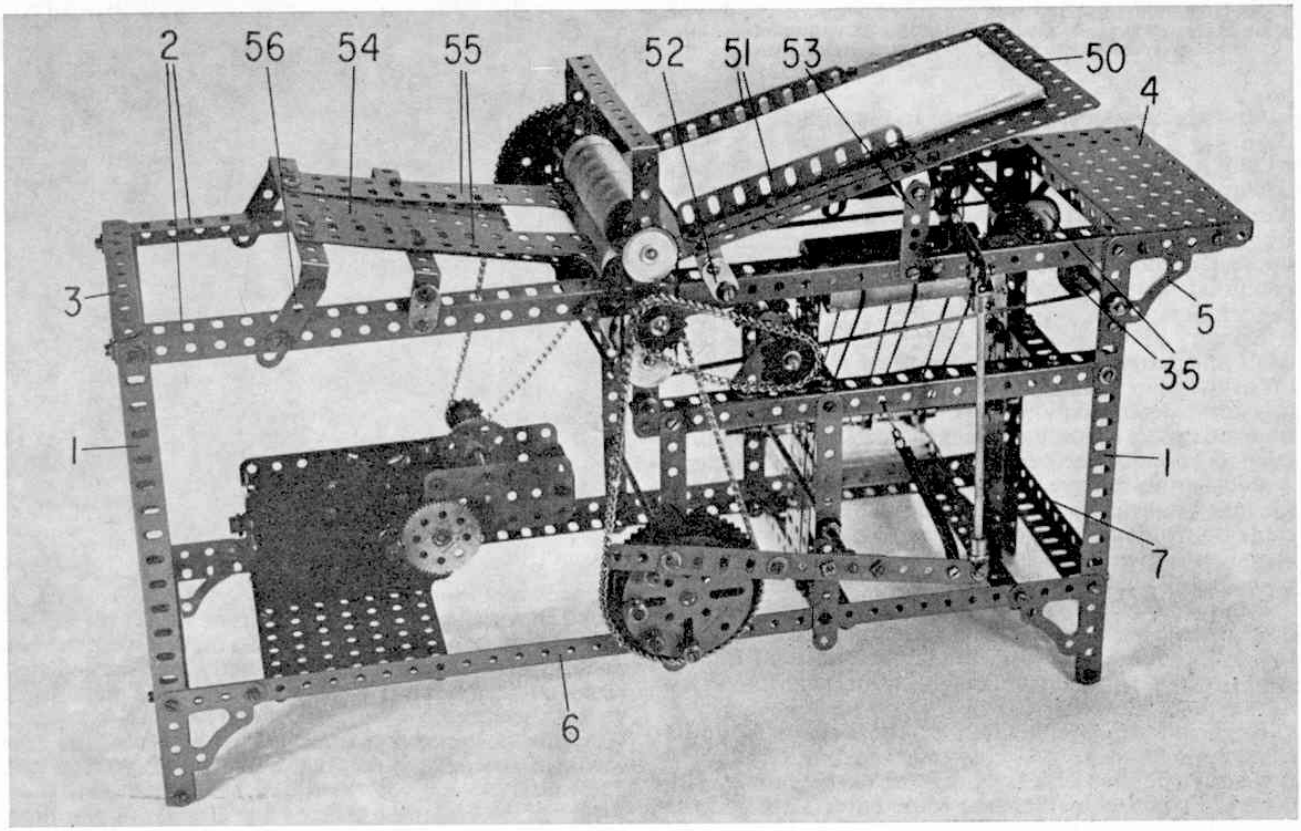


Paper-Folding Machine

'Spanner' describes an intriguing model for experienced builders

By their very nature, working Meccano models invariably prove more appealing than static models. This does not mean of course that static models require less skill to build, or are less realistic when completed, but it does mean that a good model becomes more interesting if it incorporates movement. If the movement itself is not just representative, but actually enables the model to reproduce the real work of the original, then the model is truly ideal.

