

# MECCANO

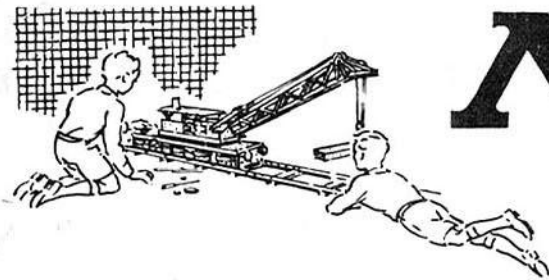


INSTRUCTIONS for OUTFIT No. 9

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BINNS ROAD, LIVERPOOL 13, ENGLAND

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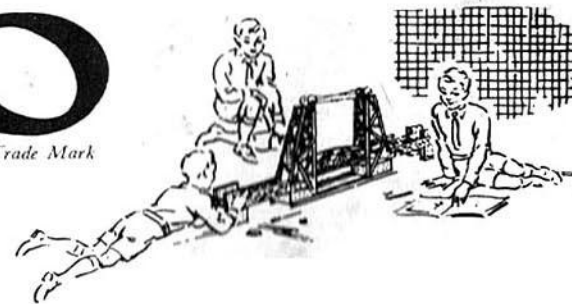




# MECCANO

Registered Trade Mark

*The World's Greatest Constructional Toy*



## MODEL-BUILDING WITH MECCANO

There is no limit to the number of models that can be built with Meccano — Cranes, Clocks, Motor Cars, Aeroplanes, Machine Tools, Locomotives — in fact everything that interests boys. A screwdriver and a spanner, both of which are provided in each complete Outfit, are the only tools necessary.

When you have built all the models illustrated in the Books of Instructions the fun is not over, it is just beginning. Now comes the chance to make use of your own ideas. First of all, re-build some of the models with small changes in construction that may occur to you; then try building models entirely of your own design. In doing this you will enjoy the real thrill of the engineer and the inventor.

## HOW TO BUILD UP YOUR OUTFIT

Meccano is sold in 12 different Outfits, ranging from No. OO to No. 10. Each Outfit can be converted into the next larger one by the purchase of an Accessory Outfit. Thus Meccano No. OO Outfit can be converted into No. O Outfit by adding to it a No. OOa Accessory Outfit. No. Oa Outfit would then convert it into a No. 1 and so on. In this way, no matter with which Outfit you begin, you can build it up by degrees until you have a complete No. 10 Outfit.

All Meccano parts are of the same high quality and finish, but the larger Outfits contain a greater quantity and variety, making possible the construction of more elaborate models.

## THE 'MECCANO MAGAZINE'

The 'Meccano Magazine' is published specially for Meccano boys. Every month it describes and illustrates new Meccano models, and deals with suggestions from readers for new Meccano parts and for new methods of using the existing parts.

There are model-building competitions specially planned to give an equal chance to the owners of small and large Outfits. In addition, there are splendid articles on such subjects as Railways, Famous Engineers and Inventors, Electricity, Bridges, Cranes and Aeroplanes, and special sections dealing with the latest Engineering, Aviation, Motoring

and Shipping News. Other pages deal with Stamp Collecting, and Books of interest to boys; and a feature of outstanding popularity is the section devoted to short articles from readers.

Write to the Editor, The Meccano Magazine, Binns Road, Liverpool 13, for particulars and a specimen copy. You can order the Magazine from your Meccano dealer, or from any newsagent.

## THE MECCANO GUILD

Every owner of a Meccano Outfit should join the Meccano Guild. This is a world-wide organisation, started at the request of Meccano boys. Its primary object is to bring boys together and to make them feel that they are all members of a great brotherhood, each trying to help others to get the very best out of life. Its members are in constant touch with Headquarters, giving news of their activities and being guided in their hobbies and interests. A leaflet containing full particulars of the Guild and an application form is included in this Book.

Clubs founded and established under the guidance of the Guild Secretary provide Meccano boys with opportunities of enjoying to the utmost the fun of model-building. Each has its Leader, Secretary, Treasurer and other officials. With the exception of the Leader, all the officials are boys, and as far as possible the proceedings of the clubs are conducted by boys.

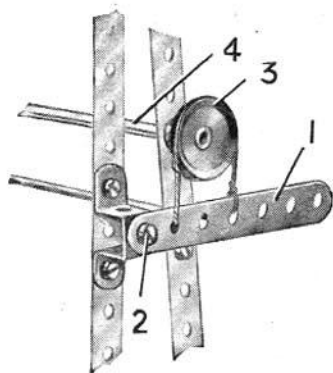
## MECCANO SERVICE

The service of Meccano does not end with selling an Outfit and a Book of Instructions. If ever you are in any difficulty with your models, or if you want advice on anything connected with this great hobby, write to us. We receive hundreds of interesting letters from boys in all parts of the world, and each of these is answered personally and promptly by one of our staff of experts.

Whatever your problem may be, write to us about it. We shall be delighted to help you in any way possible. Address your letters to *Information Service*.

Here are a few simple and interesting movements showing how easily real mechanisms can be reproduced with Meccano.

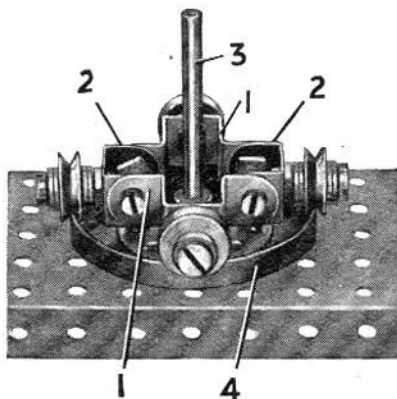
### USEFUL BAND BRAKE



S.M.111. The brake lever consists of a  $3\frac{1}{2}$ " Strip 1, pivotally attached at a suitable point on the frame of the model, to be fitted, by means of a lock-nutted  $\frac{3}{8}$ " Bolt 2. The driven shaft 4 is fitted at one end with a 1" fast Pulley 3 round which a short length of cord is passed. The two ends of this Cord are secured to the brake lever at the points shown in the illustration.

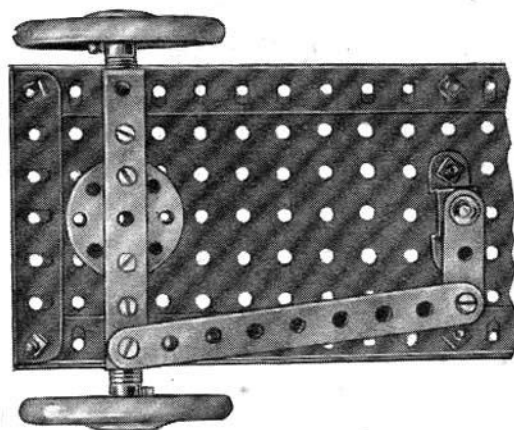
If increased braking effect is desired a larger Pulley may be used in place of the 1" fast Pulley 3, the brake lever 1 being attached in a lower position if necessary. Alternatively a weight can be hung from the end of the brake lever.

### BUILT UP ROLLER BEARING



S.M.136. The spider frame is built up from Double Bent Strips 1 connected together by two Double Brackets 2. The four wheels used are represented by  $\frac{1}{2}$ " loose Pulleys journalled on Pivot Bolts secured to the outer ends of the four arms of the frame. Four Washers, two on each side of the Pulleys are passed on to the shank of each of the Pivot Bolts that are attached to the Double Brackets 2. In the case of the other two Pivot Bolts, two Washers are placed against the external side only of the Pulley.

### SIMPLE STEERING GEAR



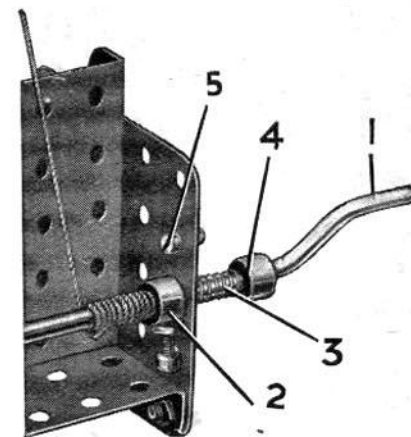
S.M.162. The simple steering gear will be found suitable for most small model vehicles.

In this example the two front wheels are mounted on separate stub axles that are secured to each end of a rigid front axle. The base of the chassis consists of two long Angle Girders connected together at the front end by a  $3\frac{1}{2}$ " Angle Girder and filled in along their length by means of  $5\frac{1}{2}$ "  $\times$   $3\frac{1}{2}$ " Flat Plates.

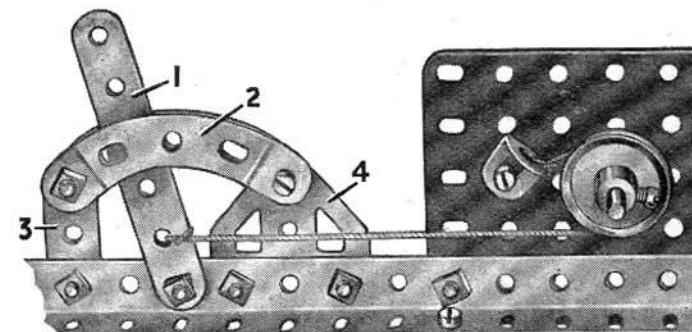
The front axle, a  $3\frac{1}{2}$ "  $\times$   $\frac{1}{2}$ " Double Angle Strip, is pivotally mounted at its centre on a Bush Wheel and short Rod. It is fitted,  $\frac{1}{2}$ " from each end, with a  $\frac{1}{2}$ "  $\times$   $\frac{1}{2}$ " Angle Bracket, this forming the inner bearing for its respective stub axle. The outer bearing for the axle consists of the upturned lug of the Double Angle Strip. One end of this latter part is fitted with a pivotally attached  $4\frac{1}{2}$ " Strip, by means of which the front axle is linked up to a Crank fixed to the steering column.

### SAFETY CATCH FOR CRANE WINDING GEAR

S.M.125. The Compression Spring 3 is mounted on the Crank Handle 1 between the Collar 4 and a Washer, and normally holds the Collar 2 against the inner side of the plate. The Collar 2 is fitted with a  $\frac{3}{8}$ " Bolt, and if the Crank Handle commences to rotate, the head of this Bolt strikes against the stop 5 and prevents further movement.



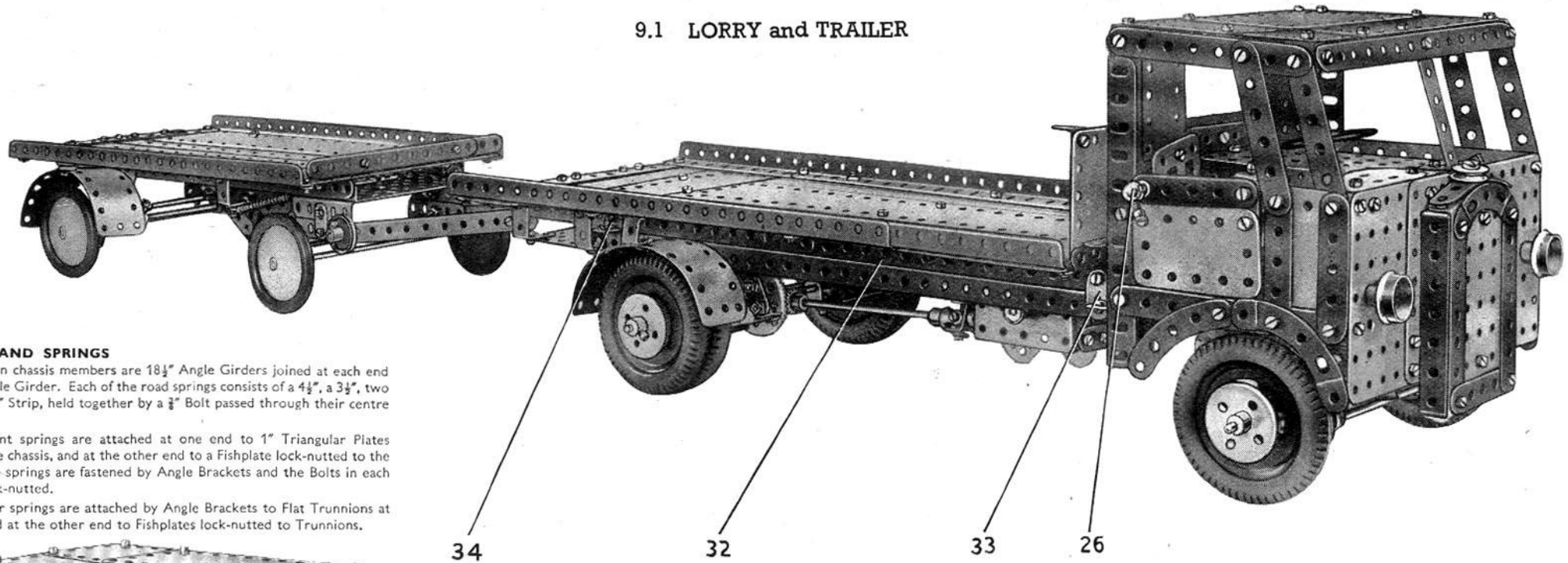
### BRAKE LEVER and QUADRANT



S.M.112. This mechanism is a form of band brake in which the lever 1 can be held in any position by means of the quadrant 2. In this way varying pressures can be applied to the Pulley forming the brake drum.

One end of the brake Cord is attached to a  $\frac{1}{2}$ "  $\times$   $\frac{1}{2}$ " Angle Bracket 4 bolted in a suitable position on the model. After passing round the 1" fast Pulley forming the brake drum the Cord is secured at the next to bottom hole of a 3" Strip 1. This Strip forms the brake lever, and it is secured to the frame of the model by a lock-nutted Bolt.

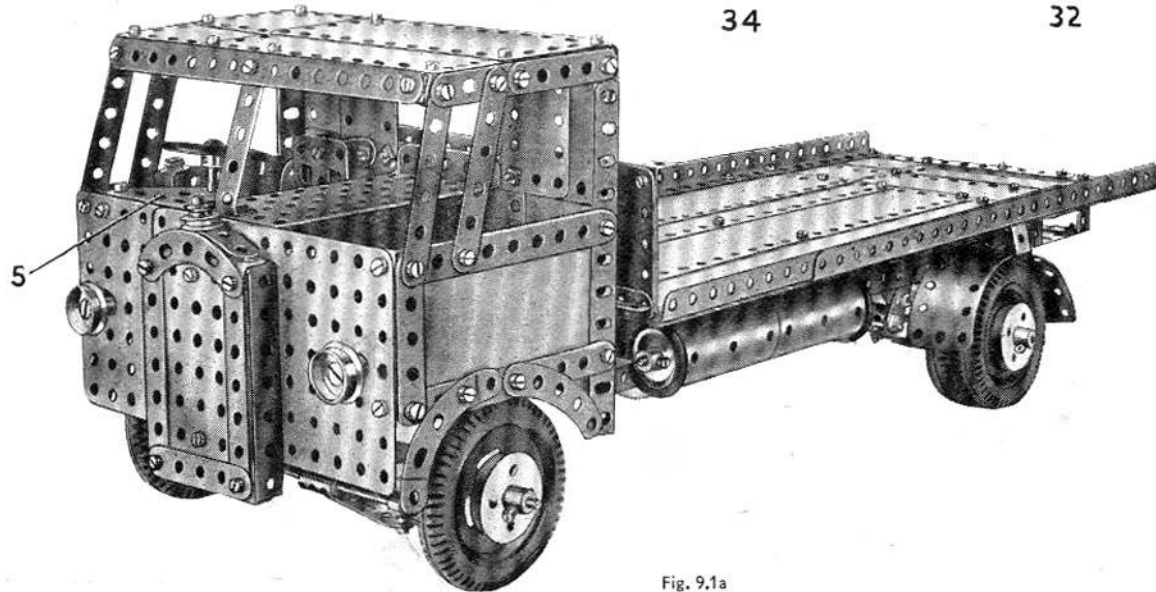
## 9.1 LORRY and TRAILER

**CHASSIS AND SPRINGS**

The main chassis members are  $18\frac{1}{2}$ " Angle Girders joined at each end by a  $5\frac{1}{2}$ " Angle Girder. Each of the road springs consists of a  $4\frac{1}{2}$ ", a  $3\frac{1}{2}$ ", two  $2\frac{1}{2}$ " and a  $1\frac{1}{2}$ " Strip, held together by a  $\frac{3}{8}$ " Bolt passed through their centre holes.

The front springs are attached at one end to 1" Triangular Plates bolted to the chassis, and at the other end to a Fishplate lock-nutted to the chassis. The springs are fastened by Angle Brackets and the Bolts in each case are lock-nutted.

The rear springs are attached by Angle Brackets to Flat Trunnions at one end, and at the other end to Fishplates lock-nutted to Trunnions.

**THE STEERING MECHANISM**

The front axle beam 1 consists of three  $5\frac{1}{2}$ " Strips bolted to the springs. The front wheels are free to turn on  $1\frac{1}{2}$ " Rods fixed in Couplings 2 and 3. A 1" Rod is passed through the end cross bore of each of these Couplings, and the Rods are pivoted in the end holes of the axle beam and in  $\frac{1}{2}$ " Reversed Angle Brackets.

A  $1\frac{1}{2}$ " Rod fixed in the centre hole of each Coupling 2 and 3 is fitted at one end with a Swivel Bearing 4. The Swivel Bearings are linked together by a compound rod consisting of a 4" and a 2" Rod joined by a Coupling.

The Steering Wheel is fixed on a  $3\frac{1}{2}$ " Rod mounted in a Semi-Circular Plate 5 and in one of the chassis members. The Rod is held in position by a Collar and a  $\frac{1}{2}$ " Pulley, and carries at its lower end a  $\frac{1}{2}$ " Pinion 6. The Pinion meshes with a 57-teeth Gear locked on a 2" Rod mounted in a Flat Trunnion 7 and a Trunnion 8. The lower end of this Rod is fitted with a Crank connected to one of the Swivel Bearings 4 by a  $4\frac{1}{2}$ " Strip.

**POWER UNIT**

A No. 1 Clockwork Motor is fixed to the chassis by three Double Brackets in the position shown. A  $\frac{1}{2}$ " Pinion on the Motor driving shaft meshes with a  $1\frac{1}{2}$ " Contrate fixed on  $2\frac{1}{2}$ " Rod 9. This Rod is mounted in two  $4\frac{1}{2}$ " x  $\frac{1}{2}$ " Double Angle Strips 10, and carries a Bush Wheel 11 fitted with two Threaded Pins. The Motor brake lever is extended by a  $2\frac{1}{2}$ " Strip, and the reversing lever by a Curved Strip and a 3" Strip. Both levers project through the rear of the cab.

(Continued on next page)

Fig. 9.1a



The model is fitted with a two-speed gear-box housed in a unit formed by two  $2\frac{1}{2}'' \times 1\frac{1}{2}''$  Flanged Plates joined at each end by a  $1\frac{1}{2}''$  Angle Girder 12 and a  $1\frac{1}{2}''$  Strip 13. A  $4\frac{1}{2}''$  Rod is journaled in the centre holes of the Angle Girders 12, and it carries a Bush Wheel that engages with the Threaded Pins in the Bush Wheel 11. The Rod is also fitted with a  $\frac{3}{4}''$  Pinion 14 and a  $\frac{1}{2}''$  Pinion 15. These are arranged so that they can be meshed with a 50-teeth Gear 16 or a 57-teeth Gear 17 fixed on a  $3\frac{1}{2}''$  Rod 18.

The gears required can be selected by movement of a Crank 19 fixed on a 2½" Rod mounted in the Flanged Plates. This Rod carries a Coupling 20 between the Flanged Plates, and a ½" Bolt 21 is fixed in the Coupling and engages between the Pinions 14 and 15.

The drive from the gear-box is taken through a built-up universal coupling to the rear axle. The built-up coupling is made from a large Fork Piece and a small Fork Piece fitted with a spider taken from one of the Swivel Bearings. The spider is replaced in the Swivel Bearing by an ordinary Collar. A 5" Rod fixed in the universal coupling is free to turn in a Coupling 22 mounted on the rear axle. The 5" Rod is fitted with a  $\frac{1}{2}$ " Bevel Gear 23 that meshes with a  $1\frac{1}{2}$ " Bevel Gear fixed on the rear axle. Washers are used to space the Coupling from the  $1\frac{1}{2}$ " Bevel Gear so that the teeth engage accurately. The rear axle consists of a 5" and a  $3\frac{1}{2}$ " Rod joined by a Coupling and it is mounted in Double Brackets bolted to the rear springs.

The construction of the cab unit is shown in Fig. 9.1f. The Flexible Plates used for the rear panelling are bolted to a 7½" Angle Girder 24 and to a similar Angle Girder that also supports the roof. The door consists of two 2½" x 1½" Flexible Plates overlapped two holes, and it is attached by an Angle Bracket to a Corner Bracket 25. The Bolt is lock-nutted so that the door can be opened or closed easily. It is fitted with a catch formed by a Handrail Support 26; this passes through the door, and a Fishplate is held tightly on the inside by two nuts. This Fishplate engages between a second Fishplate and the Angle Girder 27. The second Fishplate is spaced from the Angle Girder by a Washer. The radiator is attached to the front of the cab by 3" Bolts.

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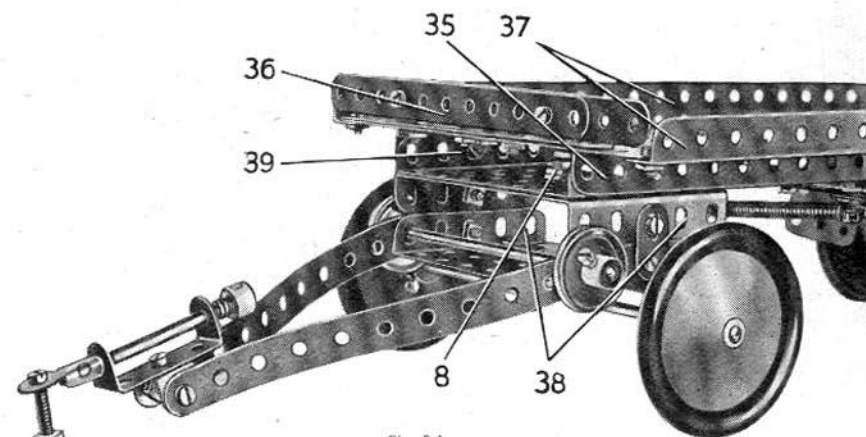


Fig. 9.1c

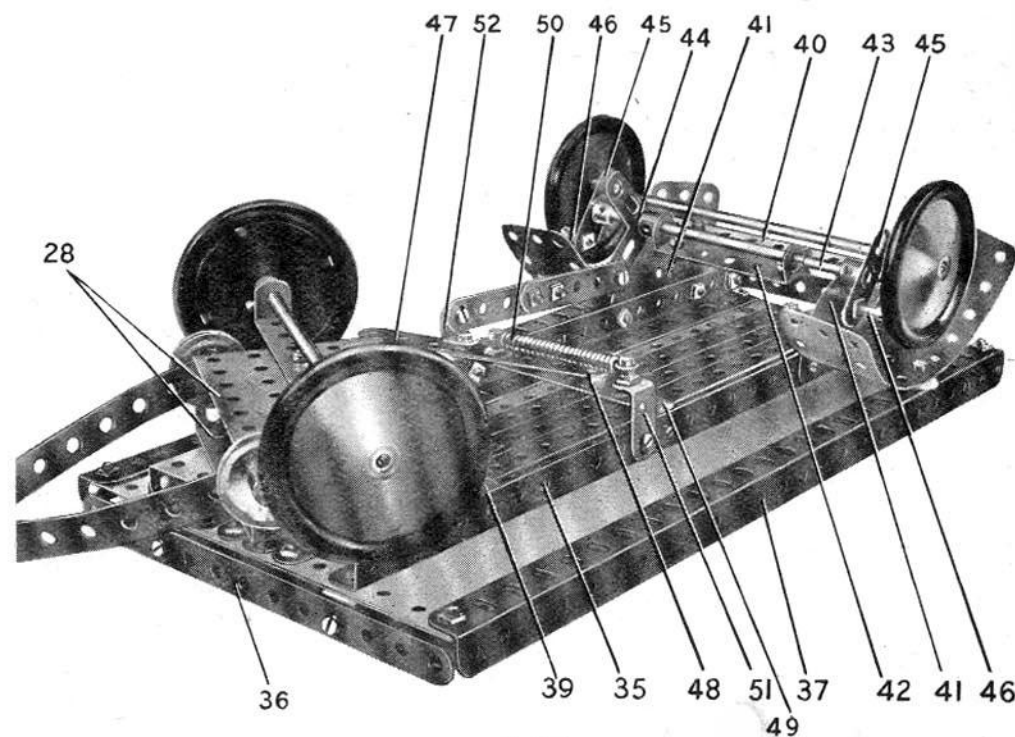


Fig. 9.1d



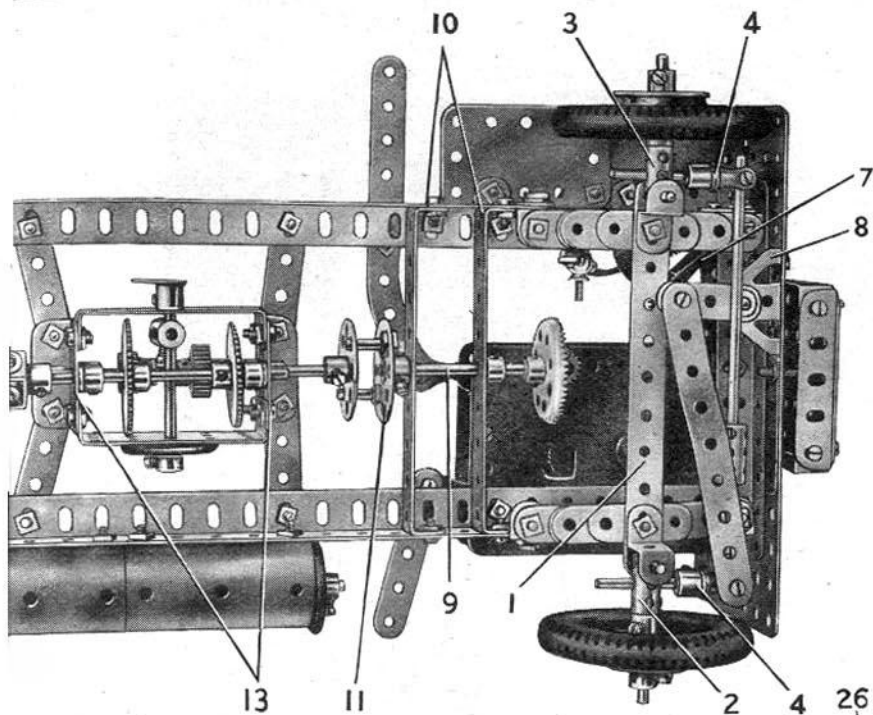


Fig. 9.1c

## 9.1 CAB and RADIATOR—Continued

A gear lever 28 inside the cab consists of a 2" Rod fixed in a Rod and Strip Connector. The Rod and Strip Connector is lock-nutted to an Angle Bracket bolted to the chassis. A Handrail Support 29 on the lever 28 engages between two 3" Contrates 30 fixed on a 6 1/2" Rod 31. The rear end of this Rod is locked in a Collar attached to the Crank 19.

## LOADING PLATFORM

The rails of the loading platform are each formed by two 12 1/2" Angle Girders overlapped 17 holes. These are joined at each end by a compound strip consisting of two 5 1/2" Strips overlapped seven holes, and the platform is filled in by four 12 1/2" x 2 1/2" Strip Plates and four 5 1/2" x 2 1/2" Flexible Plates. It is fitted underneath with two compound girders 32 each consisting of a 12 1/2" and a 9 1/2" Angle Girder overlapped 12 holes. These Angle Girders are attached to the chassis by Fishplates 33 and by Angle Brackets 34.

The loading board at the front of the platform is formed by two 5 1/2" x 2 1/2" Flexible Plates overlapped seven holes, and it is attached to the platform by 2 1/2" x 1/2" Double Angle Strips.

The spare wheel carrier is a 4 1/2" x 2 1/2" Flat Plate attached to the Angle Girders 32 by 1" Angle Brackets.

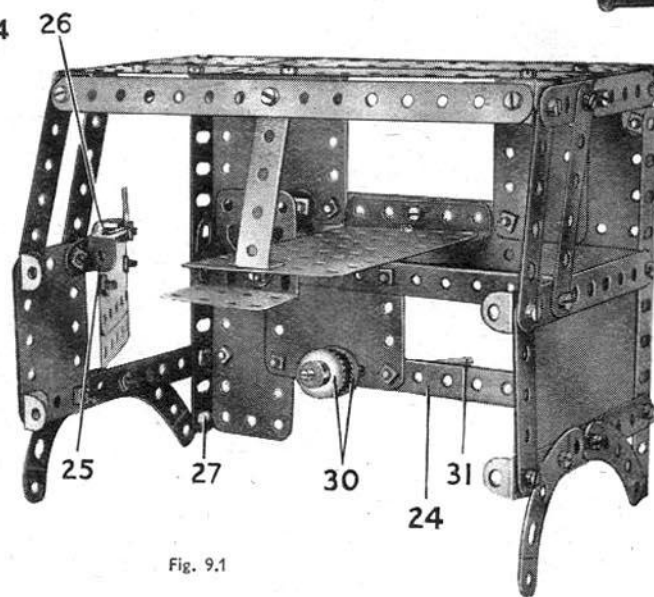


Fig. 9.1

## 9.1 LORRY and TRAILER—Continued

## THE TRAILER

Two 12 1/2" Angle Girders 35 (Fig. 9.1d) form the chassis of the trailer. They are bridged at the rear end by a 3 1/2" x 1/2" Double Angle Strip.

The platform consists of two 12 1/2" x 2 1/2" Strip Plates and three 12 1/2" Strips. These are bolted at their rear ends to two 5 1/2" Strips overlapped, and at the front end two further 5 1/2" Strips 36 (Fig. 9.1c) overlapped are attached to the platform by Angle Brackets. The sides of the platform are edged with 12 1/2" Angle Girders 37.

The front wheel mounting consists of two 3 1/2" x 2 1/4" Flanged Plates 38 joined together by Fishplates. This structure pivots freely on a Bolt passed through the upper Plate and through the centre of a further 3 1/2" x 2 1/4" Flanged Plate 39 bolted between the Angle Girders 35 (see Fig. 9.1c).

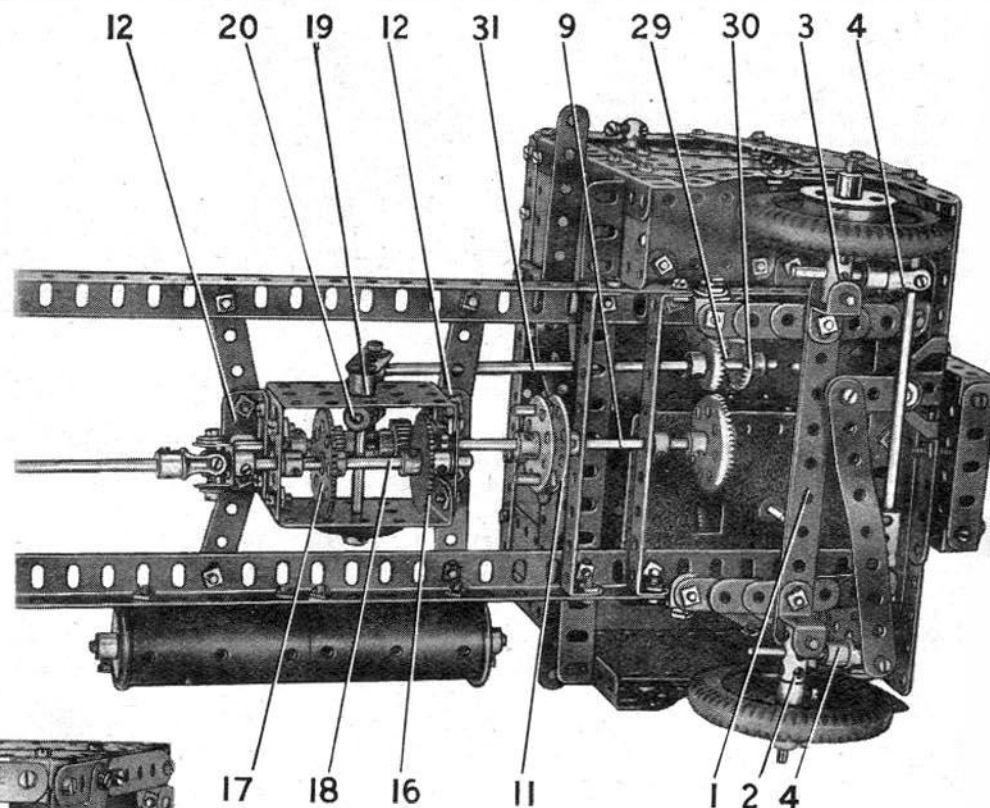


Fig. 9.1g

The rear axle is journaled in a 5 1/2" x 1 1/2" Double Angle Strip 40, which is bolted to a 3 1/2" x 1 1/2" Double Angle Strip. The latter is fixed between two Semi-Circular Plates 41, bolted to the vertical flanges of the Angle Girders 35.

A 2 1/2" x 1 1/2" Double Angle Strip 42 is fixed to the Double Angle Strip 40 by two Fishplates, and this carries the brake rod 43. Rod 43 carries a Bell Crank with Boss 44 and two Double Arm Cranks 45. A 1/2" Bolt 46 in each Crank projects into the concave rim of the Road Wheel and serves as a brake shoe.

The brake is operated by the lever 47, which is freely pivoted on the Bolt 48 passed through a Double Angle Strip 49. A Spring 50 is attached at one end to a Bolt lock-nutted in the Strip 47 and at its other end to a Bolt held in a 1/2" x 1" Angle Bracket 51.

An Angle Bracket 52, pivoted freely to lever 47, is connected by two 2 1/2" Strips overlapped two holes to the Bell Crank 44. The connection to the Bell Crank is made with a lock-nutted Bolt.

Details of the draw-bar and its fittings are shown in Fig. 9.1c

**Note:** The Motor used in this model is not included in the Outfit.



## 9.2 DUTCH WINDMILL

### CONSTRUCTION OF THE TOWER AND SIDES

Construction is commenced with the octagonal base, four sides of which are filled in with  $5\frac{1}{2}" \times 3\frac{1}{2}"$  Flat Plates. The column 1 consists of four  $3\frac{1}{2}" \times 2\frac{1}{2}"$  Flanged Plates bolted together, and is joined to the base by eight Obtuse Angle Brackets, two of which are fastened to each of the  $5\frac{1}{2}" \times 3\frac{1}{2}"$  Flat Plates.

The body of the windmill is made up of four  $12\frac{1}{2}"$  Angle Girders 3, two  $7\frac{1}{2}"$  Angle Girders, two  $7\frac{1}{2}"$  Strips 4 and five  $5\frac{1}{2}"$  Strips, and is joined to the column 1 by two  $9\frac{1}{2}"$  Angle Girders 2. The two side walls and front of the building are completed with Flexible Plates. The roof also is completed with Flexible Plates and four  $5\frac{1}{2}"$  Strips, and is secured to the body by two  $1" \times \frac{1}{2}"$  Angle Brackets 5, two  $\frac{1}{2}" \times \frac{1}{2}"$  Angle Brackets, and two Fishplates.

The four sails are identical and each is built up of one  $12\frac{1}{2}"$  Angle Girder, one  $5\frac{1}{2}"$  Angle Girder, three  $12\frac{1}{2}"$  Strips, a  $3\frac{1}{2}"$  Strip and one  $4\frac{1}{2}"$  Strip, the centre being filled in with a  $12\frac{1}{2}" \times 2\frac{1}{2}"$  Strip Plate. The sails are connected at the centre to a 3" Pulley Wheel, over which is secured a Road Wheel, the Pulley being fastened to a  $11\frac{1}{2}"$  Rod 8 that runs through to the back of the model.

### THE OPERATING MECHANISM

The outside Gears to the No. 1 Clockwork Motor 14 should first of all be fitted. The 2" Axle Rod 15 passes through the fourth pair of holes from the right of the Motor. The  $\frac{1}{2}"$  Pinion on the Motor shaft drives a 57-teeth Gear Wheel on the rear end of the Rod 15. A  $\frac{1}{2}"$  Pinion is secured on the front end of Rod 15 and drives a 57-teeth Gear Wheel on the Rod 16, which carries also a  $\frac{1}{2}"$  Pinion that drives a 50-teeth Gear Wheel on Rod 17. A  $\frac{3}{4}"$  Sprocket Wheel on the end of the  $2\frac{1}{2}"$  Rod 17 is connected by Sprocket Chain to a 3" Sprocket Wheel on Rod 18. On this Rod also is arranged the drive for the directional vanes at the back of the model. This is driven through a  $1\frac{1}{2}"$  and a  $\frac{1}{2}"$  Bevel Gear. The  $\frac{1}{2}"$  Bevel Gear is fixed to a Rod at right angles to the Rod 18. On one end of this Rod is a Collar and on the other end is fastened a 1" fast Pulley, which drives, by means of a Driving Band, the directional vanes on the Rod 19. The vanes consist of eight  $2\frac{1}{2}"$  Strips bolted to a Bush Wheel 11 fixed to Rod 19.

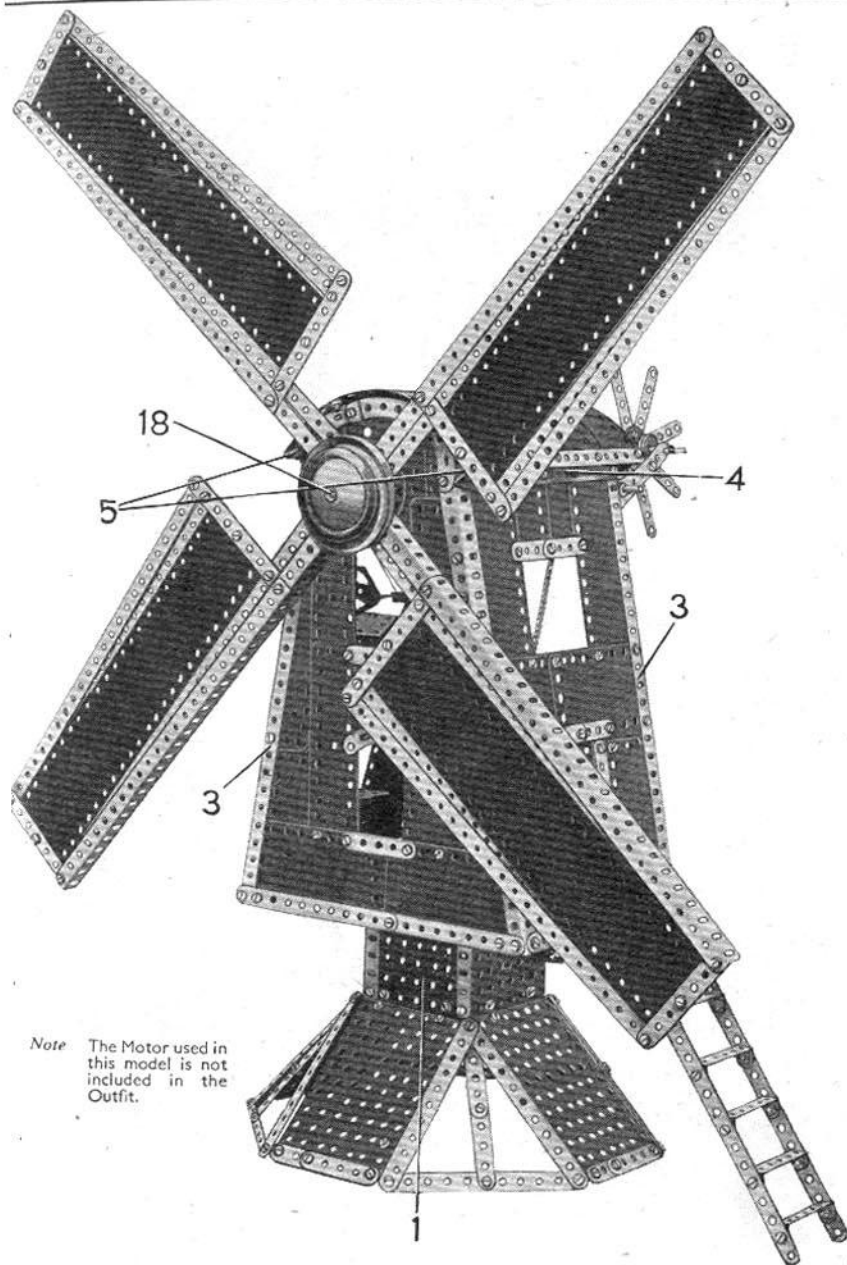
The drive for the sack loader at the side of the model is operated by rotating Crank Handle 13, which is secured in its bearings,  $2\frac{1}{2}"$  Triangular Plates, at one end by a Road Wheel and at the other by a 1" fast Pulley. A belt of Cord connects this Pulley to another 1" fast Pulley on Rod 12. A second Cord is tied to and wound several turns around Rod 12, and then passes over the loose Pulley carried on lock-nutted Bolt 9, a Loaded Hook being attached to its end.

The structure for the loading gear is fastened to the side of the model by means of a  $1\frac{1}{2}" \times \frac{1}{2}"$  Double Angle Strip 8. Owing to the inward slope of the sides of the model, four Washers are used at the top of the Double Angle Strip, between it and the Flexible Plate to which it is fastened, in order to keep it vertical.

The platform 6 is a  $2\frac{1}{2}" \times 2\frac{1}{2}"$  Flexible Plate fastened to two  $\frac{1}{2}" \times \frac{1}{2}"$  Angle Brackets that in turn are secured to a  $2\frac{1}{2}" \times \frac{1}{2}"$  Double Angle Strip. The platform is secured to the body of the model by two  $\frac{1}{2}" \times \frac{1}{2}"$  Angle Brackets fastened at right angles to the previously mentioned  $\frac{1}{2}" \times \frac{1}{2}"$  Angle Brackets. Each side of the platform is edged with a  $1\frac{1}{2}"$  Strip.

The lower platform 7 is secured to the model by two  $\frac{1}{2}" \times \frac{1}{2}"$  Angle Brackets. A  $2\frac{1}{2}" \times \frac{1}{2}"$  Double Angle Strip also is fastened to the Angle Brackets.

The weather vane at the top of the model is made separately. A Double Bent Strip is attached to a Wheel Disc across the centre of which are fastened also two  $2\frac{1}{2}"$  Strips at right angles to one another. On the end of each of these Strips is secured a  $\frac{1}{2}" \times \frac{1}{2}"$  Angle Bracket representing the points of the compass. Through the centre of the Wheel Disc is passed a Rod 10, on the top of which is fastened an End Bearing and an arrow consisting of a  $2\frac{1}{2}"$  Strip, two Fishplates and a 1" Triangular Plate.



Note The Motor used in this model is not included in the Outfit.

