

BODY AND LEGS

To begin with, two rectangles are each built up from two 7½ in. Angle Girders 1 and two 5½ in. Angle Girders 2, then the rectangles are joined by two 5½ in. by 3½ in. Flat Plates 3 and 4, each extended by a 3½ in. by 2½ in. Flexible Plate 5. Note that the upper edges of Plates 3 and 4 are overlaid by a 3½ in. Strip 6. Bolted between Angle Girders 1 in each rectangle is a 5½ in. Strip 7 which is situated a distance of six holes from lower Girder 2.

The front of the body is now enclosed by another 5½ in. by 3½ in. Flat Plate 8, two 4½ in. Flat Girders 9 and a 4½ in. by 2½ in. Flexible Plate 10, this last edged by a 2½ in. and two 4½ in. Strips in addition to Strip 7. Bolted to top Girder 2, but projecting upwards, are a 2½ in. by 1½ in. Flexible Plate 11, two 1½ in. Corner Brackets 12 and two 2½ in. Stepped Curved Strips. A duplicate set of all these parts is bolted to upper Girder 2 at the back of the body, then a 3½ in. by 2½ in. Flanged Plate 13 is fixed between Plates 11 and Corner Brackets 12 at each side, at the same time securing 2½ in. Strip 14 in position. A 2½ in. by 2½ in. and a 2½ in. by 1½ in. Plastic Plate 15 are bolted to each side of the Flanged Plate. These are curved to shape and are wedged behind corresponding Strip 6.

Two 7½ in. Angle Girders 16, connected by a 3½ in. Angle Girder 17 are bolted, along with two 7½ in. by 2½ in. Strip Plates and a 7½ in. Strip 18, to each lower Angle Girder 2, then Girders 16 at the sides are joined by a 3½ in. by 2½ in. Flexible Plate and a 5½ in. by 3½ in. Flat Plate 19. The upper edge of the Flexible Plate is overlaid by a 3½ in. Strip 20.

MOTOR AND DRIVE

Fixed by Angle Brackets between upper Angle Girders 2 are two 3½ in. Strips, while another two similar Strips are fixed between Strips 7, also by Angle Brackets. Two 4½ in. by 2½ in. Flat Plates 21 and 22 are bolted to these Strips, as shown. A 3½ in. Rod 23 is journalled in Flat Plates 3 and 21, being held in place by a Crank at one side of Plate 21 and a ¾ in. Contrate Wheel 24, at the other side, the latter spaced from Plate 21 by a Washer. A 3 in. Rod is journalled in Flat Plates 4 and 22, this being held in position by a Collar and a Crank 25.

