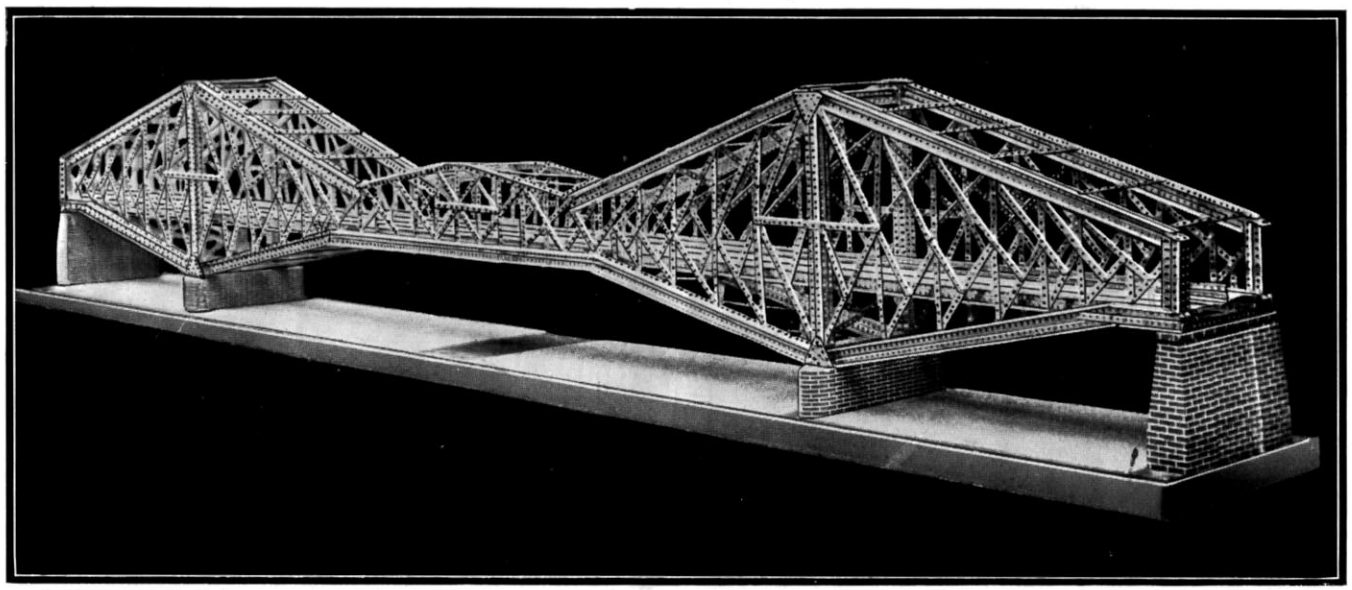
MECCANO
BOOK OF NEW MODELS

9d

The Wonderful Quebec Bridge : A Fine Subject for Model-builders

OUR cover shows the giant bridge that crosses the St. Lawrence River at Quebec. Not only is this the largest cantilever bridge in the world, but also it has a history of tragedy that makes it unique among the bridges of modern times.

The first terrible disaster during the building of the bridge occurred on 29th August 1907. Shortly before work was due to cease for the day, the compression cords of the south anchor arm suddenly crumpled up. The entire cantilever rocked violently and collapsed with a fearful crash upon its pier, carrying with it 86 men who unfortunately had been at work upon the erection at the time. In spite of all rescue efforts, only 11 men were saved.



A fine model of the wonderful Quebec Bridge, measuring over 15ft. in length. The "K" pattern interlaced girder bracing used throughout the model is immensely strong, and was employed for the first time in the construction of the actual bridge, after every other system of girder bracing had been considered.

Of the 17,000 tons of steel contained in the structure, some 8,000 tons fell into the deep channel of the river, while the remainder lay astride the pier and along the bank—a gigantic mass of girders and plates 40ft. in height, twisted and distorted almost beyond belief. Thus in a few minutes was undone the labour of three years.

The Canadian Government now placed a contract for a new bridge. Construction started again, and all went well until September 1916, when everything was ready for hoisting into position the huge centre span that was to link up the two great shore cantilevers. This span had been built in the meantime at a point about 3½ miles down stream from the site of the bridge, and when all was ready it was conveyed on pontoons to the bridge site and manoeuvred into position beneath the gap between the cantilevers ready for being raised. It had been raised about 32ft. when suddenly there was a loud report and, almost before anyone realised what had happened, the great span had partially twisted over. With an appalling rumble and splash it disappeared into the river, bearing with it 90 men who had been engaged in the hoisting operations. Of these men 81, including the chief engineer, were saved.

The engineers were not beaten, however. Another centre span was built, and on 17th September 1917, it was safely hoisted into position. One month later the first train passed over the bridge.

Bridge-building is undoubtedly one of the most interesting branches of engineering for Meccano boys and the remarkable reproduction of the Quebec Bridge illustrated here is an excellent example of the adaptability of Meccano parts for this purpose. This model is over 15 ft. in length and carries two lines of Hornby track, which are separated, as in the actual bridge, by a strong steel partition constructed from Angle Girders and Flat Girders. The complete bridge is mounted on four wooden piers painted to represent brickwork. It will be noticed that K-pattern interlaced bracing, which has proved to be immensely strong, is used throughout.

To-day the Quebec Bridge carries the trans-continental line of the Canadian National Railways over the St. Lawrence River, and stands as a monument to the ability, courage and tenacity of its engineers.

Model No. 1. The Meccano Bowman

Fig. 1

One of the most fascinating uses for Meccano parts is in the making of model "men" or "Meccanitians", as they are known to model builders. With a little ingenuity and skilful choice of parts it is possible to produce some very humorous and realistic figures, and in Fig. 1 is shown a miniature bowman that gives some idea of the excellent work that can be done in this connection. The bowman is complete with long-bow and arrow, and is no doubt a highly skilled archer, although his efforts probably would not rival those of William Tell!

The long-bow is a 5½" Strip, to the ends of which a piece of string is attached. The bowman's hands are Angle Brackets, and his head is a 1" Pulley, which is secured to the end hole in the Strip that forms his body. The right arm is made up from a Curved Strip and a 2½" Strip pivotally joined together as shown, and arranged in a realistic attitude. The arrow is a Rod held in the Angle Brackets that form the hands.

Parts required:

2 of No. 2	3 of No. 12	11 of No. 37	1 of No. 90a
3 „ 5	1 „ 16	1 „ 40	1 „ 111c
1 „ 10	1 „ 22	1 „ 48a	
1 „ 11	1 „ 35	1 „ 52	

Model No. 2. Tram Car

One pair of road wheels is mounted on a Rod that takes the place of the usual 1½" spindle of a No. 1 Clockwork Motor, placed under the chassis. The ends of the Rod are journalled in Flat Trunnions bolted to the side Girders of the chassis. A 3½" Rod also is passed through the Girders of the chassis and through the sides of the Clockwork Motor.

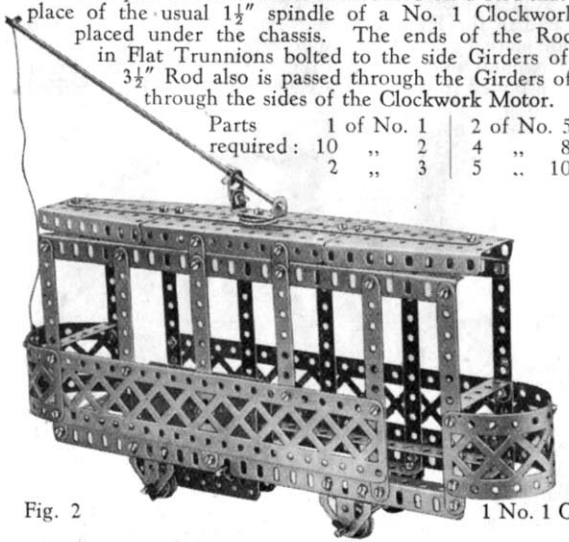


Fig. 2

Parts required:

1 of No. 1	2 of No. 5	4 of No. 12	1 No. 1 Clockwork Motor
10 „ 2	4 „ 8	1 „ 13	
2 „ 3	5 „ 10	3 „ 16	
		4 „ 20b	
		1 „ 22a	
		4 „ 35	
		60 „ 37	
		2 „ 37a	
		5 „ 38	
		1 „ 48	
		2 „ 48a	
		1 „ 52	
		2 „ 54	
		2 „ 99	
		2 „ 100	
		2 „ 111c	
		2 „ 126	
		2 „ 126a	

Model No. 3. Windmill Pump

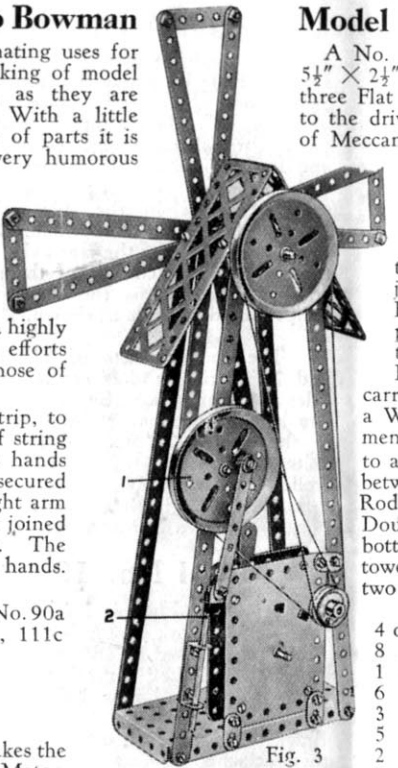


Fig. 3

A No. 1 Clockwork Motor is mounted on a 5½" × 2½" Flanged Plate and is fixed in place by three Flat Brackets. Two 1" Pulleys are secured to the driving shaft of the Motor, and a length of Meccano Cord is passed round one of them and then round a Pulley on the axle of the sails. The sails consist of Strips bolted to a Bush Wheel that serves as a hub. The other 1" Pulley on the Motor driving shaft drives the Pulley 1, the Rod of which is journalled in a ½" Reversed Angle Bracket and a 12½" Strip that forms part of the tower. A ⅜" Bolt is attached to one of the inner holes of the 3" Pulley by means of two Nuts, and this carries a 3½" Strip, on each side of which a Washer is placed to allow it free movement. The Strip is pivoted at its other end to a ½"×½" Angle Bracket that is clamped between two Spring Clips on the pump Rod 2. The pump Rod slides in a 1½" × ½" Double Angle Strip bolted 2" from the bottom of one of the 12½" Strips of the tower. The windmill roof is made from two 5½" Braced Girders.

Parts required:

4 of No. 1	2 of No. 19b	1 of No. 40	
8 „ 2	2 „ 22	1 „ 48	
1 „ 3	1 „ 23	2 „ 52	
6 „ 5	1 „ 24	2 „ 100	
3 „ 10	3 „ 35	2 „ 111c	
5 „ 12	37 „ 37	1 „ 125	
2 „ 16	4 „ 37a	1 No. 1 Clockwork Motor	
1 „ 18a	3 „ 38		

Model No. 4. Tipping Motor Wagon

To the lower Trunnion fixed to the body is bolted an Angle Bracket and a Reversed Angle Bracket to which the front axle is pivoted. The steering column is held in a Flat Bracket, and carries at its lower end a Bush Wheel that is joined by cords to the front axle.

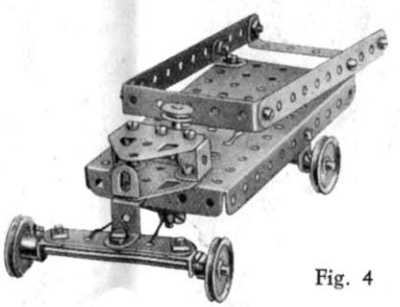


Fig. 4

Parts required:

2 of No. 2	
1 „ 5	
3 „ 10	
2 „ 11	
5 „ 12	
2 „ 16	
1 „ 17	
4 „ 22	
1 „ 23	
1 „ 24	
2 „ 35	
16 „ 37	
4 „ 37a	
1 „ 40	
2 „ 48a	
1 „ 52	
3 „ 111c	
1 „ 125	
2 „ 126a	

Model No. 5. Match-Box Stand

The match box is held between two Flat Trunnions, which are mounted on the vertical Rod by means of Angle Brackets.

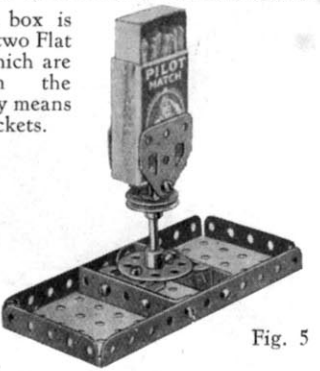


Fig. 5

Parts required:

2 of No. 12
1 „ 17
1 „ 22
1 „ 24
10 „ 37
2 „ 48a
1 „ 52
2 „ 126
2 „ 126a

Model No. 6. Fire Escape

A 5½" × 2½" Flanged Plate is fitted with a Flat Trunnion at one end and two Trunnions are bolted to the upper surface at the other end. The ladder is made from two 5½" Strips bolted to the Trunnions. The ladder is also secured by means of a Double Bracket to a 2½" × ½" Double Angle Strip that is bolted vertically between the Strips by the same Bolt that secures the Double Bracket to the Plate.

The front axle is carried in a Double Angle Strip, to which is bolted a Bush Wheel pivoted to the Flat Trunnion on the front of the Flanged Plate. A Double Bracket fixed to a 2½" Strip by means of a Pivot Bolt, is fitted with a Flat Trunnion in which the steering Rod is journalled.

Parts required:

4 of No. 2	16 of No. 37	1 of No. 52
2 „ 5	5 „ 37a	6 „ 111c
2 „ 10	1 „ 40	2 „ 126
2 „ 11	2 „ 48a	2 „ 126a
5 „ 12		
2 „ 16		
1 „ 17		
4 „ 22		
1 „ 23		
1 „ 24		
2 „ 35		

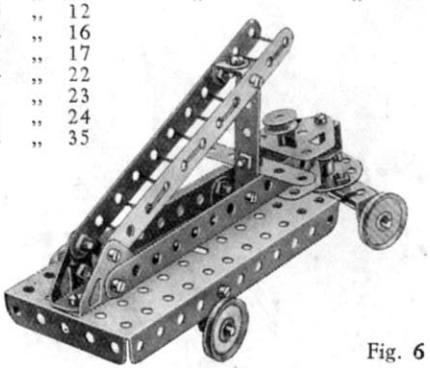


Fig. 6

Model No. 7. Toy Horse on Wheels

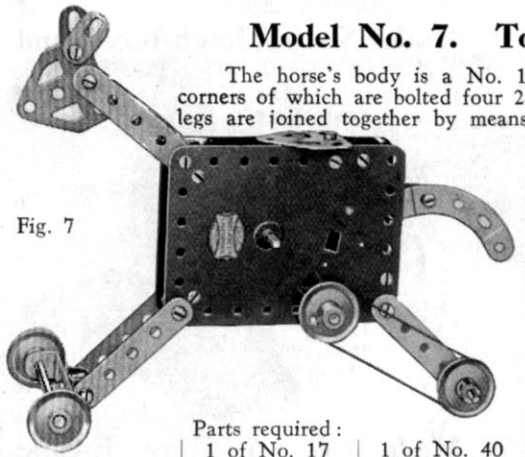


Fig. 7

The horse's body is a No. 1 Clockwork Motor, to the two lower corners of which are bolted four 2½" Strips to form the legs. The front legs are joined together by means of two Angle Brackets, to which is secured a 2½" × ½" Double Angle Strip. A 3½" Rod is passed through the holes in the ends of the Double Angle Strip and is fitted with two 1" Pulley Wheels. At the rear is a 1" fast Pulley carried on a 2" Axle Rod that passes through the end holes in the Strips forming the hind legs, and is held in position by a Spring Clip. The Pulley is driven from a similar Pulley on the Motor driving shaft.

Two further 2½" Strips represent the neck, and between them is held a Flat Trunnion fitted with two Flat Brackets, which represents the horse's head. The tail is bolted to the Motor brake lever, and the saddle is a Flat Trunnion attached to the Motor by an Angle Bracket bolted to the side plate.

Parts required:

6	of No. 5	1	of No. 17	1	of No. 40
2	,, 10	4	,, 22	1	,, 48a
3	,, 12	2	,, 35	1	,, 90a
1	,, 16	14	,, 37	2	,, 126a

1 No. 1 Clockwork Motor.

Model No. 8. Travelling and Swivelling Crane

The base of the travelling truck is made from a 5½" × 2½" Flanged Plate, to the sides of which four 2½" small radius Curved Strips are bolted to form bearings for 3½" Axle Rods, which carry 1" fast Pulleys at their ends. A 2½" × ½" Double Angle Strip 1 is pivoted to the Plate by means of a Bolt passed through its central hole and through the central hole of the Plate. The Bolt is retained in place by two lock-nuts underneath the Flanged Plate. At each end of the Double Angle Strip is bolted a ½" Reversed Angle Bracket, and a 1½" Rod 2 is then passed through them and also through the side plates of the Clockwork Motor so as to hold the latter in place.

At the front of the Motor two 5½" Strips are bolted to the lower corners, and they are extended by further similar Strips and joined together at their upper ends by a Double Bracket, to which is attached a Flat Bracket 3. A 1½" Axle Rod is held in place at the jib head by Spring Clips, and carries a ½" loose Pulley Wheel. A 2" Axle Rod is used in place of the ordinary Motor driving spindle, and the hoisting cord is attached to it by a Spring Clip. The hoisting cord is passed through the hole in the Flat Bracket of the jib and then over the ½" Pulley Wheel at the jib head.

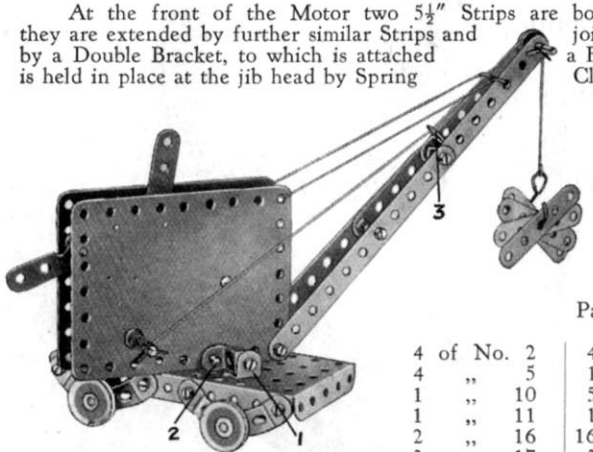


Fig. 8

Parts required:

4	of No. 2	4	of No. 22	1	of No. 48a
4	,, 5	1	,, 23	1	,, 52
1	,, 10	5	,, 35	1	,, 57
1	,, 11	1	,, 40	4	,, 90a
2	,, 16	16	,, 37	2	,, 111c
2	,, 17	3	,, 37a	2	,, 125

1 No. 2 Clockwork Motor.

Model No. 9. Clockwork Tram Car

The model is driven by a Clockwork Motor secured to a 5½" × 2½" Flanged Plate by Angle Brackets 2. A 3½" Rod 1 is used in place of the ordinary 1½" Motor spindle, and this passes through the flanges of the Plate and is fitted with a 1" fast Pulley at each end. A 2½" Strip is bolted to each end hole in the sides of the Flanged Plate, and two similar Strips are held in place by the rear axle. The three Strips at each side of the model are connected across the top by 5½" Strips bolted in place as shown.

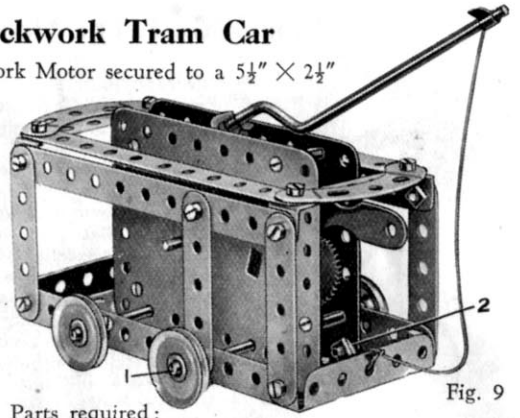


Fig. 9

The roof consists of 5½" Strips and 2½" Strips, and is secured to the sides of the tram by four Angle Brackets. To enhance the appearance of the model, 2½" Curved Strips are bolted to the ends of the roof. The trolley is a Crank Handle that is passed through an Angle Bracket and held in position by two Spring Clips.

Parts required:

4	of No. 2	4	of No. 22	2	of No. 48a
6	,, 5	3	,, 35	1	,, 52
3	,, 12	16	,, 37	2	,, 90a
2	,, 16	4	,, 37a	3	,, 111c
1	,, 19s	1	,, 40		

1 No. 1 Clockwork Motor.

Model No. 10. Clockwork Driven Motor Tractor

A Sector Plate is bolted to the upper surface of a 5½" × ½" Flanged Plate and a No. 1 Clockwork Motor is then fixed to it by means of Angle Brackets. Further Angle Brackets are used to secure a second Sector Plate across the top of the Motor. A Flat Trunnion is bolted beneath the lower Plate and a 1½" × ½" Double Angle Strip is pivoted to it. A 2" Rod passed through a Double Angle Strip is fitted with two 1" fast Pulley Wheels that form the front road wheels. An Angle Bracket, to which is bolted a Flat Bracket, is bolted to one of the side plates of the Motor, and a second Flat Bracket is then attached to the first. A 3½" Rod is passed through the hole of the second Flat Bracket and journalled at its lower end in the Flanged Plate. At its upper end the Rod carries a Bush Wheel, and is held in place by a Collar underneath the Flanged Plate.

Steering is carried out by cord wound once round a 1" fast Pulley on the lower end of the steering column 2 and then bolted to the front Axle. The rear Axle is carried in a 2½" × ½" Double Angle Strip bolted to the base plate. A 2" Rod is substituted for the ordinary driving spindle of the Motor and is passed through one of the Flanges of the lower Sector Plate. The Rod carries the 1" Pulley Wheel 1 that drives the rear wheels by means of a rubber band.

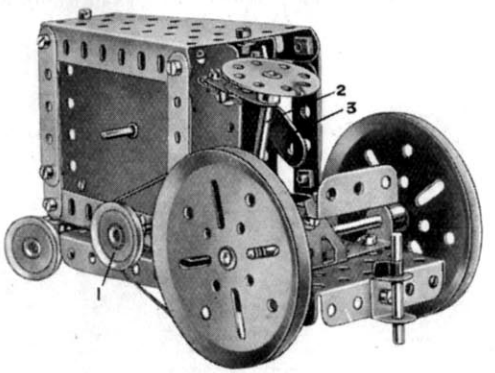


Fig. 10

Parts required:

8	of No. 5	33	of No. 37		
2	,, 10	1	,, 37a		
1	,, 11	5	,, 38		
6	,, 12	1	,, 48		
2	,, 16	1	,, 48a		
2	,, 17	1	,, 52		
2	,, 19b	2	,, 54		
4	,, 22	2	,, 126		
1	,, 24	2	,, 126a		
1	,, 35	1	Rubber Band		

1 No. 1 Clockwork Motor.

Model No. 11. Motor Cycle

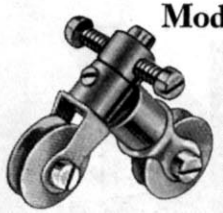


Fig. 11

The frame and forks of the miniature motor cycle shown in Fig. 11 consist of two small Fork Pieces connected together by a ¾" Bolt passed through the boss of one of the Fork Pieces and then screwed into the tapped bore of the other. A ½" loose Pulley is held between the arms of each Fork Piece by means of a ¾" Bolt. The handlebars consist of ⅜" Bolts screwed into the tapped bore of a Collar that is attached to one of the Fork Pieces by means of a ½" Bolt.

Parts required:

2 of No. 23	2 of No. 59	5 of No. 111c
2 „ 37a	1 „ 111a	2 „ 116a

Model No. 12. Wringing Machine

The construction of the miniature wringing machine shown in Fig. 12 is quite simple and very few parts are required. The bed on which the roller unit is mounted consists of a 5½" × 2½" Flanged Plate, and it is supported by four 3½" Strips suitably braced with shorter Strips.

The crossbeam, by means of which pressure is applied to the rollers, consists of a 3½" Strip. At each end it is fitted with a 1" Corner Bracket, and at its centre with a ½" Bolt, on the shank of which is a small piece of Spring. The Bolt passes also through the centre hole of a bent 2½" Strip and is fitted with a Threaded Boss, in the side holes of which Bolts are screwed to form a wing-nut. Each Corner Bracket is fitted with a 1" × ½" Angle Bracket that serves as a bearing for the upper roller, and the complete unit is then bolted to the uprights by means of ½" Corner Angle Brackets (Parts Nos. 154a and 154b). The rollers each consist of two Sleeve Pieces and three Chimney Adapters, and the lower roller is fixed to a 5" Screwed Rod by means of Nuts at each end.

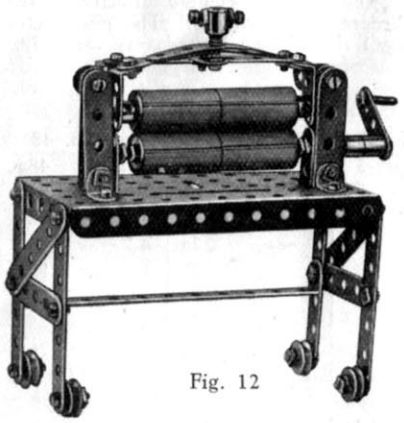


Fig. 12

Parts required:

5	of No.	3	3	of No.	59
2	„	4	1	„	62
3	„	5	1	„	64
4	„	6	1	„	80
1	„	10	1	„	111a
4	„	12	6	„	111c
4	„	12b	1	„	115
1	„	15a	1	„	133a
4	„	23	1	„	154a
24	„	37	1	„	154b
11	„	37a	4	„	163
1	„	48d	6	„	164
1	„	52			

Model No. 13. "Rocket" Locomotive

A 3½" and a 2" Strip overlapped and bolted together to make a 4½" Strip form the chassis, and to it are bolted two Double Brackets in which are journalled 1" Rods for the axles. Three 1½" Strips are then bolted to the front end of the chassis and their end holes are connected by cord to the boss of a ¾" Flanged Wheel. A 3½" Screwed Rod passed through the boss of the ¾" Flanged Wheel is secured to the chassis and carries a Collar and two Couplings, which are retained in position by a ¾" Contrate. A Sleeve Piece pushed over the ¾" Flanged Wheel represents the boiler.

A 1" × ½" Angle Bracket is bolted 1½" from the rear of the model, and across its top is a 1½" Strip that in turn carries at one end a Hinge. A Coupling is attached to the Hinge, and in its central bore slides a Rod, one end of which is secured in a Collar pivoted to one of the front wheels. The fire-box is built from two 1" Triangular Plates and two Double Brackets.

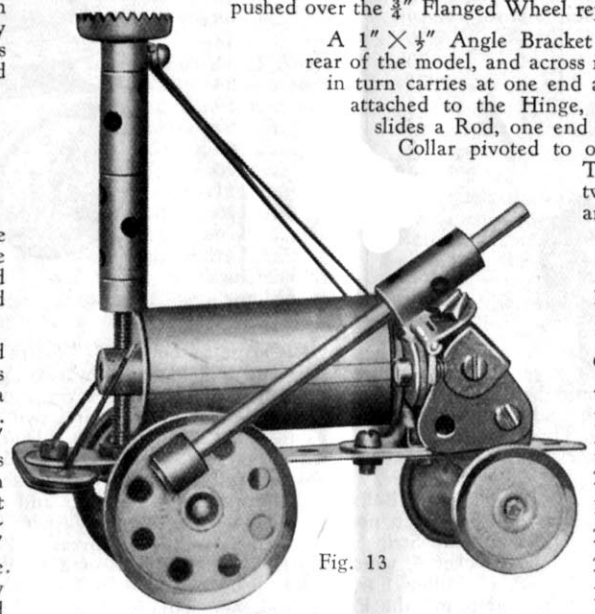


Fig. 13

Parts required:

1	of No.	3	12	of No.	37
1	„	6	3	„	37a
6	„	6a	1	„	40
4	„	11	5	„	59
1	„	12b	3	„	63
1	„	16	2	„	77
2	„	18b	1	„	80a
1	„	20b	1	„	111c
2	„	21	1	„	114
2	„	22	1	„	163
1	„	29			

Model No. 15. Electric Vacuum Cleaner

Fig. 15

The construction of the model is commenced by pushing a Pivot Bolt through the boss of a ½" fast Pulley. Two 1" Triangular Plates are then placed on the projecting end of the Bolt and are held in position by means of a Nut. A 1" Screwed Rod is held between the Triangular Plates.

A ½" Bolt is next passed through the "spider" of a Swivel Bearing and then through the loop at one end of a Tension Spring, and finally is screwed into the boss of the ½" fast Pulley. The other end of the Tension Spring is held on a 2½" Rod in the boss of the Swivel Bearing.

Parts required:

1 of No. 16a	1 of No. 82
1 „ 23a	1 „ 111a
1 „ 43	1 „ 147b
2 „ 77	1 „ 165

Model No. 14. Portable Electric Fire

The back of the model electric fire shown in Fig. 14 consists of two 2½" × 2½" Flat Plates bolted together with an overlap of three holes. Each side of the framework is made with a 2½" Strip and a 1½" Flat Girder, which are secured to the back by Angle Brackets. Two 2½" Strips bolted between the lower ends of the Flat Girders form the bottom of the model and are attached to the sides by Angle Brackets. Two 1½" Strips fixed vertically to the front edges of the 1½" Flat Girders, are connected to a 2½" Flat Girder by means of two ½" Reversed Angle Brackets as shown. A 2½" Angle Girder is bolted across the front of the fire between the central holes of the 1½" Strips, and on its flange are placed some small pieces of coal to represent the imitation fuel in an actual fire of this type. Two 2" Strips are bolted to the 2½" Flat Girder and between them are stretched two Tension Springs, which represent the heating elements. A piece of flex wire is connected to the back of the fire and its other end is attached to an adaptor formed by a ¾" Flanged Wheel.

Parts required:

6 of No. 5	10 of No. 12	2 of No. 72
2 „ 6	1 „ 20b	1 „ 103f
2 „ 6a	32 „ 37	2 „ 103h
1 „ 9d	1 „ 40	2 „ 125
2 „ 11	2 „ 43	

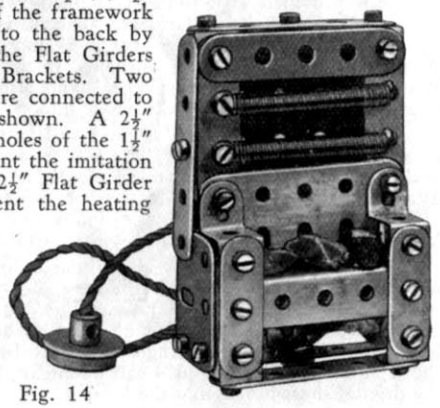


Fig. 14

Model No. 16. Skimmer Scoop Excavator

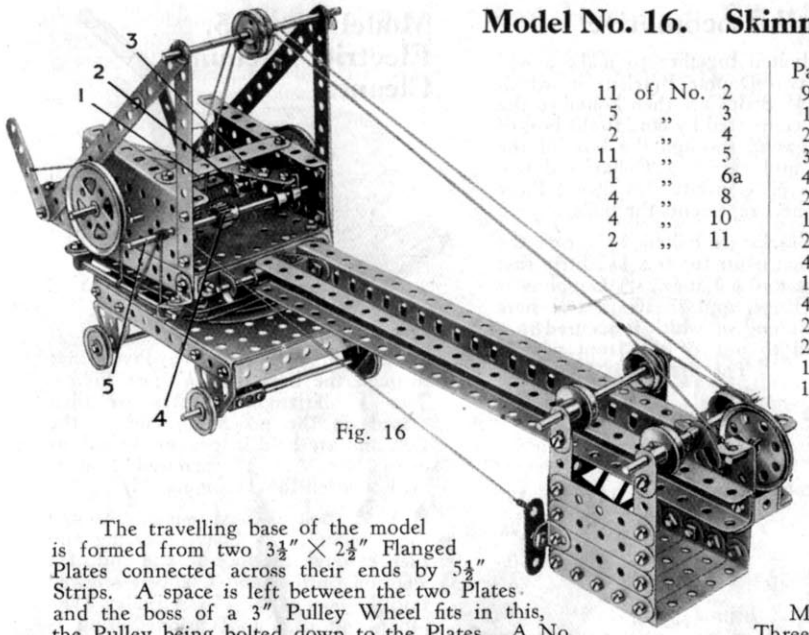


Fig. 16

Parts required:

11	of No.	2
5	,,	3
2	,,	4
11	,,	5
1	,,	6a
4	,,	8
4	,,	10
2	,,	11
9	of No.	12
1	,,	12a
2	,,	15
3	,,	15a
4	,,	16
2	,,	18a
1	,,	19b
2	,,	20
4	,,	20b
1	,,	21
4	,,	22
2	,,	22a
2	,,	26
1	,,	27a
1	,,	32
9	of No.	35
72	,,	37
11	,,	37a
14	,,	38
2	,,	40
2	,,	48
6	,,	48a
2	,,	48b
3	,,	53
2	,,	54
4	,,	59
2	,,	62
1	,,	63
1	,,	98
6	,,	111c
2	,,	126
2	,,	126a
1	,,	147b
1 No. 2 Clockwork Motor		

The travelling base of the model is formed from two $3\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plates connected across their ends by $5\frac{1}{2}''$ Strips. A space is left between the two Plates and the boss of a 3″ Pulley Wheel fits in this, the Pulley being bolted down to the Plates. A No. 2 Clockwork Motor rests on the 3″ Pulley Wheel. The method of pivoting the Motor is as follows. Two $3\frac{1}{2}''$ Strips with a $2\frac{1}{2}''$ Strip at right angles between their centres are bolted to the Motor so that a Pivot Bolt inserted through the centre hole of the $2\frac{1}{2}''$ Strip is retained in position.

A $3\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate is fixed at the rear of the upper Motor side plate and has a $5\frac{1}{2}''$ Strip bolted to each of its flanges. These Strips are attached to the front of the Motor by Angle Brackets, and a $3\frac{1}{2}''$ Strip is connected across their ends.

The jib is built up from four $12\frac{1}{2}''$ Angle Girders. The bucket is provided with four $\frac{3}{4}''$ Flanged Wheels, which traverse the upper pair of Angle Girders. The jib is raised and lowered by means of a cord passing over a 1″ loose Pulley and wound round the $4\frac{1}{2}''$ Axle Rod 1 journalled in the Sector Plates. The Rod carries a 57-teeth Gear Wheel, and also a 2″ Pulley, which is provided with a band brake.

The Rod 2 carries a $\frac{1}{2}''$ Pinion and two Collars, in addition to a 2″ Pulley for a brake. The Collars are secured in position with a space between them to accommodate the shank of a Bolt attached to the lever 3. The Rod 2 carries the dragging cord and is slidable so that the $\frac{1}{2}''$ Pinion can be engaged with a Worm on the Motor shaft and with the Gear on Rod 1.

The Rod 5, which is also slidable, operates the slewing movement. It carries the $\frac{1}{2}''$ Pinion 4 and two Collars, between which fits the shank of the Bolt at the end of the lever 3. A cord is wound round the end of the Rod and is guided over a horizontal Rod held in Angle Brackets before passing round the 3″ Pulley. The Pinion 4 can be engaged with the Worm on the driving shaft by moving the lever 3.

Model No. 17. Fire Engine

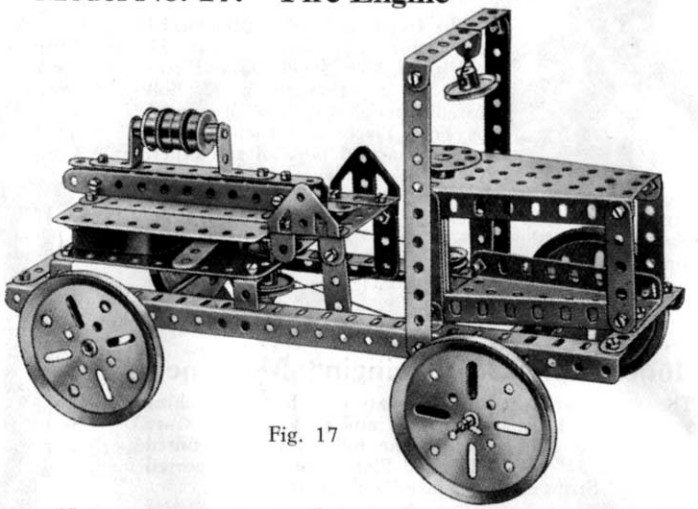


Fig. 17

The frame is made by bolting $3\frac{1}{2}''$ Strips between two $12\frac{1}{2}''$ Angle Girders. A Sector Plate is bolted to the front Strip, and is held down by two Angle Brackets bolted to the side members. Four $2\frac{1}{2}''$ Strips bolted to the flanges of the Plate carry another similar Plate that forms the bonnet. The Clockwork Motor is mounted on four Double Brackets, and two $5\frac{1}{2}''$ Strips bolted to the Motor support the driver's seat. Three additional $5\frac{1}{2}''$ Strips are fixed at one end to a Double Bent Strip and at the other end to two $\frac{1}{2}''$ Reversed Angle Brackets, between which is fixed a hose reel made of four $\frac{3}{4}''$ Flanged Wheels and a 2″ Rod.

The front axle 7 is formed from two $5\frac{1}{2}''$ Strips fixed to the side Girders by Angle Brackets. At each end of the front axle $\frac{3}{8}''$ Bolts are passed through the holes and inserted in the tapped bores of Cranks 4 (Fig. 17a). The Bolts are locked in position by Nuts, and carry Washers for spacing purposes. An Angle Bracket is bolted to each Crank and the Strip 5 is pivoted to each. A Threaded Pin fixed to the Strip engages the elongated hole in the Angle Bracket 6, which is attached to the boss of a 1″ Pulley on the lower end of the steering column.

A 1″ Pulley 1 is carried on a 2″ Rod that is inserted in place of the Motor driving spindle. A length of cord is passed round the Pulley, and then led round guide Pulleys 2 before passing round the Pulley 3. The Pulleys 2 are carried on $\frac{3}{4}''$ Bolts, one of which is held in place by an Angle Bracket. The other is secured directly to the Angle Girders of the chassis. The position of the Pulley 1 should be adjusted very carefully.

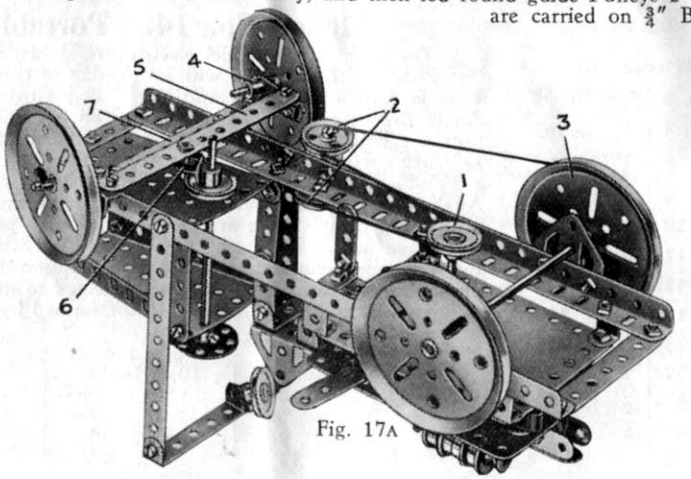


Fig. 17A

Parts required:

10	of No.	2
2	,,	3
4	,,	5
2	,,	6a
2	,,	8
1	,,	10
4	,,	11
8	,,	12
2	,,	12a
1	,,	15
1	,,	15a
2	,,	17
1	of No.	18a
4	,,	19b
4	,,	20b
3	,,	22
2	,,	22a
1	,,	24
5	,,	35
58	,,	37
8	,,	37a
7	,,	38
1	,,	40
1	,,	45
1	of No.	48
3	,,	48a
2	,,	54
2	,,	62
4	,,	111c
1	,,	115
2	,,	125
2	,,	126
2	,,	126a
1 No. 2 Clockwork Motor		

Model No. 18. Petrol-Electric Mobile Crane

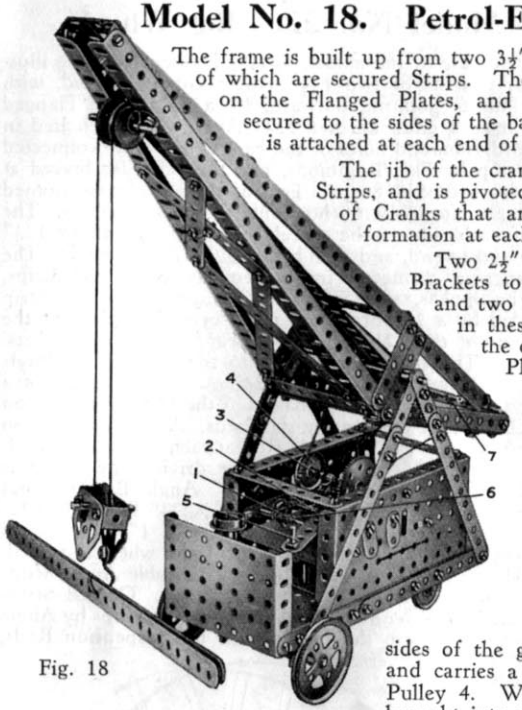


Fig. 18

The frame is built up from two 3½" × 2½" Flanged Plates, to the flanges of which are secured Strips. The No. 1 Clockwork Motor is mounted on the Flanged Plates, and 5½" × 2½" Flanged Plates are then secured to the sides of the base to form the gear-box. A 3½" Strip is attached at each end of the gear-box frame.

The jib of the crane is built up from Angle Girders and Strips, and is pivoted on a Rod that rotates in the bosses of Cranks that are bolted to Strips mounted in "V" formation at each side of the frame.

Two 2½" Strips are secured by means of Angle Brackets to the upper side plate of the Motor, and two 2½" Axle Rods 1 and 2 are journalled in these Strips. Flat Brackets are bolted to the outside faces of the 5½" × 2½" Flanged Plates forming the sides of the gear-box so as to close the holes and prevent the 3½" Rods 1 and 2 from slipping out of their bearings. A ½" Pinion is mounted on each of the shafts 1 and 2, and either of these may be brought into gear with a Worm mounted on the Motor driving shaft by means of the pivoted lever 5.

The lever 5 is lock-nutted to a ½" × ½" Angle Bracket bolted to the 1½" × ½" Double Angle Strip 6. The Axle Rod 3 is mounted between the sides of the gear-box in Reversed Angle Brackets, and carries a 57-teeth Gear Wheel and a 1" fast Pulley 4. When the ½" Pinion on the shaft 2 is brought into mesh with the Worm by means of the lever 5, the teeth of the 57-teeth Gear should also engage with the Pinion. The hoisting cord is fitted to the Rod 1, while the Rod 3 carries the two luffing cords, which are secured to the Rod by a Spring Clip and are attached to the rear of the jib by means of Rod 7. A strap and lever brake is fitted to the shaft 3 and to the luffing barrel.

The front road wheels are secured to the frame of the crane by means of Flat Brackets. The rear wheels are carried on a swivelling bogie composed of two 1" × 1" Angle Brackets locked together by means of a Bolt and Nut, and the projecting end of the Bolt is passed through the underside of the frame of the crane and held in place by two further lock-nuts. Cords are attached to the ends of the Angle Brackets and to a Bush Wheel mounted on the lower end of a Rod forming the steering column, the upper end of which carries a ¾" Flanged Wheel.

Parts required:

2	of No. 1	7	of No. 12	2	of No. 22a	1	of No. 45	1	of No. 63
17	„ 2	2	„ 12a	2	„ 26	1	„ 46	2	„ 90
6	„ 3	3	„ 15a	1	„ 27a	1	„ 48	1	„ 111
1	„ 4	4	„ 16	1	„ 32	1	„ 48b	6	„ 111c
12	„ 5	1	„ 17	14	„ 35	2	„ 52	1	„ 115
1	„ 6	1	„ 18a	92	„ 37	3	„ 53	2	„ 125
6	„ 8	2	„ 20a	6	„ 37a	1	„ 57	2	„ 126a
4	„ 10	1	„ 20b	14	„ 38	2	„ 59	1	No. 1 Clockwork Motor
3	„ 11	4	„ 22	1	„ 40	2	„ 62		

Model No. 19. Trench Shovel

The Clockwork Motor forms the base of the swivelling superstructure of the model. Two 5½" Angle Girders are bolted to the upper side plate of the Motor, and a 3½" × 2½" Flanged Plate is secured in position, as can be seen in Fig. 19, to extend the base. A strip of lead is attached to the underside of the Flanged Plate in order to balance the jib and bucket. The strip is approximately 1" wide, and is fixed to the Flanged Plate by means of two ¾" Bolts.

