $5\frac{1}{2}$" x $2\frac{1}{2}$" Flanged Plates 3, two $5\frac{1}{2}$" x $\frac{1}{2}$" Double Angle Strips, and a made-up double angle strip 4 consisting of two $4\frac{1}{2}$" x $\frac{1}{2}$" Double Angle Strips overlapped. A $5\frac{1}{2}$" Angle Girder 5 is fixed to the upper flange of each of the Plates 3 and is connected to the Girders 2 by 1" x 1" Angle Brackets. The upper corners of the base are strengthened by Corner Gussets.

Each side of the vertical column is formed by two $9\frac{1}{2}$" Angle Girders joined together by $3\frac{1}{2}$" Strips and a $3\frac{1}{2}$" Angle Girder, with two $4\frac{1}{2}$" x $2\frac{1}{2}$" Flexible Plates bolted to the Strips between the vertical Girders. A $2\frac{1}{2}$" x $\frac{1}{2}$" Double Angle Strip 6 and a $3\frac{1}{2}$" Angle Girder 7 are bolted to the column as shown, and an E20R(S) Electric Motor is fixed by its flanges to one side and is connected to the other side by two $1\frac{1}{2}$" Angle Girders. The column is bolted to one of the Flanged Plates 1, and a $4\frac{1}{2}$" Angle Girder 8 is attached to the front $9\frac{1}{2}$" Angle Girder of each side.

Assembly of the Work Table

The work table is provided with longitudinal and transverse travel movements controlled by screw operated mechanisms. The table consists of a $5\frac{1}{2}$" x $3\frac{1}{2}$" Flat Plate to which are bolted two $5\frac{1}{2}$" Angle Girders 9, two $2\frac{1}{2}$" Angle Girders 10 and two $3\frac{1}{2}$" Angle Girders 11. At each end of the table two $5\frac{1}{2}$" Angle Girders 12 are arranged as shown, with a slight gap between their vertical flanges. The gaps should be sufficient to accommodate the vertical flanges of the Girders 2 and allow the table to slide freely along these Girders. The sliding movement is controlled by a handle 13 formed by Couplings on a Rod held in a Threaded Coupling, which is fixed by a nut at one end of an $11\frac{1}{2}$" Screwed Rod. The Screwed Rod is supported in the Girders 5 and is screwed into a Rod Socket 14 fixed centrally to the $5\frac{1}{2}$" x $3\frac{1}{2}$" Flat Plate. The Threaded Coupling is spaced from one of the Girders 5 by Washers and a Collar, and the Screwed Rod is held in position by lock-nuts arranged at the end opposite to the handle. Two $11\frac{1}{2}$" Rods 15 form guides and they are held in the Girders 5 by Collars.

Two $2\frac{1}{2}$" Angle Girders 16 are fixed to a $3\frac{1}{2}$" x $2\frac{1}{2}$" Flanged Plate 17, which slides freely on the Girders 9. A $2\frac{1}{2}$" Angle Girder is bolted by its slotted holes to each end of the Flanged Plate, the bolts used for this purpose being indicated at 18. The sliding movement of the Plate 17 is controlled by a handle 19 made from Couplings on a Rod held in a Threaded Coupling. The Threaded Coupling is fixed by a nut on a 6" Screwed Rod, which is supported in the Girders 10 and is screwed into a Rod Socket placed underneath the Flanged Plate 17. The guide rods 21 are held in place by Collars, and the Screwed Rod is retained in position by lock-nuts at one end. The material to be machined should be bolted firmly to the Flanged Plate 17.

Arrangement of the Milling Head and Drive

Each side of the milling head is made by bolting two 3" Angle Girders to a 3" Flat Girder. The sides are connected at the front

by two Semi-Circular Plates, to which Double Arm Cranks 22 are bolted, and at the rear by two $3\frac{1}{2}$" Angle Girders 23. The Girders 23 are attached to a $3\frac{1}{2}$" x $2\frac{1}{2}$" Flanged Plate 24, which carries also two $2\frac{1}{2}$" Angle Girders 25. A Threaded Boss 26 is fixed to the centre of the Flanged Plate, and two 3" Angle Girders 27 are bolted in position as shown, leaving a slight gap between them and the flanges of the Plate. A $3\frac{1}{2}$" Angle Girder is bolted to the lower edge of the Flanged Plate, and a $1\frac{1}{2}$" Corner Bracket 28 on each side is attached to Angle Brackets bolted to the 3" Girders. Two 3" x $1\frac{1}{2}$" Flat Plates are fixed between the Girders 23 and the Semi-Circular Plates, the upper Flat Plate being strengthened by 3" Strips as shown in Fig. 1. A $1\frac{1}{2}$" x $\frac{1}{2}$" Double Angle Strip is bolted between the Semi-Circular Plates.

The flanges of Plate 24 and the Girders 27 form guides that slide freely over the Girders 8. Two 5" Rods 29 are passed through the side-plates of the Electric Motor, the $2\frac{1}{2}$" Angle Girders 25 and the $3\frac{1}{2}$" Angle Girder 7, and these Rods are held in place by Collars.

The milling head can be raised or lowered by turning a handle 30, formed by a Threaded Pin in a $2\frac{1}{2}$" Strip bolted to a Bush Wheel. The Bush Wheel is fixed on a Rod 31 passed through one side of the vertical column into a Coupling 32 that is mounted freely on a Rod 33. A $\frac{7}{8}$" Bevel Gear on Rod 31 drives a similar Gear on Rod 33, which is supported in Double Angle Strip 6 and in a $2\frac{1}{2}$" Strip bolted to the Girder 7. Collars are used to hold the Rods in place, and a Rod 34 is fixed in Coupling 32 and projects through the side of the column. A $\frac{7}{8}$" Bevel Gear 35 fixed on Rod 33 drives a similar Gear fixed between two nuts on a 6" Screwed Rod 36, which is screwed into the Threaded Boss 26 and is supported in the Motor side-plates and Girders 25 and 7. Lock-nuts are used to prevent the Screwed Rod from sliding in its bearings.

The milling spindle is a 5" Rod, which must be able to turn freely in the bosses of the Double Arm Cranks 22. The Rod is held in place by Collars and it carries a Coupling 37, a Bush Wheel 38 and a $1\frac{1}{2}$" Sprocket 39. The Sprocket is loose on the Rod, but it is connected to the Bush Wheel by two Threaded Pins. The Bush Wheel is fixed on the Rod and Sprocket 39 is connected by Chain to a 2" Sprocket on the Motor shaft. The Coupling 37 is used to support the milling tool.

Parts Required

10 of No. 3	1 of No. 16a	6 of No. 63
4 " " 4	3 " " 17	2 " " 63c
3 " " 5	2 " " 18b	2 " " 72
2 " " 6a	2 " " 24	2 " " 73
6 " " 8a	4 " " 30	1 " " 78
8 " " 9	175 " " 37	2 " " 79a
2 " " 9a	12 " " 37a	1 " " 94
11 " " 9b	66 " " 38	1 " " 95
4 " " 9c	1 " " 48	1 " " 95a
15 " " 9d	1 " " 48a	2 " " 103c
2 " " 9f	2 " " 48c	4 " " 108
4 " " 12	2 " " 48d	2 " " 111
4 " " 12a	4 " " 52	3 " " 115
2 " " 13	1 " " 52a	2 " " 133
2 " " 14	3 " " 53	2 " " 179
3 " " 15	20 " " 59	4 " " 191
1 " " 16	3 " " 62b	2 " " 214

1 E20R(S) Electric Motor.