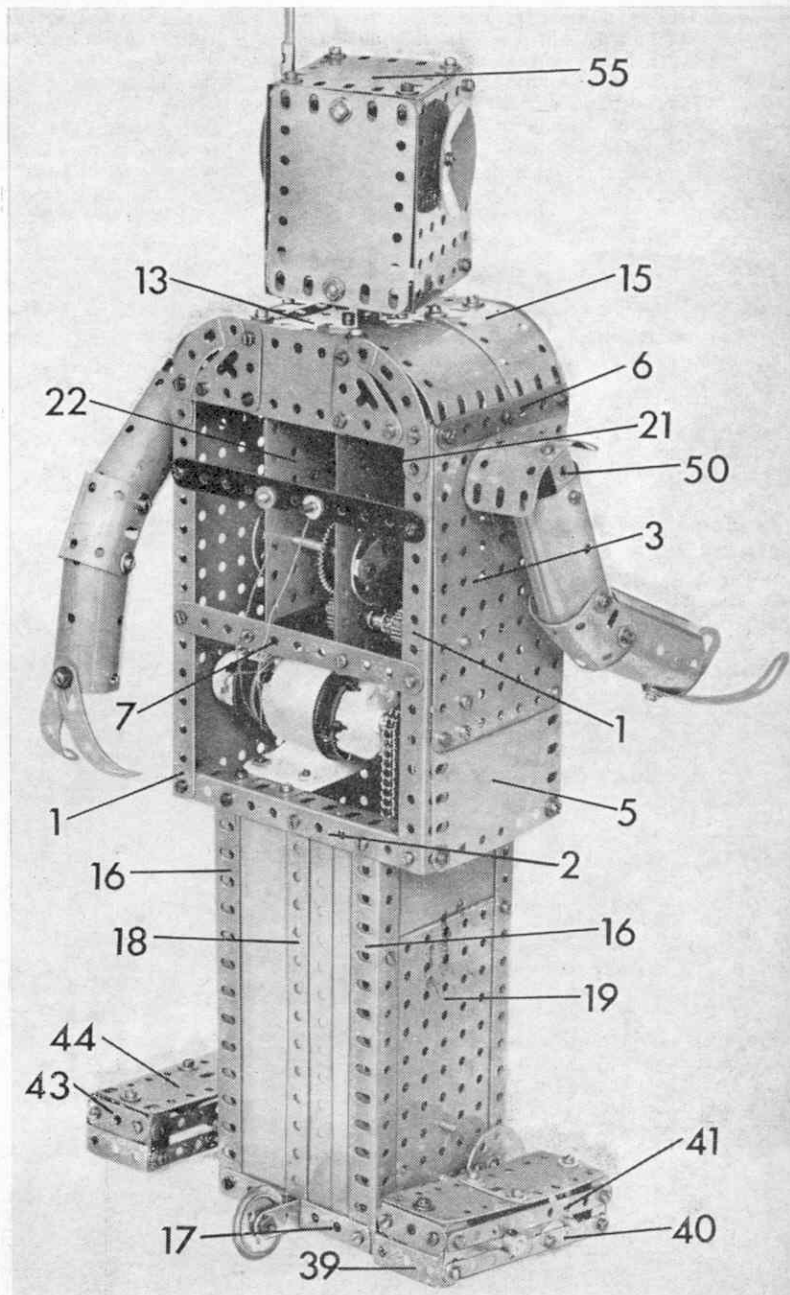
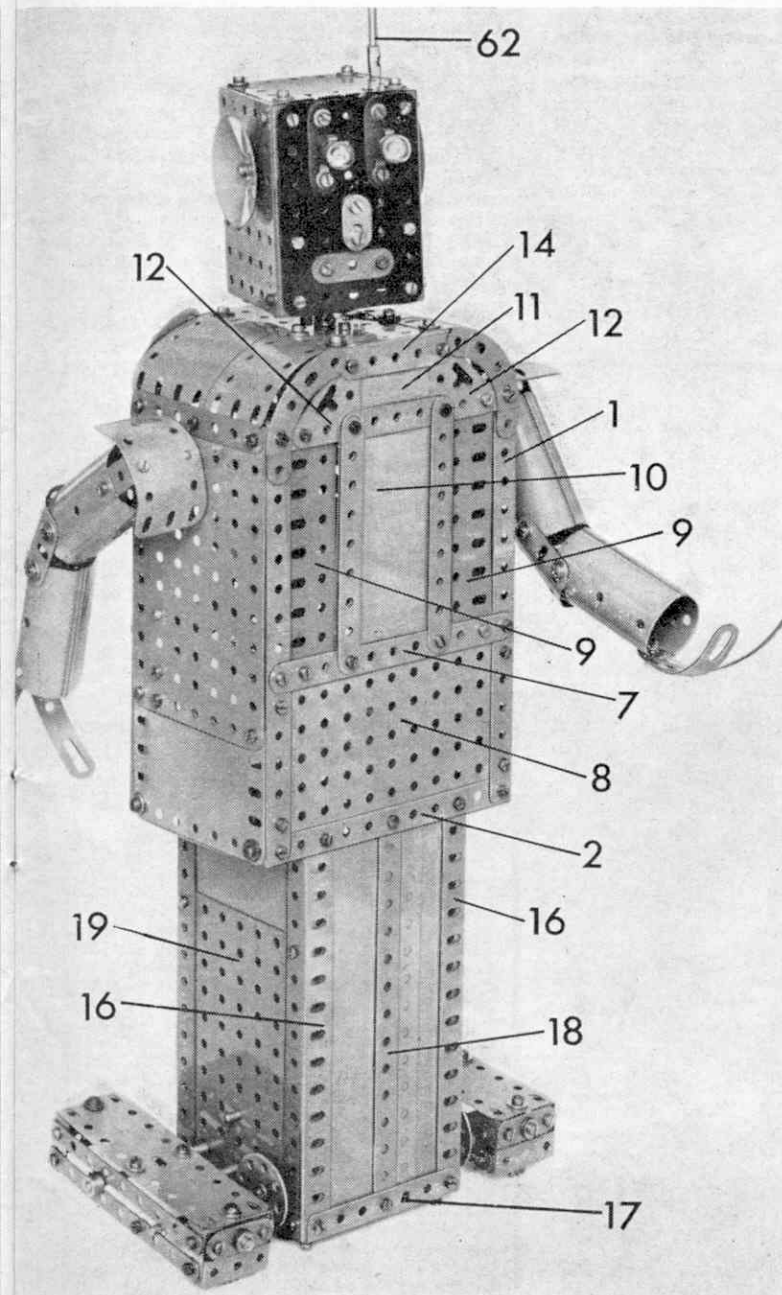
Lock-nutted to each Crank is a 2½ in. Strip 26, the other end of which is, in turn, lock-nutted to an 8-hole Bush Wheel 27, mounted on a 2 in. Rod journalled in Plates 21 and 22 and carrying a 50-teeth Gear Wheel 28. This Gear is in mesh with a ¾ in. Pinion on a 3 in. Rod, held by a Collar in

Plates 3 and 21, and carrying a ½ in. Pinion 29. Engaging with Pinion 29 is a ¾ in. Contrate Wheel, fixed on the end of a 3½ in. Rod held by Collars in a 1 in. by 1 in. Angle Bracket bolted to Flat Plate 3 and in a ½ in. by ½ in. Angle Bracket bolted to Strip 20. Also fixed on this Rod is another ½ in. Pinion 30.