The jib of the crane consists of two "U" section girders built up from four 12½" Angle Girders and spaced apart by means of 1½" × ½" Double Angle Strips. A 1½" × ½" Double Angle Strip is secured to the front edge of the side plate of the Motor, and a 2" Rod is passed through the end holes of the "U" girders, thus enabling the jib to pivot. The Rod is held in place by means of Spring Clips.

A Sector Plate is bolted on each side of the swivelling superstructure to form the sides of the gear-box.

A Worm is mounted on the driving spindle of the Clockwork Motor and two ½" Pinions 1 and 2 are mounted on 4½" Axle Rods in the side plates of the gear-box. These Pinions are arranged so that either may be brought into gear by operating the pivoted gear lever, which consists of a 5½" Strip pivoted close to one end on a Bolt secured to an Angle Bracket bolted to one of the side plates of the gear-box. Spring Clips and Washers are placed on the Rods on each side of the pivoted Strip, so that when the Strip is moved the Rods carrying the Pinions 1 and 2 are pushed from side to side in the gear-box, thereby bringing the Pinions into engagement with the Worm.

A 5" Rod is mounted in the gear-box side plates, and this carries a 57-teeth Gear 3. The Pinion 2 should be arranged so that it can be brought into engagement with the Worm, and by a further movement to mesh also with the 57-teeth Gear 3. A length of cord is wound round the free end of the 5" Rod carrying the Gear 3. The ends of the cord are then passed round a horizontal guide Rod mounted in Angle Brackets at the side of the gear-box, and the cords are finally taken round a 3" Pulley secured to the travelling base of the model, the ends then being tied so as to form an endless belt.

The superstructure is pivoted to the travelling base by means of a Pivot Bolt mounted in an "H" frame composed of two 3½" and one 2½" Strips, and by engaging Pinion 2 with Gear 3 the superstructure can be rotated.

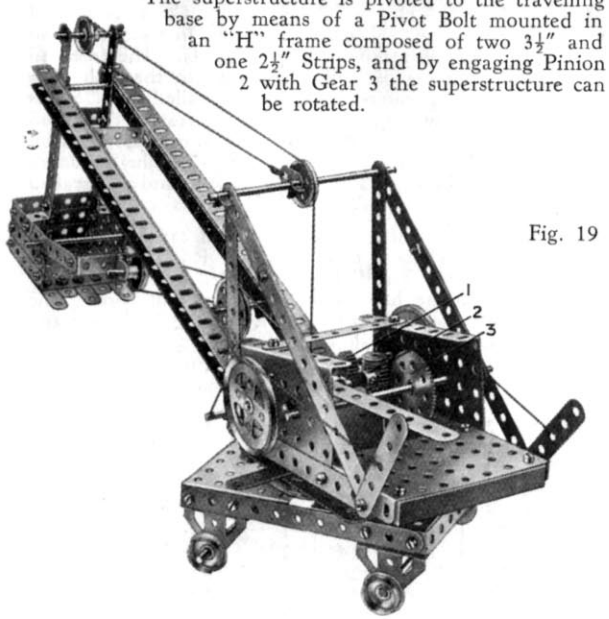


Fig. 19

Parts required:

13	of No. 2	14	of No. 35
2	„ 4	94	„ 37
14	„ 5	6	„ 37a
2	„ 6a	8	„ 38
4	„ 10	2	„ 40
6	„ 12	1	„ 44
2	„ 15	1	„ 46
3	„ 15a	2	„ 48
2	„ 16	4	„ 48a
2	„ 17	2	„ 48b
4	„ 18a	3	„ 53
1	„ 19b	2	„ 54
2	„ 20a	1	„ 59
1	„ 21	1	„ 63
2	„ 22	6	„ 111c
1	„ 22a	2	„ 125
2	„ 26	2	„ 126
1	„ 27a	2	„ 126a
1	„ 32	1	„ 147b

1 No. 2 Clockwork Motor

Model No. 20. Bacon Slicing Machine

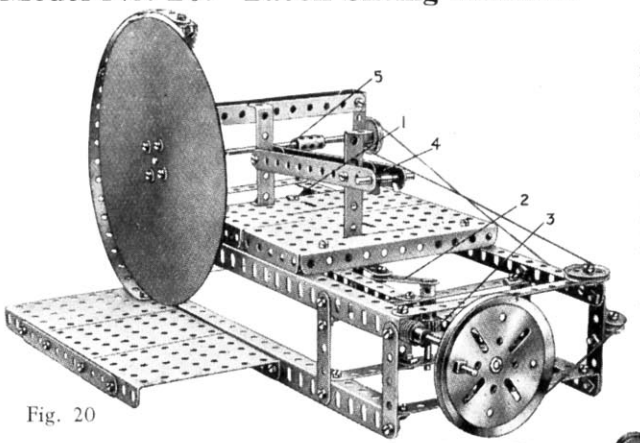


Fig. 20

The oscillating table consists of two Flanged Plates. Two $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips support the movable "gripper" which consists of two $5\frac{1}{2}''$ Strips spaced apart by means of two Double Brackets to which a $1\frac{1}{2}''$ Axle 4 is attached at one end to act as a handle. Four Reversed Angle Brackets are bolted to the $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plates that form the table, and they engage with the flanges of the upper pair of $12\frac{1}{2}''$ Angle Girders.

A Pivot Bolt 1 is placed in the end centre hole of one of the $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plates, and a Collar is slipped on to the shank. A $5\frac{1}{2}''$ Strip also is held in position on the end of the Bolt by means of two lock-nuts. The free end of the $5\frac{1}{2}''$ Strip is pivotally connected to the web of a Crank 2, which is mounted on a Rod journalled in $5\frac{1}{2}''$ Strips that are fixed between the Girders of the frame. The Rod bears a $\frac{1}{2}''$ Pinion 3 that meshes with a Worm mounted on a second Rod journalled as shown. A 3″ Pulley is placed on the end of the Rod carrying the Worm, and a Threaded Pin is secured to the Pulley.

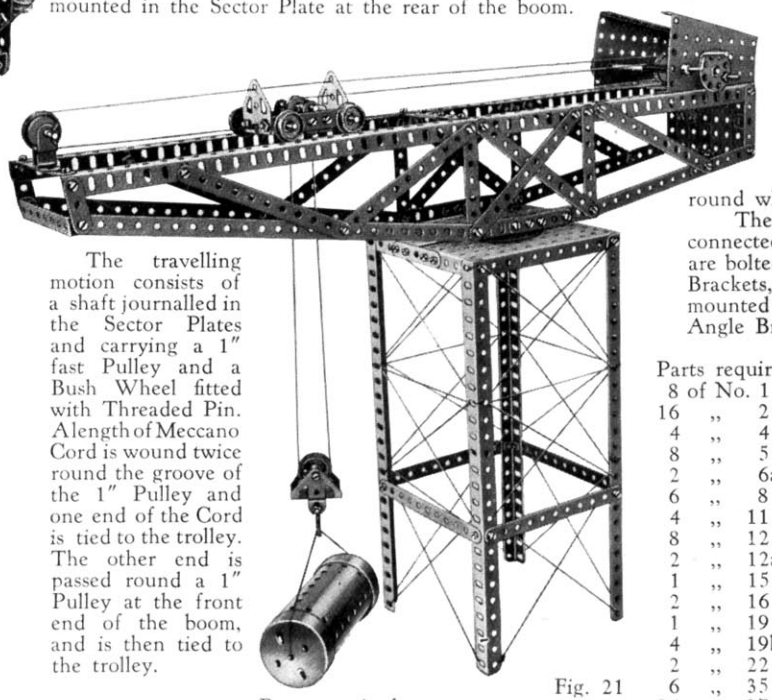
The rotating knife is a circle of stiff cardboard bolted to a Bush Wheel fixed to a composite Rod 5 that carries a 1″ fast Pulley. The Pulley is coupled to the 3″ Pulley that represents the hand wheel, by means of cord. The cord is first passed round the groove of the 3″ Pulley and guided round 1″ and $\frac{1}{2}''$ loose Pulleys pivotally mounted on bearings attached to the frame. The cord is then taken round the 1″ fast Pulley on the knife shaft.

Parts required:

14	of No. 2	2	of No. 17	2	of No. 35	2	of No. 59
1	,, 3	1	,, 18a	71	,, 37	1	,, 62
1	,, 4	1	,, 19b	14	,, 37a	1	,, 63
6	,, 5	1	,, 22	9	,, 38	1	,, 111
4	,, 8	1	,, 22a	1	,, 40	2	,, 111c
4	,, 11	1	,, 23	1	,, 48	1	,, 115
7	,, 12	1	,, 24	2	,, 48a	4	,, 125
4	,, 15a	1	,, 26	2	,, 52	1	,, 126
1	,, 16	1	,, 32	3	,, 53		

Model No. 21. Hammerhead Crane

The boom of the model crane shown in Fig. 21 swivels on a Bolt in the boss of a 3″ Pulley that is mounted boss downward on the Flanged Plates forming the top of the tower. Two Sector Plates at the rear end of the boom provide supports for the operating Rods. The crane block trolley consists of two $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips held apart by means of Flat Trunnions, and is fitted with four $\frac{3}{4}''$ Flanged Wheels mounted on $3\frac{1}{2}''$ Axle Rods. A Flat Bracket is secured to each side Angle Strip, and these Brackets serve to support an Axle that carries a $\frac{1}{2}''$ loose Pulley. One end of the crane block hoist cord is attached to the frame of the trolley, while the other passes round the crane block sheave and round the $\frac{1}{2}''$ Pulley on the trolley, afterwards being attached to a Crank Handle mounted in the Sector Plate at the rear of the boom.



The travelling motion consists of a shaft journalled in the Sector Plates and carrying a 1″ fast Pulley and a Bush Wheel fitted with Threaded Pin. A length of Meccano Cord is wound twice round the groove of the 1″ Pulley and one end of the Cord is tied to the trolley. The other end is passed round a 1″ Pulley at the front end of the boom, and is then tied to the trolley.

Fig. 21

Parts required:

2	of No. 1	2	of No. 16	94	of No. 37	1	of No. 57
16	,, 2	1	,, 17	4	,, 38	3	,, 59
4	,, 3	2	,, 18a	1	,, 40	1	,, 90a
2	,, 4	1	,, 19	1	,, 44	1	,, 111
12	,, 5	1	,, 19b	1	,, 48	1	,, 115
2	,, 6a	4	,, 20b	7	,, 48a	2	,, 126
8	,, 8	4	,, 22	2	,, 48b	2	,, 126a
4	,, 10	1	,, 23	2	,, 52	1	,, 162
1	,, 12	1	,, 24	3	,, 53		
1	,, 15a	7	,, 35	2	,, 54		

Model No. 22. Big Wheel

The base of the model, as may be seen from the illustration, consists of two $12\frac{1}{2}''$ Angle Girders spaced, with their flanges pointing outward, by a $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate at each end. Further $12\frac{1}{2}''$ Angle Girders, bolted in the third from end holes of the base Girders, are connected at the top by Flat Trunnions, and they are also braced at the sides with $5\frac{1}{2}''$ Strips. Two of these Strips are joined together to form the 6″ horizontal bracing members. The rim of each side of the wheel is formed by bolting $12\frac{1}{2}''$ Strips end to end, and then bending them into a circle. The two rings are connected by four equally spaced $3\frac{1}{2}''$ Strips, and the spokes, each of which consists of a $5\frac{1}{2}''$ Strip extended by a $2\frac{1}{2}''$ Strip, are next secured in place at the junctions of the $12\frac{1}{2}''$ Strips by means of Angle Brackets. The spokes are bolted to the 3″ Pulley Wheels that form the hub, and the wheel is mounted on a 5″ Axle Rod journalled in the Flat Trunnions on top of the bearing-standards. A 3″ Pulley is also secured to the Axle Rod at each side of the wheel. A $3\frac{1}{2}''$ Crank Handle for driving the model is journalled in two $1'' \times 1''$ Angle Brackets that are fixed to one of the $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plates of the base, and it carries two 1″ fast Pulleys round which a cord from the hub of the wheel is passed.

The cars consist of two $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips connected across their ends by $1\frac{1}{2}''$ Strips. Curved Strips are bolted to the ends of the Double Angle Strips by Angle Brackets, and form the journals for the suspension Rods, mounted in $\frac{1}{2}''$ Reversed Angle Brackets.

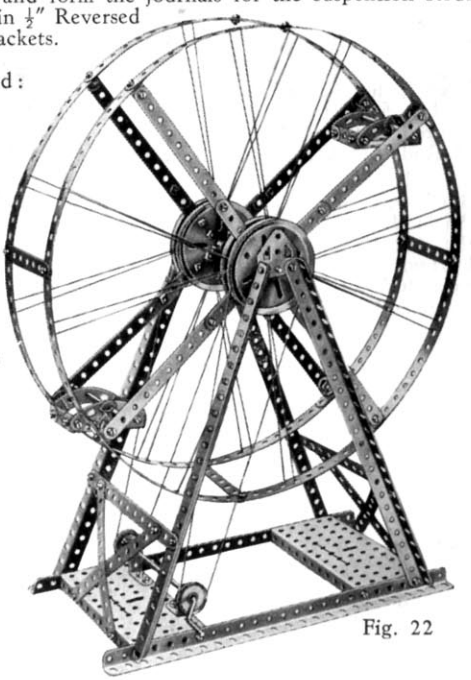


Fig. 22

Parts required:

8	of No. 1	2	of No. 16	94	of No. 37	1	of No. 57
16	,, 2	1	,, 17	4	,, 38	3	,, 59
4	,, 4	2	,, 18a	1	,, 40	1	,, 90a
8	,, 5	1	,, 19	1	,, 44	1	,, 111
2	,, 6a	1	,, 19b	1	,, 48	1	,, 115
6	,, 8	4	,, 20b	7	,, 48a	2	,, 126
4	,, 11	4	,, 22	2	,, 48b	2	,, 126a
8	,, 12	1	,, 23	2	,, 52	1	,, 162
2	,, 12a	1	,, 24	3	,, 53		
1	,, 15	7	,, 35	2	,, 54		
2	,, 16						
1	,, 19						
4	,, 19b						
2	,, 22						
6	,, 35						
94	,, 37						
4	,, 37a						
12	,, 38						
2	,, 48						
4	,, 48a						
2	,, 52						
2	,, 59						
4	,, 90a						
2	,, 111c						
4	,, 125						
2	,, 126a						

Model No. 23. Shipyard Crane

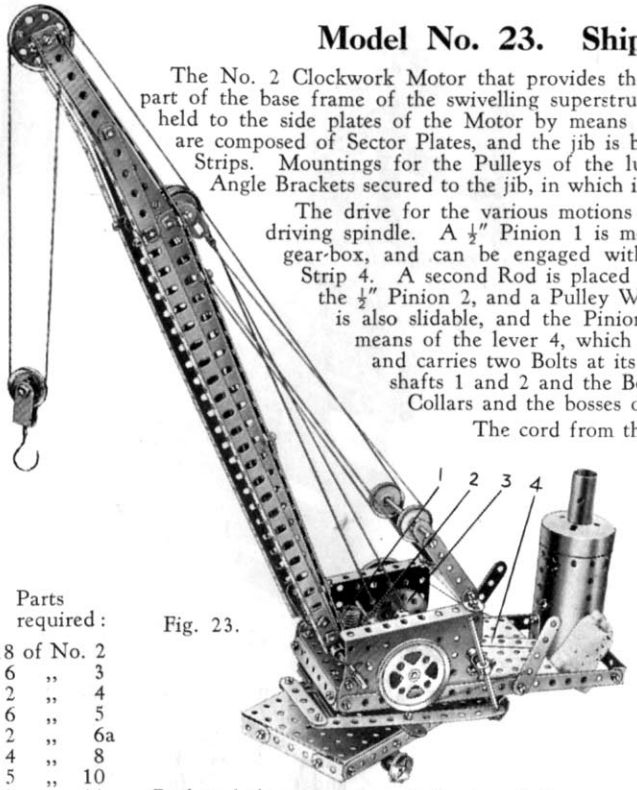


Fig. 23.

The No. 2 Clockwork Motor that provides the power for the model serves also as part of the base frame of the swivelling superstructure. A 3½" × 2½" Flanged Plate is held to the side plates of the Motor by means of Strips. The sides of the gear-box are composed of Sector Plates, and the jib is built up from 12½" Angle Girders and Strips. Mountings for the Pulleys of the luffing gear system are formed by two Angle Brackets secured to the jib, in which is journalled a 2" Axle Rod.

The drive for the various motions is taken from a Worm on the Motor driving spindle. A ½" Pinion 1 is mounted on a slidable Axle Rod in the gear-box, and can be engaged with the Worm by moving the pivoted Strip 4. A second Rod is placed in the gear-box side plates and carries the ½" Pinion 2, and a Pulley Wheel. The Rod carrying the Pinion 2 is also slidable, and the Pinion can be engaged with the Worm by means of the lever 4, which is pivoted to the side of the gear-box and carries two Bolts at its inner end. Collars are placed on the shafts 1 and 2 and the Bolts on the lever 4 engage between the Collars and the bosses of the Pinions.

The cord from the slewing drum 5 (Fig. 23A) is guided round the 2" Rod 7 and then passed twice round a 3" Pulley secured to the travelling base and carrying the crane pivot 6 which consists of a Pivot Bolt mounted in the centre hole of a 2½" Strip as shown.

The Rod carrying the ½" Pinion 2 forms the hoisting drum. A length of cord is wound round the drum and passed over guide Pulleys to the Pulley at the jib-head. It is then taken round the sheave of the crane block and tied to the top of the jib.

The Rod carrying a 57-teeth Gear Wheel forms the luffing barrel. The luffing cord is first wound round the Rod and then over one of the two Pulleys mounted on the upper portion of the jib. The cord is then taken to one of the Pulleys linked to the gear-box, and is finally passed round the remaining two Pulleys and secured to a Flat Bracket, as shown in Fig. 23. The reversing and brake levers controlling the Clockwork Motor are connected together by means of lock-nutted Strips, which are operated by a 3½" Rod. The mounting for this Rod consists of a Swivel Bearing held to the side of the gear-box by means of a Bolt passed into the boss of the fork piece of the unit.

The traveling base consists essentially of two 3½" × 2½" Flanged Plates held together by means of two compound 10½" Strips and fitted with a 5½" × 2½" Flanged Plate. Pairs of Trunnions and Flat Trunnions form bearings for the axles. These are 4½" Rods, and ¾" Flanged Wheels are used for the road wheels.

Although the model described above is driven by a Clockwork Motor, by making slight structural alterations it is possible to use a Meccano Steam Engine to provide the power. Those model-builders who possess Steam Engines should certainly make use of them in this model.

Parts required:

18	of No. 2	1	of No. 52	2	of No. 62	2	of No. 126a
6	,, 3	3	,, 53	2	,, 111	1	,, 147b
2	,, 4	2	,, 54	4	,, 111c	1	,, 162a
6	,, 5	1	,, 57	1	,, 115	1	,, 162b
2	,, 6a	3	,, 59	2	,, 126	1	,, 163
4	,, 8						
5	,, 10						
2	,, 11						
12	,, 12						
4	,, 12a						
2	,, 15						
2	,, 15a						
4	,, 16						
2	,, 17						
7	,, 18a						
1	,, 19b						
2	,, 20a						
4	,, 20b						
1	,, 21						
4	,, 22						
2	,, 22a						
2	,, 26						
1	,, 27a						
1	,, 32						
4	,, 35						
90	,, 37						
6	,, 37a						
12	,, 38						
2	,, 40						
1	,, 44						
2	,, 48a						

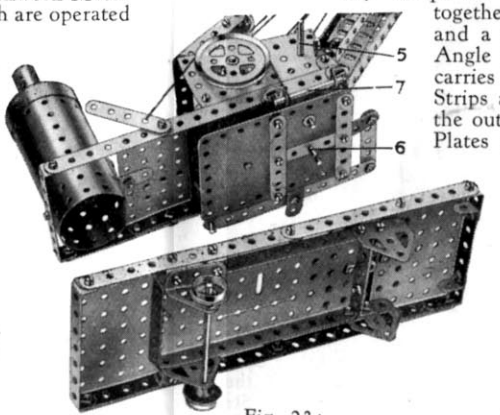


Fig. 23A

Model No. 24. Flying Machine

Parts required:

4	of No. 1
4	,, 2
6	,, 5
4	,, 12
2	,, 16
1	,, 19b
3	,, 22
1	,, 24
1	,, 35
35	,, 37
6	,, 38
1	,, 40
4	,, 48a
1	,, 52
2	,, 54
1	,, 100
1	,, 125
2	,, 126
2	,, 126a
1	No. 2 Clockwork Motor

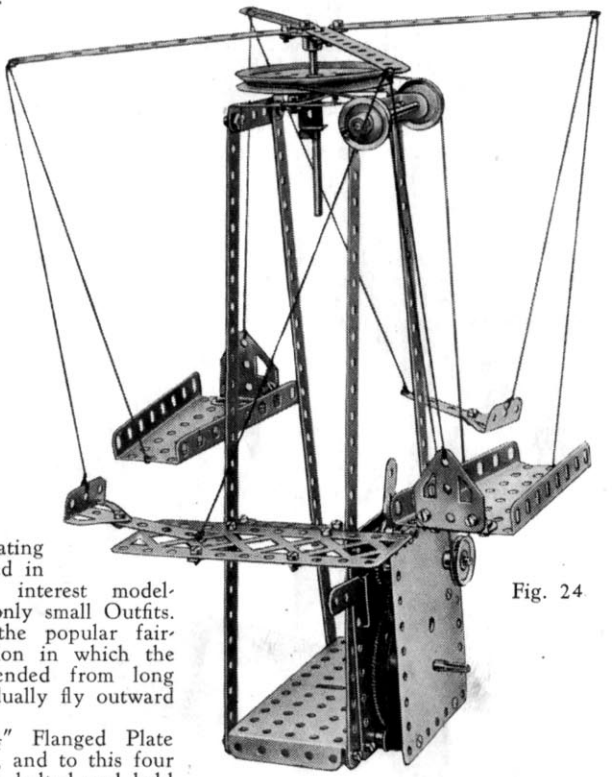


Fig. 24

The fascinating model illustrated in Fig. 24 will interest model-builders with only small Outfits. It represents the popular fair-ground attraction in which the cars are suspended from long arms, and gradually fly outward as they rotate.

A 5½" × 2½" Flanged Plate forms the base, and to this four 12½" Strips are bolted and held together at their upper ends by three 2½" × ½" Double Angle Strips and a 2½" Strip. A second 2½" Strip carries a ½" × ½" Reversed Angle Bracket to form a bearing for a 3½" Axle Rod. The Rod carries a 3" Pulley Wheel and a Bush Wheel to which four 5½" Strips are bolted. The cars are suspended by lengths of cord from the outer ends of the Strips. Two of the cars are made from Sector Plates and Flat Trunnions, and the remaining two each consist of a 2½" Strip and a Trunnion.

A landing platform is arranged slightly below the level of the cars. This is a 5½" Braced Girder attached by means of two 2½" Strips to a 2½" × ½" Double Angle Strip bolted between the two 12½" Strips. The Clockwork Motor is bolted in place to the side flange of the base plate, each securing Bolt carrying a Washer for spacing purposes. The driving spindle of the Motor carries a 1" Pulley Wheel, and cord passed round this goes over two guide Pulleys before passing round the 3" Pulley on the vertical Rod. The guide Pulleys are carried on a 3½" Axle Rod journalled in a 2½" × ½" Double Angle Strip, but one of them should be free on the Rod. Two Washers space each Pulley from the Double Angle Strip.

Model No. 25. Side Lever Marine Engine

The frame of the model consists of Angle Girders, the sides being spaced by means of 3½" Strips. The platform that supports the air pump consists of a 3½" × 2½" Flanged Plate, which is held in place by 2½" Flat Girders, and the air pump is made of Boiler Ends fastened together with Flat Brackets and bolted to the platform. A condenser chamber built with 3½" × 2½" Flanged Plates is fitted immediately below the valve gear.

The steam cylinder consists of 3½" Strips bolted by means of ½" × ½" Angle Brackets between two Face Plates, one of which is fitted with a 3½" × ½" Double Angle Strip for attaching the cylinder to the framework. A bearing for the piston rod is made by bolting a Double Bent Strip to the Double Angle Strip. The valve chest is made from two Double Brackets bolted to the ends of a 2½" × 2½" Double Angle Strip and to them are attached 2½" Strips. The valve chest and the cylinder are secured to a 3½" × 2½" Flanged Plate that forms part of the main frame. The movement of the piston is transmitted to the crankshaft by means of two beam levers, built from 5½" Angle Girders and fitted with Double Arm Cranks that form the pivots for the Rod on which the beam rocks. The beam is linked to the piston rod by a frame of Strips, connection to the piston rod being made by means of a Double Arm Crank, held in place by two ¾" Bolts. The Crank is also connected to the main frame by two 4½" Strips, which are pivoted to the frame and journalled on the ends of a 5" Rod held in two Corner Brackets.

The main bearings for the crankshaft consist of two 1½" Angle Girders joined at their ends by two 1" × ½" Angle Brackets, the actual bearing being provided by a Double Arm Crank bolted to two Flat Trunnions. The Trunnions are bolted together to form a square plate, which is then fixed to the 1½" Angle Girders. Each half of the crankshaft is fitted at its inner end with a Crank, and the two halves are joined together by a ¾" Bolt. Two 3½" Strips

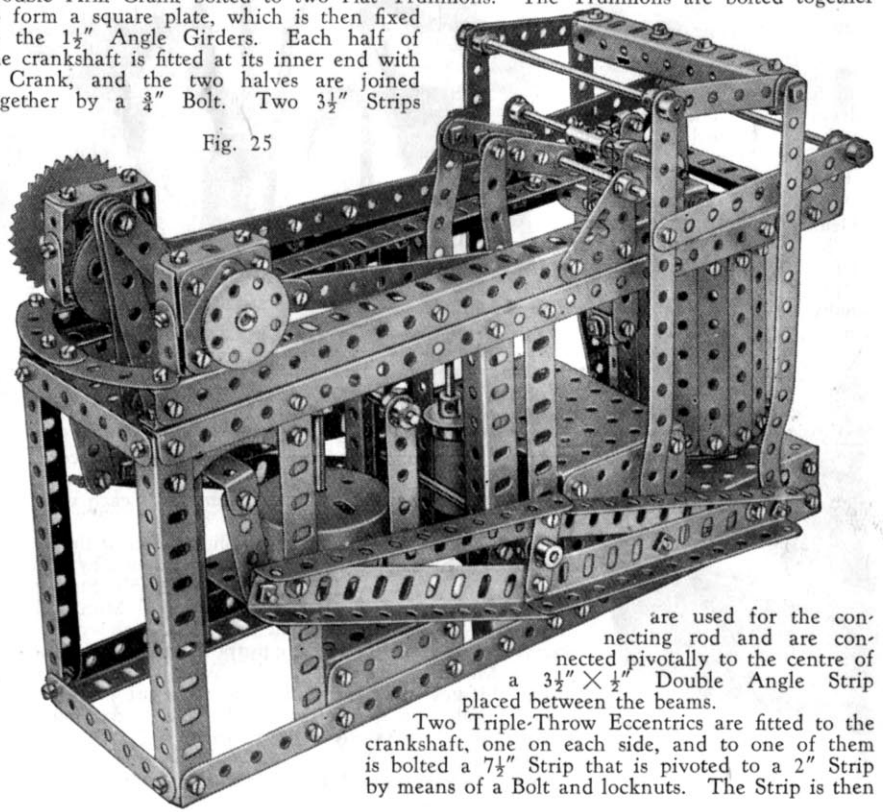


Fig. 25

are used for the connecting rod and are connected pivotally to the centre of a 3½" × ½" Double Angle Strip placed between the beams.

Two Triple-Throw Eccentrics are fitted to the crankshaft, one on each side, and to one of them is bolted a 7½" Strip that is pivoted to a 2" Strip by means of a Bolt and locknuts. The Strip is then bolted to a Coupling secured on a 4½" Rod journalled in the bosses of Cranks, which are fixed to the longitudinal members of the frame. The Rod also carries a second Coupling to which a Collar is secured by means of a Threaded Pin. A Flat Bracket is pivoted to the Collar and carries a second pivoted Collar through which is a Rod. This Rod passes through the Double Brackets in the ends of the valve chest. The second Eccentric is bolted to one end of a

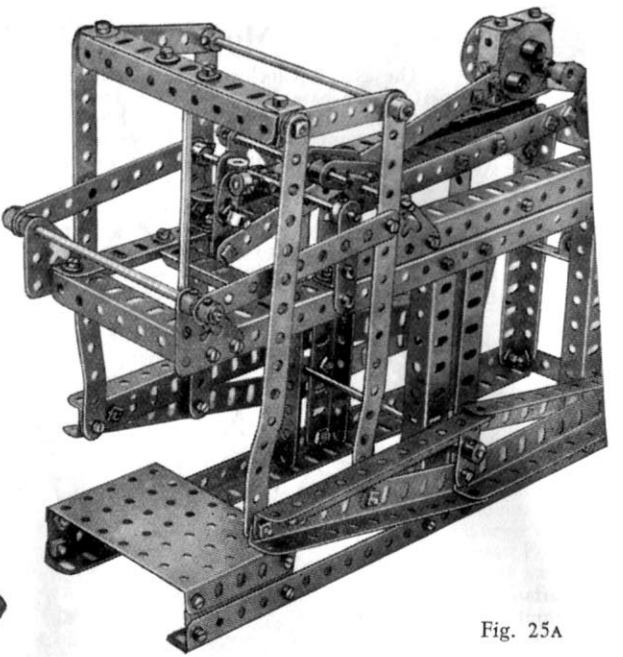


Fig. 25A

compound 6½" Strip, which is pivotally connected to one of the transverse tapped holes of a Coupling on a Rod journalled in two Corner Brackets; this Rod also carries two Cranks. The Cranks are extended by 1½" Strips, and to these 3½" Strips are pivoted with Bolts and locknuts. Rods are connected to the ends of the 3½" Strips by means of Collars, and these slide in the bosses of ¾" Flanged Wheels that fit over the ends of Sleeve Pieces that form the two bilge pumps.

The air-pump piston rod is connected by a 5" Rod and two 3" Strips to a point 3" from one end of the side beams. The Rod passes through one of the end transverse bores of a Coupling, which is then secured to the end of the piston rod. The 3" Strips from the side beams are pivoted to the lever and are located on the ends of the 5" Rod that forms the air pump crosshead by Collars.

Parts required:

5	of	No.	1b	2	of	No.	9b	1	of	No.	16b	26	of	No.	59	6	of No. 111a
4	,,		2a	4	,,		9f	3	,,		17	4	,,		62	6	,, 111c
21	,,		3	16	,,		10	1	,,		18a	1	,,		62b	1	,, 115
4	,,		4	6	,,		11	2	,,		20b	3	,,		63	4	,, 126a
4	,,		5	17	,,		12	1	,,		24	2	,,		72	2	,, 130
5	,,		6	4	,,		12a	211	,,		37	2	,,		90	4	,, 133
6	,,		6a	4	,,		12b	42	,,		37a	2	,,		94	2	,, 162a
4	,,		8	4	,,		15	36	,,		38	1	,,		95	2	,, 163
4	,,		8a	2	,,		15a	2	,,		48	4	,,		103f	1	,, 165
16	,,		9	2	,,		16	1	,,		48a	2	,,		109		
2	,,		9a	1	,,		16a	5	,,		53	3	,,		111		

Model No. 26. Direct-Acting Steam Marine Engine

The model direct-acting marine engine shown in Fig. 26 is a reproduction of the power unit of the famous steam tug *Charlotte Dundas*, which was built in 1802.

The ship's deck is represented by two 12½" Angle Girders spaced by three 2½" × 3½" Flanged Plates and supported by two further Flanged Plates. Two 5½" Angle Girders, each of which is fitted with a Trunnion to act as the bearings for the paddle-wheel spindle, are then bolted by means of Flat Brackets to the projecting ends of the 12½" Angle Girders.

The construction of the paddle-wheel is shown in the illustration. A 1½" Pulley Wheel is bolted to the wheel, to form a hub by means of which the wheel is secured to its shaft.

An E1 Electric Motor is bolted below the deck and a ½" Pinion on its armature shaft engages a 57-teeth Gear on a Rod journalled in the side plates of the Motor. By means of a further Pinion and 57-teeth Gear Wheel the Motor drive is transmitted to a Rod journalled in 2½" Strips as shown. At one end this Rod is held in place by a Collar, and at the other end by a ½" fast Pulley, which by means of a belt imparts the drive to a 2" Pulley. The shaft of the 2" Pulley also carries a ¾" Sprocket Wheel, and this drives a 2" Sprocket Wheel on the paddle-wheel shaft by means of Sprocket Chain.

The steam cylinder consists of two Bush Wheels and eight 2½" × ½" Double Angle Strips, and is bolted to the deck by two ⅜" Bolts. A Rod passed through the bosses of the Bush Wheels represents the piston rod, and at one end it is fitted with a Coupling by means of which connection is made to the crosshead. This consists of a 3" Rod, which is passed through the Coupling and carries two ¾" Flanged Wheels and two 3" Strips, which are held in place by Collars. The Wheels run on guide rails consisting of 2½" Strips.

The outer end of the crosshead Coupling carries a Threaded Pin fitted with a "spider" from a Swivel Bearing. The "spider" is attached by a Bolt to one end of a 5½" Strip, the other end of which is attached by a Pivot Bolt to a Coupling on the paddle shaft.

On each side of the cylinder two 2½" Strips are bolted to form supports for the valve gear. On each end of a short Rod journalled in these Strips is a Crank, which is linked to the 3" Strips of the crosshead by means of further 3" Strips. The Rod passes through a Coupling on one end of a short Rod, on the other end of which is a Swivel Bearing. A Rod connected to the Swivel Bearing passes through the deck Plate and is journalled in a Chimney Adapter mounted in a Sleeve Piece beneath the deck.

Parts required:

12	of No. 2	4	of No. 10	1	of No. 16a	1	of No. 26	24	of No. 38
1	„ 3	4	„ 11	1	„ 16b	2	„ 27a	1	„ 40
4	„ 4	10	„ 12	1	„ 17	108	„ 37	7	„ 48a
8	„ 5	1	„ 15	1	„ 18a	7	„ 37a	1	„ 48b
2	„ 6a	2	„ 15a	1	„ 20a			5	„ 53
2	„ 8	1	„ 16	3	„ 20b			8	„ 59
2	„ 9			1	„ 21			2	„ 62
				1	„ 23a			3	„ 63
				2	„ 24			2	„ 90a
								10″	„ 94
								1	„ 95
								1	„ 96a
								2	„ 111c
								1	„ 115
								2	„ 126
								4	„ 126a
								1	„ 147b
								1	„ 163
								1	„ 164
								2	„ 165
								1	E1 Electric Motor

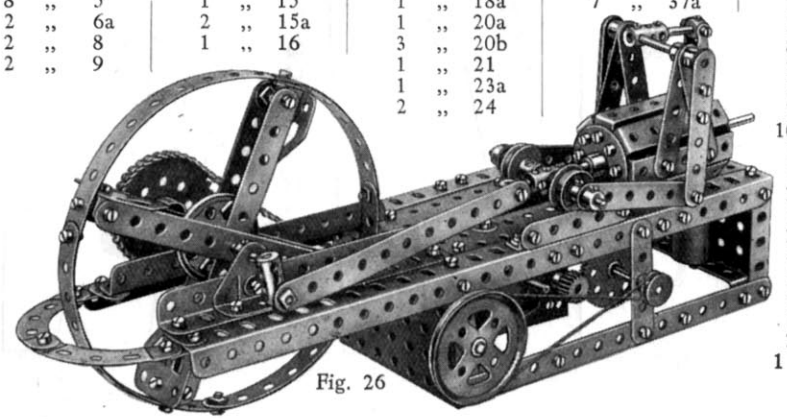


Fig. 26

Model No. 27. Symington's Original Marine Engine

Parts required:

1	of No. 1b	2	34	of No. 37	1	of No. 62	2	of No. 63	
2	„ 2		41	„ 37a	1	„ 62b	1	„ 77	
23	„ 3		36	„ 38			36″	„ 94	
1	„ 4		4	„ 48a			2	„ 96	
31	„ 5		6	„ 48b			2	„ 111	
10	„ 6		2	„ 52			4	„ 111a	
14	„ 6a		1	„ 52a			4	„ 111c	
4	„ 8a		8″	„ 58			2	„ 115	
14	„ 9		29	„ 59			2	„ 125	
2	„ 9b						5	„ 126a	
6	„ 9d						2	„ 137	
4	„ 9f						2	„ 147a	
16	„ 10						2	„ 147b	
8	„ 11						2	„ 148	
42	„ 12								
2	„ 13								
4	„ 14								
4	„ 15								
1	„ 15a								
3	„ 16								
1	„ 16a								
1	„ 16b								
4	„ 19b								
2	„ 20								
2	„ 22								
6	„ 35								

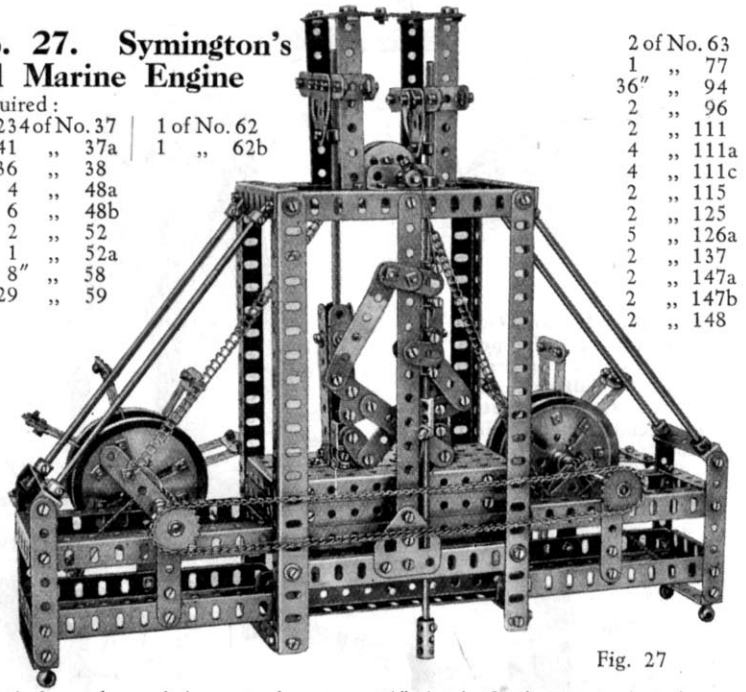


Fig. 27

The vertical members of the main frame are 9½" Angle Girders, spaced at the top by 5½" and 3½" Angle Girders, and at the bottom by 5½" Angle Girders, 3½" Strips, and 3½" × ½" Double Angle Strips. A 5½" × 3½" Flat Plate is bolted to the 5½" Angle Girders, and to this are then bolted two further 5½" Angle Girders.

The cylinders, consisting of four 3½" Strips held together by Double Brackets, are bolted to a 5½" × 2½" Flanged Plate by means of Angle Brackets. An Angle Bracket, which serves as a bearing for the piston-rod, is fixed inside the top of each cylinder. The Flanged Plate is bolted by means of Flat Brackets to a second similar Plate, and the complete unit is then bolted to the main frame.

The lower Angle Girders of the two smaller portions of the frame are bolted to the Double Angle Strips that space the vertical 9½" Angle Girders.

The paddle-wheels are mounted on 3½" Rods that carry also 1" Sprockets, Ratchet Wheels, and 2" Strips, each of which is fitted with a Pawl. Spring Cord is attached to each Pawl to hold it in engagement with the Ratchet teeth, and the 2" Strip is brought back into its initial position at the end of each stroke by further lengths of Spring Cord. The two paddle-wheels are connected by means of a length of Sprocket Chain that passes over the 1" Sprockets.

On top of the central portion of the structure are bolted four 3½" × ½" Double Angle Strips to form the slides for the crosshead, and these are braced at the top with Strips. The crossheads consist of Double Brackets placed at each side of the vertical Double Angle Strips and bolted to 2½" Strips. The frame is fitted with a drum consisting of two 1⅛" diameter Flanged Wheels secured with their flanges together on a Rod that carries also a Collar fitted with a Bolt. The Bolt is attached by cord to a vertical shaft that is journalled in the frame and consists of two 5" Rods connected by a Coupling. Two other Couplings also mounted on the Rod are each fitted with two Bolts that operate the valves. A length of cord is attached to each crosshead, then wound once round the drum in opposite directions and then attached to the appropriate 2" Strips on the paddle-wheel shafts.

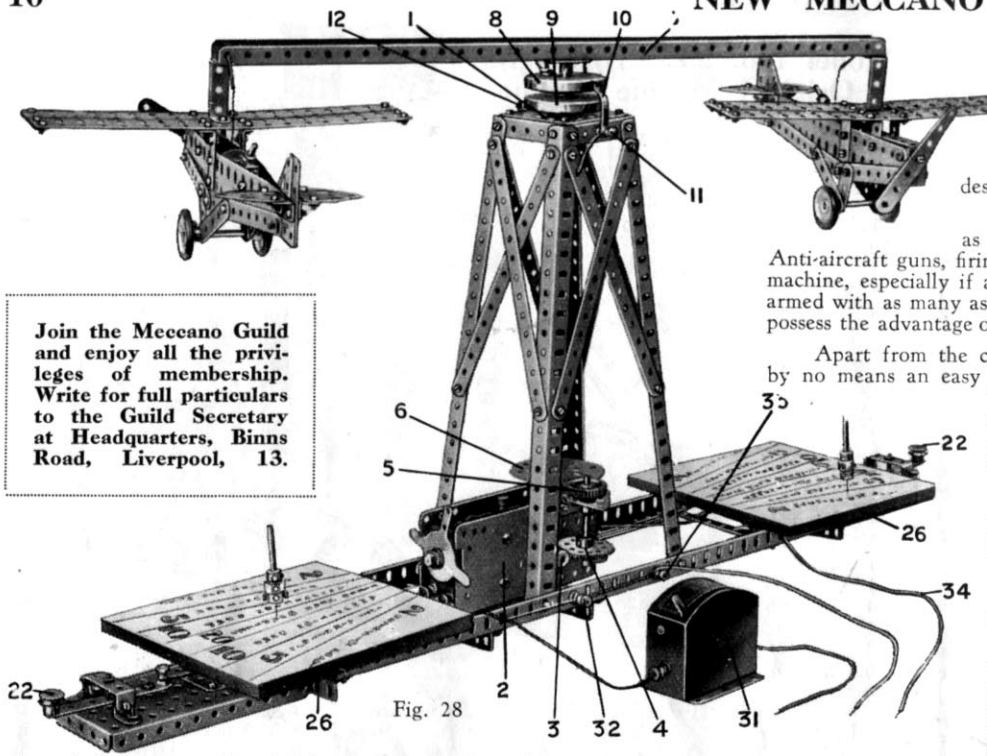


Fig. 28

Model No. 28. Meccano Aerial Bombing Game

One of the most powerful and destructive military weapons that have been devised in recent times is the bombing aeroplane. Those who have witnessed a raid on an ammunition dump, aerodrome, or field position (through the medium of the cinematograph screen!) will at once realise the tremendous amount of destruction a successful bombing attack is capable of inflicting.

The operator of a bombing machine does not have matters all his own way, however, as science has not been slow to devise methods of repulsing the bomb-laden aeroplane. Anti-aircraft guns, firing time-exploded shells to great heights, prove a considerable menace to the bombing machine, especially if a "dose" of shrapnel finds its way into the petrol tank! High-speed fighter machines armed with as many as six machine guns are used to pour death into the attacking bombers, and these machines possess the advantage of being much more easily manœuvred than the comparatively slow and heavy bombing craft.