Qualifying as " ideal " under this definition, therefore, is the Meccano model illustrated in the accompanying photographs. Produced as a Paper-Folding Machine, it is fully working in that it will take a flat piece of paper, fold it in half and then fold it in half again, finally depositing it in a small collection tray built on to the side of the model. I cannot say that the model would be exactly suitable for folding your own letters or circulars to send out to correspondents, but it is undoubtedly fascinating to watch, as well as to operate.

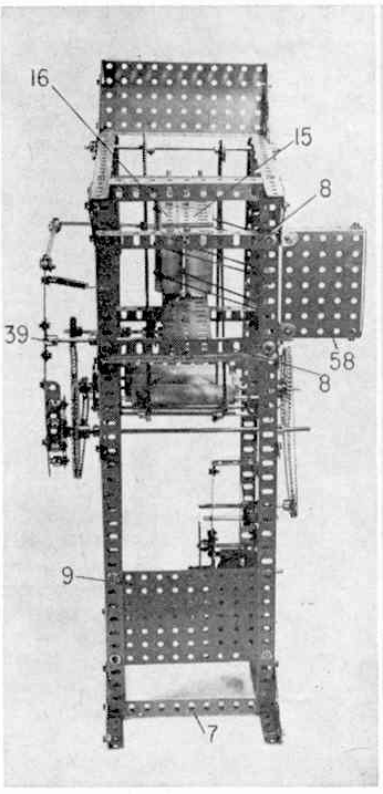
Used in the model are five Wood Rollers, which should be specially covered to improve the operation of the finished Machine and it is advisable to prepare these Rollers before starting assembly of the model, proper. The face of one of the Rollers is covered by a sheet of glasspaper, glued into position, while the four remaining Rollers are covered with strong, brown paper, also glued into place. Two of the latter Rollers also have 1 in. Gear Wheels, mounted one in each end of the Rollers, boss inwards, these Gear Wheels also serving as the anchoring points when the Rollers are mounted on their respective Rods in the model.

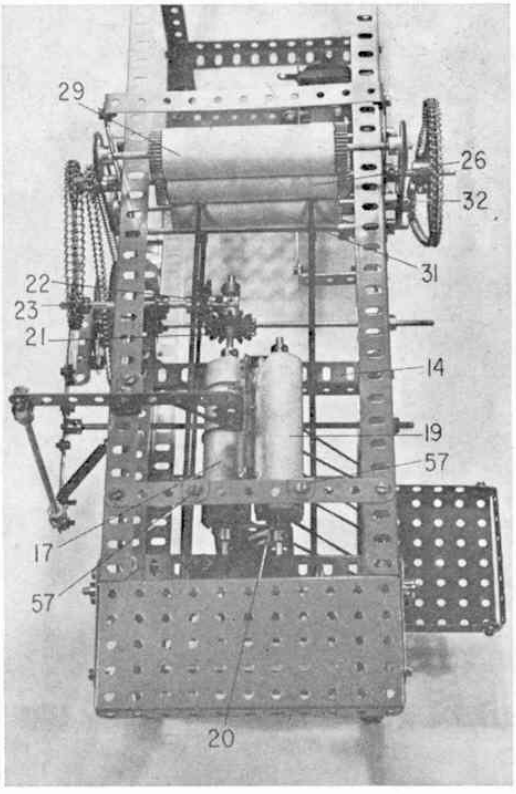
Main framework

In building the main framework, four uprights are provided by 9½ in. Angle Girders 1, these being connected at the top by two 18½ in. Angle Girders 2, a 5½ in. Angle Girder 3 and a 5½ × 2½ in. Flanged Plate 4, the Flanged Plate being secured to the Girders by two Corner Gussets 5. Girders 1 are further connected, through their fifth holes up, by two more 18½ in. Angle Girders 6 and two 5½ in. Angle Girders 7, Girders 6 themselves being joined by two additional 5½ in. Angle Girders 8 and a 5½ × 3½ in. Flat Plate 9.