At this stage three 4½ in. Rods 31, 32, and 33 are journalled in Flat Plates 19 in the positions shown. Rod 31 carries a 50-teeth Gear 34 and is held in place by two 8-hole Bush Wheels to the face of each of which a Rod Socket 35 is fixed. Rod 32 carries a 60-teeth Gear 36 and is held in place by a Collar and a ¾ in. Pinion, the latter in mesh with Gear 34. Rod 33, on the other hand, carries a 1½ in. Sprocket Wheel 37 and is held in place by a Collar and a 1/8 in. Pinion, the latter in mesh with Gear Wheel 36.

Two 3½ in. Strips are bolted between lower Angle Girder 2 to provide the mounting for the Power Drive Unit on the output shaft of which a ¾ in. Sprocket Wheel and a Worm are secured. The Sprocket Wheel is connected to Sprocket Wheel 37 by Sprocket Chain, while the Worm engages with Pinion 30. At the top of the model, a Rod with Keyway is held by Collars in Flanged Plate 13, and in a Double Bent Strip bolted to the underside of

Meet the Mechanical Man—A self-propelled, walking robot driven by a Meccano Power Drive Unit. A rear view of the robot, showing the Motor mounting and construction of the 'legs'



the Flanged Plate. A $\frac{1}{2}$ in. Pinion 38, fixed on the lower end of this Rod, engages with Contrate Wheel 24.

FEET AND ARMS

Both feet are similarly built so only one need be described. Two $1\frac{1}{2}$ in. by $\frac{1}{2}$ in. Double Angle Strips 39 are joined by two $4\frac{1}{2}$ in. Narrow Strips 40, bolted to their lugs, at the same time fixing four Fishplates in position. These Fishplates are, themselves, connected by a further two $4\frac{1}{2}$ in. Narrow Strips 41, at the same time bolting another two $1\frac{1}{2}$ in. by $\frac{1}{2}$ in. Double Angle Strips 42 between the sides and also fixing four Angle Brackets in place. These Angle Brackets are joined by two $1\frac{1}{2}$ in. Strips 43, one at each end of the foot. A $4\frac{1}{2}$ in. by $1\frac{1}{2}$ in. Compound Flexible Plate 44 is built up from two $2\frac{1}{2}$ in. by $1\frac{1}{2}$ in. Flexible Plates and is bolted to Double Angle Strips 42.

A $2\frac{1}{2}$ in. Rod 45 is located in the gaps between Narrow Strips 40 and 41, being held in place by two Collars. This Rod must, however, be free to slide in the gaps. The inside end of the Rod is then fixed in a Rod Socket 46 attached to Flat Plate 19. Two Fishplates 47 are bolted to each Narrow Strip 40 and are angled so that their circular holes coincide with the gaps between Narrow Strips 40 and 41. Passed through these holes is a 2 in. Rod which is fixed in Rod Socket 35 attached to the Bush Wheel on the end of Rod 31. Attached to forward Strip 43 is a Short Coupling in the longitudinal bore of which a Centre Fork 48 is held. At the rear of the body, a Single Bent Strip is bolted to Angle Girders 17 and a $\frac{1}{2}$ in. Bolt, carrying a 1 in. loose Pulley with Rubber Ring, is held by two Nuts in the lugs of this Single Bent Strip.

Two arms are each built up from two Cylinders 49

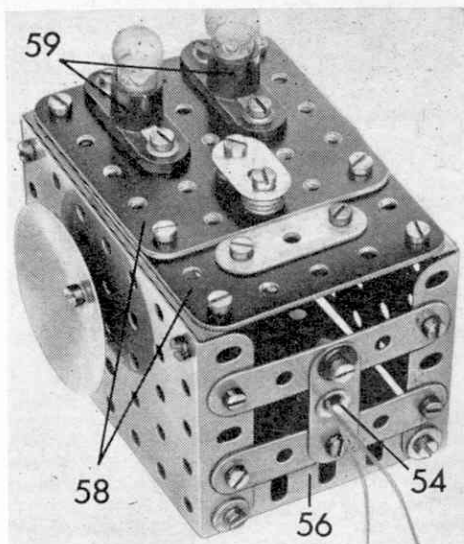
joined by a curved $2\frac{1}{2}$ in. by $1\frac{1}{2}$ in. Flexible Plate. A 1 in. by $\frac{1}{2}$ in. Angle Bracket 50 and a Crank 51 are bolted to the upper Cylinder, while another curved $2\frac{1}{2}$ in. by $1\frac{1}{2}$ in. Flexible Plate is attached to Angle Bracket 50. Hands are provided by two Formed Slotted Strips 52, then the completed arm is attached to the body by securing Crank 51 on Rod 23, the other arm being mounted on the corresponding 3 in. Rod.