Apart from the chance of failure due to a counter-attack, the actual hitting of the required target is by no means an easy task, and calls for a considerable amount of skill on the part of the aircraftsman. When the bomb is released, the machine is travelling at high speed (perhaps 100 m.p.h.) and the bomb consequently will not drop downward in a straight line, but will follow a slightly curved path in the direction in which the machine is travelling. This factor, among others, has to be taken into account if a direct hit is to be made.

It is to be hoped that Meccano model-builders will never be called upon to demonstrate their prowess in releasing death from actual military aircraft. By building the model Aerial Bomber shown in Fig. 28, however, they may carry out some exciting "bomb dropping" in miniature, and with practice may become expert target hitters.

The Aerial Bomber forms an exciting game that may be played by two or more people, and it is particularly suitable for use at a party, bazaar or similar function.

As will be seen from the general view (Fig. 28), the model consists of a vertical standard that supports a horizontal arm. A model aeroplane is suspended from each end of the horizontal arm, and each aeroplane is fitted with an electric solenoid. The solenoids are connected to the Accumulator or Transformer operating the model through rotary current collectors, and when the current is passing the solenoids hold the "bombs" in position in the aeroplanes by magnetic force. The bombs consist of Axle Rods fitted with Octagonal Couplings. A switch key is fitted at each end of the framework of the model, and by depressing these the current supply is broken and the bombs fall from the aeroplanes.

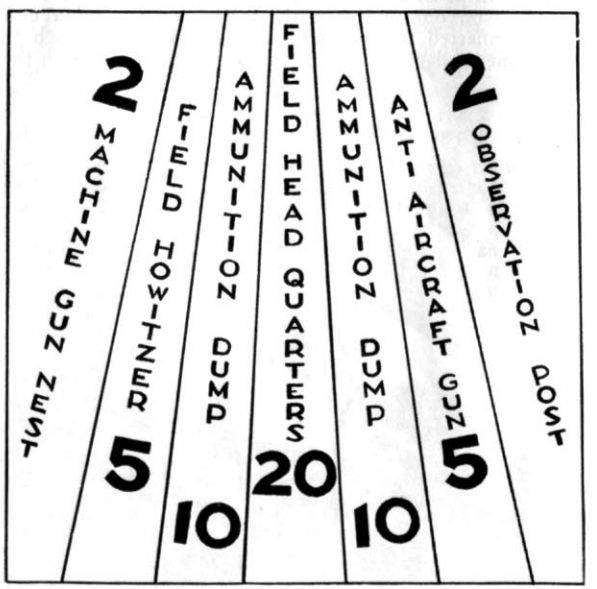


Fig. 28A

Targets suitably marked are secured to the base-frame of the model in such a position that they are directly in the path of the revolving aeroplanes, and by depressing the keys at the correct moment the bombs may be made to hit a section of the target, and a score registered.

The base-frame consists of two 18½" Angle Girders spaced apart by means of 4½" Angle Girders and Strips. A 5½" × 2½" Flanged Plate is secured at each end of the base-frame, and these Plates carry switch keys that will be described later. The vertical support is built up from four 12½" Angle Girders held together at the top by four 2½" Angle Girders. The 12½" Angle Girders are braced by means of 7½" Strips. A 2½" × 2½" Flat Plate 1 is secured in position on top of the framework, and a Bush Wheel is bolted to the centre of this Plate to provide the top bearing for the vertical shaft.

The Motor 2 is secured to the 4½" Girders of the base, and a Worm 3 on its armature shaft engages a 57-teeth Gear Wheel 4, mounted on a Rod that revolves in vertical bearings consisting of two Corner Brackets secured to the Motor side plates by means of 1½" Angle Girders. A 1" Gear Wheel 5 is mounted on the top end of the Rod, and this engages with a 2½" Gear Wheel 6 secured to the vertical shaft. The latter shaft consists of an 11½" Axle Rod, which is mounted at the top end of the frame in the Bush Wheel secured to the Plate 1, and at the base in the boss of a Double Arm Crank that is mounted between the Motor side plates by means of Angle Brackets.

A Bush Wheel is fixed on the top end of the Rod, and an arm 7 consisting of two 18½" Angle Girders is attached to the Bush Wheel. Two insulated current collector discs 8 and 9 are also fixed in position on the upper end of the Rod, each disc being built up as follows. A Bush Wheel is mounted on the Rod and a Wheel Flange is secured to this by 6BA Bolts and Nuts, Insulating Bushes and Washers being interposed between the faces of the Bush Wheel and the Wheel Flange, so that the latter is insulated electrically from the Bush Wheel. A second 6BA Nut is placed on one of the 6BA retaining Bolts, and this serves to form a connecting point for the insulated wire from one of the solenoids fitted in the aeroplanes. The brush 10 of the upper rotary collector is a Pendulum Connection (part No. 172), secured to the

Model No. 28. Meccano Aerial Bombing Game (continued)

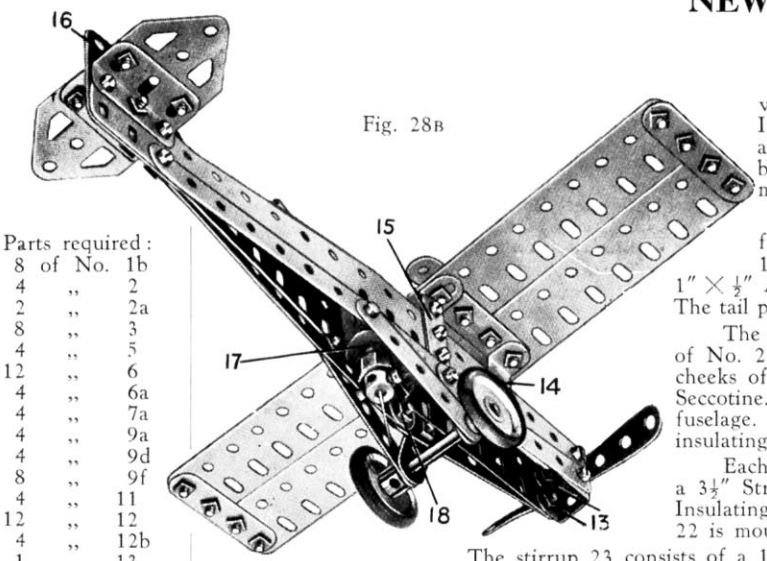


Fig. 28B

Parts required:

8	of No.	1b
4	,,	2
2	,,	2a
8	,,	3
4	,,	5
12	,,	6
4	,,	6a
4	,,	7a
4	,,	9a
4	,,	9d
8	,,	9f
4	,,	11
12	,,	12
4	,,	12b
1	,,	13
1	,,	16a
2	,,	17
2	,,	18a
4	,,	22
3	,,	24
1	,,	27a
1	,,	27c
1	,,	31
1	,,	32
178	,,	37
6	,,	37a
6	,,	38
4	,,	48
2	,,	52
12"	,,	58
4	,,	59
1	,,	62b
2	,,	63a
1	,,	72
8	,,	103a
2	,,	103g
2	,,	103h
2	,,	107
2	,,	111
2	,,	111a
4	,,	111c
2	,,	115
4	,,	126a
4	,,	133
2	,,	136
2	,,	137
4	,,	155
2	,,	172
2	,,	181
17	,,	182
1	E6 Electric Motor	

Elektron Parts:

9	of No.	1563
25	,,	1570
18	,,	1575
22	,,	1583
1	,,	1587

vertical frame of the model by means of a 6BA Bolt and Nut insulated from the frame by means of an Insulating Bush and Washer. A Terminal 11 is fitted to the 6BA Bolt to enable a length of flex to be attached. The Brush 12 at the far side of the model is assembled in a similar manner to the Brush that can be seen in the illustration, but the Pendulum Connection is bent into a "U" so that the tip of the connection may rub against the edge of the Wheel Flange 9 as the latter revolves.

Fig. 28B is an underside view of one of the aeroplane machines with bomb in place. The sides of the fuselage of the model consist of two 9½" Flat Girders held apart at the nose by means of two Double Brackets 13, and the wing is composed of two further 9½" Flat Girders held together by means of 2" Strips. Two 1" × ½" Angle Brackets 14 and 2" Strips 15 fitted with ½" × ½" Angle Brackets are used to hold the wing in position. The tail planes are two Flat Trunnions held to the fuselage by means of 1½" Angle Girders.

The solenoid 17 that holds the bomb in place is assembled as follows. A Bobbin (Part No. 181) is wound full of No. 26 S.C.C. Wire (Elektron Part No. 1586). The ends of the wire are passed through holes in the fibre cheeks of the Bobbin, and a strip of stiff brown paper is bound round the outside turns of wire and secured with Seccotine. The complete solenoid is then pushed into position between the Flat Girders forming the sides of the fuselage. One end of the wire is bared and secured under the Nut 18, while the other end is fastened to a length of insulating flex that passes along the arm 7 to one of the rotary collector discs.

Each of the two switch keys is mounted on a 5½" × 2½" Flanged Plate (see Fig. 28D). The key arm consists of a 3½" Strip 20 secured to the Plate 19, and insulated from the Plate by means of two Insulating Bushes and four Insulating Washers. A Terminal 21 is fixed on the end of the shank of one of the 6BA Bolts, and a ½" fast Pulley 22 is mounted on the free end of the Strip 20.

The stirrup 23 consists of a 1½" × ½" Double Angle Strip and two ½" × ½" Angle Brackets. Insulating Bushes and Washers are used to isolate the stirrup from the framework of the model. A ½" Bolt 29 is fixed in position in the centre of the stirrup 23 by means of two Nuts. These Nuts should be adjusted so that the head of the Bolt 29 presses against the upper surface of the Strip 20.

A 1½" Angle Girder 25 is mounted on the Plate 19 and serves to support one side of the Designing Table 26 (see Fig. 28) forming the target board. The table is held in position by means of the ⅜" Bolt 27. A Terminal 28 is mounted on a 6BA Bolt insulated from the frame by an Insulating Bush and Washer. A piece of Spring Cord about 4" long is stretched between the Terminals 24 and 28. One end of a length of insulating flex is secured under the Terminal 28 and the other end of the flex is attached to one of the Terminals of the brush contacts 10 and 12. The Terminal 21 is connected to the corresponding Terminal at the other end of the model.

On no account must the Spring Cord resistance between the Terminals 24 and 28 be removed entirely from the circuit. If this were done a very large current would flow, and damage to the Accumulator or Transformer might result.

The bombs consist of an Octagonal Coupling 30 (Fig. 28C) fitted to a 1½" Axle Rod 31. A short sewing needle 32 about 1" long is inserted in one end of the Coupling and held in a central position by means of two Set Screws. The targets are sheets of stiff paper or card marked out as shown in Fig. 28A. In operation the aeroplanes are rotated at a comparatively slow speed, and a Meccano Resistance Controller 31 (Fig. 28) is therefore included in series with the Motor. A short fixed-resistance composed of Meccano Spring Cord is also included in the circuit.

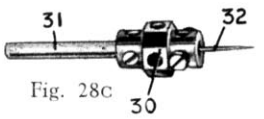


Fig. 28C

One terminal of the Motor is first of all joined to the Terminal 32, which is insulated from the frame, and one end of a short length of Spring Cord is secured to it. The other end of the Spring Cord is attached to the Terminal 33, which is in contact with the frame of the model. The other Motor terminal is joined to one terminal of the Resistance Controller 31. This completes the connections, and it only remains to couple up the Motor with the current supply, which may be either an Accumulator or a Transformer. A length of flex 34 is first of all attached to one of the Terminals 21 and the flex is joined to one pole of the Accumulator or Transformer. A length of flex attached to the second Terminal of the Resistance Controller 31 is also secured to this pole of the Accumulator, and finally a length is joined between Terminal 33 and the second pole of the Accumulator.

To operate the game, the Accumulator and Resistance Controller are connected as described, and the bombs are slipped into the solenoids in the aeroplanes. The Motor is then started up in a clockwise direction and the aeroplanes are set at the required speed by means of the Resistance Controller. The players then take up positions at each end of the model with their fingers on the bomb-release keys 22. When their own aeroplane sails past over the target the key is depressed and the bomb drops, registering a direct hit on the "Field Headquarters" or some other important position in the enemy's line!

Fig. 28D

Read the "Meccano Magazine". Full particulars of this fine monthly are given on page iv of cover.

Model No. 29. Galleass

The hull of the model is composed of 12½" Strips held together by 3" Angle Girders and 3" Strips. The top and bottom pairs of longitudinal Strips are clamped between pairs of 2½" small radius Curved Strips, which form the stem. Two further Strips are bolted between the first pair to form the projecting portion of the bows. Small radius Curved Strips are joined to the top of the bow and stern post, and are connected to two 5½" Curved Strips and two 2" Strips, to give the bows and stern an upward curve.

The deck plates, which are placed 1" below the gunwales, consist of 5½" × 2½" Flat Plates, and are held in place by 4½" Angle Girders bolted across the model, and by 4½" Angle Girders fixed to the sides. The mast is an 11½" Rod, journalled in one of the central cross members of the hull, and at the bottom it is stepped in a Double Arm Crank fixed between the two central transverse 4½" Girders.

To complete the vessel, two 4½" Strips connected across their ends by 1½" × ½" Double Angle Strips are secured in a central position across the model by means of two Flat Brackets. The steering oar is a Rod passed through a Hinge fixed to the hull near the stern. The Rod is held in place by two Collars, and at its upper end is fitted with a Collar into which is screwed a Threaded Pin. Three 2½" Strips held between the arms of an End Bearing are attached to the lower end of the Rod. The oars are 6½" Rods that are pushed through the side Strips of the hull and prevented from falling out by Collars placed on the Rods inside the hull.

The sail is a stiff piece of white paper, one edge of which is gummed to an 11½" Rod. In the centre is a Collar that is attached to a second Collar by means of a Grub Screw. The latter Collar is fixed about 2" from the top of the mast, and cords are used to connect the ends of the horizontal 11½" Rod to a Handrail Coupling on top of the mast. Cords are also used to hold the bottom corners of the sail in position.

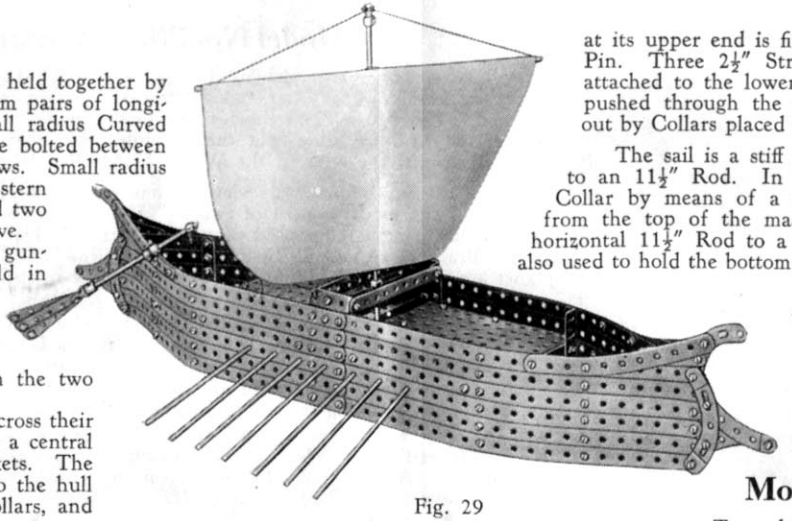


Fig. 29

Parts required:

24	of No.	1	8	of No.	9c	11	of No.	37a	4	of No.	89a
4	,,	2a	2	,,	10	1	,,	40	4	,,	90
4	,,	4	1	,,	11	2	,,	48	2	,,	90a
3	,,	5	2	,,	13	19	,,	59	11	,,	111c
4	,,	6	13	,,	14	1	,,	62b	1	,,	114
1	,,	6a	1	,,	15a	4	,,	70	1	,,	115
10	,,	9a	138	,,	37	4	,,	89	1	,,	166

Model No. 30. Catapult

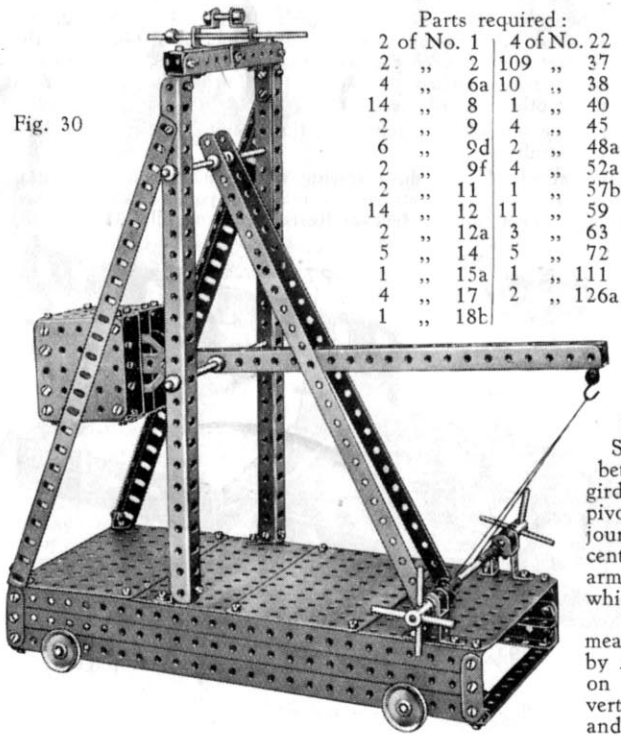


Fig. 30

Parts required:

2	of No.	1	4	of No.	22
2	,,	2	109	,,	37
4	,,	6a	10	,,	38
14	,,	8	1	,,	40
2	,,	9	4	,,	45
6	,,	9d	2	,,	48a
2	,,	9f	4	,,	52a
2	,,	11	1	,,	57b
14	,,	12	11	,,	59
2	,,	12a	3	,,	63
5	,,	14	5	,,	72
1	,,	15a	1	,,	111
4	,,	17	2	,,	126a
1	,,	18b			

Angle Brackets are used to hold together the two 12½" Angle Girders that form the main uprights of the frame, and further similar parts join the uprights to the base. Bracing is provided by placing two 12½" Angle Girders between the tops of the columns and the baseplate, and also by 12½" Strips bolted to the baseplate and secured to a Rod that passes through the uprights. The Rod and Strips are held in place by means of Collars. The uprights are connected across their tops by a tubular crossbeam consisting of two 5½" Angle Girders. A ¾" Bolt is used to fix two Double Bent Strips in the centre of the crossbeam, and their other ends are held on a 1" Rod by means of Collars. The Double Bent Strips make a carriage for a 4½" Rod that forms the missile.

The catapult hammer is now made. The weight is a cube built from 2½"×2½" Flat Plates held together by Angle Girders. Two 2½" × ½" Double Angle Strips are bolted across the open end of the cube, and between them is secured, by Flat Trunnions, a tubular girder consisting of 12½" Angle Girders. The arm is pivoted, 2½" from the weight end, on a Rod that is journalled in the uprights. The Rod is retained in a central position between the uprights by Collars, and the arm is fitted at its outer end with a Hook, by means of which the arm can be drawn down by a hand winch.

To operate the model, the arm is drawn down by means of cords, which are secured to the winch spindle by Anchoring Springs. The cord is then unhooked, and on account of the weight the arm springs back into a vertical position. In doing so it hits the end of the missile and propels it for a considerable distance.

Model No. 31. Lumber Wagon

To make the axle-boxes, a 1½" Strip and a Flat Bracket are bolted to each end of a Double Bent Strip, and a 1½" Strip is fixed across the Double Bent Strip to form the bearing for the axle. Two Double Brackets are then held in place by means of two Flat Brackets.

The brake-lever is a 5½" Strip, fitted at one end with a Crank in the boss of which is a 1" Rod. The Rod is journalled in two 2" Strips bolted to a Flat Trunnion and secured to the chassis by means of two ½" × ½" Reversed Angle Brackets. On the inside end of the 1" Rod is a second Crank, to the end of which is pivoted a 3" Strip. The Strip in turn is connected to the 1½" Strip that carries the brake shoe, a 1" Corner Bracket.

Parts required:

10	of No.	2	4	of No.	15	2	of No.	48	3	of No.	70
4	,,	3	10	,,	18b	2	,,	48a	2	,,	90
2	,,	4	6	,,	22	1	,,	52	2	,,	103
8	,,	5	4	,,	24	2	,,	57	4	,,	109
4	,,	6	136	,,	37	10	,,	59	4	,,	111
14	,,	6a	8	,,	37a	4	,,	62	4	,,	111c
4	,,	8	4	,,	45	4	,,	63	4	,,	125
4	,,	9							2	,,	126a
24	,,	10							2	,,	133a
10	,,	11							4	,,	137
8	,,	12							2	,,	166

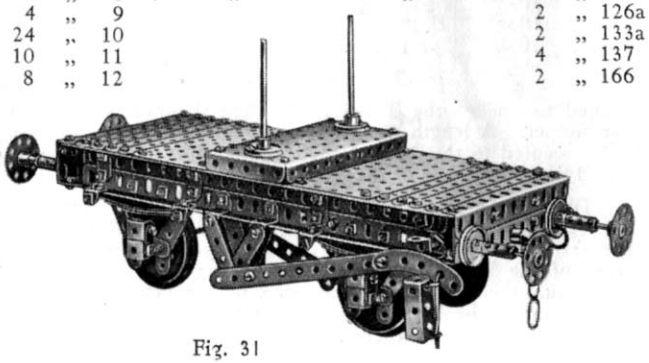


Fig. 31

Model No. 32. Cheshire Cat

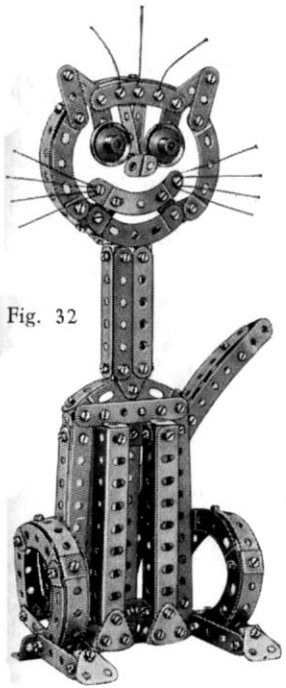


Fig. 32

The sides of the head consist of three 5½" Strips bolted together and bent to form a circle. The front of the face is made of three 2½" small radius Curved Strips, and four 1½" Strips are used for the ears. The two parts of the head are connected by means of ½" × ½" Angle Brackets. Two 1" fast Pulleys are used for the eyes, and the nose is made from two 2" Strips and Angle Brackets, and is held in place by ½" × ½" Angle Brackets. A 2½" small radius Curved Strip serves as the mouth, and the whiskers are short lengths of wire.

To make the body, two 5½" Strips are spaced by a 3" Strip at one end, and at the other end are bolted 3½" apart to a 5½" Angle Girder. A 2½" small radius Curved Strip and a 3½" Strip, secured in place by Angle Brackets, form the shoulders.

For the hind legs two parts, each made from two 2½" small radius Curved Strips, a 1½" Strip and a 2½" Strip, are constructed. These are then joined by Double Brackets, and a 7½" Strip is bent and bolted into place. For the lower part of the legs two 2" Strips, a Double Bracket and a 1" Triangular Plate are used. The legs are bolted to the side Strips of the body and also to the 5½" Angle Girders that form the base. The tail consists of four 7½" Strips bolted together by means of Double Brackets, and attached to the body by Angle Brackets.

Parts required:

11	of No.	2	6	of No.	6	8	of No.	10	2	of No.	22	1	of No.	89a
2	,,	2a	10	,,	6a	15	,,	11	125	,,	37	5	,,	90
3	,,	3	1	,,	9	34	,,	12	5	,,	77	11	,,	90a
5	,,	4	4	,,	9a	1	,,	12b	4	,,	89	2	,,	111c

Model No. 33. Stork

Parts required:

2	of No.	1	5	of No.	6	18	of No.	89
1	,,	1a	4	,,	10	6	,,	90
4	,,	1b	16	,,	12	4	,,	90a
7	,,	2	69	,,	37	2	,,	102
4	,,	2a	10	,,	37a	2	,,	111a
1	,,	3	1	,,	38	1	,,	111c
8	,,	5	2	,,	68	2	,,	126a

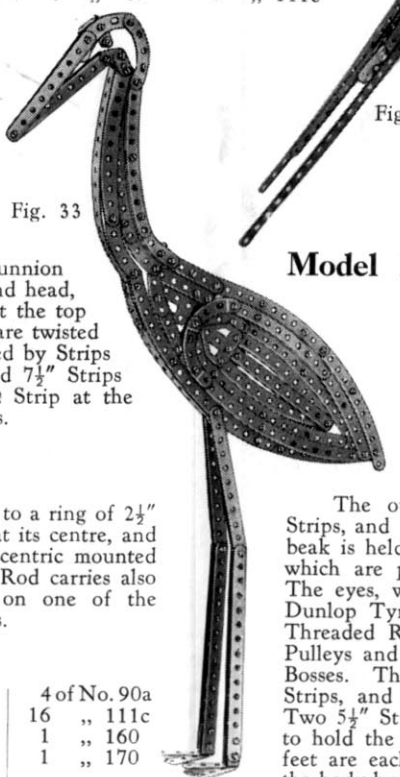


Fig. 33

The body is built up from Strips and Curved Strips, and a Flat Trunnion is used to form part of the wing. Curved Strips are used for the neck and head, and 5½" Strips for the beak, the two upper Strips being bolted together at the top by means of an Angle Bracket. At the outer end of the beak the Strips are twisted slightly and bolted together. The outline of the model is then strengthened by Strips bent to shape and bolted in place with Angle Brackets. Pairs of 5½" and 7½" Strips joined together are secured to the body, and are fixed to a single Bent Strip at the bottom. The feet, three 2" Strips, are then bolted to the Single Bent Strips.

Model No. 34. Water Beetle

Fig. 34

The legs are 5½" Strips and are attached to a ring of 2½" small radius Curved Strips, which is pivoted at its centre, and connected by means of a 4½" Strip to an Eccentric mounted on a Rod journalled inside the model. The Rod carries also a ¾" Contrate that engages a ½" Pinion on one of the axles. The model runs on four ½" fast Pulleys.

Parts required:

10	of No.	2	25	of No.	12	1	of No.	29	4	of No.	90a
1	,,	2a	2	,,	16	67	,,	37	16	,,	111c
18	,,	3	4	,,	22a	16	,,	37a	1	,,	160
18	,,	5	2	,,	23	1	,,	45	1	,,	170
2	,,	6	1	,,	26	4	,,	59			

Fig. 35

Model No. 35. Cockatoo

Parts required:

18	of No.	1	2	of No.	18b
4	,,	1a	2	,,	23
2	,,	1b	120	,,	37
6	,,	2	3	,,	63
6	,,	2a	8	,,	89
4	,,	3	6	,,	89b
6	,,	4	4	,,	90
8	,,	5	2	,,	90a
8	,,	6	2	,,	111a
2	,,	6a	2	,,	116
50	,,	10			

The body of the Cockatoo (Fig. 35) is mainly composed of 12½" Strips bolted to further Strips bent to shape. For the back four 12½" and four 4½" Strips are used, and the tail is formed with further 12½" Strips. In addition to being bolted to the framework, the Strips of the body are held together at various points by means of Flat Brackets and Angle Brackets. Curved Strips are used for the wings and are bolted to the Strips of the body. The head is built of Strips and Curved Strips interwoven, and the beak is made from two Strips bolted together at one end, then bent to shape and secured by Angle Brackets to the head. The eyes are ½" loose Pulleys held in place by ½" Bolts, and the legs are secured to the body by large Fork Pieces. The claws are composed of pieces of wire bent to shape.

Model No. 36. A Wise Old Owl

Parts required:

2	of No.	1a	19	of No.	12	10	of No.	89
10	,,	2	2	,,	22	9	,,	90
6	,,	2a	73	,,	37	4	,,	90a
7	,,	3	7	,,	37a	1	,,	111c
2	,,	5	2	,,	38	1	,,	125
10	,,	6a	2	,,	64	2	,,	142c
1	,,	10	2	,,	81			

The outline of the face is made from Curved Strips, and 1½" Strips represent the ears and beak. The beak is held in place with a ½" Bolt, on the shank of which are placed two Washers for spacing purposes. The eyes, which consist of 1" fast Pulleys fitted with Dunlop Tyres, are attached to the head by means of Threaded Rods screwed into the tapped holes of the Pulleys and held to the model by means of Threaded Bosses. The outline of the bird is built from Curved Strips, and the body is filled in with straight Strips. Two 5½" Strips are bolted across the back of the model to hold the Strips forming the body in position. The feet are each composed of three 1½" Strips secured to the body by ½" × ½" Angle Brackets.

Fig. 36

Model No. 37. Twin Anti-Aircraft Guns

One of the latest forms of warfare is bombing from aeroplanes, and in order to combat this menace many methods of defence and counter-attack have been adopted. Counter-attacking is, of course, only possible by aeroplanes of equal or greater power than the attacking force, but for defence gun-fire has proved the most universally suitable method, and it is for this purpose that the anti-aircraft gun has been evolved. By mounting two guns on one pedestal the rate of fire is speeded up, and in this manner also the possibility of a "hit" is greatly increased. It is upon this pattern of twin mounted anti-aircraft guns that the design for the Meccano model is based.

Commence the model by constructing the guns. The barrel (Fig. 37B) consists of an 18½" Angle Girder 1 to which is fixed by means of a ½" × ½" Angle Bracket 3, a 12½" Angle Girder 2. The Angle Bracket 3 is drawn out to the extremity of its slotted hole on one side in order to allow a clear passage for the "shot." The 18½" Angle Girder 1 also carries a 2½" Girder 45, secured in place at its outer end by two Double Brackets. The Girders 2 and 45 are connected on one side by 5½" Strips.

The actual barrel of the gun, consisting of an 11½" Rod 4, is attached to the outside casing by means of two Couplings, one of which is shown at 5. The other Coupling is not shown, but is secured by Bolts entering its threaded holes, to the Girders 1 and 45. The Rod 4 carries a Collar next to the Coupling 5, and to this are attached three interlocked Compression Springs. Three Double Brackets are bolted to the Girder 45 as shown in the photograph, and these carry a 6½" Rod, one end of which carries a handle 11 and the other end an End Bearing 7. The End Bearing supports a loosely mounted Flat Bracket on a Bolt between its two ends, and the Flat Bracket in turn is fitted with two rigidly fixed 1" × ½" Angle Brackets. The upper portions of these Angle Brackets are kept in permanent contact, by a piece of Spring Cord, with the filed-off end of the upper Rod, as shown in Fig. 37B. The end of the Rod on which the Angle Brackets press is filed to a wedge shape in order to provide a smooth surface, as can be seen in Fig. 37A.

When a Washer, representing the shell, is passed down the Rod 4 (Fig. 37B), and the handle 11 is pulled toward the operator, the two 1" × ½" Angle Brackets are forced downward until their two bent-out ends pass one on each side of the Rod 4 and press against the Washer. If the handle is pulled still farther the Washer is forced down the Rod against the pressure of the Compression Springs until it passes the end of a ⅜" Bolt 6, which is raised sufficiently to allow the Washer to pass. The Bolt is attached by an Angle Bracket to the handle 10. When the Compression Springs are fully compressed the Bolt 6 is lowered by raising the handle 10, the handle 11 then being returned to its original position. The Washer is now held by the Bolt 6, and pressure on handle 10 releases it.

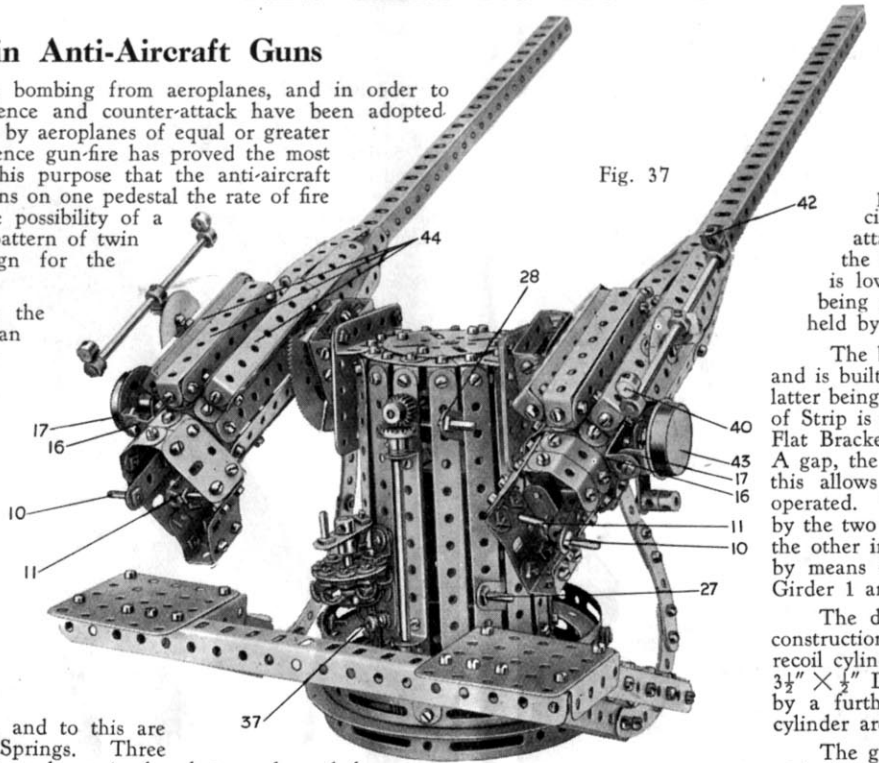


Fig. 37

The broad part of the gun is shown in Figs. 37A and 37E, and is built up from alternate lengths of 7½" and 6½" Strips, the latter being composed of one 5½" and one 2½" Strip. Each length of Strip is joined to its neighbour by means of two slightly bent Flat Brackets, one of which is placed at each end of the Strip. A gap, the width of one Strip, is left as shown in Fig. 37E, and this allows sufficient space for the loading mechanism to be operated. When the mechanism is inserted the gap is bridged by the two 1½" Strips, one of which is shown at 9, Fig. 37B, and the other in Fig. 37E. The casing is attached to the gun barrel by means of a ¾" Bolt 15 that passes through a hole in the Girder 1 and is secured in a threaded hole of the Coupling 5.

The dummy breech-block is now fitted to the gun and its construction is shown in Figs. 37A and 37E. Three dummy recoil cylinders 44 are also fitted, and each of these consists of a 3½" × ½" Double Angle Strip bolted to the gun and surmounted by a further similar Double Angle Strip. The sides of each cylinder are filled in by 3½" Strips bolted to Double Brackets.

The gun pivot consists of two 1½" Angle Girders 12, fitted with three 1½" × ½" Double Angle Strips 13. These latter parts carry two Rack Segments 14 placed edge to edge as shown, and are used for elevating and depressing the gun. Two further 1½" Angle Girders are mounted on the Double Angle Strips that form the main turning surface of the gun.

The base of the model consists of a Circular Plate on each side of which is fitted a Hub Disc. The upper Hub Disc is fitted with a Circular Girder, the necessary connection being made by four insulated Flat Brackets. A 3½" Gear Wheel is fixed to the base by means of eight ⅜" Bolts, two Washers being placed under the Gear Wheel on each Bolt for spacing purposes. A Ball Casing (Part No. 168c) is placed on the 3½" Gear Wheel, and this supports a Flanged Disc that in turn carries a Face Plate 45 (Fig. 37C). A circle of 2½" small radius Curved Strips, to which ½" × ½" Angle Brackets are bolted at every hole, is attached to this Face Plate by means of four Flat Brackets. Two 5½" Strips bolted to two opposite of these Angle Brackets, support an Electric Motor.

A ½" Pinion on the Motor armature shaft engages with a 57-teeth Gear 22. This Gear is mounted on a 2½" Rod that carries a Worm 23 engaging a ½" Pinion mounted on

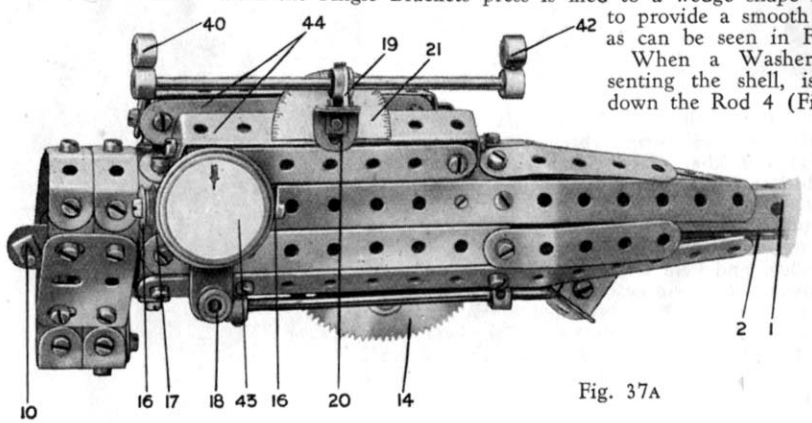


Fig. 37A

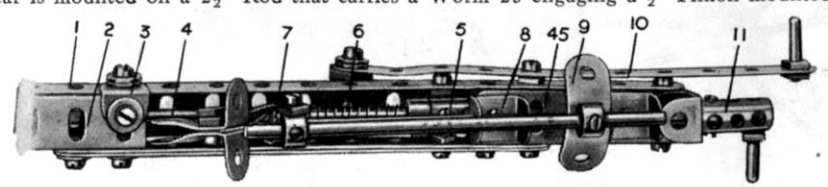


Fig. 37B

Model No. 37. Twin Anti-Aircraft Guns—(continued)

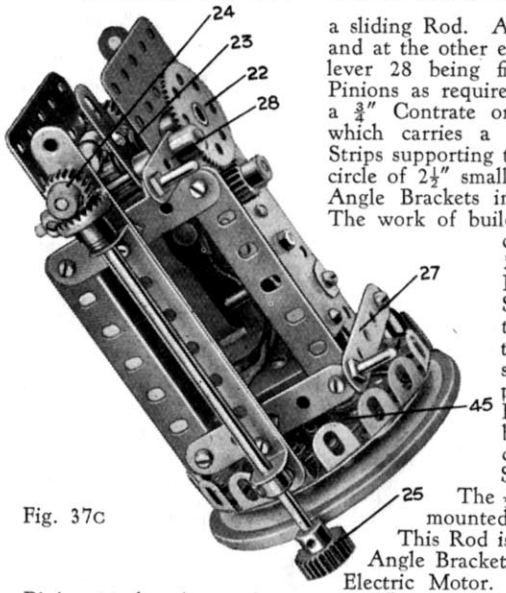


Fig. 37C

a sliding Rod. At one end of the Rod is a ½" Pinion 24, and at the other end a ½" Pinion 30 (see Figs. 37C and 37D), lever 28 being fitted for engaging or disengaging these Pinions as required. The Pinion 24 drives, when desired, a ¾" Contrate on a vertical 5" Rod, the lower end of which carries a ¾" Pinion 25. The two vertical 5½" Strips supporting the Motor carry at their top ends a second circle of 2½" small radius Curved Strips fitted with ½" × ½" Angle Brackets in a similiar manner to the lower circle. The work of building up the sides of the pedestal is now carried out, and this consists of securing 5½" Strips between the two sets of Angle Brackets. To the upper circle of Curved Strips at two opposite points, parallel to the Electric Motor side plates, are bolted two 2½" Angle Girders, each of which supports two 2½" × 2½" Flat Plates that provide the bearing surface for the ⅜" Bolts 36 forming the gun pivots. It will be seen from Fig. 37D that the front lower corners of the 2½" × 2½" Flat Plates carry Simple Bell Cranks fitted with Cranks. The ½" Pinion 30 engages with a similar Pinion mounted on a 1½" Rod carrying the Worm 29. This Rod is journalled at its inner end in a 1" × 1" Angle Bracket attached to one of the side plates of the Electric Motor. The Worm 29 is in mesh with a ½" Pinion 31 that drives, through two ½" Pinions, a ½" diameter ½" face Pinion 32 on each side of the pedestal. The bearings carrying the Rod for the last stage of gearing are prevented from being distorted by a 3½" Rod fixed in the bosses of the Cranks mentioned earlier. The Pinions 32 are carried on 2" Threaded Rods, which support the rear platform.

The electrical equipment of the model consists of a resistance controller 34 and a collector brush 35 (Fig. 37D). The brush 35 is made from a Hinge insulated from the pedestal and carrying a Flat Bracket. This Flat Bracket is kept in contact with the insulated Circular Girder of the base by means of a short length of Spring Cord attached to, but insulated from, the Flat Bracket. The resistance controller is attached to the pedestal by means of a ½" × ½" and a 1" × 1" Angle Bracket, and its construction is similar in every respect to Standard Mechanism No. 115. One lead from the source of electrical supply is connected to an earth Terminal, and the other lead is connected to a Terminal that is in contact with the insulated Circular Girder. The current passes from this Girder to the collector shoe 35, from where it passes to one side of the resistance controller 34. The remaining Terminal on the controller is then connected to one terminal of the Electric Motor, the other Motor terminal being earthed.

The Motor is started or reversed by means of the lever 27, protruding through the pedestal casing as shown in Fig. 37, and control over the guns is obtained from the lever 28.

The sight of each gun consists of a 4½" Rod, fitted at each end with two Collars 40 and 42, and mounted centrally in a Collar 19. Each set of Collars 40 and 42 are joined together by means of a Grub Screw, half of which is passed into each Collar. The Collar 42 has a vertical thin piece of wire gummed across it, and 40 is fitted with a small piece of tinfoil, the centre of which is pierced with a pin. The Collar 19 is lock-nutted to a ½" × ½" Angle Bracket 20, which in turn is lock-nutted to a similiar Angle Bracket on one of the recoil cylinders. A scale for reading the lateral movement of the sight is fitted to the Collar 19 and to the Angle Bracket 20, and a semi-circular scale 21 is fitted for indicating the vertical movement.

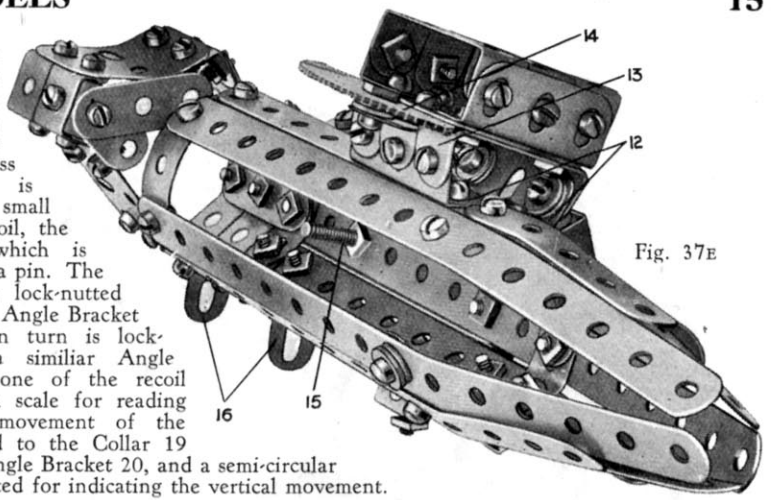


Fig. 37E

The range indicator consists of a large Flanged Wheel carrying a Pivot Bolt in its boss, on the head of which is gummed a circle of thin cardboard. A Crank is locked securely on to the outer threaded shank of the Pivot Bolt, and the weighted lever so formed always ensures that the inner cardboard disc remains in the same position relative to the pedestal and the surface of the earth. The slotted circle of cardboard 43 shown in Fig. 37A is gummed on to the rim of the Flanged Wheel. Thus when the gun is elevated or depressed, the ranges appear through the slot in the card 43.

In shooting, the operation of the model is as follows. If the range is 40 ft., the guns are elevated until 40 appears in the range indicator slot, and the sight is moved inward slightly so that the line of vision converges with the line of fire. The sight may now be moved vertically without interfering with the loading of the guns, and the guns are then rotated until, on looking through the hole at 40, the object of attention appears directly in front of the vertical line at 42 (Fig. 37).