Now bolted to each Girder 6 through its twelfth and eighteenth holes are two 5½ in. Strips 10 and 11, both these Strips projecting one hole below the Girder. The upper ends of the Strips are connected together and to nearest Girder 1 by a 9½ in. Angle Girder 12, to the free end of which a 5½ in. Perforated Slotted Strip 13 is fixed. These Slotted Strips at each side project half their length above Girders 2, their upper ends being connected by a 5½ × ½ in. Double Angle Strip. Girders 12 at each side, on the other hand, are connected by two 5½ in. Angle Girders 14, positioned above Girders 8, each Girder 12 then being attached to respective Girder 8 by a 7 in. compound flat girder 15, built up from one 5½ in. and one 3½ in. Flat Girder, and a 7 in. compound strip 16 built up from one 5½ and one 3½ in. Strip. Both the flat girder and strip project a distance of three holes abov- Girder 12, and note that the elone gated holes in the flat girder are positioned farthest from the strip.

Qualifying as a true working model, this Paper-folding Machine will actually fold a flat piece of paper into four quarters. Power is supplied by a Meccano E15R Motor. Right, an underside view of the model showing the layout of the lower framework. Far right, in this view of the model, the paper guides have been removed to show the positions of the second-fold Rollers.





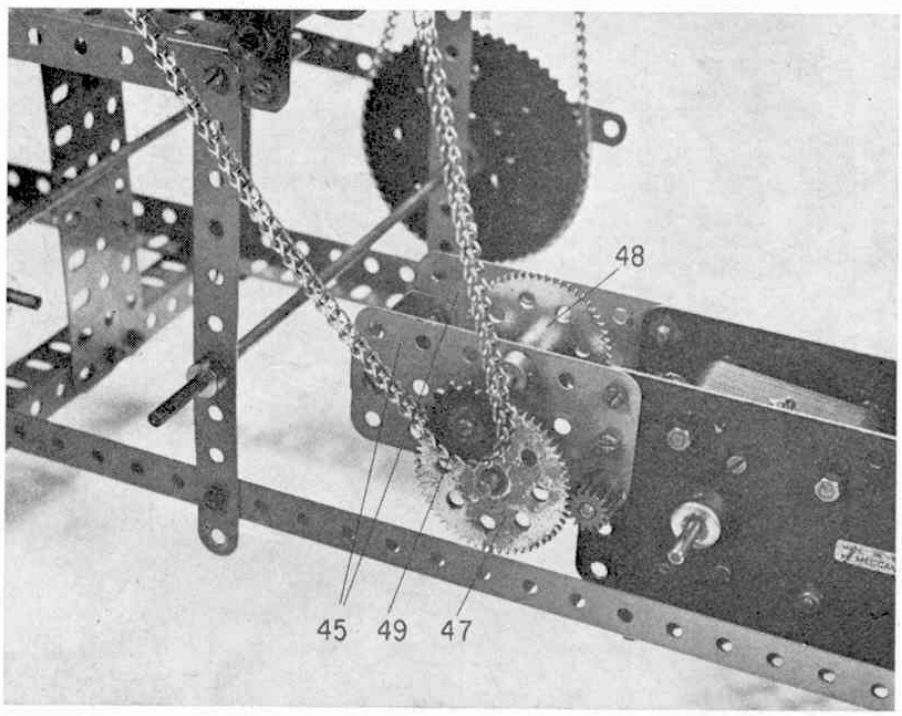
Held by Collars in the upper end holes of compound strips 16 is a 6½ in. Rod on which one of the plain paper-covered Wood Rollers 17 is fixed. This Roller is connected by three 10 in. Light Driving Bands to three ½ in. Pulleys on another 6½ in. Rod 18, journalled in Angle Brackets bolted to Strip 10 and nearby Angle Girder 1. The glasspaper-covered Roller 19 is mounted on a 5 in. Rod journalled in the upper end elongated holes of compound flat girders 15, this being tensioned against Roller 17 by two 2½ in. Driving Bands, each attached to a Fishplate 20 mounted on one or the other end of the 5 in. Rod, the other end of the Driving Band being looped over a ⅜ in. Bolt held by a Nut in respective Girder 14.