THE HEAD

Only the head remains to be built, and this is by no means difficult. Two $3\frac{1}{2}$ in. by $2\frac{1}{2}$ in. Flanged Plates 53 are joined at the bottom by two $2\frac{1}{2}$ in. Strips, bolted between the centre holes of which is a Double Arm Crank 54, and at the top by a $2\frac{1}{2}$ in. by $2\frac{1}{2}$ in. Flexible Plate 55, the securing Bolts also holding a $2\frac{1}{2}$ in. Angle Girder in place. A corresponding $2\frac{1}{2}$ in. Angle Girder 56 is bolted between the Flanged Plates at the bottom of the head, then a $3\frac{1}{2}$ in. by $2\frac{1}{2}$ in. Plastic Plate 57 is bolted to the vertical flanges of these Angle Brackets.

The face is provided by two $2\frac{1}{2}$ in. by $2\frac{1}{2}$ in. Insulating Flat Plates 58 overlapped three holes, which are bolted to two $3\frac{1}{2}$ in. Angle Girders. Two Lamps in Lamp Holders 59 represent the eyes, while the nose is a Fishplate, attached to the Insulating Flat Plates by two $\frac{1}{2}$ in. Bolts, but spaced from the Plates by four Washers on the shank of each Bolt. The mouth is simply a $1\frac{1}{2}$ in. Strip, whereas the ears are each provided by a Conical Disc 60.

When completed, the face is fixed in position by bolting the $3\frac{1}{2}$ in. Angle Girders to Flanged Plates 53, but before this is done the Lamp Holders should be wired in parallel. In other words, the upper terminals of the Lamp Holders are wired together,



A close-up view of the head

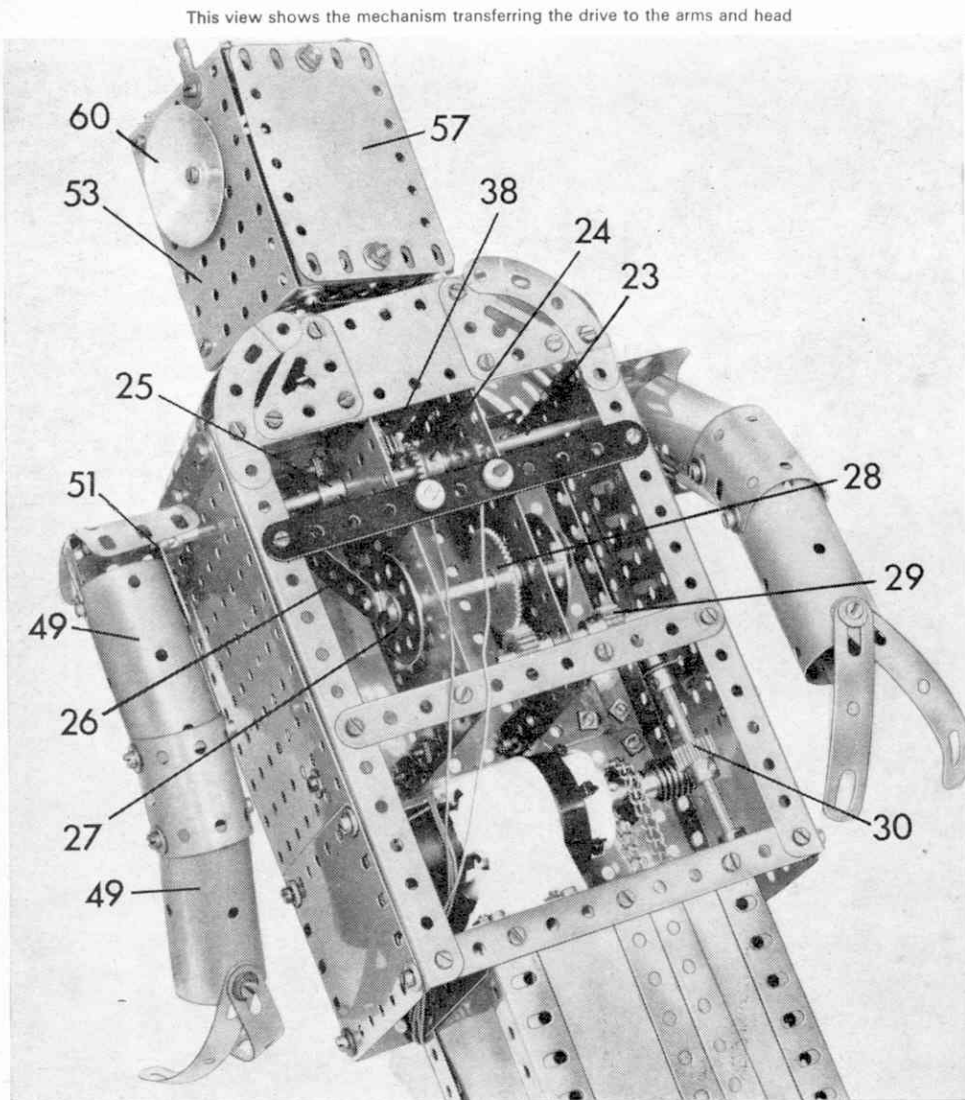
as also are the lower terminals, then two lengths of insulated wire are connected one to the upper terminal and one to the lower terminal of one of the Lamp Holders. These wires are passed through the boss of Double Arm Crank 54 and are threaded down the Keyway of the Rod with Keyway into the inside of the Robot, where they are connected to two terminals X and Y on a $5\frac{1}{2}$ in. Insulating Strip 61, bolted to rear Angle Girders 1. Each terminal is obtained from a $\frac{1}{2}$ in. Bolt, a Nut and a Terminal Nut. The head is then mounted in position by fixing Double Arm Crank 54 on the Rod with Keyway. An 'aerial' is provided by a 2 in. Rod 62 and is attached to the head by a Rod and Strip Connector bolted to left-hand Flanged Plate 53. Finally, the leads from the Power Drive Unit are taken to terminals X and Y, which also, of course, serve as the connecting points for the leads from the power source.