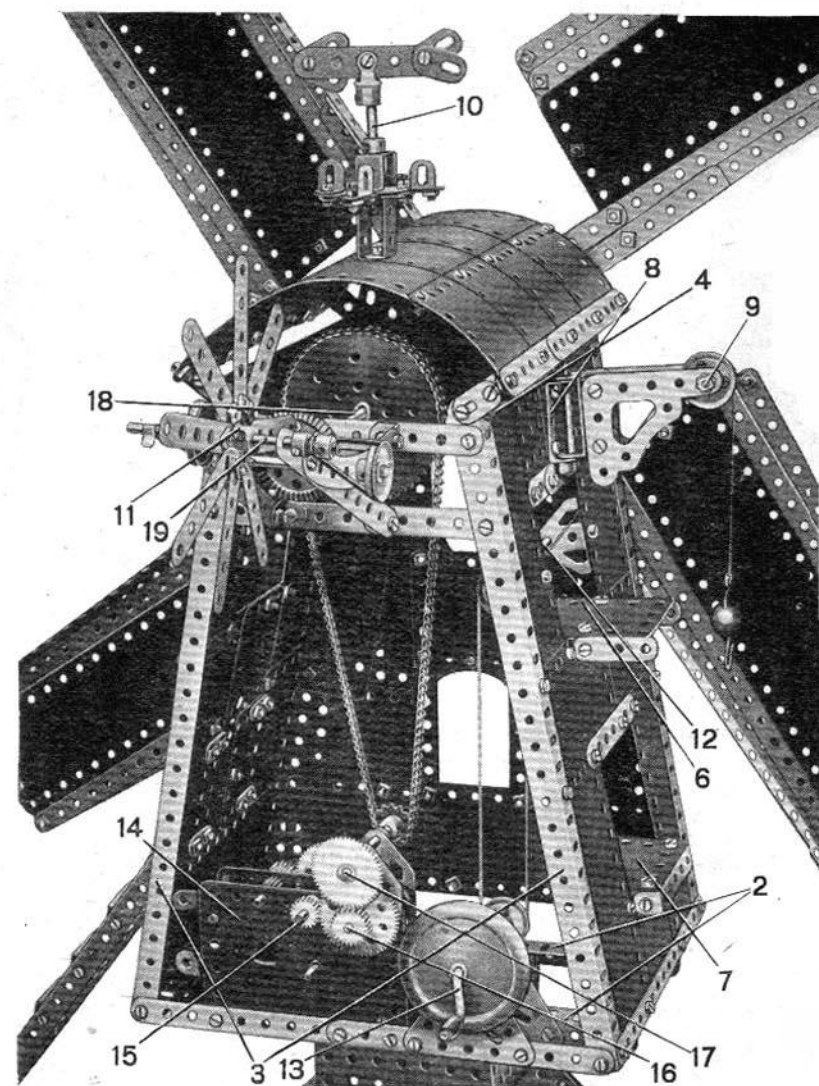
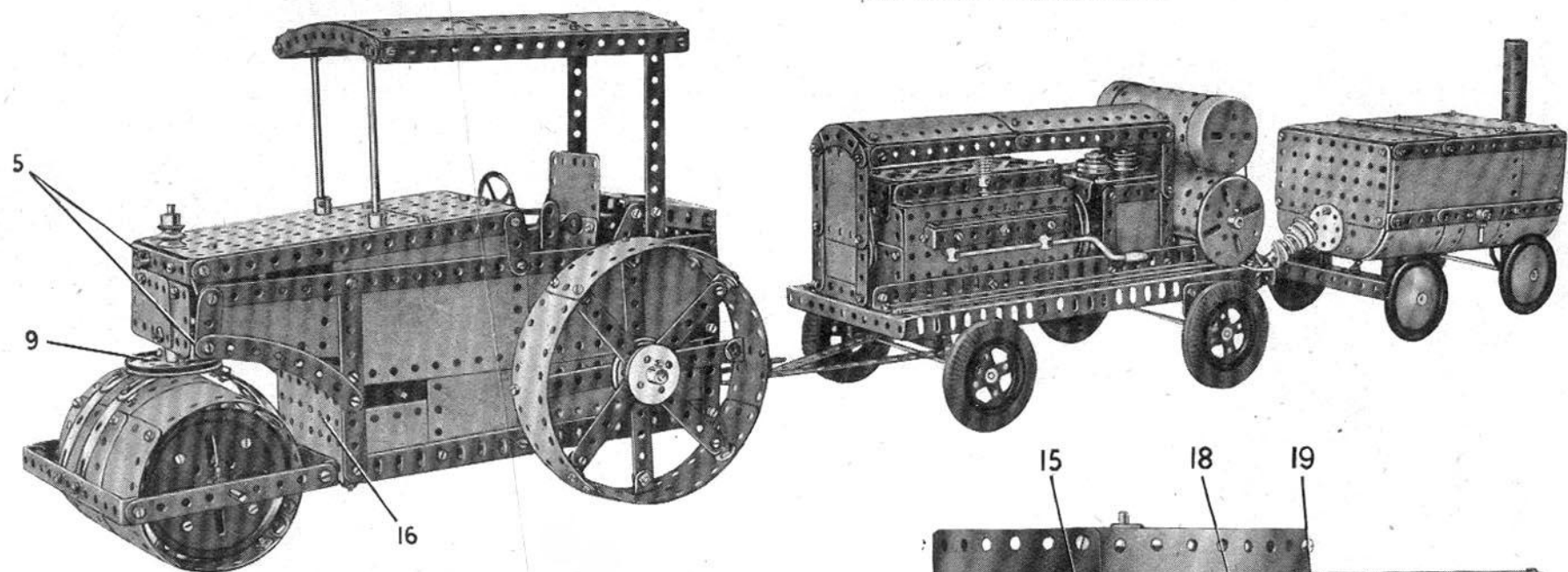


Fig. 9.2a



## 9.3 ROAD REPAIR UNIT



## ROAD ROLLER BODY

The off-side of the diesel roller is formed by two  $5\frac{1}{2}" \times 3\frac{1}{2}"$  Flat Plates overlapped three holes and bolted to a  $9\frac{1}{2}"$  Angle Girder 1. The Flat Plates are extended upward by a  $5\frac{1}{2}" \times 2\frac{1}{2}"$  and a  $4\frac{1}{2}" \times 2\frac{1}{2}"$  Flexible Plate braced by  $4\frac{1}{2}"$  Strips 2, and a  $12\frac{1}{2}"$  Strip 3 is bolted along the edges of the Flexible Plates. A  $4"$  Curved Strip 4 and a  $5\frac{1}{2}" \times 1\frac{1}{2}"$  Flexible Plate are fixed in position as shown (Fig. 9.3b).

The near side is similar in construction, but a  $2\frac{1}{2}" \times 2\frac{1}{2}"$  and a  $2\frac{1}{2}" \times 1\frac{1}{2}"$  Flexible Plate are used in place of one of the  $5\frac{1}{2}" \times 3\frac{1}{2}"$  Flat Plates. This construction allows a slight gap for the winding spindle of the Clockwork Motor.

The sides are connected at the rear by two  $3\frac{1}{2}" \times 2\frac{1}{2}"$  Flanged Plates, and at the front by two  $3\frac{1}{2}" \times \frac{1}{2}"$  Double Angle Strips 5.

The bonnet is a  $5\frac{1}{2}" \times 3\frac{1}{2}"$  Flat Plate and a  $3\frac{1}{2}" \times 2\frac{1}{2}"$  Flanged Plate 6 bolted together. It is attached to  $1\frac{1}{2}"$  Strips 7 by the flanges of the Plate 6, and to one of the Double Angle Strips 5 by  $1" \times 1"$  Angle Brackets. The bonnet is edged by a  $7\frac{1}{2}"$  Strip 8, and the space between Strips 3 and 8 is filled in by a  $5\frac{1}{2}" \times 1\frac{1}{2}"$  Flexible Plate bolted at a slight angle.

## FRONT ROLLER

The front roller is made from four  $5\frac{1}{2}" \times 2\frac{1}{2}"$  Flexible Plates and two  $2\frac{1}{2}" \times 1\frac{1}{2}"$  Flexible Plates. These are joined together to form a compound plate  $4\frac{1}{2}"$  wide, and this is bolted to two  $3\frac{1}{2}" \times \frac{1}{2}"$  Double Angle Strips fixed across the face of a  $3"$  Pulley at each side of the roller. A  $6\frac{1}{2}"$  Rod is fixed in the  $3"$  Pulleys, and it is mounted in a framework formed by two  $5\frac{1}{2}" \times \frac{1}{2}"$  Double Angle Strips joined by  $4\frac{1}{2}"$  Strips. The framework is attached to a  $2"$  Pulley 9 by two semi-circular strips, each made from three Formed Slotted Strips.

A  $3\frac{1}{2}"$  Rod 10 is fixed in the Pulley 9, and this Rod is mounted in an Angle Bracket 11 and in the  $5\frac{1}{2}" \times 3\frac{1}{2}"$  Flat Plate of the bonnet. The Rod 10 is held in position by a  $\frac{1}{2}"$  Pulley with boss, spaced from the bonnet by a Washer and a  $\frac{1}{2}"$  loose Pulley.

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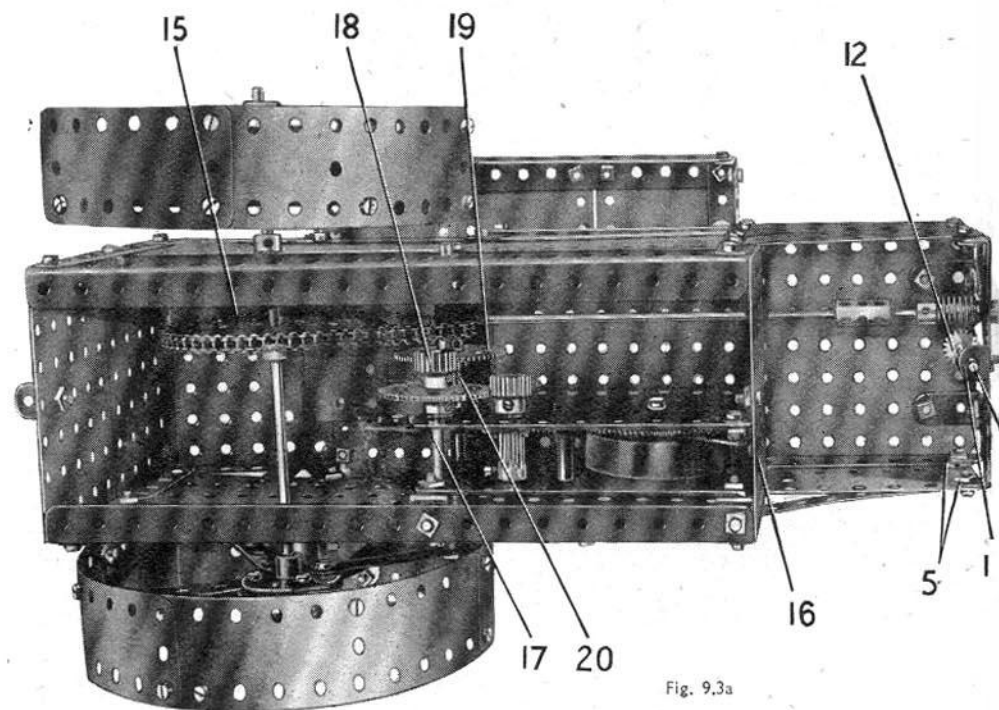


Fig. 9.3a

## 3 ROAD REPAIR UNIT—Continued

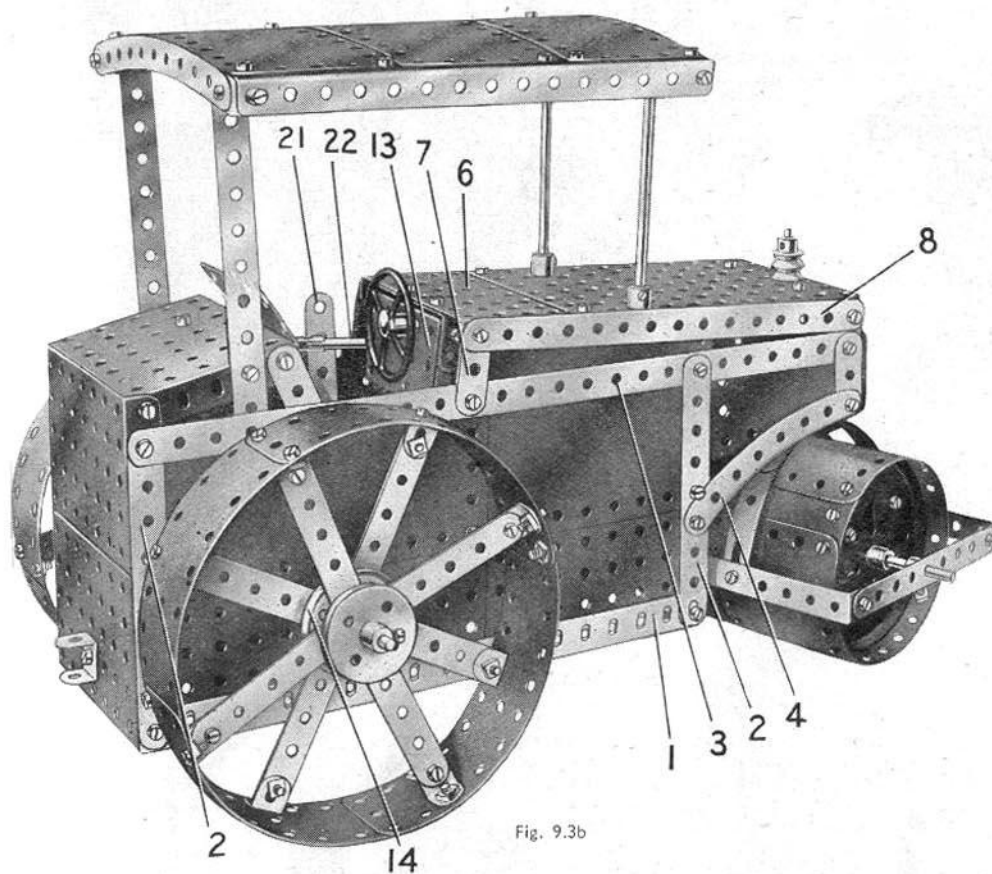


Fig. 9.3b

The Rod carries inside the bonnet a  $\frac{1}{2}$ " Pinion 12, which meshes with a Worm on the steering column. The steering column is a  $6\frac{1}{4}$ " and a 2" Rod joined by a Coupling. It is mounted in one of the Double Angle Strips 5 and in a  $2\frac{1}{2}$ " $\times$ 1 $\frac{1}{2}$ " Flanged Plate 13. Flanged Plate 13 is attached to a  $2\frac{1}{2}$ " $\times$  $\frac{1}{2}$ " Double Angle Strip bolted to Flanged Plate 6.

**REAR ROLLERS**

Each of the rear rollers is formed by four  $5\frac{1}{2}$ " $\times$ 1 $\frac{1}{2}$ " Flexible Plates attached to Angle Brackets bolted to spokes consisting of 5 $\frac{1}{2}$ " Strips. There are two sets of spokes to each wheel. The outer set are bolted to a Bush Wheel and the inner set to a 1 $\frac{1}{2}$ " Pulley 14. The Bush Wheel and the Pulley 14 are fixed on an 8" Rod, which is mounted in the sides of the body and carries a 3" Sprocket 15 (Fig. 9.3a).

Driving Bands are placed round the front and rear rollers to provide a smooth running surface.

**ROOF**

The construction of the roof is clear from the illustrations. It is supported at one end by 5 $\frac{1}{2}$ " Strips attached to 1" $\times$  $\frac{1}{2}$ " Angle Brackets bolted to the roof, and at the other end by two 4" Rods. The latter are fixed in Rod Sockets and in Cranks fixed to the roof.

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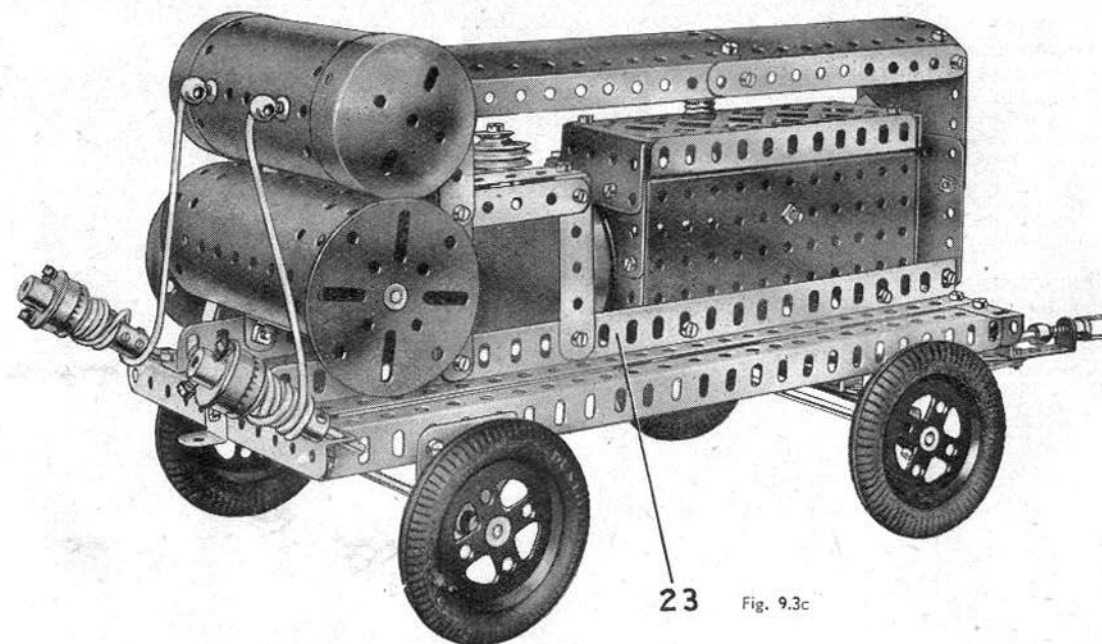


Fig. 9.3c

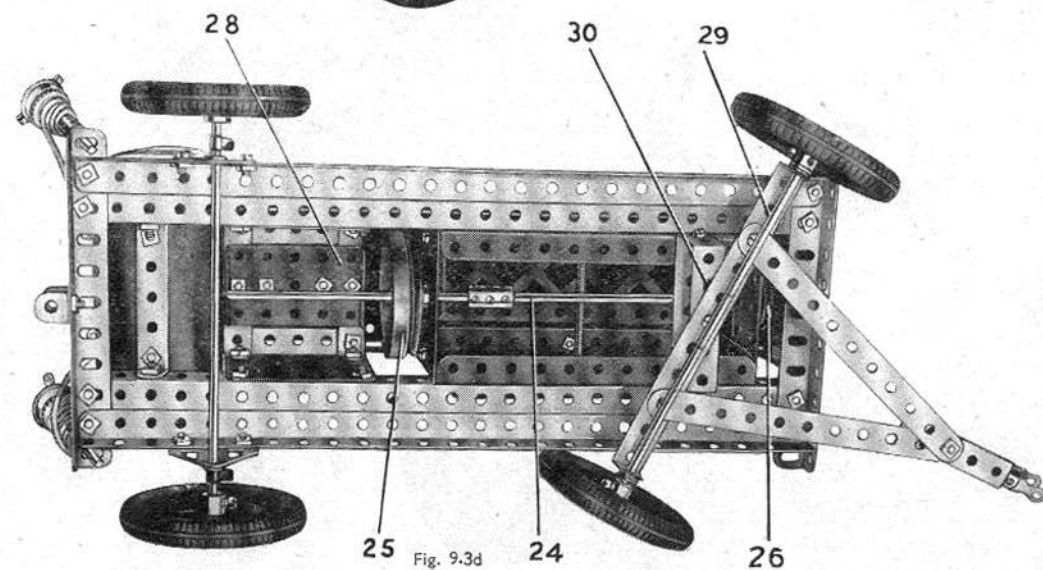


Fig. 9.3d



## 9.3 ROAD REPAIR UNIT—Continued

**POWER UNIT AND GEARING**

A No. 2 Clockwork Motor is attached to one of the Angle Girders 1 by Angle Brackets, and to an Angle Bracket bolted to a  $3\frac{1}{2}" \times 2\frac{1}{2}"$  Flanged Plate 16.

A  $\frac{1}{2}"$  Pinion on the Motor driving shaft meshes with a 57-teeth Gear on a 2" Rod 17 mounted in the Motor side-plates. Rod 17 carries also a  $\frac{1}{2}"$  Pinion 18 which meshes with a 57-teeth Gear 19 fixed on a  $2\frac{1}{2}"$  Rod 20. Rod 20 is journaled in one of the Motor side-plates and in one side of the body of the roller. A  $\frac{3}{4}"$  Sprocket on Rod 20 is connected by Chain to the 3" Sprocket 15.

A  $3\frac{1}{2}"$  Strip 21 is fixed to the Motor brake lever by a 1" Corner Bracket. A 2" Rod 22 is locked in an End Bearing lock-nutted to the reversing lever.

**AIR COMPRESSOR UNIT**

The construction of the air-compressor unit is seen in Figs. 9.3c, 9.3d, and 9.3e. The chassis is made from two  $12\frac{1}{2}"$  Angle Girders connected at each end by a  $5\frac{1}{2}"$  Angle Girder. Two  $12\frac{1}{2}"$  Angle Girders 23 are bolted to the  $5\frac{1}{2}"$  Angle Girders.

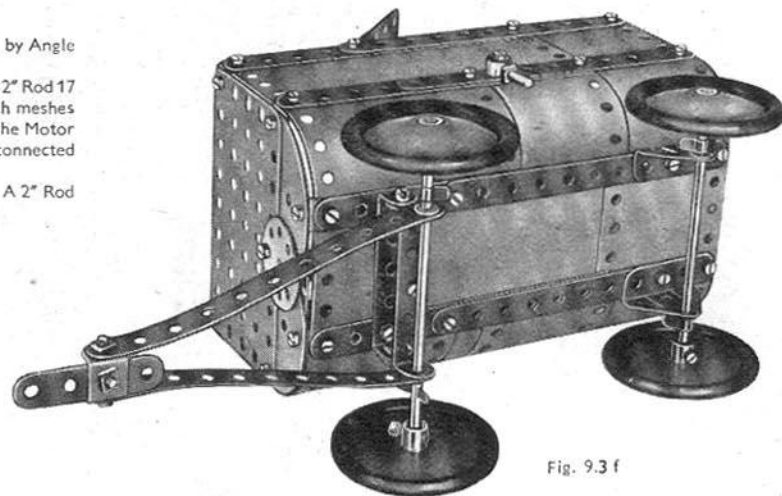


Fig. 9.3 f

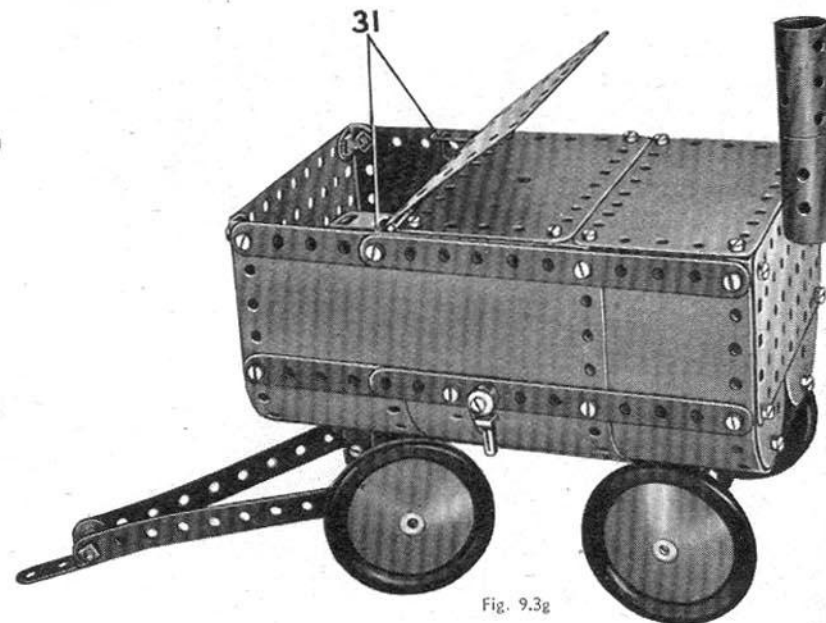


Fig. 9.3g

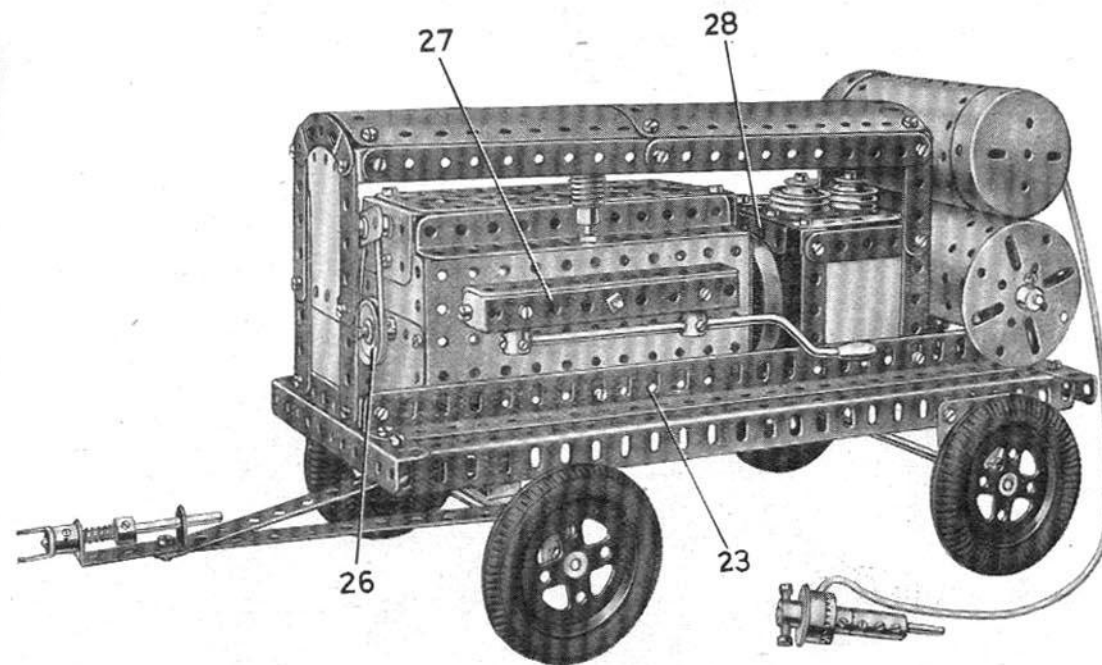


Fig. 9.3e

The compressor engine is represented by a  $5\frac{1}{2}" \times 2\frac{1}{2}"$  Flanged Plate bolted to each of the Angle Girders 23. The front and rear of the engine are each formed from two  $2\frac{1}{2}" \times 1\frac{1}{2}"$  Flexible Plates, and a compound rod 24 (Fig. 9.3d) is passed through the centre holes of these Plates. A flywheel 25 consisting of a Wheel Flange bolted to a 2" Pulley, is carried on this rod, and 1" Pulley 26 is connected by a Driving Band to a Double Arm Crank representing the engine fan. The fan is free to turn on a Pivot Bolt fixed to a Girder Bracket bolted to the front of the engine. The  $4\frac{1}{2}" \times \frac{1}{2}"$  Double Angle Strips 27 are fixed to the engine by a Screwed Rod.

The sides of the air-pump are  $2\frac{1}{2}" \times 2\frac{1}{2}"$  Flexible Plates, and the top is a  $2\frac{1}{2}" \times 1\frac{1}{2}"$  Flanged Plate 28. It is fixed to  $2\frac{1}{2}" \times \frac{1}{2}"$  Double Angle Strips bolted to the sides.

The rear axle is mounted in Flat Trunnions, and the front axle in a  $5\frac{1}{2}" \times \frac{1}{2}"$  Double Angle Strip 29. The Double Angle Strip 29 is lock-nutted to a  $2\frac{1}{2}" \times \frac{1}{2}"$  Double Angle Strip 30, fixed to a  $2\frac{1}{2}" \times 1"$  Double Angle Strip bolted to the flanges of the  $5\frac{1}{2}" \times 2\frac{1}{2}"$  Flanged Plates.

**TAR BOILER**

The construction of the sides and bottom of the tar boiler are shown clearly in Figs. 9.3f and 9.3g. The sides are joined to the ends by Angle Brackets. A  $4\frac{1}{2}" \times 2\frac{1}{2}"$  Flexible Plate forming part of the top is bolted to  $2\frac{1}{2}"$  Angle Girders, and a Hinged Flat Plate is bolted to  $1\frac{1}{2}"$  Angle Girders 31. Two Sleeve Pieces forming the chimney are connected by a Chimney Adaptor.

*Note:* The Motor used in this model is not included in the Outfit.

## 9.4 TOWER BRIDGE

## CONSTRUCTION OF THE TOWERS

Construction of the model is commenced with the towers, each of which consists of two pairs of  $12\frac{1}{2}$ " Angle Girders 1, joined by  $4\frac{1}{2}$ " Strips. The narrow sides of the towers are filled in with  $12\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Strip Plates, and the wider sides by  $5\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " and  $4\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flexible Plates. The wider sides of each tower are extended upwards by  $2\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flexible Plates, the upper edges of which are joined by a Double Bracket. A  $2\frac{1}{2}$ " Strip is secured to the centre hole of the Double Bracket by a Rod Socket 2, and to each end of the  $2\frac{1}{2}$ " Strip three  $2\frac{1}{2}$ " Strips are fastened by Obtuse Angle Brackets as shown in the main illustration.

The two towers are connected by two compound girders 3, each comprising a  $12\frac{1}{2}$ " and a  $1\frac{1}{2}$ " Angle Girder overlapped two holes. Two  $12\frac{1}{2}$ " Strips 4 are supported by  $1\frac{1}{2}$ " Strips from the girders 3, cord being threaded alternately through the holes of the Strips and compound girders.

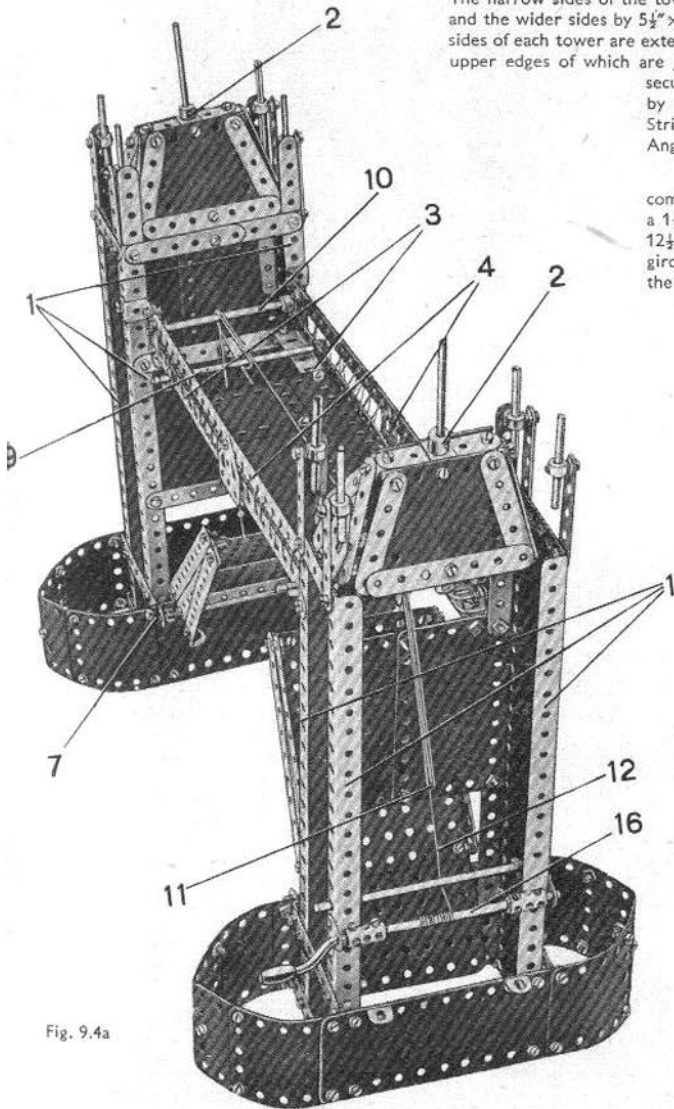
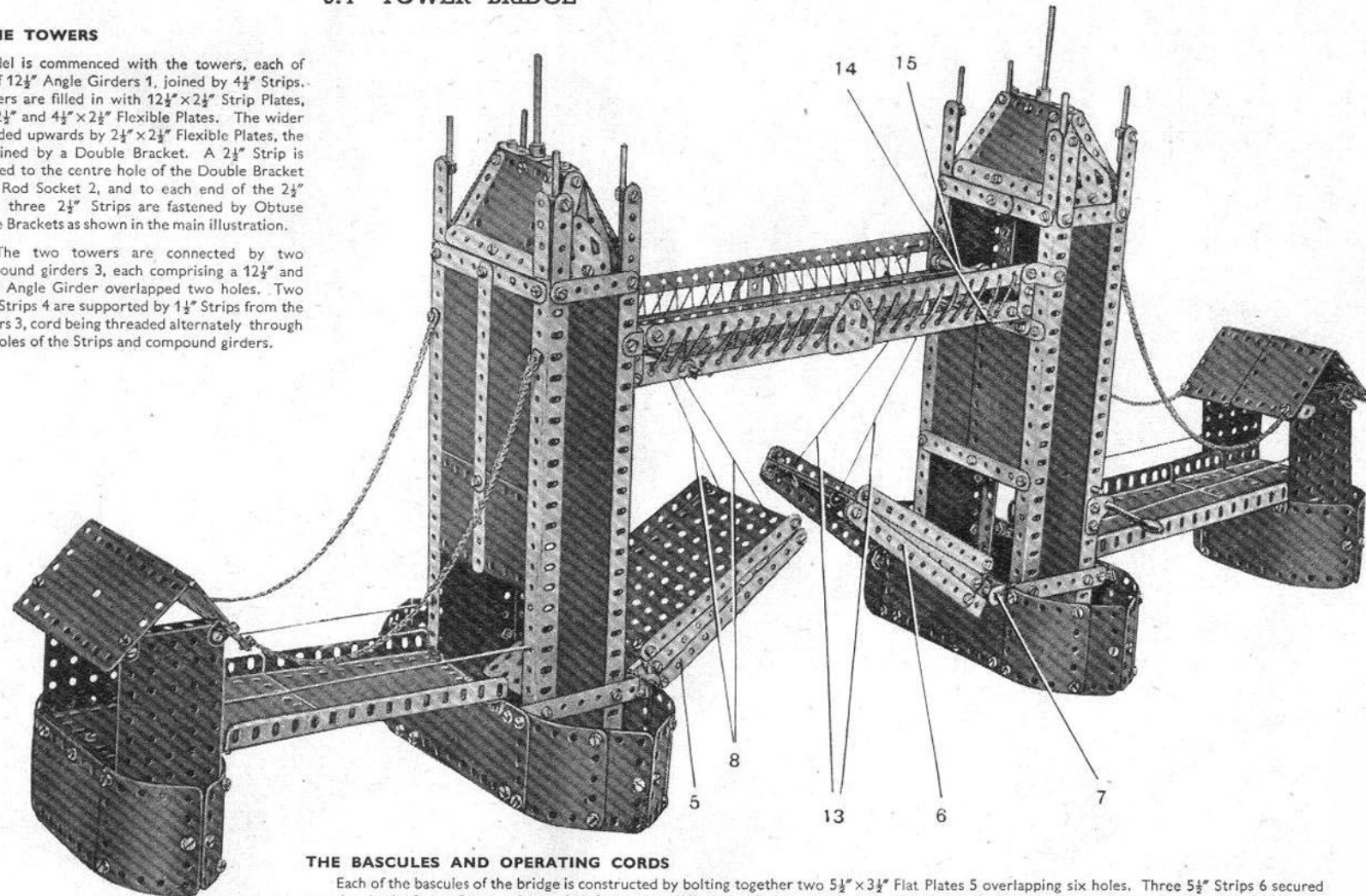


Fig. 9.4a



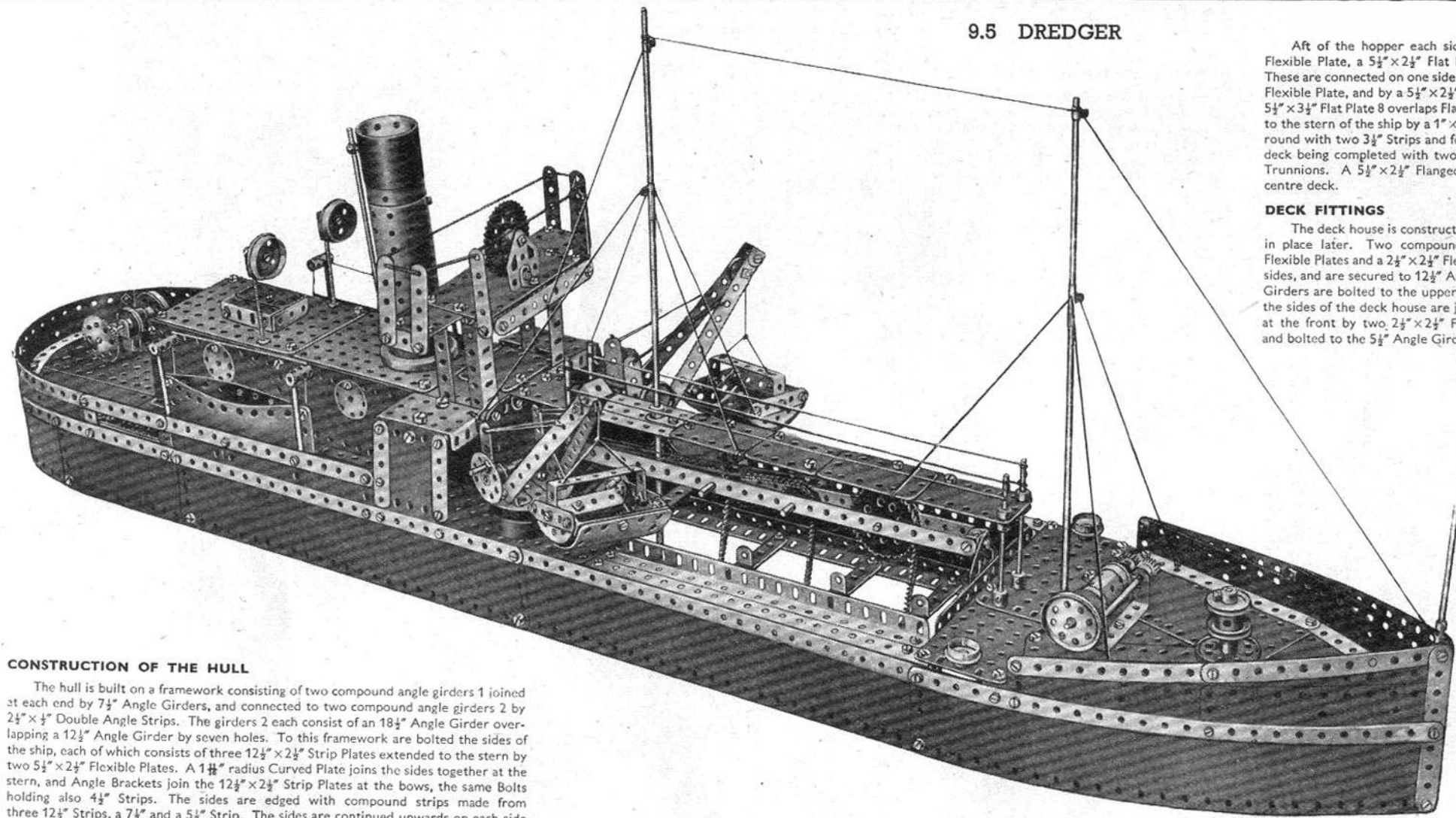
## THE BASCULES AND OPERATING CORDS

Each of the bascules of the bridge is constructed by bolting together two  $5\frac{1}{2}$ "  $\times$   $3\frac{1}{2}$ " Flat Plates 5 overlapping six holes. Three  $5\frac{1}{2}$ " Strips 6 secured together in the form of a triangle are then fastened to each side of the compound plate 5 by Angle Brackets, as shown in the main illustration. Two  $2\frac{1}{2}$ " Strips also are attached to the plate 5 by Angle Brackets, their ends being pivoted on the  $5\frac{1}{2}$ " Rod 7 that is journaled in the ends of a  $4\frac{1}{2}$ "  $\times$   $\frac{1}{2}$ " Double Angle Strip.

Raising and lowering of the bascules is controlled by a large Crank Handle 16 journaled in two  $1\frac{1}{2}$ " Corner Brackets bolted to the sides of the right-hand tower. Cord 12 is fastened to a Cord Anchoring Spring on the Crank Handle and its free end is tied at 11 to three other lengths of Cord. Two of these, which are indicated at 13, are led over the Rods 14 and 15 and anchored by Washers to the front of the right-hand bascule. The third Cord is taken over a  $\frac{1}{2}$ " loose Pulley on the Rod 15, then over two Rods 9 and 10, and finally is tied to two Cords 8, which are fastened by Washers to the left-hand bascule.



## 9.5 DREDGER



## CONSTRUCTION OF THE HULL

The hull is built on a framework consisting of two compound angle girders 1 joined at each end by  $7\frac{1}{2}$ " Angle Girders, and connected to two compound angle girders 2 by  $2\frac{1}{2}$ "  $\times$   $\frac{1}{2}$ " Double Angle Strips. The girders 2 each consist of an  $18\frac{1}{2}$ " Angle Girder overlapping a  $12\frac{1}{2}$ " Angle Girder by seven holes. To this framework are bolted the sides of the ship, each of which consists of three  $12\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Strip Plates extended to the stern by two  $5\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flexible Plates. A  $1\frac{1}{8}$ " radius Curved Plate joins the sides together at the stern, and Angle Brackets join the  $12\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Strip Plates at the bows, the same Bolts holding also  $4\frac{1}{2}$ " Strips. The sides are edged with compound strips made from three  $12\frac{1}{2}$ " Strips, a  $7\frac{1}{2}$ " and a  $5\frac{1}{2}$ " Strip. The sides are continued upwards on each side of the bows by three  $5\frac{1}{2}$ "  $\times$   $1\frac{1}{2}$ " Flexible Plates and two  $5\frac{1}{2}$ " Strips.

The constructional details of the raised sides of the stern are shown in Fig. 9.5b. The  $2\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flexible Plates seen amidships are reinforced by  $2\frac{1}{2}$ " Strips and are attached to the sides by Fishplates. The sides of the hopper are  $9\frac{1}{2}$ " Angle Girders and they are attached to the main framework by Fishplates. The  $12\frac{1}{2}$ " Strips 3, which support the forward deck are bolted to the hopper sides and at their other ends to a  $2\frac{1}{2}$ " Triangular Plate. Two  $4\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flat Plates overlapped three holes are bolted to the main framework and are attached to the sides by Double Brackets. The deck is extended forward by the  $5\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flexible Plates 4 and the  $2\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flexible Plates 5, which are supported by a  $5\frac{1}{2}$ " Strip and a Flanged Sector Plate (Fig. 9.5a). The Flexible Plates are edged with  $5\frac{1}{2}$ " and  $4\frac{1}{2}$ " Strips, and the  $2\frac{1}{2}$ " Triangular Plate is supported by an Angle Bracket.

Aft of the hopper each side of the deck consists of a  $2\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flexible Plate, a  $5\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flat Plate 6 and a  $5\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flexible Plate. These are connected on one side to a  $5\frac{1}{2}$ "  $\times$   $3\frac{1}{2}$ " Flat Plate 7 by a  $2\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flexible Plate, and by a  $5\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flexible Plate on the other side. The  $5\frac{1}{2}$ "  $\times$   $3\frac{1}{2}$ " Flat Plate 8 overlaps Flat Plate 7 by two holes, and is connected to the stern of the ship by a  $1" \times \frac{1}{2}"$  Angle Bracket. The stern is edged round with two  $3\frac{1}{2}"$  Strips and four  $2\frac{1}{2}"$  large radius Curved Strips, the deck being completed with two  $4\frac{1}{2}" \times 2\frac{1}{2}"$  Flexible Plates and two Flat Trunnions. A  $5\frac{1}{2}" \times 2\frac{1}{2}"$  Flanged Plate seen in Fig. 9.5a supports the centre deck.

## DECK FITTINGS

The deck house is constructed as a separate unit and can be bolted in place later. Two compound plates consisting of two  $5\frac{1}{2}" \times 2\frac{1}{2}"$  Flexible Plates and a  $2\frac{1}{2}" \times 2\frac{1}{2}"$  Flexible Plate bolted end to end form the sides, and are secured to  $12\frac{1}{2}"$  Angle Girders 9, and further  $12\frac{1}{2}"$  Angle Girders are bolted to the upper edges of the plates. At the rear end the sides of the deck house are joined by a  $3\frac{1}{2}" \times 2\frac{1}{2}"$  Flanged Plate and at the front by two  $2\frac{1}{2}" \times 2\frac{1}{2}"$  Flexible Plates overlapped three holes and bolted to the  $5\frac{1}{2}"$  Angle Girders that support the bridge. The top

of the deck house is completed with two  $5\frac{1}{2}" \times 3\frac{1}{2}"$  Flat Plates 10 and two  $2\frac{1}{2}" \times 2\frac{1}{2}"$  Flexible Plates overlapped three holes. The base of the funnel is a Wheel Flange 12 bolted to the deck house, and the funnel consists of two Boilers 13 compressed to a smaller diameter and attached to the Wheel Flange by Angle Brackets. The siren steam pipe is a  $6\frac{1}{2}"$  Rod held in a Handrail Support. Two Girder Brackets joined by  $1\frac{1}{2}" \times \frac{1}{2}"$  Double Angle Strips are used for the skylight 14. The ventilators are  $1\frac{1}{2}"$  Flanged Wheels held by  $\frac{1}{2}"$  Bolts screwed into the end transverse tapped bores of Couplings, which are locked on the ends of  $3"$  Screwed Rods. The bridge consists of two  $2\frac{1}{2}" \times 1\frac{1}{2}"$  Flexible Plates bolted to a  $4\frac{1}{2}" \times 2\frac{1}{2}"$  Flexible Plate, and edged round with two  $1\frac{1}{2}"$  Angle Girders and a  $5\frac{1}{2}"$  Angle Girder extended by a  $2\frac{1}{2}"$  Strip. The bridge is attached to the  $5\frac{1}{2}"$  Angle Girders at the front of the deck house by Angle Brackets and is supported also by two  $4\frac{1}{2}"$  Strips. The  $2\frac{1}{2}" \times 1\frac{1}{2}"$  Flanged Plates below the bridge are attached to the deck house by  $1" \times 1"$  Angle Brackets. The deck house can now be bolted in position.