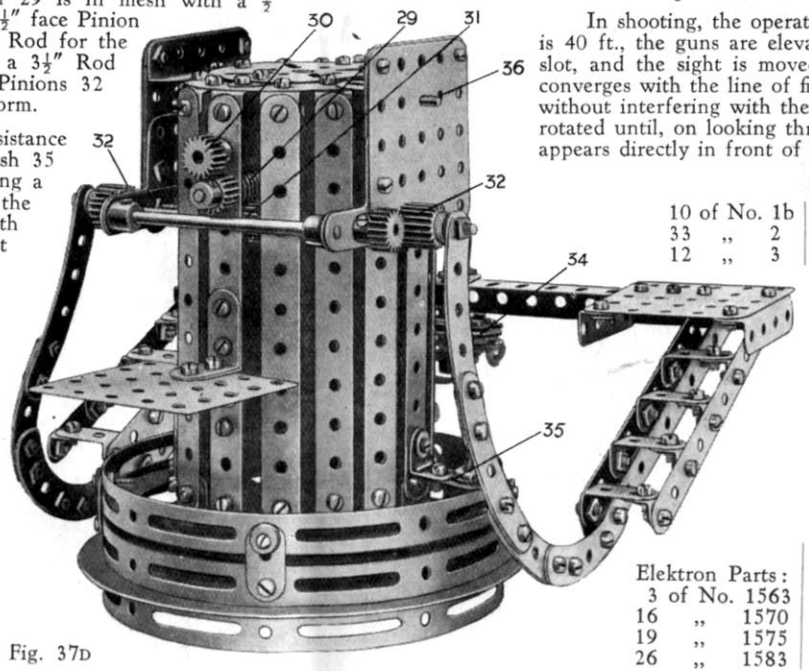


Fig. 37D

Parts required:

10 of No. 1b	11 of No. 5		3 of No. 25a		2 of No. 100		
33 „ 2	12 „ 6a		7 „ 26		6 „ 103h		
12 „ 3	2 „ 7a		1 „ 27a		1 „ 109		
	2 „ 8		1 „ 27b		4 „ 111		
	1 „ 8a		1 „ 29		12 „ 111c		
	4 „ 9d		2 „ 32		1 „ 114		
	4 „ 9e		429 „ 37		6 „ 115		
	8 „ 9f		10 „ 37a		2 „ 118		
	57 „ 10		2 „ 37b		1 „ 120a		
	18 „ 11		59 „ 38		6 „ 120b		
	68 „ 12		16 „ 48		2 „ 127		
	19 „ 12a		13 „ 48b		4 „ 129		
	13 „ 12b		1 „ 58		1 „ 143		
	2 „ 14		27 „ 59		2 „ 147b		
	3 „ 15		6 „ 62		2 „ 166		
	2 „ 15a		1 „ 62b		1 „ 168a		
	2 „ 16a		6 „ 63		1 „ 168c		
	2 „ 16b		7 „ 72		18 „ 182		
	1 „ 18b		2 „ 81				
Elektron Parts:	2 „ 20		4 „ 89a		1 E6 Electric Motor		
3 of No. 1563	1 „ 24		12 „ 90				
16 „ 1570	1 „ 25		8 „ 90a				
19 „ 1575							
26 „ 1583							

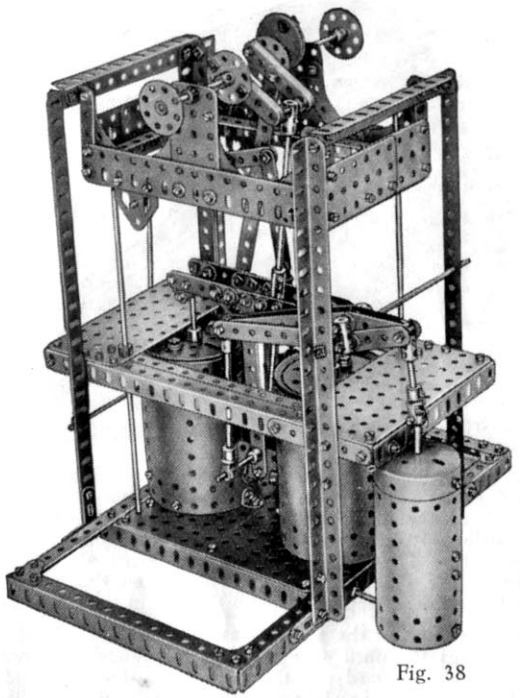


Fig. 38

Model No. 38. Twin Cylinder Paddle Engine

The base of the main frame consists of two 12½" Angle Girders across the ends of which 7½" Girders are bolted, the whole being strengthened at the corners by 1" Corner Brackets. Two further Angle Girders are fitted across the frame 5½" apart, and four 12½" Angle Girders are then bolted vertically as shown in the illustration. The vertical Girders are connected together 5" from the bottom by means of 7½" Angle Girders extended to a length of 10½" by 1½" Angle Girders. These Girders in turn are connected across their ends by means of 5½" Girders.

To make the main bearing support, a 1½" × 3" Flat Plate is fixed in the centre of a 7½" Flat Girder, to the face of which a 7½" Angle Girder is bolted to give rigidity. The unit is then secured to the main frame by means of 2½" Angle Girders, and is held in place by 11½" Rods that pass through the platform.

Each of the cylinders consists of two Boilers opened out and bolted by means of 1" × ½" Angle Brackets round the periphery of a 3" Pulley. The Pulleys are fixed to the base-plate in such positions that the bosses of the Pulleys are 4½" apart.

The piston rods are 3½" long and are joined in tandem across their upper ends by means of a yoke made from four Corner Brackets to which 2½" Strips are bolted with an overlap of two holes. The Corner Brackets are then joined in pairs so that the Strips are in line, and 1" Triangular Plates are bolted to each end. These units are connected in parallel by means of Couplings to form the yoke, and the piston rods are secured in the Couplings.

The crosshead or sliding portion, which is connected to the centre of the yoke by 5½" Strips, consists of two 1½" Flat Girders held together by Double Brackets, which fit one on each side of 3½" Strips bolted to each cylinder and spaced by three Washers.

The crankshaft is made in two halves fitted at each end with a Bush Wheel, and is held in place by Collars. A number of 2½" Strips are bolted to the inner Bush Wheel on each half of the shaft, and these are then connected by means of the crank-pin to a 1½" Rod held in the bosses of two Cranks bolted to the Strips. Two Rods connected by a Coupling are used to provide a link between the yoke and the crank-pin.

The air-pump is a Boiler fixed to the model by means of a length of Screwed Rod and Angle Brackets. Inside the Boiler is a 1" × 1" Angle Bracket that acts as one of the bearings for the piston rod, the outer end of which is connected to the crosshead by means of a beam and Rods. The beam is built from Strips, and is mounted by means of Couplings on a screwed Rod. The valve chest consists of Bush Wheels bolted to 3½" × ½" Double Angle Strips.

The valve gear is operated by a ½" Triple-Throw Eccentric on the crankshaft. The Eccentric is connected to a 7½" Strip, which in turn is lock-nutted to one end of a Double Arm Crank on a Rod journalled between the uprights visible in the left of Fig. 38. The other end of the Double Arm Crank carries a 5½" Strip that is lock-nutted to one end of a 3½" Strip mounted on a Rod passed through its second hole and journalled in two Flat Trunnions bolted to the main bearing. The motion of the Eccentric is finally transmitted by a 3½" Strip to the valve rod.

Parts required:

1	of No.	1a	8	of No.	8b	4	of No.	12b	3	of No.	19b	2	of No.	62	5	of No.	82	8	of No.	127
2	,,	1b	4	,,	9	1	,,	14	6	,,	24	4	,,	62b	8	,,	90a	1	,,	130
4	,,	2	2	,,	9a	3	,,	15	202	,,	37	10	,,	63	2	,,	103h	4	,,	133
4	,,	2a	4	,,	9d	4	,,	15a	56	,,	37a	2	,,	70	2	,,	103k	4	,,	133a
4	,,	3	5	,,	9f	3	,,	16	57	,,	38	6	,,	73	10	,,	111a	1	,,	162a
2	,,	4	2	,,	11	1	,,	16a	8	,,	48b	4	,,	77	15	,,	111c	5	,,	162b
16	,,	5	4	,,	12	1	,,	16b	2	,,	52a	1	,,	80a	1	,,	116a	1	,,	165
4	,,	6	5	,,	12a	2	,,	18a	31	,,	58a	1	,,	80b	2	,,	126a	3	,,	166
5	,,	8																		

Model No. 39. Engine of "The Comet"

An E1 Electric Motor inside the body has a ½" Pinion on its armature shaft, and this engages a 57-teeth Gear Wheel on a secondary shaft that carries also a ½" Pinion. This Pinion meshes with a 57-teeth Gear on a 4½" Rod, on which is a ¾" Sprocket that transmits the drive to the crankshaft.

The crankshaft consists of a 2" Rod and a 3½" Rod, each carrying a Bush Wheel at its inner end; the Bush Wheels are connected by a ½" Bolt and locknuts. The ½" Bolt also carries loosely a 3½" Strip that forms the connecting rod between the crankshaft and a bridge consisting of a 5" Rod journalled at both ends in 2" Strips, each of which is attached to a Strip on a 5" Rod held in a Double Angle Strip.

A 4½" Rod carrying two Cranks set at right angles to each other is journalled between the sides of the model 2" from one end, in such a position that one of the Cranks is actuated by a cam consisting of a Bolt held in the tapped bore of a Collar fitted on the crankshaft. The other Crank carries a Collar in the bore of which is secured a 1" Rod.

A ½" × ½" Angle Bracket is bolted inside the valve chest to form a journal for the valve Rod, which is fitted with a Collar bearing a pivoted 2" Strip. The Strip is bolted to a Coupling at its lower end, and the Coupling is fixed to a 4½" Rod supported by two 2" Strips. The Rod carries also a second Coupling that is connected by means of a Flat Bracket and a Collar to the 1" Rod in the Crank inside the model.

Parts required:

2	of No.	1b	4	of No.	48	8"	of No.	94	1	E1 Electric Motor	
14	,,	2	6	,,	48a	1	,,	96a			
4	,,	2a	2	,,	48b	1	,,	109			
1	,,	3	2	,,	52a	2	,,	111			
4	,,	4	2	,,	53	6	,,	111c			
32	,,	5	2"	,,	58	1	,,	162b			
4	,,	6	19	,,	59	1	,,	165			
6	,,	6a	2	,,	62						
2	,,	8b	4	,,	63						
4	,,	9									
2	,,	10									
8	,,	11									
20	,,	12									
2	,,	15									
4	,,	15a									
5	,,	16									
3	,,	16a									
2	,,	17									
2	,,	18a									
1	,,	20a									
1	,,	21									
2	,,	23									
2	,,	24									
1	,,	26									
2	,,	27a									
13	,,	35									
165	,,	37									
10	,,	37a									
24	,,	38									

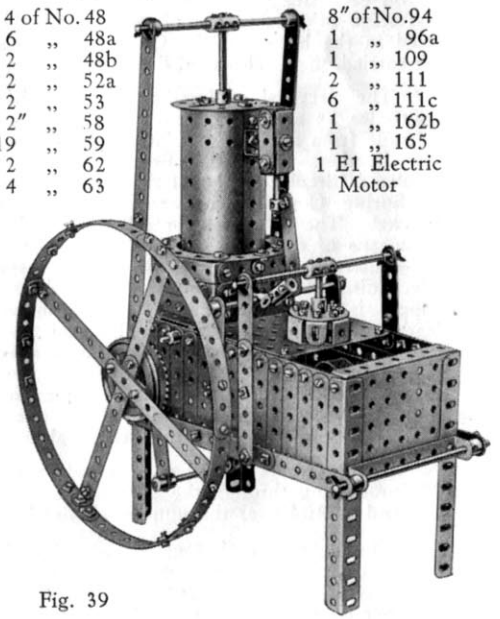


Fig. 39

Model No. 40. Stage Coach

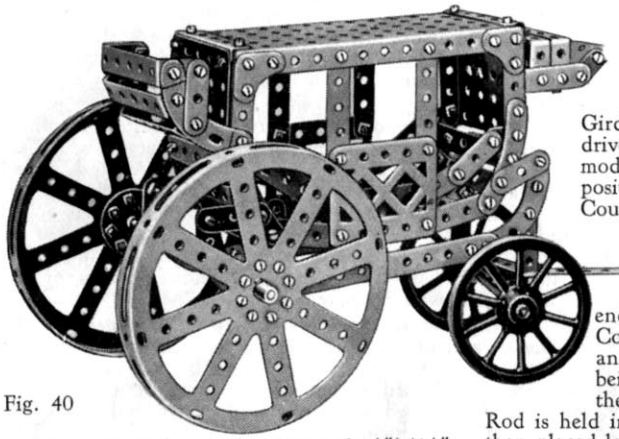


Fig. 40

The ends of the coach consist of $2\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plates fitted on three sides with $2\frac{1}{2}''$ Angle Girders. A further $2\frac{1}{2}''$ Angle Girder bolted to one of the Angle Girders on each Plate enables the parts to be secured to the ends of the roof, a $2\frac{1}{2}'' \times 5\frac{1}{2}''$ Flanged Plate. To the lower ends of the side Girders are bolted $2\frac{1}{2}''$ large radius Curved Strips, and at the bottom these are connected by $5\frac{1}{2}''$ Curved Strips. The sides of the coach are made from $2\frac{1}{2}''$ Strips and $2\frac{1}{2}''$ Braced Girders.

Dummy spring straps are bolted to the $2\frac{1}{2}''$ Curved Strips and each is fitted with a $2\frac{1}{2}''$ small radius Curved Strip. To these Curved Strips similar parts are bolted with an overlap of four holes, and the composite Curved Strips so formed are connected in pairs by $5\frac{1}{2}''$ Strips.

The front axle consists of a $3\frac{1}{2}''$ Rod journalled in a $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip, which is pivoted to a $2\frac{1}{2}'' \times 1\frac{1}{2}''$ Double Angle Strip secured between the front springs by a Bolt fitted with two locknuts.

The shaft is fixed by a Flat Trunnion to the $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip that holds the front axle.

Parts required:

1 of No. 1a		137 of No. 37		2 of No. 89b	
2 „ 2		2 „ 37a		4 „ 90	
5 „ 5		3 „ 38		10 „ 90a	
10 „ 6a		3 „ 46		2 „ 98	
8 „ 9d		2 „ 47		2 „ 103f	
6 „ 10		7 „ 48a		1 „ 111c	
12 „ 12		1 „ 52		2 „ 118	
1 „ 14		4 „ 59		1 „ 126a	
1 „ 15a		1 „ 70		4 „ 133a	
2 „ 19a		2 „ 72			
2 „ 24		2 „ 89			

Model No. 41. Portable Log Saw

A 57-teeth Gear Wheel, mounted on a Rod journalled in the Motor side plates, engages with the special pinion on the armature shaft of the Motor. The Rod is held in place by a Collar, and carries also a 1" Sprocket that is connected by Sprocket Chain with a $1\frac{1}{2}''$ Sprocket Wheel on a Rod journalled in the $12\frac{1}{2}''$ Angle Girders. On the shaft of the $1\frac{1}{2}''$ Sprocket is a $\frac{1}{2}''$ Pinion, which drives a 57-teeth Gear Wheel on the main driving shaft of the model. This shaft carries a Coupling that is retained in position by a Crank; the Rod is free to rotate in the Coupling. The Coupling is fitted with 5" Rods in its end transverse bores and these are spaced at their outer ends by a second Coupling. Two further Couplings on the two 5" Rods are free to slide and to one of them is bolted a $6\frac{1}{2}''$ Rack Strip, a Washer being used for spacing purposes. The Rack Strip is held to the second Coupling by a 1" Rod and a Collar, and the 1" Rod is held in the Coupling by means of a Grub Screw. A Collar is then placed loosely on the Rod and is held in position by a fast Collar.

A 2" Screwed Rod is screwed into the tapped bore of the loose Collar and its other end is then attached in a similar manner to another Collar loose on a 1" Screwed Rod, fixed in the arm of a Crank by two Nuts. The loose Collar is spaced from the Crank by a fast Collar. A $1\frac{1}{2}''$ Strip is bolted to the frame to form a "catch" to hold the saw when not in use.

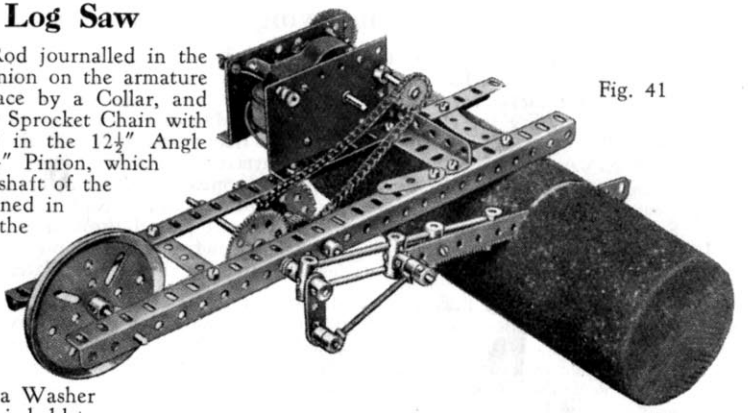


Fig. 41

Parts required:

1 of No. 6a		1 of No. 18a		1 of No. 48a		1 of No. 95a
2 „ 8		1 „ 19b		12 „ 59		1 „ 96a
1 „ 9a		1 „ 26		1 „ 62		1 „ 110a
2 „ 15		2 „ 27a		4 „ 63		1 E1 Electric Motor
1 „ 15a		10 „ 37		1 „ 81		
1 „ 16		1 „ 37a		1 „ 90		
2 „ 16b		4 „ 38		11" „ 94		

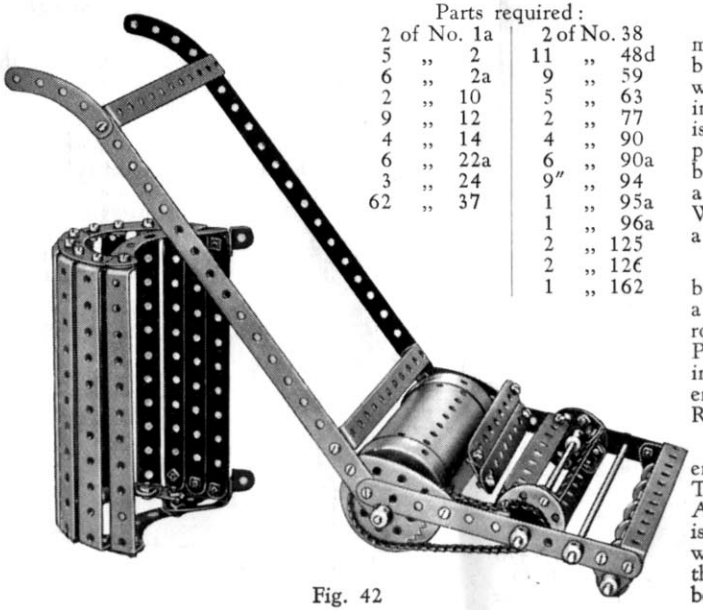


Fig. 42

Parts required:

2 of No. 1a		2 of No. 38	
5 „ 2		11 „ 48d	
6 „ 2a		9 „ 59	
2 „ 10		5 „ 63	
9 „ 12		2 „ 77	
4 „ 14		4 „ 90	
6 „ 22a		6 „ 90a	
3 „ 24		9" „ 94	
62 „ 37		1 „ 95a	
		1 „ 96a	
		2 „ 125	
		2 „ 126	
		1 „ 162	

Model No. 42. Lawn Mower

The construction of the model shown in Fig. 42 should be commenced by making the shafts. These consist of two $9\frac{1}{2}''$ Strips spaced by two $5\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips and fitted at their outer ends with $2\frac{1}{2}''$ large radius Curved Strips for handles. A $5\frac{1}{2}''$ Strip is bolted in the second hole from the lower end of each shaft and each Strip is made rigid by means of a $2\frac{1}{2}''$ large radius Curved Strip fixed in position as shown. The two $5\frac{1}{2}''$ Strips are spaced at their outer ends by means of a $5\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip. The roller consists of a Boiler complete with two Ends, inside one of which is fitted a Bush Wheel for securing the roller to its spindle. This spindle also carries a $1\frac{1}{2}''$ Sprocket Wheel, and is retained in position by two Collars.

The cutting blades are $4\frac{1}{2}''$ Strips held between two Bush Wheels by means of Angle Brackets, and the cutting cylinder axle is fitted with a $\frac{3}{4}''$ Sprocket Wheel, which is connected to the $1\frac{1}{2}''$ Sprocket on the roller by Sprocket Chain. The front rollers consist of six $\frac{1}{2}''$ loose Pulleys spaced on a $6\frac{1}{2}''$ Rod by Couplings, and the Rod is journalled in two 1" Triangular Plates bolted to the ends of the $5\frac{1}{2}''$ Strips. The end Pulleys are spaced from the Strips by Collars. A guard and a Rod are also placed in position to complete the body of the machine.

The grass-box, shown standing on its end in Fig. 42, consists of two end sections composed of three $2\frac{1}{2}''$ small radius Curved Strips and a Trunnion. The two sections are joined by eight $5\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips and also by three $5\frac{1}{2}''$ Strips. When completed the box is attached to the mower by means of two $\frac{1}{2}''$ Reversed Angle Brackets, which should be bolted to the bottom of the box and arranged so that they clip under the Rod secured between the $5\frac{1}{2}''$ Strips that form the bearings for the cutting cylinder.

Model No. 43. Engraving Machine

By means of the model shown in Fig. 43 it is possible to engrave name-plates, medallions, etc., of a fairly soft metal such as copper or brass. The model will be found useful for a large number of different purposes, but it will be of greatest utility for engraving names and addresses on articles to prevent loss. The mechanism is mounted on the side plates of a No. E6 Electric Motor. A ½" Pinion on the Motor armature spindle drives a 57-teeth Gear on a secondary shaft carrying a 1" Sprocket Wheel. This drives, through a short length of Chain, a ¾" Sprocket on a Rod fitted with a Single Throw Eccentric, the strap of which is passed through an Eye Piece 1 pivoted on a Pivot Bolt passed through one of the Motor side plates. Washers are placed on the Bolt between the Eye Piece and Plate.

As the Eccentric strap moves up and down it strikes the end of the Axle Rod 2, which is filed to a point to form the engraving tool. This Rod is free to slide in a Double Bracket and 1½" × ½" Double Angle Strip attached to a framework of Strips bolted to the side plates of the Motor. At its upper end the Rod carries a Collar and Compression Spring, and a second Collar, free to slide on the Rod, is placed below the Spring for spacing purposes. The Rod is prevented from rotating by means of a Flat Bracket 3 fixed to a Collar placed below the Double Angle Strip. The Bolt that fixes the Bracket has a Washer under its head, and a second Washer between the Flat Bracket and Collar. A Collar beneath the Double Angle Strip prevents the Rod from being raised to its full extent by the action of the Compression Spring.

When the Motor is set in motion, the Eccentric strap strikes the upper end of the Rod once in each revolution, so that it receives a series of blows in quick succession, and is forced down against the action of the Compression Spring, which returns it to its original position before it is forced down again. The position of the Rod should be so adjusted that its maximum movement is only about 1/16th in. As the Rod is applied to a metal surface the continuous up-and-down movement results in a series of tiny dents appearing in the metal.

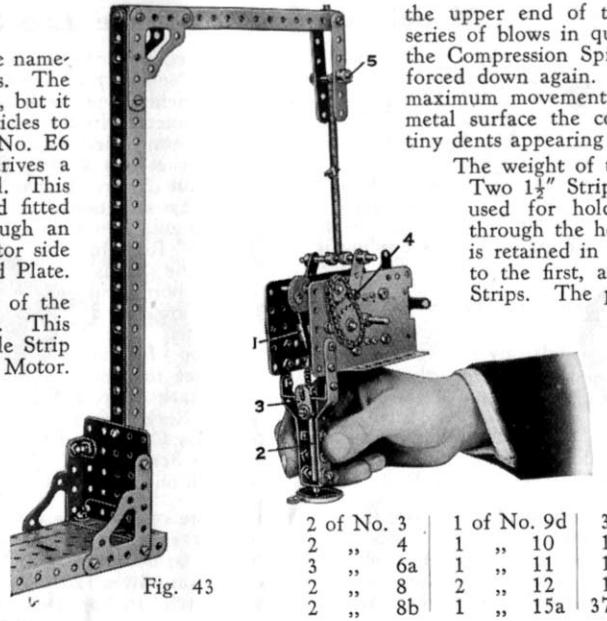


Fig. 43

The weight of the Motor is supported on Springs to facilitate handling. Two 1½" Strips are fixed in position by the hexagon nuts 4, which are used for holding the Motor side plates together. A Rod passed through the holes at the upper ends of the Strips carries a Spring that is retained in a central position by Collars. A second Spring is bolted to the first, and supported on a Rod 5 passed through a pair of 3" Strips. The position of the Rod may be varied to suit the height of the article being engraved, and the flexibility of the Springs allows free movement of the "pen."

Any convenient support may be arranged for the device, and in the illustration a stand is shown built up from Angle Girders, strengthened by means of Architraves and bolted to a base consisting of a 5½" × 2½" Flanged Plate. The Plate should be screwed down to a worktable or bench.

Parts required:

2 of No. 3	1 of No. 9d	3 of No. 16a	2 of No. 37a	1 of No. 52	1 of No. 96a
2 „ 4	1 „ 10	1 „ 18a	25 „ 38	10 „ 59	4 „ 108
3 „ 6a	1 „ 11	1 „ 26	2 „ 43	1 „ 72	1 „ 111a
2 „ 8	2 „ 12	1 „ 27a	1 „ 48	5" „ 94	1 „ 147b
2 „ 8b	1 „ 15a	37 „ 37	1 „ 50a	1 „ 96	1 „ 170

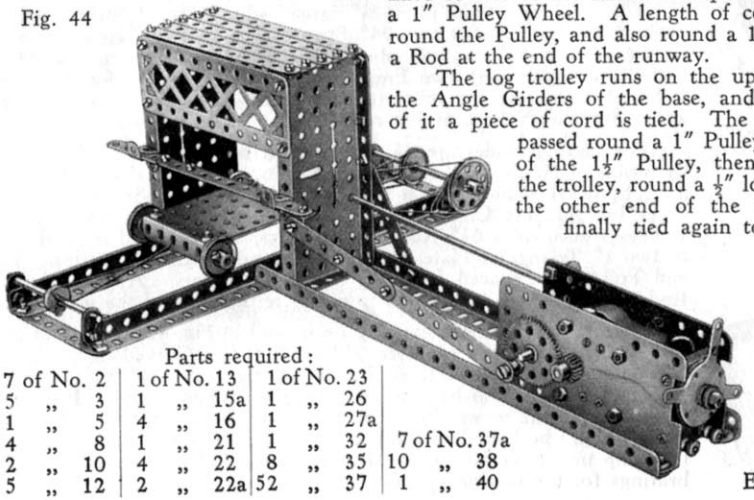
1 No. E6 Electric Motor

Model No. 44. Log Sawing Machine

The saw consists of a 5½" Strip extended to 7½" by a 3½" Strip, and at the Motor end it is pivoted to a 3½" Strip by means of an Angle Bracket. The 3½" Strip overlaps a 5½" Strip four holes, and the latter is pivoted to a 57-teeth Gear Wheel driven by a ½" Pinion on the Motor armature shaft. The Rod of the Gear is also provided with a Worm that engages a ½" Pinion on an 11½" Rod, which is journalled in a 2½" Strip fixed to one of the Motor side plates and carries a 1" Pulley Wheel. A length of cord is passed round the Pulley, and also round a 1½" Pulley on a Rod at the end of the runway.

Fig. 44

The log trolley runs on the upper edges of the Angle Girders of the base, and to one side of it a piece of cord is tied. The cord is then passed round a 1" Pulley on the Rod of the 1½" Pulley, then led beneath the trolley, round a ½" loose Pulley at the other end of the runway, and finally tied again to the trolley.



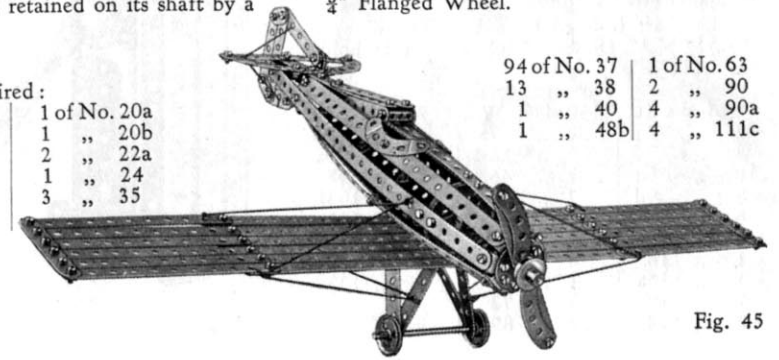
Parts required:

7 of No. 2	1 of No. 13	1 of No. 23		2 of No. 48a
5 „ 3	1 „ 15a	1 „ 26		2 „ 52
1 „ 5	4 „ 16	1 „ 27a		1 „ 53
4 „ 8	1 „ 21	1 „ 32	7 of No. 37a	3 „ 59
2 „ 10	4 „ 22	8 „ 35	10 „ 38	2 „ 100
5 „ 12	2 „ 22a	52 „ 37	1 „ 40	2 „ 111
				2 „ 125
				2 „ 126
				1 „ 147b
				No. 1 E6 Electric Motor

Model No. 45. Single-Seater Fighter Monoplane

The nose of the fuselage consists of a Bush Wheel to which Angle Brackets are bolted. Four 12½" Strips are fixed to the Angle Brackets, and four composite Strips built up from 5½" Strips, overlapped and bolted together, are also attached to the Brackets. A 2" Pulley Wheel is placed between the Strips and held in place by Bolts, as shown in the illustration. The Strips are joined to the tail unit, which is built up from 2½" straight and Curved Strips, and the tailplanes are connected to the top of the fuselage.

The mainplane of the model is built up from a number of 12½" and 5½" Strips, across the ends of which 3" Strips are bolted. The undercarriage consists of two "V" struts composed of 2½" and 3½" Strips held to the lower side of the wing by means of Angle Brackets. A 4½" Axle Rod, on which are two 1" loose Pulleys, completes the undercarriage assembly. The propeller is a 5½" Strip, to which are bolted two 2½" Curved Strips, and is retained on its shaft by a ¾" Flanged Wheel.



Parts required:

10 of No. 1	1 of No. 20a	94 of No. 37	1 of No. 63
18 „ 2	1 „ 20b	13 „ 38	2 „ 90
6 „ 3	2 „ 22a	1 „ 40	4 „ 90a
2 „ 4	1 „ 24	1 „ 48b	4 „ 111c
12 „ 5	3 „ 35		
2 „ 6a			
7 „ 10			
4 „ 11			
10 „ 12			
1 „ 15a			
1 „ 18a			

Fig. 45

Model No. 46. Electric Motor

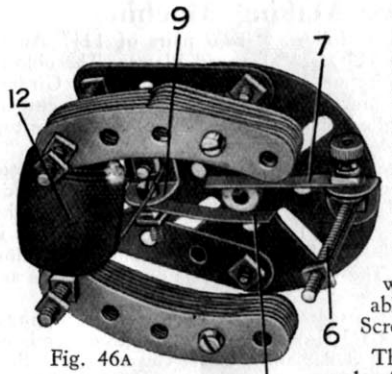
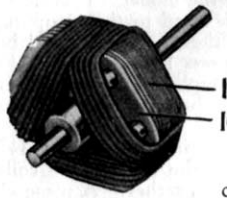


Fig. 46A

The motor shown in Fig. 46 is constructed from Meccano parts and the compact arrangement of the components makes it very suitable for use in confined spaces. Fig. 46a shows the motor partially dismantled to reveal its construction. The core for the field windings 12 consists of six 2" Strips between which 2½" large radius Curved Strips are secured as shown. Six 1½" Strips are held between the Curved Strips at their outer ends. Insulating tape is wound round the core before the wire is wound on, and a further layer covers the windings to prevent damage. If tape is not available, brown paper serves the purpose quite well. Screwed Rods hold the field to the motor side plates.



The armature is built up on a 2½" Axle Rod, and each of the three cores consists of fourteen Flat Brackets 11 between two Triangular Plates 10. This length of Rod will be found most suitable for general use, but a Rod of any length may, of course, be substituted if found necessary. The three coils are wound in a similar manner and the inner wire of each coil is connected to the outer wire of the next to form the three leads that are to be taken to the commutator. Fine wire or cotton is used to hold the three coils together, thus preventing them from slipping off the ends of the cores. A Collar is placed on the Rod at each side of the armature and one of these is covered with insulating material. The insulation is removed from the ends of the three leads from the coils, and the bare copper wires are spaced equal distances apart and secured to the insulated Collar by a length of cotton. The wires are curved round the Collar for a little over ¼" to form the three commutator "segments" 4. The ends of the wires are bent inward and passed under the cotton. Wear on the brushes will be minimised if the wires are arranged slightly obliquely. The position of the commutator segments in relation to the armature is important; they should be placed so that the space between each segment is in line with each magnet core.

The brushes 7 and 8 consist of Pendulum Connections secured by 6 BA Bolts to Angle Brackets, but insulated by fibre Bushes and Washers. The screwed Rod 6 holds the Bracket for the Brush 7 at the end of which is the Terminal 2. The Brush 8 is attached to the Bracket 9 and one of the wires from the field is connected to it. The remaining wire from the field windings is attached to the Terminal 1 (see Fig. 46) which is bolted to the Face Plate but insulated therefrom. The Terminals 1 and 2 should be connected to the Accumulator or Transformer. The motor will operate satisfactorily from 4 or 6-volts, if wound as shown with No. 26 gauge wire. For 6-volt working it is advisable to increase the number of turns on the field.

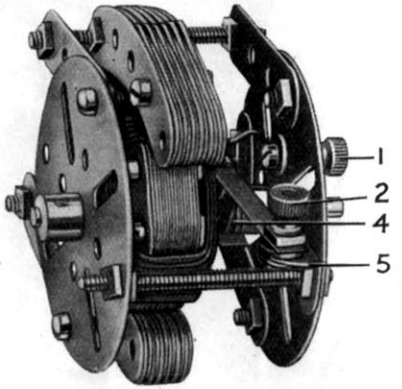


Fig. 46

Parts required:

10	of	No.	6	2	of	No.	59	Elektron	Parts:
12	,,		6a	6	,,		77	2 of No.	1563
42	,,		10	3	,,		81	3 ,,	1570
2	,,		12	14	,,		90	3 ,,	1575
1	,,		16a	2	,,		109	3 ,,	1583
5	,,		37	8	,,		111	1 ,,	1586
24	,,		37a	2	,,		172		
2	,,		38	3	,,		182		

Model No. 47. Electric Horn

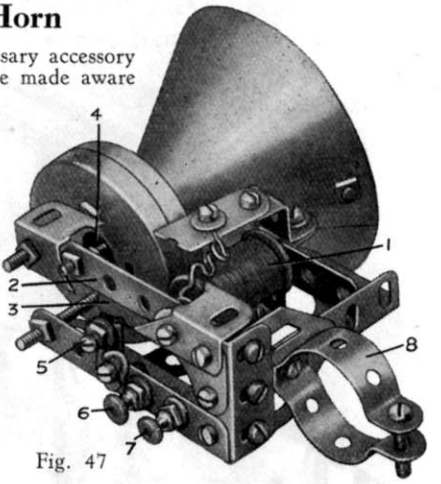


Fig. 47

A warning device of some kind is a necessary accessory for all vehicles, so that other road users can be made aware of their presence. The device shown in Fig. 47 is an electric horn made from Meccano and although its efficiency is doubtful when subjected to the severe jolting caused by rough roads, it is likely to be of use for numerous other purposes to which an electric bell or buzzer can be put. The clip 8 can be removed if necessary, so that the model can be fixed in position on a board by means of Wood Screws.

Angle Girders are used in the construction of the frame, and to make these quite rigid a Trunnion and a 1" Corner Bracket are employed. The clip 8 consists of a 4½" Strip curved to fit the top tube of the bicycle. To curve the Strip it is a good plan to obtain a rod or pipe and shape the Strip round this.

The electro-magnet 1 is formed from a Bobbin (Part No. 181) wound with No. 26 gauge cotton-covered wire. A Pole Piece inserted in the centre of the Bobbin secures it to a 1½" Angle Girder to which also an Angle Bracket is fixed. Reversed Angle Brackets and 2" Strips attach this Girder to the 3" Girders, one of which has been cut away in the illustration to show the mechanism more clearly. The Strip 2 is attached to the frame by an Angle Bracket, and a Pendulum Connection 3 is secured to the Strip which, being held at one end only, easily vibrates. The Silver Tipped Contact Screw 5 (Elektron part No. 1569) is passed through the centre hole of a 1½" Strip that connects the 3" Angle Girders, but is insulated from the Strip by fibre Bushes and Washers.

Two Wheel Flanges clamp the metal diaphragm, which is a disc of thin sheet metal. Three holes are drilled in this, two to take the 2" Screwed Rods that hold the diaphragm in position, and the third in the centre for securing the Bolt 4. The Screwed Rods clamp the two Wheel Flanges together but should not foul the diaphragm. A suitable horn is cut from a piece of sheet metal or cardboard and is attached by Angle Brackets to one of the Wheel Flanges.

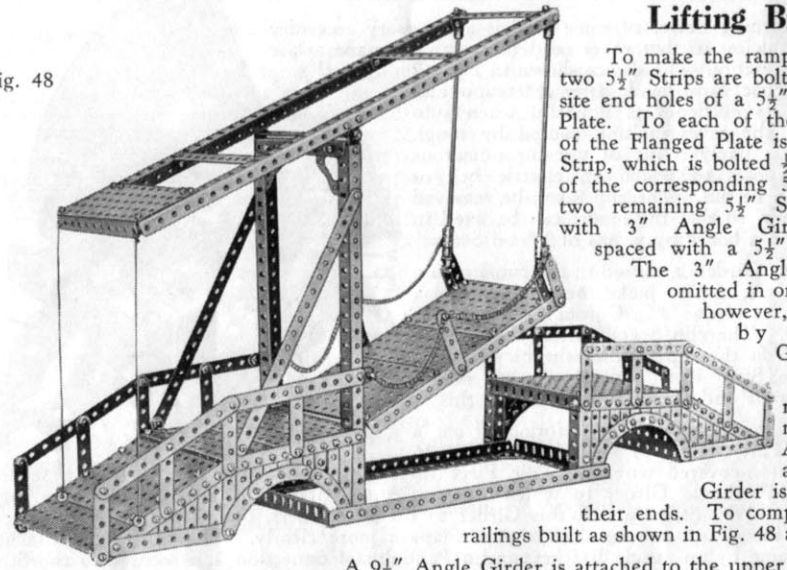
One of the wires from the electro-magnet 1 is "earthed," that is connected to the frame of the model; and the other wire is led to the insulated Terminal 7. The Contact Screw 5 is connected to the Terminal 6, which is also insulated from the frame. The Pendulum Connection 3 normally makes contact with the tip of the Screw 5, thus completing the electric circuit and energising the magnet, which attracts the Strip 2 toward it. This causes the Bolt at the end of the Strip to strike the Bolt 4 on the diaphragm. Immediately the Strip is attracted to the magnet, the Pendulum Connection 3 also moves forward and so breaks contact. The Strip then moves back to its normal position and the cycle of operations is repeated in rapid succession. The result is that the Bolt 4 receives a series of blows, the noise being amplified by the horn.

Parts required:

1	of	No.	2a	2	of	No.	9d	2	of No.	38	2	of No.	133a	Elektron	Parts:
1	,,		4	2	,,		9f	3	,,	81	2	,,	137	2 of No.	1563
2	,,		6	4	,,		12	2	,,	111	1	,,	172	1 ,,	1569
1	,,		6a	20	,,		37	2	,,	125	1	,,	181	3 ,,	1570
2	,,		9c	11	,,		37a	1	,,	126a	3	,,	182	2 ,,	1575
														4 ,,	1583
														1 ,,	1586

Model No. 48. Lifting Bridge

Fig. 48



To make the ramps of the bridge two 5½" Strips are bolted to the opposite end holes of a 5½" × 2½" Flanged Plate. To each of the lower corners of the Flanged Plate is attached a 4½" Strip, which is bolted ½" from the end of the corresponding 5½" Strip. The two remaining 5½" Strips are fitted with 3" Angle Girders and are spaced with a 5½" Angle Girder. The 3" Angle Girders are omitted in one of the ramps, however, and replaced by 12½" Angle Girders.

The two ramps are connected by 12½" Angle Girders, and a 5½" Angle Girder is bolted between their ends. To complete the ramps, railings built as shown in Fig. 48 are fitted.

A 9½" Angle Girder is attached to the upper portion of each of the upright 12½" Angle Girders to form a tubular girder, and the 9½" Angle Girders are held in place by ½" × ½" Angle Brackets. An Angle Bracket is used to hold the two Girders together at their upper ends. The vertical 12½" Angle Girders are each fitted with a 1½" Strip, which projects above the top, and the two girders are then joined across their upper ends by means of two 5½" Angle Girders, which are held in place by two Flanged Brackets (Part Nos. 139 and 139a).

The leaf of the bridge is now made. The main longitudinal Girders are 9½" in length and are spaced 1" from each end by 5½" Angle Girders and the roadway is filled in with three 5½" × 3½" Flat Plates. The leaf is then connected to the end of one of the ramps by means of two Hinges, and is prevented from falling below the level of the roadway by the projecting heads of two Bolts, which are fixed to the other ramp in the positions indicated.

The leaf is balanced by a beam that consists of two 18½" channel girders built up from pairs of 18½" Angle Girders. The channel girders are spaced at intervals by 5½" × ½" Double Angle Strips, and at one end also by a 5½" Angle Girder. A 5½" × 2½" Flat Plate and a 4½" Angle Girder provide the balance weight, and are bolted in place on the outer ends of the channel girders. Two 1" Triangular Plates are attached to the vertical 12½" Angle Girders in the positions shown in Fig. 48, and two Washers are placed on the securing Bolts between the Triangular Plates and the Girders. A Rod is then pushed into position and fixed in place by Collars. At the end of the beam opposite to the weight two small Fork Pieces are pivoted on ¾" Bolts. An 8" Rod is held in the boss of each Fork Piece and is extended by a 1" Rod. An End Bearing is then secured to the end of each 1" Rod and is pivoted by means of a 1" × ½" Angle Bracket to the end of the bridge.

Parts required:

2	of No.	1a	4	of No.	7a	36	of No.	10	242	of No.	37	9	of No.	52a	19"	of No.	94	4	of No. 133a
16	,,	2	4	,,	8	23	,,	12	8	,,	37a	2	,,	59	4	,,	111	1	,, 139
4	,,	2a	4	,,	8a	2	,,	12b	18	,,	38	2	,,	63	2	,,	111c	1	,, 139a
26	,,	5	8	,,	9	2	,,	13a	1	,,	40	3	,,	70	2	,,	114	2	,, 166
12	,,	6	1	,,	9a	1	,,	14	3	,,	48c	2	,,	77	2	,,	116a		
16	,,	6a	2	,,	9c	2	,,	18b	2	,,	52	16	,,	90	4	,,	133		

Model No. 49. Fence Making Machine

The frame of the model is constructed as follows. Two pairs of 12½" Angle Girders are each spaced at the ends by two 3½" × 2½" Flanged Plates. The oblong frames so formed are then spaced 4½" apart, by means of 9½" and 5½" Angle Girders as shown in the illustration. Diagonal 5½" bracing Strips are fitted to each end of the structure and a 12½" Angle Girder is bolted in place down the centre of the top of the frame between the end transverse Angle Girders.

The 12½" Angle Girder is fitted with two Trunnions, which are placed 3" from either end of the model. Two further Trunnions are also bolted to one of the side Girders and form the journals for 3" Rods that carry 1" Sprocket Wheels. The Sprocket Wheels are located centrally between the Trunnions. One of the Rods is retained in position by a Collar and a Coupling, and a ⅞" Bevel Gear and a Coupling are used to hold the second Rod in place. The Sprocket Wheels on these Rods are connected by Sprocket Chain.

A 3½" Rod is passed through the central transverse bore of each of the Couplings, and is held in place by two Collars. Collars are also placed on the extreme ends of the Rods. A 3½" Crank Handle on which is a Collar and a Bevel Gear, is journalled in a 1" × 2½" Double Angle Strip bolted to the framework of the model. This Bevel engages the Bevel on the transverse shaft. A Bush Wheel is fixed to the Coupling on each transverse shaft by a 1" Rod. It is important that the 1" Rods should be secured to the Couplings in such a manner that their ends press lightly on the 3½" Rods that pass through the central transverse bores of the Couplings. Two Corner Brackets are bolted to the ends of the model in the positions shown to form guides for the wood strips when the machine is in motion.