TIMING

Before the Robot can be operated the head, arms and feet movements must be synchronised. Cranks 24 and 26 and Bush Wheels 27 should be so positioned that when one arm is swinging forward, the other is swinging backwards. Also, when the right arm is in its forward position, the head should be turned to the right. It should be remembered that the feet do not move alternately but simultaneously in the same direction. Because of this, Rod Sockets 35 must be in identical positions in relation to the Bush Wheels. The exact timing for all movements, however, can best be obtained by experimenting.

PARTS REQUIRED

2 of No. 1b	1 of No. 27d	4 of No. 133
2 of No. 2	2 of No. 29	1 of No. 155
2 of No. 2a	1 of No. 32	4 of No. 179
12 of No. 3	202 of No. 37a	2 of No. 187a
6 of No. 5	180 of No. 37b	10 of No. 188
5 of No. 6a	48 of No. 38	1 of No. 190
8 of No. 8b	1 of No. 45	2 of No. 190a
4 of No. 9	8 of No. 48	1 of No. 191
4 of No. 9b	4 of No. 52a	2 of No. 194
2 of No. 9d	3 of No. 53	2 of No. 194a
13 of No. 10	2 of No. 53a	1 of No. 194b
17 of No. 12	12 of No. 59	4 of No. 195
1 of No. 12a	4 of No. 62	1 of No. 212
2 of No. 12b	1 of No. 62b	4 of No. 215
3 of No. 15a	2 of No. 63d	4 of No. 216
2 of No. 16	2 of No. 65	1 of No. 230
2 of No. 16a	1 of No. 70	8 of No. 235e
1 of No. 16b	4 of No. 90a	1 of No. 501
3 of No. 17	1 of No. 94	2 of No. 511
1 of No. 22a	1 of No. 95a	2 of No. 539
4 of No. 24	1 of No. 96a	2 of No. 540c
2 of No. 25	1 of No. 102	1 Power
3 of No. 26	2 of No. 103c	Drive Unit
1 of No. 26c	17 of No. 111a	
2 of No. 27	4 of No. 111c	



This view shows the mechanism transferring the drive to the arms and head

the Flanged Plate. A $\frac{1}{2}$ in. Pinion 38, fixed on the lower end of this Rod, engages with Contrate Wheel 24.

FEET AND ARMS

Both feet are similarly built so only one need be described. Two $1\frac{1}{2}$ in. by $\frac{1}{2}$ in. Double Angle Strips 39 are joined by two $4\frac{1}{2}$ in. Narrow Strips 40, bolted to their lugs, at the same time fixing four Fishplates in position. These Fishplates are, themselves, connected by a further two $4\frac{1}{2}$ in. Narrow Strips 41, at the same time bolting another two $1\frac{1}{2}$ in. by $\frac{1}{2}$ in. Double Angle Strips 42 between the sides and also fixing four Angle Brackets in place. These Angle Brackets are joined by two $1\frac{1}{2}$ in. Strips 43, one at each end of the foot. A $4\frac{1}{2}$ in. by $1\frac{1}{2}$ in. Compound Flexible Plate 44 is built up from two $2\frac{1}{2}$ in. by $1\frac{1}{2}$ in. Flexible Plates and is bolted to Double Angle Strips 42.