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9.5 DREDGER—Continued

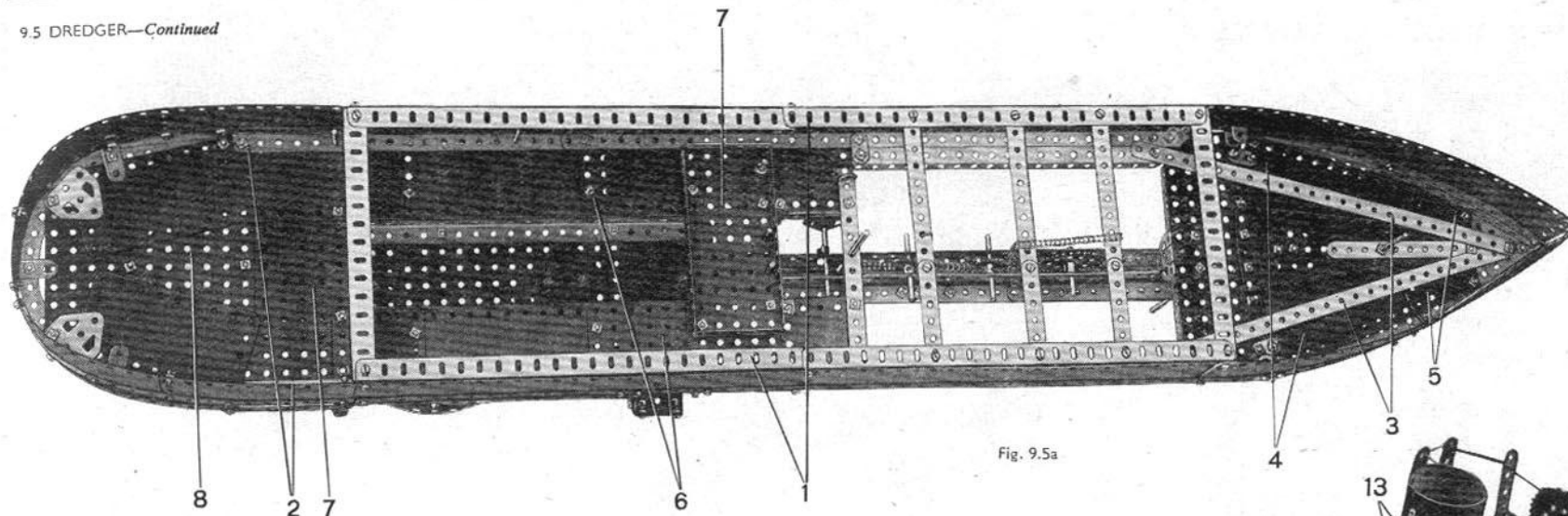


Fig. 9.5a

The gangway 11 over the hopper is built of two compound strips made by overlapping a  $12\frac{1}{2}$ " Strip six holes with a  $5\frac{1}{2}$ " Strip. Five  $2\frac{1}{2}" \times 1\frac{1}{4}"$  Flexible Plates are bolted to the compound strips, the rear one carrying also a  $5\frac{1}{2}"$  Strip, which is bolted to the deck house. At the forward end the gangway is supported by Collars fastened on  $3\frac{1}{2}"$  Rods held in Rod Sockets, while at the rear end  $5"$  Rods are used and they are held in place by Spring Clips. Handrails are provided by Cord. Below the gangway is the framework carrying the bucket chains. This consists of two  $12\frac{1}{2}"$  Strips supported at one end by a Double Bracket and a Flat Trunnion, and at the other end by a  $3\frac{1}{2}"$  Rod journaled in the ends of Flat Trunnions. The arrangement of the chains is clear from the illustrations.

**DETAILS OF THE GRAB CRANES**

The Boiler Ends 15 form the bases of the grab cranes and are fitted over the ends of  $1\frac{1}{2}"$  Rods that are retained in position on the deck by Collars and Spring Clips.

One of the grab cranes is shown in Fig. 9.5c; and consists of two Trunnions bolted to a Face Plate. Two  $2"$  Strips and two  $5\frac{1}{2}"$  Strips are bolted to the Trunnions, the  $5\frac{1}{2}"$  Strips being joined at the top by a Double Bracket. A  $2\frac{1}{2}"$  Rod fitted at one end with a Bush Wheel and at the other end with a  $1"$  Pulley forms the hoisting drum. The grab hoisting Cord is taken over a  $\frac{1}{2}"$  loose Pulley on a  $\frac{3}{8}"$  Bolt at the jib head.

The winch 21 (Fig. 9.5b) consists of a  $2\frac{1}{2}"$  Rod, which is journaled in a Stepped Bent Strip and carries a 57-teeth Gear, a  $\frac{1}{2}"$  loose Pulley, a  $1"$  fast Pulley, a Chimney Adaptor and a  $1\frac{1}{8}"$  Flanged Wheel. The drum of the winch 17 is a Sleeve Piece fitted with a  $\frac{3}{8}"$  Flanged Wheel at each end. The capstan 18 consists of a  $3\frac{1}{2}"$  Screwed Rod carrying a  $1\frac{1}{2}"$  Pulley, a  $1"$  fast Pulley, a Chimney Adaptor and a second  $1"$  fast Pulley, the complete assembly being fastened to the deck by a nut.

The mast 19 consists of an  $8"$  Rod joined to a  $5"$  Rod by a Rod Connector, and it is held in the boss of a Crank bolted to the gangway. The lower end passes through a  $5\frac{1}{2}" \times \frac{1}{2}"$  Double Angle Strip bolted to the deck. The forward mast 20 consists of an  $11\frac{1}{2}"$  Rod and a  $4"$  Rod joined by a Rod Connector, and is held in the boss of a Double Arm Crank bolted to the deck.

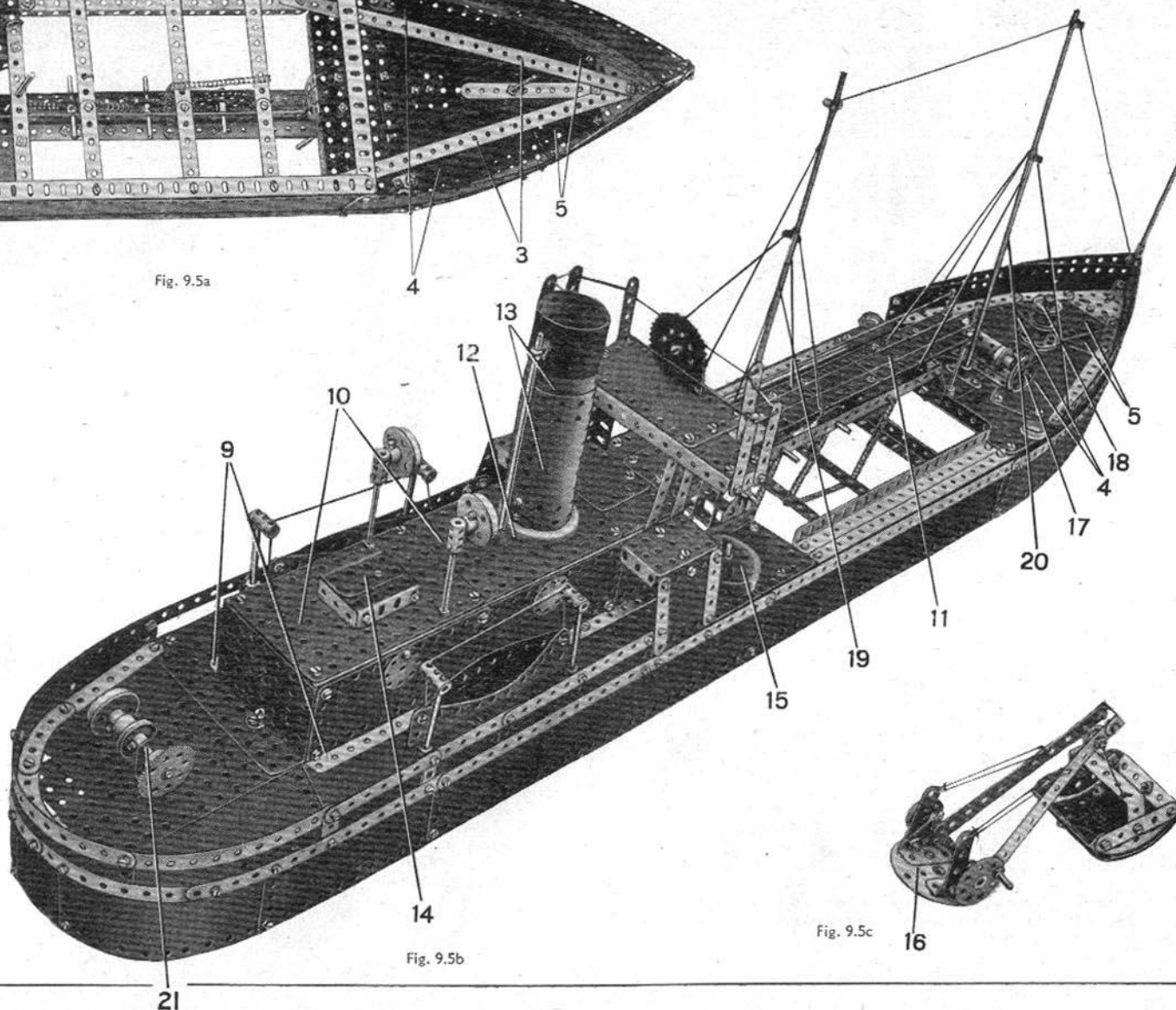
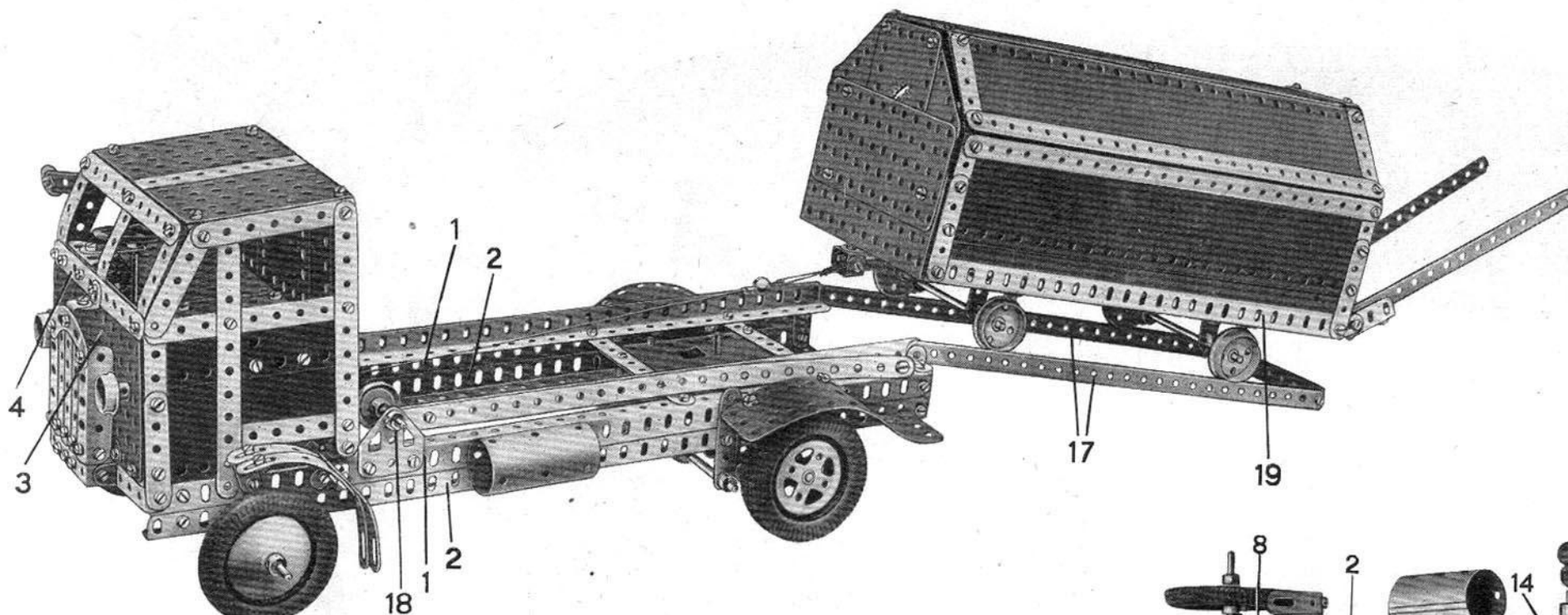


Fig. 9.5b

Fig. 9.5c



## 9.6 REFUSE COLLECTING VEHICLE



Note: The Motor used in this model is not included in the Outfit.

## THE CHASSIS AND CAB

The lorry unit is first constructed, the chassis for this consisting of two U-section girders joined at each end by a  $5\frac{1}{2}$ " Strip. The two girders are each built up from an  $18\frac{1}{2}$ " Angle Girder 1 and a compound  $18\frac{1}{2}$ " girder 2, formed by a  $12\frac{1}{2}$ " and  $7\frac{1}{2}$ " Angle Girder joined at each end by Fishplates.

The sides of the cab are each formed by a  $4\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flexible Plate and two  $2\frac{1}{2}$ "  $\times$   $1\frac{1}{2}$ " Flexible Plates, which are fastened to the chassis by  $5\frac{1}{2}$ " Strips and also are supported by Angle Brackets from the back of the cab. This latter consists of two  $5\frac{1}{2}$ "  $\times$   $3\frac{1}{2}$ " Flat Plates overlapped three holes, and is secured to the chassis by two  $1"$   $\times$   $1"$  Angle Brackets.

Two  $3\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flanged Plates and one  $3\frac{1}{2}$ "  $\times$   $\frac{1}{2}$ " Double Angle Strip are used for the roof, and all are bolted direct to the back of the cab. The roof is supported also from the sides by  $5\frac{1}{2}$ " and  $2\frac{1}{2}$ " Strips. A further  $5\frac{1}{2}$ "  $\times$   $3\frac{1}{2}$ " Flat Plate 3 held in position by two  $5\frac{1}{2}$ "  $\times$   $\frac{1}{2}$ " Double Angle Strips is used for the front of the cab, and on the centre of it is mounted the radiator, which is constructed by joining two  $2\frac{1}{2}$ " Angle Girders at one end by a  $2\frac{1}{2}$ " Strip and at the other by a  $2\frac{1}{2}$ "  $\times$   $\frac{1}{2}$ " Double Angle Strip. The space between the Angle Girders is filled by three  $2\frac{1}{2}$ " Strips, and the top of the radiator is finished with a small radius Curved Strip. The radiator is fastened to the chassis by two  $1\frac{1}{2}$ "  $\times$   $\frac{1}{2}$ " Double Angle Strips and Fishplates, and is joined to the front of the cab by a reversed angle bracket built up from two Angle Brackets.

A view of the cab with the roof removed is shown in Fig. 9.6b. The seat consists of a  $2\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flexible Plate and  $3\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flanged Plate 5, and is secured to the sides of the cab by one of the flanges of the Flanged Plate and a  $1"$   $\times$   $1"$  Angle Bracket.

The front wheels are each held by two Collars on a  $2"$  Rod locked in the longitudinal bore of a Coupling, which is secured by two Collars on the end of a Rod 7 that passes through one of the side members of the chassis. Two  $\frac{3}{8}"$  Bolts 8 screwed into the end tapped holes of the Couplings are joined by a compound strip consisting of a  $5\frac{1}{2}"$  and a  $2"$  Strip overlapped two holes. This Strip is connected by a Fishplate to a Crank fastened on the lower end of the steering column, Bolt 9 being lock-nutted. The steering column is formed by a  $3\frac{1}{2}"$  Rod and a  $2\frac{1}{2}"$  Rod joined by Coupling 10, and is journaled in the end holes of two  $1\frac{1}{2}"$  Strips secured to the front of the cab by Trunnions.

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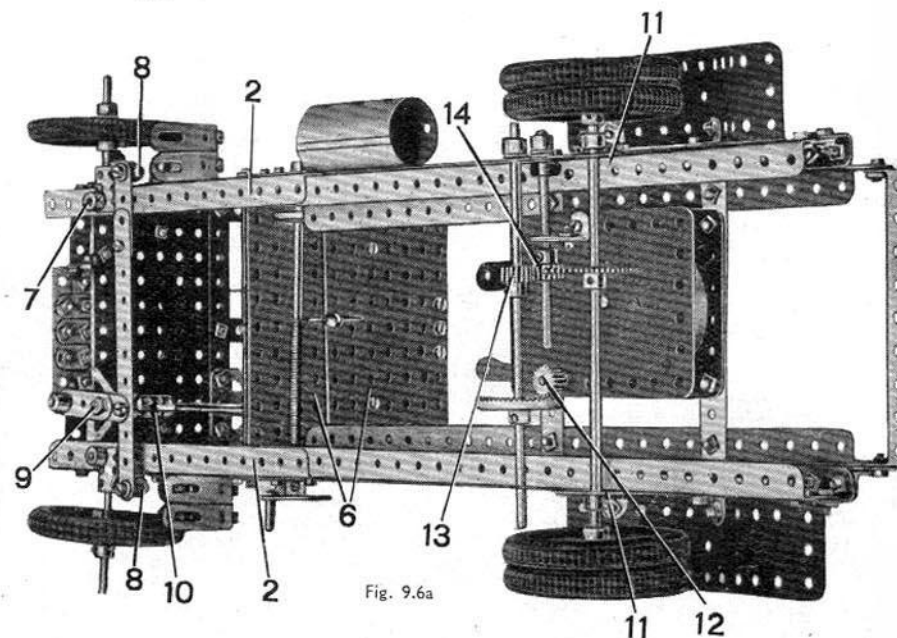


Fig. 9.6a

# 9.6 REFUSE COLLECTING VEHICLE—Continued

## DETAILS OF THE REFUSE CART

The chassis of the cart consists of two 12½" Angle Girders 19 joined at each end by a 5½"×2½" Flanged Plate 20 (Fig. 9.6d). The Flanged Plates are extended by 5½"×2½" Flat Plates and form the ends of the cart. Each of the sides consists of two 12½"×2½" Strip Plates overlapped three holes, and is bolted direct to the chassis and to the shorter flanges of the two 5½"×2½" Flanged Plates 20.

One side and also the top of the roof are formed by 12½"×2½" Strip Plates fastened to the sides of the cart by Obtuse Angle Brackets. The other side of the roof is shown in the illustration below and is built up from a 2½"×2½" Flexible Plate, a 5½"×2½" Flexible Plate and a Hinged Flat Plate 21 (Fig. 9.6d). The Flexible Plates are held in position by Obtuse Angle Brackets, and the Hinged Flat Plate is bolted to the top of the roof to form a flap. The

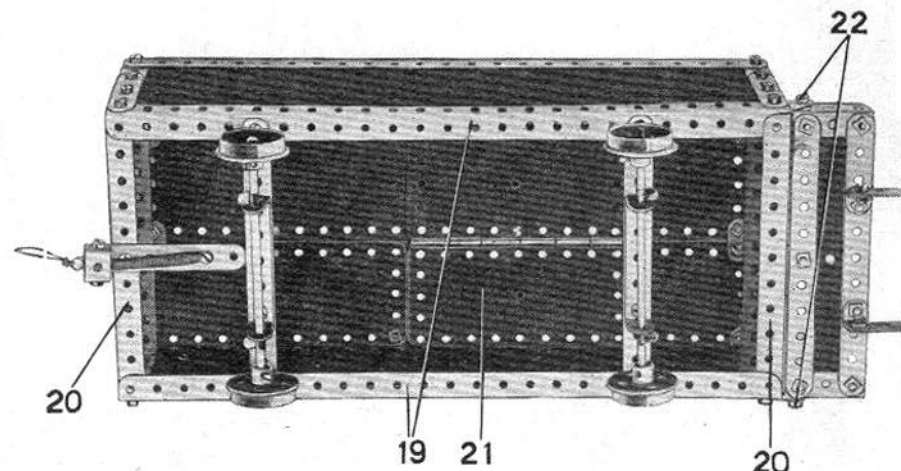


Fig. 9.6d

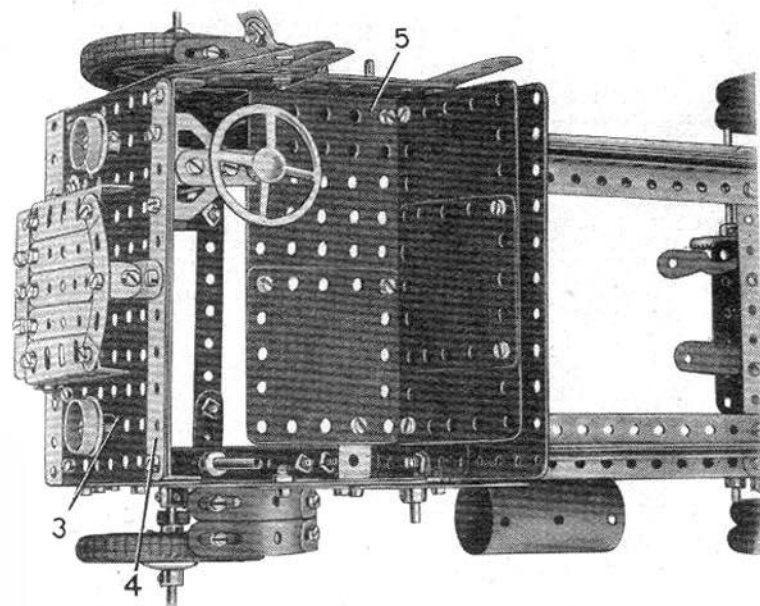


Fig. 9.6b

## THE POWER UNIT AND GEARING

A No. 1 Clockwork Motor is secured to the chassis by two 5½" Strips, the winding spindle projecting upwards. A ¼" Pinion 12 (Fig. 9.6a) on the Motor driving shaft meshes with a 1½" Contrate on a horizontal 6½" Rod journaled in the lower end holes of two 2½" Strips bolted to the chassis. This Rod carries also a ¼" Pinion 13 and from this the drive is taken through a second ½" Pinion 14 to a 57-teeth Gear on the back axle. For this axle an 8" Rod is used, and each double wheel is formed by two 2" Pulleys fitted with Rubber Tyres. The axle is journaled in two Corner Gussets 11 bolted to the sides of the chassis. The rear mudguards, 5½"×1½" Flexible Plates, are each secured to the chassis by two Angle Brackets.

The 5½" Strips holding the Motor form also supports for the fixed rails consisting of the 12½" Angle Girders 15 (Fig. 9.6c). The extending rails 17 are two 12½" Strips joined by a 5½"×½" Double Angle Strip, and when not in use they are housed between the fixed rails 15 and 12½" Strips 16. The forward ends of Strips 16 are bolted to the fixed rails, but spaced away from them by four Washers, and their rear ends are fastened to the chassis by Angle Brackets, as shown.

## THE WINCH GEAR

The mechanism for hauling the cart on to the lorry consists of a 6½" Rod 18 journaled at each end in a Flat Trunnion bolted to the chassis. At one end the Rod carries a Bush Wheel fitted with a Threaded Pin for a handle, and to the centre of the Rod is tied a length of Cord. A Small Loaded Hook is fastened to the end of the Cord and it can be secured to a coupling unit at the rear of the cart.

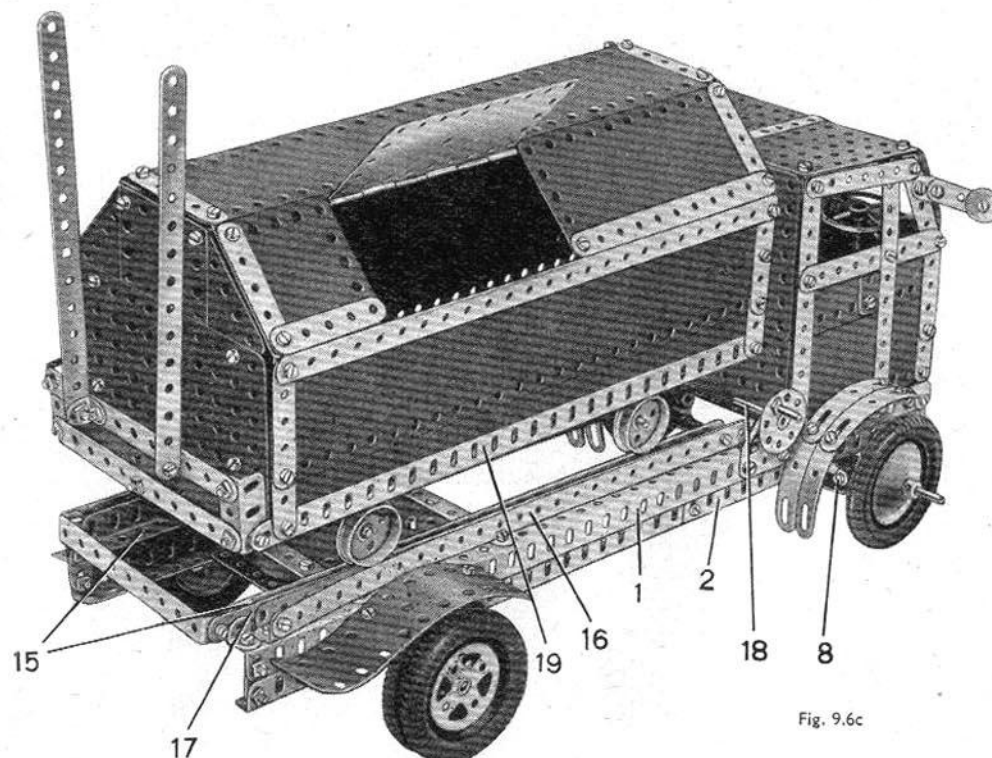


Fig. 9.6c

wheels of the cart are 1½" Flanged Wheels, and are fastened on the ends of a 4½" and a 5" Rod, each of which is journaled in the ends of a 2½"×1" Double Angle Strip secured to the chassis by a 5½" Strip.

The method of mounting the 7½" Strips representing the shafts of the cart is shown in Fig. 9.6c. The Strips are fastened by Angle Brackets to a 5½" Strip, to each end of which is bolted a 1½" Angle Girder. The lower ends of the Angle Girders are attached by lock-nutted Bolts 22 to two Fish-plates bolted to the frame of the cart.

The coupling unit at the rear of the cart is constructed by attaching a 3½" Strip to the lower flange of one of the Flanged Plates 20 by a lock-nutted Bolt. A Spring is bolted to the 3½" Strip, and its free end passes through a pair of Double Brackets that are also fastened to the Strip. A loop of Cord tied to the end of the Spring serves to attach the coupling unit to the Hook of the hauling mechanism.

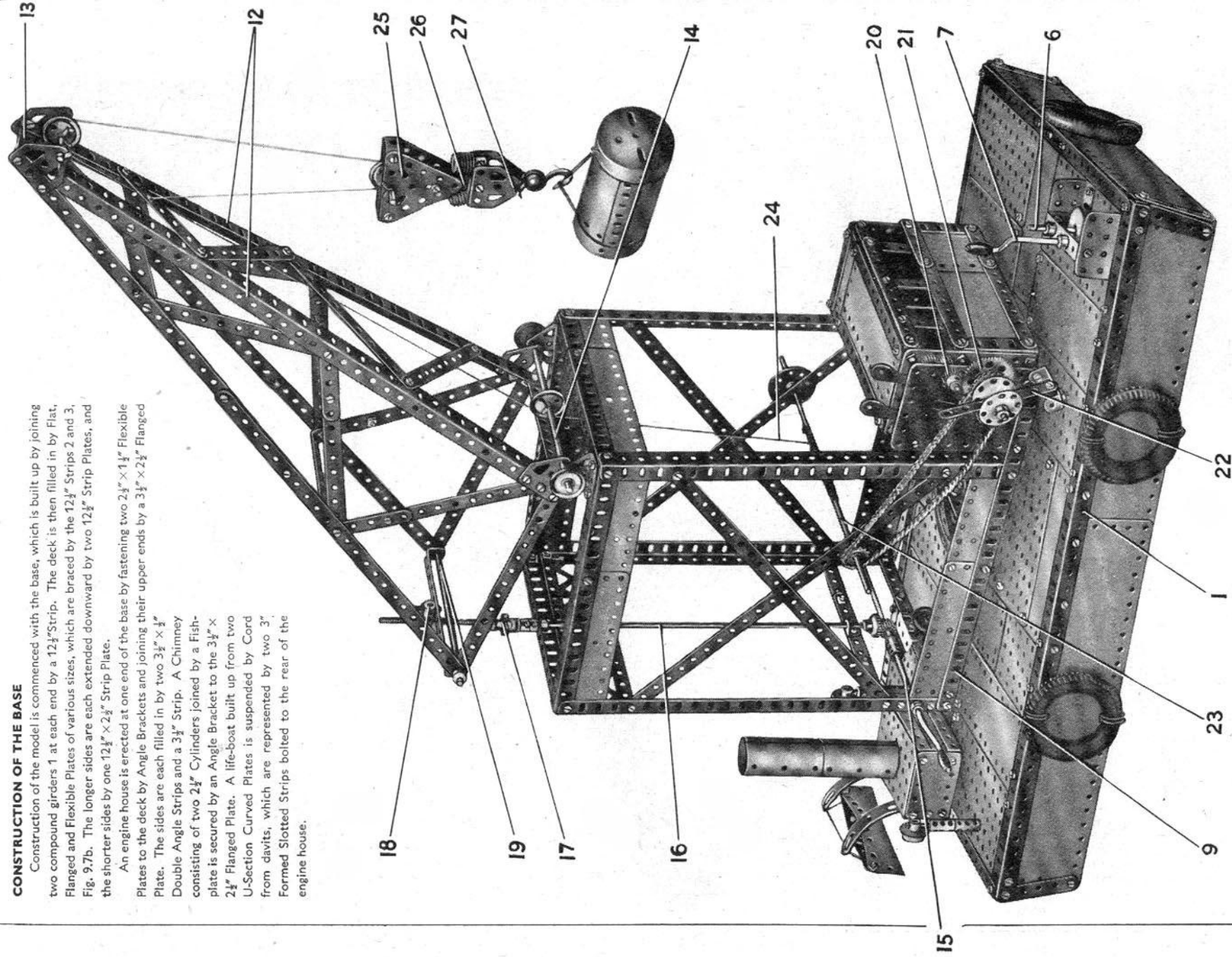


## 9.7 PONTOON CRANE

### CONSTRUCTION OF THE BASE

Construction of the model is commenced with the base, which is built up by joining two compound girders 1 at each end by a  $12\frac{1}{2}$ " Strip. The deck is then filled in by Flat, Flanged and Flexible Plates of various sizes, which are braced by the  $12\frac{1}{2}$ " Strips 2 and 3, Fig. 9.7b. The longer sides are each extended downward by two  $12\frac{1}{2}$ " Strip Plates, and the shorter sides by one  $12\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Strip Plate.

An engine house is erected at one end of the base by fastening two  $2\frac{1}{2}$ "  $\times$   $1\frac{1}{2}$ " Flexible Plates to the deck by Angle Brackets and joining their upper ends by a  $3\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flanged Plate. The sides are each filled in by two  $3\frac{1}{2}$ "  $\times$   $\frac{1}{2}$ " Double Angle Strips and a  $3\frac{1}{2}$ " Strip. A Chimney consisting of two  $2\frac{1}{2}$ " Cylinders joined by a Fish-plate is secured by an Angle Bracket to the  $3\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flanged Plate. A life-boat built up from two U-Section Curved Plates is suspended by Cord from davits, which are represented by two  $3\frac{1}{2}$ " Formed Slotted Strips bolted to the rear of the engine house.



Tyres are fitted at intervals along the sides of the pontoon to represent fenders.

A  $3\frac{1}{2}$ " Pulley fitted with a Wheel Flange is bolted to the two  $5\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flanged Plates at the centre of the base, and a  $4\frac{1}{2}$ " Rod 4 passes through its boss. The Rod carries at its lower end a  $3\frac{1}{2}$ " Sprocket Wheel 5 connected by Sprocket Chain to a  $1\frac{1}{2}$ " Sprocket on  $3\frac{1}{2}$ " Rod 6. The Rod 6 carries at its centre a  $50\text{-teeth}$  Gear that meshes with a  $\frac{3}{4}$ " Pinion on a Crank Handle 7. Both the Rod 6 and the Crank Handle 7 are journaled in a  $5\frac{1}{2}$ "  $\times$   $3\frac{1}{2}$ " Flat Plate of the base and a  $2\frac{1}{2}$ "  $\times$   $1\frac{1}{2}$ " Double Angle Strip, which is secured in position by a Girder Bracket at each end.

### THE TOWER AND SUPERSTRUCTURE

The building of the tower is commenced by joining two  $12\frac{1}{2}$ " Angle Girders 9 at the centre by two compound girders 10 and 11, each consisting of two  $5\frac{1}{2}$ " Angle Girders overlapped seven holes. A  $12\frac{1}{2}$ " Angle Girder is used for each corner of the tower and the four are joined at their upper ends by  $7\frac{1}{2}$ " and  $12\frac{1}{2}$ " Angle Girders. The sides of the tower are braced also by  $12\frac{1}{2}$ " Strips.

A control cabin is provided at the forward end of the superstructure. One side of this is formed by the No. 1 Clockwork Motor bolted direct to one of the Angle Girders 9, and the other by two  $2\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flexible Plates and one  $2\frac{1}{2}$ "  $\times$   $1\frac{1}{2}$ " Flexible Plate. The top of the cab is filled in by a  $2\frac{1}{2}$ "  $\times$   $1\frac{1}{2}$ "  $\times$   $5\frac{1}{2}$ "  $\times$   $1\frac{1}{2}$ "  $\times$   $5\frac{1}{2}$ "  $\times$   $1\frac{1}{2}$ " Flexible Plate, and the back by two  $5\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flexible Plates. For the front, a  $5\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " and a  $2\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flexible Plate overlapped three holes are used, and are secured to the sides by two  $2\frac{1}{2}$ " Angle Girders. The window partitions are formed by  $2\frac{1}{2}$ " Strips.

A Double Arm Crank is bolted to the compound girder 10 and in its boss is locked the upper end of the Rod 4. Rotation of the Crank Handle 7 causes the superstructure to revolve. A  $5\frac{1}{2}$ " Circular Girder also is bolted to the girder 10, and round its perimeter four  $1\frac{1}{2}$ " Flanged Wheels are fastened by lock-nutted  $\frac{3}{4}$ " Bolts and Pivot Bolts. When the superstructure is in position, these Wheels rest on the deck of the pontoon and form a simple type of roller bearing.

(Continued on next page)

## 9.7 PONTOON CRANE—Continued

**THE JIB**

The jib sides are triangular and each consists of an  $18\frac{1}{2}$ " Angle Girder and a  $21\frac{1}{2}$ " compound strip formed by two  $12\frac{1}{2}$ " Strips overlapped seven holes. The Angle Girder and compound strip are bolted together at their upper ends, and joined at the bottom by a  $7\frac{1}{2}$ " Strip. The two sides of the jib are joined at the top by a  $1\frac{1}{2}$ " x  $3\frac{1}{2}$ " Double Angle Strip 13, and at the bottom by a  $5\frac{1}{2}$ " Strip. The jib is pivoted on a  $6\frac{1}{2}$ " Rod, which passes through two Flat Trunnions bolted to the lower corner of the jib and also through two Trunnions bolted to the tower. The  $6\frac{1}{2}$ " Rod is held in position by two  $1\frac{1}{2}$ " fast Pulleys, and carries at its centre a  $1\frac{1}{2}$ " loose Pulley, the purpose of which will be described later.

The angle of the jib is controlled by a Crank Handle 15, which is extended by a  $5\frac{1}{2}$ " Rod and journalled at the rear of the tower. A  $\frac{1}{2}$ " Pinion secured to the centre of the Crank Handle shaft, meshes with a  $\frac{3}{4}$ " Contrate Wheel on a vertical  $11\frac{1}{2}$ " Rod 16 journalled as shown. At its upper end the Rod is connected by a universal coupling 17 to a  $3\frac{1}{2}$ " Screwed Rod that passes at its upper end through one of the end tapped holes of a Coupling 18, which is secured by a  $\frac{3}{4}$ " Bolt to the centre of a  $5\frac{1}{2}$ " Double Angle Strip. The last mentioned is pivotally secured by a  $6\frac{1}{2}$ " Rod to the rear end of the jib. The universal coupling is built up from a Swivel Bearing and a Small Fork Piece.

**THE PULLEY BLOCK AND HOISTING CORDS**

Raising of the pulley block is controlled by the No. 1 Clockwork Motor, on the driving shaft of which is locked a  $\frac{1}{2}$ " Pinion 20. A  $3\frac{1}{2}$ " Rod is journalled in the side plates of the Motor two holes below the driving shaft, and it carries a 57-teeth Gear 21. The Rod carries also a  $1\frac{1}{2}$ " Sprocket Wheel connected by Sprocket Chain to a  $\frac{3}{4}$ " Sprocket Wheel on the  $11\frac{1}{2}$ " Rod 23. The 57-teeth Gear 21 can be thrown out of mesh with the Pinion 20 by the lever 22. This consists of a  $3\frac{1}{2}$ " Strip, which is pivotally attached at its lower end to an Angle Bracket secured by a  $1\frac{1}{2}$ " x  $\frac{1}{2}$ " Double Angle Strip to the side plate of the Motor. At its upper end the Strip passes between two Wheel Discs fastened on the  $3\frac{1}{2}$ " Rod by Collars.

The Cord 24 is fastened to Rod 23 by a Cord Anchoring Spring, wound round the Rod several times and then taken over the  $1\frac{1}{2}$ " loose Pulley on the  $6\frac{1}{2}$ " Rod on which the jib pivots. The Cord then is led over a second  $1\frac{1}{2}$ " Pulley at the top of the jib, round a Pulley in the hoisting block, and finally is tied to the jib.

The hoisting block consists of two  $2\frac{1}{2}$ " Triangular Plates joined by Double Brackets, to the lower end of which two Flat Trunnions are fastened by a Stepped Bent Strip 26 and a Double Bracket. The Hook is attached by a  $1\frac{1}{2}$ " Rod 27 to the two Flat Trunnions, and it carries a load consisting of a Boiler. The hoisting block is weighted by two Worms clamped between the Flat Trunnions.

*Note:* The Motor used in this model is not included in the Outfit.

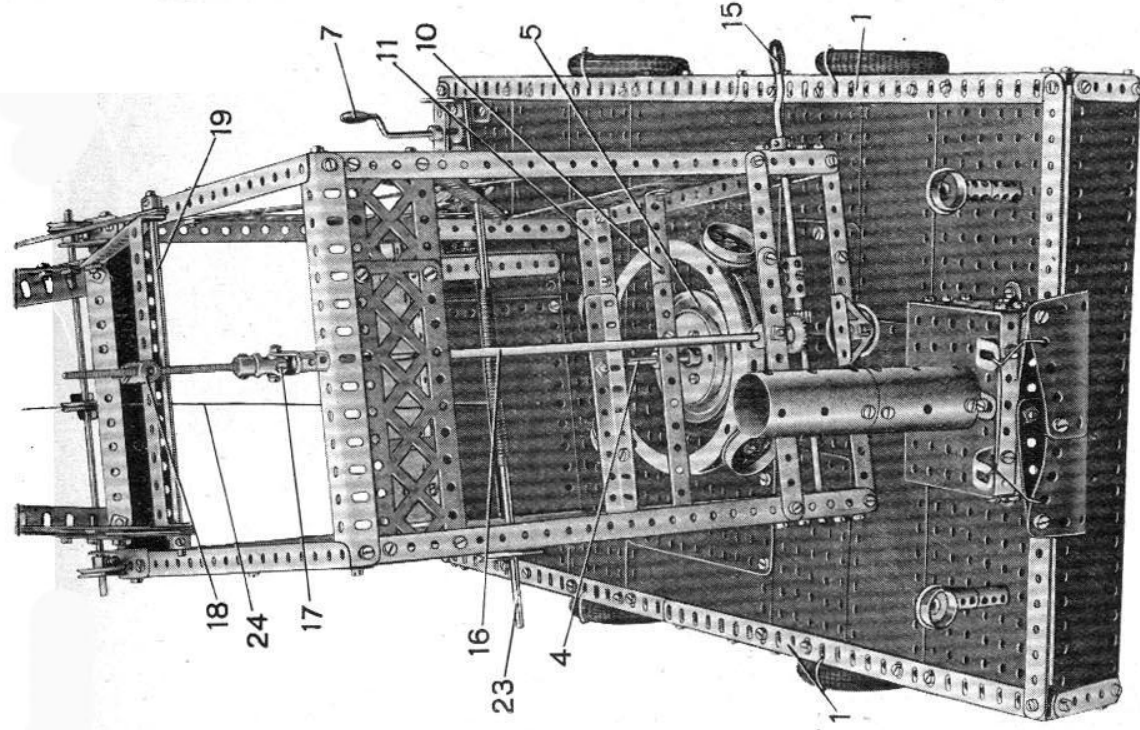
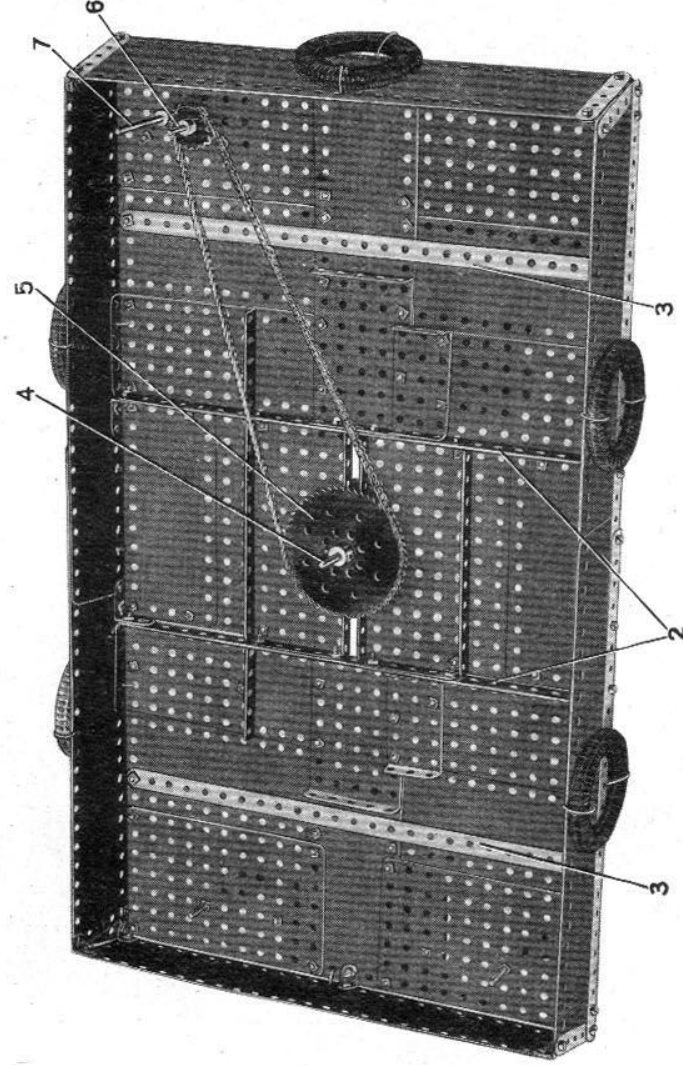


Fig. 9.7a

Fig. 9.7b





## 9.8 MOTOR COACH

Motor coaches specially designed for long distance travel are familiar sights on the roads today. Generally they are equipped with luxurious bodywork and seating arrangements so that passengers can travel considerable distances in complete comfort. The Meccano model shown here is based on a typical coach of this type.

No attempt has been made to equip the chassis with all the essential mechanisms, but it is fitted with a No. 1 Clockwork Motor that drives the two rear-wheel axles through gearing and Sprocket Chain. The model is also fitted with a simple but efficient steering system. Particularly pleasing features of the body are a sliding door, and a roomy luggage compartment at the rear.

### CHASSIS AND POWER UNIT

The main chassis girders are each formed by two  $12\frac{1}{2}$ " Angle Girders overlapped five holes. They are joined at the front by two  $5\frac{1}{2}$ " Strips. One of these Strips is indicated at 1, and it is bolted to a  $3\frac{1}{2}$ "  $\times$   $\frac{1}{2}$ " Double Angle Strip fixed to the chassis. The other  $5\frac{1}{2}$ " Strip is bolted to the chassis immediately above Strip 1. At the rear the chassis girders are connected by a  $5\frac{1}{2}$ "  $\times$   $\frac{1}{2}$ " Double Angle Strip 2.

A No. 1 Clockwork Motor is attached to two  $3\frac{1}{2}$ " Strips 3 bolted across the chassis, and a  $\frac{1}{2}$ " Pinion 4 is fixed on the Motor driving shaft. The Pinion meshes with a  $1\frac{1}{2}$ " Contrate carried on a 5" Rod 5 mounted in Flat Trunnions. Rod 5 carries also a  $\frac{3}{4}$ " Sprocket 6, and this is connected by Chain to a 2" Sprocket on a compound rod 7. Rod 7 consists of a  $3\frac{1}{2}$ " and a 4" Rod joined by a Coupling, and is connected to a similar Rod 8 by 1" Sprockets and Chain.