The manner of using the machine is as follows. The projecting ends of the 3½" Rods in the Couplings are wound with fairly strong wire, and the ends of the coils after being pulled through the Bush Wheels are twisted tightly together. A piece of wood is then passed through the loop between the twists and the Bush Wheel and pushed up against the guides. On turning the handle the wires are twisted tightly round the wood. The fencing should then be withdrawn to the required distance from the guides and the operation repeated.

Parts required:

6	of No.	2	2	of No.	16b	72	of No.	37	2	of No.	63
3	,,	6	2	,,	18b	30	,,	38	15"	,,	94
8	,,	8	1	,,	19s	1	,,	46	2	,,	96
2	,,	8a	2	,,	24	4	,,	53	2	,,	103b
2	,,	9	2	,,	30	10	,,	59	4	,,	126
2	,,	9b							2	,,	133
2	,,	16							2	,,	133a

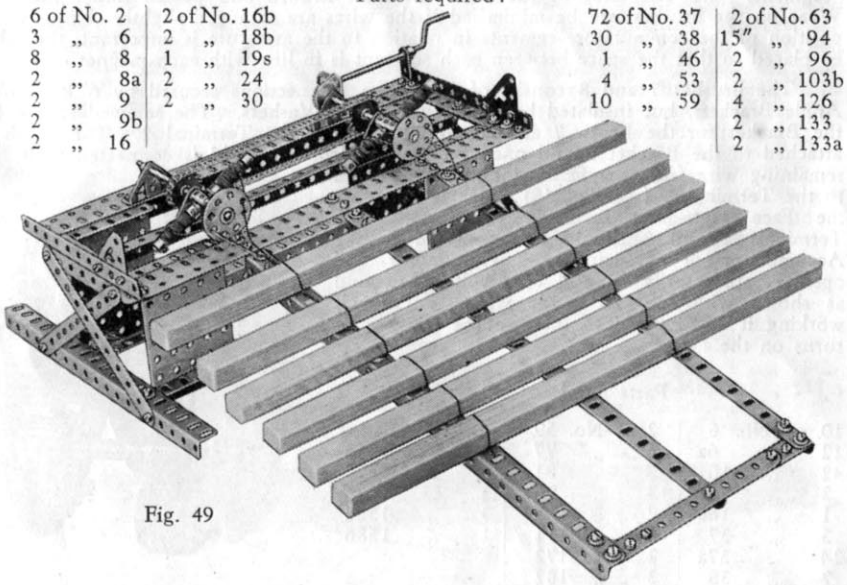


Fig. 49

Model No. 50. Water Cycle

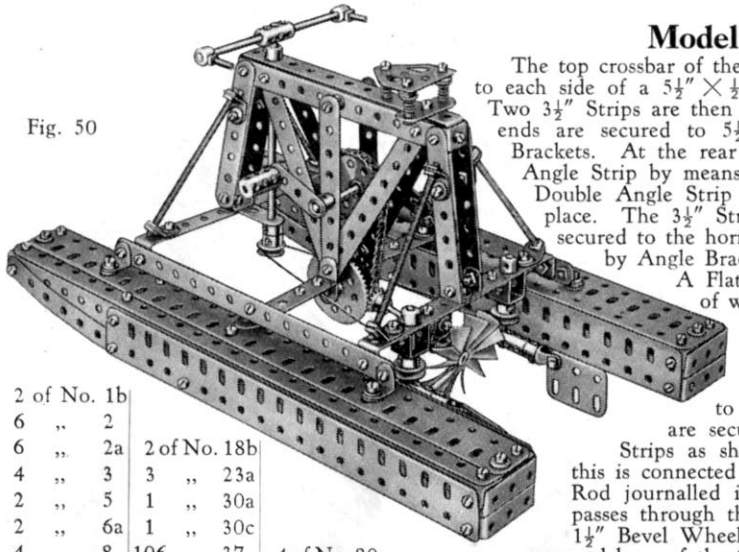


Fig. 50

The top crossbar of the frame of the cycle consists of two 5½" Strips attached to each side of a 5½" × ½" Double Angle Strip by means of Double Brackets. Two 3½" Strips are then bolted to each end of the crossbar and at their lower ends are secured to 5½" × ½" Double Angle Strips, by means of Double Brackets. At the rear end of the frame a Crank is secured to the Double Angle Strip by means of a 1" × ½" Angle Bracket, which is bolted to the Double Angle Strip by the same Bolt that holds the Double Brackets in place. The 3½" Strips are strengthened by means of 3½" Screwed Rods, secured to the horizontal 5½" Double Angle Strips and to the 3½" Strips by Angle Brackets.

A Flat Trunnion fitted with three ¾" Bolts, on the shanks of which are placed Compression Springs, forms the saddle and is attached to the crossbar and to a 1½" Strip bolted across the bar. Strips, 4½" in length, form the bearings for the driving spindles.

Couplings are used for the pedals and are secured to the ends of Cranks by Threaded Pins. The Cranks are secured to the ends of a 1½" Rod journalled in vertical Strips as shown. The Rod carries a 1½" Sprocket Wheel, and this is connected by Sprocket Chain to a 1" Sprocket Wheel on a 1" Rod journalled in the lower holes of the 4½" Strips. The 1" Rod passes through the central transverse bore of a Coupling and bears a 1½" Bevel Wheel. A 2" Rod carrying a ½" Bevel is pushed into the end bore of the Coupling and its other end is supported in the boss of the Crank that is fixed to the underframe. The Rod is held in place by means of two Collars placed one on each side of the Crank boss, and carries at its other end a Fan that represents the propeller. The ½" Bevel engages with the 1½" Bevel.

The rudders each consist of a 1½" Flat Girder, connected at one corner to an End Bearing, which is attached to a Coupling secured on the lower end of a 2" Rod by means of a 1" Rod. The rudders are operated by means of a length of cord that is wound twice round a ½" fast Pulley on the steering column and once round each of the Pulleys on the rudder-posts.

2	of	No. 1b									
6	,,	2									
6	,,	2a	2	of	No. 18b						
4	,,	3	3	,,	23a						
2	,,	5	1	,,	30a						
2	,,	6a	1	,,	30c						
4	,,	8	106	,,	37	4	of	No. 80a			
4	,,	8a	28	,,	37a	4	,,	89			
4	,,	11	32	,,	38	8	,,	94			
18	,,	12	2	,,	45	1	,,	95a	6	of	No. 111c
3	,,	12b	6	,,	48	1	,,	96	4	,,	115
1	,,	15	3	,,	48d	4	,,	103a	3	,,	120b
1	,,	16b	10	,,	59	4	,,	103b	1	,,	126a
5	,,	17	3	,,	62	2	,,	103h	1	,,	157
1	,,	18a	6	,,	63	3	,,	111	2	,,	166

Model No. 51. Rocket Car

The chassis consists essentially of two 12½" Angle Girders connected at the rear by a 5½" × 3½" Flat Plate and at the front by a 3½" × 2½" Flanged Plate. The rocket rack is made from two 5½" × 2½" Flanged Plates held in place by 2½" × ½" Double Angle Strips, and the dash-board is a 3½" × 2½" Flanged Plate, which is bolted at its lower edge to an Angle Girder. A second Flanged Plate with its flanges pressed slightly outward forms the top of the bonnet, and two 2½" × 5½" Flat Plates are used for the sides. At the front the Plates are bent inward and bolted to the ends of a 2½" × ½" Double Angle Strip.

The stub-axles of the steering gear are 1" Rods clamped into horizontally mounted Couplings, in the central transverse bores of which are 1½" Rods. The Rods are held vertically in the bosses of Cranks attached to the chassis. Collars are placed underneath each Coupling, and the whole unit is held in place on the Rod by further Collars. A 1" Rod in one of the end transverse bores of each Coupling is fitted with a Swivel Bearing, by means of which the stub-axles are connected to the tie-rod.

The steering column is fitted with a crank pivotally attached to the tie-rod by means of a Set Screw and a Collar.

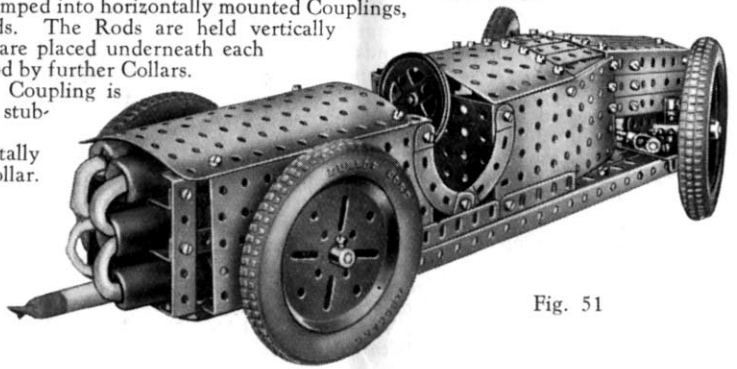


Fig. 51

Parts required:

2	of	No. 2a	1	of	No. 15	80	of	No. 37	2	of	No. 63
5	,,	6a	1	,,	15a	8	,,	48a	1	,,	69
2	,,	8	1	,,	16	4	,,	52	2	,,	70
8	,,	9a	2	,,	18a	2	,,	52a	4	,,	90a
1	,,	9b	2	,,	18b	3	,,	53	4	,,	103f
2	,,	9d	4	,,	19b	9	,,	59	4	,,	142b
2	,,	12	1	,,	20a	3	,,	62	2	,,	165

Model No. 52. Electric Roulette Wheel

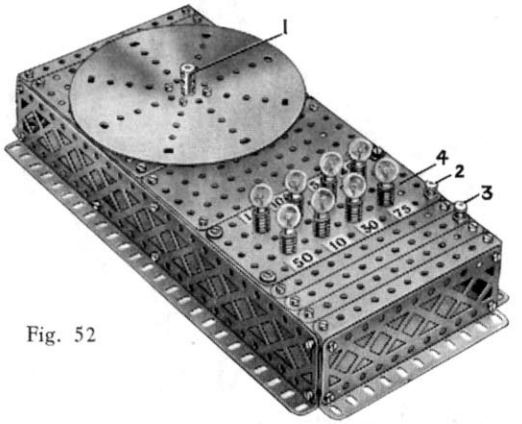


Fig. 52

Each of the eight electric bulbs is allotted a number, and as the roulette wheel rotates the bulbs light up in turn. The winning number is indicated by the bulb remaining alight after the wheel has come to rest.

The Plate 4 in the top of the frame is insulated from the Angle Girders and adjacent Plates by means of Insulating Bushes and Washers on 6BA Bolts. One of these Bolts is inserted with its shank upward and carries a Nut that is in metallic contact with the Plate, and also the Terminal 2. The Lamp Holders are held in position by 6BA Bolts, each of which is insulated from the Plate by an Insulating Bush.

The wheel consists of two 6" diameter Circular Plates bolted to a Bush Wheel fixed on a short Rod. The Axle of the Bush Wheel carries also the Coupling 1, which forms a knob by means of which the wheel is rotated. The Rod is journalled in one of the Flat Plates and a 5½" × ½" Double Angle Strip. A Bush Wheel is fixed in the centre of the Double Angle Strips but is insulated from the Strip by Insulating Washers, and the holes in the Bush Wheel are provided with insulated 6BA Bolts. A Double Arm Crank fixed above the Bush Wheel is fitted with a Pendulum Connection, which is bent to make contact with the heads of the 6BA Bolts. Each of the Bolts is connected by wire to one of the Lamps.

Parts required:

3	of	No. 2	50	of	No. 37	2	of	No. 99	Elektron parts:		
2	,,	8	5	,,	38	2	,,	100	2	of	No. 1563
2	,,	9	1	,,	48c	2	,,	146	20	,,	1570
4	,,	12	1	,,	62b	1	,,	172	22	,,	1575
1	,,	16b	1	,,	63	20	,,	182	30	,,	1583
2	,,	24	4	,,	70	8	,,	183			

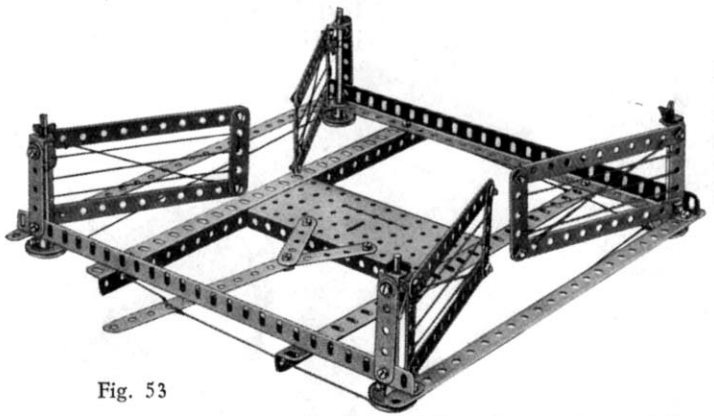


Fig. 53

Model No. 53. Level-Crossing Gates

The model level-crossing gates shown in Fig. 53 can be incorporated in a model railway layout with very little modification. The operating lever could be connected by rodding and cranks to a lever in the signal cabin and the gates arranged to work automatically with the line signals. This would add considerably to the interest of the layout.

The model is very simple to build, and the main constructional points will be clear from the illustration. The operating cord, which is connected to the pivoted lever, is passed once round the groove of each 1" Pulley fixed to the gate pivots, the cord being taken round the Pulleys in opposite directions.

Parts required:

2 of No. 1	4 of No. 12	4 of No. 38
9 „ 2	4 „ 16	1 „ 40
10 „ 5	4 „ 22	4 „ 48a
4 „ 8	8 „ 35	1 „ 52
4 „ 10	35 „ 37	

Model No. 54. Grabbing Crane

The model grabbing crane shown in Fig. 54 is driven by means of a Meccano No. 2 Clockwork Motor that forms the framework of the swivelling superstructure. A $3\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate and two Sector Plates are secured to one of the Motor side plates to make the sides of the gear-box.

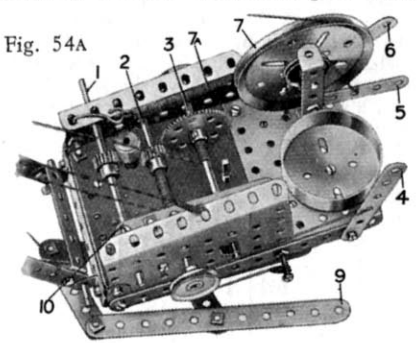
The jib is composed of $12\frac{1}{2}''$ and $5\frac{1}{2}''$ Strips, between which a $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip is bolted at the bottom end, and two $1\frac{1}{2}''$ Strips at the centre. Two $5\frac{1}{2}''$ Strips are pivotally attached by means of Bolts and Nuts near the top of the jib, and a Threaded Pin is held in the lower end hole of each Strip. Each Threaded Pin bears a small Fork Piece, and these support a $\frac{1}{2}''$ Bolt on the shank of which is a $\frac{1}{2}''$ loose Pulley 9. The Pulley 9 carries the luffing cord.

The arrangement of the luffing and hoisting drives can be followed from Figs. 54 and 54A. A Worm on the Motor Spindle may be brought into engagement with a $\frac{1}{2}''$ Pinion on each of the Rods 1 and 2 by the operation of a $3\frac{1}{2}''$ Strip 10, which is pivotally attached to a $1'' \times 1''$ Angle Bracket bolted to the side of the gear-box. The Strip carries Bolts the shanks of which engage between Collars on the Rods 1 and 2. On the Rod 3 is a 57-teeth Gear, and this must be so placed that when the $\frac{1}{2}''$ Pinion on the Rod 2 is in mesh with the Worm, it also engages the 57-teeth Gear. When the Rod is moved slightly in its bearings, however, the $\frac{1}{2}''$ Pinion should disengage the 57-teeth Gear, but still remain in mesh with the Worm.

The Rods 2 and 3 comprise the hoisting and luffing barrels. When the hoisting barrel pays out, the luffing barrel winds in, so that an approximation to level luffing is obtained.

An automatic coiling drum is provided for the grab holding rope. The action of this is governed by the Spring 7a. A piece of cord tied to the Set Screw of the Pulley 7 is wrapped four times round the Rod and is then connected to the Spring 7a. The other end of this Spring is fixed to the side of the gear-box by means of a Hook. When the grab holding cord is attached to the rim of the Pulley 7 (see Figs. 54 and 54A) the action of the crane is as follows. As the grab ascends, the Spring 7a turns the Pulley 7, and in doing so winds in the holding rope. When the grab is lowered, however, and is near the bottom of its descent, the brake 5 is applied and the grab is opened.

Fig. 54A



The luffing cord is attached to the Rod 3, then passed over the $\frac{1}{2}''$ Pulley 9, and its end fixed to the gear-box.

The travelling base of the crane is built up from two $3\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plates held together by means of $5\frac{1}{2}''$ Strips. A $3\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip is bolted to each end of the base frame. Trunnions fixed to the frame bear Rods on which $\frac{3}{4}''$ Flanged Wheels are mounted. One $2\frac{1}{2}''$ and two $3\frac{1}{2}''$ Strips are joined together in "H" formation (Fig. 54B), and a Pivot Bolt is passed through the centre hole of the $2\frac{1}{2}''$ Strip. The complete assembly is then bolted to the lower side plate of the Clockwork Motor. In fastening the "H" pieces in place, Washers should be used so as to allow the head of the Pivot Bolt to rotate freely.

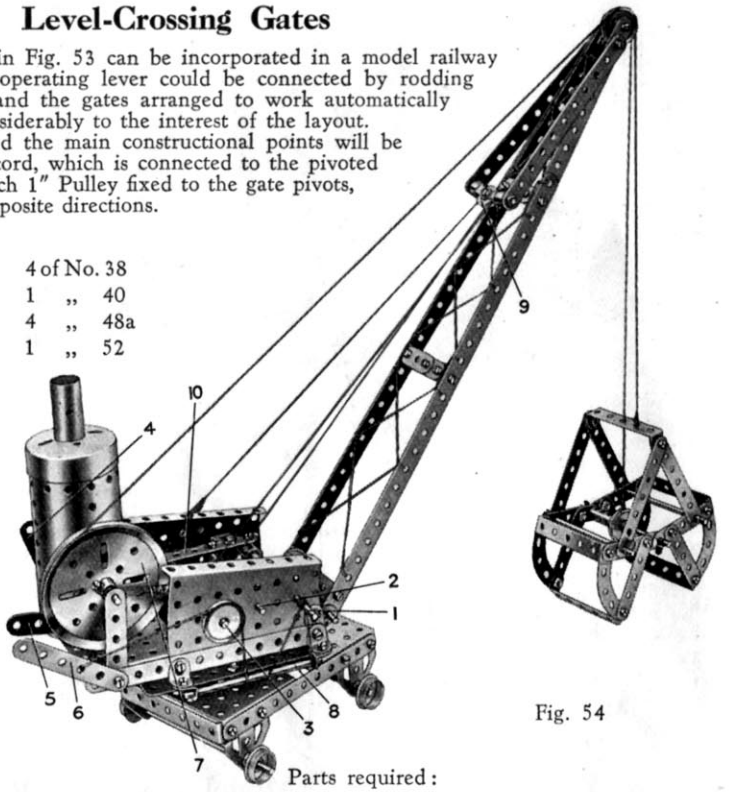


Fig. 54

Parts required:

2 of No. 1	2 of No. 26	1 of No. 116a	1 of No. 163
9 „ 2	1 „ 27a	2 „ 125	1 „ 164
6 „ 3	1 „ 32	2 „ 126	1 „ 166
2 „ 4	12 „ 35	2 „ 126a	1 No. 2 Clockwork Motor
12 „ 5	90 „ 37	1 „ 147b	
2 „ 6a	8 „ 38	1 „ 162	
3 „ 10	2 „ 40		
13 „ 12	1 „ 43		
3 „ 12a	7 „ 48a		
2 „ 15	2 „ 48b		
3 „ 15a	3 „ 53		
4 „ 16	2 „ 54		
2 „ 17	1 „ 57		
1 „ 18a	4 „ 59		
2 „ 19b	1 „ 63		
4 „ 20b	4 „ 90a		
4 „ 22	1 „ 111		
2 „ 22a	3 „ 111c		
1 „ 23	2 „ 115		

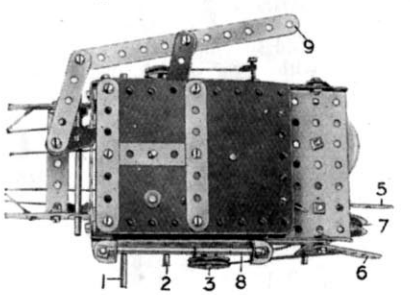


Fig. 54B

Model No. 55. An Exciting Race Game

Race games of various kinds are always popular, and the motor car race illustrated in Fig. 55 has been designed to provide maximum excitement! The game is intended for three competitors, each one controlling the movements of his car by means of a hand-wheel; the individual who exceeds the speed limit finds that his car automatically stops.

Each of the tracks, as shown, is built up from 18½" Angle Girders spaced apart 2½", but the interest of the game will be increased if these are extended to at least twice the length. The number of tracks and their length depends, of course, upon individual requirements. Six 5½" Angle Girders are used for supporting the tracks, and 18½" and 12½" Girders bolted across the lower ends of these form a base for the model. Flat Trunnions and Braced Girders make the structure rigid. At one end of the track an extension is built to hold the control mechanism. Two 12½" Girders are attached to the transverse Girders of the track and to these 3½" Angle Girders are bolted. Further 12½" and 5½" Girders complete the framework.

The cars each consist of two 4½" Angle Girders, connected together by a Channel Bearing and two Trunnions fixed in the slotted holes. The appearance of the cars is improved if the Girders are tapered slightly toward the rear. The Channel Bearings are bent as shown, and a 2½" × ½" Double Angle Strip connects the Trunnions. Flat Girders are suspended from Double Brackets attached to the Strip, and a ½" loose Pulley representing the steering wheel is held on a ⅜" Bolt, the shank of which carries two Nuts holding one end of the Double Angle Strip to the Trunnion. Axle Rods journalled in the 4½" Angle Girders carry 1" Pulleys, the grooves of which engage the upturned flanges of the Girders forming the track. Washers should be placed on the rear axle for spacing purposes.

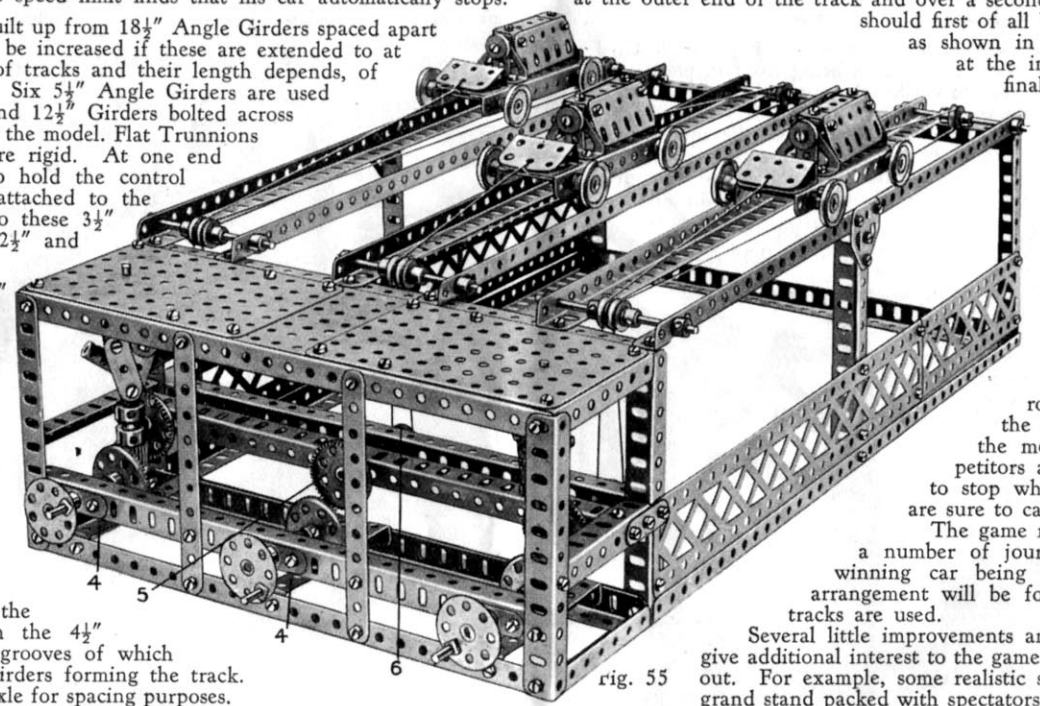


Fig. 55

The operating mechanism is now ready to be assembled. Three handwheels are fitted on 2" Rods journalled in bearings formed by Double Arm Cranks on one side of a 12½" Angle Girder, and Double Bent Strips on the other side. Each of these Cranks carries a 1½" Contrate Wheel engaging the ¾" double width face Pinion of their respective governor. The centre governor has been removed and is shown separately in Fig. 55A to simplify its construction. Two pairs of 1½" Strips are pivotally attached to a fixed Collar 1 at the upper end of the governor shaft by ⅜" Bolts inserted in its tapped bores. The Bolts carry Washers for spacing and are screwed tight to grip the Rod. Two further pairs of Strips are pivotally attached to the Coupling 2 by 7/32" Bolts, and a lock-nut on the shank of each Bolt prevents it gripping the Rod. The Strips are connected to Hand-rail Supports 3 carrying Couplings that form weights. A Socket Coupling is fitted over the Coupling 2 so that Grub Screws inserted in opposite bores screw into the lower tapped holes of the Coupling, and the ¾" Pinion (½" wide) is fitted in a similar manner in the lower socket. The Grub Screws should be screwed in until their ends are flush with the Socket Coupling or they will be found to foul the teeth of the Contrates. Before proceeding further all moving parts should be carefully adjusted to work freely, and the parts comprising the unit at the lower end of the governor should be in perfect alignment so that they slide smoothly on the Rod.

The governor shafts are journalled in 5½" × 3½" Flat Plates covering the top of the gear-box, and in Reversed Angle Brackets attached to 3½" × ½" Double Angle Strips 4 fitted between the 12½" Angle Girders of the frame. To complete the mechanism 2½" Rods are arranged as shown, each carrying a 1½" Contrate 5 and a ½" fast Pulley 6. As the Rods pass through the elongated holes of one of the Angle Girders, Flat Brackets should be bolted over the holes to form bearings for the Rods.

A length of cord attached to the front of each car is passed round a ½" loose Pulley at the outer end of the track and over a second ½" Pulley at the opposite end. The cord should first of all be passed twice round the driving Pulley 6 as shown in Fig. 55 and then over a further Pulley at the inner end of the track. The cord is then finally secured to the car. The cord should not be tied too tightly or it will interfere with the smooth working of the governors, the purpose of which will now be apparent. On rotating the handwheels the governors revolve and the drive is transmitted through the ¾" Pinions to the Contrates 5 providing the drive for the cars. As the speed of the governors increases, the weights fly outward, causing the sliding units to be raised, and thus drawing the Pinions out of mesh with the driven Contrates. The Contrates on the driving Rod remain in mesh with the governing Pinions so that the governors continue to rotate, but the cars remain stationary until the speed of the handwheels is reduced. If the mechanism is totally enclosed, so that competitors are unable to observe what causes the cars to stop when a certain speed is reached, the results are sure to cause considerable mystification.

The game may be varied by arranging a race to cover a number of journeys from end to end of the track, the winning car being the first to complete the course. This arrangement will be found particularly suitable when only short tracks are used.

Several little improvements and refinements that will give additional interest to the game may easily be carried out. For example, some realistic scenery depicting a grand stand packed with spectators, with the finishing post visible in the distance, might be made and then fixed round the sides and finishing end of the track. The scenery could be painted on stiff paper with ordinary water-colour paints. Also electric lights might be placed at the end of the track to indicate the winning car.

Fig. 55A

Parts required:

2 of No. 2	12 of No. 16	18 of No. 38	2 of No. 99a
26 „ 6a	6 „ 17	1 „ 40	6 „ 103f
8 „ 7a	12 „ 22	3 „ 45	9 „ 111c
11 „ 8	12 „ 23	3 „ 48a	3 „ 115
8 „ 9	3 „ 23a	3 „ 48b	3 „ 125
6 „ 9a	3 „ 24	3 „ 52a	6 „ 126
6 „ 9b	3 „ 25a	36 „ 59	2 „ 126a
3 „ 10	6 „ 28	3 „ 62b	6 „ 136
6 „ 11	143 „ 37	90 „ 63	3 „ 160
3 „ 15	12 „ 37a	2 „ 99	3 „ 171

Model No. 56. Swiss Embroidery Machine

The prototype of the model shown in Fig. 56 is used for the mass production of embroidery, and machines of this type are found in great numbers in Switzerland, their country of origin. Although in the model provision is made for one needle only, in actual practice as many as 80 needles are in use at one time. The model may be built with a No. 6 Meccano Outfit and will be found to do excellent work.

The two bottom members of the main frame each consist of two 12½" Angle Girders connected together by a 5½" Angle Girder, the 12½" Girders being fixed in place so that their inner ends are ½" apart. Two 1½" Angle Girders 1 are also bolted between the inner ends of the long girders. The two complete compound girders are joined together at their outer ends by two 5½" × 2½" Flanged Plates and in the centre by two 9½" Angle Girders 2. Four 5½" × 2½" Flat Plates are now fitted as shown in Fig. 56, and each of these carries a 12½" Angle Girder lying parallel to the main base girders. Each pair of 12½" Girders is joined together in the centre by 9½" Angle Girders 3.

The two sets of Angle Girders 2 and 3 are now connected together by four vertical 12½" Angle Girders, and these, at their upper ends, are rigidly connected together by two girders, one of which is 9½" in length. The other girder is 16½" in length and is built up from a 12½" Angle Girder and a 5½" Angle Girder. At the points where the vertical girders are attached to the upper and lower horizontal girders, ¾" Bolts are used, and each of these Bolts supports two 12½" Strips. These Strips are spaced apart by two Washers at each end, and one Washer is placed between the Strips and the Girders.

The two vertical slots thus formed are used for guiding a pantograph frame, composed of two vertical 7½" Strips connected together by three 12½" Strips, the upper one of which rests on two ½" loose Pulleys 4 (see Fig. 56A). A ¾" Bolt supports each of these Pulleys, and five Washers are used between each Pulley and its respective Strip. The Bolts are locked to the Strips by means of two Nuts. One of the Pulleys 4 is mounted at the end of a 3" Strip bolted to one arm of a Boss Bell Crank on a 2" Rod. The second Pulley is fixed at the end of a 12½" Strip secured by its fifth and sixth holes to a second Boss Bell Crank mounted similarly to the previous one. The outer end of the 12½" Strip bears a weight composed of ten 3½" Strips and seven 2½" Strips, which is used for balancing the pantograph frame.

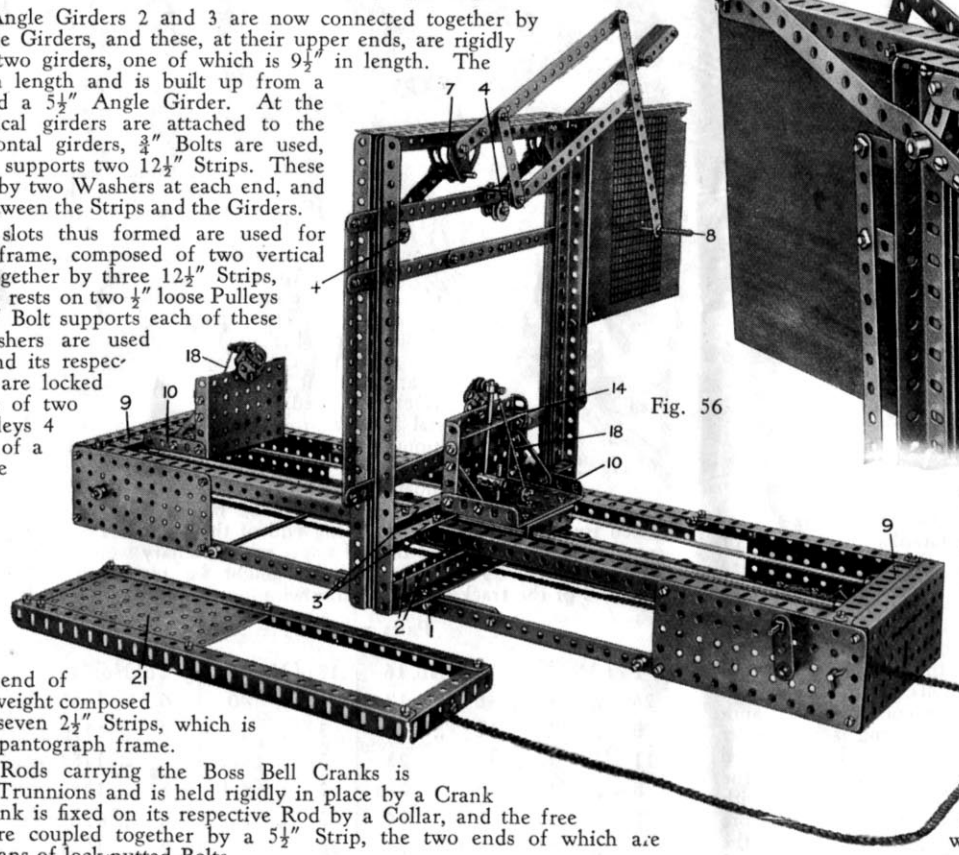


Fig. 56

Each of the 2" Rods carrying the Boss Bell Cranks is journalled in two Flat Trunnions and is held rigidly in place by a Crank 6. Each Boss Bell Crank is fixed on its respective Rod by a Collar, and the free arms of the Cranks are coupled together by a 5½" Strip, the two ends of which are fastened in place by means of lock-nutted Bolts.

If the frame is moving freely in its slides it will now be possible to move it both horizontally and vertically, and in any position it will be found to remain stationary.

The upper 12½" Strip of the frame bears a 1" × ½" double bracket, built up from two 1" × ½" Angle Brackets, and the free lug of the built-up bracket is pivotally attached to a pantograph, the construction of which is shown in Fig. 56. The pantograph carries a Double Arm Crank 7 that supports a Rod mounted in the two upper girders of the vertical frame. A pointer 8 consisting of a 2" Threaded Rod pointed at one end is carried at the end of the long arm of the pantograph, and is moved over a series of ¼" squares drawn on a board attached to the projecting end of one of the horizontal upper girders. The board is divided up into ¼" squares, the purpose of which will be described later.

When the pantograph and frame is complete the needle grippers and slides are constructed and bolted in position as shown. Two 5½" Angle Girders 9 are bolted in place on the frame and each of these supports the ends of two 11½" Rods, the other ends of which are journalled in holes in the Girders 3. The Rods are spaced five holes apart and they each carry a slide, the two finished slides being coupled together by two 12½" Angle Girders, as shown in Fig. 56B. Each slide is built up from two 3½" × 2½" Flanged Plates bolted rigidly together, at right-angles, by means of two large Corner Brackets. The horizontal Flanged Plate 10 carries on its underside two 2½" Angle Girders spaced 1½" apart. The 11½" Rods already mentioned pass through the end holes of these Angle Girders, and in this manner the carriages are enabled to slide freely in one direction only. The 2½" Angle Girder nearest to the pantograph frame carries a 1½" Angle Girder, and to this are bolted the 12½" Angle Girders joining the two carriages. These latter Girders are connected to the 1½" Angle Girder one hole from their ends, and at the extreme ends are bridged by means of the 1½" Strips 11 and 11a.

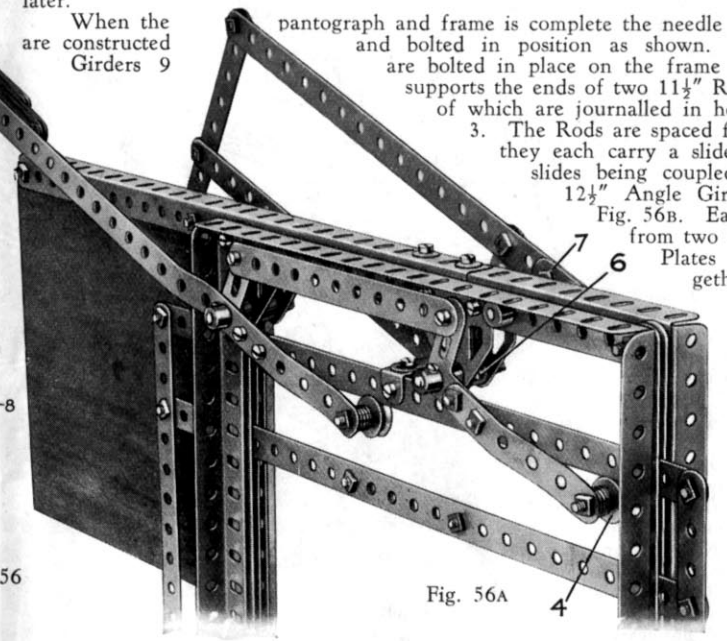


Fig. 56A

When the construction of the carriages has proceeded so far and both have been coupled together, they may be fitted with the endless belt of Sprocket Chain shown in Fig. 56B. This Chain is attached at one end to the Strip 11. It then passes round the 1" Sprocket Wheel 12, after which it passes round a second 1" Sprocket Wheel 13 and is fixed to the 1½" Strip 11a. The Sprocket Wheel 13 is mounted on a 6½" Rod on one end of which is a crank handle built up from a Crank fitted with a Threaded Pin. Thus by operating the handle the two carriages are made to travel forward or backward as desired.

Each of the vertical 3½" × 2½" Flanged Plates, bolted to the Plates 10, bears a gripper built up in two separate and similar sections. Each consists of two pairs of Flat Brackets set at 90 deg. to each other, the separate Flat Brackets of one pair overlapping the corresponding Flat Brackets of the other pair. When the two sections of the grippers have

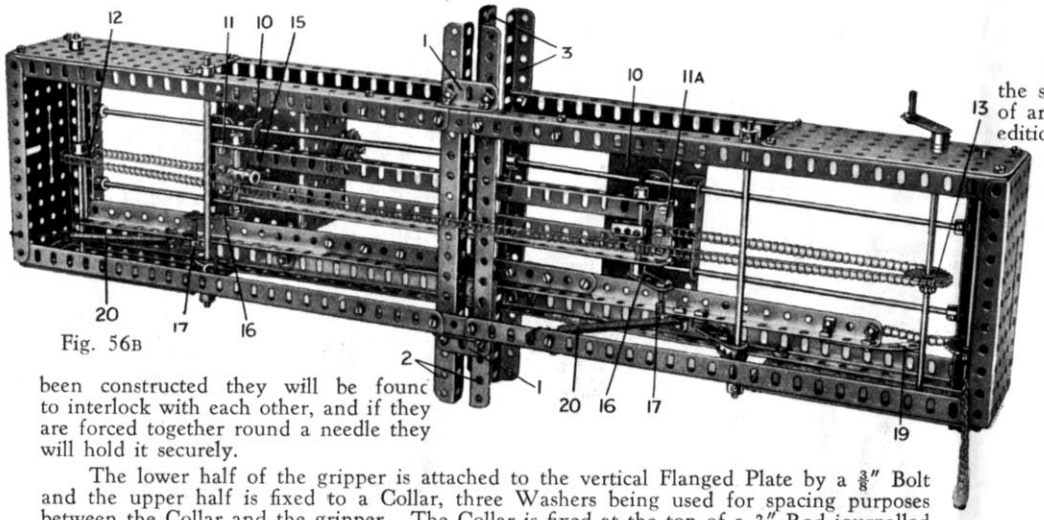


Fig. 56B

been constructed they will be found to interlock with each other, and if they are forced together round a needle they will hold it securely.

The lower half of the gripper is attached to the vertical Flanged Plate by a $\frac{3}{8}$" Bolt and the upper half is fixed to a Collar, three Washers being used for spacing purposes between the Collar and the gripper. The Collar is fixed at the top of a 3" Rod journalled in the centre hole of a $3\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strip 14 and also in the centre of the second row of holes of the Plate 10. On the lower end of the Rod is a second Collar and this forms a surface against which a $\frac{1}{2}$" Bolt 15 works. This Bolt is held in the threaded hole of a Coupling, and is locked in place by means of a Grub Screw driven into the Coupling from the opposite side. The Coupling is mounted on a 2" Rod, on which is also a Crank 16 that is fitted at its end hole with a $\frac{3}{4}$" Bolt 17.

To complete the gripper the spring 18 is fitted. This consists of a 2" length of Spring Cord attached at one end to the Collar carrying the upper half of the gripper. At the other end it is bolted to a $\frac{1}{2}" \times \frac{1}{2}"$ Angle Bracket attached to the Plate 10. This spring should exert considerable power, as it is upon this that the security of the needle depends.

The $\frac{3}{4}$" Bolts 17 bear against the underside of two $9\frac{1}{2}$" Angle Girders joined together by means of two $7\frac{1}{2}$" Strips. One of the $9\frac{1}{2}$" Angle Girders is fitted with a $2\frac{1}{2}$" small radius Curved Strip 19, and the complete set of Girders and Strips is mounted at two pivot points on two 2" Strips. These Strips are connected at their lower ends to Couplings by means of $\frac{1}{2}$" Bolts, and the $6\frac{1}{2}$" Rods on which these Couplings are fixed are journalled in the lower set of girders of the main frame. The Girders and Strips are held in a "down" position by means of two Springs 20, thus keeping the needle grippers open. The grippers are closed by means of the foot pedal 21, which is coupled to one of the $9\frac{1}{2}$" Angle Girders, near the Curved Strip 19, by a length of Sprocket Chain.

A piece of fairly heavy material is stretched across the pantograph frame and is held in place by two Strips sufficiently long to overlap the material one hole at each side. The needle, of the double-ended embroidery type, is passed through the material and gripped alternately in the two holders. The design, which is drawn on transparent paper and placed over the squares drawn on the board, is altered by moving the pointer after every stitch, one square representing one stitch.

Parts required:

8	of No.	1	17	of No.	8	5	of No.	13	36	of No.	38	6	of No.	63	1	of No.	115
1	,,	1a	7	,,	8a	5	,,	14	2	,,	43	4	,,	70	4	,,	126a
6	,,	1b	7	,,	9	2	,,	16b	2	,,	48b	1	,,	81	2	,,	128
1	,,	2	2	,,	9b	3	,,	17	2	,,	52	1	,,	90a	4	,,	133
12	,,	3	4	,,	9d	4	,,	18a	1	,,	52a	70"	,,	94	1	piece	of board
4	,,	4	4	,,	9f	2	,,	23	4	,,	53	3	,,	96			
7	,,	5	16	,,	10	2	,,	35	25	,,	59	9	,,	111			
2	,,	6	2	,,	12	173	,,	37	4	,,	62	7	,,	111a			
2	,,	6a	4	,,	12b	29	,,	37a	1	,,	62b	6	,,	111c			

Model No. 57. A Simple Meccanograph

Most Meccano model-builders will be familiar with the fine Meccanograph that forms the subject of Super Model Instruction Leaflet No. 13, and which enables a wide variety of artistic designs to be produced merely by turning a handle. In Fig. 57 is shown a small edition of the Meccanograph, less elaborate than the Super Model, but capable of producing a large number of interesting designs.

The frame of the model consists of four $12\frac{1}{2}$" Angle Girders with a $5\frac{1}{2}" \times 2\frac{1}{2}"$ Flanged Plate fixed in position at each end. The carriage on which the pencil arm is pivoted is built up from a $5\frac{1}{2}$" Strip, two Flat Trunnions and two $1\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strips, and is mounted on guides consisting of Axle Rods held in Angle Brackets bolted to the frame. The pencil arm is made from a $12\frac{1}{2}$" Strip fitted with a Cranked Bent Strip at one end, and the pencil is placed in this Strip and held in position by means of a small elastic band 1. The pencil arm is pivoted on an Axle Rod fixed in the boss of a Crank attached to the carriage, and the $12\frac{1}{2}$" Strip is mounted between a 1" fast Pulley and a $\frac{3}{4}$" Flanged Wheel. By removing the Flanged Wheel and then altering the pivoting point of the Strip, designs of various patterns can be produced.