Now mounted on the protruding inside end of the Rod carrying Roller 17 is a Multi-purpose Gear 21, a Coupling 22 and a Collar, the Rod passing through one end transverse bore of the Coupling. The Gear and Collar are fixed on the Rod, while the Coupling is free, but prevented from sliding on the Rod by the other two parts. The longitudinal bore of the Coupling serves as one of the bearings for a 3½ in. Rod 23, the other bearing for which is provided by a 1½ in. Strip bolted to a Trunnion 24 which is in turn bolted to nearby Girder 2. Fixed on the inside end of the Rod is a Multi-purpose Gear which meshes with Gear 21, while a 1 in. Sprocket Wheel 25 is fixed on the outside end of the Rod.

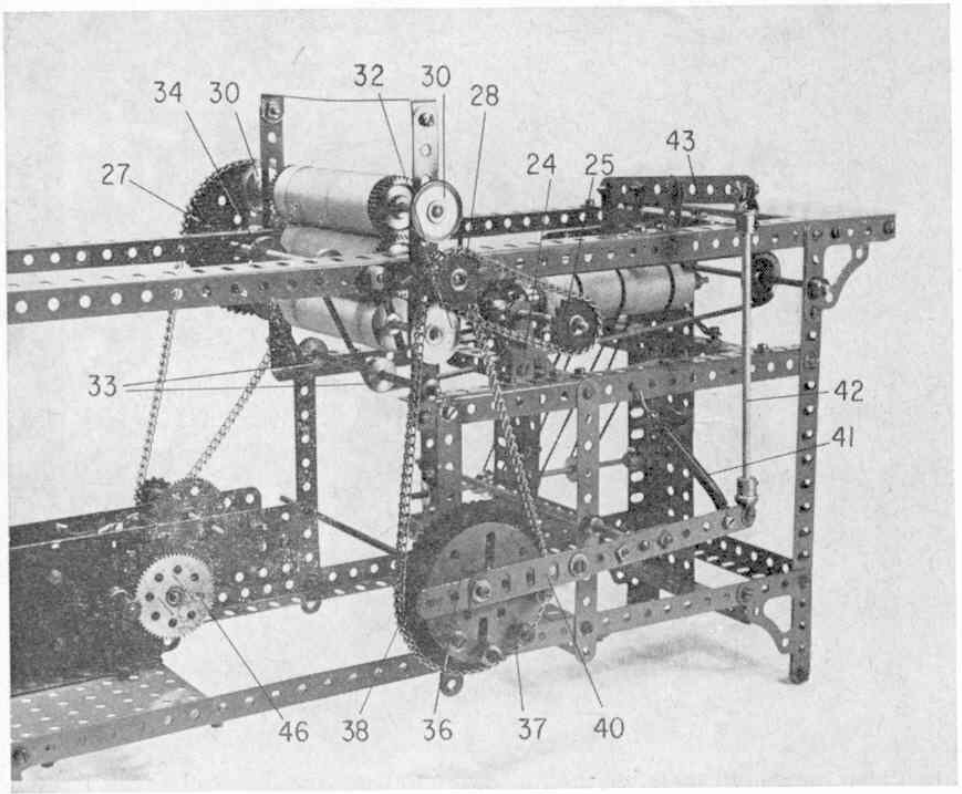
Journalled in the centre holes of Slotted Strips 13 and in Girders 2 is an 8 in. Rod, held in place by Collars, this Rod carrying one of the Rollers (26) incorporating the 1 in. Gears. Fixed on one end of the Rod, as shown, is a 3 in. Sprocket Wheel 27, while on the other end of the Rod are mounted a ¾ in. Sprocket Wheel and a 1 in. Sprocket Wheel 28. Sprocket Wheel 28 is connected by Chain to Sprocket Wheel 25. Journalled in the slotted holes in Slotted Strips 13, above Roller 26, is a 6½ in. Rod carrying the other Roller with 1 in. Gears 29 and held in place by two 1 in. fixed Pulleys 30. The Gears included with the Roller, of course, mesh with the Gears included with Roller 26.