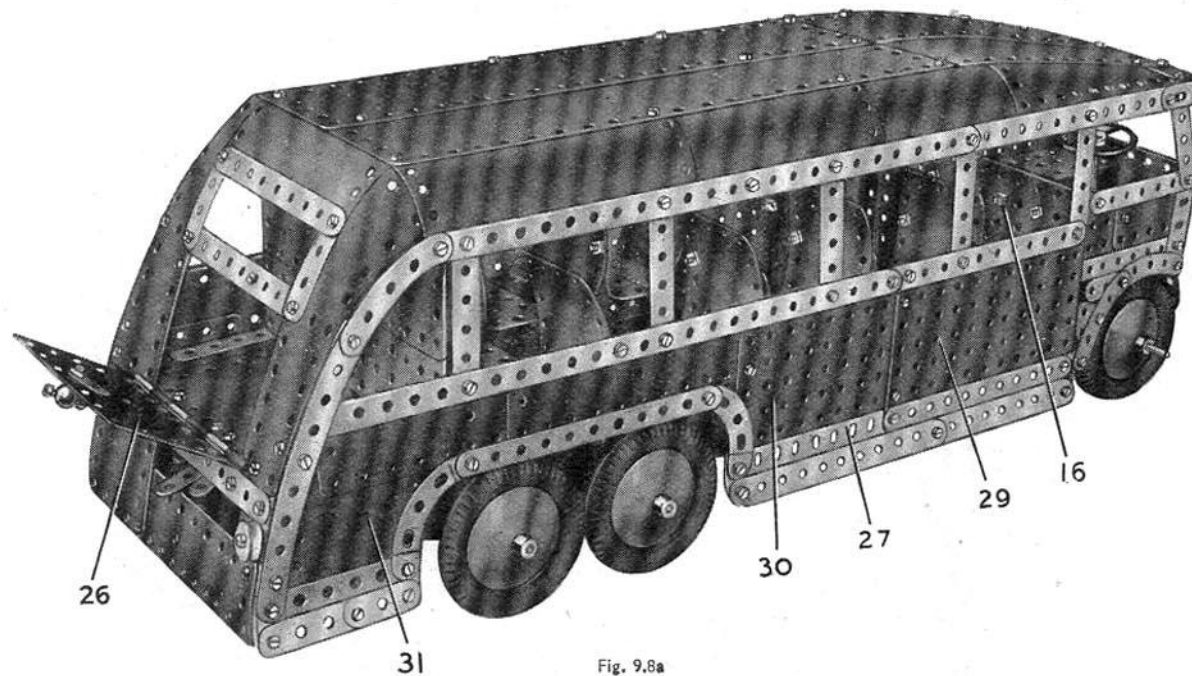
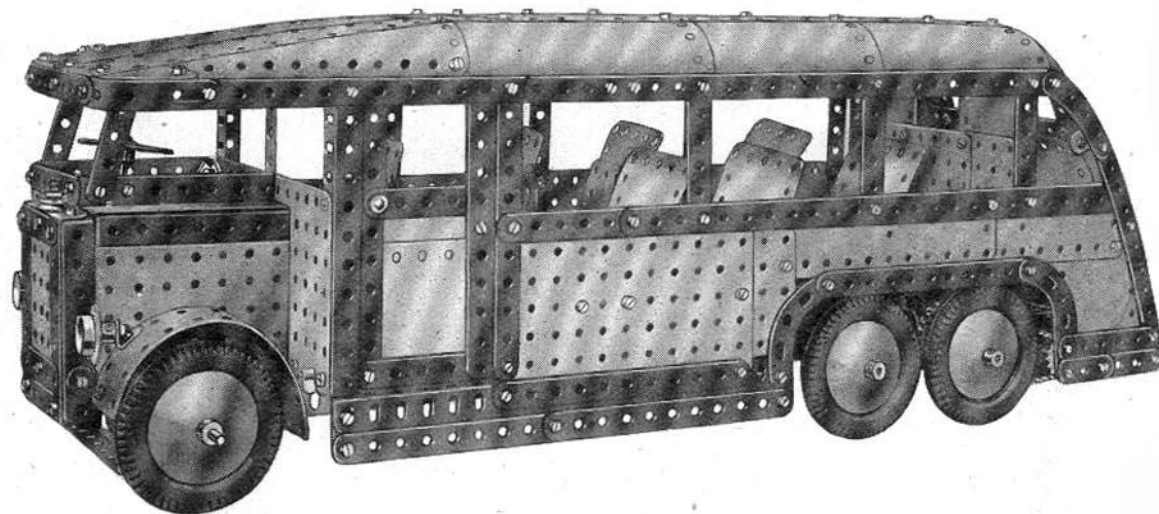


Fig. 9.8a



### STEERING MECHANISM

The front wheels are free on  $1\frac{1}{2}$ " Rods fixed in Couplings 9 and 10. These Couplings carry a  $1\frac{1}{2}$ " Rod in their centre cross bores, and the Rods are mounted in the  $5\frac{1}{2}$ " Strips at the front of the chassis. Washers are placed on the Rods between the Strips for spacing purposes. The lower ends of the Rods carry Cranks 11 and 12, which are linked together by a  $4\frac{1}{2}$ " Strip held by lock-nutted bolts.

The steering column is a  $4\frac{1}{2}$ " Rod journalled in one of the chassis girders and in a 1" Reversed Angle Bracket 13 bolted to this girder. The Rod carries a Collar and a  $\frac{1}{2}$ " Pinion between the Reversed Angle Bracket and the girder, and the Pinion meshes with a 57-teeth Gear 14. The Gear 14 is fixed on a 2" Rod mounted in a 1" Corner Bracket bolted to each of the  $5\frac{1}{2}$ " Strips at the front of the chassis, and the Rod carries at its lower end a Bell Crank with Boss 15. One arm of the Bell Crank is connected by a  $2\frac{1}{2}$ " Strip to the Crank 12.

### BONNET AND CAB

The dividing panel 16 between the cab and the saloon is formed from two  $5\frac{1}{2}$ "  $\times$   $3\frac{1}{2}$ " Flat Plates overlapped nine holes and fixed to Angle Brackets attached to the chassis. A vertical  $5\frac{1}{2}$ " Angle Girder 17 is bolted to each edge of the dividing panel and the Girders are connected by a compound strip 18. This consists of a  $5\frac{1}{2}$ " and a  $2\frac{1}{2}$ " Strip overlapped three holes.

The sides of the bonnet are  $3\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flanged Plates bolted to the panel 16. The off-side Plate is attached at a point one hole from the top of the panel, and the near side Plate two holes from the top as shown in Fig. 9.8b. A  $3\frac{1}{2}$ "  $\times$   $\frac{1}{2}$ " Double Angle Strip 19 is fixed in position, and the top of the bonnet is a  $3\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flanged Plate.

The radiator is also a  $3\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flanged Plate. It is fitted at each side with a  $3\frac{1}{2}$ "  $\times$   $\frac{1}{2}$ " Double Angle Strip and is edged with Strips as shown. It is attached to the flanges of the bonnet Plates by  $\frac{3}{4}$ " Bolts.

The side of the cab is built up on a framework formed by a  $2\frac{1}{2}$ " Angle Girder 20 attached to the panel 16 by a  $3\frac{1}{2}$ " Strip and a  $3\frac{1}{2}$ "  $\times$   $\frac{1}{2}$ " Double Angle Strip 21.

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9.8 MOTOR COACH—Continued

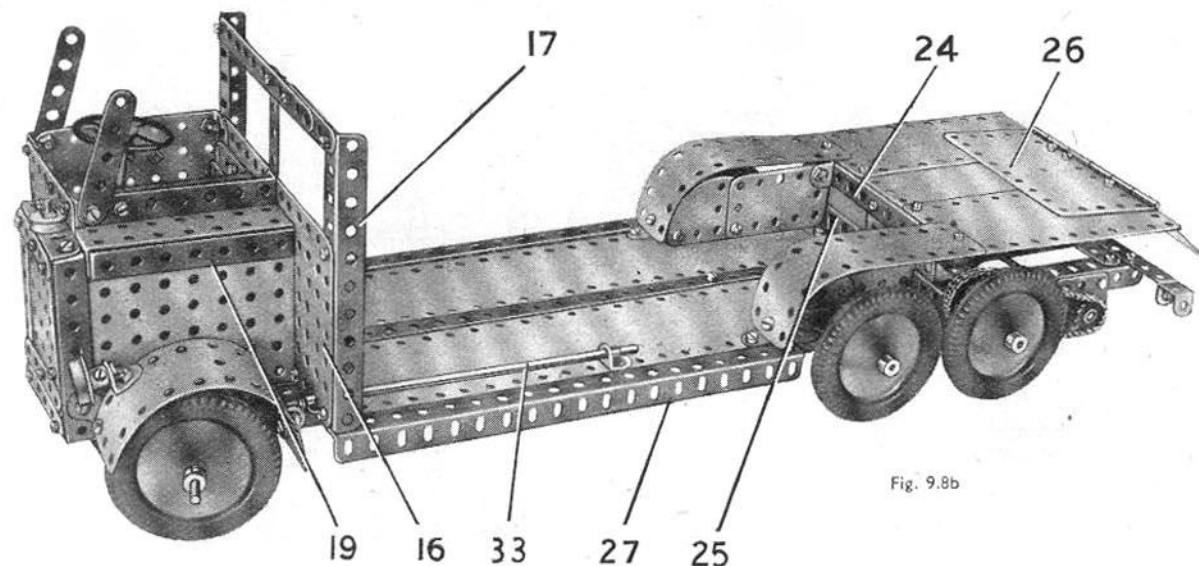


Fig. 9.8b

The construction of the rear of the body is shown in Figs. 9.8d and 9.8e.

The lower section of the rear panelling is formed by a  $2\frac{1}{2}'' \times 2\frac{1}{2}''$  and a  $5\frac{1}{2}'' \times 1\frac{1}{2}''$  Flexible Plate attached to the sides by Angle Brackets. These Plates are bolted together as shown in Fig. 9.8d so that a narrow gap is left through which the brake and reverse levers of the Clockwork Motor protrude. The lower Flexible Plates are continued upward at each side by a  $5\frac{1}{2}'' \times 1\frac{1}{2}''$  Flexible Plate, placed vertically and curved slightly so that it corresponds to the Curved Strips edging the sides of the model. The upper ends of the vertical Flexible Plates are sprung under the ends of the  $5\frac{1}{2}'' \times 2\frac{1}{2}''$  Flexible Plates used in the construction of the roof. The centre portion of the rear panelling is formed by one half of the Hinged Flat Plate 26.

A rear view window is provided by two  $4\frac{1}{2}''$  and two  $2''$  Strips edging the Flexible Plates. A catch fitted to the Hinged Flat Plate 26 engages a Fishplate bolted to the lower  $4\frac{1}{2}''$  Strip of the window, so that the Hinged Flat Plate is used as the door of a luggage locker. The catch is formed by a Handrail Support passed through a hole in the Hinged Flat Plate, and fitted with a Fishplate held tightly on the shank of the Handrail Support between two nuts.

The luggage locker is separated from the seating accommodation of the coach by a dividing panel. This is shown in Fig. 9.8d and consists of two  $4\frac{1}{2}'' \times 2\frac{1}{2}''$  Flat Plates overlapped and bolted to the flange of the  $5\frac{1}{2}'' \times 2\frac{1}{2}''$

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The space between the  $3\frac{1}{2}'' \times \frac{1}{2}''$  Double Angle Strip 21 and the  $3\frac{1}{2}''$  Strip is filled in by a  $2\frac{1}{2}'' \times 1\frac{1}{2}''$  Flanged Plate and a  $2\frac{1}{2}'' \times 1\frac{1}{2}''$  Flexible Plate. These Plates are overlapped three holes, and the  $2\frac{1}{2}'' \times 1\frac{1}{2}''$  Flanged Plate is bolted by one of its flanges to the panel 16. The front wheel arch is edged by two  $2\frac{1}{2}''$  Curved Strips, bolted to the Angle Girder 20 and attached to the side of the saloon by a Fishplate. The slight gap between the Curved Strips and the Double Angle Strip 21 is filled in by a  $1\frac{1}{2}''$  Strip and a  $1''$  Triangular Plate, arranged as shown in Fig. 9.8c.

The driving seat consists of two Girder Brackets bolted together and attached to panel 16.

### SALOON FLOOR

The construction of the floor is seen in Figs. 9.8b and 9.8c. Two  $12\frac{1}{2}'' \times 2\frac{1}{2}''$  Strip Plates separated by a  $12\frac{1}{2}''$  Strip 22 are bolted to the chassis and to a compound strip 23. This strip consists of two  $5\frac{1}{2}''$  Strips overlapped nine holes.

The wheel arches at each side are  $5\frac{1}{2}'' \times 1\frac{1}{2}''$  Flexible Plates fixed to the Strip Plates by Obtuse Angle Brackets and bolted to  $5\frac{1}{2}'' \times 2\frac{1}{2}''$  Flexible Plates at the rear. The  $5\frac{1}{2}'' \times 2\frac{1}{2}''$  Flexible Plates are bolted to a  $5\frac{1}{2}''$  Angle Girder 24, and the latter is supported from a similar Girder 25 by a  $5\frac{1}{2}'' \times 1\frac{1}{2}''$  Flexible Plate. The rear ends of the  $5\frac{1}{2}'' \times 2\frac{1}{2}''$  Flexible Plates are attached to a Double Bracket bolted to the Clockwork Motor, and a Hinged Flat Plate 26 is fixed in position as shown.

### SALOON BODY

A  $9\frac{1}{2}''$  Angle Girder 27 is attached to each end of the compound strip 23 and to a similar strip 28. The off-side panelling consists of a  $5\frac{1}{2}'' \times 3\frac{1}{2}''$  Flat Plate 29 and a  $5\frac{1}{2}'' \times 2\frac{1}{2}''$  Flat Plate 30 overlapped three holes. These Plates are extended at the rear by two  $5\frac{1}{2}'' \times 1\frac{1}{2}''$  Flexible Plates overlapped four holes, and by a  $2\frac{1}{2}'' \times 2\frac{1}{2}''$  Flexible Plate 31. The Plates are edged by Strips of various sizes.

The near-side panelling is similar to the off-side, except that the  $5\frac{1}{2}'' \times 3\frac{1}{2}''$  and  $5\frac{1}{2}'' \times 2\frac{1}{2}''$  Flat Plates are overlapped nine holes to allow space for the door.

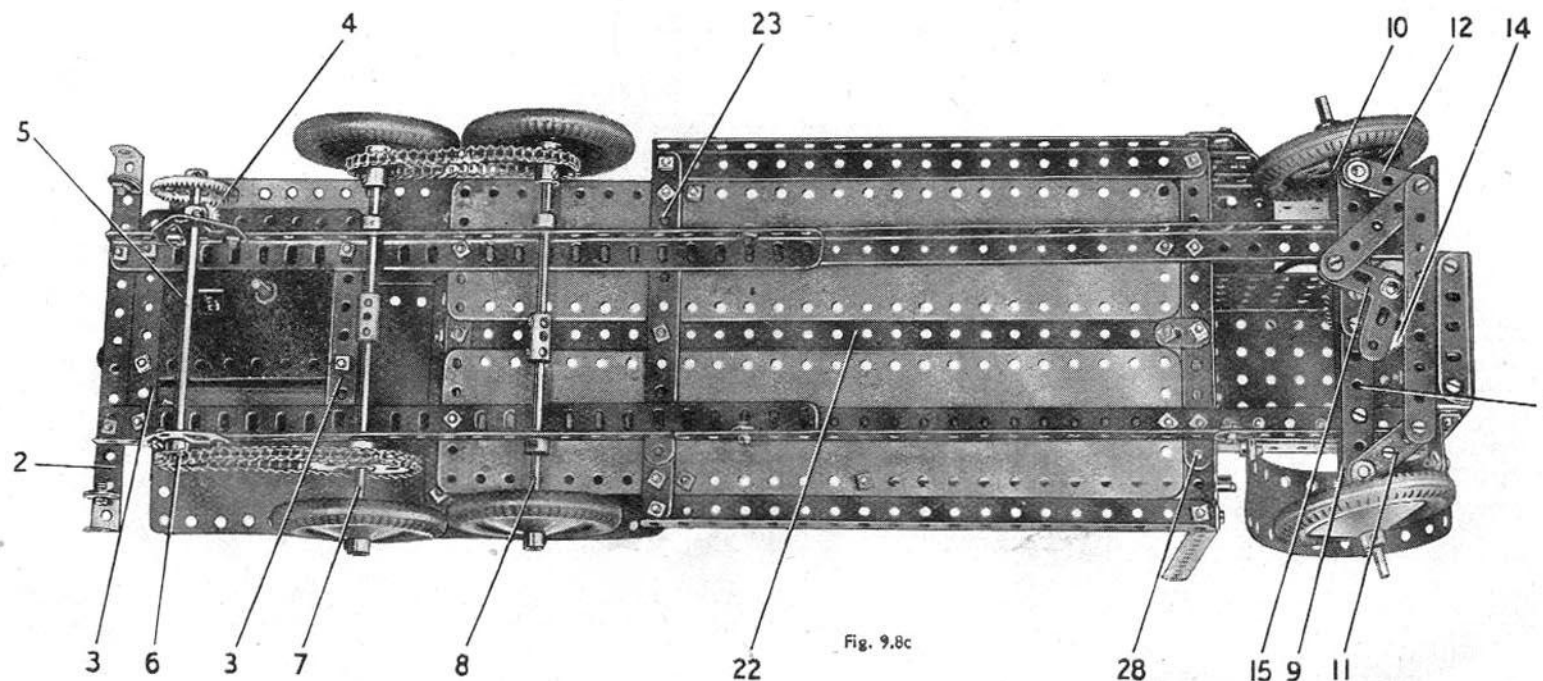


Fig. 9.8c



## 9.8 MOTOR COACH—Continued

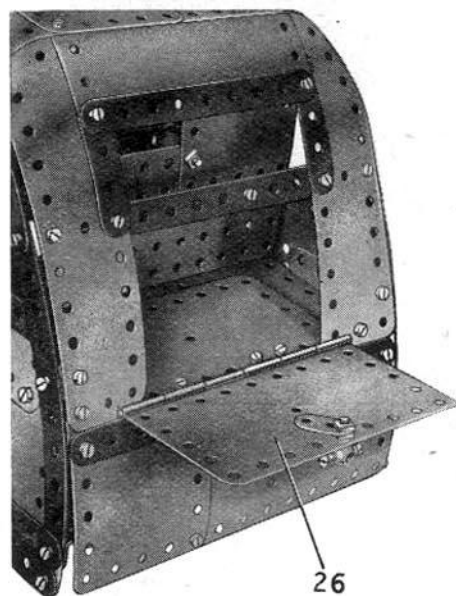


Fig. 9.8d

Four  $5\frac{1}{2}'' \times 2\frac{1}{2}''$  Flexible Plates are attached to each side rail and curved to shape.

The centre of the roof is filled in by four  $12\frac{1}{2}'' \times 2\frac{1}{2}''$  Strip Plates bolted to the Flexible Plates and attached to the  $4\frac{1}{2}''$  Strip at the front by Angle Brackets. The front is completed by a Semi-Circular Plate at each side.

The completed roof is bolted to the Angle Girders 17, and to the Curved Strips at the rear. The window frames are 3'' Strips.

**Note :** The Motor used in this model is not included in the Outfit.

Flanged Plate used for the rear seat. The Flat Plates are extended upward at each side by a  $2\frac{1}{2}'' \times 2\frac{1}{2}''$  Flexible Plate. This form of construction leaves a gap in the centre of the dividing panel to provide an uninterrupted view through the rear window.

**SLIDING DOOR AND SEATS**

The door is built up on a framework of two  $5\frac{1}{2}''$  Strips joined at each end and at the centre by  $2\frac{1}{2}''$  Strips. Two  $2\frac{1}{2}'' \times \frac{1}{2}''$  Double Angle Strips 32 are also fixed in position, and  $6\frac{1}{2}''$  Rods 33 are passed through the lugs of the Double Angle Strips. The forward ends of Rods 33 are mounted in the Strip 18 and in the panel 16. The rear end of the upper Rod is held in a  $1'' \times 1''$  Angle Bracket fixed to the roof. The lower Rod is mounted in a  $\frac{1}{2}'' \times \frac{1}{2}''$  Angle Bracket attached to the floor.

The rear seat is a  $5\frac{1}{2}'' \times 2\frac{1}{2}''$  Flanged Plate backed by two  $4\frac{1}{2}'' \times 2\frac{1}{2}''$  Flat Plates overlapped five holes. It is attached to Angle Girder 24 by a  $\frac{3}{4}''$  Bolt.

The double seats are made from Flexible Plates as shown in Fig. 9.8e, and they are bolted to a  $12\frac{1}{2}''$  Strip 34 at each side. Strips 34 are bolted to the wheel arches at the rear and they are attached at the front to Angle Brackets fixed to the body.

The single seat is a  $2\frac{1}{2}'' \times 1\frac{1}{2}''$  Flexible Plate curved to shape and fitted with a Flat Trunnion. It is bolted to a  $1\frac{1}{2}'' \times \frac{1}{2}''$  Double Angle Strip fixed to the floor.

**DETAILS OF THE COACH ROOF**

The roof of the coach is made as a separate unit and bolted in position when complete. The side rails are compound strips, each consisting of two  $12\frac{1}{2}''$  Strips overlapped 12 holes. The strips are extended at the front by Formed Slotted Strips, which are joined by a  $4\frac{1}{2}''$  Strip.

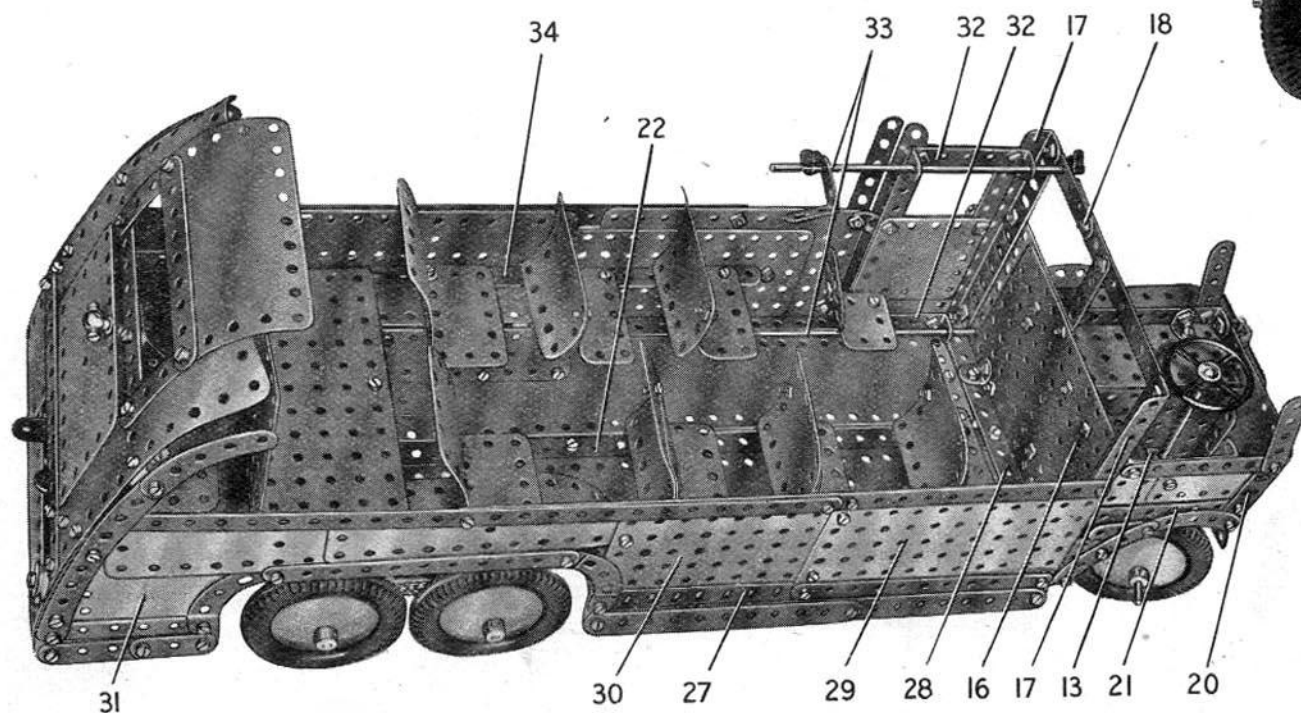


Fig. 9.8e

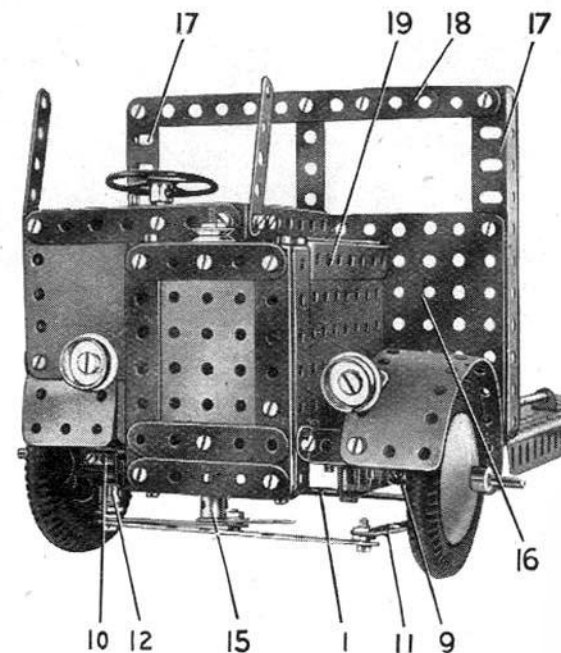


Fig. 9.8f

Meccano Parts can be purchased separately from your Meccano Dealer. Ask him for the latest price list.

## 9.9 TRAVELLING GANTRY CRANE

### BASES AND TOWERS

The construction of the base and tower on each side is similar. The sides of the bases are  $12\frac{1}{2}" \times 2\frac{1}{2}"$  Strip Plates braced by  $12\frac{1}{2}"$  Angle Girders 1 and  $12\frac{1}{2}"$  Strips 2. The sides are connected together at the ends by  $2\frac{1}{2}" \times \frac{1}{2}"$  Double Angle Strips, and at the centre by  $2\frac{1}{2}"$  Strips 3. The towers consist of  $12\frac{1}{2}"$  Angle Girders 4 bolted to  $1" \times 1"$  Angle Brackets, and built up girders 5. The built up girders are formed by  $12\frac{1}{2}"$  Strips connected by Angle Brackets. They are fixed to Fishplates and Angle Brackets bolted to the base. The towers are braced by Strips as shown in Fig. 9.9b. The Girders 4 are joined at the top by  $4\frac{1}{2}"$  Strips, and the girders 5 by  $4\frac{1}{2}" \times \frac{1}{2}"$  Double Angle Strips.

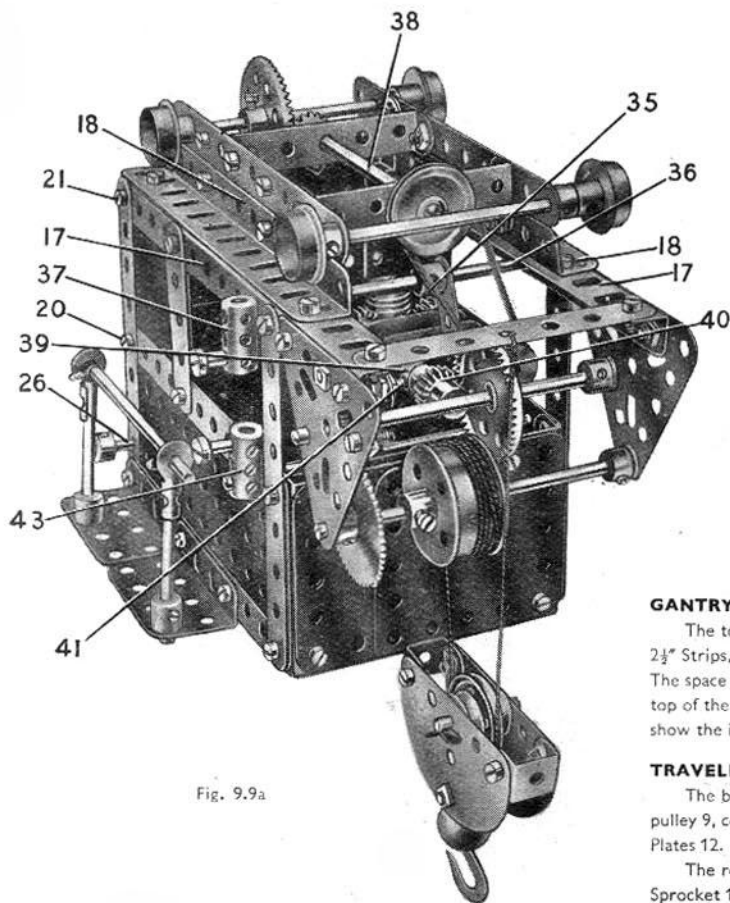
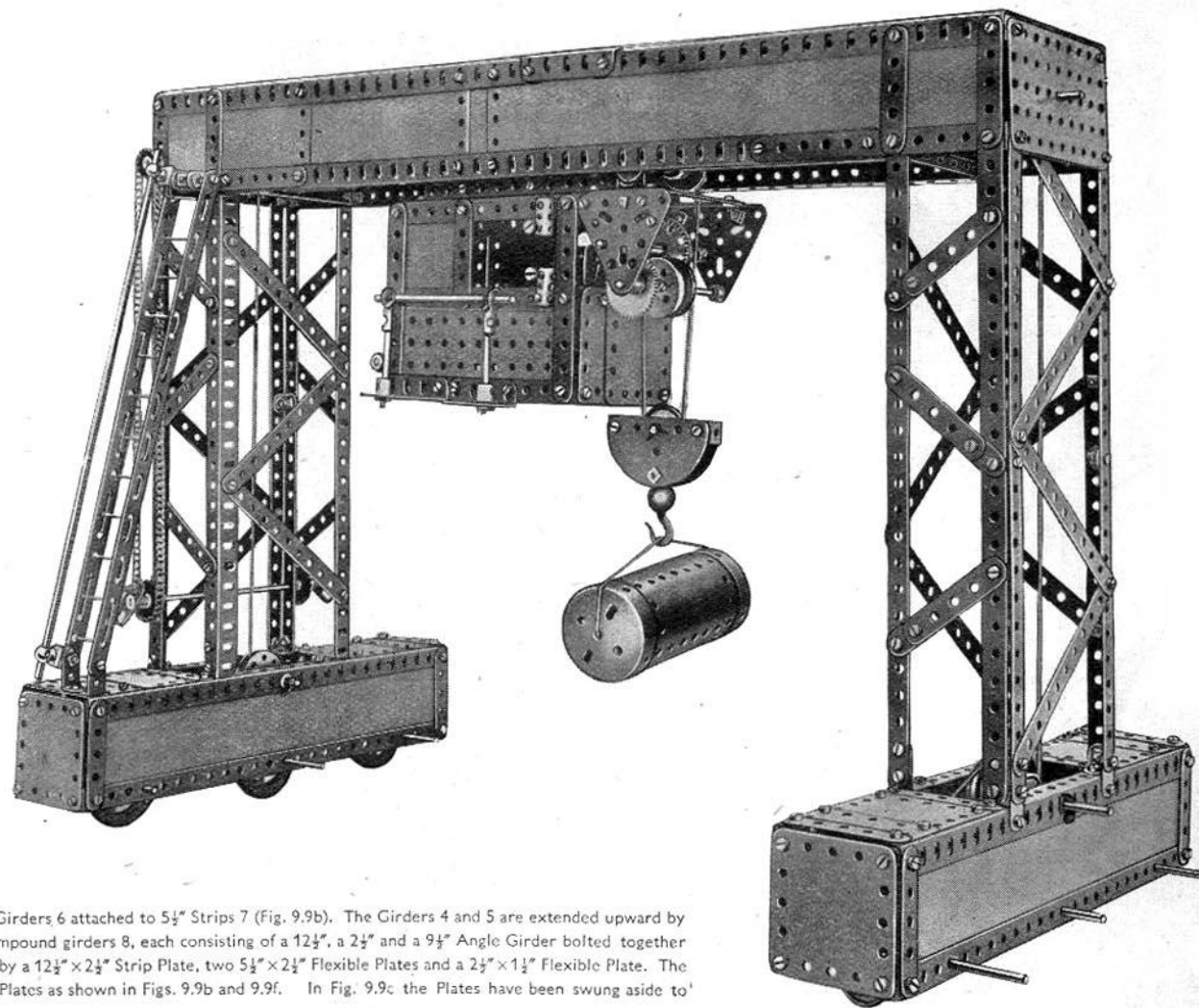


Fig. 9.9a



### GANTRY BEAM

The towers are connected by  $18\frac{1}{2}"$  Angle Girders 6 attached to  $5\frac{1}{2}"$  Strips 7 (Fig. 9.9b). The Girders 4 and 5 are extended upward by  $2\frac{1}{2}"$  Strips, and the latter are connected by compound girders 8, each consisting of a  $12\frac{1}{2}"$ , a  $2\frac{1}{2}"$  and a  $9\frac{1}{2}"$  Angle Girder bolted together. The space between Girders 6 and 8 is filled in by a  $12\frac{1}{2}" \times 2\frac{1}{2}"$  Strip Plate, two  $5\frac{1}{2}" \times 2\frac{1}{2}"$  Flexible Plates and a  $2\frac{1}{2}" \times 1\frac{1}{2}"$  Flexible Plate. The top of the gantry beam is filled in by Flexible Plates as shown in Figs. 9.9b and 9.9f. In Fig. 9.9c the Plates have been swung aside to show the inside of the beam.

### TRAVELLING MECHANISM

The bases are supported on six 2" Pulleys fixed on Rods mounted in the Strips 2 and held in place by Spring Clips. Two of the Pulleys in each base are connected by Driving Bands to a built-up pulley 9, consisting of a  $1\frac{1}{2}"$  Flanged Wheel and a Bush Wheel butted together. The pulley 9 is connected by a Driving Band to a  $1\frac{1}{2}"$  Pulley 10 fixed on a compound rod 11 journalled in  $4\frac{1}{2}" \times 2\frac{1}{2}"$  Flat Plates 12. The compound rod consists of two  $11\frac{1}{2}"$  and a  $1\frac{1}{2}"$  Rod joined by Couplings, and is supported at the centre in a  $1\frac{1}{2}" \times \frac{1}{2}"$  Double Angle Strip 13.

The rod 11 is fitted with a  $\frac{1}{2}"$  Pinion 14, that meshes with a Worm on a 5" Rod 15. This Rod is held in position by a Collar and a  $\frac{3}{4}"$  Sprocket, and the Sprocket is connected by Chain to a 1" Sprocket 16. The Sprocket 16 is on a  $6\frac{1}{2}"$  Rod carrying two Double Arm Cranks fitted with Threaded Pins to act as handles.



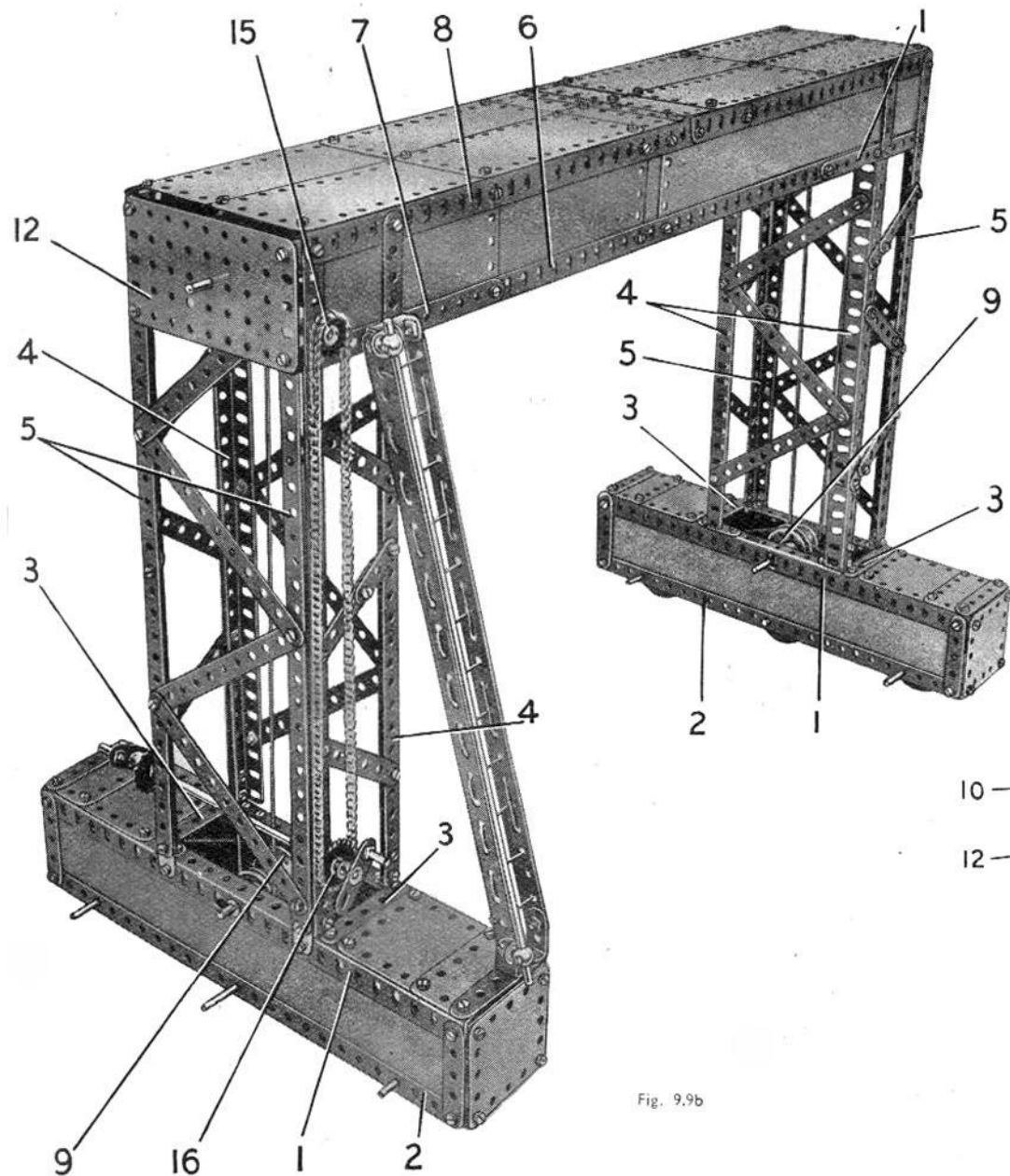


Fig. 9.9b

## 9.9 TRAVELLING GANTRY CRANE—Continued

**CAB AND HOIST**

The base of the cab is formed by two  $3\frac{1}{2}'' \times 2\frac{1}{2}''$  Flanged Plates, and the sides are  $5\frac{1}{2}'' \times 2\frac{1}{2}''$  Flat Plates and  $2\frac{1}{2}'' \times 2\frac{1}{2}''$  Flexible Plates arranged as shown in Fig. 9.9d. A  $7\frac{1}{2}''$  Angle Girder 17 is bolted at the top of each side, and a  $5\frac{1}{2}''$  Angle Girder 18 is fixed to the Girder 17. The sides are connected at the front by a  $3\frac{1}{2}'' \times \frac{1}{2}''$  Double Angle Strip held by the Bolt 19 and by two similar Double Angle Strips at the rear held by Bolts 20 and 21.

The hoisting drum consists of two  $1\frac{1}{2}''$  Flanged Wheels fixed on a  $4''$  Rod 22 mounted in  $2\frac{1}{2}''$  Triangular Plates. Rod 22 is fitted with a 50-teeth Gear meshing with a  $\frac{3}{4}''$  Pinion 45 on a  $4''$  Rod 23. This Rod carries also a  $1\frac{1}{2}''$  Contrate 24.

**POWER UNIT AND DRIVING MECHANISM**

An E20R Electric Motor 25 is bolted by its flanges to one side of the cab, and a Rod 26 is fixed in an End Bearing lock-nutted to the Motor control switch. A Worm 27 is fixed on the Motor armature shaft.

A Channel Bearing 28 is bolted to the Motor side-plate as shown in Fig. 9.9e, and this provides bearings for Rods 29 and 30, fitted with  $\frac{1}{2}''$  Pinions 31 and 32.

Rod 29 is also fitted with a  $\frac{1}{2}''$  Pulley 33, and a Collar 34. A Crank 35 is fixed on a  $4\frac{1}{2}''$  Rod 36 and is fitted with a  $\frac{3}{8}''$  Bolt that engages between the Collar 34 and the Pulley 33. Rod 36 carries a  $1''$  Pulley with Rubber Ring pressed against the Angle Girder 17, and a Coupling 37 outside the cab. The Pinion 31 can be moved in or out of mesh with the Worm 27 by turning the Coupling 37.

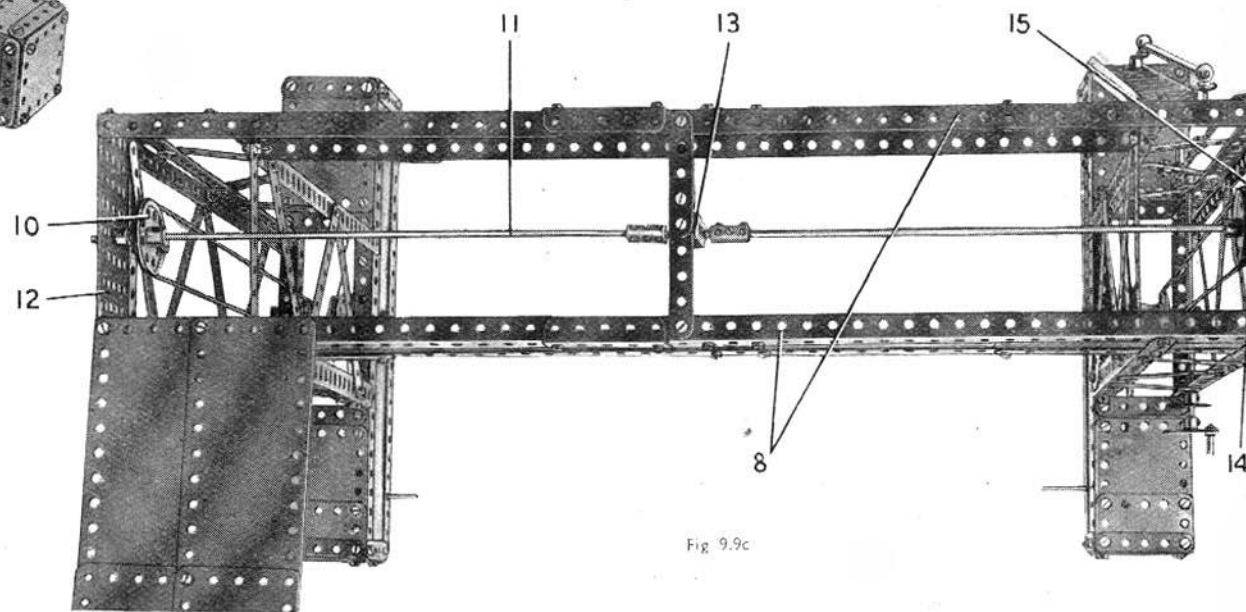


Fig. 9.9c

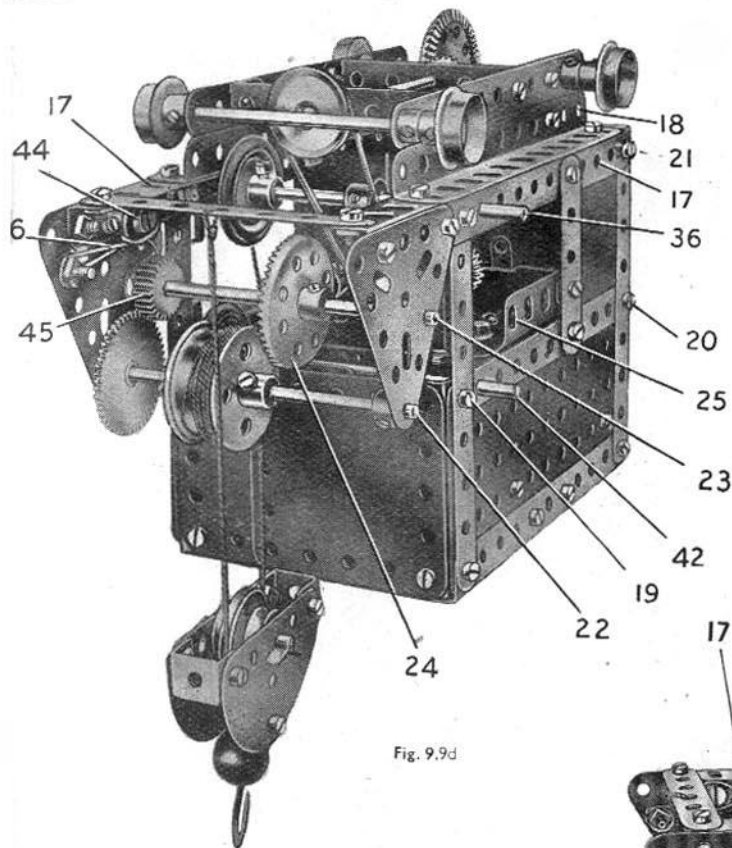


Fig. 9.9d

#### AUTOMATIC HOIST BRAKE

A Pawl 44 is pivoted on a Pivot Bolt fixed to one of the Angle Girders 17, and is spaced from the Girder by a Collar. The Pawl is normally held against the teeth of the  $\frac{3}{4}$ " Pinion 45 by a Driving Band 46. The Pawl is raised clear of the Pinion when the drive to the hoist is engaged by a short length of Cord tied to the centre hole of the Pawl. The Cord passes over Rod 36, and is tied to a Coupling fixed on Rod 42. The position of the Coupling is adjusted so that it is depressed when the Coupling 43 is moved to engage the drive. As the Coupling is depressed it causes the Cord to lift the Pawl 44 clear of the Pinion 45.