The speed at which the table rotates can also be altered in the following manner. The table, which may consist of a sheet of stiff cardboard or plywood, is fixed to a 3" Pulley Wheel mounted on an Axle Rod journalled in the main frame, and a second 3" Pulley and a 2" Pulley are mounted on its lower end. An Axle Rod is journalled in the centre of the Flanged Plate at the other end of the frame, and this bears a 1" and a $1\frac{1}{2}$" Pulley Wheel. An endless length of cord is used to couple either of these Pulleys with the Pulleys on the table shaft, any slackness in the belt being taken up by means of a spring-mounted jockey pulley arranged as follows. A 1" loose Pulley is mounted on a $\frac{1}{2}$" Bolt fixed to a cross-shaped arm composed of $3\frac{1}{2}$" and $1\frac{1}{2}$" Strips, and the arm is pivoted to an Angle Bracket bolted to the frame. A Spring is connected in the position shown in order to keep the cord under tension.

The Rod bearing the 1" and $1\frac{1}{2}$" Pulleys is fitted with a 57-teeth Gear Wheel that engages with a Worm on the Crank Handle shaft and also meshes with $\frac{1}{2}$" Pinions on the pencil arm and carriage oscillator shafts respectively. It will be noticed that a length of elastic 2 is attached to the pencil arm and also to a $5\frac{1}{2}$" Strip bolted to the frame in an upright position. The elastic serves to keep the pencil arm in contact with the Threaded Pin attached to the Bush Wheel on the oscillator shaft.

Parts required:

1	of No.	1	1	of No.	27a	2	of No.	62	2	of No.	115
6	,,	2	1	,,	32	2	,,	111	1	,,	125
1	,,	3	10	,,	35	4	,,	111c	2	,,	126a
4	,,	5	52	,,	37						
1	,,	6a	9	,,	37a						
4	,,	8	11	,,	38						
1	,,	10									
11	,,	12									
2	,,	15									
2	,,	16									
2	,,	17									
1	,,	18a									
1	,,	19									
2	,,	19b	1	,,	40						
1	,,	20a	1	,,	43						
1	,,	20b	1	,,	44						
1	,,	21	2	,,	45						
2	,,	22	2	,,	48						
1	,,	22a	2	,,	52						
1	,,	24	2	,,	53						
2	,,	26	3	,,	59						

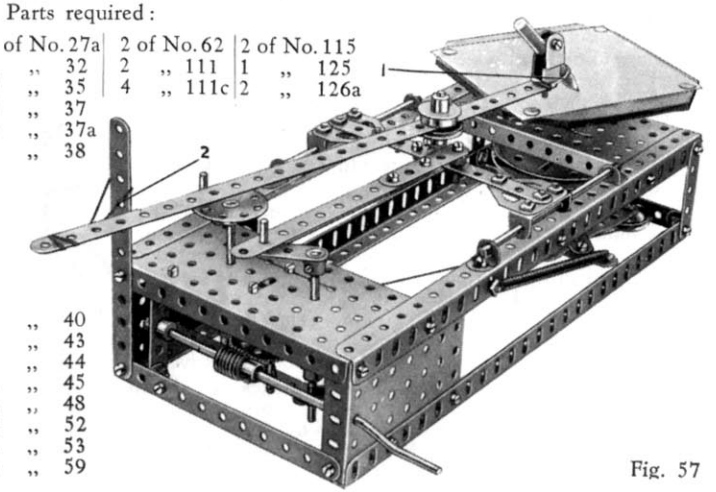


Fig. 57

Model No. 58. Front Wheel Drive Motor Chassis

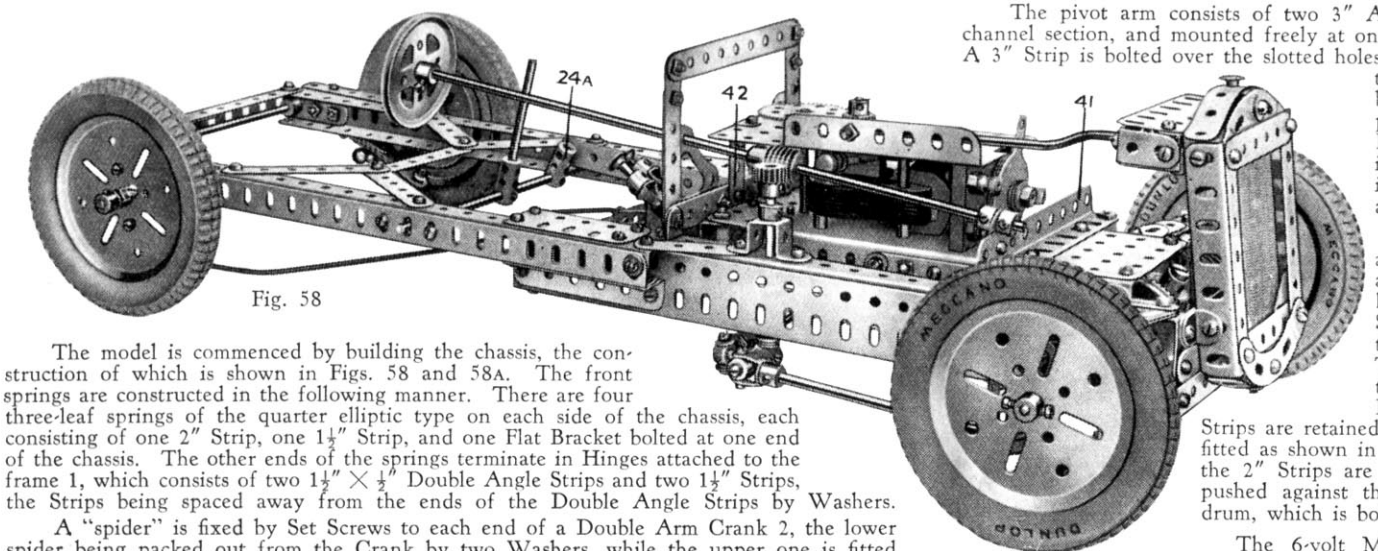


Fig. 58

The model is commenced by building the chassis, the construction of which is shown in Figs. 58 and 58A. The front springs are constructed in the following manner. There are four three-leaf springs of the quarter elliptic type on each side of the chassis, each consisting of one 2" Strip, one 1½" Strip, and one Flat Bracket bolted at one end of the chassis. The other ends of the springs terminate in Hinges attached to the frame 1, which consists of two 1½" × ½" Double Angle Strips and two 1½" Strips, the Strips being spaced away from the ends of the Double Angle Strips by Washers.

A "spider" is fixed by Set Screws to each end of a Double Arm Crank 2, the lower spider being packed out from the Crank by two Washers, while the upper one is fitted flush against the Crank. The Double Arm Crank is retained in the frame by means of a 1" Rod and a Threaded Pin inserted in the upper and lower spiders respectively, and secured in the spiders by Grub Screws. Four Washers serve to space the upper spider, and one Washer the lower spider, from the frame.

The universal-coupling drive to each of the front wheels consists of a 1" Threaded Rod 6 that forms the stub axle, to which two ½" × ½" Angle Brackets are attached by lock-nuts. The slotted portions of the Brackets must be parallel to one another, and the whole unit must be fixed very rigidly to the Rod. The arms of the Angle Brackets are bent slightly toward one another. The end of a 2" Rod 5 carries a Collar that is mounted loosely between the Angle Brackets by passing Set Screws through the slotted holes and screwing them into the tapped holes of the Collar, until the Rod 5 is nipped by them. The stub axle is inserted in the boss of the Double Arm Crank 2, and the road wheel is then secured to its end by duplicate Set Screws. It will be found that the centre of the universal coupling is practically coincident with the centre line of the pivot pin, and that the latter, if produced, would fall within ¼" of the centre of the wheel track.

A Crank 3 is fixed rigidly to the end of each 1" Rod pivot as shown in Fig. 58A, and a 5" Rod acts as a drag link by connecting the Crank to a Swivel Bearing 4 mounted on a ½" Bolt held in the end bore of a Coupling. The Coupling is secured to a Rod journalled in the chassis girders and carrying at its upper end a ½" Pinion. This Pinion will mesh eventually with a Worm on the steering column. A 1" Rod 4a is fixed in the centre transverse bore of the Coupling, and this is attached to the track rod by a Swivel Bearing.

The rear wheel suspension and the brakes are shown in detail in Fig. 58B. The spring 38 is of the cantilever type, and it consists of one 3½", one 3", one 2½" and one 2" Strip, all bolted together at one end to a 1½" Angle Girder 39 fixed to the chassis. The stub axle is held in the boss of a Crank bolted on the inside of a pivot arm 37, the two parts being separated the space of one Washer.

The pivot arm consists of two 3" Angle Girders bolted together in the form of a channel section, and mounted freely at one end on a Rod that passes through the chassis. A 3" Strip is bolted over the slotted holes of one of the Girders to provide a bearing for the pivot. The arm is connected to the spring by means of a Flat Bracket 40, which is attached pivotally by a lock-nutted Bolt to a ½"×½" Angle Bracket on the spring. The other end of the arm is inserted in the space between the Crank holding the stub axle and the pivot arm; the stub axle passes through the hole in the Flat Bracket.

The brake is of the internal expanding type, and consists of two 2" Strips mounted together at one end on a Bolt lock-nutted in the centre hole of a 1½" Strip. The end hole of the 1½" Strip is attached pivotally to the arm 37 and the other end is fitted with a Handrail Support. The 2" Strips, carrying the Collars that form the brake shoes, ride in the groove of a 1" fast Pulley 36 that is loose on the stub axle, and the Strips are retained in the groove by a short length of Spring Cord fitted as shown in Fig. 58B. By moving the 1½" Strip to the left, the 2" Strips are forced apart, and consequently the Collars are pushed against the rim of a Wheel Flange forming the brake drum, which is bolted to the road wheel.

The 6-volt Motor, gear-box, clutch, differential, and front brakes, shown in Fig. 58C, all form part of a compact unit. Each of the gear-box side plates consists of a 4½" Flat Girder, that on the far side of the Motor being bolted to the flange of the Motor by its slotted holes. The plate on the near side is attached to a 4½" Angle Girder spaced away from the Motor side plates by three 2" Strips.

The Rod 8 is journalled in three bearings, a 2½" Flat Girder 33a, a 2½" × 1" Double Angle Strip 8a, and a 2½" Strip 7. The Double Angle Strip 8a is bolted to the side plates of the gear-box and it carries a Flat Trunnion in the top hole of which one end of the layshaft is journalled. The Strip 7 is one of two that are attached to the gear-box sides by means of ½" × ½" Angle Brackets. The Rod 15 runs in the second of the Strips 7, and also in another 2½"× 1" Double Angle Strip, which carries a Flat Trunnion that provides a bearing for the other end of the layshaft. Two Washers are placed under the heads of each of the Bolts retaining the Trunnion in place, so that the shanks of the Bolts do not foul the face of the 1" Gear 20. It is very important that all the bearings should be in alignment, especially those of the Rod 8, for as there are three bearings, alignment has to be carefully carried out if the Rod is to run easily.

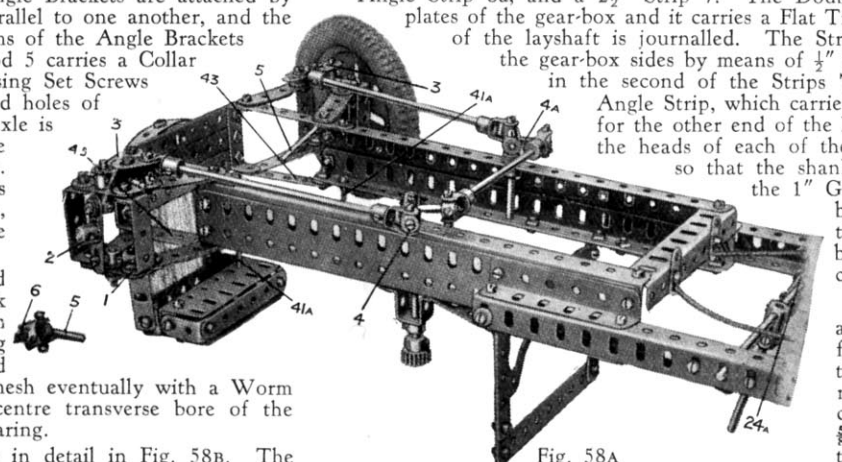
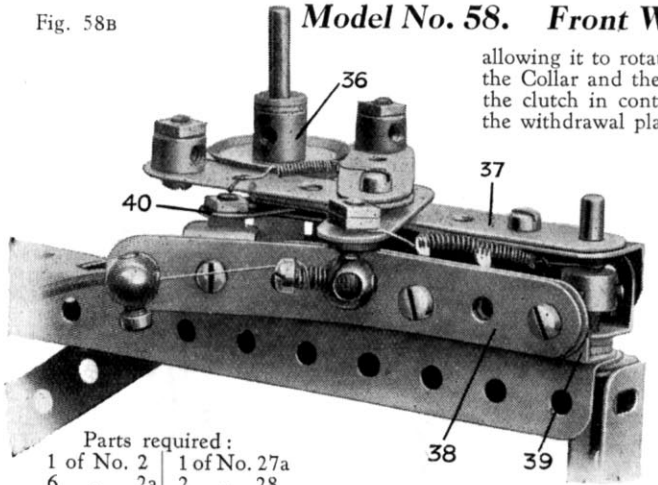


Fig. 58A

The clutch is of the single plate type and consists of a 1½" Contrate Wheel 9 free on the Rod 8, which is driven from the Motor armature spindle through a reduction gear of 3 : 1. The floating plate consists of a ½" loose Pulley fitted with a ⅝" Rubber Ring, and is pressed against the face of the Contrate Wheel by a ¾" Flanged Wheel mounted in a Socket Coupling, which represents the withdrawal plate. A Collar 10 is fixed to the Rod in such a manner that its Grub Screw is always in engagement with the slot of the Socket Coupling, thus permitting limited longitudinal movement to the unit and at the same time

Fig. 58B



Model No. 58. Front Wheel Drive Motor Chassis—(continued)

allowing it to rotate the Rod. Half of a Compression Spring is placed between the Collar and the recess in the Socket Coupling in order to keep the parts of the clutch in contact. The Contrate 9 is prevented from moving away from the withdrawal plate by a Collar secured on the Rod.

The clutch withdrawal mechanism consists of a Rod sliding in suitable bearings and carrying at one end a Coupling to which is attached a 2" Strip. This Strip pivots on the end of a Rod 33 and its upper end is joined to the clutch pedal proper 12. A Coupling 11 fixed to the Rod supports two short Rods that engage with the groove of the Socket Coupling.

Details of the differential can be seen in Fig. 58C. Two ¾" Contrate Wheels 26 are secured on the ends of two separate Rods, the outer ends of which are journalled in the ends of the gear-box side plates, and the inner ends in the longitudinal bore of a Coupling. The ¾" Pinions 27 mesh with the Contrates, and are mounted freely on Pivot Bolts inserted in the centre tapped holes of the Coupling, and screwed home sufficiently to grip a Rod in the centre transverse hole of the Coupling. This Rod carries, at each end, Collars 28 in which are inserted 1" Screwed Rods. A 1½" Contrate, free to revolve on its Rod, is locked to the Screwed Rods, and is spaced from the adjacent ¾" Contrate by two Washers.

Owing to the vertical movement of the back wheels, the brake control wire must pass through an outer flexible sheath, on the Bowden cable principle. This sheath is composed of Spring Cord, and the manner of attaching it should be clear on reference to Figs. 58A and 58B. A stop consisting of a ⅜" Bolt inserted in a Collar comes in contact with a fixed Bolt shank in order to limit the movement of the brake pedal shaft 33.

The gear change lever is carried on a cross shaft that is journalled in the chassis girders, and is prevented from free rotation by means of a Spring Clip mounted on the Rod so that its lugs press against a ½" × ½" Angle Bracket bolted to the inside of the chassis girder. The Coupling 24a on the cross shaft is connected by means of a Strip to a 2" Strip 24 pivoted on the side of the gear-box. The upper end of this Strip has a Rod attached to it by a Crank, and the Rod locates between the boss of the Gear 23 and a Collar on the layshaft, so that when the gear lever is moved the layshaft slides longitudinally in its bearings.

Parts required:

1	of No.	2	1	of No.	27a
6	,,	2a	2	,,	28
4	,,	3	2	,,	29
16	,,	4	4	,,	31
6	,,	5	1	,,	32
23	,,	6	1	,,	35
20	,,	6a	145	,,	37
4	,,	8	32	,,	37a
4	,,	8a	80	,,	38
3	,,	9a	1	,,	45
6	,,	9c	3	,,	46
2	,,	9d	6	,,	48
2	,,	9f	1	,,	58
17	,,	10	32	,,	59
3	,,	11	8	,,	62
19	,,	12	2	,,	62b
2	,,	12b	7	,,	63
1	,,	13	1	,,	72
1	,,	13a	2	,,	77
1	,,	14	4	,,	82
3	,,	15	3	,,	89a
1	,,	15a	2	,,	103a
3	,,	16	2	,,	103c
3	,,	16a	2	,,	103e
3	,,	16b	1	,,	103f
3	,,	17	2	,,	108
8	,,	18a	1	,,	111
4	,,	18b	6	,,	111a
4	,,	19b	16	,,	111c
1	,,	19s	8	,,	114
2	,,	20	2	,,	115
1	,,	20a	3	,,	120a
1	,,	20b	2	,,	126a
2	,,	22	7	,,	136
1	,,	23	2	,,	137
4	,,	23a	4	,,	142b
4	,,	25	2	,,	147b
5	,,	26	1	,,	155
2	,,	27	8	,,	165
2	of No.	166	1	6-volt	
1	,,	171	Motor		

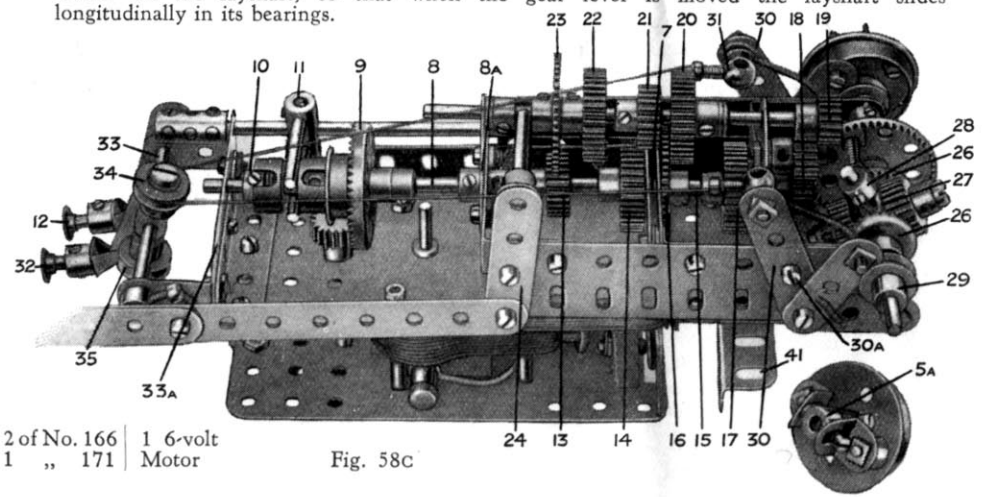


Fig. 58C

Model No. 59. Watt's Beam Engine

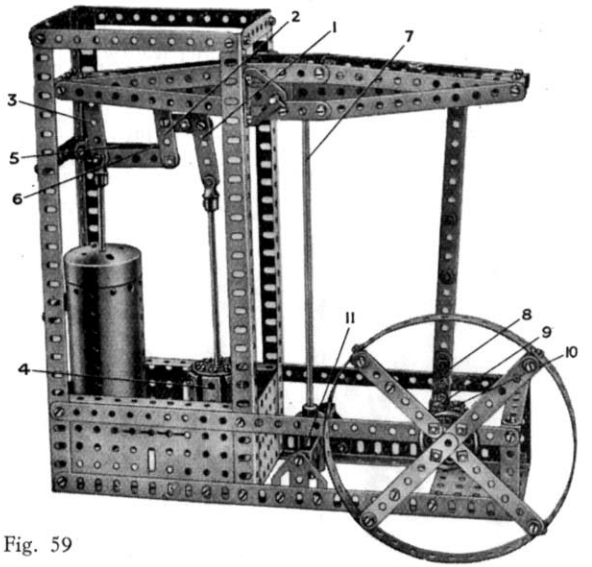


Fig. 59

The example shown in Fig. 59 is a simple but none the less realistic model of the historic beam engine constructed by James Watt. Most of the constructional details will be clear from the illustration.

The parallel motion is built up from three 2½" Strips, the Strips 2 and 3 being lock-nutted to Angle Brackets bolted to the beam. The lower end of Strip 3 is connected to the piston rod, and the corresponding end of the Strip 2 is pivotally attached to the frame of the model by a ½" Reversed Angle Bracket 6 and a 2½" Strip 5. An extra link 1 is fitted to the Strip 2 and this transmits the beam movement to the pump 4.

The beam movement is converted into rotary motion by "sun and planet" gear, which is built up as follows. The Rod of the fly-wheel carries a loose Coupling 9 and a fixed ½" Pinion 10 that meshes with a second ½" Pinion secured on a 1½" Rod in the end holes of the Coupling 9. A Crank 8 and two Strips link the "sun and planet" gear to the beam.

Parts required:

2	of No.	1	1	of No.	15	6	of No.	37a
18	,,	2	2	,,	16	8	,,	38
6	,,	3	1	,,	17	1	,,	45
2	,,	4	1	,,	18a	6	,,	48a
12	,,	5	1	,,	20b	2	,,	48b
2	,,	6a	2	,,	21	2	,,	52
8	,,	8	1	,,	24	3	,,	53
4	,,	10	2	,,	26	4	,,	59
13	,,	12	4	,,	35	1	,,	62
1	,,	13	94	,,	37	1	,,	63

6	of No.	111c			
1	,,	116a			
1	,,	125			
2	,,	126			
2	,,	126a			
1	,,	162b			
1	,,	166			

The Meccano devices and mechanisms shown on this and the following eight pages have been selected from the "Suggestions Section" of various issues of the MECCANO MAGAZINE, *and are shown here because they are adaptable to various models and will provide the keen Meccano boy with many new ideas.*

No. 1. Self-Tipping Skip

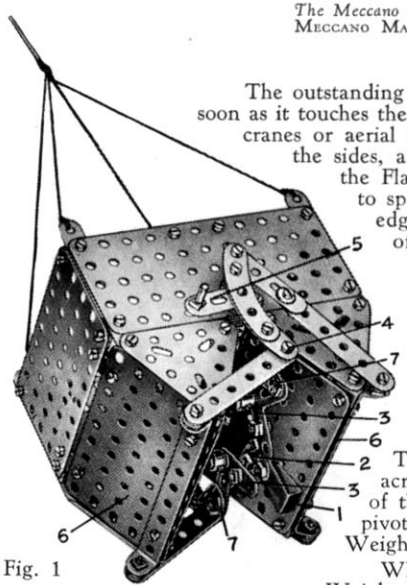


Fig. 1

The outstanding feature of the model illustrated in Fig. 1 is that it automatically unloads as soon as it touches the ground. The model may be used in connection with various kinds of model cranes or aerial ropeways. The skip is built up from two $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plates that form the sides, and each Plate has two $2\frac{1}{2}''$ Triangular Plates secured to it. The ends of the Flat Plates have $4\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plates attached by means of Angle Brackets to space them apart, and similar Plates are fixed by Angle Brackets at the inner edges of the Triangular Plates as shown. The Plates 6 are hinged by means of two Hinges on each, and carry $4\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips along their lower edges. The Double Angle Strips have pivoted at each end a 3" Strip and one pair of these is also pivoted to the lower ends of $2\frac{1}{2}''$ Curved Strips, one on each side of the skip. The Curved Strips are extended by similar parts, and the upper ends carry 2" Slotted Strips to which the second pair of 3" Strips is bolted. A Boss Bell Crank 5 is bolted to the Curved Strips on each side of the skip, and both Cranks are mounted on a Rod journalled in the side Plates. The Bell Cranks are provided with Threaded Pins for handles.

Two Simple Bell Cranks 3 are pivoted on $\frac{3}{8}''$ Bolts gripped in Collars. The Collars are carried on 1" Screwed Rods secured to a $4\frac{1}{2}''$ Strip fitted across the centre of the skip. Angle Brackets 7 are fitted at the outer ends of the Bell Cranks, and a 2" Strip 2 is pivoted between the inner arms. The pivots are passed through the elongated holes of the Cranks. A 25 gramme Weight 1 is attached to the Strip 2 by means of a 1" Triangular Plate.

When the skip is held in the normal position, suspended from the crane, the Weight 1 causes the Angle Brackets 7 on the Bell Cranks to move upward. By depressing the handle 5, the flaps 6 are closed and the $\frac{3}{4}''$ Bolts 4 force down the Angle Brackets on the Cranks 3. As soon as they have passed the Brackets, the Weight 1 causes the Brackets to move up again and thus retain the Bolts in position. The Weight protrudes below the skip, so that it touches the ground first, and thus releases the Bolts 4. The weight of the material in the skip causes the flaps to open and release the contents without external handling, but the flaps must be closed by hand.

No. 2. Automatic Clutch

Electric Motors do not develop their maximum power until the armature shaft has picked up speed, and the device shown in Fig. 2 ensures that the Motor has attained the necessary number of revolutions before the drive is transmitted to the model. The Rod 1 is driven from the armature shaft through a $\frac{1}{2}''$ Pinion and a 57-teeth Gear giving a 1 : 3 reduction ratio. A $1\frac{1}{2}''$ Pulley 2 is fixed on the Rod, which carries also a 1" loose Pulley fitted with a Dunlop Tyre, and the $1\frac{1}{2}''$ Pulley 3. The Pulley 3 takes the drive to the model, and is free to rotate on its Rod until it is pressed against the Dunlop Tyre, so forming a friction clutch.

A Coupling is carried on the end of the Rod 1 and has two 3" Strips attached to it by means of $\frac{3}{4}''$ Bolts. Each Strip is spaced from the Coupling by two Washers, and a $3\frac{1}{2}''$ Strip 4 is retained in place on the Rod between the two Strips. The Couplings 5 are fastened on 1" Axle Rods and are fitted with similar Rods, each of which bears two Collars connected by Spring Cord.

When the Motor is started the Pulley 2 and the clutch operating mechanism rotate, but the Pulley 3 does not transmit the power. As the speed increases, the weights on the Couplings 5 fly outward and cause the friction clutch to engage. Suitable reduction gearing will of course have to be inserted between the Pulley 3 and the driving shaft of the model.

This novel clutch will save wear and tear of the Motor and will ensure that it is running as fast as possible and that the maximum efficiency is being obtained. The mechanism has certain limitations, however, and precautions should be taken in models such as lifts and cranes where gravity is likely to take effect. The mechanism is of most value in demonstration models where stopping and starting have to be carried out at frequent intervals.

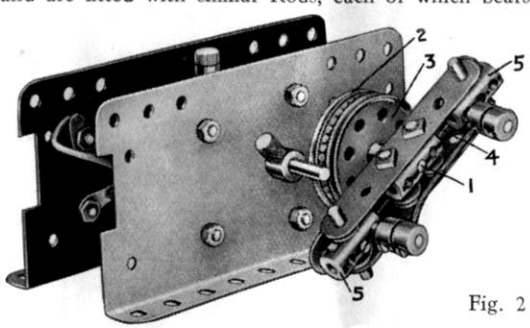


Fig. 2

No. 3. Device to Increase Crank Stroke

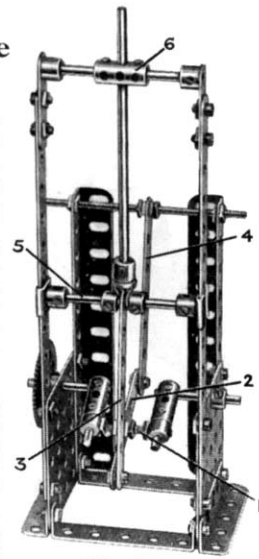


Fig. 3

The ingenious mechanism shown in Fig. 3 gives a stroke almost double the length of the actual crank stroke. Modified forms of this mechanism are employed in certain air compressors, one of the advantages of the arrangement being the saving of space made possible by the use of a smaller crankcase than would be necessary with the full size of crank. Several instances in which this mechanism may be used will no doubt suggest themselves to model-builders.

A suitable frame is built up from two $2\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plates spaced apart by $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips. Two $5\frac{1}{2}''$ Angle Girders are placed vertically at one side of the Flat Plates and at the other side is a pair of $7\frac{1}{2}''$ Strips. In fitting these, care should be taken to see that they are quite straight, as even a slight bend will impair smooth running. They should also be placed parallel for the same reason.

The crankshaft is built up from two $1\frac{1}{2}''$ Rods, and on the inner end of each is a Coupling placed transversely and carrying a 1" Rod. These two Rods are provided with Collars that are connected by a 1" Screwed Rod 1. It is necessary to fit the Collars on the Screwed Rod before placing them in position. The details and arrangement of the crankshaft assembly will be quite clear on reference to Fig. 3.

The $2\frac{1}{2}''$ Strip 2 is pivoted at its centre hole on the Rod 1, and is held in place by lock-nuts on each side. One end of the Strip is pivoted to a $3\frac{1}{2}''$ Strip 4, the upper extremity of which is held loosely on the Screwed Rod connecting the vertical $5\frac{1}{2}''$ Angle Girders. For the connecting rod a $3\frac{1}{2}''$ Strip 3 is used, and a $2\frac{1}{2}''$ Rod 5 is passed through its end hole. The Strip is placed in the fork of an End Bearing and is centred on the Rod by two Collars. Eye Pieces are fixed one at each end of the Rod and these slide up and down on the $7\frac{1}{2}''$ Strips. The Strips are spaced apart at the top by two 1" Rods held in Cranks and a Coupling 6. The latter forms a guide for the reciprocating Rod that is fixed in the End Bearing at the end of the connecting rod 3.

The Strip 2 forms a lever of the third order and its fulcrum is located at the lower extremity of the Strip 4. As the crankshaft is rotated its movement is imparted to the Strip 2, and since the pivot for the connecting rod is double the distance of the Rod 1 from the fulcrum, it travels twice the distance, and thus doubles the crank stroke. This extra movement, however, is obtained at the sacrifice of power, but the connecting rod moves at twice the speed of the crank. The mechanism should be thoroughly oiled before being put to work.

No. 4. Hobbs' Inertia Gear

The motor car gear-box and clutch in general use have many disadvantages, and although modern gear-boxes are vastly superior in design to the earlier types, they are still far from the ideal aimed at by designers of transmission systems. Various schemes for dispensing with these units have occupied the attention of inventors for many years, and an ingenious scheme intended to eliminate the clutch and gear-box entirely has been developed by Mr. H. F. Hobbs, an Australian engineer. His mechanism is automatic in operation, and adjusts the gear ratio according to the load imposed upon the road wheels. The Hobbs' Inertia Gear, as it is called, forms an excellent subject for a Meccano model. Fig. 4 shows the complete arrangement.

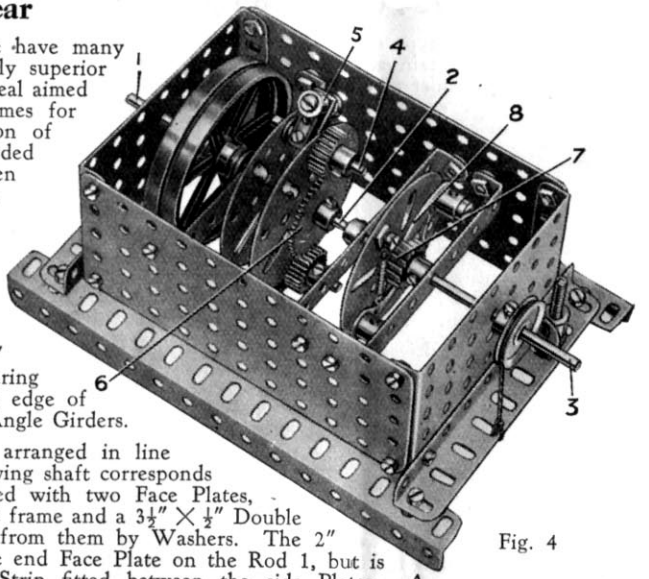


Fig. 4

A casing for the mechanism is built up of two $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plates bolted at each end to $3\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plates, but spaced by a Washer on each securing Bolt. A $4\frac{1}{2}''$ Angle Girder is attached along the lower edge of each end Plate, and these Girders are connected by $7\frac{1}{2}''$ Angle Girders.

The driving shaft 1 and the driven shaft 3 are arranged in line with a short intermediate shaft 2 (see Fig. 4A). The driving shaft corresponds to the engine crankshaft in actual practice, and is fitted with two Face Plates, bearings for the Rod being formed by the end Plate of the frame and a $3\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip bolted between the side Plates, but spaced from them by Washers. The 2" Rod 2 is inserted for a short distance in the boss of the end Face Plate on the Rod 1, but is free to rotate, and is also supported in a Double Angle Strip fitted between the side Plates. A 50-teeth Gear, a Collar and a Face Plate are fixed to the Rod. The driven Rod 3, which is journalled in a Double Angle Strip and the $3\frac{1}{2}'' \times 2\frac{1}{2}''$ Plate of the casing, carries a Ratchet Wheel, and a Pulley fitted with a band brake.

The two Face Plates on the Rod 1 carry two $1\frac{1}{2}''$ Rods 4 that are free to rotate and are provided with $\frac{3}{4}''$ Pinions and Couplings. The Rods are inserted in the end transverse bores of the Couplings, and the latter each bear two Collars firmly fixed by means of $\frac{3}{8}''$ Bolts. The Couplings are spaced from the Face Plates by a Washer on each side. The Pinions mesh with the Gear Wheel 6, and when they are correctly placed the weights 5 should be arranged in exactly opposite positions before the Grub Screws are tightened up. The correct placing of the weights in relation to each other is most important if smooth running is to be obtained, as any inaccuracy will cause excessive vibration at high speeds.

The Face Plate on the Rod 2 carries two Pawls 8, mounted on Pivot Bolts and held in constant engagement with the Ratchet Wheel 7 by means of Spring Cord. This arrangement serves as a freewheel and smooths out the drive. If the shaft 1 is rotated and the Gear 6 held stationary, the planet Pinions will rotate round the Gear, causing the weights 5 also to rotate. Centrifugal force acting on these weights imparts a series of impulses to the Gear 6, tending to turn it first in one direction and then in the other, and as the speed of the driving shaft increases a greater force is exerted on the weights 5, and the resistance offered by the Gear 6 is overcome. Further increase in speed causes a tendency for the weights to remain in their outermost position, and when this stage is reached the device gives the equivalent of a "straight through" drive. When the car is running under a heavy load, a lower gear is brought into operation automatically as soon as the resistance of the Gear 6 overcomes the centrifugal force acting on the weights 5. The gear ratio is always adjusted according to the relation between the load and the power of the engine. As an alternating movement is imparted to the Gear 6 at slow speeds, it is necessary to provide the freewheel already described. On the forward movement of the Gear the Pawls engage the Ratchet Wheel, but on the backward stroke they trail idly over the Ratchet teeth. For the purpose of demonstrating the working of the model when under load, a hand brake is fitted on the driven shaft. A length of cord is passed round a 1" Pulley on the Rod and tied at one end to the frame and at the other end to an Angle Bracket that is passed over a vertical Screwed Rod and held down by a Threaded Boss, rotation of which varies the tension on the brake band and so alters the load.

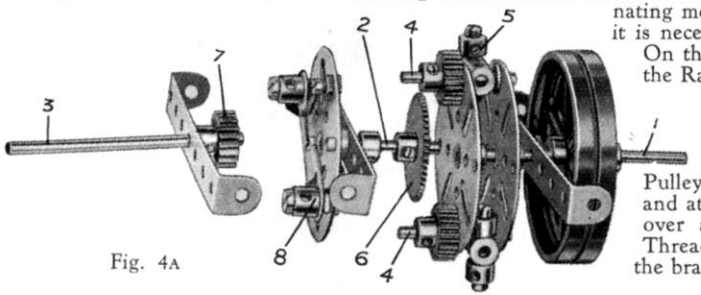


Fig. 4A

No. 5. Compact Reduction Gear

Gear-boxes always provide plenty of scope for the designer, and the possibilities of Meccano parts in this connection are almost without limit. Reduction gearing plays a very important part in almost all power driven models, especially those driven by the Meccano Electric Motors. In order to obtain the greatest power from the Motor this should always be allowed to "rev." at its highest speed, so that in all models that are required to move slowly and yet require a powerful drive, some form of intermediate reduction gearing is essential. An excellent example of the great power obtained by the use of a large gear reduction ratio is to be found in the Super Model Traction Engine, which is fully described and illustrated in Instruction Leaflet No. 22. In low gear this model has a total reduction ratio of 567:1 between the Motor and driven road wheels, and the model will haul with ease any boy of average weight. This is by no means the highest gear ratio that can be contrived with Meccano parts, for by an ingenious arrangement of worm gearing it is possible to build up a gear train that occupies a space measuring only $2\frac{1}{2}'' \times 2\frac{1}{2}'' \times 1\frac{1}{2}''$, and is capable of the enormous reduction ratio of $2\frac{1}{2}$ millions to 1! This device is not of any practical use in Meccano model-building, however, but it serves to illustrate the possibilities of worm gearing.

A very compact gear-box is shown in Fig. 5, and this will be found of utility in many instances where a fairly large reduction ratio is required. A ratio of 243:1 is provided between the driving shaft 1 and driven shaft 2, yet spur gearing is used throughout and only two shafts are necessary.

The Rod 1 carries a fixed Pinion 3 that engages a 57-teeth Gear, loose on the Rod 2. The Gear is provided with two Bolts, the shanks of which are arranged on each side of the $\frac{3}{8}''$ Bolt 4. This Bolt is inserted in the boss of a $\frac{1}{2}''$ Pinion, but a Nut prevents it from gripping the Rod, and in this way the Gear and Pinion rotate freely on the Rod as one unit. The Pinion engages a second 57-teeth Gear coupled in a similar manner to another $\frac{1}{2}''$ Pinion. The final Gear 5 is fixed on its Rod, and a glance at the illustration will show that the drive can be taken from either end of the Rod 2. In like manner the Rod 1 may be driven from whichever end is most convenient in the model.

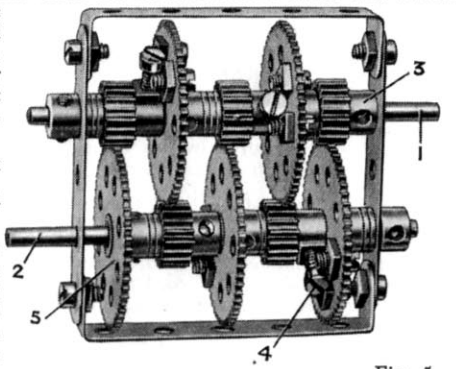


Fig. 5

The framework of the gear-box, which is of very simple form, may readily be replaced by the frame of almost any Meccano model such as a traction engine or crane.

No. 6. Two-speed Reversing Crane Hoist

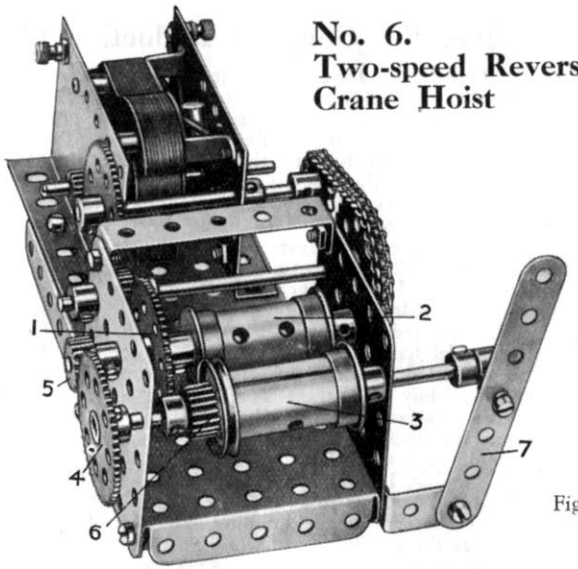


Fig. 6

When a non-reversing motor is used in a model crane, the lowering of the load and the jib is generally effected by disengaging the hoisting shafts from their respective driving shafts and regulating the amount of cord paid out by means of a brake. Fig. 6 shows an ingenious device that enables the paying out and hauling in of the hoisting cord to be operated by the motor.

Two drums 2 and 3 are utilised for this purpose, and are driven by a No. E1 Electric Motor. A 57-teeth Gear engages the Motor driving pinion, and the drive is led through Sprocket Gearing to a Rod bearing a ½" Pinion. The Pinion meshes with a 57-teeth Gear 1, the shaft of which also carries a ½" Pinion 5, and the drum 2. The Rod of the drum 3 is slidable in its bearings, and in order to allow sufficient movement of the Rod, the drum carries a ¾" Flanged Wheel at one end only. The other end of the Sleeve Piece is passed over a Chimney Adaptor, and a 1" loose Pulley is clamped in position by the Pinion 6. The sliding movement of the Rod is controlled by the lever 7, which is pivoted at its lower end and loosely connected to the Rod by a ⅜" Bolt, passed through its centre hole and inserted in the tapped bore of a Collar revolving idly between two fixed Collars.

The hoisting cord is wound round one of the drums and passed over a Pulley at the jib head, and after passing through a Single Sheave Pulley Block it returns over a second Pulley at the jib head, and is wound on to the remaining drum.

With the lever 7 in the position shown the drive between the two drums passes from the Pinion 5 to the Gear 4, so that the drum 2 rotates three times as fast as the drum 3. The former should be arranged to wind in the hoisting cord and the latter to pay out. As three times the amount of cord paid out is hauled in, the load is raised. When the lever 7 is moved to the left, the Pinion 6 engages the Gear 1, and the Gear 4 is moved out of engagement with the Pinion 5. This causes the drum 3 to pay out the cord faster than it is hauled in, thus lowering the load.

No. 7. Two Speed Epicyclic Gear-Box

The type of epicyclic gear-box reproduced in Fig. 7 has certain advantages over the more orthodox gear-box, chief of which are the smoothness with which the drive can be taken up, and the fact that all gears are in constant mesh.

The gear-box illustrated is shown mounted between the side girders of a Meccano motor chassis.

Two Face Plates, which are spaced apart about ½" and carry two 2" Axle Rods 3, are fitted on the driving shaft 1. The Rods each carry a ½" and a ¾" Pinion, and a 2½" Strip 4 is inserted between the two Pinions, a Washer being placed between the Strip and each ½" Pinion. The Rods 3 are held in place by Collars.

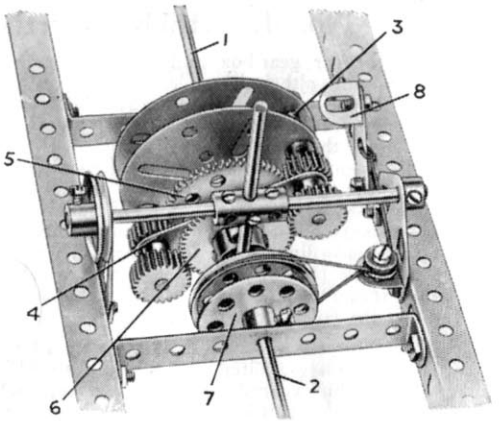


Fig. 7

The driven shaft 2 is passed through the centre hole of the Strip 4, and is inserted for a short distance in the boss of the Face Plate on the Rod 1 to keep it correctly centred. A 57-teeth Gear 5, fixed on the Rod, is spaced from the Face Plate by a Washer, and from the Strip 4 by three Washers. The 50-teeth Gear 6 is held in a Socket Coupling in which also a 1½" Pulley is fixed. The Socket Coupling unit is free on the Rod 2 and a Collar is placed between the Gear 6 and the 2½" Strip. A length of cord is tied to an Angle Bracket attached to the frame and passed round the 1½" Pulley. The cord is then led round a ⅜" Bolt that is fixed by Nuts to the Angle Bracket. The Bolt carries two Washers to keep the cord in place. The cord is finally tied to the foot pedal 8, consisting of a pivoted 1½" Strip to which an Angle Bracket is bolted. A Bush Wheel 7 is fixed on the driven Rod and the shanks of Bolts fitted to the 1½" Pulley can be made to engage the holes in the Bush Wheel to form a dog-clutch.

The Socket Coupling unit is free to slide on its Rod, and its movement is controlled by a hand lever consisting of a 2½" Axle Rod. The lever is held in a Coupling fitted with two 2" Rods journalled in Flat Trunnions bolted to the side girders. To engage low gear the hand lever is pulled back, thus disengaging the dog-clutch, and the foot pedal is depressed to apply the brake to the 1½" Pulley, which is then held stationary. Top gear is engaged simply by releasing the foot pedal and moving the hand lever forward. This engages the dog-clutch and gives a "straight-through" drive, as the two Gears 5 and 6 become solid on the driven Rod 2.