The final Roller 31 is mounted on another 6½ in. Rod held by 1 in. Pulleys 32 in the lower slotted holes of Strips 13. Pulleys 30 and 32 at each side are connected by a 6 in. Driving Band which not only provides drive to the lower Roller, but also tensions the upper and lower Rollers against Roller 26.

Also mounted in Slotted Strips 13, two holes below Roller 31, is another 6½ in. Rod carrying two ½ in. loose Pulleys 33. Diagonally above these, on a further 6½ in. Rod journalled in Angle Girders 2, are two ½ in. fixed Pulleys 34, while two 1 in. fixed Pulleys 35 are mounted on yet another 6½ in. Rod journalled in



The gearbox which is built onto the Motor to reduce its speed, while increasing its torque, or power.



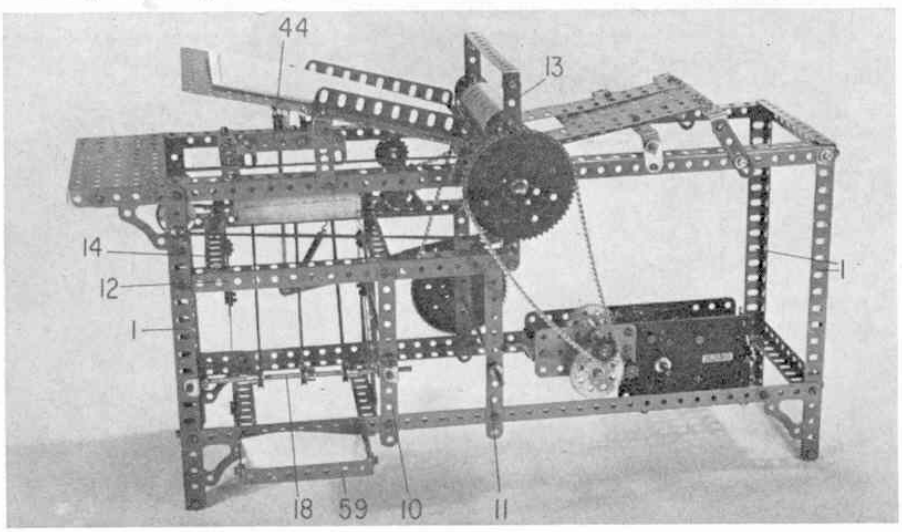
A close-up view of the model showing the drive to the Rollers and the built-up cam controlling the second-fold pressure lever.

the third holes from the top of opposite end Girders 1. Two 20 in. Driving Bands are then passed between Rollers 26 and 31 and around Pulleys 33, 34 and 35 to provide an endless belt which carries the paper from the first-fold Rollers to the second-fold Rollers already described.

A special cam is next built up from a Face Plate 36, in adjacent outside holes of which four ½ in. Bolts are locked by Nuts, a Collar 37 being mounted on the shank of each Bolt. The Collars should revolve freely on the Bolts. When completed, the cam is mounted, along with a 3 in. Sprocket Wheel 38, on an 11½ in. Rod journalled in the fifth holes from the lower ends of Strips 11. Sprocket Wheel 38 is connected by Chain to the ¾ in. Sprocket Wheel on the Rod carrying Roller 26.

Journalled in the sixth holes from the lower ends of Strips 10 is another 11½ in. Rod, on one end of which a Double Arm Crank 39 is fixed. Bolted to the arm of this Crank is a 7½ in. Strip to which, in turn, a 2½ in. Angle Girder 40 is bolted, the end hole of the Girder coinciding with the third hole of the Strip. The spare flange of the Angle Girder makes contact with Collars 27 in the above cam, being held in contact by the action of a Tension Spring 41 bolted through the second hole from the opposite end of the Strip, its other end being attached to nearby Girder 12 by a Wire Hook.