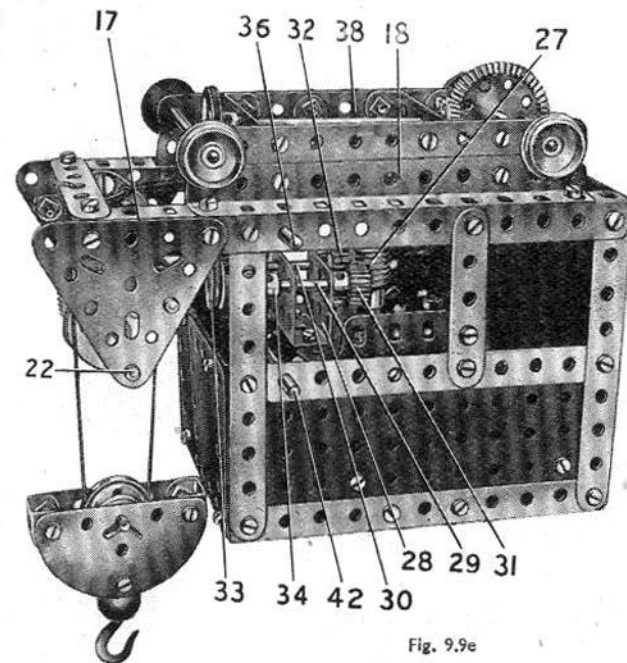


Fig. 9.9e

#### 9.9 TRAVELLING GANTRY CRANE—Continued

The Pulley 33 is connected by a Driving Band to a 1" Pulley fixed on a  $3\frac{1}{2}$ " Rod 38 mounted in  $2\frac{1}{2}$ "  $\times$   $\frac{1}{2}$ " Double Angle Strips. A  $\frac{1}{2}$ " Bevel locked on Rod 38 meshes with a  $1\frac{1}{2}$ " Bevel on one of the traversing axles. These axles are  $3\frac{1}{2}$ " Rods and they are mounted in  $5\frac{1}{2}$ " Strips attached by Fishplates to the Angle Girders 18. Four  $\frac{3}{4}$ " Flanged Wheels fixed on the axles run on the slotted flanges of the Girders 6.

Rod 30 carries a Collar 39 and a second  $\frac{1}{2}$ " Pinion 40. The Pinion 40 meshes with the Contrate 24, and a  $\frac{3}{8}$ " Bolt 41 engages between the Collar 39 and the Pinion 40 (Fig. 9.9a).

The Bolt 41 is fixed in a Crank on a  $4\frac{1}{2}$ " Rod 42. A 1" Pulley with Rubber Ring is fixed on this Rod and presses against the side of the cab, and the Rod carries also a Coupling 43. The Pinion 32 can be moved in or out of mesh with the Worm 27 by the Coupling 43.

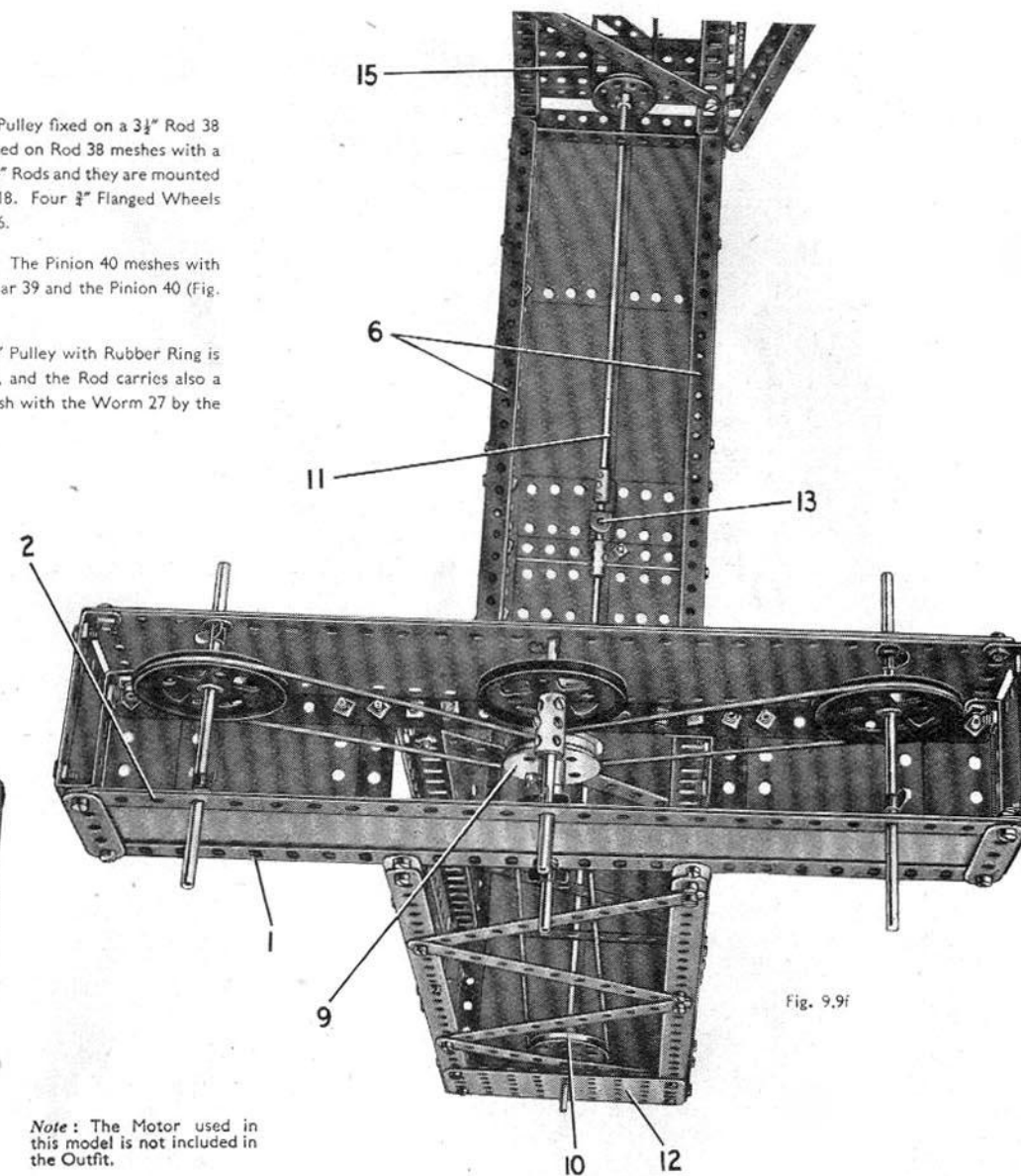
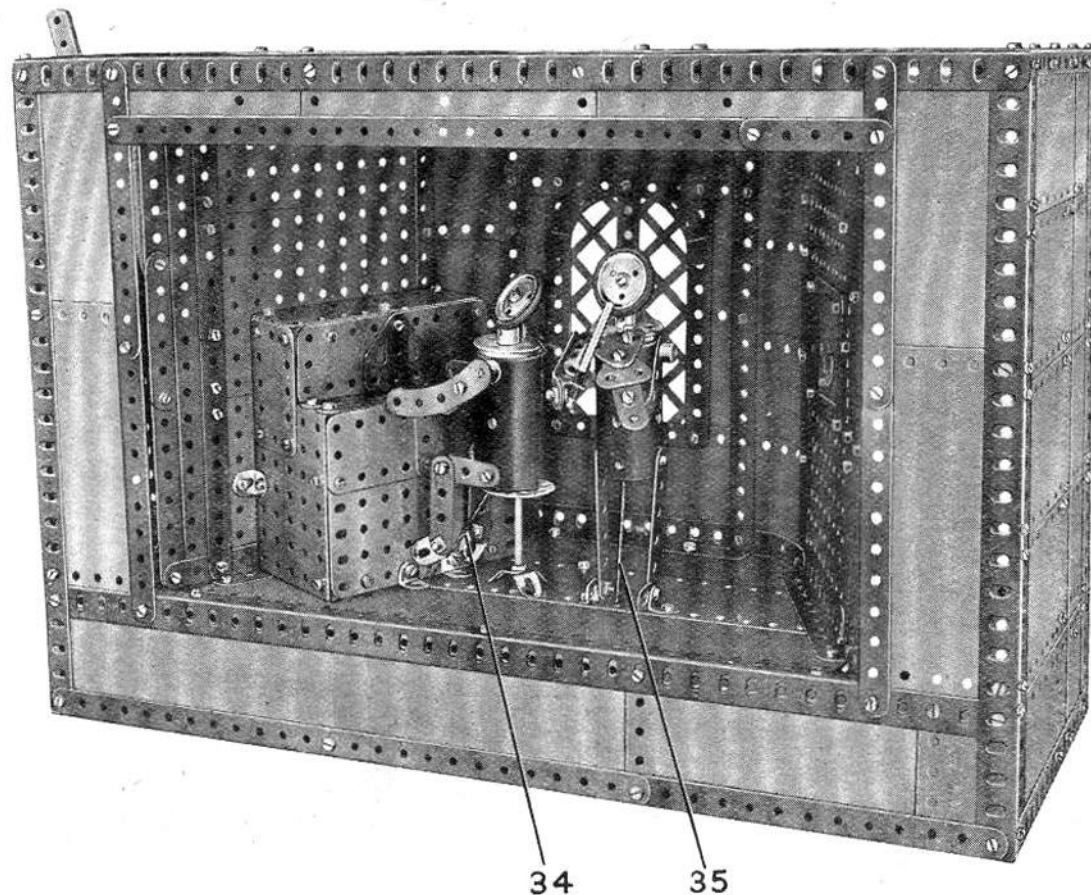


Fig. 9.9f

Note: The Motor used in this model is not included in the Outfit.





#### THE STAGE FRAMEWORK

It is best to commence construction by building the framework of the proscenium and the stage.

Each corner of the framework is a vertical  $12\frac{1}{2}$ " Angle Girder. The front Girders are joined by the  $18\frac{1}{2}$ " Angle Girders 1 and 2, and by a compound strip 3 consisting of two  $12\frac{1}{2}$ " Strips overlapped 13 holes. The rear Girders are joined by compound girders 4 and 5. Each of these consists of two  $12\frac{1}{2}$ " Angle Girders overlapped 13 holes.

The front and rear vertical Girders are connected together at their lower ends by  $7\frac{1}{2}$ " Angle Girders 6, and at the top by  $7\frac{1}{2}$ " Strips 7 (Fig. 9.10b). The space between the Girders 2 and the strip 3 is filled in by a  $12\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Strip Plate, a  $5\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flexible Plate and a  $2\frac{1}{2}$ "  $\times$   $1\frac{1}{2}$ " Flexible Plate.

The sides of the front of the stage are formed by two  $5\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flexible Plates overlapped two holes, and the top is completed by three  $5\frac{1}{2}$ "  $\times$   $1\frac{1}{2}$ " Flexible Plates 8 bolted to the Girder 1. The inner edges of the Flexible Plates are braced by compound strips as shown.

The floor of the stage consists of three  $12\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Strip Plates bolted to compound strips 9 and 10. Each of these is formed by two  $5\frac{1}{2}$ " Strips overlapped seven holes, and they are bolted to the Girders 2 and 4.

(Continued on next page)

#### 9.10 "PENNY-IN-THE-SLOT" THEATRE

When a penny is placed in a slot provided in this model a Clockwork Motor is set in motion and this operates cranks and cords which cause the figures of the pianist and violinist to perform in a very realistic manner. After a short interval the motion ceases and can only be re-started by inserting another coin.

The coins fall into a shallow tray, and can be removed when required by opening a small door in the base.

The automatic mechanism used in this model is adaptable for many other models operated on the "penny-in-the-slot" principle, and model-builders will be able to fit it quite easily to other such models they build from time to time.

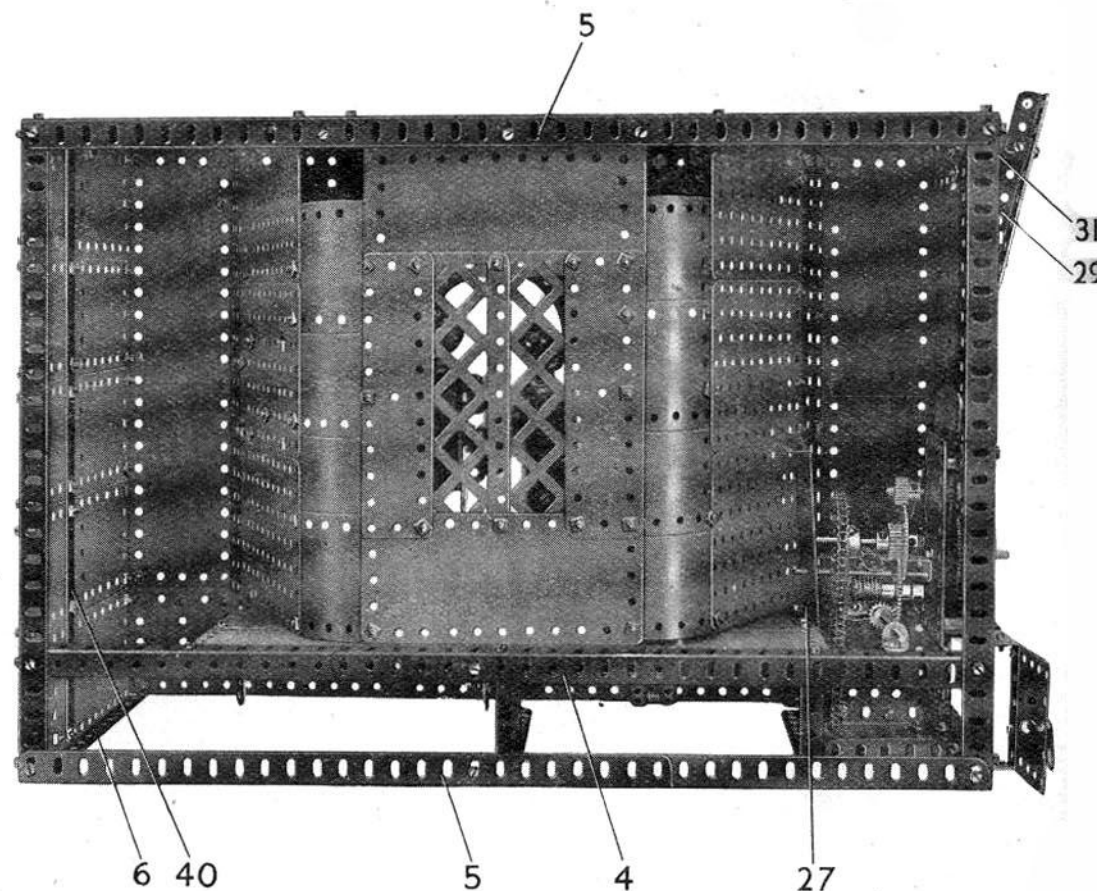


Fig. 9.10a

## 9.10 "PENNY-IN-THE-SLOT" THEATRE—Continued

## THE SCENERY

The scenery is built up on three  $5\frac{1}{2}$ " Angle Girders 11 and 12. The Girder 11 is bolted at the rear of the stage, and Girders 12 are attached at an angle to the front as shown. Each of the Girders 12 is connected to Girder 11 by a Formed Slotted Strip.

Each wing is formed by two  $5\frac{1}{2}$ "  $\times$   $3\frac{1}{2}$ " Flat Plates and a  $5\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flat Plate braced by compound strips as shown. The wings are extended to the front by a  $12\frac{1}{2}$ " Strip 13 and a compound strip 14. These are attached to the Flat Plates by  $2\frac{1}{2}$ " Strips at the top and bottom. The upper  $2\frac{1}{2}$ " Strips are connected to the Girder 1 by Obtuse Angle Brackets. The construction of the rear of the scenery is shown in Fig. 9.10a.

## OPERATING MECHANISM

The model is driven by a No. 1 Clockwork Motor attached to one of the vertical  $12\frac{1}{2}$ " Angle Girders and to a  $5\frac{1}{2}$ " Angle Girder 15. A  $\frac{1}{2}$ " Pinion on the Motor driving shaft meshes with a 57-teeth Gear 16 on a  $3\frac{1}{2}$ " Rod 17. Rod 17 is mounted in the Motor side-plates, and carries a  $\frac{1}{2}$ " Pinion 18 meshing with a 50-teeth Gear on a  $2\frac{1}{2}$ " Rod 19, also mounted in the side-plates. Rod 19 is fitted with a Worm 20, and this meshes with a  $\frac{1}{2}$ " Pinion 21 on an 8" Rod 22 mounted in Angle Brackets bolted to the Girders 2 and 4.

Rod 22 carries a  $1\frac{1}{2}$ " Pulley 23, fitted with two Angle Brackets in diametrically opposite holes. The Angle Brackets form part of the release mechanism, and they engage against a  $3\frac{1}{2}$ " Strip 24. This Strip is bolted to a  $2\frac{1}{2}$ "  $\times$   $\frac{1}{2}$ " Double Angle Strip 25, pivoted on a 4" Rod 26. The Rod is mounted in the side of the model and in a  $3\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flanged Plate 27 bolted to the floor of the stage.

The Strip 24 is arranged so that its end rests on the rim of Pulley 23, and it carries an Angle Bracket 28. As Pulley 23 is rotated by the Motor one of its Angle Brackets engages the Angle Bracket 28, thus acting as a brake and stopping the mechanism. When a coin is inserted in the chute 29, however, it falls on one end of the Strip 24, thus raising the opposite end and lifting Angle Bracket 28 clear of the Angle Brackets on Pulley 23. The mechanism can then operate until Pulley 23 completes half a revolution and its second Angle Bracket engages Angle Bracket 28.

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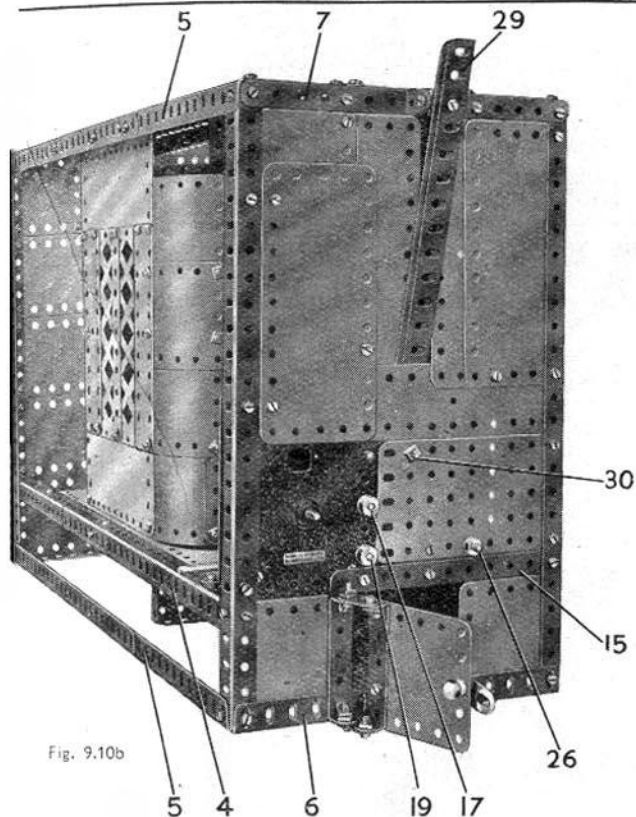


Fig. 9.10b

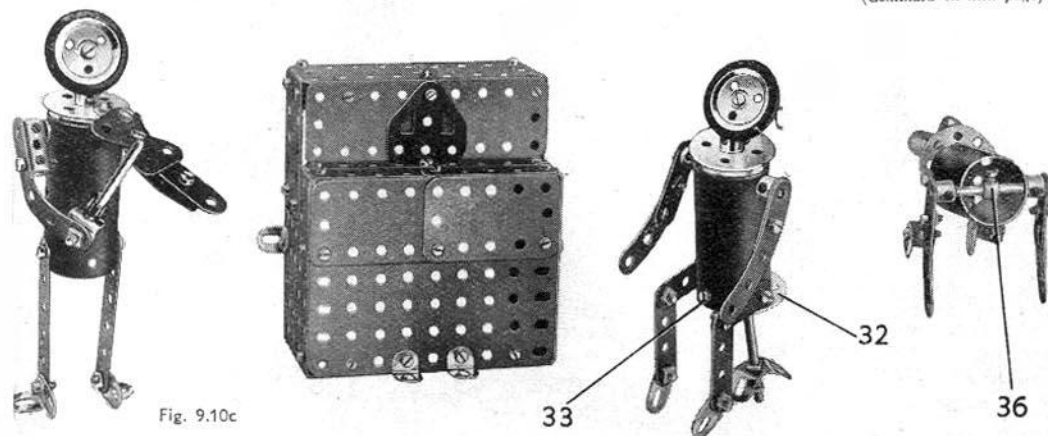


Fig. 9.10c

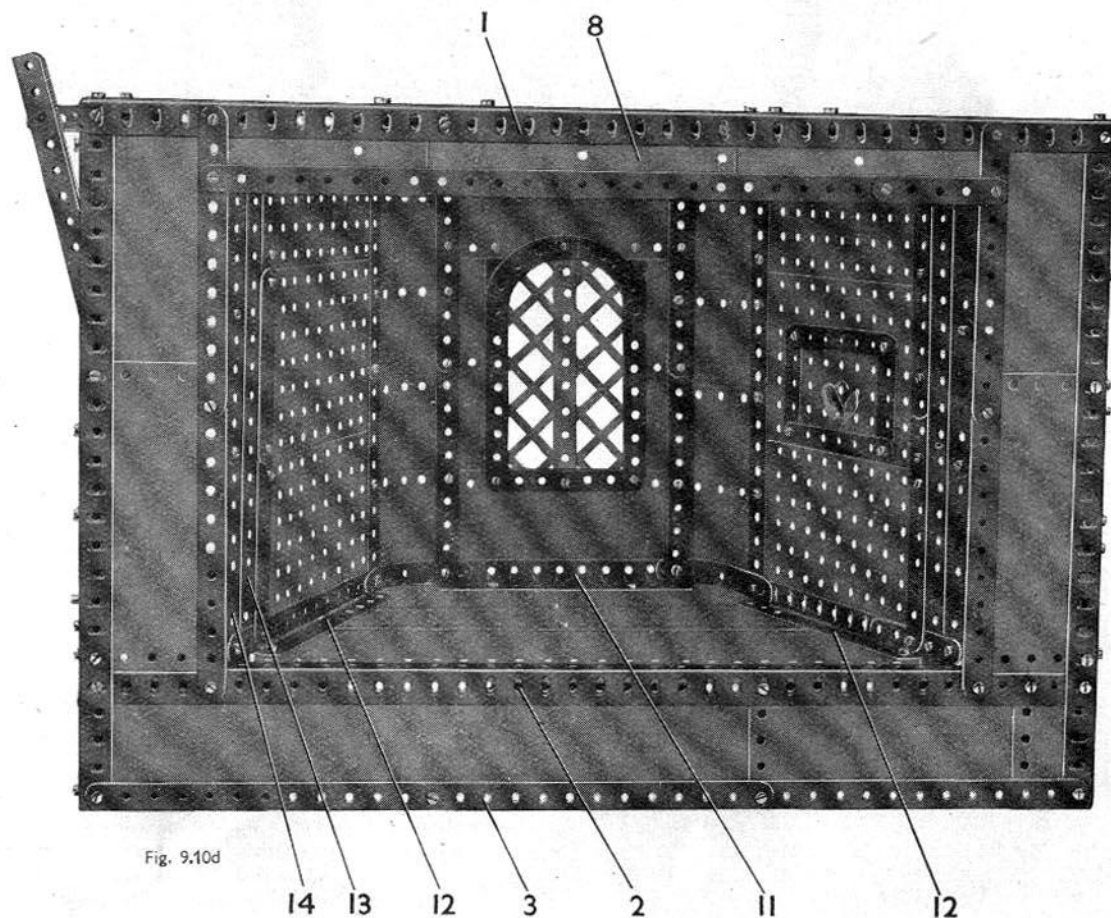


Fig. 9.10d



## 9.10 "PENNY-IN-THE-SLOT" THEATRE—Continued

The chute 29 is formed by two  $9\frac{1}{2}$ " Angle Girders bolted together by their slotted flanges so that a gap sufficient to accommodate a penny is left between the other flanges. The chute is attached to the side by a  $\frac{3}{4}$ " Bolt 30, and by a  $1" \times \frac{1}{4}"$  Angle Bracket 31. The latter is bolted to Strip 7 and is attached to the chute by an Angle Bracket. Two Washers are placed between Angle Bracket 31 and Strip 7. In Fig. 9.10g a penny is shown at the end of the chute 29 in the position it strikes Strip 24.

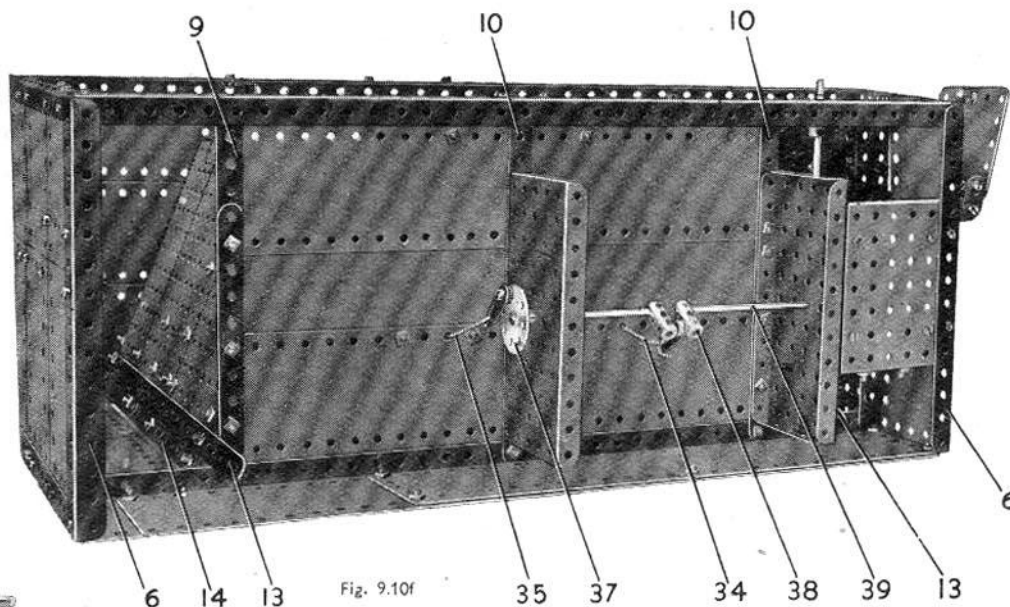


Fig. 9.10f

The coins' all into a shallow tray formed by a  $3\frac{1}{2}" \times 2\frac{1}{2}"$  Flanged Plate, attached to one of the Girders by Fishplates, and to the  $5\frac{1}{2}" \times 2\frac{1}{2}"$  Flanged Plate by Angle Brackets. To remove the coins, open the small door fitted at the side of the model. The door consists of a  $2\frac{1}{2}" \times 2\frac{1}{2}"$  Flexible Plate, and a  $2\frac{1}{2}" \times \frac{1}{2}"$  Double Angle Strip is bolted along one edge. A Fishplate is bolted to each lug of the Double Angle Strip, and lock-nutted to the lugs of a similar Double Angle Strip attached to the framework at the side of the model.

**DETAILS OF THE PERFORMING FIGURES**

The construction of the performers is shown in Fig. 9.10c. The stool of the pianist is formed by a Wheel Disc 32 attached to an Angle Bracket held by Bolt 33. A 3" Screwed Rod fixed in the centre hole of the Wheel Disc is attached to the stage by two nuts. The feet of the stool are Obtuse Angle Brackets.

The body of each performer is formed by a  $2\frac{1}{2}"$  Cylinder fitted at one end with a  $1\frac{1}{8}"$  Flanged Wheel. Their heads are 1" loose Pulleys, complete with Rubber Rings, and these are attached by  $\frac{3}{8}"$  Bolts to Fishplates. The Fishplates are held tightly against the bosses of the  $1\frac{1}{8}"$  Flanged Wheels by bolts screwed into the tapped holes of the Wheels.

The violinist's legs are 3" Strips bolted to the lower end of the Cylinder, and the feet are Fishplates. The figure is attached to the stage by two Angle Brackets. The upper portions of the pianist's legs are  $1\frac{1}{2}"$  Strips bolted to the Cylinder representing the body, and they are extended by 2" Strips and Fishplates.

The pianist's arms are Curved Strips, each of which is bolted tightly to a Crank. The Cranks are fixed on a 2" Rod passed through the upper holes in the  $2\frac{1}{2}"$  Cylinder and carries a Collar 36 fitted with a bolt. The Collar is placed on the Rod inside the Cylinder, and care should be taken to adjust the  $1\frac{1}{8}"$  Flanged Wheel so that the Collar can move freely.

One arm of the violinist is fixed to a Coupling locked on a 2" Rod passed through his body. The other arm is free on this Rod and is held in place by a Collar. The free arm is attached to the violin by an Angle Bracket.

The figures are operated by the Cords 34 and 35. These are tied to a Crank formed by a Bolt screwed into the Collar 36 on the 2" Rods supporting the arms. (See Fig. 9.10c).

The Cords 34 and 35 are attached to Fishplates pivoted on a Bush Wheel 37 and on a built-up crank 38. A 2" Sprocket on the end of Rod 39 is connected by Chain to a similar Sprocket on Rod 17.

**SIDES AND ROOF OF THE STAGE**

The side of the stage housing the mechanism is shown in Fig. 9.10b. The other side is filled in by six  $4\frac{1}{2}" \times 2\frac{1}{2}"$ , two  $2\frac{1}{2}" \times 2\frac{1}{2}"$  and two  $5\frac{1}{2}" \times 2\frac{1}{2}"$  Flexible Plates. These are bolted to the framework, and are braced by a  $12\frac{1}{2}"$  Strip 40.

Each side of the roof is filled in by a  $12\frac{1}{2}" \times 2\frac{1}{2}"$  Strip Plate, a  $2\frac{1}{2}" \times 1\frac{1}{2}"$  and a  $5\frac{1}{2}" \times 2\frac{1}{2}"$  Flexible Plate bolted to the Girders 1 and 5. The centre of the roof is filled in by a  $2\frac{1}{2}" \times 2\frac{1}{2}"$  and three  $5\frac{1}{2}" \times 2\frac{1}{2}"$  Flexible Plates. These are attached to  $2\frac{1}{2}"$  Angle Girders bolted to the Strips 7, and are braced by compound strips extending along the joins of the Plates.

*Note:* The Motor used in this model is not included in the Outfit.

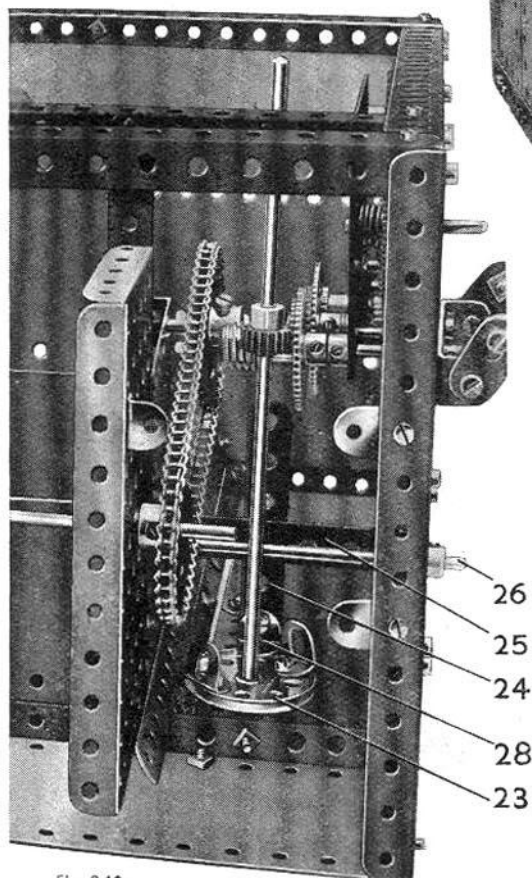


Fig. 9.10e

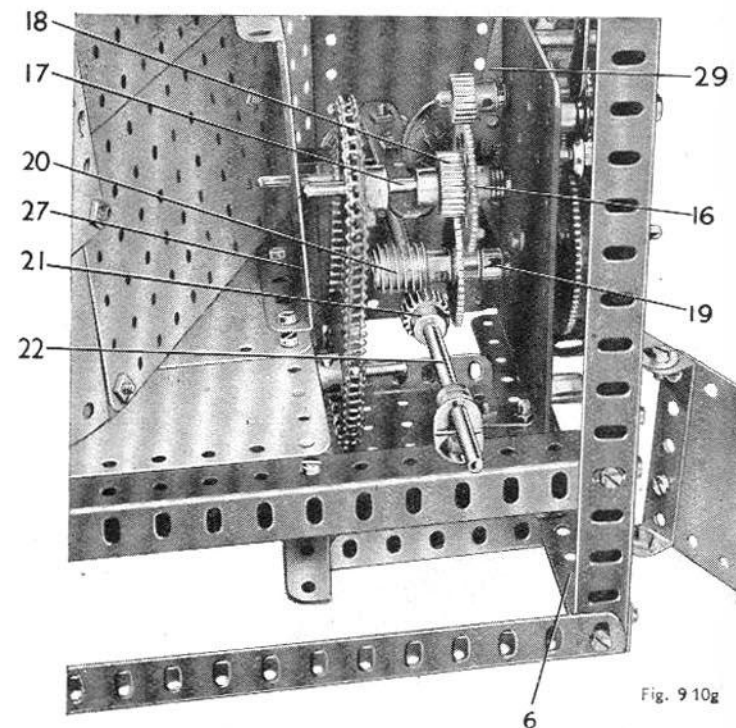


Fig. 9.10g

## 9.11 AUTOMATIC PRESS

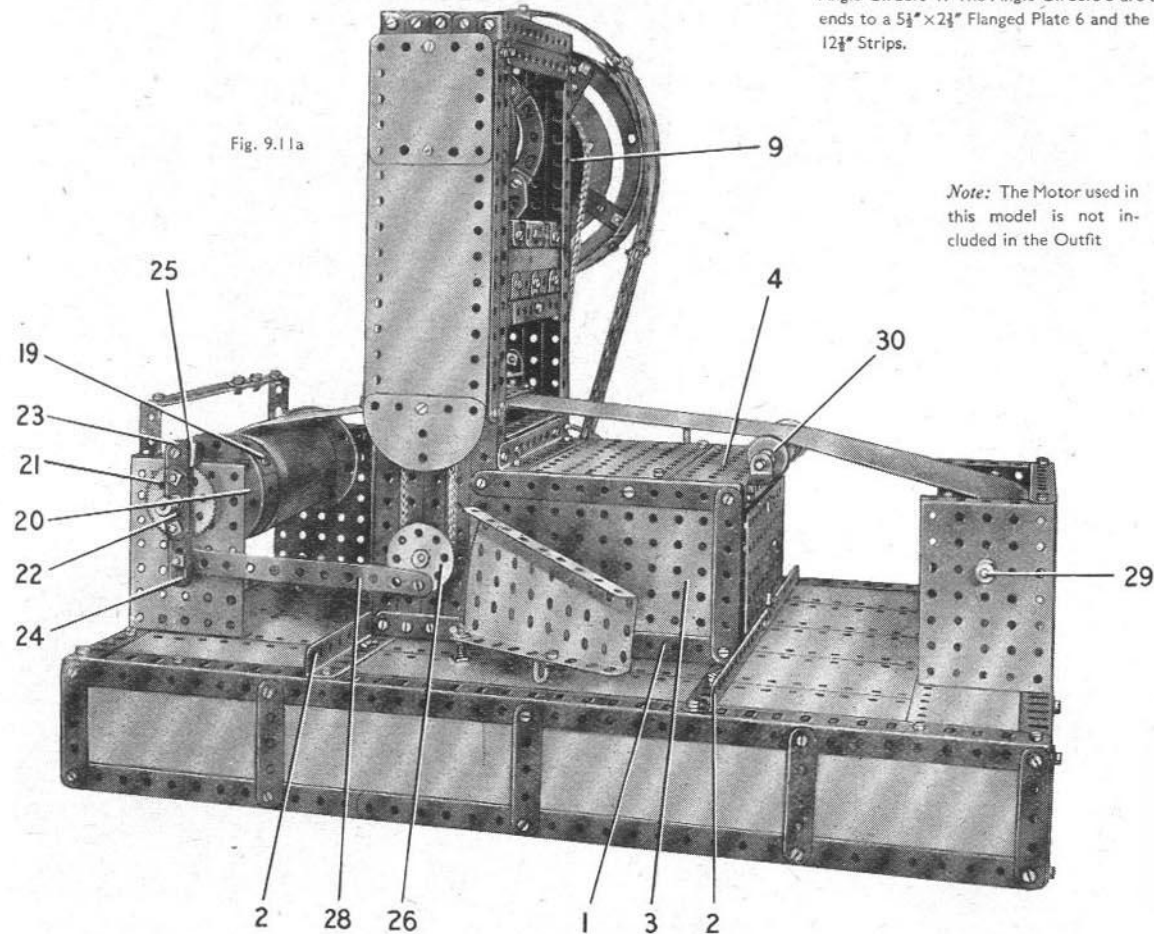
## THE PRESS BED

The press bed is seen in the general view of the model and in Fig. 9.11f. The rectangular framework is built up from two 18½" Angle Girders joined at each end by a 12½" Angle Girder. Its sides are extended downward by Flexible Plates edged with Strips as shown, and the top is filled in with 12½"×2½" Strip Plates arranged as shown.

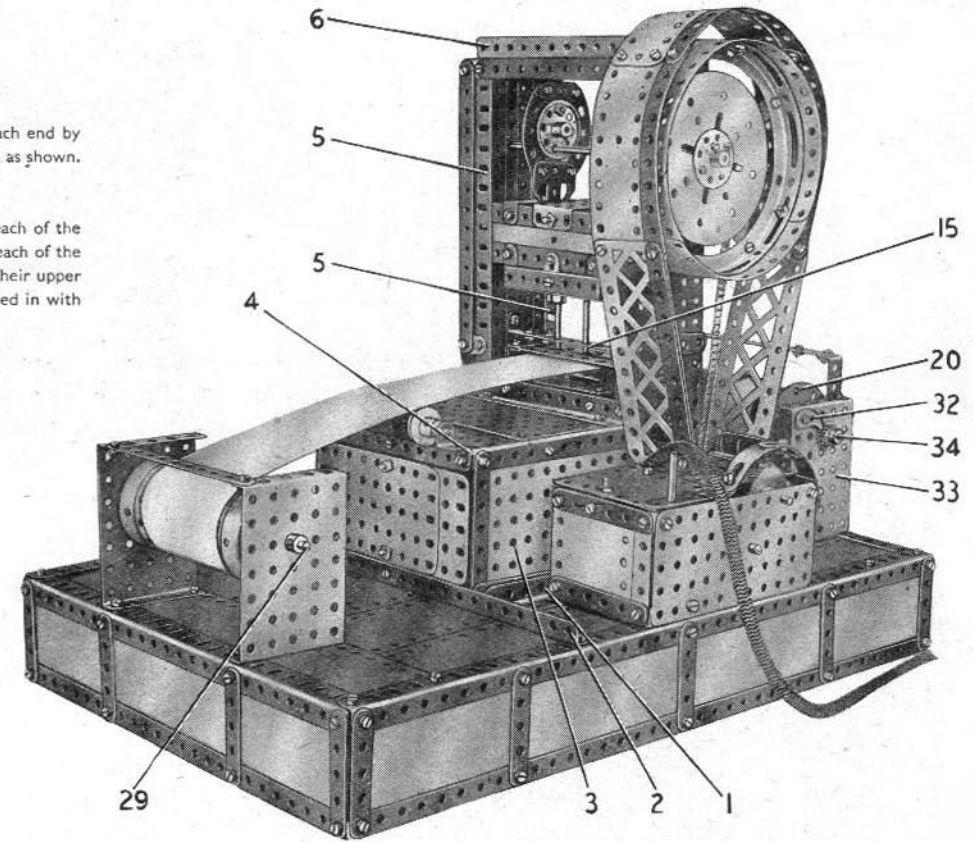
## FRAMEWORK

Each side of the press body is built up on a 7½" Angle Girder 1 (Fig. 9.11a) bolted between the 12½" Angle Girders 2. A 5½"×3½" Flat Plate 3 is bolted to each of the Angle Girders 1, and the Flat Plates on each side are bridged by a 5½"×2½" Flanged Plate 4. Two vertical 12½" Angle Girders 5 (Fig. 9.11d) are also bolted to each of the Angle Girders 1. The Angle Girders 5 are attached at their upper ends to a 5½"×2½" Flanged Plate 6 and the sides are filled in with 12½" Strips.

Fig. 9.11a



*Note:* The Motor used in this model is not included in the Outfit



## THE ECCENTRICS AND FLYWHEEL

The press is operated by two eccentrics. Each of these consists of two small radius Curved Strips connected at one end by a 1½" Strip and at the other end by a Flat Trunnion, and fitted in the groove of a 1½" Pulley (see Fig. 9.11g). A Crank 7 is bolted across the face of the Pulley in the position shown, and the Cranks on each eccentric are fixed on an 8" Rod mounted in the framework. The Rod is held in position by a 1" Sprocket 8 (Fig. 9.11b) and by a Collar on the other side. The Rod carries also a 3" Sprocket 9 and a flywheel 10.

The flywheel consists of 5½"×1½" Flexible Plates bolted around a Circular Girder. Two 5½" Strips are bolted across the Circular Girder and the centre is filled in by a 4" Circular Plate and a Bush Wheel. The Bush Wheel is then fixed on the 8" Rod.

(Continued on next page)



## 9.11 AUTOMATIC PRESS—Continued

## THE RAM AND TOOL ASSEMBLY

Each side of the ram consists of a  $5\frac{1}{2}" \times 1\frac{1}{2}"$  Flexible Plate 11 (Fig. 9.11g) edged with  $5\frac{1}{2}"$  Strips. The sides are connected together by four  $2\frac{1}{2}" \times \frac{1}{2}"$  Double Angle Strips 12, and by a  $2\frac{1}{2}" \times 1\frac{1}{2}"$  Flanged Plate 13. The ram slides between the slotted flanges of the Angle Girders 5, and is attached to the Flat Trunnions of the eccentrics by Angle Brackets bolted to the upper Double Angle Strips 12. The Bolts that connect the Angle Brackets to the Flat Trunnions are lock-nutted.