No. 8. Variable Ratchet Feed

The necessity sometimes arises to adjust the feed of a ratchet without stopping the driving mechanism, and an ingenious arrangement for carrying this out is shown in Fig. 8. The Bush Wheel 1 forms the driving crank that imparts reciprocating motion to the 5½" Strip forming the connecting rod. The end of this Strip is connected to two pivoted links. One of the links is attached by a Bolt and lock-nuts to a 1" Triangular Plate at the end of the 2" Strip swinging about the Rod that carries the 57-teeth Gear. The Strip is spaced from the Gear by two Washers, and at its other end is a Pivot Bolt carrying a Pawl 4 that is held in constant engagement with the Gear Wheel by a length of Spring Cord. A second Pawl prevents backward movement.

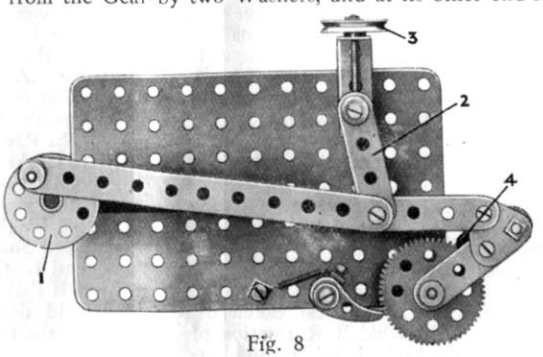


Fig. 8

The 2" Strip 2 is pivoted on a Bolt that is screwed into the end hole of a Threaded Boss and locked by a Nut. The Threaded Boss is carried on a 2" Screwed Rod, the upper end of which is fitted with a hand-wheel 3. By operating this wheel the position of the link 2 can be varied. When the Threaded Boss is at the lower end of its Screwed Rod the maximum movement is imparted to the swinging Strip carrying a Pawl 4, which causes the 57-teeth Gear to move through a corresponding distance. As the link 2 is raised the movement of the connecting rod is partially absorbed by the two 2" Strips, and the movement of the Pawl is decreased. The movement reaches its minimum when the Threaded Boss carrying the link 2 is at the end of its travel.

No. 9. Maltese Cross Mechanism

The Maltese Cross mechanism derives its name from the shape of the driven member, which as the name implies, closely resembles a Maltese Cross. It is also called a Geneva Wheel, as it is similar to the Geneva stop used to prevent the overwinding of springs in watches, etc., and is used to a large extent to produce the intermittent motion in cinematographs. The Geneva gear converts the continuous rotary motion of the driving member to intermittent motion, the driven rod rotating a quarter of a revolution for each complete turn of the driving shaft.

The device shown in Fig. 9 is a typical example of Maltese Cross gear, and operates remarkably well at slow speeds. It is not suitable for high speed work, however, and could not be employed in a model cinematograph, but other uses are likely to occur in other types of models.

The driving Rod carries a Face Plate 1 to which five ½" loose Pulleys are attached by means of ⅜" Bolts, the Pulleys being free to rotate on the Bolt shanks. A Crank on the same Rod is extended by a 2" Slotted Strip at the end of which is a ¾" Bolt carrying the Pulley 2. The driven member is built up from 4½" Strips arranged to form four radial slots, and four 2½" small radius Curved Strips are secured by Flat Brackets in the positions shown. The complete cross is held on its Rod by means of two Double Arm Cranks.

The ½" Pulleys on the Face Plate prevent the cross from rotating until the Pulley 2 moves into one of the slots. As the driving member continues to rotate, the Pulley travels up the slot and in doing so rotates the cross until it moves through 90 degrees. The Wheels on the Face Plate are then brought to bear on the next Curved Strip until the Pulley 2 is again in position for turning the driven member. The ¾" Bolt carrying the Pulley is adjustable in the slot of the Strip, and should be carefully placed so that the Pulley is in the correct position in relation to the slot of the driven "wheel."

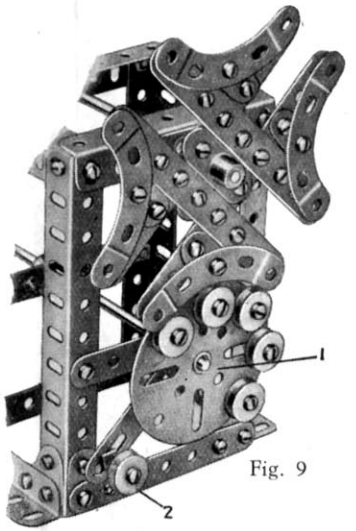


Fig. 9

No. 10. Remote Control for Gear-Box

By means of the remote control device shown in Fig. 10, a Meccano Electric Motor can be started or stopped without being touched. The device is intended for operating a two-speed gear-box from a distance, and in a model with several movements it will be necessary to fit a controller for each movement. In a model crane, for instance, hoisting, luffing and slewing operations could be carried out at will by operating the appropriate switches.

The drive from the armature shaft of the Motor is conveyed through Sprocket gearing to a 1½" Rod journalled between one of the Motor side plates and a 2½" × 2½" Flat Plate. The Rod carries a ½" Pinion that is constantly in mesh with the Gear 1 on a sliding 3½" Rod, which carries also a ½" Pinion 2 and a ¾" Pinion 3. A Collar at each end limits its longitudinal movement. The final driven shaft consists of a further 1½" Rod journalled in line with the first in the opposite Motor side plate and Flat Plate.

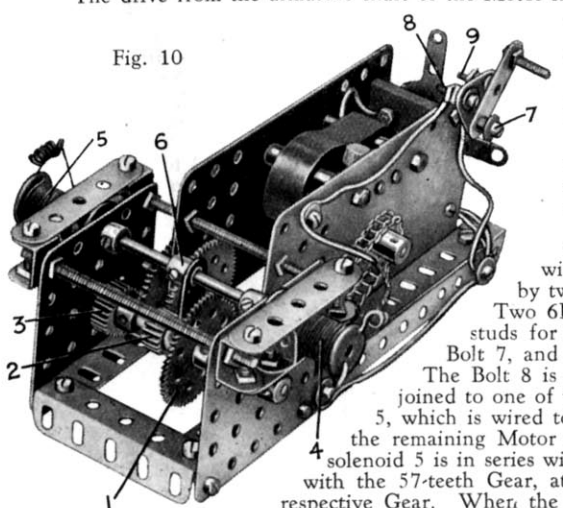


Fig. 10

A Crank 6 forms the selector and its web fits between the Gear 1 and Pinion 2, being spaced from the Gear by Washers. The boss of the Crank is fitted on a sliding 4½" Rod and the ends of the Rod project beyond the Plates and are inserted in the solenoids 4 and 5.

The gear control switch is shown near the Motor reversing switch for convenience, but this can be taken to any position and wired up accordingly. A 1" Triangular Plate is held on a ¾" Bolt 7 by two Nuts, and two further Nuts fix the Bolt in position on the Motor. Two 6BA Bolts 8 and 9 are insulated from the Triangular Plate and form studs for the contact arm, which is made from a 1½" Strip mounted on the Bolt 7, and held against the heads of the 6BA Bolts by a Compression Spring. The Bolt 8 is connected to one end of the solenoid 4, the other end of which is joined to one of the Motor terminals. The same terminal is connected to the solenoid 5, which is wired to the Bolt 9. To connect up, one of the Accumulator wires goes to the remaining Motor terminal and the other is "earthed." With the lever as shown the solenoid 5 is in series with the Motor and causes the Crank 6 to bring the Pinion 2 into mesh with the 57-teeth Gear, at the same time throwing the Pinion 3 out of engagement with its respective Gear. When the control lever is moved to the left to make contact with the Bolt 8 the solenoid 4 is energised, causing the Pinion 3 to engage its Gear Wheel.

No. 11. Self-acting Brake for Cranes

Safety devices now play a very important part in our everyday life, and in every branch of engineering many ingenious mechanisms are employed to minimise the possibility of accidents.

The device shown in Fig. 11 automatically applies the brake to the hoisting drums of a model crane immediately they are thrown out of gear with the driving shaft. The shaft 1 is slidable in its bearings and carries a ½" Pinion that can be brought into mesh with a 57-teeth Gear on the Rod 2, or with a similar Gear on the Rod 3. The Rod 1 bears two fixed Collars, between which is a third Collar free to rotate on the Rod; and a Bolt is inserted through the elongated hole of a Crank and fitted with a Nut before being screwed into the tapped bore of the centre Collar. The Nut locks the Bolt in position and prevents it from touching the Rod 1, but should allow free movement of the Crank.

The Crank is fixed on a 3½" Axle Rod journalled in a 2½" × ½" Double Angle Strip, and a second Crank is fixed on the other end of the Rod. To this is bolted a 2½" Strip 9 bearing a Threaded Pin and serving as the gear-change lever. By moving the lever to the left the Pinion on the Rod 1 is brought into engagement with the 57-teeth Gear on the Rod 2, and with the lever 9 in its right-hand position the Pinion is thrown out of gear and engaged with the Gear Wheel on the Rod 3.

Both driven Rods carry Ratchet Wheels fitted with Pawls 4 and 6 as shown in Fig. 11. The Pawls are held in engagement by short lengths of Spring Cord, and the Pawl 4 has a Bolt in its tapped hole. The Collar 5 on a sliding 3½" Rod 8, bears against the head of the Bolt. The Rod 8 is free to slide in a 2½"×1" Double Angle Strip, and carries at its outer end a Compression Spring and a Collar.

The pressure of the lever 9 overcomes the Spring, causing the Collar 5 to raise the Pawl 4 off its Ratchet Wheel. So long as the Rod 2 is connected to the power unit it is free to rotate in either direction; but when the lever 9 is moved to the right the Pawl 4 is released and prevents backward movement of the Rod 2. In the second position the lever releases the Pawl 6 by means of Rod 7.

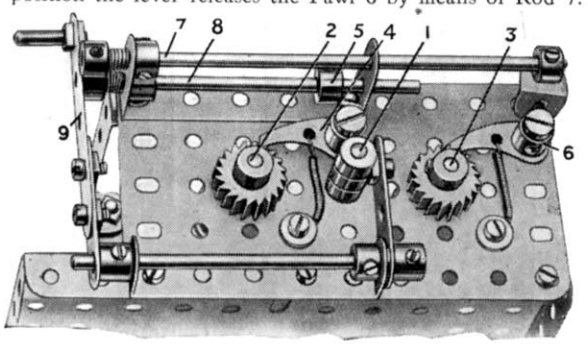


Fig. 11

No. 12. Automatic Opening and Closing Lift Doors

In Fig. 12 is illustrated a model elevator or lift with double doors that automatically open when the lift cage comes into position, and close as soon as it moves away. The ground floor only is shown in Fig. 12, but a similar arrangement can be operated equally well on the top or intermediate floors. The sliding doors with operating mechanism are shown detached from the main structure in Fig. 12A.

The top and bottom members of the door frame are each built up of three 9½" Angle Girders, two of which are fixed one inside the other by their elongated holes, so that a slot is left between the two remaining edges. The third Girder is attached by its elongated holes and forms a channel section girder. The two composite girders so formed are arranged with the pairs of Girders forming the slots at the back of the frame. The front Girders are bolted to four 4½" × 2½" Flat Plates placed two on each side of the door to leave a central opening 2½" wide. Each pair of Plates is overlapped three holes.

The slots at the rear form guides for the doors 9 and 10 (see Fig. 12A), each consisting of a 4½" × 2½" Flat Plate. Two 4½" channel section girders are each made by joining two Angle Girders together, and are bolted to the outer edges of the Flat Plates. Angle Girders are attached also to the inside edges of the Plates and to the top and bottom members to form the door frame. A 2½" × 2½" Flat Plate is bolted at each end of the upper 9½" Girder, and at the rear of the Plates are 2½" Angle Girders, which are connected to the lift shaft structure.

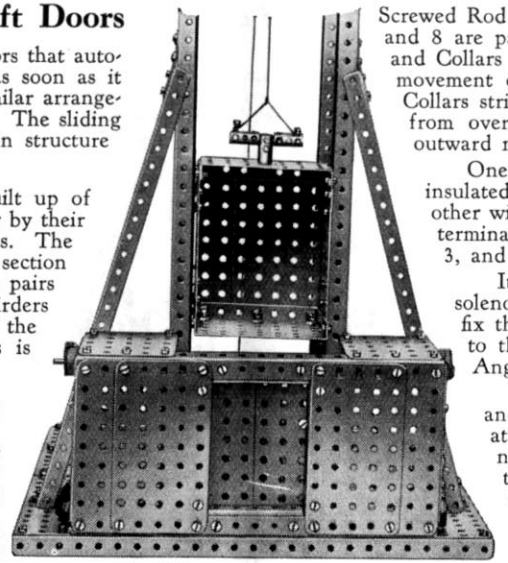


Fig. 12

Four Bobbins are wound with 26 Gauge S.C.C. Wire and covered with a layer of paper. The completed solenoids so formed are shown at 1, 2, 3 and 4, and are clamped in pairs to each Girder at the end of the frame by means of a further 4½" Angle Girder held down by 1" Screwed Rods. Before finally tightening up the Nuts on the Rods, the solenoids should be carefully lined up in pairs, 1 and 4 being in a direct line, and also 2 and 3. To do this an 11½" Axle Rod should be pushed through the centres of each pair, and the solenoids adjusted until the Rods slide quite freely. The holding Nuts are then screwed down firmly so that the coils are securely clamped between the Angle Girders; and the Rods are removed.

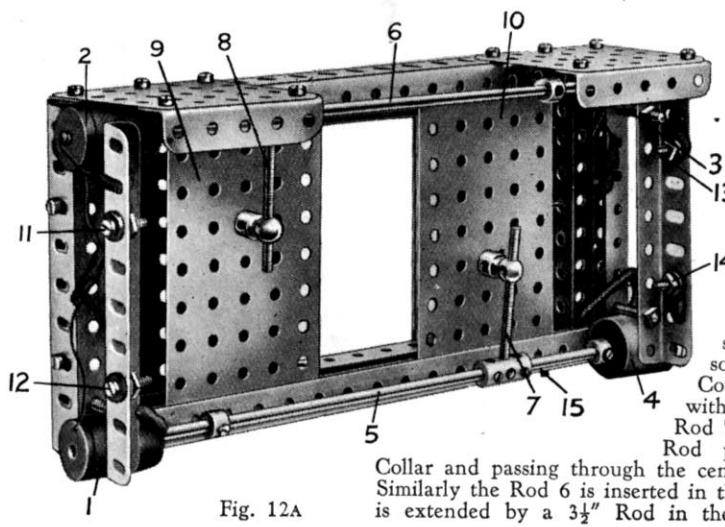


Fig. 12A

A 6½" Axle Rod 5, on which is a Collar and a Coupling, is inserted in the solenoid 1, and the Coupling is fitted with a 2" Screwed Rod 7 and a 3½" Axle Rod provided with a Collar and passing through the centre of the coil 4. Similarly the Rod 6 is inserted in the solenoid 3 and is extended by a 3½" Rod in the solenoid 2, the Screwed Rod 8 being threaded into the Coupling as at 7. The Screwed Rods 7 and 8 are passed through Handrail Couplings attached to the doors 9 and 10, and Collars at each end of the composite Rods 5 and 6 form stops to limit the movement of the doors. When the Rods are drawn into the solenoids the Collars strike the coil cheeks as soon as the doors meet, and so prevent them from overlapping. The Collars on the other ends of the Rods limit the outward movement of the doors.

One wire from the solenoid 2 is connected to the terminal 11, which is insulated from the frame by means of 6BA Bushes and Washers; and the other wire goes to solenoid 4, the second wire from which is attached to the terminal 14. The solenoid 1 is connected to the terminal 12 and the coil 3, and the second wire from the latter is taken to the terminal 13.

It now remains to arrange the contacts by means of which the solenoids are energised, thus causing the doors to open and close; and to fix the door frame in position. Two ⅜" Bolts 15 hold the lower Girder to the "floor," and the top of the frame is secured by means of 2½" Angle Girders bolted to the 2½" × 2½" Flat Plates.

The lift is fitted at each side with a ½" Reversed Angle Bracket, and these are arranged to make contact with Pendulum Connections attached to and insulated from the lift shaft. The Pendulum Connection on the right-hand side is connected to the terminal 13, and that on the left to the terminal 14. The terminals 11 and 12 are wired together and from them a wire is taken to the Accumulator, the remaining terminal of the Accumulator being connected to the frame of the model.

As the lift cage descends, the Angle Bracket on the right-hand side touches the Pendulum Connection, causing the current to flow through the coils 1 and 3; when the lift descends a little lower the left-hand contact is completed, which causes the coils 2 and 4 to be energised, and the doors to open. The left-hand contact should be placed so that the Angle Bracket on the lift touches it but moves off again before the lift comes to rest, so that the current is cut off when the cage is stationary.

No. 13. An Original Quick-Return Motion

Quick-return mechanisms are used extensively in machine tools for speeding up operations by increasing the speed of the return or idle stroke. They may be employed also for intermittent feed movements where a moving pawl is used for rotating a ratchet wheel. In this case the arm carrying the pawl would be speeded up on the return stroke, so that the pause between each movement of the ratchet would be decreased.

The interesting device illustrated in Fig. 13 is operated by a crank and an ingenious system of pivoted connecting rods.

The driving Crank 1 is pivoted to a 3½" Strip that is pivoted at 2 to a further 3½" Strip and a 3" Strip. The 3" Strip is bolted to a Crank that is free to swing about a fixed pivot 4, consisting of a Pivot Bolt attached to the frame by two Nuts. The second 3½" Strip is connected to the part of the model requiring a quick return motion, and in Fig. 13 is shown pivoted at 3 to a sliding Eye Piece.

In the position shown the Crank 1, rotating anti-clockwise, is on the power stroke, and the Eye Piece slides slowly over to the left. When the web of the Crank swings over toward the pivot 4, the Eye Piece returns more rapidly. The closer the Crank 1 is to the pivot 4, the more rapid will be the movements of the Eye Piece. The device is smooth in operation and gives satisfactory results at fairly high speeds.

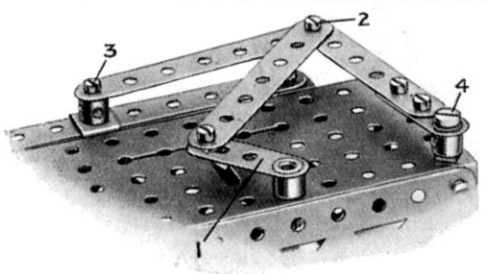


Fig. 13

No. 14. Internal Expanding Brake

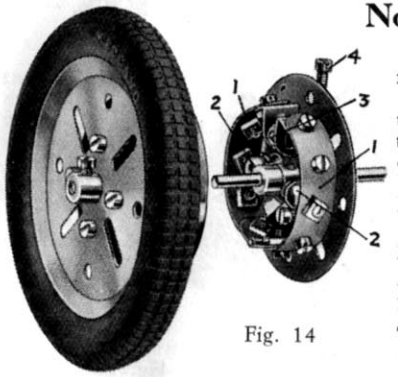


Fig. 14

An improved type of internal expanding brake is illustrated in Fig. 14. This closely follows actual practice, and is remarkably efficient in operation on account of the comparatively large frictional surface on the brake shoes. The shoes consist of $2\frac{1}{2}$" Strips 1, curved to fit inside a Boiler End, and bolted at one end to a Meccano Hinge. In their centre holes they carry Threaded Pins that are free to slide in Handrail Supports 2 pivoted to the Face Plate on which the brake is mounted. The outer ends of the shoes carry Angle Brackets between which is a Collar 3 with a Threaded Pin screwed into one of its tapped bores. The Pin is passed through the Face Plate and retained in place by a second Collar carrying the $\frac{3}{4}$" Bolt 4, which is connected up to the brake operating lever. The shoes fit inside a Boiler End attached to the road Wheel. When the Collar 3 is turned the shoes are expanded and the Bolt heads press on the inside of the Boiler End, thus retarding its rotation. The shoes are normally held in the "off" position by a length of Spring Cord, the ends of which are attached to the Bolts adjacent to those fixing the Hinge. In the centre the Cord is fixed to the Face Plate by a Nut and Bolt. If the Strips that constitute the shoes are bent round a cylinder of suitable diameter they will not scrape when the brake is "off." A Collar should be placed on the axle between the boss of the Face Plate and the inside face of the Boiler End, to prevent these two parts from touching as the wheel revolves. When in use in a model motor lorry the Plate is fixed to the spring.

No. 15. Spontan Transmission Gear

Most Meccano users are familiar with the ordinary three speed and reverse gear-box fitted to some motor cars, but there are a number of other very ingenious gear-changing devices now in use on motor vehicles that are not so well known. An example of these is the Spontan Transmission Gear, a Meccano model of which is shown in Fig. 15.

A car fitted with Spontan Gear requires only one control in addition to the steering wheel and emergency hand brake. This takes the form of a foot pedal with a metal loop or strap into which the foot is inserted, so that the pedal can be depressed or raised at the will of the driver. Depression of the pedal releases the brakes, engages the clutch and accelerates the engine, causing the car to gradually pick up speed. The pressure on the pedal governs the speed of the car, which is stopped by raising it to the neutral position, thus reversing the operations just mentioned.

To engage reverse gear, the pedal is raised from the neutral position and then pushed downward again. This causes the vehicle to start backward, the speed being governed once again by the pressure on the pedal, the gear ratio between the engine and the rear wheels being adjusted automatically as in the case of the forward drive. To re-engage the forward gear the pedal is once more raised above the neutral position, and the car starts forward when it is pressed down again. An outstanding point in favour of the mechanism is that no skill is required for operating the foot pedal, which requires no delicate movement, and thus enables even a very inexperienced driver to control the car without difficulty.

The operation of the mechanism will be best understood by referring to the illustrations of the Meccano model shown in Figs. 15 and 15A. The upper illustration shows the different components before assembling. The working parts are housed in a frame consisting of two $7\frac{1}{2}$" Angle Girders, between which are bolted four $4\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strips and a $4\frac{1}{2}" \times 2\frac{1}{2}"$ Flat Plate. These form bearings for the driving shaft 1, the intermediate shaft 2 (Fig. 15A) and the driven shaft 3. The Rod 1 carries a 4" Circular Plate that is bolted to a Bush Wheel and fitted with two 1" Screwed Rods 4 each held firmly in place by two Nuts screwed tightly against the Plate. The $3\frac{1}{2}$" Rod 2 is journalled in the Flat Plate, and also in the boss of the inner Bush Wheel bolted to the Circular Plate on the Rod 3.

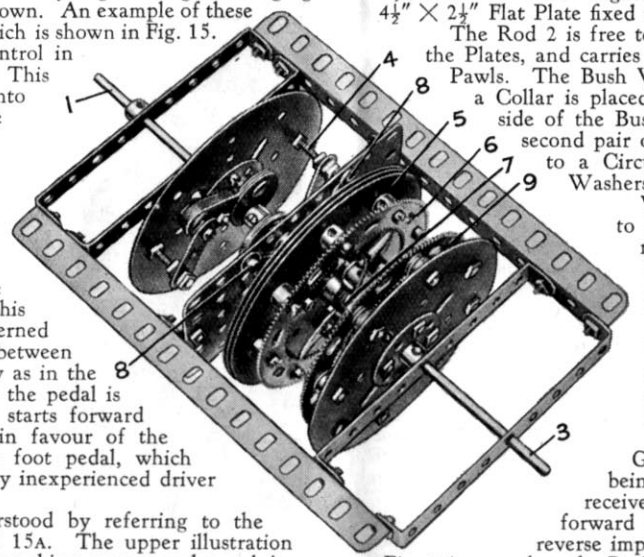


Fig. 15

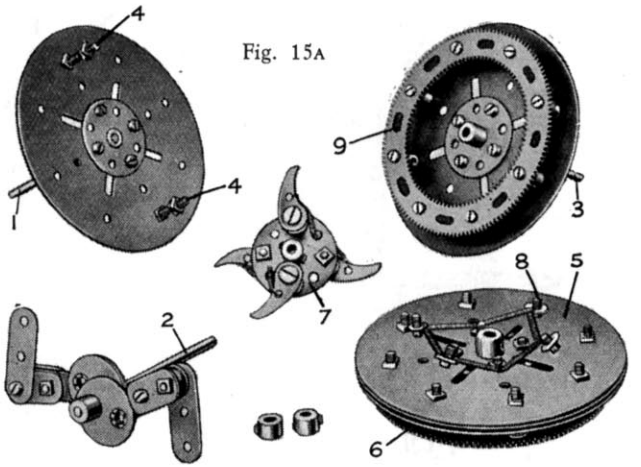


Fig. 15A

The end of the Rod 2 carries two Single Throw Eccentrics mounted with the bosses facing outward and in directly opposite positions. The strap of each Eccentric is fitted with a weight made up of a number of Flat Brackets. The actual number used will depend upon the maximum speed of the driven shaft, and they are pivotally connected by means of $1\frac{1}{2}$" Strips to the Screwed Rods 4 on the driving Plate. The flywheel or "pendulum wheel" 5 is built up by placing the bosses of Bush Wheels through the centre holes of two 4" Circular Plates, the two Plates then being mounted with the Bush Wheels inward on each side of a third Plate, and fixed by eight $\frac{3}{4}$" Bolts on the shanks of each of which are two Washers, one between each Plate. The same Bolts hold the Gear Ring 6, which is spaced from the Plate by a Collar and Washer on each Bolt. To the rear of the flywheel so formed lengths of Spring Cord are fitted, being attached by Bolts 8 to the $4\frac{1}{2}" \times 2\frac{1}{2}"$ Flat Plate fixed to the frame.

The Rod 2 is free to rotate in the bosses of the two Bush Wheels mounted between the Plates, and carries the Bush Wheel 7, which is fitted with four Pivot Bolts carrying Pawls. The Bush Wheel is spaced from the flywheel 5 by means of Washers, and a Collar is placed between the wheel 5 and the Flat Plate. The Pawls on one side of the Bush Wheel engage the inside teeth of the Gear Ring 6, and the second pair of Pawls engage the teeth inside the Gear Ring 9, which is fixed to a Circular Plate by eight $\frac{1}{2}$" Bolts each bearing a Collar and two Washers for spacing purposes.

When the Rod 1 is rotated slowly, the connecting links attached to the Rods 4 cause the bob weights on the Eccentric straps to rotate round the Eccentrics. These unbalanced weights tend to turn the Eccentrics first in one direction and then in the other, the impulses increasing in intensity as the engine speed increases. This alternate to-and-fro motion is transmitted through the Rod 2 to the Bush Wheel 7, and backward rotation is damped out by the action of the Pawls on the flywheel 5, which is prevented from rotating by the Spring Cord. The spring-mounted wheel tends to smooth out the drive, and the reaction of the springs by which it is held assists the forward motion.

The second set of Pawls on the Bush Wheel 7 rotate the Gear Ring 9, thus causing the car to travel forward, the tendency being for the car to free-wheel on the backward stroke until it receives another forward impulse. As the car picks up speed the forward impulses act on the Eccentrics for a longer period, and the reverse impulses are proportionately reduced. Eventually a stage is reached when the Rod 2 rotates uniformly with the driving shaft.

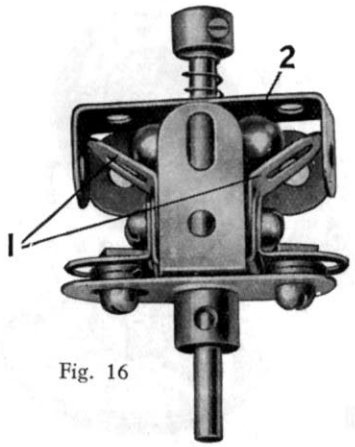
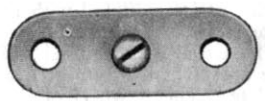


Fig. 16



No. 16. Centrifugal Speed Governor

The novel type of governor shown in Fig. 16 has been designed specially for incorporation in a model gramophone. An efficient means of controlling the speed of the motor is probably the most important point to be considered when designing the power unit for a gramophone, as the turntable must be rotated at a constant speed, usually 78 r.p.m. The governor described here is particularly useful on account of its compactness.

Two Angle Brackets are fixed to a Double Arm Crank and are spaced apart by Washers. Between the Angle Brackets a Double Bracket and two Flat Brackets 1 are placed, and the Flat Brackets are bent slightly and are held by the same Bolts that fix the Double Brackets in place. The shorter arm of a 1" × ½" Angle Bracket is pushed under the Double Bracket at each side, and the Rod in the boss of the Crank is pushed through to hold the Brackets in position. A 1½" Strip is attached to each side Bracket, but in Fig. 16 one of these is shown removed to reveal the position of two Steel Balls. When the Balls are in their places, the 1½" × ½" Double Angle Strip 2 is passed over the end of the Rod and is held by a Compression Spring.

When the governor is stationary the Steel Balls occupy the position shown, but as it rotates, centrifugal force causes the Balls to move outward, and as they move up the inclines formed by the Flat Brackets 1 they raise the Double Angle Strip 2. As the speed increases the Balls continue to fly outward until their movement is checked by the arms of the Double Angle Strip. The 1½" Strips at the side of the governor serve the dual purpose of keeping the Balls in position and of preventing the Double Angle Strip from rotating independently of the governor. To control the speed, the Double Angle Strip is pressed downward by means of a Strip or other suitable part, which should be arranged so that its position can be varied by operating a Screwed Rod.

Another method of regulating the movement of the Double Angle Strip is to place a Bush Wheel face downward under the Compression Spring on the governor shaft, and insert a short screwed Rod in its boss. A Nut should be placed in position to hold the Rod firmly in the boss, and care should be taken to see that it does not grip the Axle, as this must revolve freely in the Wheel. The end of the Screwed Rod should be screwed into the longitudinal bore of a Threaded Boss. The position of the Wheel can be controlled by a further Screwed Rod placed parallel to the governor shaft, and inserted in the transverse hole of the Threaded Boss. Different ranges of speeds can be obtained by using two or more Compression Springs.

No. 17. Intermittent Drive

Automatic machines frequently require a mechanism that causes certain parts to operate intermittently instead of continuously. The most widely used form of intermittent drive is probably pawl and ratchet gearing, but there are many other forms, almost all of which can be reproduced in Meccano. A simple method of obtaining an idle period for a driven shaft during every revolution of the driving shaft is to cut away a section of the driving gear. As the wheel rotates the teeth alternately engage and disengage the driven gear. In actual practice there would be a tendency for the teeth to be damaged, and the mechanism illustrated in Fig. 17 shows an ingenious method of obviating this.

The driving shaft 1 carries a Bush Wheel to which two Rack Segments are firmly secured. The Rod is extended beyond the Bush Wheel, and a 1½" Strip is passed over the end and held in position by a Collar. The Strip is spaced from the Wheel by a Washer to allow for the thickness of the Rack Segment 3 connected to the end hole of the Strip. It will be seen that the Rack Segment is free to swing, but it is normally held in the position shown by a length of Spring Cord attached to the Bolt passed through the 1½" Strip.

When rotated in an anti-clockwise direction, the Segments 2 transmit a positive drive to the Gear 5, but as soon as the teeth of the Segment 3 engage the Gear, the Gear remains stationary, although the driving shaft continues to rotate. The Rack Segments 2 move round with the driving Rod and strike the Rack Segment 3, which is then forced to drive the Gear 5. The Spring Cord returns the Segment 3 to its former position as soon as its teeth cease to be in engagement with the Gear 5.

It should be remembered that the force exerted by the Spring Cord must not exceed the resistance offered by the Gear 5, as this will cause the Gear Wheel to rotate rather than to move the Rack Segment.

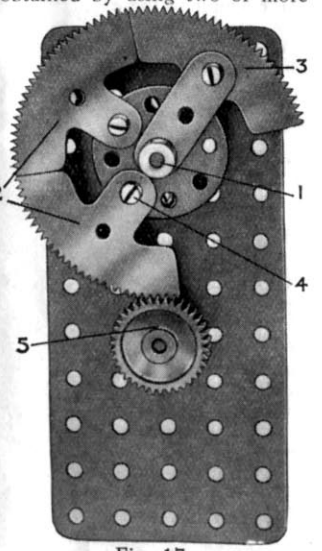


Fig. 17

No. 18. Reverse Drive

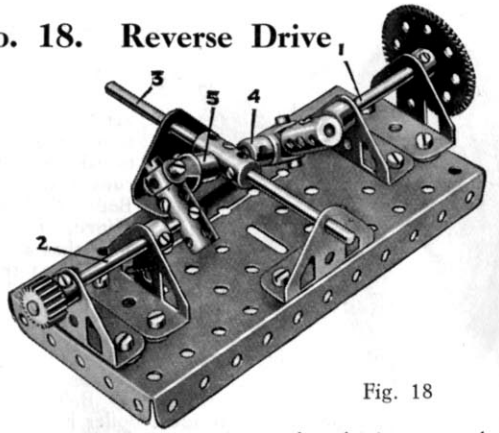


Fig. 18

This is an ingenious device for driving two shafts, arranged in line, so that they revolve in opposite directions. The mechanism is primarily intended as a demonstration model and is not of much practical value, but it is included here because it should provide model-builders with ideas for further experiment.

Fig. 18 shows the details of the mechanism, and it will be noted that the actual reverse drive is obtained without the use of gears. The driven Rod 1 bears a Collar and a Coupling mounted on the end of the Rod by its centre transverse hole. The driven Rod 2 is provided with a Coupling similarly mounted, and both Rods are journalled in Trunnions spaced from the base plate by two Washers on each fixing Bolt. The Washers raise the mechanism slightly and prevent it from fouling the base plate. Two further Trunnions provide bearings for the transverse unit 3 formed by fixing two 2" Rods in a Coupling, through the centre of which is a 1½" Rod. At each end of this short Rod the forks of Swivel Bearings 4 and 5 are free to slide, and their "spiders" are pivotally attached by means of ¾" Bolts to the Couplings on the driving and driven shafts. The final drive is taken from the ½" Pinion on the Rod 2. This completes the constructional details, and if all the moving parts are well oiled and adjusted to work freely, the device will give a silent drive with very little vibration.

In making the necessary adjustments it is important to ensure that the transverse unit 3 slides perfectly easily in its bearings, otherwise the mechanism will not work smoothly. Owing to the number of sliding pieces that are incorporated in this device its mechanical efficiency is rather low, but in most cases where this driving gear can be used this defect is outweighed by the convenience of the mechanism. The applications of this unique drive unfortunately are limited to some extent by the large amount of space that is necessary to accommodate it.

In addition to using the mechanism for reversing the direction of rotation of the two shafts, use might also be made of the movement of the sliding shaft 3, which moves to and fro as the shafts revolve.

No. 19. Combination Safe Door Lock

A great deal of ingenuity has been expended in perfecting the various types of locks now in common use, and some of the mechanisms devised for safeguarding valuables make splendid subjects for Meccano models. There are many kinds of locks, ranging from the simple bolt and spring arrangement to the massive combination locks used on the safes installed at banks.

The modern combination lock is a very intricate and ingeniously arranged mechanism, and it forms a most formidable barrier to unauthorised intruders. Fig. 19 shows a Meccano model combination safe door lock that can be put to many useful purposes. With the aid of the illustrations and the following description no one should find any difficulty in constructing the device successfully. In Fig. 19 the lock forms part of a complete safe door, and when properly constructed and carefully adjusted it is absolutely fool-proof. Only one dial is necessary for obtaining the combination, and a second knob 2 is used for withdrawing the bolts. The handle 3 is provided for opening the door, but this in no way controls the mechanism of the lock. The construction of the safe door and frame is clear from the illustrations (see Figs. 19 and 19B).

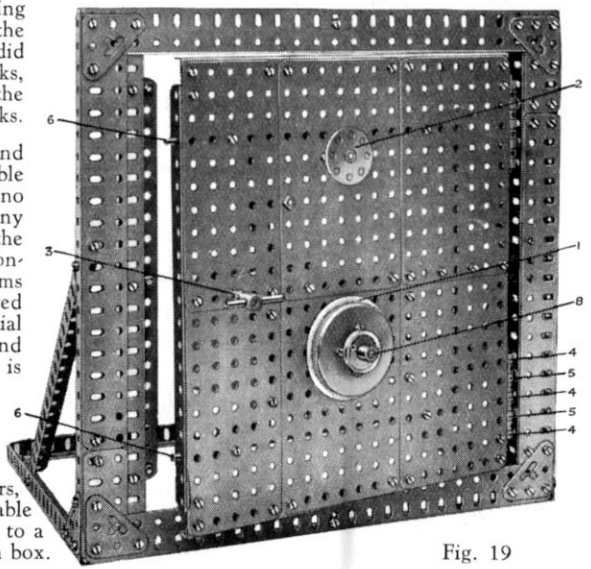


Fig. 19

The frame is built from Angle Girders and Flat Girders, and the safe is built round this. If insufficient parts are available for the complete safe, this may be made of sheet metal bolted to a framework of Angle Girders, or may even consist of a wooden box.

The door and frame need not be of the same size as shown, and should be built to suit individual requirements. The Collars 4 are fixed to the door and the Collars 5 to the frame. They are held in place by Bolts inserted in their tapped holes and spaced from the Angle Girders by Washers. Each Bolt also carries a Washer beneath its head. A 2½" Rod is firmly held by Grub Screws in the Collars 4, but is free to turn in the others.

The bolts 6 can be seen projecting slightly in Fig. 19 and their arrangement is shown in Fig. 19B. Two 8" Axle Rods form the bolts and are connected across their ends by a further 8" Rod. The Rods 6 slide in Angle Brackets spaced from the door by Washers, and it is important that the Angle Brackets should be in line with the holes in the Angle Girders, so that the Rods slide freely. The Rod 7 is journalled in the boss of a Double Arm Crank and carries the Bush Wheel 2 (Fig. 19) and a ½" Pinion that engages with a Worm on the upper bolt.

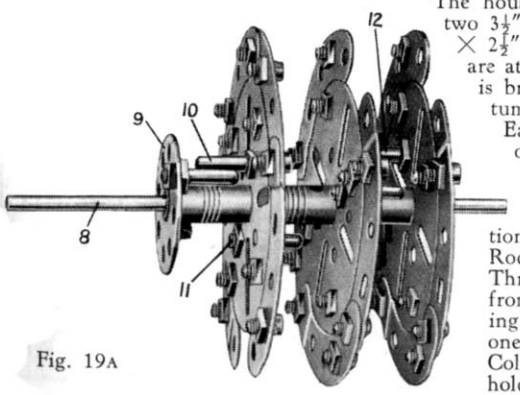


Fig. 19A

The housing for the tumblers is made from two 3½" × 2½" Flanged Plates and one 4½" × 2½" Flat Plate. Two 3½" Angle Girders are attached to the sides, and the structure is braced by 1½" Corner Brackets. The tumblers are shown removed in Fig. 19A. Each consists of a Face Plate loose on the Rod and bearing four 2½" Curved Strips fixed in place by Flat Brackets. A gap is left in each set of Strips as shown in the illustration. The Bush Wheel 9 is fixed to the Rod and is fitted with a Threaded Pin. Three Washers space the Bush Wheel from the first Face Plate, and the remaining Plates are each spaced apart by one Collar and four Washers. A Collar placed behind the end Face Plate holds them all in position. Two of the Face Plates are provided with two Threaded Pins, each placed as shown at 10 and 11, but the third Plate has only one Threaded Pin 12. The Rod 8 passes through the safe door and is fitted with a Face Plate 1 (Fig. 19) to which a piece of paper carrying numbers is glued. A Wheel Flange is bolted to the Face Plate, and a 1" Pulley on the end of the Rod provides a handy knob.

The 4½" Rod 13 is fixed in a Double Arm Crank bolted to the safe door, and on it is a Boss Bell Crank that is loose on the Rod and is retained in position by a Collar. Six 2½" Strips 14 are fixed between the arm of the Bell Crank and a Crank at the other end of the Rod, by means of 1" × 1" Angle Brackets. Two 2½" Strips 15 are fixed to the Bell Crank and carry a Threaded Boss. When the Strips 14 are in the raised position the bolts cannot be withdrawn on account of the Threaded Boss and the Rod 16. As soon as the tumblers are arranged with all the gaps in the Curved Strips in line immediately beneath the Strips 14, the latter drop into place, and the Threaded Boss on the Strips 15 no longer prevents the bolts from being shot back. A 1" Screwed Rod stops the Strips 15 from moving back too far, so that by turning the dial again the Strips 14 are raised. Pendulum Connections are arranged to bear on each set of Curved Strips and serve as brakes.

To find the combination the following procedure should be adopted. The dial should be turned until all the Threaded Pins on the Face Plates are engaged, and the reading noted when the gap in the third tumbler takes up its correct position. The reading should be taken against a certain hole in one of the Plates, the omission of a pointer making it more difficult for the safe to be opened in the event of the would-be safe-breaker finding out the combination. When the first reading has been obtained the dial should be turned in the reverse direction for two complete turns, and the reading noted when the second tumbler is correctly placed. Then the dial should be turned in the original direction for one complete turn and then rotated slowly until all three tumblers are correctly arranged for the Strips 14 to drop.

Two different combinations may be taken, according to the direction of rotation of the dial. For instance, if turned clockwise first, the combination might be 3321515. By writing it this way it would be difficult for a person finding the figures to open the safe, but to the one who knows, they would mean that the first dial reading is 33 after turning the knob several times in a clockwise direction. It is then necessary to give two complete turns in the opposite direction and continue turning until a reading of 15 is obtained. Again reverse the direction of rotation for one complete turn, and the final reading of 5 is taken before the knob 2 can be turned and the safe opened. By first turning the dial anti-clockwise a combination such as 22222133 may be obtained. This means 22 first reading, two turns clockwise, 22 second reading, one turn anti-clockwise, and 33 third reading. From these figures it will be seen that the possibilities of the safe being opened by an uninitiated person are very remote. A safe built on these lines can be put to many uses.

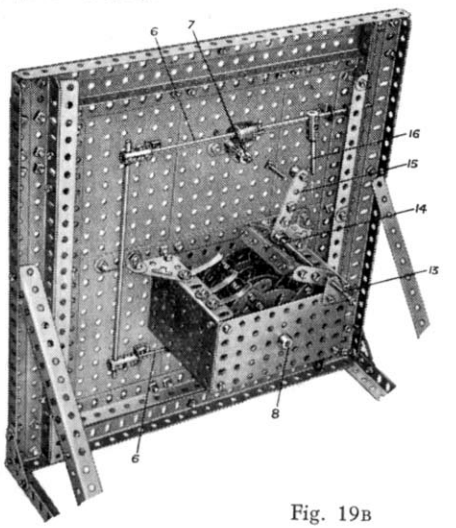


Fig. 19B

No. 20. A Compact Three-speed Gear-box

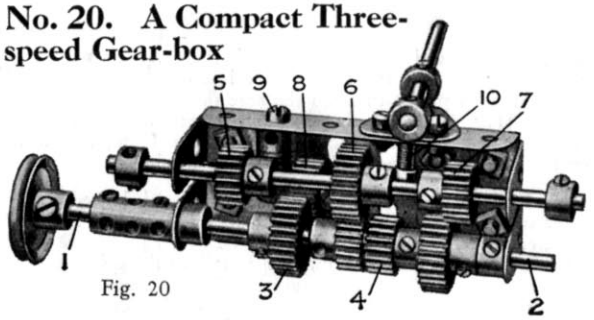


Fig. 20

The frame is made by securing two 3" Angle Girders to a Flat Girder and then fixing two 1" × 1" Angle Brackets at each end of the channel girder so formed. The Brackets are each spaced from the Angle Girders by means of a Flat Bracket, this being necessary to enable the Pinions 3 and 8 to mesh correctly. The driving shaft 1, which consists of two Rods held together by a Coupling, carries a 1" Pulley forming one of the clutch members, and also a ¾" Pinion 3 and a ½" Pinion.

The end of the Rod 1 is inserted in the bore of the ½" Pinion 4 on a Rod 2, from which the final drive is taken. The latter Rod carries also a ¾" Pinion and a Collar. The sliding layshaft is a 4½" Rod on which are a ½" Pinion 5, a ¾" Pinion 6 and a ½" Pinion 7, and its movement is limited by the Collars. A ½" Pinion 8 is mounted on a ¾" Bolt screwed into the transverse bore of a Threaded Boss and locked by means of a Grub Screw screwed into the opposite end of the bore. The Threaded Boss is attached to the gear-box frame by a ½" Bolt 9.