Lock-nutted through the end hole of the 7½ in. Strip is an End Bearing, in the boss of which a 5 in. Rod 42 is fixed. Mounted on the upper end of this Rod is another End Bearing, the lugs of which are pivotally attached to one end of a 4½ in. Strip 43, lock-nutted at its centre to a 1 × 1 in. Angle Bracket bolted to nearby Girder 2. A 1½ in. Corner Bracket is secured to the free end of the Strip, a 3 in. Strip 44 being attached at right angles to the lower corner of this Bracket by a 1 × ½ in. Angle Bracket. Two Fishplates are bolted, one to each end of Strip 44 and the whole arrangement should be so constructed that, when the Strip is pivoted down, the Fishplates engage in the slot between Rollers 17 and 19.



The uncomplicated nature of the Paper-folding Machine is evident from this general view of the model. Care, however, must be taken in adjusting the machine.

Motor and Gearing

Power for the model is supplied by an E15R Electric Motor bolted to one Angle Girder 6 and to Flat Plate 9. Before fitting the Motor, however, it is advisable first to add a reduction gear train to reduce the output speed. Two 3 × 1½ in. Flat Plates 45, connected by a 1½ × ½ in. Double Angle Strip, are bolted one to each sideplate of the Motor, the securing Bolts using the respective upper two end holes of the Flat Plates and sideplates. Journalled in the lower corner holes of the Flat Plates and in the centre sideplate holes is a 2½ in. Rod held in place by a $\frac{7}{16}$ in. Pinion and a 60-teeth Gear Wheel 46. This Gear Wheel meshes with a $\frac{7}{16}$ in. Pinion fixed on the Motor output shaft, while the first Pinion meshes with another 60-teeth Gear Wheel 47 fixed on another 2½ in. Rod journalled in Flat Plates 45. Also fixed on this latter Rod, inside the Plates, is a ½ in. Pinion which meshes with a 57-teeth Gear Wheel 48 on a 3 in. Rod held by a Collar in the Flat Plates vertically above it. Gear 48, by the way, is spaced from the Flat Plate by two Washers. Mounted on the end of the 3 in. Rod is a ¾ in. Sprocket Wheel 39 which is connected by Chain to Sprocket Wheel 27.

Paper Guides

At this stage the guides for the paper can be built up and added to the model. The feed-in guide consists of an $8\frac{1}{2} \times 5\frac{1}{2}$ in. compound flat plate 50, built up from one $5\frac{1}{2} \times 2\frac{1}{2}$ in. and two $5\frac{1}{2} \times 3\frac{1}{2}$ in. Flat Plates, bolted together. Bolted to this compound plate, in the positions shown, are two $4\frac{1}{2}$ in. Angle Girders 51, then the plate is secured to Girders 2 by two Fishplates 52 and two 2 in. Strips 53, all attached to the plate by Angle Brackets. Note that the forward edge of the plate is positioned close to, but not quite touching, the central Rollers.

The other guide is supplied by another $5\frac{1}{2} \times 3\frac{1}{2}$ in. Flat Plate 54, to which two $5\frac{1}{2} \times \frac{1}{2}$ in. Double Angle Strips are bolted through the end and fifth holes of the Plate, the securing Bolts also fixing two $5\frac{1}{2}$ in. Flat Girders 55 in position. The Flat Girders are spaced from the Plate by a Washer on the shank of each Bolt securing the inner Double Angle Strip to the Plate and note also that the free ends of the Girders are curved up slightly to allow easy access of the paper to be folded. The completed guide is attached to Angle Girders 2 on the opposite side of the central rollers from the first guide by two Fishplates and two 2 in. Slotted Strips 56, the former bolted to the inner Double Angle Strip and the latter to the outer Double Angle Strip.