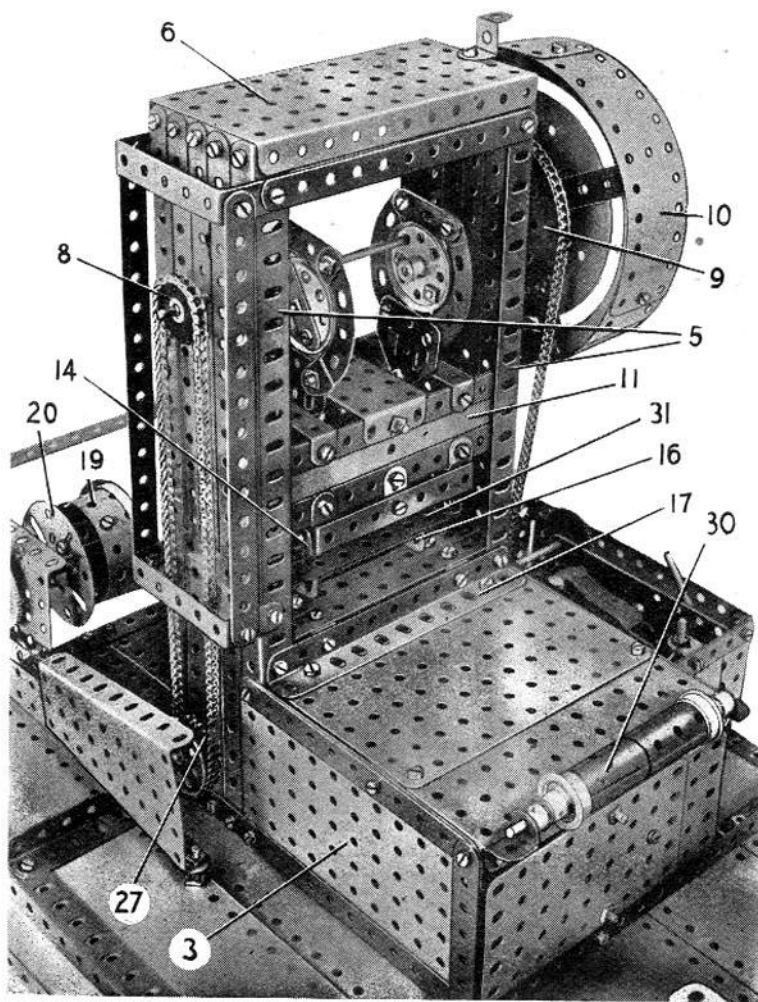


Fig. 9.11b



Fig. 9.11c

The press tools are made by two  $1\frac{1}{2}"$  and one  $2"$  Rod attached to a  $3\frac{1}{2}" \times 2\frac{1}{2}"$  Flanged Plate 14. The  $1\frac{1}{2}"$  Rods are fixed in Rod Sockets, and the  $2"$  Rod is locked in a Double Arm Crank bolted inside the Flanged Plate. The Flanged Plate is fitted at each side with a  $3\frac{1}{2}" \times \frac{1}{2}"$  Double Angle Strip, and these are attached to the ram by Fishplates. The Rods are guided in holes in a  $5\frac{1}{2}" \times \frac{1}{2}"$  Double Angle Strip 15 bolted to the framework. When the eccentrics are in their lowest position the Rods also pass through holes in a  $2\frac{1}{2}" \times 1\frac{1}{2}"$  Flanged Plate 16. This Flanged Plate is attached by Angle Brackets to two  $2\frac{1}{2}" \times \frac{1}{2}"$  Double Angle Strips bolted to a  $5\frac{1}{2}"$  Angle Girder 17 (see Fig. 9.11b) and to a  $5\frac{1}{2}"$  Strip 18 (Fig. 9.11g).

## FEED MECHANISM

A roll of paper is fed automatically through the press and wound on a drum 19 (Fig. 9.11a). This drum consists of a Boiler without Ends bolted to two  $5\frac{1}{2}" \times \frac{1}{2}"$  Double Angle Strips fixed between the Face Plates 20. The Face Plates are fixed on a compound rod consisting of a  $4"$  and a  $5"$  Rod joined by a Coupling. The rod is mounted in  $3\frac{1}{2}" \times 2\frac{1}{2}"$  Flanged Plates as shown.

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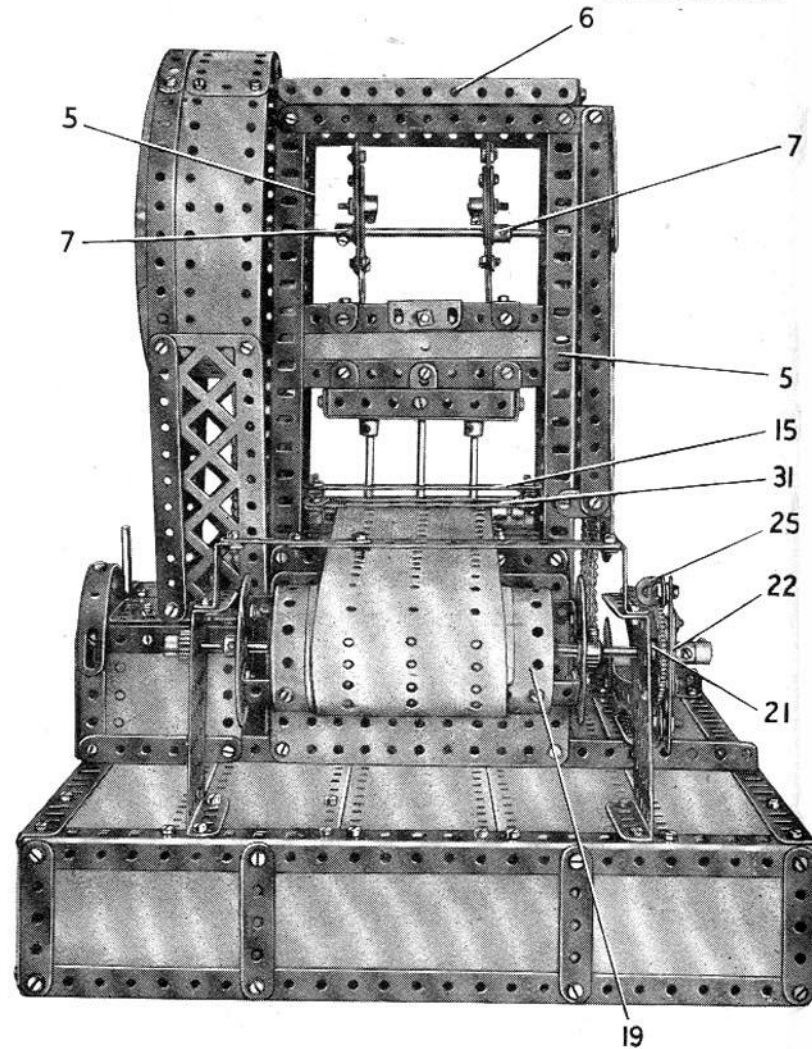


Fig. 9.11d

9.11 AUTOMATIC PRESS—Continued

A 57-teeth Gear 21 is fixed on the rod, and it carries also a Double Arm Crank 22 that is free to turn but is held in position by a Collar. The arms of the Crank are extended by a  $1\frac{1}{2}$ " Strip 23 and a 2" Slotted Strip 24. An Angle Bracket 25 is lock-nutted to the end hole of the  $1\frac{1}{2}$ " Strip and the 2" Strip is connected by a  $5\frac{1}{2}$ " Strip 28 to a Bush Wheel 26. The Bush Wheel is fixed on a  $6\frac{1}{2}$ " Rod mounted in the sides of the press, and the Rod carries also a 1" Sprocket 27 (Fig. 9.11b). This Sprocket is connected to the Sprocket 8 by Chain. The Bolts holding the  $5\frac{1}{2}$ " Strip 28 (Fig. 9.11a) in position are lock-nutted

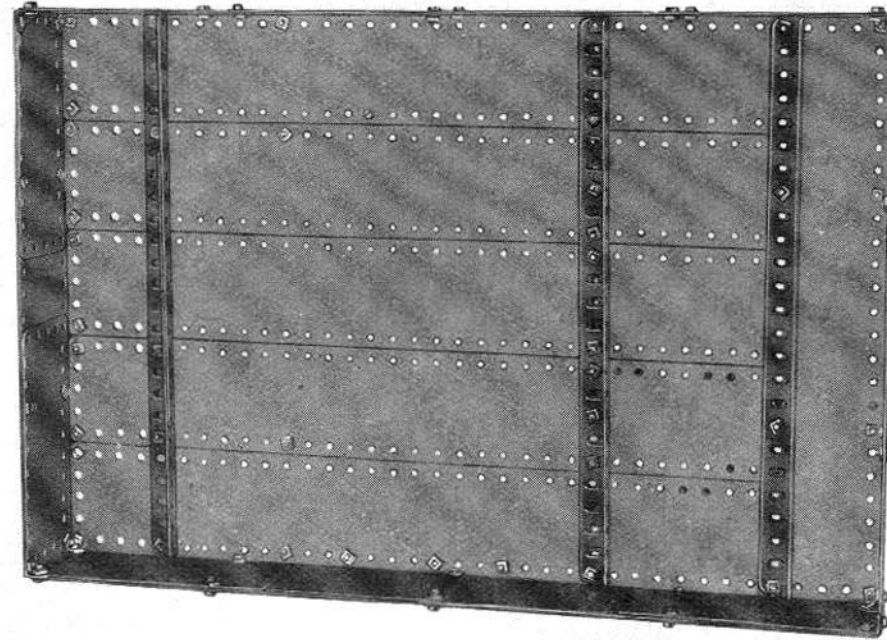


Fig. 9.11

The roll of paper is fed from a drum formed by a Boiler complete with Ends fixed between two 2" Pulleys on a  $6\frac{1}{2}$ " Rod 29. The paper passes over a roller 30, and between two  $4\frac{1}{2}$ " Strips 31 (Fig. 9.11b) and the  $2\frac{1}{2}$ " x  $1\frac{1}{2}$ " Flanged Plate 16. The  $4\frac{1}{2}$ " Strips are connected across by  $1\frac{1}{2}$ " Strips and attached to the Double Angle Strip 15 by  $\frac{1}{2}$ " Bolts. They are spaced from the Double Angle Strip 15 by nuts so that the paper can pass freely.

A ratchet is fitted to the drum 19 and it consists of a Pawl 32 (see general view) lock-nutted to the Flanged Plate 33. The Pawl engages the teeth of a  $\frac{1}{2}$ " Pinion 34, and allows the drum to rotate in one direction only.

The position of the Bush Wheel 26 (Fig. 9.11a) should be adjusted so that the drum 19 is turned by the Angle Bracket 25 as soon as the press tools are raised clear of the paper by the eccentrics.

The rate of feed can be altered by moving the Strip 28 in the slotted hole of Strip 24.

# OPERATING MECHANISM

The press is operated by an E20R Electric Motor bolted at one side of the base (see Fig. 9.11e). The Motor is housed in a box formed by two  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ " Flat Plates joined at each end by 3" Strips bolted to Angle Brackets.

The ends are filled in by  $2\frac{1}{2}$ " x  $2\frac{1}{2}$ " Flexible Plates. A  $\frac{1}{2}$ " Pinion on the Motor armature shaft meshes with a 57-teeth gear on a  $2\frac{1}{2}$ " Rod 35. This Rod carries also a  $\frac{1}{2}$ " Pinion that meshes with a 50-teeth Gear 36. The 50-teeth Gear is fixed on a  $3\frac{1}{2}$ " Rod that carries a  $\frac{1}{2}$ " Sprocket 37. The  $\frac{1}{2}$ " Sprocket is connected by Chain to the 3" Sprocket 9 (Fig. 9.11b). An End Bearing fitted with a 2" Rod is lock-nutted to an arm of the Motor Switch (Fig. 9.11e). Details of the guard over the Motor and driving chain are seen in Fig. 9.11c

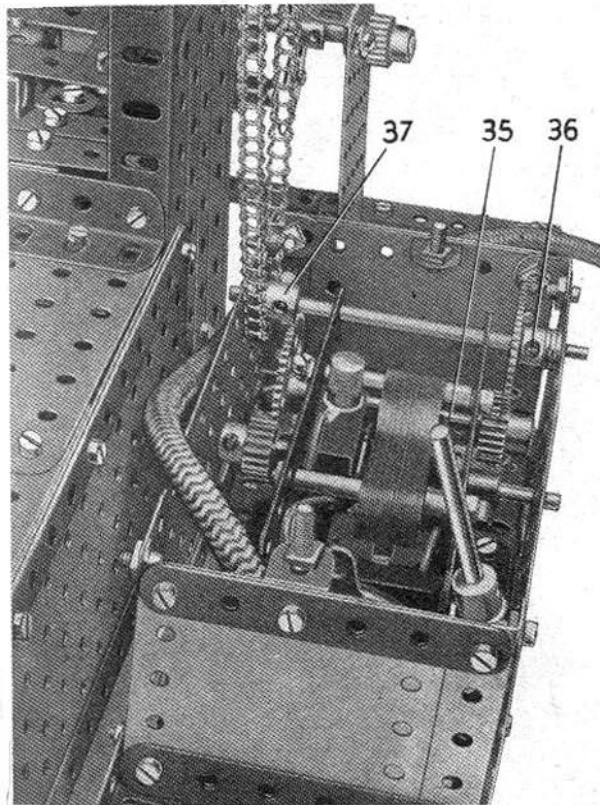


Fig. 9.11e

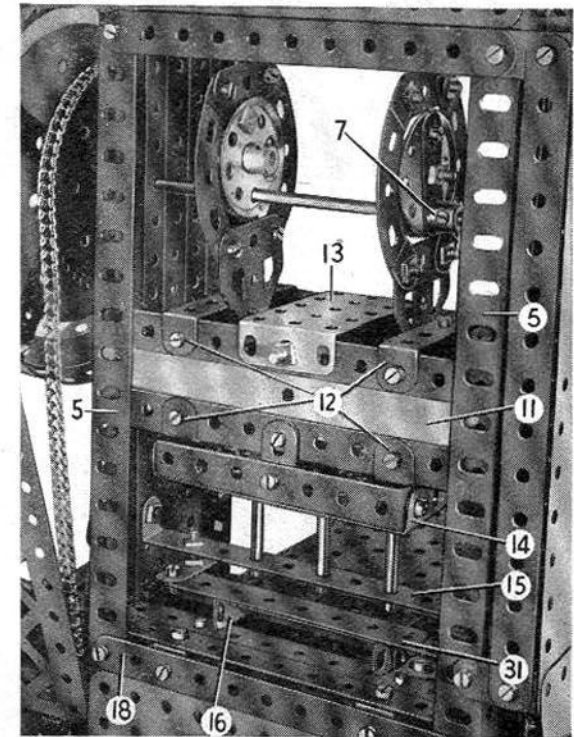
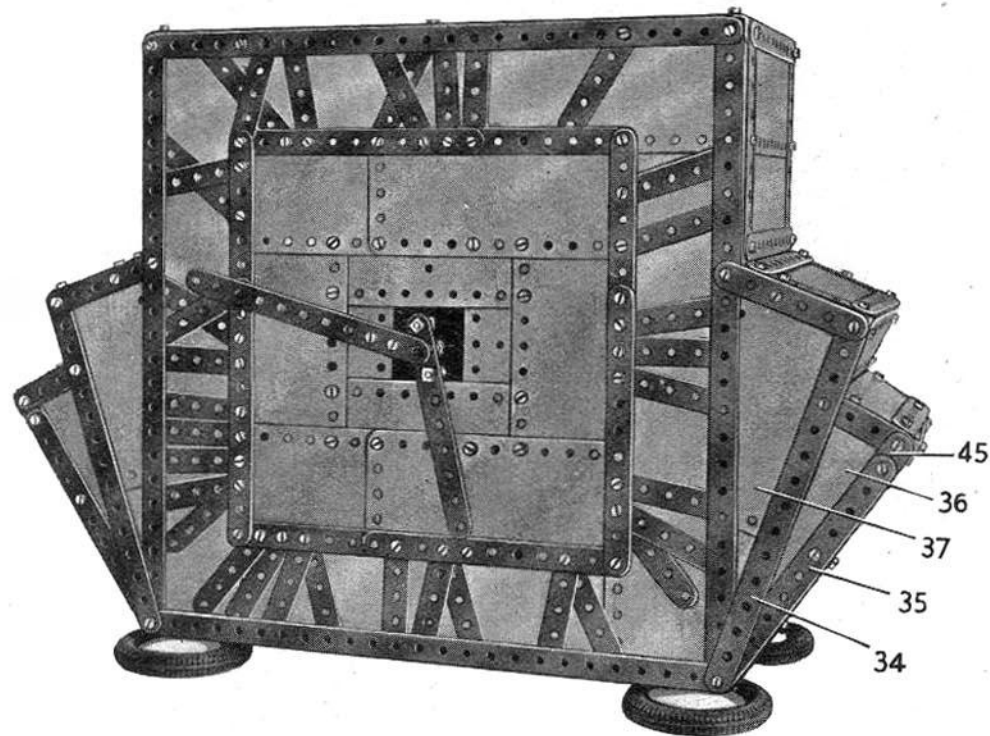


Fig. 9.11g





Note: The Clockwork Motor used in this model is not included in the Outfit.

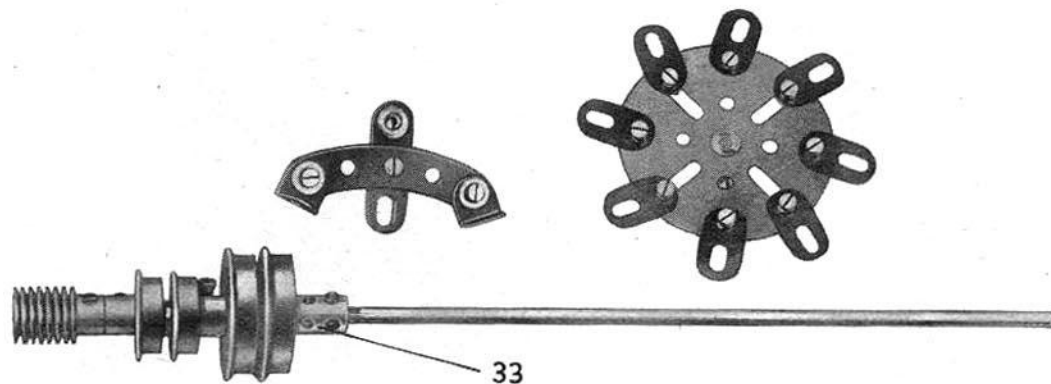


Fig. 9.12a

## 9.12 MANTEL CLOCK

### THE CLOCK MECHANISM

The clock mechanism forms a self-contained unit that is assembled separately, and when completed is fixed in place in the clock case. The mechanism unit, complete except for the pendulum, is shown in Figs. 9.12c and 9.12e.

The driving power is provided by a No. 2 Clockwork Motor, 1, which is bolted to two  $12\frac{1}{2}$ " Angle Girders. To the upper plate of the Motor two  $7\frac{1}{2}$ " Angle Girders 2 are attached, and to these are bolted a  $5\frac{1}{2}$ "  $\times$   $3\frac{1}{2}$ " Flat Plate 3 and a  $5\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flat Plate 4. Between these plates two  $3\frac{1}{2}$ "  $\times$   $\frac{1}{2}$ " Double Angle Strips 5 and 6 (Fig. 9.12c) are fixed, and to the  $5\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Plate a 3" Strip 7 is attached by the same Bolts that hold the Double Angle Strips to this Plate. Attached to this Plate also is a  $4\frac{1}{2}$ " Strip 8, and to the  $5\frac{1}{2}$ "  $\times$   $3\frac{1}{2}$ " Flat Plate a  $5\frac{1}{2}$ " Strip 9 is attached. Between these two Strips is a further  $3\frac{1}{2}$ "  $\times$   $\frac{1}{2}$ " Double Angle Strip 10.

The gear train from the Motor is as follows. A  $\frac{1}{2}$ " Pinion on the driving shaft of the Motor engages a 57-teeth Gear 11 mounted on a  $2\frac{1}{2}$ " Rod journaled in the Double Angle Strips 5 and 6. This Rod carries also a Worm 12 and a  $1\frac{1}{2}$ " Bevel Gear 13, the Bevel being spaced from the upper Double Angle Strip by two Washers. Six Washers are used to space the 57-teeth Gear from the lower Double Angle Strip. The  $1\frac{1}{2}$ " Bevel 13 engages a  $\frac{1}{2}$ " Bevel on a 4" Rod mounted as shown, and carrying also a 2" Sprocket 15, which is connected by Chain with a  $\frac{3}{4}$ " Sprocket mounted on Rod 16. The Rod carries the pallet wheel 17 (Fig. 9.12e). A crutch 18 is carried on Rod 19. The Worm 12 engages a 57-teeth gear on Rod 20, which carries the minute hand 21. A  $\frac{3}{4}$ " Pinion 22 on this Rod meshes with a 50-teeth gear on Rod 23. Also on this Rod is a 1" Sprocket connected by Chain to a 2"

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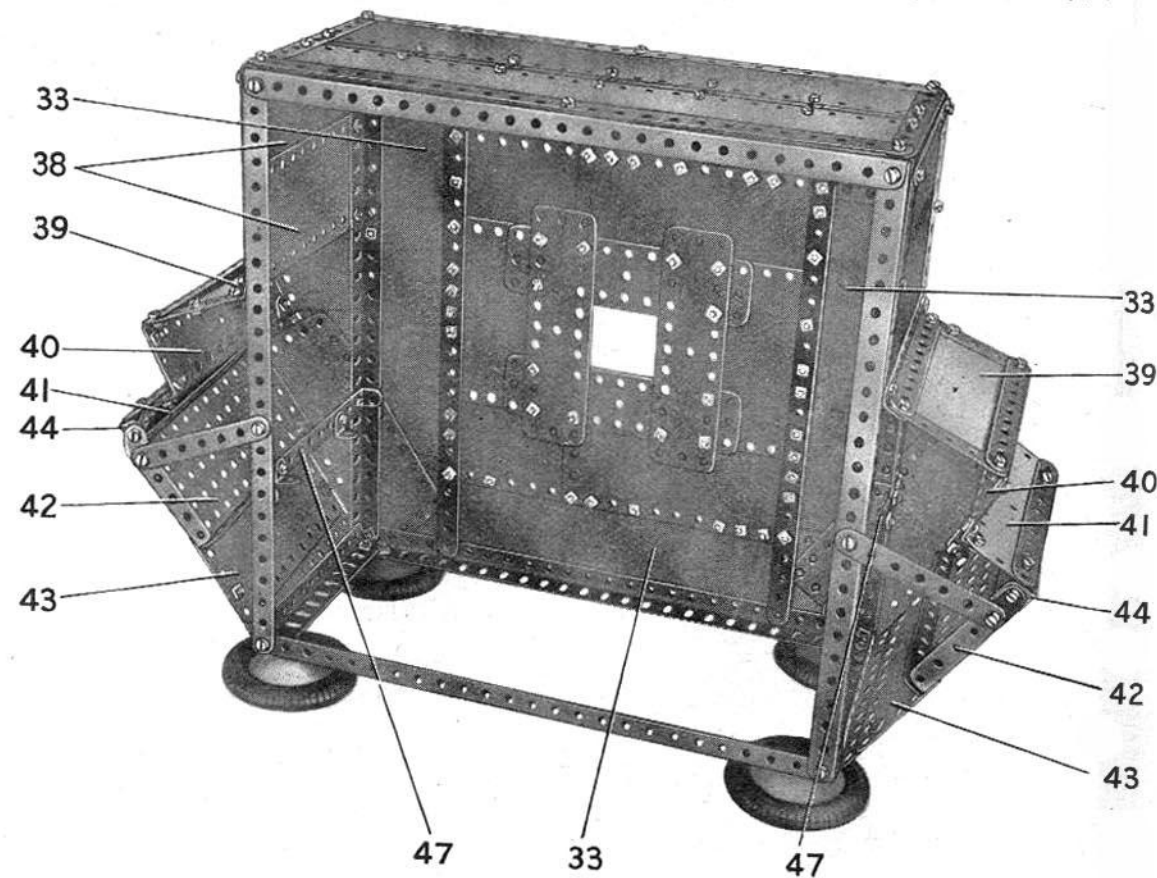


Fig. 9.12b

## 9.12 MANTEL CLOCK—Continued

Sprocket 24 on Rod 25. From this Rod the drive is transmitted to the hour hand 26, by means of a  $\frac{1}{2}$ " Pinion 27 that engages another  $\frac{1}{2}$ " Pinion fixed on a 2" Rod. 28.

Rod 28 is mounted in the sideplate of the mechanism case and in a Double Bent Strip held by the Bolts 29. It carries the 1" Sprocket 30, and this is connected by Chain to a 3" Sprocket 31.

The hour hand is a  $\frac{1}{2}$ " Strip. It is attached by locking it between nuts on  $\frac{3}{4}$ " Bolts 32 held by nuts in the 3" Sprocket 31. The minute hand is a  $\frac{1}{2}$ " Strip attached to a Crank mounted on Rod 20.

**CRUTCH, PALLET AND PENDULUM (Figs. 9.12a and 9.12d)**

The crutch (Fig. 9.12a) is a  $2\frac{1}{2}$ " Curved Strip, to each end of which an Angle Bracket is bolted. The Curved Strip is attached to a Crank as shown.

The pallet (Fig. 9.12a) is a Face Plate to which eight Fishplates are firmly

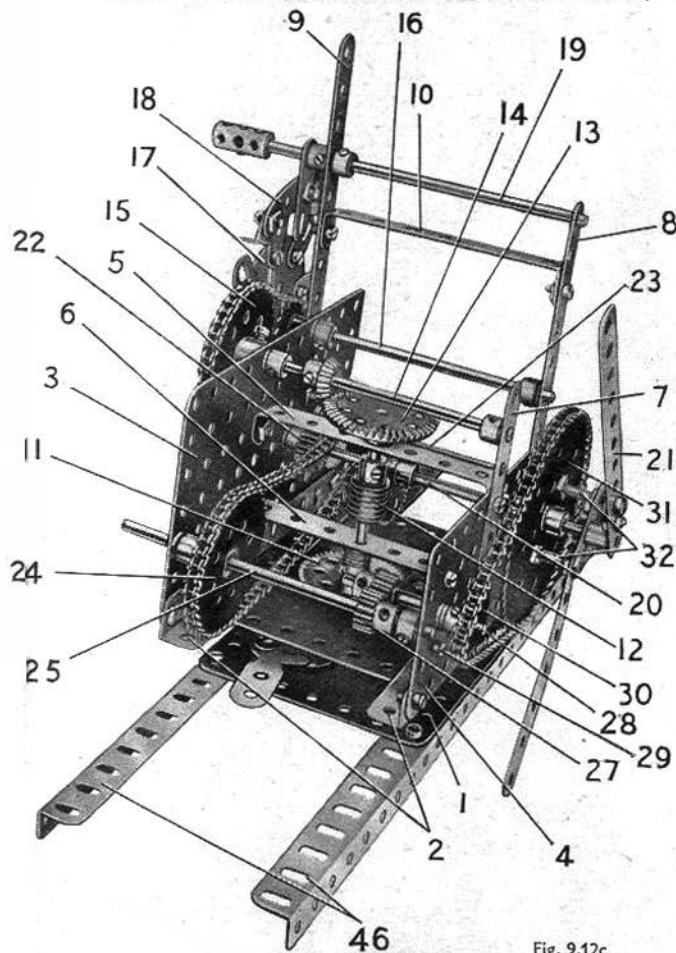


Fig. 9.12c

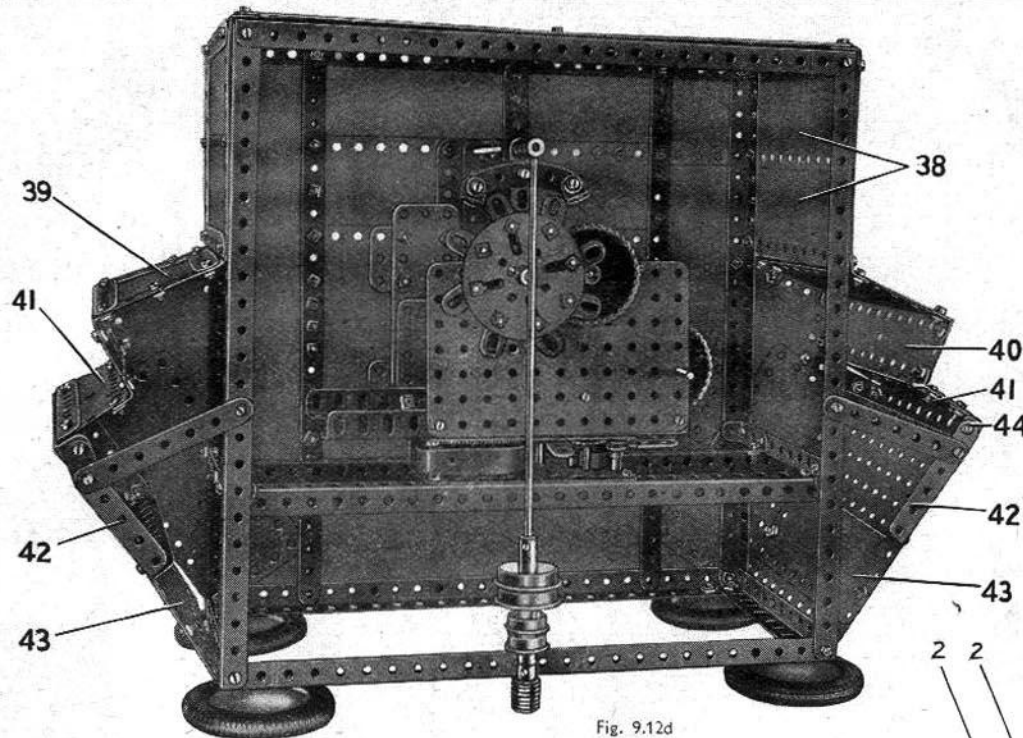


Fig. 9.12d

bolted. The Fishplates are arranged at an angle to the rim of the Face Plate as indicated.

The pendulum (Fig. 9.12a) is an 8" Rod which carries a Coupling 33. A  $2\frac{1}{2}$ " Rod is inserted in this Coupling, and this carries a bob weight made up of two  $1\frac{1}{2}$ " and two  $\frac{3}{4}$ " Flanged Wheels and a Worm.

**ADJUSTMENT OF THE MECHANISM**

After the clock is completed it will be necessary to adjust the angles of the Angle Brackets on the crutch, and the positions of the Fishplates forming the pallet wheel, until the clock ticks evenly. It may take some little time to adjust the relative positions correctly, but once these have been obtained the clock will be found to work quite satisfactorily, and by careful adjustment of the position of the weights of the bob on the pendulum rod, the accuracy of the clock can be regulated very closely.

**CLOCK CASE**

The case is built up on a framework of  $12\frac{1}{2}$ " and  $5\frac{1}{2}$ " Angle Girders arranged as shown in Fig. 9.12b. The top is filled in by a  $12\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Strip Plate at each side, and by six  $2\frac{1}{2}$ "  $\times$   $1\frac{1}{2}$ " Flexible Plates in the centre. The edges of the face consist of four  $12\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Strip Plates 33, and the centre is filled in by six  $5\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " and four  $5\frac{1}{2}$ "  $\times$   $1\frac{1}{2}$ " Flexible Plates arranged as shown in the general view of the model. The figures are built up from  $2\frac{1}{2}$ " and 3" Strips. The face is edged by  $12\frac{1}{2}$ " Strips and by compound strips consisting of two  $5\frac{1}{2}$ " Strips overlapped five holes.

A  $7\frac{1}{2}$ " Strip 34 and a  $5\frac{1}{2}$ " Strip 35 are fixed at an angle to the lower front corners of the face. The  $5\frac{1}{2}$ " Strip is connected to the  $7\frac{1}{2}$ " Strip by a 2" Strip, and the  $7\frac{1}{2}$ " Strip is connected to the face by a 3" Strip. The spaces between these strips are filled in by a  $5\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flexible

Plate 36 and a  $4\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flexible Plate 37.

The sides are identical in construction, and the top section of each consists of two  $5\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flexible Plates 38. They are completed by a  $5\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flexible Plate 39, two  $5\frac{1}{2}$ "  $\times$   $1\frac{1}{2}$ " Flexible Plates 40 and 41, a  $5\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flanged Plate 42 and a  $5\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flexible Plate 43. These Plates are edged with Strips as shown and connected together by Angle Brackets. A  $5\frac{1}{2}$ "  $\times$   $\frac{1}{2}$ " Double Angle Strip 44 is attached to the Flanged Plate 42 by a  $\frac{1}{2}$ " Strip 45 at the front and by a Fishplate at the rear.

The Angle Girders 46 of the mechanism are bolted to Angle Brackets attached to  $5\frac{1}{2}$ "  $\times$   $\frac{1}{2}$ " Double Angle Strips 47 fixed to the framework.

The clock case rests on feet formed by 2" Pulleys fitted with Motor Tyres. These are attached to the framework by Pivot Bolts and a  $\frac{3}{4}$ " Bolt.

Before attempting to operate the clock it is advisable to lubricate all the bearings, gears and chains and to make sure that the table or other support for the clock is horizontal. Even a slightly sloping table will make it difficult to adjust the pendulum and pallet mechanism satisfactorily.

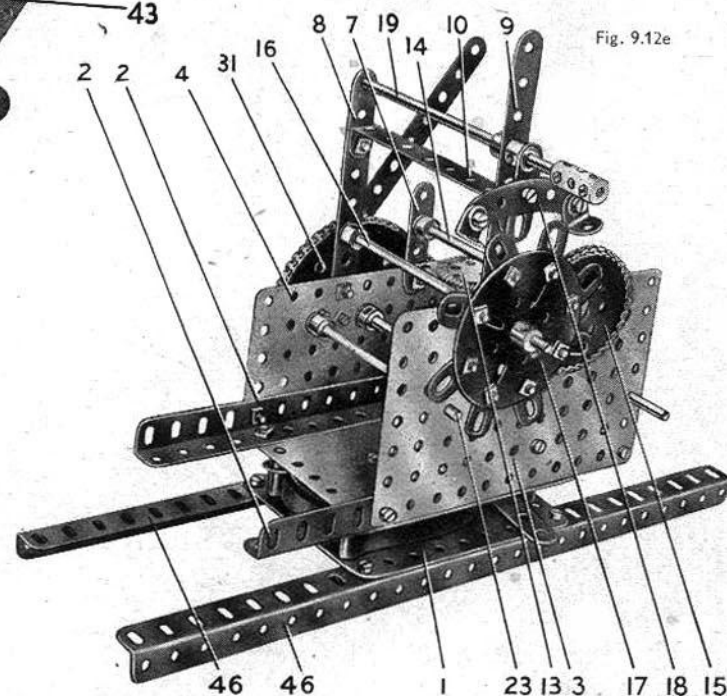


Fig. 9.12e



## 9.13 TRAMCAR

## CONSTRUCTION OF THE BODY

Construction is begun by joining two compound Angle Girders 1 (Fig. 9.13c), each formed by an  $18\frac{1}{2}$ " and a  $12\frac{1}{2}$ " Angle Girder overlapped nine holes, by the Angle Girders 2. These last consist of  $5\frac{1}{2}$ " and  $2\frac{1}{2}$ " Angle Girders overlapped three holes. Three vertical  $12\frac{1}{2}$ " Strips on each side are bolted to the Girders 1, one at each end indicated at 3 and the remaining one as shown at 4. These Strips support the roof and the compound Girders 5, each of which consists of two  $12\frac{1}{2}$ " Angle Girders overlapped seven holes. The spaces between Girders 1 and 5 are filled in by  $12\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Strip Plates.

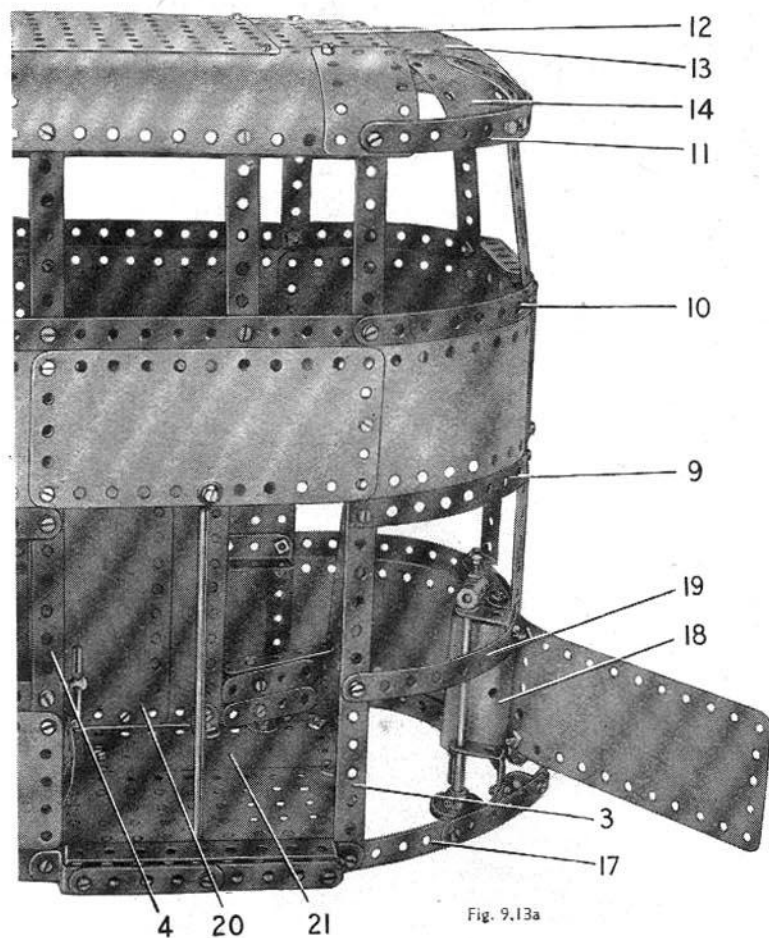
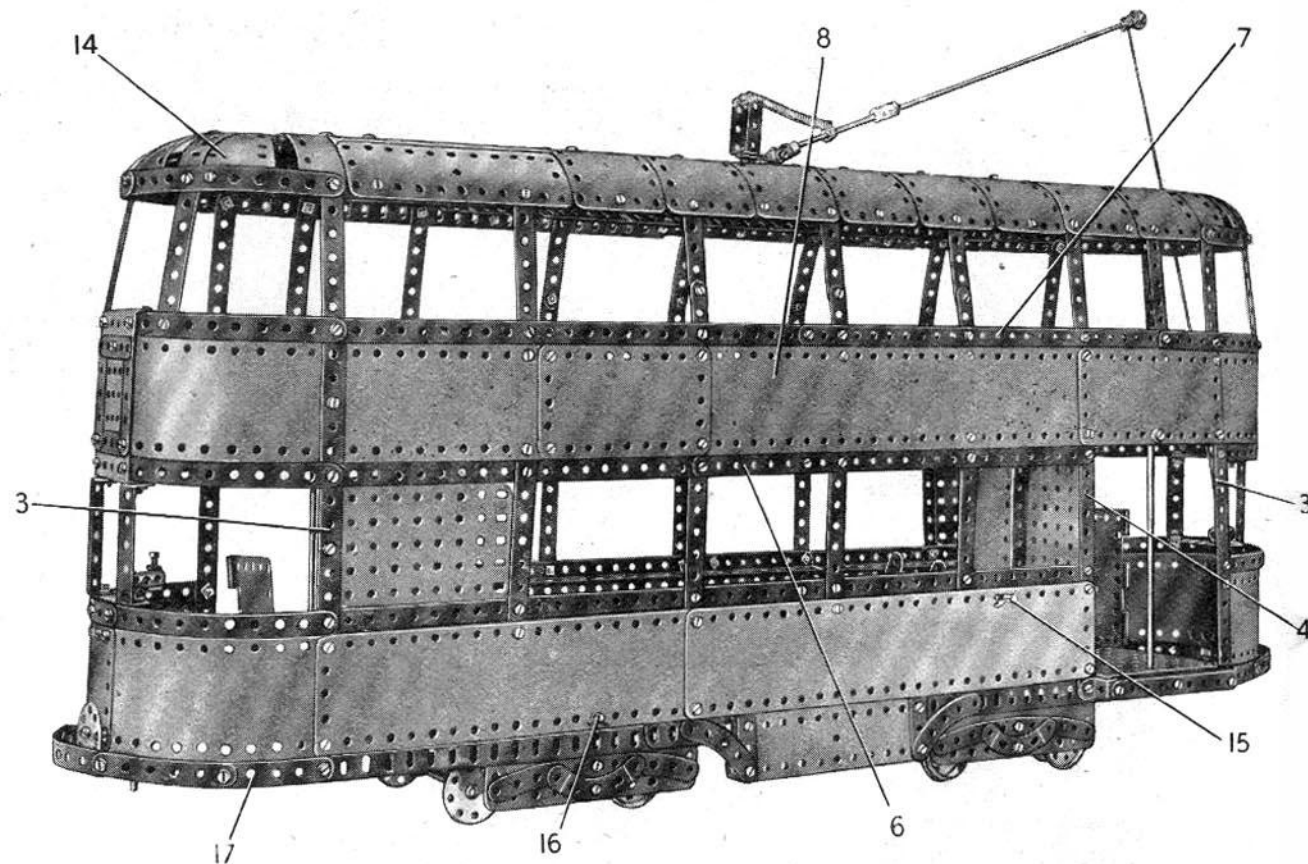


Fig. 9.13a

*Note:* The Motor used in this model is not included in the Outfit.



The window frames are formed by Strips of various sizes, and are connected at their upper ends by compound strips 6. The spaces between strips 6 and 7 are filled by  $12\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Strip Plates 8 and  $5\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flexible Plates at each side.

The Girders 1 are extended by  $4\frac{1}{2}$ " Strips 17 (Fig. 9.13a), joined together by a  $3\frac{1}{2}$ " Strip. The bumpers are each made from two 3" Strips and a  $3\frac{1}{2}$ "  $\times$   $\frac{1}{2}$ " Double Angle Strip. Two  $5\frac{1}{2}$ " Strips 19 are joined at the centre by a  $1\frac{1}{2}$ " Strip, and the space between Strips 17 and 19 is filled by a  $2\frac{1}{2}$ "  $\times$   $1\frac{1}{2}$ " and two  $5\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flexible Plates.

The control handle is a Coupling fixed on a  $4\frac{1}{2}$ " Rod mounted in two  $1\frac{1}{2}$ "  $\times$   $1\frac{1}{2}$ " Angle Brackets. A Cylinder 18 is also bolted in position, and a  $3\frac{1}{2}$ " Rod is held by a 1" Pulley and a Collar in a  $1\frac{1}{2}$ "  $\times$   $1\frac{1}{2}$ " Angle Bracket bolted to the Cylinder.

A compound plate 20 consisting of two  $5\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flexible Plates is attached by an Angle Bracket to the Flexible Plate 21. Half of a Hinged Flat Plate divides the driver's cab from the stairs. The  $5\frac{1}{2}$ " Strips 9 and 10 are joined at the centre to a  $3\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flanged Plate.

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## 9.13 TRAMCAR—Continued

The framework of the roof consists of two compound girders, formed from  $1\frac{1}{2}$ " and  $9\frac{1}{2}$ " Angle Girders, joined at each end by a  $5\frac{1}{2}$ " Strip. Flexible Plates are bolted to the Girders as shown, and these are connected at the top by four  $5\frac{1}{2}$ "  $\times$   $3\frac{1}{2}$ " Flat Plates and three  $3\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flanged Plates. The girders are extended by  $5\frac{1}{2}$ " Strips 11, which are connected to the Flanged Plates 12 by  $4\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flexible Plates 13 (Fig. 9.13a). The roof is completed by the  $2\frac{1}{2}$ "  $\times$   $1\frac{1}{2}$ " Flexible Plates 14.

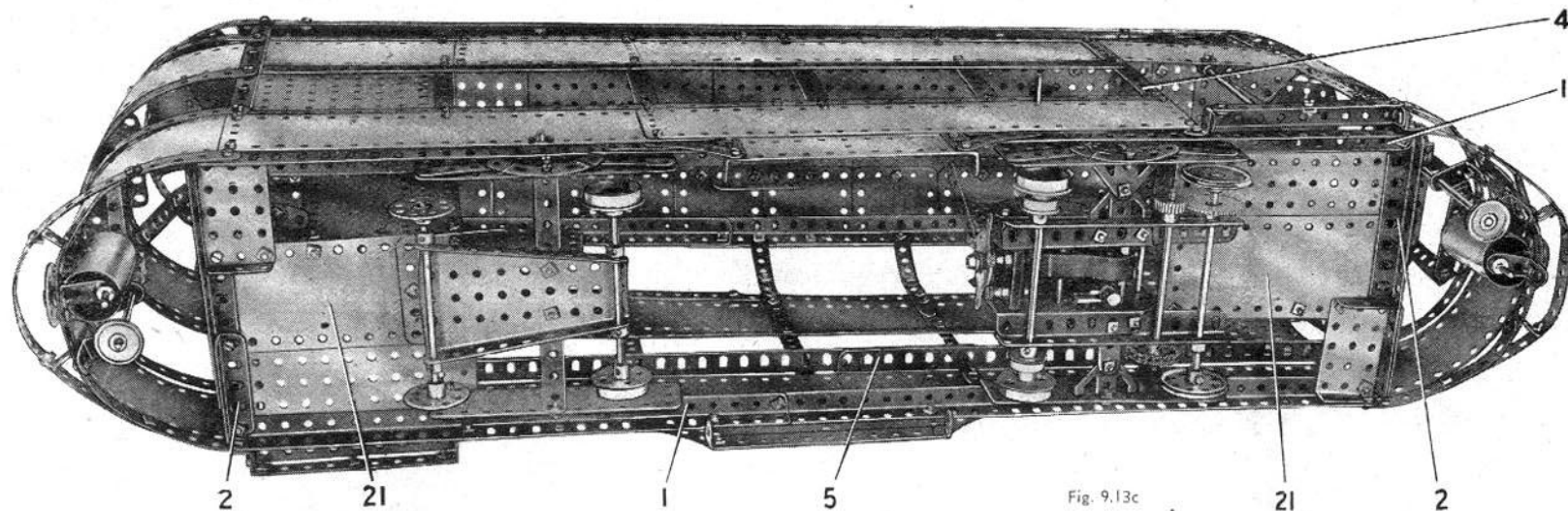


Fig. 9.13c

## THE TROLLEY

The trolley pole is an  $11\frac{1}{2}$ " and a 4" Rod joined by a Coupling and fixed in a Swivel Bearing bolted to a  $1\frac{1}{2}$ " Strip. A Pivot Bolt is passed through the centre hole of this Strip and lock-nutted to the roof, a Collar being used for spacing purposes. Two  $1\frac{1}{2}$ "  $\times$   $1\frac{1}{2}$ " Double Angle Strips are also bolted to the  $1\frac{1}{2}$ " Strip, and they are connected to the trolley pole by a Spring. The Spring is attached to a Collar fixed to the pole.