A $2\frac{1}{2}$ in. Rod 45 is located in the gaps between Narrow Strips 40 and 41, being held in place by two Collars. This Rod must, however, be free to slide in the gaps. The inside end of the Rod is then fixed in a Rod Socket 46 attached to Flat Plate 19. Two Fishplates 47 are bolted to each Narrow Strip 40 and are angled so that their circular holes coincide with the gaps between Narrow Strips 40 and 41. Passed through these holes is a 2 in. Rod which is fixed in Rod Socket 35 attached to the Bush Wheel on the end of Rod 31. Attached to forward Strip 43 is a Short Coupling in the longitudinal bore of which a Centre Fork 48 is held. At the rear of the body, a Single Bent Strip is bolted to Angle Girders 17 and a $\frac{1}{2}$ in. Bolt, carrying a 1 in. loose Pulley with Rubber Ring, is held by two Nuts in the lugs of this Single Bent Strip.

Two arms are each built up from two Cylinders 49

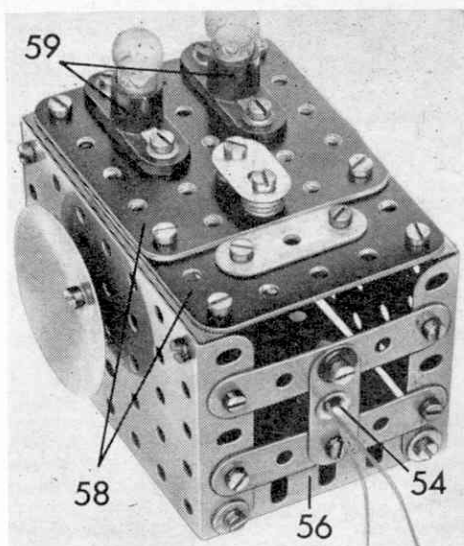
joined by a curved $2\frac{1}{2}$ in. by $1\frac{1}{2}$ in. Flexible Plate. A 1 in. by $\frac{1}{2}$ in. Angle Bracket 50 and a Crank 51 are bolted to the upper Cylinder, while another curved $2\frac{1}{2}$ in. by $1\frac{1}{2}$ in. Flexible Plate is attached to Angle Bracket 50. Hands are provided by two Formed Slotted Strips 52, then the completed arm is attached to the body by securing Crank 51 on Rod 23, the other arm being mounted on the corresponding 3 in. Rod.

THE HEAD

Only the head remains to be built, and this is by no means difficult. Two $3\frac{1}{2}$ in. by $2\frac{1}{2}$ in. Flanged Plates 53 are joined at the bottom by two $2\frac{1}{2}$ in. Strips, bolted between the centre holes of which is a Double Arm Crank 54, and at the top by a $2\frac{1}{2}$ in. by $2\frac{1}{2}$ in. Flexible Plate 55, the securing Bolts also holding a $2\frac{1}{2}$ in. Angle Girder in place. A corresponding $2\frac{1}{2}$ in. Angle Girder 56 is bolted between the Flanged Plates at the bottom of the head, then a $3\frac{1}{2}$ in. by $2\frac{1}{2}$ in. Plastic Plate 57 is bolted to the vertical flanges of these Angle Brackets.

The face is provided by two $2\frac{1}{2}$ in. by $2\frac{1}{2}$ in. Insulating Flat Plates 58 overlapped three holes, which are bolted to two $3\frac{1}{2}$ in. Angle Girders. Two Lamps in Lamp Holders 59 represent the eyes, while the nose is a Fishplate, attached to the Insulating Flat Plates by two $\frac{1}{2}$ in. Bolts, but spaced from the Plates by four Washers on the shank of each Bolt. The mouth is simply a $1\frac{1}{2}$ in. Strip, whereas the ears are each provided by a Conical Disc 60.

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A close-up view of the head

as also are the lower terminals, then two lengths of insulated wire are connected one to the upper terminal and one to the lower terminal of one of the Lamp Holders. These wires are passed through the boss of Double Arm Crank 54 and are threaded down the Keyway of the Rod with Keyway into the inside of the Robot, where they are connected to two terminals X and Y on a $5\frac{1}{2}$ in. Insulating Strip 61, bolted to rear Angle Girders 1. Each terminal is obtained from a $\frac{1}{2}$ in. Bolt, a Nut and a Terminal Nut. The head is then mounted in position by fixing Double Arm Crank 54 on the Rod with Keyway. An 'aerial' is provided by a 2 in. Rod 62 and is attached to the head by a Rod and Strip Connector bolted to left-hand Flanged Plate 53. Finally, the leads from the Power Drive Unit are taken to terminals X and Y, which also, of course, serve as the connecting points for the leads from the power source.