In operation, a sheet of paper, approximately $7 \times 3\frac{1}{2}$ in. in size, is fed down the first guide, between Rollers 26 and 29 and into the second guide. There, the paper travels along under Flat Girders 5 until it meets the first set of Bolts which prevent it going any farther. However, the Rollers are still feeding paper through and so the paper starts to " bulge," this bulge being caught by the 20 in. Driving Bands passed round Pulleys 33, 34 and 35 and fed back between Rollers 26 and 31 to fold the paper in two. The folded paper then continues along the " belt " provided by the Driving Bands until positioned over the remaining set of Rollers, being prevented from travelling farther by two stops provided by two $1 \times \frac{1}{2}$ in. Angle Brackets 57, bolted to a $5\frac{1}{2}$ in. Strip fixed between the fourth holes of Angle Girders 2. In due sequence, Strip 44, with its two Fishplates, drops down and pushes the paper between Rollers 17 and 19 to give it its second and final fold. The paper continues down the 10 in. Driving Band and is collected in a tray, supplied by a $3\frac{1}{2} \times 2\frac{1}{2}$ in. Flanged Plate 58, attached by Angle Brackets to appropriate Angle Girder 6. A $3\frac{1}{2} \times \frac{1}{2}$ in. Double Angle Strip 59 is bolted between the flanges of the Plate, as shown.

Obviously adjustments to the machine will be required before it will operate successfully, but, once everything is right, it will prove fascinating. The position of the first fold in the paper, incidentally, can be varied by fixing two Bolts in Flat Plate 54 to provide alternative stops for the paper. Also, the second-fold action may be improved by increasing the tension of Tension Spring 41, perhaps by using a second Spring as well as the first. The paper used with the model should be fairly thin and flexible.

PARTS REQUIRED

1—1b	6—14	1—48	2—96a
7—2	3—15	1—48b	2—103
1—2a	2—16	3—48d	2—103d
2—3	2—16a	1—52	5—106
1—4	6—22	3—52a	6—108
2—6	2—23	1—53	1—109
1—6a	5—23a	2—55	4—111a
4—7a	1—26	2—55a	5—111c
6—8a	2—26c	1—57d	1—126
7—9	1—27a	23—59	1—133
2—9a	2—27d	1—62b	2—166
1—9d	2—27f	1—63d	2—186
8—10	4—31	1—70	2—186a
6—12	257—37a	2—73	2—186b
1—12a	243—37b	1—94	2—186e
3—12b	45—38	2—95b	1 E15R
3—13a	1—43	2 96	Motor

AIR NEWS (continued from page 347)

Swedish Air Force, on the other hand, made it clear that the Bulldog was the aeroplane it wanted and let its order for 58 stand, with an option on 45 more later. The Kenya Air Force also confirmed that it still wanted the five Bulldogs it had ordered.

While getting production under way, Scottish Aviation pressed on as fast as possible with flight testing of the original prototype. To prove its versatility, the aircraft was given a thorough testing on skis from snow-covered areas of Sweden. Early in 1971 it was joined by the second prototype (G-AXIG) and deliveries to Sweden are expected to begin during the summer of this year.

Powered by a 200 h.p. Lycoming 10-360-A1C engine, the Bulldog has a top speed of 162 m.p.h. in level flight, can reach 241 m.p.h. in a dive and is fully aerobatic. The big canopy over the two side-by-side seats can be jettisoned in an emergency.

How many Bulldogs will be built eventually is anyone's guess, but many hundreds of aircraft in this category are needed by air forces throughout the world, to give their pupil pilots initial training before putting them on to jet basic trainers like the Jet Provost and Aermacchi M.B.326. The R.A.F., as a start, would dearly like to replace its veteran Chipmunks with Bulldogs, and this would not appear to be too expensive as the five Kenyan aircraft are to cost £20,000 each, complete with a very full set of navigation/communications electronics and spares.

Photo at right is of the four-shilling Heller plastic Lunar Module kit, built and photographed by M.A.P. Staff members R. Rimell and R. Simpson. Lunar light effect was achieved by using a single spotlight for the picture.