The movement of the sliding shaft is controlled by a ⅜" Bolt 10 that fits between the bosses of the Pinions 6 and 7. The Bolt is fixed in a Collar on the end of the gear change lever. The lever is pivoted to a 1" Triangular Plate by a further Collar held in place by its Grub Screw, and carrying a Bolt whose shank passes through one of the holes in the Triangular Plate. The Bolt is locked in position by a Nut to allow the Rod to pivot freely.

In Fig. 20, first forward speed is in engagement, the drive passing through the ½" Pinion on the driving shaft 1 to the ¾" Pinion 6 on the layshaft. The ½" Pinion 7 engages the ¾" Pinion on the driven shaft so that there are two stages of reduction gearing between driving and driven Rods. When the layshaft is slid to the right the Pinion 7 disengages, but Pinion 6 remains in engagement with its ½" Pinion and at the same time meshes with Pinion 4. This gives a straight through drive. Further movement of the sliding Rod brings into engagement Pinions 3 and 5, and 6 and 4, in this case providing two step-up stages for top gear. Reverse gear is obtained when the Rod is moved over to the extreme left, when the drive goes through Pinions 3 and 8, which are in constant mesh, to Pinion 6, and Pinion 7 engages the ¾" Pinion.

No. 21. An Ingenious Quick-Return Motion

In actual practice large numbers of machines incorporate some form of quick-return motion, and it is therefore natural that a mechanism of this kind is frequently of use in Meccano model-building. In such cases an oscillating lever is generally employed, and an Eye Piece pivotally attached to a rotating wheel slides up and down the lever as it swings to and fro. The speed of movement of the lever depends upon the position of the Eye Piece in relation to the pivot.

A novel variation of this device is shown in Fig. 21. The driving shaft 1 is journalled in two 2½" Triangular Plates fixed in the slotted holes of 2½" Angle Girders, which are spaced from the base plate by two Washers on each securing Bolt. The bearings for the driven Rod 2 are formed by 2" Strips held in Trunnions. The two sets of bearings should be so arranged that the centres of the Rods are exactly ½" apart, and it is essential that the Rods should be in perfect alignment. Two Face Plates 3 are secured on the Rod 1 and spaced apart about ⅜", with the slots in each Plate directly opposite. The Face Plates 4 are mounted in a similar manner on the Rod 2, and a 1½" Rod 5 is passed through slots in each pair of wheels. Five ½" loose Pulleys are arranged on the Rod as shown, and a Collar on each end holds the Rod in position.

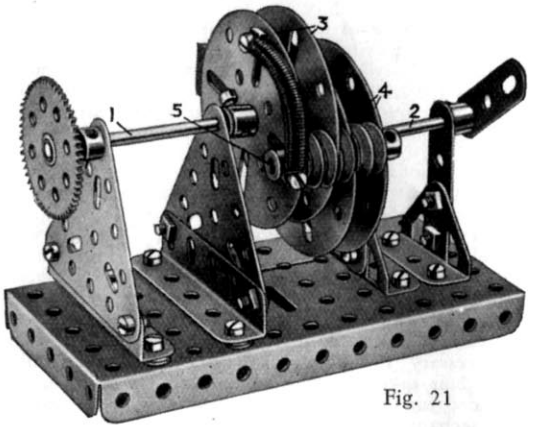


Fig. 21

The drive from the Rod 1 passes through the Face Plates to the Rod 2 by means of the Rod 5. This Rod slides up and down in the slots so that in its lowest position it is at the lower ends of the slots in the Face Plates 3, and at the upper ends of the slots in the Face Plates 4. Thus the Rod 2 rotates faster than the Rod 1, but as the Plates move round the increase in speed is gradually reduced, and in the opposite position the difference in the speed of the two Rods is reversed.

No. 22. Variable Speed Gear

The ingenious variable speed gear shown in Fig. 22, is based on the principle of the differential gear that forms such an important part of the transmission system of a motor car. If the gear described here is compared with the Meccano differential gear (S.M. 251) it will be seen that the two mechanisms are very similar. The Pulley Wheels 4 and 5 take the place of the road wheels of a car, but are not secured to the shaft 2.

The drive is taken up by the 2½" Gear Wheel 1 on a 2" Rod journalled in a Double Bent Strip and a Double Arm Crank. A 4" Circular Plate is fixed to a Bush Wheel on the end of the Rod, and drives two 1½" Pulleys fitted with Dunlop Tyres 4 and 5. The Pulleys are held in Socket Couplings, the inner ends of which carry ⅞" Bevel Wheels. A "spider" 3 taken from a Swivel Bearing or Universal Coupling is fixed on the 8" Rod 2 and carries two Pivot Bolts. These Pivot Bolts are locked in place by Nuts and each bears a ⅞" Bevel Wheel, which is spaced from the Nut by two Washers. Collars retain the Socket Coupling units in position, but should allow a little play between the Bevel Wheels to ensure free movement.

The Rod 2 is slidable, its movement being controlled by the Bush Wheel 8 on the end of a 3½" Screwed Rod. This Rod is threaded through the boss of a fixed Threaded Crank and bears a Coupling that is held in position by lock-nuts on each side. The Coupling is also passed over the end of the Rod 2 and is held between the ½" diam., ¾" face Pinion 6 and a Collar. The Pinion 6 engages a similar Pinion on the Rod of the Pinion 7, which supplies the final drive.

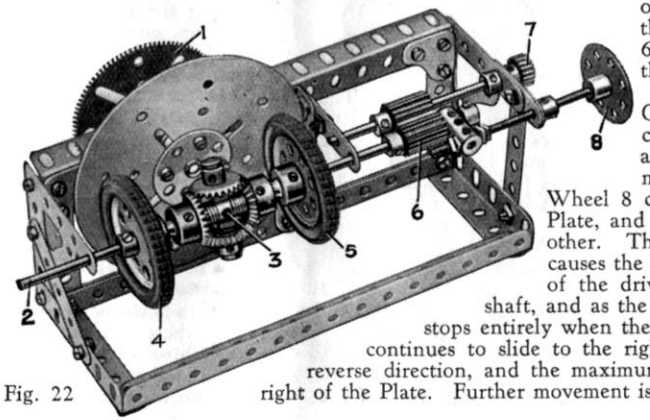


Fig. 22

The Pulleys 4 and 5 are caused to rotate by the 4" Circular Plate, and the drive is taken from the "spider" carrying the idle Bevel Gears. When the Wheels 4 and 5 are at equal distances from the centre of the Plate, no movement at all is conveyed to the Rod 2. Rotation of the Wheel 8 causes the differential unit to slide across the face of the Plate, and the Wheel farther from the centre rotates faster than the other. The differential makes up for the difference in speed, and causes the Rod 2 to rotate. When the Wheel 4 is at the extreme left of the driving plate the maximum speed is attained by the driven shaft, and as the wheels slide over to the right the shaft 2 slows down and stops entirely when the central position is reached by the differential unit. As it continues to slide to the right the shaft 2 slowly rotates again, but this time in the reverse direction, and the maximum speed is attained when the Wheel 5 is at the extreme right of the Plate. Further movement is prevented by the right hand bearing.

Opportunities to Win Prizes with Your Models

Every Meccano boy likes to build models from his own ideas, and there are very few who do not prefer this method to merely copying the models described in the various Instruction Manuals. These boys have splendid opportunities to win valuable prizes in the special competitions that are announced each month in the *Meccano Magazine*. In addition to the prospect of winning a prize, these contests afford the Meccano boy a chance of measuring his model-building ability with that of his fellows in all parts of the world.

Complete information concerning the prizes and the types of models to be submitted in each competition is given in the Magazine. There are no entrance fees to pay, and special entry forms are not required. The contests are open to every owner of a Meccano Outfit, living in any part of the world, no matter what his or her age may be, and owing to the special conditions under which the contests are organised every competitor stands an equal chance of winning the biggest prize. Each competitor's age is taken into consideration in judging the models.

How to Enter the Competitions

When a new model is completed the next step is to decide for which contest it is best suited. Full details of the current competition and the kind of models eligible for entry will be found each month in the *Meccano Magazine*. The model itself must not be sent; a good photograph or a drawing is all that is required. If the model is very intricate a short description of the mechanism may be advisable. This should be enclosed with the photograph or drawing and addressed to "Meccano Model-Building Contest," Meccano Ltd., Binns Road, Liverpool 13.

A model will not win a prize unless it is new. That is to say, a competitor must not copy models from the Meccano Instruction Manuals, or any other Meccano publication.

On this and the following three pages we illustrate a number of models that won prizes in recent competitions. It must not be thought that because the models shown here are big and complicated that a simple model will not win a prize in the competitions. That is not the case. A simple well-built model receives just the same consideration as the most intricate structure submitted. The large models shown here are chosen for illustration only because we think that they are the most interesting to constructors generally.

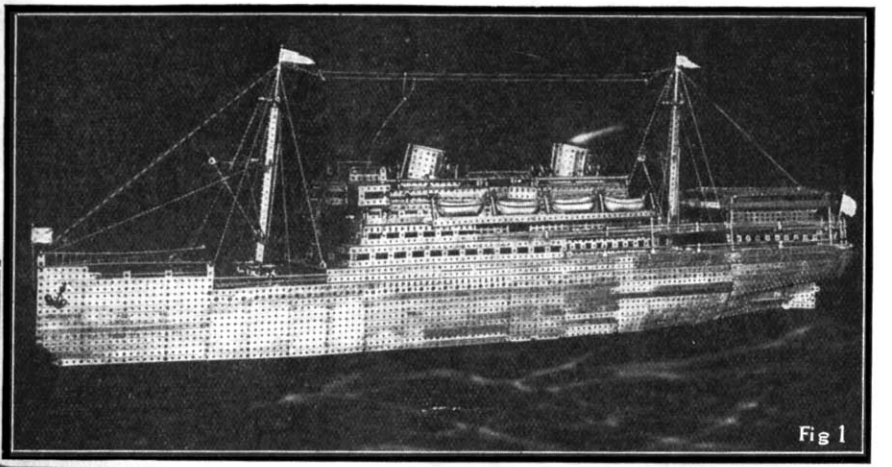


Fig 1

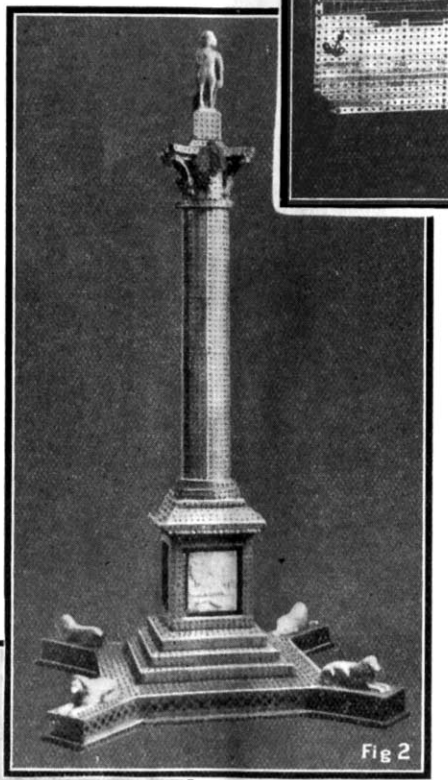


Fig 2

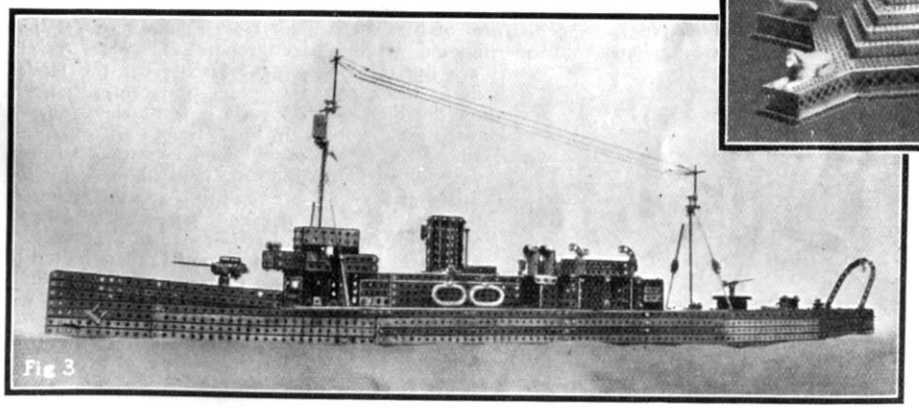


Fig 3

No. 1. An Atlantic Passenger Liner

The fine model Atlantic liner shown in Fig. 1 was built by J. Willems, of Antwerp, and won a prize in a *Meccano Magazine* model-building competition.

Willems has attempted to reproduce in miniature the magnificence of actual vessels of this type, and his efforts have been distinctly successful. Particularly good work has been done in the construction of the masts, rigging and funnels, and the result is both neat and realistic. The lower parts of the masts are box girders made by bolting Angle Girders together, and the upper parts are Rods. Angle Girders have been skilfully used in making the decks, and short Strips for the stanchions. The solid appearance of the superstructure and the finely shaped stern are other outstanding features of the model.

No. 2. The Nelson Column in Meccano

The model of the Nelson Column shown in Fig. 2 is the work of Mr. L. W. Grey, Cowes, I.O.W. The proportions of this famous monument have been well preserved in the model, and the manner in which the construction of the delicate moulding of the capital is carried out is evidence of the care and trouble the builder has taken in his work. The base of the model is 19½ in. square and the overall height is more than 5 ft. The base of the plinth is 7½ in. square.

No. 3. A Realistic Model of H.M.S. "Newark"

The prototype of the model illustrated in Fig. 3 is a minesweeper of the "Hunt" class. The actual vessel is propelled by vertical triple-expansion engines, which develop 2,200 h.p. and propel the boat at a speed of 16 knots.

The model was built by C. J. and M. D. Keats, of London, S.E.21, and among its many features are miniature 4 in. guns, searchlights and minesweeping gear. The deck equipment includes a winch, forward and after capstans, anchors and cables, chain leads and cable stoppers.

The model shows several novel uses for Meccano parts, among which the use of Meccano Dunlop Tyres for the rafts, and Couplings fitted with 1" Rods for anchors, are of interest. For the davits, Curved Strips are used, and a Sleeve Piece represents the crow's nest.

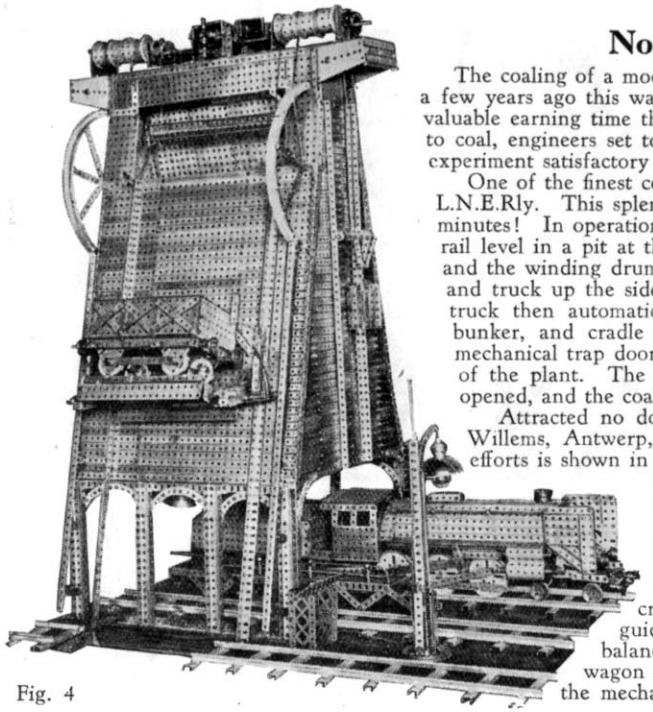


Fig. 4

No. 4. Locomotive Coaling Plant

The coaling of a modern railway engine involves a tremendous amount of work, and until a few years ago this was nearly all done by manual labour. In order to avoid the waste of valuable earning time that occurred when engines were held up for hours waiting their turn to coal, engineers set to work to devise some mechanical means of coaling, and after much experiment satisfactory machines were produced.

One of the finest coaling plants now working in this country is that at Doncaster on the L.N.E.Rly. This splendid installation is capable of coaling the "*Flying Scotsman*" in three minutes! In operation, the loaded coal trucks are run one at a time on to a cradle lying at rail level in a pit at the bottom of an inclined elevator. The truck is secured in position, and the winding drums at the top of the tower are then set in motion and hoist the cradle and truck up the side of the tower until it reaches a hopper opening near the top. The truck then automatically cants over, its contents are tipped into a hopper or storage bunker, and cradle and truck then descend to rail level. The hopper is fitted with mechanical trap doors, controlled from a central switchboard installed in a hut at the base of the plant. The engine to be fuelled is run beneath the hopper, the trap doors are opened, and the coal falls into the engine tender.

Attracted no doubt by the mechanical perfection and massiveness of this plant, J. Willems, Antwerp, decided to build a model of it in Meccano, and the result of his efforts is shown in Fig. 4. The model is a very close copy of the original in practically every detail, but the power house, which is an imposing feature of the actual machine, has been removed to expose the winding drums.

All the operations of the actual plant are carried out faithfully in the model. The motive power for the hoisting drums is an Electric Motor mounted on the top of the tower, and the drive is transmitted to the drums through suitable reduction gearing. The wagon cradle is hoisted by cords, and is balanced by weights running on guide rails up the sides of the tower. In the actual machine the balance weights compensate for the weight of the cradle and wagon and half the load, and they form a very important part of the mechanism.

No. 5. A Realistic Model 4—6—4 Tank Locomotive

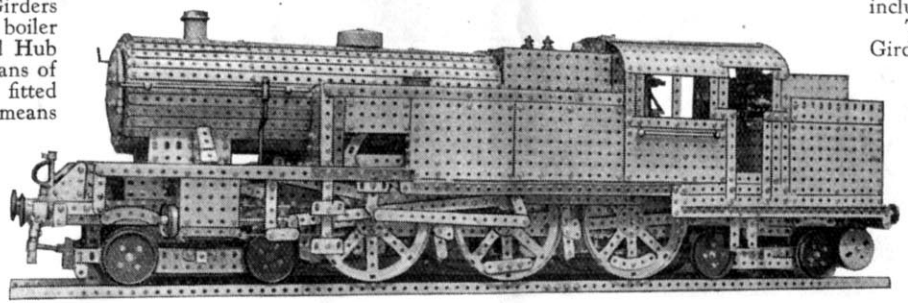
Fig. 5 shows a model of a "Baltic" type tank locomotive by Mr. S. Croft-Grey, Edinburgh. A glance at the illustration will reveal several constructional details that should be helpful to model-builders interested in this kind of work.

One of the many good points of the model is to be found in the construction of the cylinders, of which there are four, one pair being mounted slightly in advance of the other. The model is driven by a 6-volt Electric Motor carried in the tender, and the drive is transmitted through a three-speed gear-box and connecting rods to a built-up crankshaft, on which the driving wheels are mounted. A gear-box is not included, of course, in the equipment of an actual steam-driven locomotive, but it is very useful in a model of this kind, as it enables considerable loads to be hauled while allowing the speed of the Motor to be kept as high as possible.

The model is fitted with Walschaerts' valve gear, which, in conjunction with the handrails, steps, buffers and vacuum pipes, makes the model look very realistic and workmanlike. The brake shoes are 1" Triangular Plates, and the brakes are applied and withdrawn by means of Rods operated from the cab.

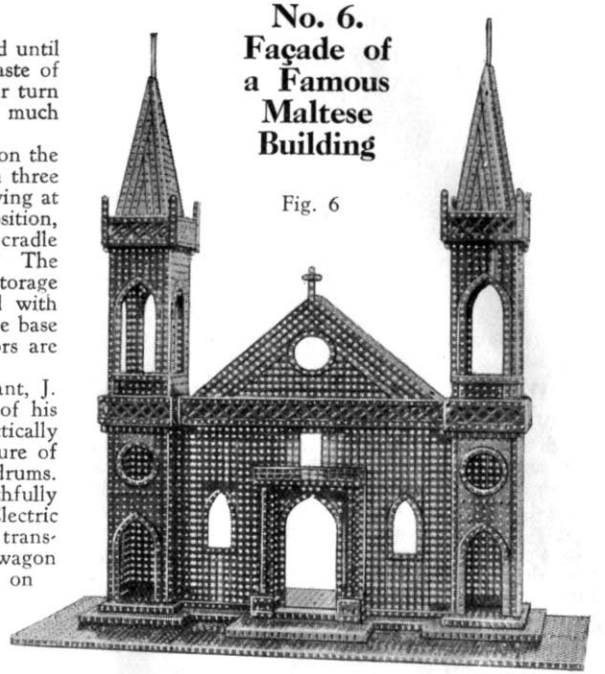
The chassis of the model is made almost entirely of Angle Girders, braced by further Angle Girders and filled in at the front with Plates. The boiler consists of a number of Strips bolted round Hub Discs and held in place on the chassis by means of Screwed Rods. The bogies, each of which is fitted with four wheels, are fully articulated, which means that they are free to move vertically as well as horizontally. Flat Plates are used throughout in the construction of the water tanks, cab and coal bunker, and owing to the care with which they are placed together they look very neat and contribute greatly to the fine appearance of the model.

Fig. 5



No. 6. Façade of a Famous Maltese Building

Fig. 6



The fine architectural model shown in Fig. 6 is in strong contrast to the other models illustrated on this page. It was built by E. Cauchi, Sliema, Malta, and is a fine example of the manner in which model-builders can give expression to their artistic abilities with the aid of Meccano parts.

The base of the model consists of a frame of Angle Girders 40" in length and 5½" wide, which is covered with Flat Plates. The Plates are supported by a central longitudinal girder running across the frame. A second platform or base plate, built from similar parts, is then superimposed on the base proper. The two towers, which are the most prominent features of the model, are built in three dimensions, but the central portion including the doorway is merely a front elevation.

The towers are built up on a framework of Angle Girders, and Strips of various lengths are used to form the walls. Curved Strips, held in place by the Strips of the wall, are used to shape the arches of the window frames. The balconies are represented by Angle Girders fastened to the structure by Angle Brackets, and Braced Girders bolted to the Angle Girders form the railings. The railings of the balcony over the main archway are composed of Windmill Sails.

The towers are capped by spires, the construction of which is praiseworthy, and the sides of the towers are filled in with Strips.

Model No. 7. Horizontal Steam Engine and Boiler

The model steam engine and boiler shown in Fig. 7 is the work of J. Matthews, Fillongley, Coventry. The construction is neat throughout and a wealth of detail enhances the realism of the model without making it clumsy or badly proportioned. The boiler and grate in particular are worthy of notice, for they are splendid examples of careful workmanship. The long Strips from which the boiler is built are very well suited for this purpose, and the ladder leaning against the boiler provides a finishing touch of realism. Many model-builders overlook small points that appear to be unimportant, but very often it is the minor details that give a model the finished appearance so essential to success in a competition.

The base of the model consists essentially of a rigid framework of Angle Girders, filled in on top with Flat Girders and Strips, and at the sides with Braced Girders. At one corner a flight of steps is provided leading up to the boiler fire-box. The fire-box is composed of Plates and Strips, and supports the boiler. The longitudinal Strips of the boiler are bolted round the rims of Hub Discs, and Ball Races (Part No. 168a) form the boiler ends. A Rod fitted with Pulley Wheels represents the safety valve.

A steam pipe made up of Strips, Curved Strips, and Angle Girders connects the boiler to the engine and represents the asbestos-covered steam main of an actual engine. The engine end of the pipe terminates in the cylinder block, which is built from Plates, and contains two low pressure and two high pressure cylinders. The manner in which the remainder of the model is built differs from that usually found in model engines. The webs of the cranks are each built up from two 3½" Strips, bolted in some cases to Bush Wheels and in others to Double Arm Cranks, which are fixed on the ends of the shafts. Strips are used also for building up the connecting rods, which, as may be seen in Fig. 7, take the form of beams, and for building the bearing blocks for the crankshaft.

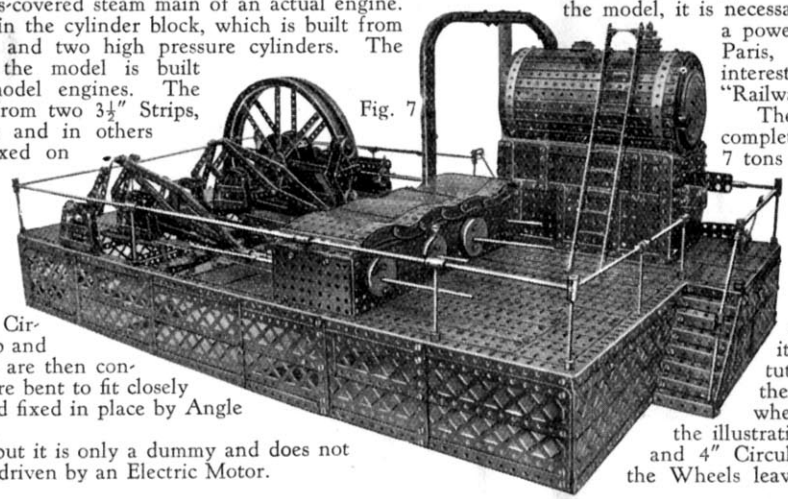


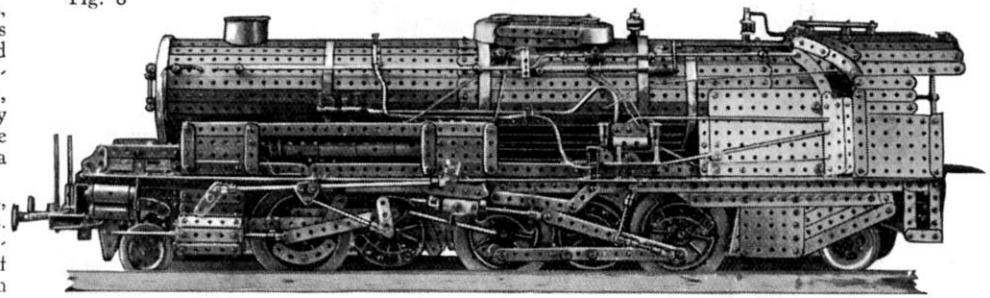
Fig. 7

The flywheel consists of two sections, each of which is made from a Circular Strip, with a Face Plate for the hub and Strips for the spokes. The two sections are then connected together by Flat Girders, which are bent to fit closely round the rims of the Circular Strips and fixed in place by Angle Brackets.

A centrifugal governor is provided, but it is only a dummy and does not control the speed of the model, which is driven by an Electric Motor.

No. 8. 2—10—2 Freight Locomotive

Fig. 8



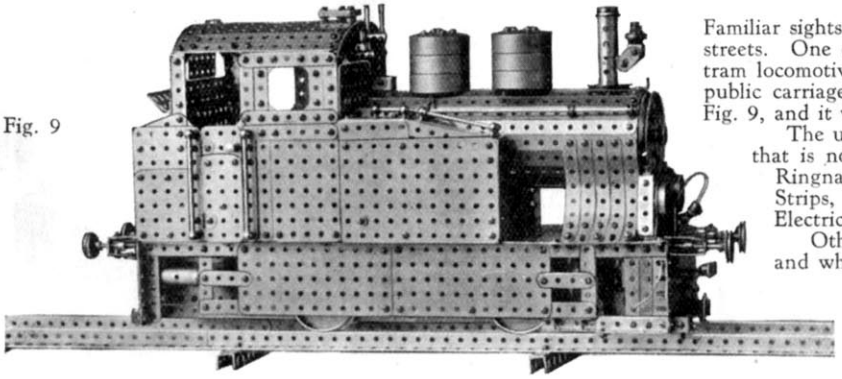
The model locomotive shown in Fig. 8 was built by J. Ringnalda, of Leeuwarden, Holland. To appreciate fully the skilful work that has been done in the construction of the model, it is necessary to compare it with an illustration of the actual engine, which is a powerful 2—10—2 freight locomotive designed by R. Vallantin for the Paris, Lyons and Mediterranean Railway. Model-builders may be interested to know that an illustration of this locomotive appeared in the "Railway News" section of the November 1932 *Meccano Magazine*.

The actual locomotive embodies many novel features, and weighs, in complete running order, approximately 120 tons. The tender carries about 7 tons of coal and 6,160 gallons of water, and loaded weighs 61½ tons.

A pleasing feature of the model is that good proportion has been preserved in spite of the complicated nature of the valve gear and driving units. The faithful manner in which the steam and feed pipes, which are such conspicuous details of the engine, have been copied from the original is a fine testimonial to the builder's skill, and is evidence also of the ease with which Meccano parts can be adapted to fill all kinds of rôles. For the steam pipes either straight Rods or Crank Handles have been used, but where it was necessary to reproduce sharp curves, Spring Cord was substituted to avoid bending Rods. The builder's choice of parts for the various portions of the model generally is good, but the driving wheels could have been made more realistic. It will be seen from the illustration that the wheels are made from a combination of artillery wheels and 4" Circular Plates. Unfortunately this is not a very wise combination, as the Wheels leave too large a flange, which spoils the appearance of the model.

No. 9. Dutch Tram Locomotive

Fig. 9



Familiar sights to the citizens of some Dutch towns are the quaint locomotives used for hauling tram cars through the streets. One of these interesting engines formed the subject of a model built recently by J. Ringnalda. The actual tram locomotives are of the tank type, and store their coal in the rear of the cab. Apart from their use for hauling public carriages they are used also at pits and quarries for drawing the trucks. Ringnalda's model is illustrated in Fig. 9, and it will be seen that at the front and rear are fitted guards that reach to within a few inches of the ground.

The use of Boiler Ends for the steam domes, and Couplings for the funnel, provide the sharp contrast in sizes that is noticeable between these parts in the actual engine. Instead of attempting to construct a large model, Ringnalda concentrated on building a small, neat one, and this enabled him to make good use of Plates and Strips, which account for the very effective appearance of the model. The locomotive is driven by a Meccano Electric Motor fitted inside the body, and the drive is transmitted to the wheels through suitable reduction gearing.

Other interesting details in the construction of the model are to be found in the vacuum pipes, safety valve and whistle fixed on the front of the cab, the small imitation lamp attached to the funnel, and the headlamps. The vacuum pipes are represented by lengths of Spring Cord held in place by End Bearings.

Current for operating the model is taken from the centre rail of a three-rail track, and the outer rails form the return conductor. The model could, with very little alteration, be arranged for Clockwork Motor drive.

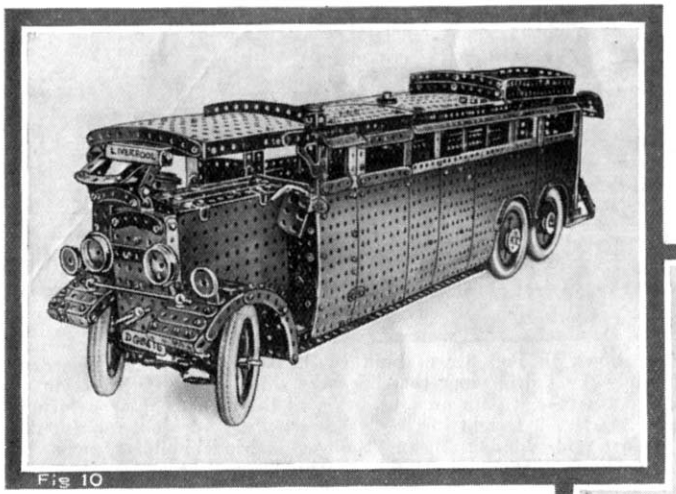


Fig 10

No. 10. Motor Omnibus

The model shown in Fig. 10 represents one of the big motor coaches now so popular for long-distance passenger travel. It was built by A. Jones, Gloucester. The model is built approximately to scale, and the chassis is complete in almost every essential detail. Among the mechanical items of interest are a gear-box and a differential for each of the two rear driving axles. Ackermann steering is fitted to the front wheels, and both front and rear wheels are independently sprung.

Among the many fittings included in the equipment of the model are headlamps and side-lights made from Flanged Wheels and 1″ fast Pulleys respectively, a bonnet that can be opened, and a luggage container built from Flat Girders and Curved Strips.

The destination plate is made of a small piece of cardboard held between two $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips, and the windscreen consists of two 2″ Strips connected by a $2\frac{1}{2}''$ Curved Strip. A 1″ fast Pulley attached to the side of the cab by means of a $\frac{3}{4}''$ Bolt, which is secured in its tapped bore, makes a realistic observation mirror.

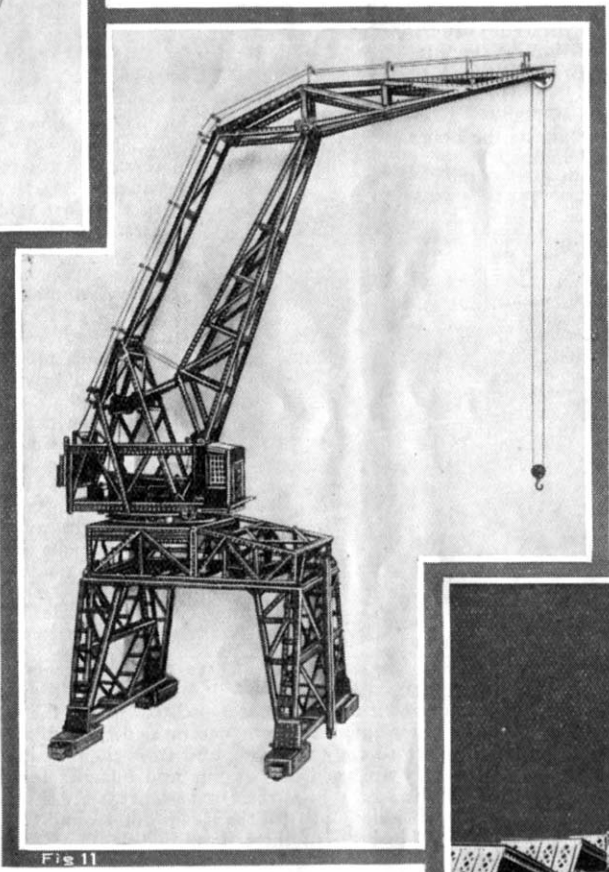


Fig 11

Model No. 11. Level-Luffing Crane

The giant model crane shown in Fig. 11 is the work of F. Van Bulck, Brussels, Belgium and is a very close copy of a "Demag" level-luffing crane. The model is fitted with all the mechanism necessary to enable it to carry out the operations of the actual crane, and is driven by a Meccano Electric Motor that works in a power house built on top of the travelling gantry. The power house forms the base of the complex jib structure, and is mounted on a Roller Bearing. The jib consists of two parts, a stout beam that forms the lower portion, and a sturdy upper part that is pivoted to the top of the lower portion and carries the hoisting pulley. The rear end of the top jib is pivotally attached to a frame of Strips, which forms a link to prevent the jib from falling, and also plays an important part in the level-luffing system.

The lower portion of the jib is pivotally mounted on the top of the power house, and by means of Threaded Bosses is connected to two Screwed Rods. The Threaded Bosses are screwed on to the Rods, the lower ends of which bear Gears that are driven by the Motor; and the result of the arrangement is that when the Motor is set in motion the Screwed Rods rotate and move up and down in the Threaded Bosses, thus raising or lowering the jib as required. By means of the pivoted upper jib and the linking gear, a parallel movement approximating to level-luffing is obtained, so that the load hook remains at a constant height from the ground when the jib is luffed.

Models of this type offer plenty of scope for model-builders to incorporate ideas of their own. Although a large assortment of parts is necessary to build the more elaborate types of cranes, there is much that can be done with only small Outfits, and provided that a suitable prototype is chosen, good results can be obtained even by inexperienced model-builders.

No. 12. Model Dock with Ships, Bridge and Warehouses

The fine collection of models shown in Fig. 12 represents a busy dock scene, and includes a great amount of interesting detail work. The vertical lift bridge that forms the imposing centre-piece is driven by means of an Electric Motor, and the span can be raised or lowered as in an actual bridge. At each end of the span are two Flanged Wheels, which run on guide rails fitted to the inner vertical faces of the end towers. Cords attached to the span pass over Pulleys at the top of the towers, and thence to winding drums operated by the Electric Motor. In the photograph the bridge is shown raised to allow shipping to pass into the dock.

The two quays are made entirely from Angle Girders and Plates, the Angle Girders being used to build the framework. A small tug has just entered the dock with a barge in tow, and is shown moored to the quay wall. Both the tug and the barge are well constructed, and are in strong contrast to the stately liner lying at the other side of the dock. Much care has been taken in the construction of the liner, and a great deal of detail is included, among which are winches and rigging. The winches each consist of two 1″ Gear Wheels and two large Flanged Wheels mounted on a Rod, which is held in a $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip. The models were built and arranged by J. Willems, Antwerp.

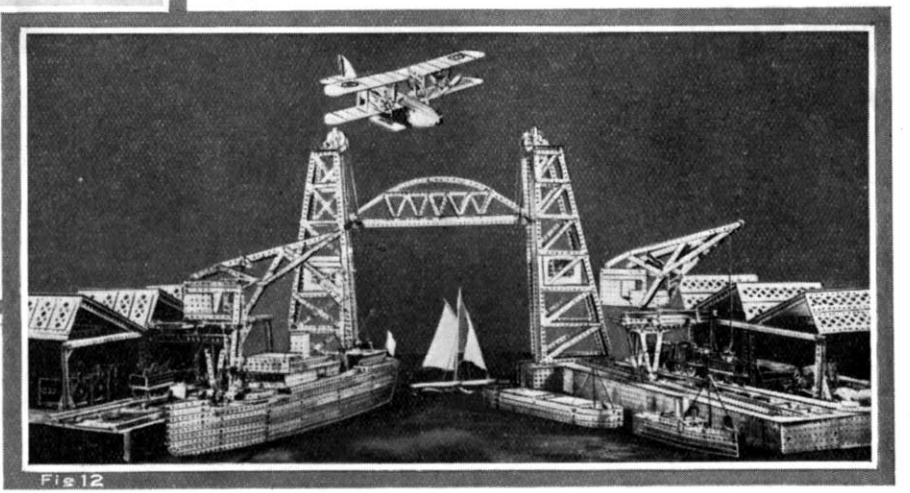
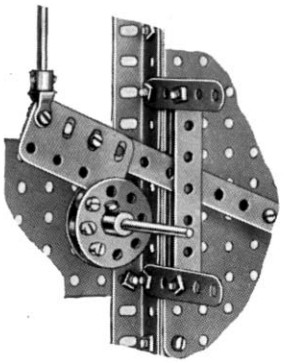


Fig 12

USES FOR MECCANO PARTS



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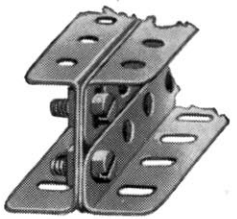

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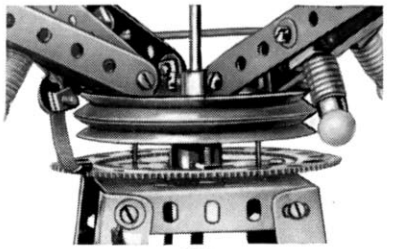

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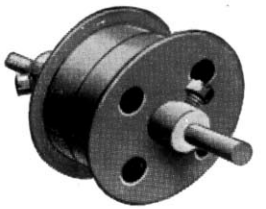

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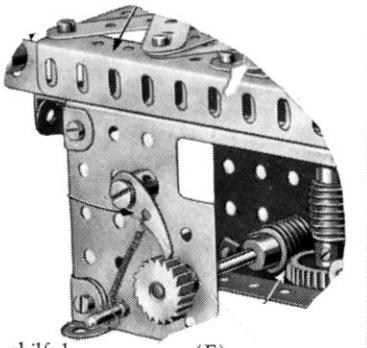
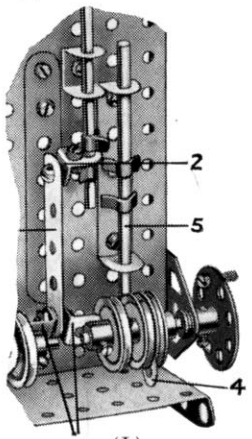


(E)

The prize-winning models included in this book have been successful in our competitions largely through the skilful manner in which Meccano parts have been used. The illustrations on this page show a few typical uses for some of the parts, and the examples will no doubt suggest many other purposes that these parts may be made to serve. Briefly, the following are the chief points of merit in the examples shown :



(L)

(A) A cam suitable for use in various mechanisms can be made by passing three Bolts through two Bush Wheels as shown. Washers should be placed on the shanks of the Bolts to form the contact surface of the cam.

(B) A Flat Girder may be used to form the web of an I-shaped girder.

(C) Although the Gear Ring (Part No. 180) is primarily intended for reproducing epicyclic gearing, it has other uses. In the illustration here it is employed as a slip ring for collecting electric current in a model roundabout. The Gear Ring is insulated from the model by means of 6 BA Bolts and Bushes, and a Pendulum Connection (Part No. 172), which is also insulated from the model, serves as the pick-up or collector.

(D) A serviceable belt pulley or brake drum may be made by mounting two Flanged Wheels together on a Rod as shown.

(E) Ratchet and Pawl Mechanism can be used to operate the feed movement of the tool head in a model machine tool. The Pawl is retained in engagement with the Ratchet by a spring made from a piece of Spring Cord.

(F) Flat Brackets fixed in the slit of a Strip Coupling provide an excellent wing-bolt.

(G) One of the wheels of a model locomotive, which consists of a 6″ Circular Plate with a Hub Disc bolted to it to form the flange.

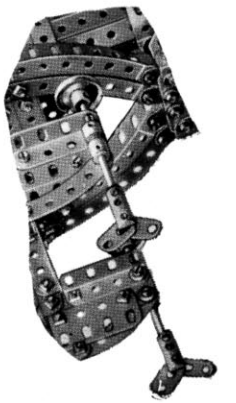
(H) Rotary motion is most easily converted into reciprocating motion by means of an Eccentric. In the illustration the Eccentric is driven by turning the handle, which is formed from a Crank and a Threaded Pin.

(I) A Spring (Part No. 43) makes an admirable vacuum pipe for a model locomotive.

(J) Two Sector Plates used to form the movable receptacle in a Meccano model of a foundry ladle.

(K) A section of a model locomotive, the bogie wheels of which each consist of a Wheel Flange bolted to a Face Plate.

(L) In this example Spring Clips are used to mount a Rod so that it may be moved up and down but not rotated in its bearings. The Clips ride against the Plate and prevent the Rod from turning.



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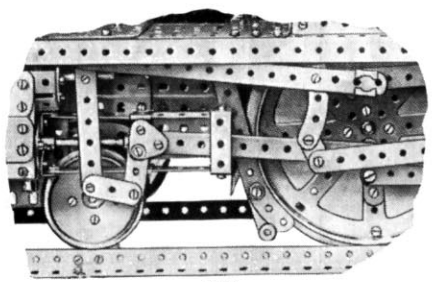

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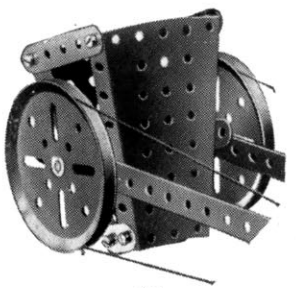

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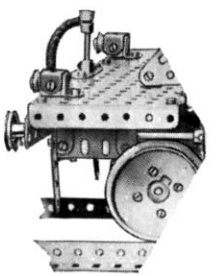

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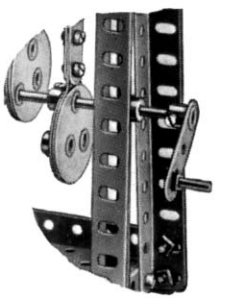

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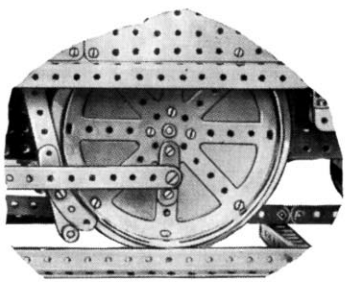

(G)

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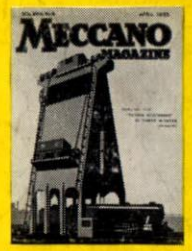

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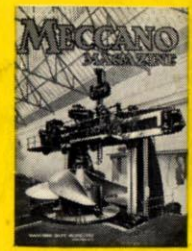

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