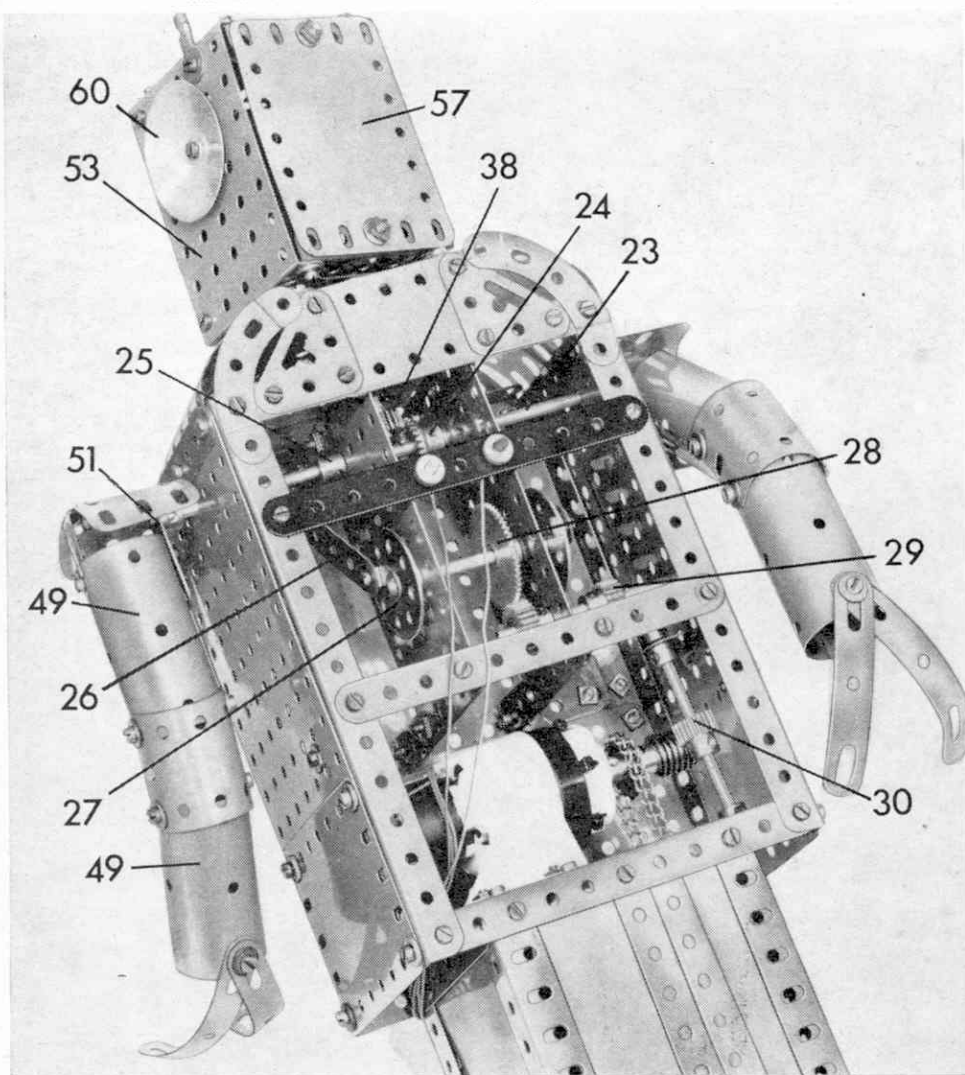
TIMING

Before the Robot can be operated the head, arms and feet movements must be synchronised. Cranks 24 and 26 and Bush Wheels 27 should be so positioned that when one arm is swinging forward, the other is swinging backwards. Also, when the right arm is in its forward position, the head should be turned to the right. It should be remembered that the feet do not move alternately but simultaneously in the same direction. Because of this, Rod Sockets 35 must be in identical positions in relation to the Bush Wheels. The exact timing for all movements, however, can best be obtained by experimenting.

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4 of No. 24	1 of No. 96a	2 of No. 540c
2 of No. 25	1 of No. 102	1 Power
3 of No. 26	2 of No. 103c	Drive Unit
1 of No. 26c	17 of No. 111a	
2 of No. 27	4 of No. 111c	

This view shows the mechanism transferring the drive to the arms and head



the Flanged Plate. A $\frac{1}{2}$ in. Pinion 38, fixed on the lower end of this Rod, engages with Contrate Wheel 24.

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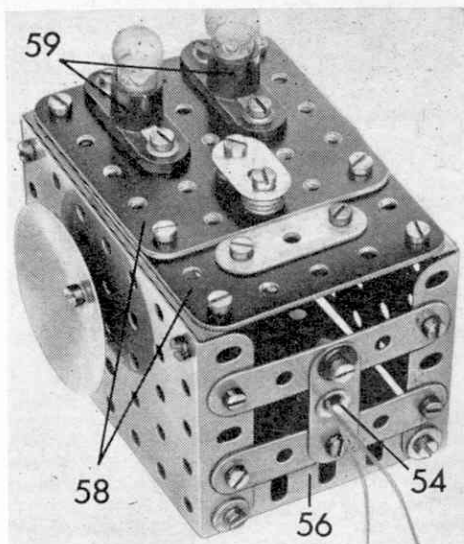
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A close-up view of the head