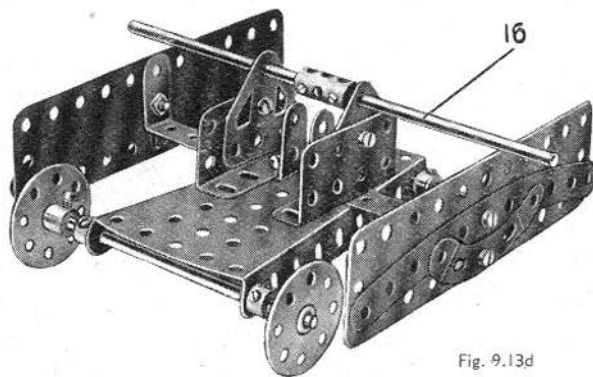


Fig. 9.13d

## THE TRUCK UNITS

Details of the truck units are seen in Figs. 9.13d and 9.13e. The wheels of the motorless truck are Bush Wheels and  $1\frac{1}{2}$ " Flanged Wheels. The motor truck is attached to the frame by an 8" Rod 15, and the other by a compound rod 16.

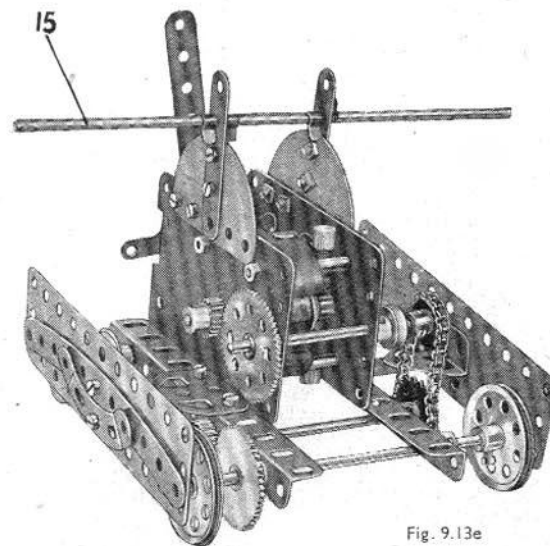


Fig. 9.13e

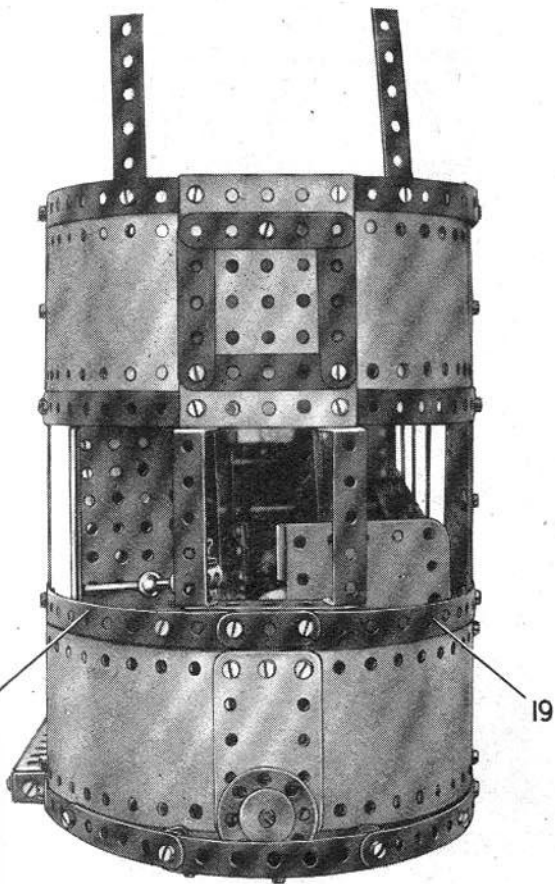
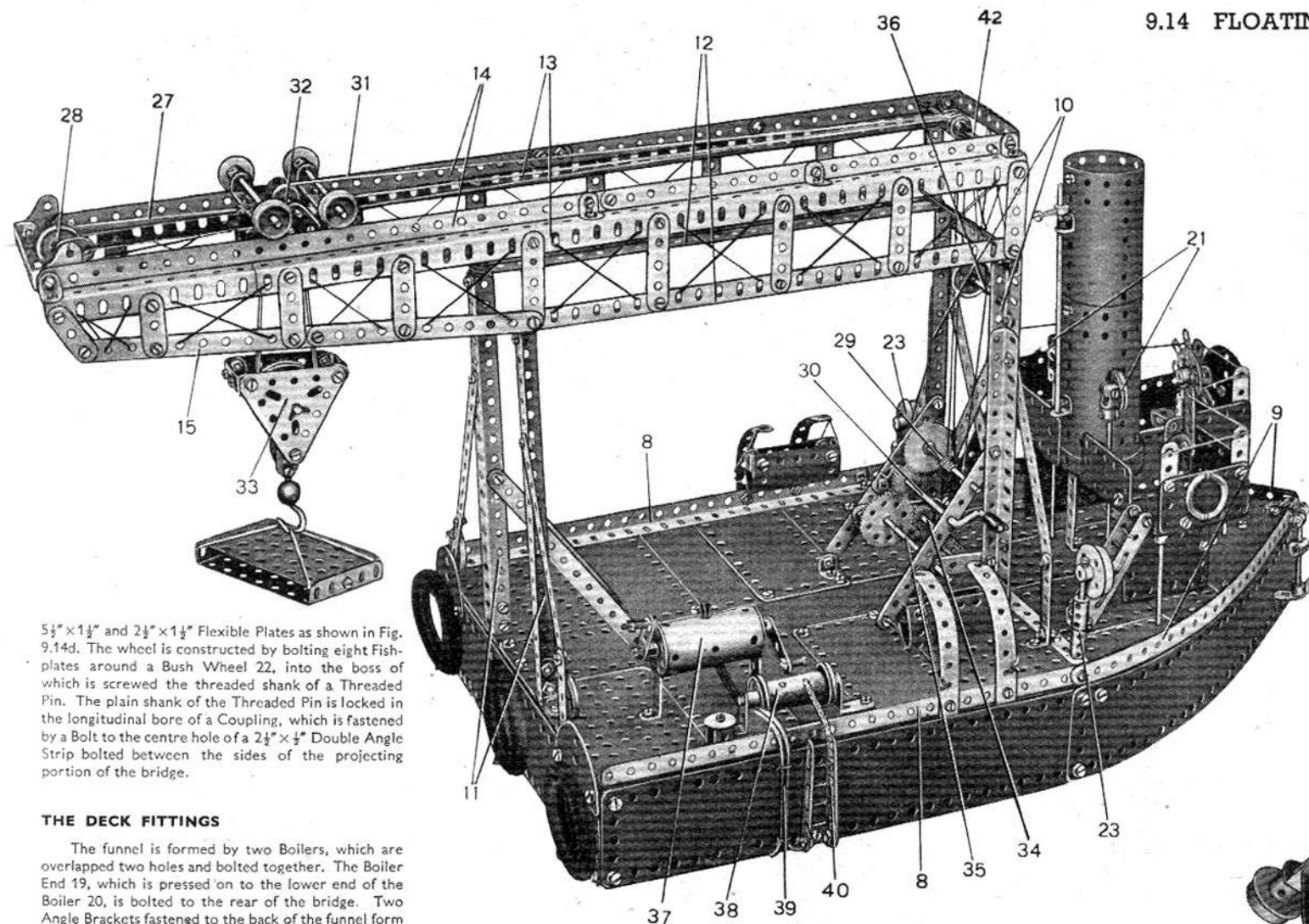


Fig. 9.13b



## 9.14 FLOATING BLOCK-SETTING CRANE



$5\frac{1}{2}" \times 1\frac{1}{2}"$  and  $2\frac{1}{2}" \times 1\frac{1}{2}"$  Flexible Plates as shown in Fig. 9.14d. The wheel is constructed by bolting eight Fish-plates around a Bush Wheel 22, into the boss of which is screwed the threaded shank of a Threaded Pin. The plain shank of the Threaded Pin is locked in the longitudinal bore of a Coupling, which is fastened by a Bolt to the centre hole of a  $2\frac{1}{2}" \times \frac{1}{2}"$  Double Angle Strip bolted between the sides of the projecting portion of the bridge.

## THE DECK FITTINGS

The funnel is formed by two Boilers, which are overlapped two holes and bolted together. The Boiler End 19, which is pressed on to the lower end of the Boiler 20, is bolted to the rear of the bridge. Two Angle Brackets fastened to the back of the funnel form supports for the  $6\frac{1}{2}"$  Rod that represents the steam pipe. The  $6\frac{1}{2}"$  Rod is held in position by a Spring Clip, and is fitted at its upper end with a "spider" from a Swivel Bearing, into one of the tapped holes of which is screwed a  $\frac{1}{2}"$  Bolt.

Two ventilators also are fitted to the rear of the bridge, one each side of the funnel. Each of the ventilators consists of a 1" fast Pulley 21 held between the jaws of a Small Fork Piece locked on the end of a 5" Rod. The 5" Rod passes through the floor of the bridge and the deck of the pontoon, and is fastened in position by two Collars.

## CONSTRUCTION OF THE PONTOON

The construction of the pontoon is commenced by bolting together four  $12\frac{1}{2}"$  Angle Girders 1 and 2 (Fig. 9.14c) to form a square, and bracing them across the centre by a further  $12\frac{1}{2}"$  Angle Girder 3. The deck is then filled in by four  $5\frac{1}{2}" \times 3\frac{1}{2}"$  Flat Plates, six  $5\frac{1}{2}" \times 2\frac{1}{2}"$  Flexible Plates and a  $12\frac{1}{2}" \times 2\frac{1}{2}"$  Strip Plate. One side of the square so formed is extended forward by bolting a compound curved strip to each of its corners. Each of the compound curved strips consist of two  $5\frac{1}{2}"$  Curved Strips bolted end to end, and the two are joined at the forward end by a  $2\frac{1}{2}"$  stepped Curved Strip. This part of the deck of the pontoon is filled by two  $5\frac{1}{2}" \times 2\frac{1}{2}"$  and four  $4\frac{1}{2}" \times 2\frac{1}{2}"$  Flexible Plates and two  $5\frac{1}{2}" \times 2\frac{1}{2}"$  Flat Plates, as shown in Fig. 9.14c.

The sides of the pontoon are formed by  $12\frac{1}{2}" \times 2\frac{1}{2}"$  Strip Plates, the two indicated at 6 being joined at their forward edges by a  $1\frac{1}{2}"$  Angle Girder 7. The sides and rear of the main part of the pontoon are braced by two  $2\frac{1}{2}"$  Angle Girders 5, between the lower ends of which is fastened a  $12\frac{1}{2}"$  Angle Girder 4. Two Angle Girders 8 are bolted to the deck of the pontoon and extended forward by two  $12\frac{1}{2}"$  Strips 9, the ends of which are joined by an Angle Bracket.

## THE CONTROL BRIDGE

The bridge is constructed by bolting a  $5\frac{1}{2}" \times 2\frac{1}{2}"$  Flanged Plate 16 to the pontoon. A  $4\frac{1}{2}" \times 2\frac{1}{2}"$  Flat Plate 17 and a  $5\frac{1}{2}" \times 2\frac{1}{2}"$  Flat Plate overlapped three holes are then bolted to the upper flange of the Flanged Plate 16, and are supported at the rear by a  $2\frac{1}{2}" \times \frac{1}{2}"$  Double Angle Strip that can be seen in the main illustration. The floor of the bridge is extended to the front by a  $2\frac{1}{2}" \times 2\frac{1}{2}"$  Flexible Plate, which also is supported from the deck of the pontoon by two  $3\frac{1}{2}"$  Rods. A  $2\frac{1}{2}" \times \frac{1}{2}"$  Double Angle Strip is fastened to the front edge of the  $2\frac{1}{2}" \times 2\frac{1}{2}"$  Flexible Plate, and to the ends of the Double Angle Strip are bolted a  $2\frac{1}{2}" \times 1\frac{1}{2}"$  Flanged Plate 18 and two  $2\frac{1}{2}"$  Strips. The bridge is walled round by

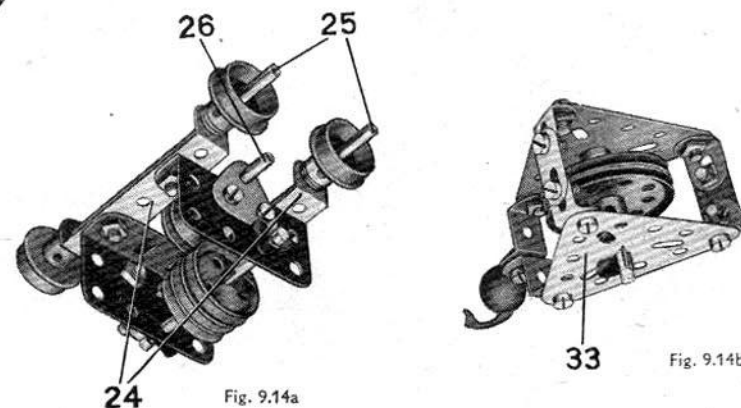


Fig. 9.14a

Fig. 9.14b

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## 9.14 FLOATING BLOCK-SETTING CRANE—Continued

Two ventilators, which are indicated at 23, also are fastened to the pontoon. Each of these consists of a  $1\frac{1}{2}$ " Flanged Wheel, through the boss of which is screwed a  $\frac{3}{4}$ " Bolt. The lower end of the  $\frac{3}{4}$ " Bolt is locked in a Coupling that carries also a 3" Screwed Rod. A second Coupling is placed on the Screwed Rod, which is then passed through the deck of the pontoon and held in position by a nut.

The diver's apparatus fixed to the pontoon consists of an air pump and a winch for the life-line. The air pump is built up by fastening a  $2\frac{1}{2}$ " Cylinder 37 in position by two 1" Reversed Angle Brackets as shown. Two Wheel Discs, through the centres of which passes a  $3\frac{1}{2}$ " Rod, are then clamped one at each end of the Cylinder by two Cranks. The end holes of the Cranks are fitted with  $\frac{1}{2}$ " Bolts to form the handles. The air delivery pipes are represented by a 10" Driving Band 39, one end of which is pressed into a hole of the Cylinder and the other end secured to the side of the pontoon. The winding drum of the life-line winch consists of a Sleeve Piece 38, into the ends of which are pressed two Chimney Adaptors. The two last-mentioned are fastened to  $1" \times 1"$  Angle Brackets by two  $\frac{1}{2}$ " Bolts, which each carry a 1" fast Pulley on their shanks between the  $1" \times 1"$  Angle Brackets and the Chimney Adaptors. A length of plaited Cord 40 is fastened round the drum and then led down the side of the diver's ladder, to be tied finally underneath the pontoon. The diver's ladder is constructed by fastening two  $2\frac{1}{2}$ " Strips to the side of the pontoon by a Double Bracket, and then threading Cord through their holes as shown to form rungs.

The life-boats are each constructed by joining the ends of a U-section Curved Plate with two Double Brackets, and they are suspended by Cord from davits formed by  $5\frac{1}{2}$ " Strips. The  $5\frac{1}{2}$ " Strips are bent over at one end, and are bolted to the  $12\frac{1}{2}$ " Angle Girders 8.

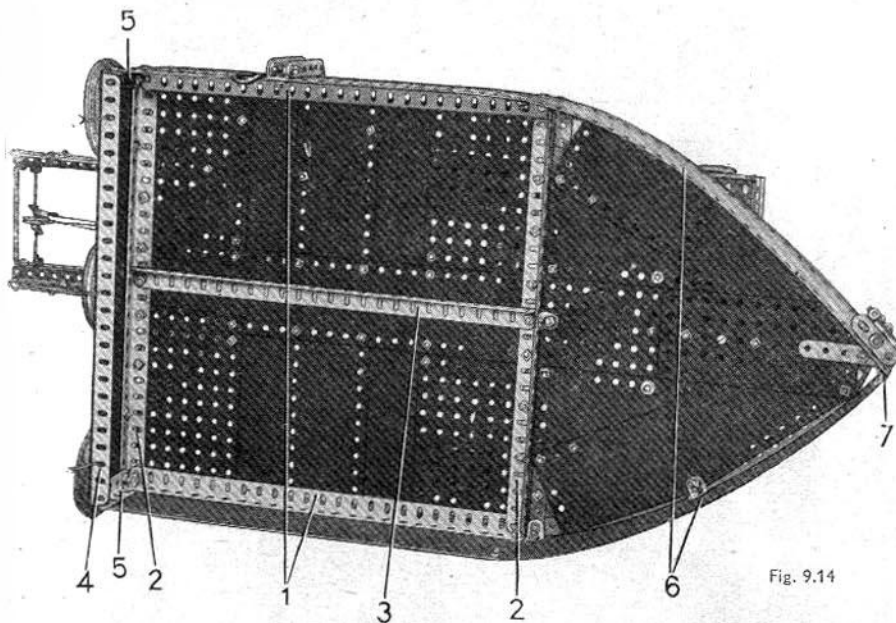


Fig. 9.14

## DETAILS OF THE JIB BOOM

Construction of the jib boom is commenced by making two compound girders 13, each of which consists of an  $18\frac{1}{2}$ " and a  $5\frac{1}{2}$ " Angle Girder overlapped two holes. A compound strip 14 formed by a  $12\frac{1}{2}$ " and two  $5\frac{1}{2}$ " Strips is then bolted along the edge of each girder, and the ends of the compound strips are joined by  $3\frac{1}{2}" \times \frac{1}{2}"$  Double Angle Strips. The sides of the compound girders 13 are then extended downwards by  $2\frac{1}{2}"$ , 2" and  $1\frac{1}{2}"$  Strips, to the lower ends of which are bolted the  $12\frac{1}{2}"$  Angle Girders 12 and the  $5\frac{1}{2}"$  Strips 15. The ends of the  $12\frac{1}{2}"$  Angle Girders 12 are supported from the deck of the pontoon by the  $9\frac{1}{2}"$  Angle Girders 11 and the compound  $9\frac{1}{2}"$  girders 10. Each of the latter consists of a  $7\frac{1}{2}"$  and a  $5\frac{1}{2}"$  Angle Girder overlapped seven holes.

## HOISTING GEAR

The hoisting carriage is shown separately in Fig. 9.14a. It consists of two  $2\frac{1}{2}" \times \frac{1}{2}"$  Double Angle Strips 24 joined as shown by Girder Brackets. The holes in the ends of the Double Angle Strips form the bearings for the axles, which are the  $4\frac{1}{2}"$  Rods 25, and each carries two  $\frac{3}{4}"$  Flanged Wheels. The lower edges of the Girder Brackets hold a  $2\frac{1}{2}"$  Rod that carries three 1" loose Pulleys. The  $\frac{1}{2}"$  loose Pulley 32 is mounted freely on a  $2\frac{1}{2}"$  Rod 26 journaled in two 1" Triangular Plates bolted to the Girder Brackets (see general view).

The hoisting block, which is shown in Fig. 9.14b, is constructed by joining of two the corners of two  $2\frac{1}{2}"$  Triangular Plates 33 by Angle Brackets and Fishplates. The bottom corners are joined by two Reversed Angle Brackets, which carry a Large Loaded Hook between them. A 2" Rod journaled in the centre holes of the Triangular Plates carries two  $1\frac{1}{2}"$  Pulleys.

The small Crank Handle 30 (see general view) which controls the movement of the hoisting carriage, is journaled at one end in a  $5\frac{1}{2}"$  Strip bracing the Angle Girder 10, and at the other end in a Reversed Angle Bracket, and it carries a  $\frac{3}{4}"$  Pinion. This Pinion meshes with a 50-teeth Gear on the 4" Rod 29. A length of Cord 27 is tied to the rear of the hoisting carriage, led over one of the  $\frac{1}{2}"$  Pulleys on the Rod 42, and then is wound several times around the Rod 29. It is then led over a second  $\frac{1}{2}"$  Pulley on the Rod 42 around the 1" Pulley 28, and finally is tied to the front of the hoisting carriage.

The movement of the hoisting block is controlled by a large Crank Handle 35 journaled as shown in the main illustration. A 57-teeth Gear on the Crank Handle meshes with a  $\frac{3}{4}"$  Pinion on the 5" Rod 34. Cord 31 is tied to this Rod, wound round it several times, and is led over the third  $\frac{1}{2}"$  Pulley on the Rod 42. It is next taken round the  $\frac{1}{2}"$  Pulley 32, through the pulley systems underneath the hoisting carriage and in the hoisting block, and tied finally to a Fishplate at the front of the jib. The  $5\frac{1}{2}"$  Crank Handle 35 has a Compression Spring on its shank, lightly compressed by a Collar. By pushing the Handle inwards, the 57-teeth Gear is pushed out of mesh with the  $\frac{3}{4}"$  Pinion on Rod 34 and the hoisting cord is allowed to unwind quickly under the weight of the load.

## THE ANCHOR AND ITS WINCH

The anchor consists of a 2" Rod, carrying a Coupling and a Double Arm Crank. The arms of the Crank are bent upwards slightly to represent the flukes of the anchor. The upper end of the Rod is secured to the side of the pontoon by two Handrail Supports and a 1" Rod. One end of a length of plaited Cord is tied to the anchor, and its other end is fastened to a small winch, which can be seen in Fig. 9.14d. The winch is constructed by fastening two Worms on a 1" Rod. A  $\frac{3}{4}"$  Bolt is passed through the centre hole of a Double Bent Strip bolted to the deck of the pontoon, and is screwed into the tapped hole in the boss of one of the Worms.

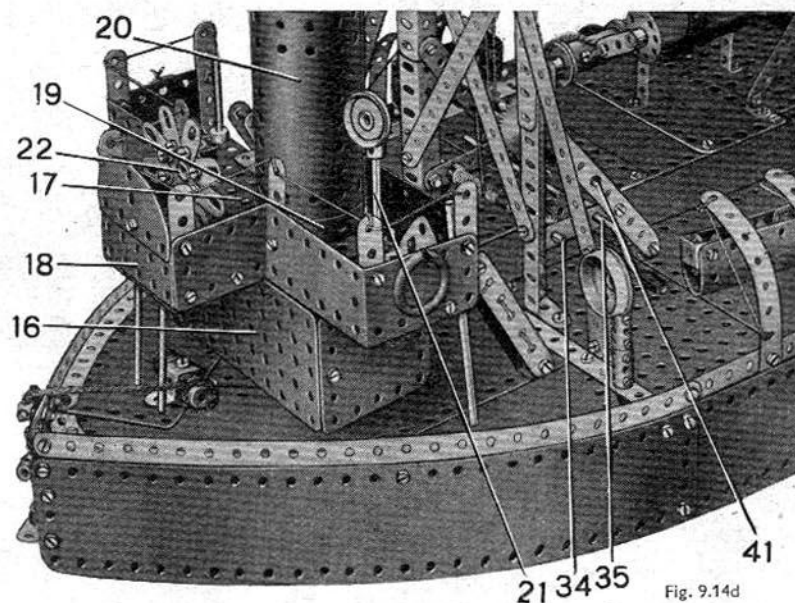
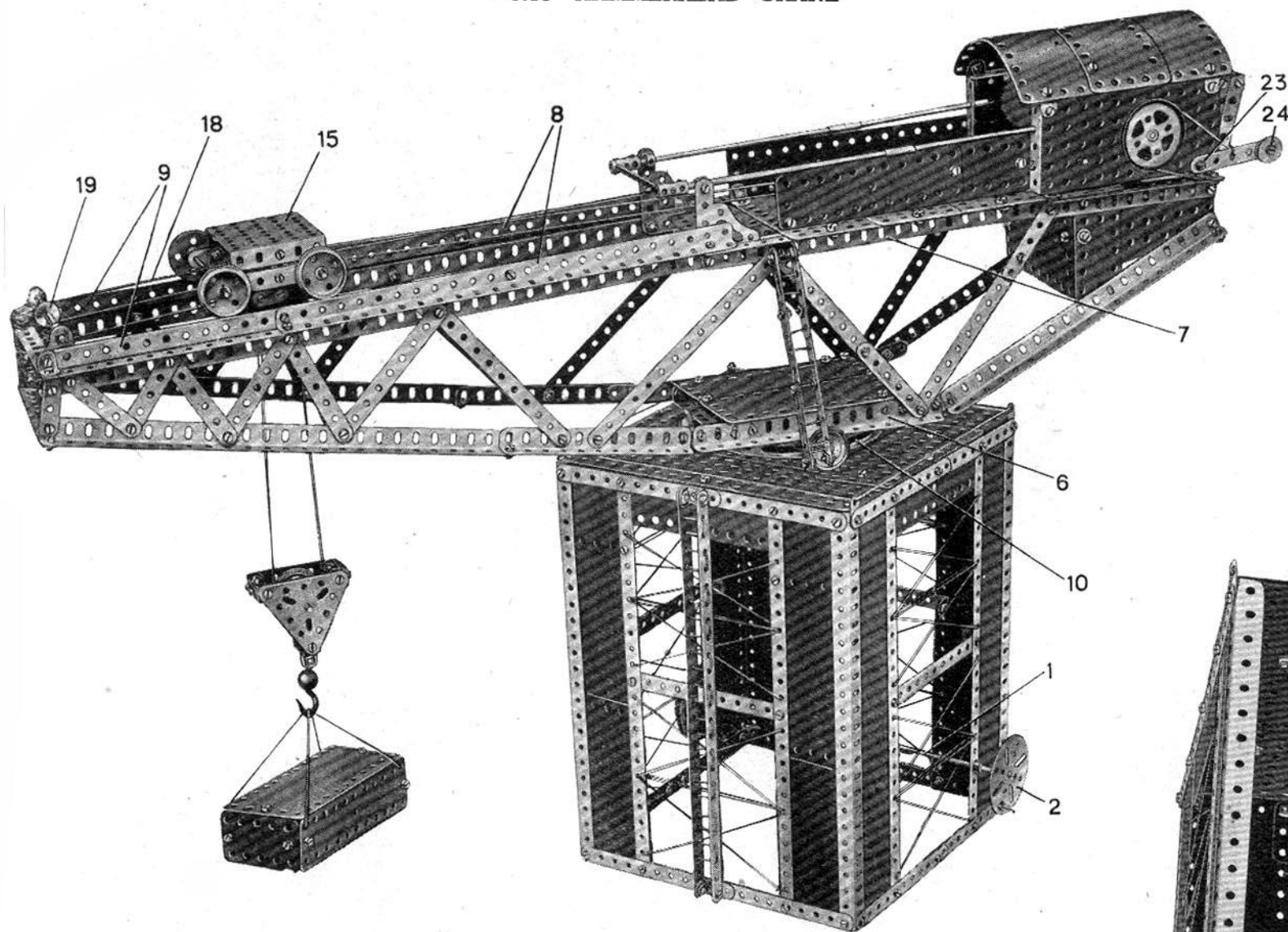


Fig. 9.14d



## 9.15 HAMMERHEAD CRANE



## DETAILS OF THE TOWER

The construction of the tower is commenced by joining the ends of four  $12\frac{1}{2}$ " Angle Girders by compound  $9\frac{1}{2}$ " strips, each of which comprises two  $5\frac{1}{2}$ " Strips overlapped three holes. Three of the sides are then partially filled in by  $12\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Strip Plates, and the fourth side by four  $5\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " and two  $2\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flexible Plates (see main illustration). The top of the tower is formed by four  $5\frac{1}{2}$ "  $\times$   $3\frac{1}{2}$ ", two  $5\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " and two  $4\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flat Plates. The arrangement of these can be seen clearly in Fig. 9.15d.

The sides of the ladder leading up to the platform of the tower are constructed by fastening two  $12\frac{1}{2}$ " Strips to the side of the tower by Double Angle Brackets, and threading Cord through their holes to represent rungs.

The Face Plate 2 is locked on the end of an  $11\frac{1}{2}$ " Rod 1 journalled as shown. A 1" fast Pulley on the centre of the Rod is connected by a Driving Band to a 2" Pulley on a  $3\frac{1}{2}$ " Rod 3 (Fig. 9.15a). The  $3\frac{1}{2}$ " Rod is journalled in two  $3\frac{1}{2}$ " Strips secure in position underneath the platform of the tower by two 1" Reversed Angle Brackets, and it carries a  $\frac{1}{2}$ " Bevel Gear. This meshes with a  $1\frac{1}{2}$ " Bevel Gear on the end of a  $2\frac{1}{2}$ " Rod 4 (Fig. 9.15d) and the drive is then taken through a  $\frac{1}{2}$ " Pinion and a 57-teeth Gear to the  $3\frac{1}{2}$ " Rod 5. Rod 5 is journalled in the boss of a Face Plate bolted to the platform, and also in the centre hole of a  $2\frac{1}{2}$ "  $\times$   $\frac{1}{2}$ " Double Angle Strip fastened under the platform by two Trunnions.

## THE JIB

The jib is next built up, construction being commenced by joining two compound girders 7, each consisting of an  $18\frac{1}{2}$ ", a  $12\frac{1}{2}$ " and a  $5\frac{1}{2}$ " Angle Girder, at each end by a  $5\frac{1}{2}$ " Strip. To the front of the frame are then bolted two  $1\frac{1}{2}$ " Strips, and to the rear two Flanged Sector Plates. A  $17\frac{1}{2}$ " girder, built up from a  $12\frac{1}{2}$ " and a  $5\frac{1}{2}$ " Angle Girder, is then bolted to the lower end of each  $1\frac{1}{2}$ " Strip, and braced from the main frame by Strips of various sizes.

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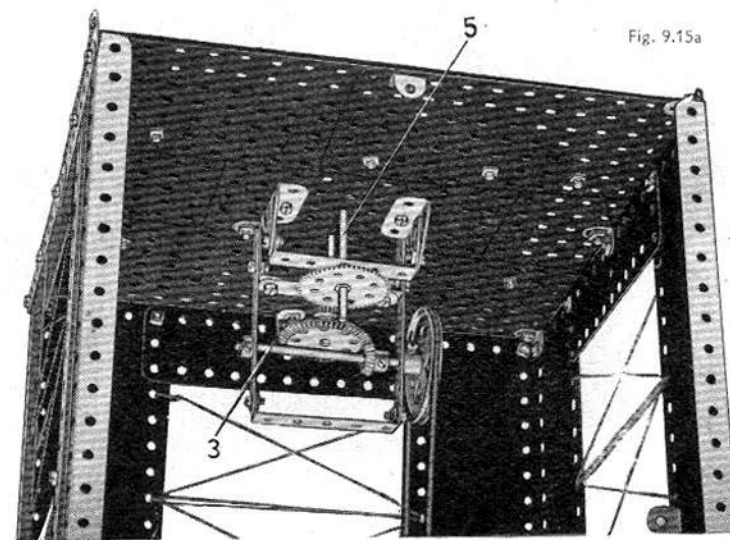


Fig. 9.15a

## 9.15 HAMMERHEAD CRANE—Continued

Two  $9\frac{1}{2}$ " Angle Girders are also bolted to the Flanged Sector Plates at the rear end of the jib. The lower ends of the  $17\frac{1}{2}$ " girders and the  $9\frac{1}{2}$ " Angle Girders are joined by two  $7\frac{1}{2}$ " Angle Girders 6, which are connected together by two  $4\frac{1}{2}$ "  $\times$   $\frac{1}{2}$ " Double Angle Strips.

The  $\frac{1}{2}$ " Pulley 19 is held by two Spring Clips on a 4" Rod, which is journaled at its ends in two Rod Sockets secured at the forward end of the jib by two 1" Corner Brackets.

## BEARING FOR THE JIB

A Circular Girder 10 is bolted between the two Angle Girders 6, and to its centre a Bush Wheel 11 is secured by a  $5\frac{1}{2}$ " Strip and two  $2\frac{1}{2}$ " Strips. The end of Rod 5 is then locked in the boss of Bush Wheel 11, so that four 1" Pulleys fastened round the edge of the Circular Girder just rest on the platform to form a roller bearing. The Circular Girder is covered by two  $5\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flexible Plates, which are fastened to the Angle Girders 6 by Angle Brackets.

The sides of the control cabin are formed by two  $5\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flanged Plates secured by their longer flanges to two  $5\frac{1}{2}$ " Strips bolted across the frame of the jib. Three  $5\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flexible Plates overlapped along their sides are used for the roof of the cabin, and they are fastened to the upper ends of the Flanged Plates by Obtuse Angle Brackets. The rear flanges of the two Flanged Plates are joined by a  $4\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flexible Plate, the centre of which is bolted a  $3\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flanged Plate. A second  $3\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flanged Plate is bolted to the lower end of the first Plate as shown in Fig. 9.15b, the Bolts holding also a  $3\frac{1}{2}$ "  $\times$   $\frac{1}{2}$ " Double Angle Strip 12. The upper ends of the two  $3\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flanged Plates are spaced apart by two Fishplates to form a container, which is filled with 24 Metal Balls to weight the end of the jib and maintain it in a horizontal position.

Two  $4\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flexible Plates are fastened between the lower flanges of the Sector Plates mentioned above, and a third Flexible Plate is secured between their wider ends. The platform in front of the cabin is formed by three  $5\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flexible Plates and two  $2\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flexible Plates, and it is walled on each side by a  $5\frac{1}{2}$ "  $\times$   $1\frac{1}{2}$ " and a  $2\frac{1}{2}$ "  $\times$   $1\frac{1}{2}$ " Flexible Plate.

## THE HOISTING CARRIAGE AND PULLEY BLOCK

The hoisting carriage, an underneath view of which is shown in Fig. 9.15c, is constructed by fastening two  $3\frac{1}{2}$ " Strips to the flanges of a  $3\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flanged Plate 15. The end holes of these Strips form the bearings for the axles, which are 5" Rods. Four  $1\frac{1}{8}$ " Flanged Wheels are used for the wheels and they run on rails formed by  $12\frac{1}{2}$ " Angle Girders 8, and  $12\frac{1}{2}$ " Strips 9. The  $3\frac{1}{2}$ " Strips are joined by two  $3\frac{1}{2}$ "  $\times$   $\frac{1}{2}$ " Double Angle Strips to the centres of which are bolted two Girder Brackets 16. A  $2\frac{1}{2}$ " Rod journaled in the Girder Brackets carries three 1" loose Pulleys 17, over which the Cord to the hoisting block passes.

The hoisting block consists of two Triangular Plates, two of the corners of which are joined by Angle Brackets and Fishplates. The large Loaded Hook is fastened to each side of the pulley block by two Reversed Angle Brackets. A 2" Rod journaled in the centre holes of the two Triangular Plates carries between the plates two  $1\frac{1}{2}$ " Pulleys, around which the operating Cord passes.

## OPERATION OF THE CRANE

Raising and lowering of the hoisting block is controlled by Crank Handle 13 journaled in the sides of the cab (Fig. 9.15b). A 57-teeth Gear fixed on the Crank Handle inside the cab, meshes with a  $\frac{1}{2}$ " Pinion on a 5" Rod journaled in front of the Crank Handle. A length of Cord passing round a 2" Pulley on the end of the 5" Rod is tied at one end to the frame of the jib, and at the other end to the centre of a  $2\frac{1}{2}$ " Strip forming the brake arm. The  $2\frac{1}{2}$ " Strip is pivoted at 23, and is loaded at 24 with a  $\frac{1}{2}$ " Pulley and two  $\frac{3}{4}$ " Washers. The winding drum is formed by a Sleeve Piece, which is slipped into the flanges of two  $\frac{3}{4}$ " Flanged Wheels on the 5" Rod. The operating Cord 21 is tied to the drum, wound round it several times, and then is taken round the 1" Pulleys 17 and the  $1\frac{1}{2}$ " Pulleys in the hoisting block, and finally is anchored to the Washer 22.

The movements of the hoisting carriage are controlled by the Crank Handle 14. This is journaled in the right-hand side of the cab and also in the second hole from the top of a  $2\frac{1}{2}$ "  $\times$   $\frac{1}{2}$ " Double Angle Strip bolted between two  $4\frac{1}{2}$ " Strips. The two  $4\frac{1}{2}$ " Strips are fastened between the flanges of the two  $5\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flanged Plates forming the sides of the cab. The Crank Handle carries a 50-teeth Gear, and this meshes with a  $\frac{3}{4}$ " Pinion on the end of a  $3\frac{1}{2}$ " Rod (Fig. 9.15b).

The operating Cord for the hoisting carriage is tied to the carriage at 20 and led around Pulley 19 (see general view). It is then wound several times round the  $3\frac{1}{2}$ " Rod and tied to the rear of the carriage.

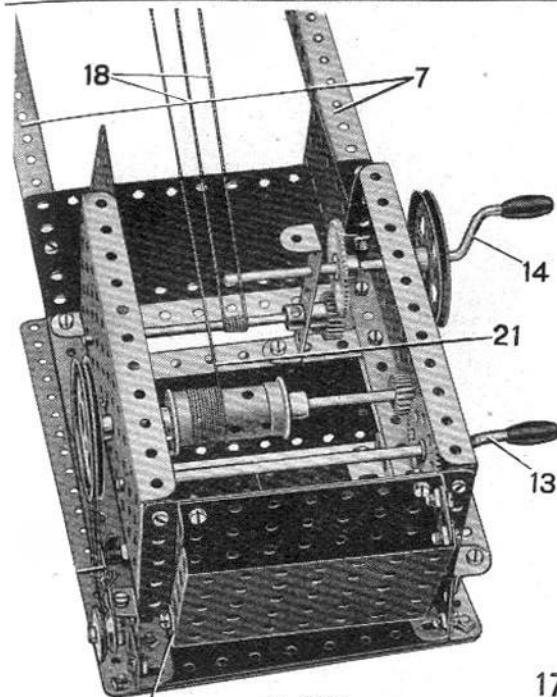


Fig. 9.15b

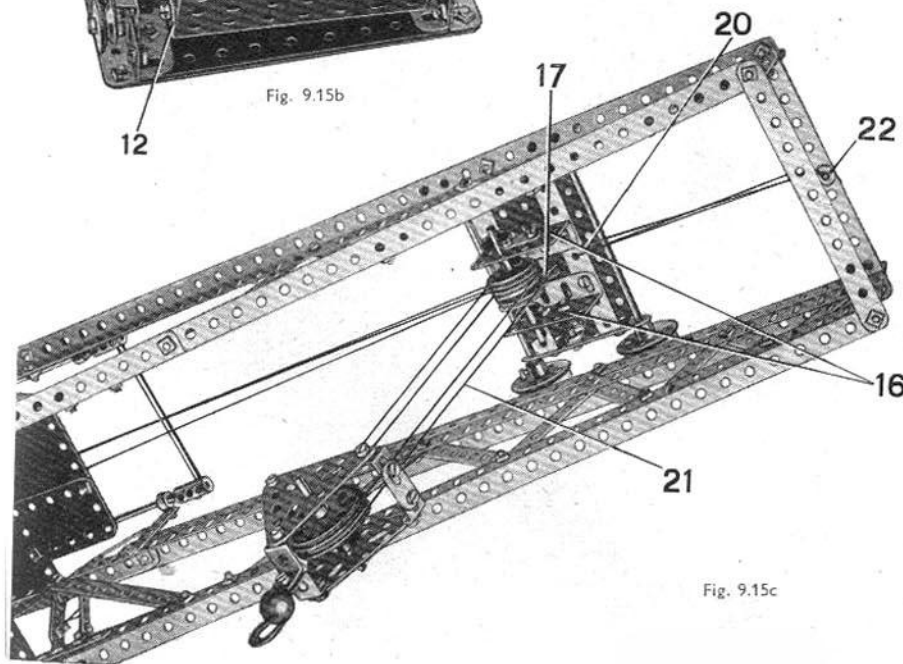


Fig. 9.15c

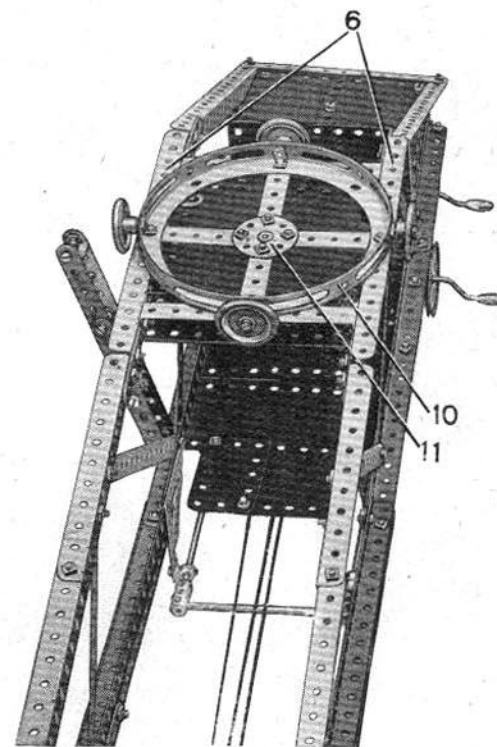
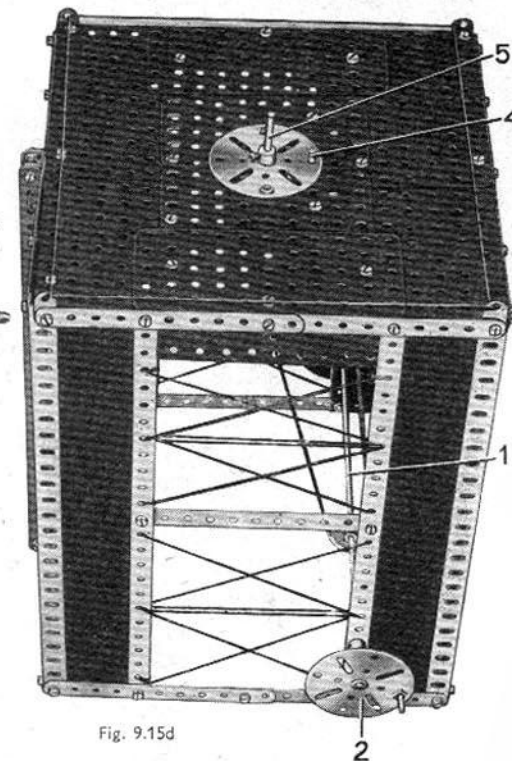


Fig. 9.15d





**CONSTRUCTION OF THE BASE**

The base of the model, an underneath view of which is shown in Fig. 9.16d, is first constructed. It consists essentially of two 18½" Angle Girders, one of which is compound. The ends of these are joined by a 9½" and a 5½" Angle girders, each formed by a 9½" and a 5½" Angle Girder overlapped five holes. The base is then filled in with Flat Plates, Flanged Plates and Flexible Plates as shown. Each of the corners of the base is extended downwards by 4½" Strips, which are joined at their lower ends by 18½" and 12½" Angle Girders. One of the 18½" girders is compounded from one 12½" Girder and one 7½" Girder. The front is filled in by four 4½" x 2½", one 5½" x 1½" and two 2½" x 1½" Flexible Plates, and a space is left at the centre for the entrance.

The roof of the porch is a 5½" x 2½" Flanged Plate, which is bolted in position by one of its flanges and also is supported at the front by two 3½" x ½" Double Angle Strips. The upper ends of these Double Angle Strips are fitted with pinnacles, each represented by a Sleeve Piece on the ends of which are ¾" Flanged Wheels. The lower Flanged Wheel in each case is secured to the Double Angle Strip by a ¾" Bolt.

The sides of the base are filled in with Strip Plates and Flexible Plates as shown in Fig. 9.16d. A Boiler is attached to two of the corners of the base by an Angle Bracket at its lower end, and by a 2½" Strip and an Angle Bracket at its upper end. A Crank is bolted to the 2½" Strip so that a 3½" Rod held in its boss passes through the centre hole of the 2½" Strip. Above the Boiler each of the 3½" Rods carries a 3" Pulley, a Boiler End and a Road Wheel.