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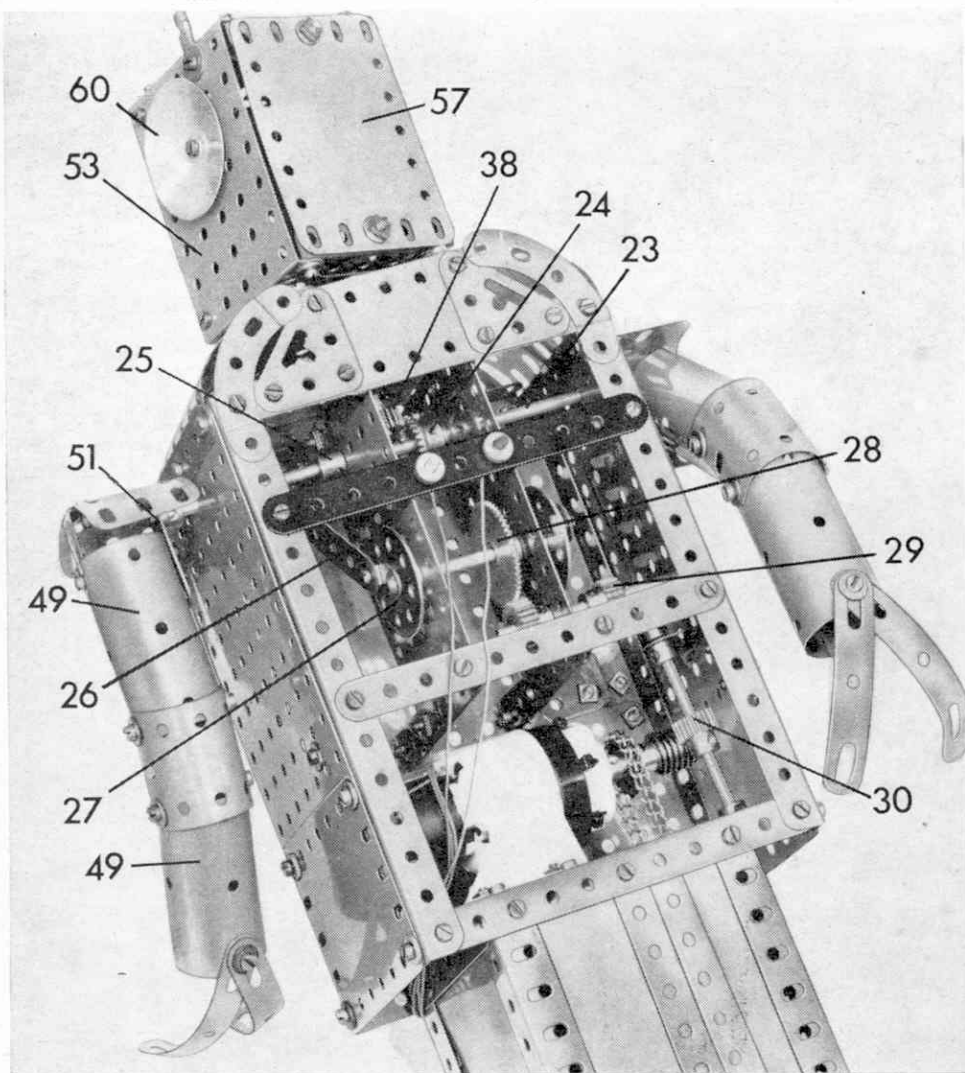
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17 of No. 12	12 of No. 59	4 of No. 195
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3 of No. 26	2 of No. 103c	Drive Unit
1 of No. 26c	17 of No. 111a	
2 of No. 27	4 of No. 111c	

This view shows the mechanism transferring the drive to the arms and head



HERE'S HOPPY. THE ROBOT

Eyes aglow,
Arms swinging,
Head turning,
'Hoppy'
perambulates
in a most
unusual manner.
Build him
with Spanner

SCIENCE fiction writers—those prophets of the mechanical age—have long foretold the existence of man-like machines, capable of movement and able to perform all sorts of physical tasks. In these days of automation the prophesies of science fiction are well on the way to realization. Already men in a wide variety of industries are being superseded by machines which are doing the job better, faster and at a greatly reduced cost, but as yet, none of these machines could, even by the widest stretch of the imagination, be described as 'human-looking'.

In spite of this, it is an easy matter to produce a man-like machine, or robot, as is proved by the fact that Meccano owners have been doing just that for close on half a century! It has been some considerable time, however, since we actually featured a robot in the 'M.M.', so I thought I would make up the deficiency this month with the typical example described below. Admittedly, it cannot do anybody's work for them, but it does walk, swing its arms and move its head, thanks to the Power Drive Unit it incorporates. The only thing to remember is that it does not walk like we do with two legs, but moves both feet forward together, while standing on its 'legs', then swings its body forward to repeat the movement. Construction should present no problem.

In this view of the model construction of the feet is clearly shown. Note that the back of the 'legs' has been removed to show the drive to the feet