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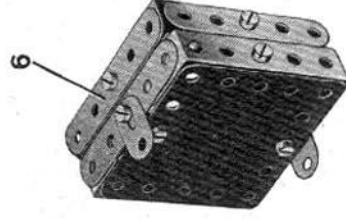
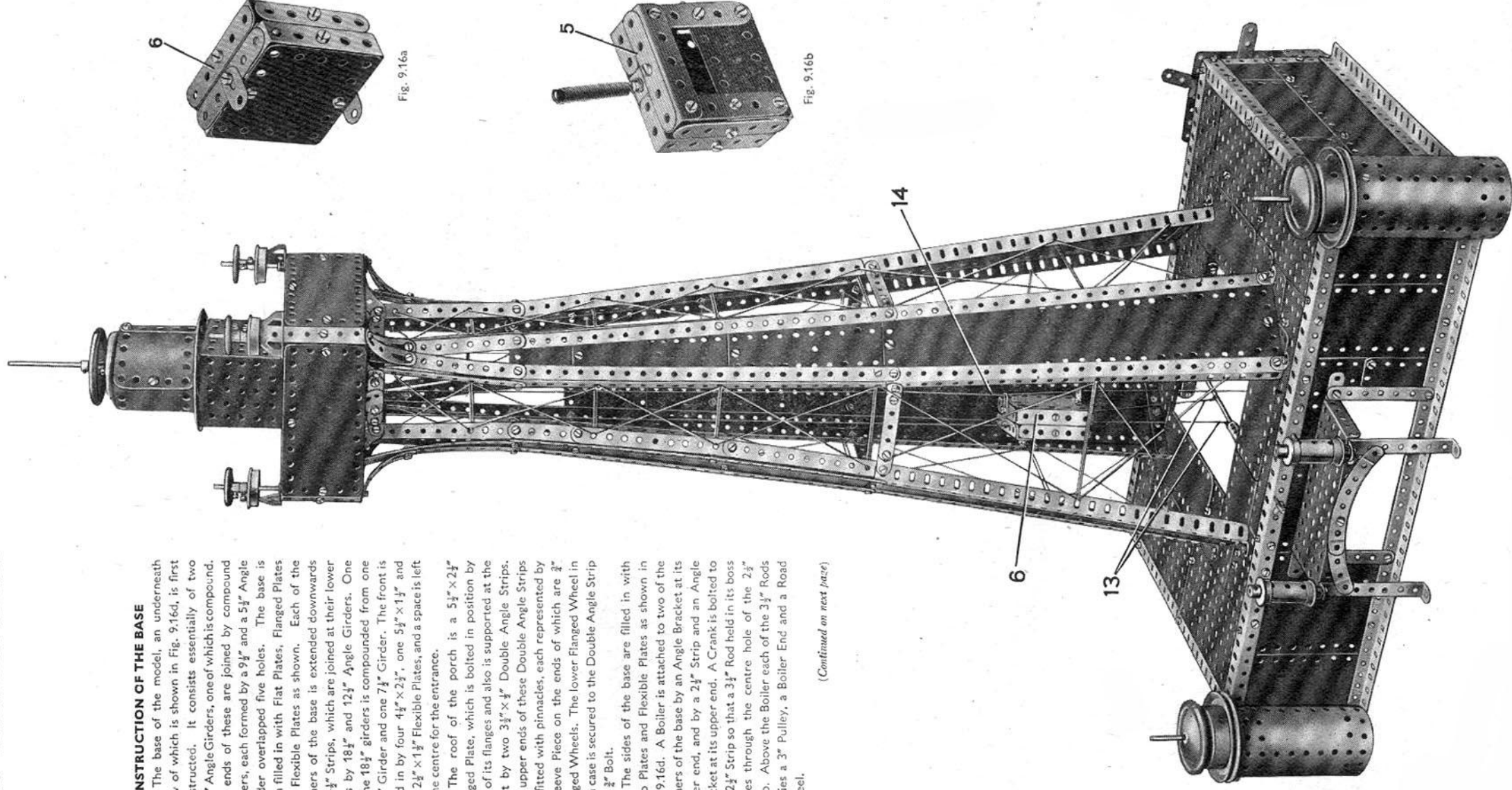


Fig. 9.16a

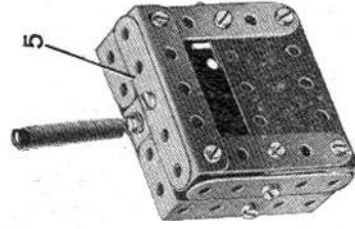


Fig. 9.16b

**THE TOWER**

Each of the four corners of the tower consists of a  $12\frac{1}{2}$ " Strip Plate and two  $5\frac{1}{2}$ "  $\times$   $1\frac{1}{2}$ " and one  $2\frac{1}{2}$ "  $\times$   $1\frac{1}{2}$ " Flexible Plate, the edges of which are strengthened by  $12\frac{1}{2}$ " Angle Girders and Strips. The upper ends of the corners are then connected by 3" Formed Slotted Strips to the lower ends of four  $2\frac{1}{2}$ "  $\times$   $\frac{1}{2}$ " Double Angle Strips (see Fig. 9.16c). The Double Angle Strips are joined by  $5\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flexible Plates, braced at the centre by four  $2\frac{1}{2}$ "  $\times$   $\frac{1}{2}$ " Double Angle Strips and two  $5\frac{1}{2}$ "  $\times$   $\frac{1}{2}$ " Double Angle Strips 3. Three of the pinnacles at the corners of the platform are each formed by fastening a  $1\frac{1}{2}$ " Flanged Wheel and a  $1\frac{1}{2}$ " Pulley complete with Rubber Ring on a Screwed Rod. The lower end of the Screwed Rod is fastened by lock-nuts to the upper end of one of the  $2\frac{1}{2}$ "  $\times$   $\frac{1}{2}$ " Double Angle Strips. The lock-nuts also hold in position a Trunnion.

The remaining pinnacle is similar to the other three with the exception that a  $3\frac{1}{2}$ " Rod is used in place of a Screwed Rod. The Rod is held in place by two Collars.

Four  $3\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flanged Plates 4 are bolted to the Double Angle Strips bracing the  $5\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flexible Plates to form a box, and to the upper flanges of two of the Flanged Plates a Circular Plate is fastened by the Bolts 1. These Bolts hold also a Face Plate, in the boss of which is locked a  $6\frac{1}{2}$ " Rod. At the upper end of the Rod is a Bush Wheel, across which is fixed a  $2\frac{1}{2}$ "  $\times$   $\frac{1}{2}$ " Double Angle Strip 2. The ends of which support a column consisting of four  $1\frac{1}{2}$ " radius Curved Plates bolted end to end. The Bush Wheel and Double Angle Strip are then covered by a Wheel Flange, which is held in place by a Road Wheel.

**OPERATING MECHANISM**

A No. 2 Clockwork Motor 7, is bolted to the  $18\frac{1}{2}$ " Girder at the rear of the base, and also is fastened to one of the sides by a  $2\frac{1}{2}$ "  $\times$   $1\frac{1}{2}$ " Flanged Plate. A  $\frac{3}{8}$ " Pinion on a 2" Rod meshes with the small pinion on the driving shaft of the Motor, and the drive is taken from the 2" Rod through a  $\frac{3}{8}$ " Pinion and a 57-teeth Gear to a second 2" Rod also journalled in the Motor side plates. A  $\frac{3}{8}$ " Sprocket Wheel on the inner end of the Rod is connected by Chain to a 1" Sprocket Wheel on the Rod 8, which is journalled at its forward end in a Corner Bracket 10 and at its rear end in a Flat Trunnion 9.

The operating Cord 14, for the lifts passes around a 1" Pulley on the Rod 8, and also around the 1" loose Pulley, seen in Fig. 9.16c, at the top of the tower. The two lifts are shown in Figs. 9.16a and 9.16b. The construction of lift 6 is commenced with the front, which consists of a  $2\frac{1}{2}$ "  $\times$   $1\frac{1}{2}$ " Flexible Plate, two  $2\frac{1}{2}$ " Strips and a  $2\frac{1}{2}$ " Angle Girder. The sides are  $2\frac{1}{2}$ " Strips and  $2\frac{1}{2}$ "  $\times$   $\frac{1}{2}$ " Double Angle Strips secured in position by the  $2\frac{1}{2}$ "  $\times$   $1\frac{1}{2}$ " Double Angle Strips previously mentioned. A Fishplate is bolted to the top and another to the rear of the lift to receive the operating Cord.

Lift 5 is similar in construction to lift 6, but in the construction of the sides  $2\frac{1}{2}$ "  $\times$   $1\frac{1}{2}$ " Double Angle Strips are used instead of  $2\frac{1}{2}$ "  $\times$   $\frac{1}{2}$ " Double Angle Strips. This lift is fitted with a Spring, to the end of which the operating Cord is tied.

The guide Cords 13 are fastened at their upper ends to the Flanged Plates 4, and their lower ends are tied to the Rods 11 and 12.

Fig. 9.16c

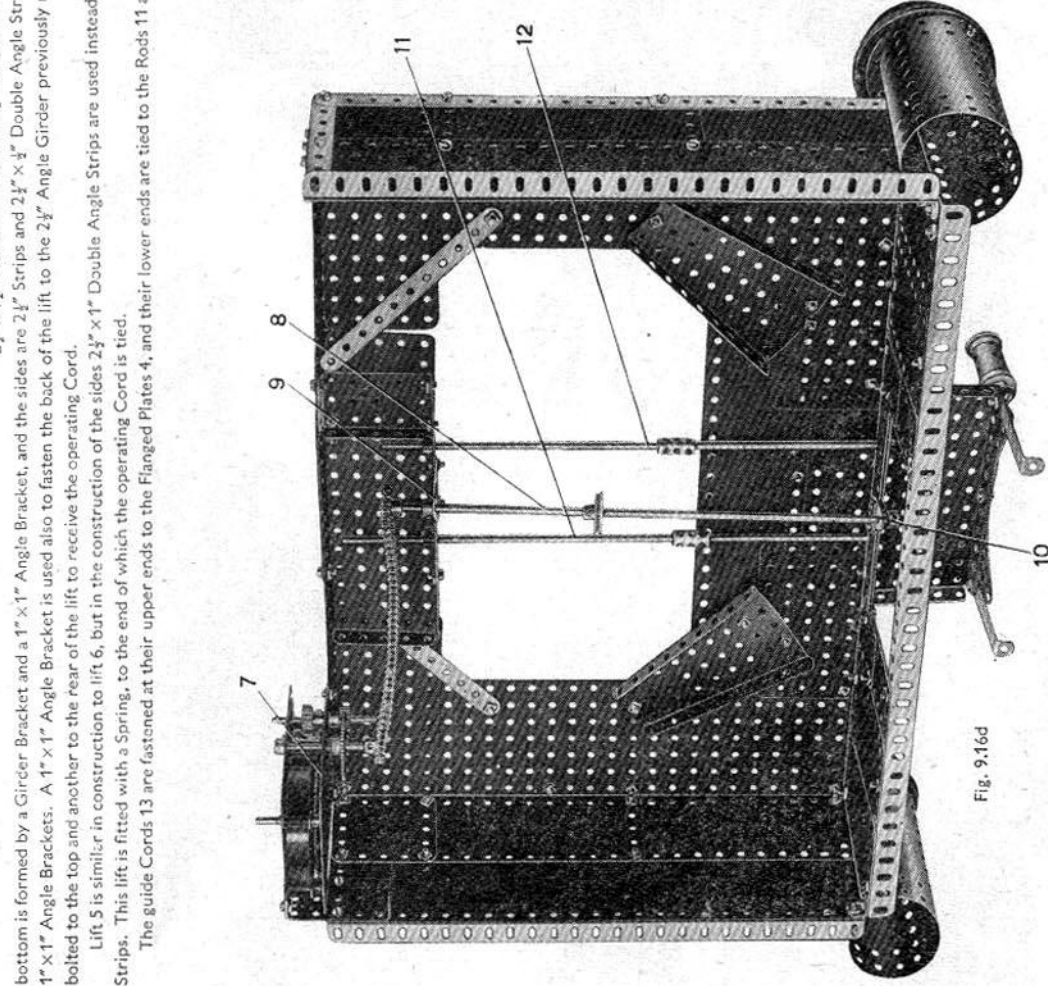
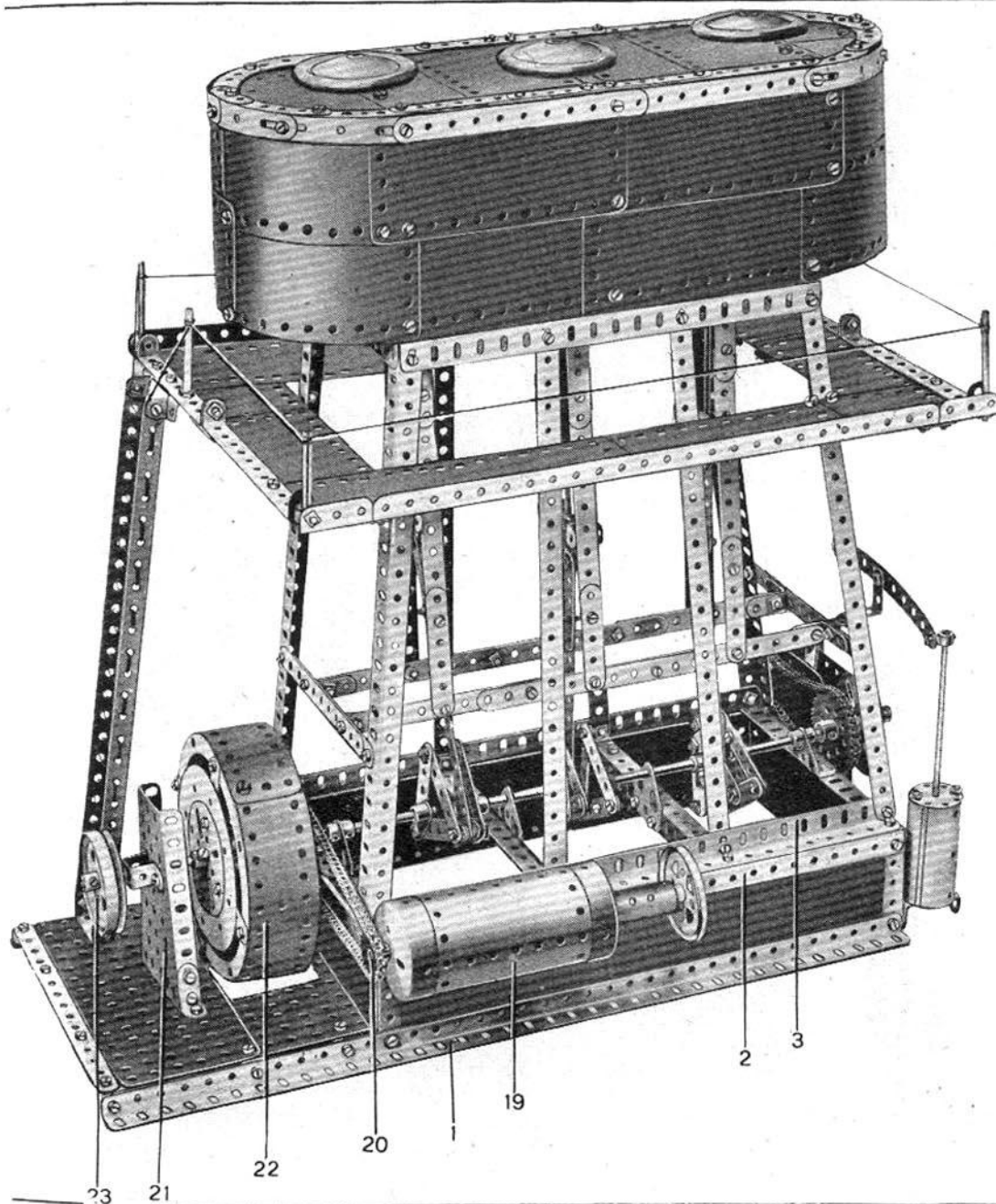


Fig. 9.16d

*Note:* The Motor used in this model is not included in the Outfit.



## 9.17 MARINE STEAM ENGINE

### BED PLATE AND COLUMNS

The model is commenced by joining two  $18\frac{1}{2}$ " Angle Girders 1 at each end by a  $7\frac{1}{2}$ " Strip. Two  $12\frac{1}{2}$ " Angle Girders 2 are supported from the  $18\frac{1}{2}$ " Angle Girders by  $2\frac{1}{2}$ " Angle Girders and Strips, and the space between them is filled by  $12\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Strip Plates. The Angle Girders 2 are joined at their ends by  $7\frac{1}{2}$ " Angle Girders 4 (Fig. 9.17c), and at their centres by two  $5\frac{1}{2}$ " Angle Girders 8 and 9, each of which is extended at one end by a  $2\frac{1}{2}$ " Strip. To the side of each of the  $7\frac{1}{2}$ " Angle Girders 4 are bolted a  $5\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " and a  $2\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flexible Plate.

The columns that support the cylinder block consist of four  $12\frac{1}{2}$ " Angle Girders 5, bolted at their lower ends to two further  $12\frac{1}{2}$ " Angle Girders 3. The latter are fastened in a horizontal position to the Angle Girders 2, and the upper ends of the Girders 5 are joined by  $5\frac{1}{2}$ " and  $9\frac{1}{2}$ " Angle Girders as shown in Fig. 9.17c. The space between the last-mentioned is filled by two  $5\frac{1}{2}$ "  $\times$   $3\frac{1}{2}$ " Flat Plates 6 and a  $5\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flat Plate 7.

### CYLINDER BLOCK AND INSPECTION PLATFORMS

Each side of the cylinder block, an underneath view of which is shown in Fig. 9.17b, is formed by four  $5\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flexible Plates. The two upper Flexible Plates are bolted together overlapping one hole, and the lower Flexible Plates overlap three holes, the two compound plates so formed being joined together by their longer edges. The rounded ends of the cylinder block each consist of two  $4\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " and two  $5\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flexible Plates, the arrangement of which is shown in Fig. 9.17b. The upper edges of the Plates used in the construction are strengthened as shown in the main illustration by  $5\frac{1}{2}$ " Strips and 3" Formed Slotted Strips. The top of the cylinder block is filled by four  $5\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flexible Plates, one  $5\frac{1}{2}$ "  $\times$   $1\frac{1}{2}$ " and four  $2\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flexible Plates, the rounded portion at each end being formed by  $2\frac{1}{2}$ " large radius Curved Strips and  $2\frac{1}{2}$ " small radius Curved Strips. The cylinder covers are represented by Road Wheels, secured in position by  $\frac{1}{2}$ " Bolts. The cylinder block is held by the  $5\frac{1}{2}$ "  $\times$   $\frac{1}{2}$ " Double Angle Strips seen in Fig. 9.17c bolted to the  $5\frac{1}{2}$ "  $\times$   $3\frac{1}{2}$ " Flat Plates 6, and also by two Angle Brackets bolted to the Flat Plate 7.

The inspection platform is constructed by bolting two  $12\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Strip Plates, overlapped 19 holes, to each pair of Angle Girders 5. Angle Girders of various sizes are then bolted along the outer edges of the Strip Plates, the ends of which are joined by two  $4\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " flat plates and two  $5\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flexible Plates. The  $4\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " flat plates are obtained by removing the centre pin from a Hinged Flat Plate, and using the halves separately. The handrail around the platform is represented by Cord, which is tied at each corner to the upper end of a 2" Rod. Two of the 2" Rods are supported by Handrail Supports and two by Rod Sockets.

The ladder leading up to the cylinder platform is formed by two  $12\frac{1}{2}$ " Strips, the upper ends of which are secured to the underside of the platform by Corner Angle Brackets. The rungs of the ladder are represented by Cord threaded through the holes of the  $12\frac{1}{2}$ " Strips.

### CRANKSHAFT AND CONNECTING RODS

The built-up crankshaft consists of a  $3\frac{1}{2}$ " Rod 10, two  $2\frac{1}{2}$ " Rods 11 and 12, and an 8" Rod 13, and is journaled in two Trunnions bolted to Angle Girders 4 and two Flat Trunnions bolted to Angle Girders 8 and 9.

Each web of the left-hand crank (Fig. 9.17c) is built up with three  $2\frac{1}{2}$ " Strips bolted in the form of a triangle, and the two webs are joined by a  $\frac{3}{4}$ " Bolt. The  $\frac{3}{4}$ " Bolt passes through the end hole of a compound 7" strip, built up from a  $5\frac{1}{2}$ " and a  $2\frac{1}{2}$ " Strip, and it carries six Washers on its shank to act as packing pieces. The webs are connected to the crankshaft by means of Bush Wheels, one of which is bolted to each of its sides.

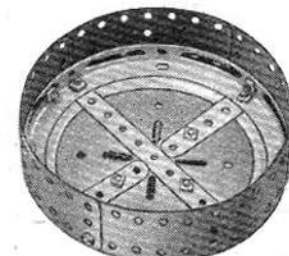


Fig. 9.17a

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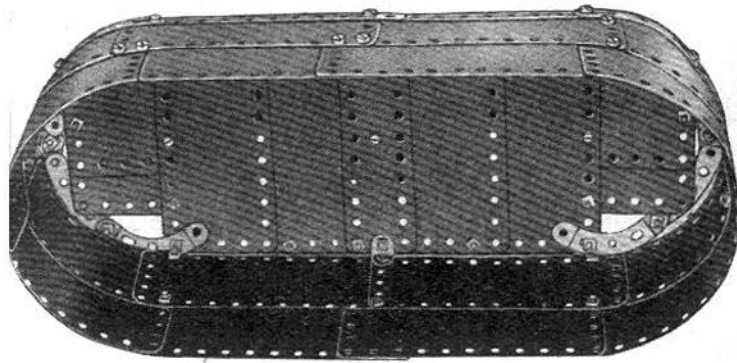


Fig. 9.17b

rod, a  $6\frac{1}{2}$ " Rod, is journaled in one of the Flat Plates 6, and it carries a 1" Pulley complete with Rubber Ring at its upper end.

The construction of the central and right-hand cranks is similar to that already described, except that Double Arm Cranks and ordinary Cranks are used instead of Bush Wheels, and in the crosshead the End Bearing is replaced by Rod and Strip Connectors.

#### DRIVING MOTOR, FLYWHEEL AND PUMP GEARS

The No. 1 Clockwork Motor 24 is fastened to the base by Reversed Angle Brackets, and on its driving shaft is locked a  $\frac{3}{4}$ " Pinion. This meshes with a 50-teeth Gear on a 2" Rod, which is journaled in the Motor side plates and carries a  $\frac{3}{4}$ " Sprocket Wheel connected by a length of Chain to a 2" Sprocket Wheel on the  $3\frac{1}{2}$ " Rod 10 of the crankshaft.

The  $3\frac{1}{2}$ " Rod 10 carries also a Face Plate, to which is fastened a Threaded Pin. A  $4\frac{1}{2}$ " Strip secured on the plain shank of the Threaded Pin by a Collar is fastened at its upper end to a  $5\frac{1}{2}$ " Curved Strip by a lock-nutted Bolt. The Curved Strip is pivoted at 16, and its free end is connected by Collar 17 to a 5" Rod. This Rod slides in the centre hole of a Wheel Disc secured by two 3" Screwed Rods at the end of a  $2\frac{1}{2}$ " Cylinder 18. The Screwed Rods serve also to clamp Cylinder 18 to a  $1\frac{1}{2}$ "  $\times$   $\frac{1}{2}$ " Double Angle Strip that is bolted to the base of the model.

The flywheel 22 is built up by bolting four  $5\frac{1}{2}$ "  $\times$   $1\frac{1}{2}$ " Flexible Plates around the circumference of a Circular Girder (see Fig. 9.17a) A Circular Plate, to which is bolted a Face Plate, is fixed to it by two  $5\frac{1}{2}$ " Strips, Rod 13 of the crankshaft being locked in the boss of the Face Plate. An auxiliary bearing for Rod 13 is provided by Flanged Sector Plate 21, and a Double Bent Strip bolted to it. Flanged Sector Plate 21 is supported by two  $1"$   $\times$   $\frac{1}{2}"$  Angle Brackets. A flywheel is not used in the actual marine engine of this type but is incorporated in the model to ensure smooth and steady running.

The coupling unit indicated at 23 consists of a Wheel Flange clamped between two 2" Pulleys.

The 2" Sprocket Wheel 25 is connected by a length of Sprocket Chain to a 1" Sprocket Wheel fastened on the end of a compound rod 20, which consists of two  $3\frac{1}{2}"$  Rods joined by a Coupling. The compound rod is journaled in the centre holes of two Boiler Ends pressed on to the Boiler 19, and it carries at its end two Chimney Adaptors, a Sleeve Piece and a 2" Pulley. The Boiler 19 is attached by two Double Brackets to the rear Angle Girder 3.

#### 9.17 MARINE STEAM ENGINE—Continued

The 7" compound strip mentioned above forms the connecting rod, and its upper end is pivotally attached to an End Bearing by a lock-nutted Bolt 14. The piston rod is locked in the boss of the End Bearing and it carries a Coupling 15. Two Double Brackets are fastened to the Coupling by  $\frac{1}{2}"$  Bolts as shown in Fig. 9.17c to form guides for the crosshead, and they slide between two compound strips, each of which is formed by a  $5\frac{1}{2}"$ , a 3" and a  $2\frac{1}{2}"$  Strip bolted end to end. The compound strips are fastened by Angle Brackets underneath Flat Plate 6, and at their lower ends are connected to cross Strips bolted to Angle Girders 5 (Fig. 9.17c). The piston

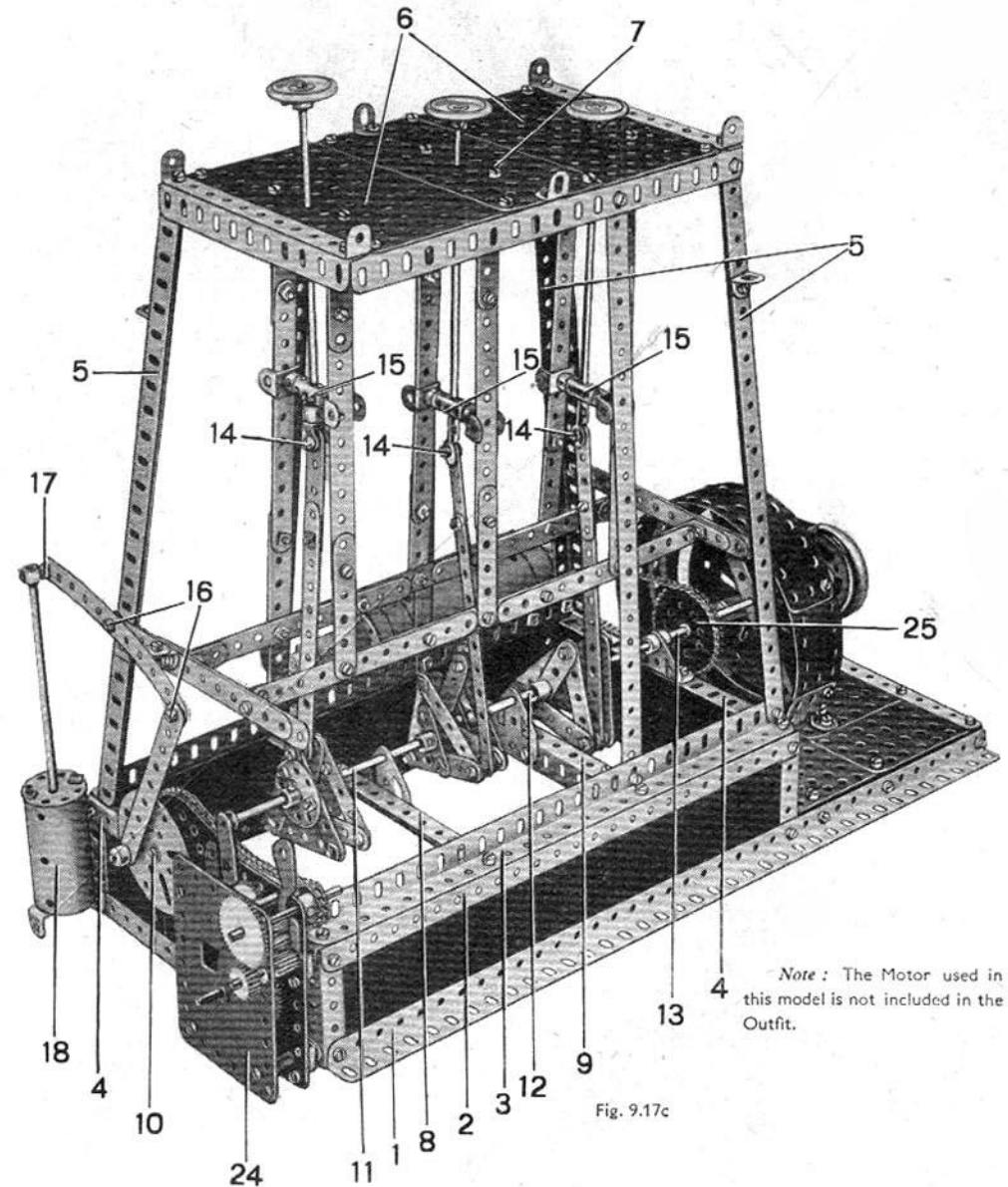


Fig. 9.17c

Note: The Motor used in this model is not included in the Outfit.

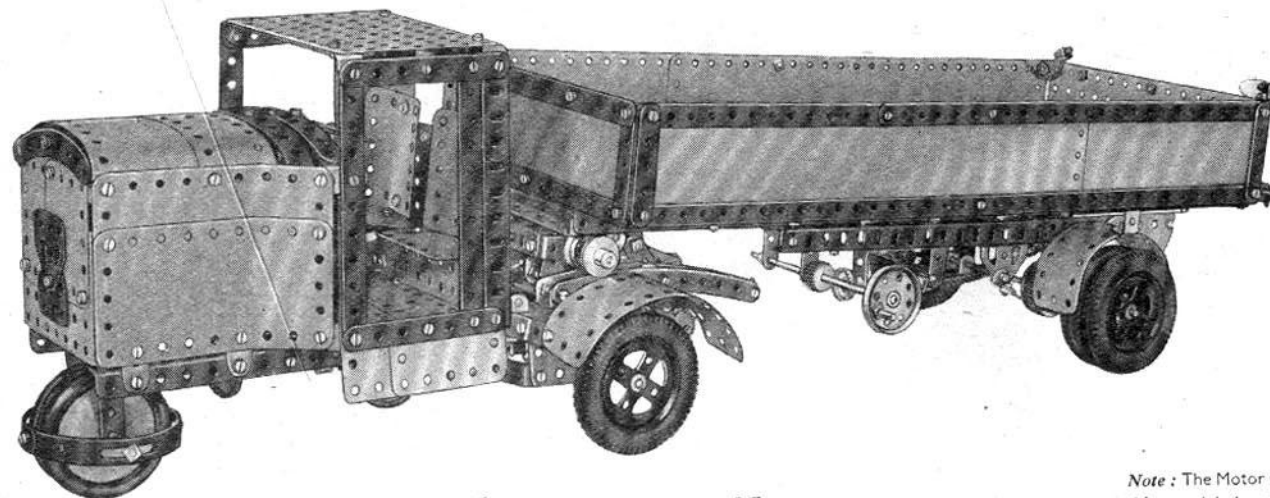
## 9.18 MECHANICAL HORSE AND TRAILER

### THE MOTOR UNIT CHASSIS

The chassis is formed by two  $12\frac{1}{2}$ " Angle Girders 1 (Fig. 9.18d), joined at the front by a  $3\frac{1}{2}$ "  $\times$   $\frac{1}{2}$ " Double Angle Strip 2, and at the rear by two  $3\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flanged Plates 3. A third  $3\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flanged Plate 4 is attached to Fishplates 5 (Fig. 9.18b) bolted to the Girders 1.

The rear wheels are fixed on a  $6\frac{1}{2}$ " Rod mounted in Girder Brackets bolted to a  $2\frac{1}{2}$ " Angle Girder 6 (Fig. 9.18d) fixed to each of the Girders 1. The  $6\frac{1}{2}$ " Rod is held in position by Collars, and carries a  $\frac{3}{4}$ " Contrate 7 and a  $1\frac{1}{2}$ " Contrate 8.

The front wheels are supported by a caster mounting built up on a Bush Wheel 9. Each side of the wheel support consists of two 2" Strips attached by Angle Brackets to adjacent holes of the Bush Wheel. A  $3\frac{1}{2}$ " Screwed Rod is fixed by nuts in the end holes



*Note:* The Motor used in this model is not included in the Outfit.

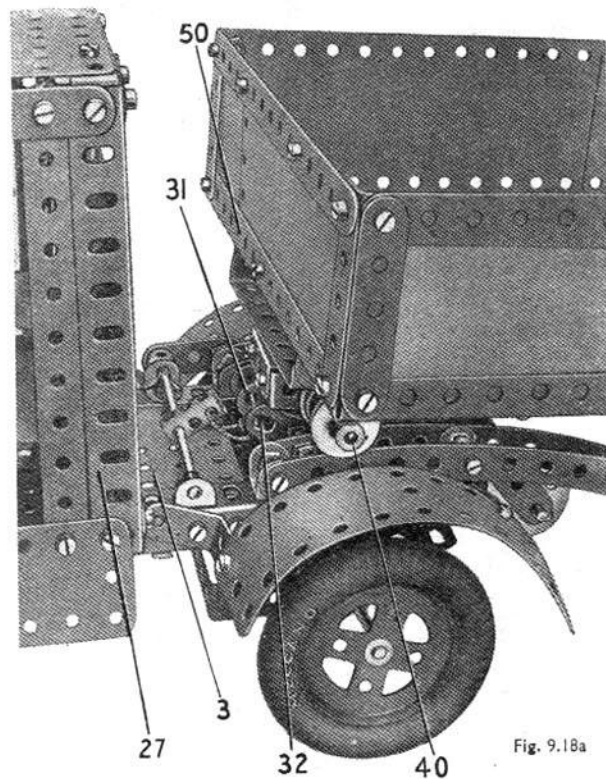


Fig. 9.18a

of the Strips, and the front wheels are free to turn on the Screwed Rod. A circular bumper 10 consisting of four Formed Slotted Strips is held tightly on the Screwed Rod by nuts, and an Angle Bracket 11 is also fixed in position. A  $1\frac{1}{2}$ " Rod is locked in Bush Wheel 9, and passed through the Flanged Plate 4. The Rod is fixed in position by a Collar, and a second Bush Wheel is used for spacing.

### POWER UNIT AND GEARS

An E020 Electric Motor is bolted to the Flanged Plate 4 (Fig. 9.18d), and a  $\frac{3}{4}$ " Sprocket on the armature shaft is connected by Chain to a 2" Sprocket 12. This Sprocket is fixed on a 5" Rod mounted in the Double Angle Strip 2 and in a similar Double Angle Strip 13. The Rod carries at its rear end a  $\frac{1}{2}$ " Pinion that meshes with a 57-teeth Gear 14 carried on a  $3\frac{1}{2}$ " Rod mounted in a Flat Trunnion 15 and in a  $3\frac{1}{2}$ "  $\times$   $\frac{1}{2}$ " Double Angle Strip 16. The  $3\frac{1}{2}$ " Rod carries also a  $\frac{1}{2}$ " Pinion 17.

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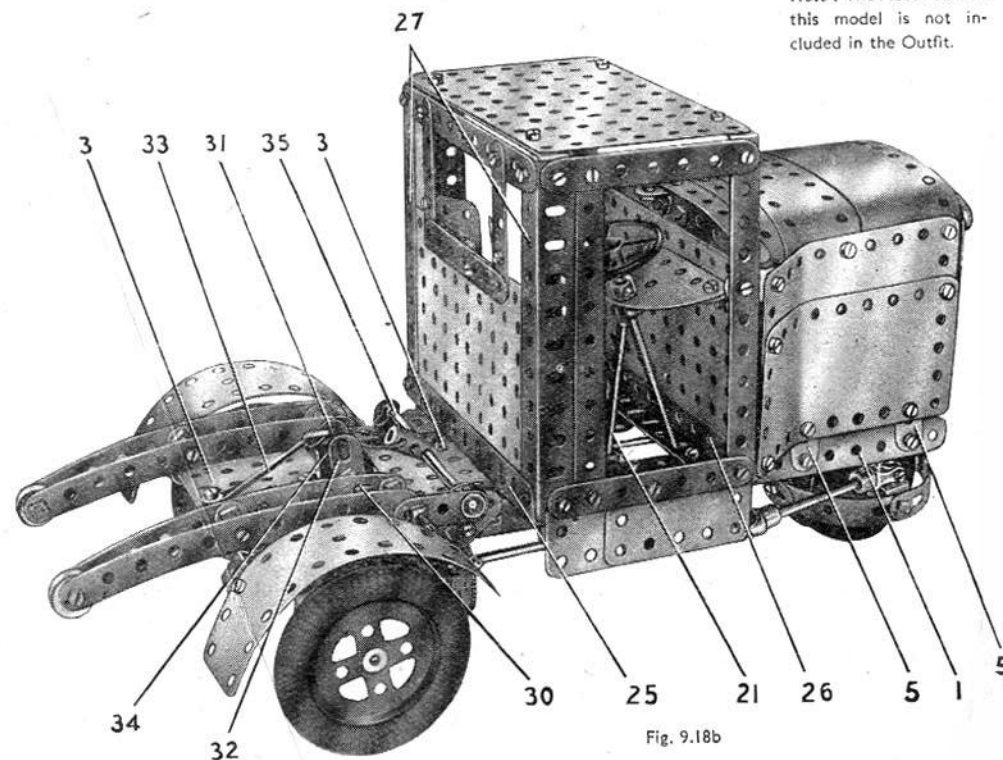


Fig. 9.18b

## 9.18 MECHANICAL HORSE AND TRAILER—Continued

A 57-teeth Gear 18 on a 5" Rod 19 is arranged so that it meshes with Pinion 17. Rod 19 is journaled in a Flat Trunnion and in Double Angle Strip 16, and is allowed to slide about  $\frac{1}{4}$ " in its bearings. The Rod is fitted with a  $\frac{1}{2}$ " Pinion 20, and this can be engaged with either of the Contrates 7 and 8 to provide forward and reverse movements. The gear required is engaged by moving a lever 21, consisting of a  $2\frac{1}{2}$ " Rod fixed in a Coupling. The Coupling is locked on a transverse Rod 22, mounted in Flat Trunnions bolted to the chassis. A second Coupling on Rod 22 is fitted with a Bolt 23, and this engages between Collars on Rod 19. The lever 21 is held in any desired position by the friction of a 1" Pulley 24 fitted with a Rubber Ring. This is pressed against one of the Flat Trunnions supporting Rod 22.

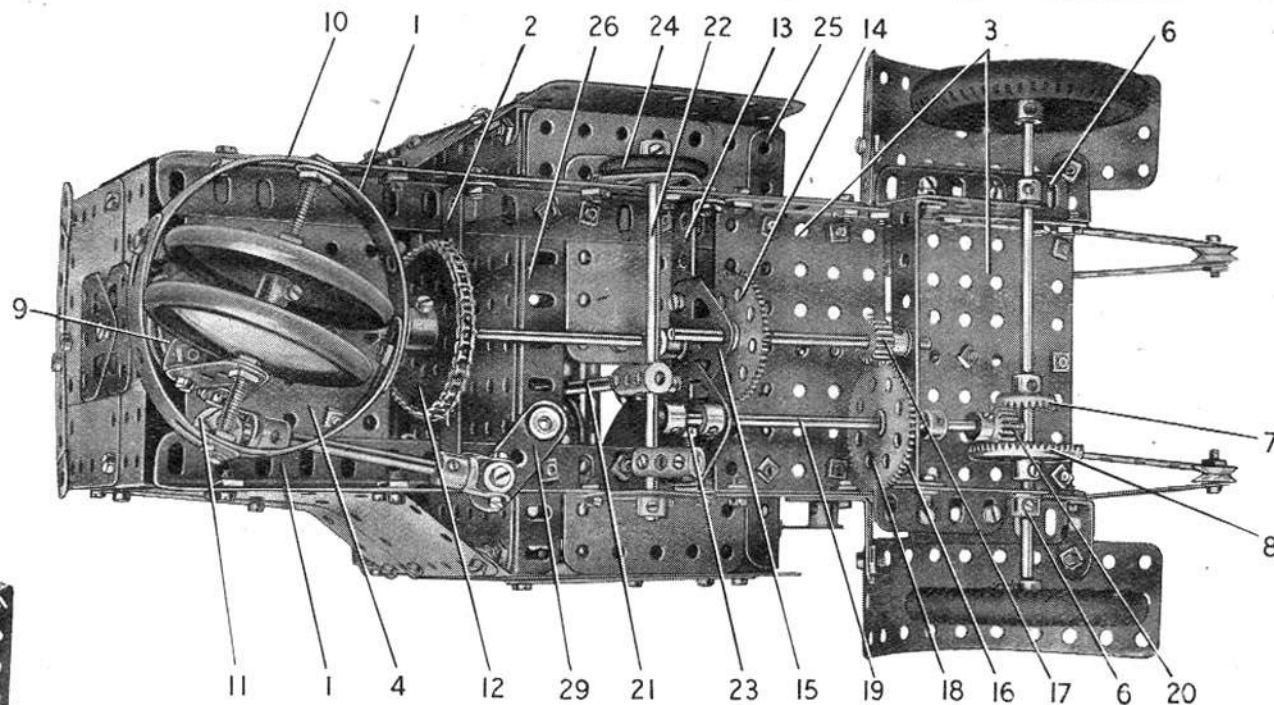


Fig. 9.18d

**STEERING MECHANISM**

The steering column is a 5" Rod, and it carries at its lower end a Crank 29 (Fig. 9.18d). The 5" Rod is mounted in the Girder 26, and in a Semi-Circular Plate attached to the front of the cab by Angle Brackets. Crank 29 is connected to the Angle Bracket 11 on the front bumper by a  $2\frac{1}{2}$ " Rod and two Swivel Bearings. The Swivel Bearings pivot on  $\frac{1}{4}$ " Bolts held in place by two nuts.

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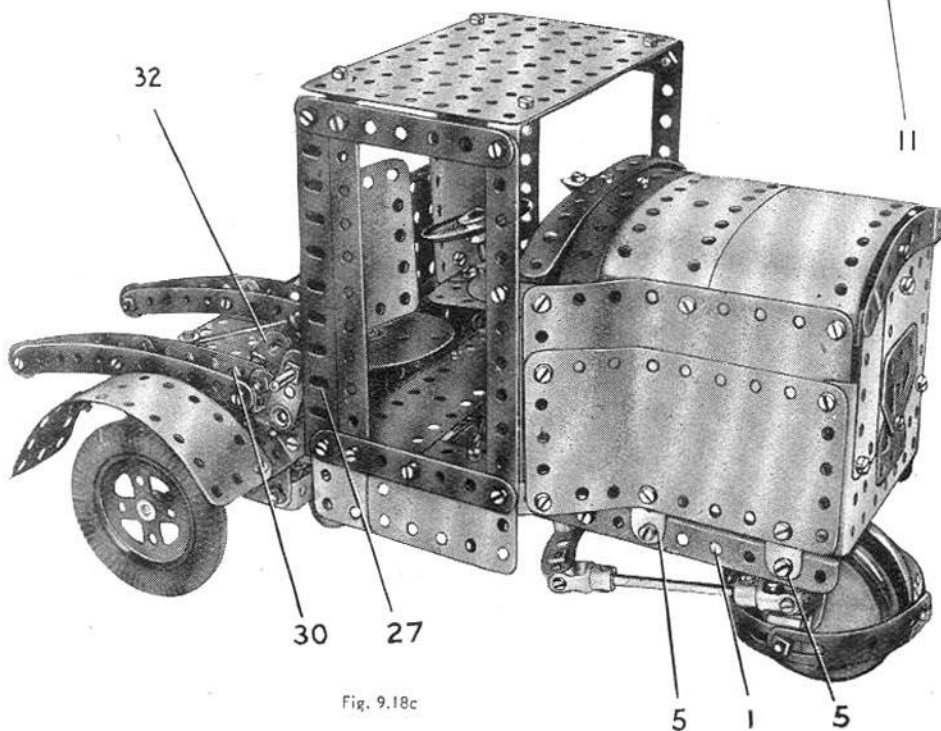


Fig. 9.18c

**BONNET AND CAB**

The cab is built up on two  $5\frac{1}{2}$ " Angle Girders 25 and 26 (Fig. 9.18c) bolted across the chassis. A vertical  $5\frac{1}{2}$ " Angle Girder 27 (Fig. 9.18b) is fixed to each end of the Girder 25, and the back of the cab is filled in by a  $5\frac{1}{2}$ " x  $3\frac{1}{2}$ " Flat Plate extended upward by two  $2\frac{1}{2}$ " x  $1\frac{1}{4}$ " Flexible Plates, leaving a gap for the rear window. Girders 27 are connected across by a  $5\frac{1}{2}$ " x  $\frac{1}{2}$ " Double Angle Strip and the roof, a  $5\frac{1}{2}$ " x  $3\frac{1}{2}$ " Flat Plate, is bolted to this and to a similar Double Angle Strip at the front. The front of the cab is also a  $5\frac{1}{2}$ " x  $3\frac{1}{2}$ " Flat Plate, and this is bolted to Girder 26.

The sides of the bonnet are  $4\frac{1}{2}$ " x  $2\frac{1}{2}$ " Flexible Plates, and the top is filled in by a  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ " and a  $5\frac{1}{2}$ " x  $1\frac{1}{4}$ " Flexible Plate curved to shape. The radiator (see Fig. 9.18c) is a  $3\frac{1}{2}$ " x  $2\frac{1}{2}$ " Flanged Plate and two  $2\frac{1}{2}$ " x  $2\frac{1}{2}$ " Flexible Plates. The bonnet is bolted to the Fishplates 5 and is attached to the cab by Obtuse Angle Brackets. A  $2\frac{1}{2}$ " Strip 28 (Fig. 9.18e) supports two  $5\frac{1}{2}$ " Strips and is fixed by an Angle Bracket to a Fishplate bolted to the front of the cab.

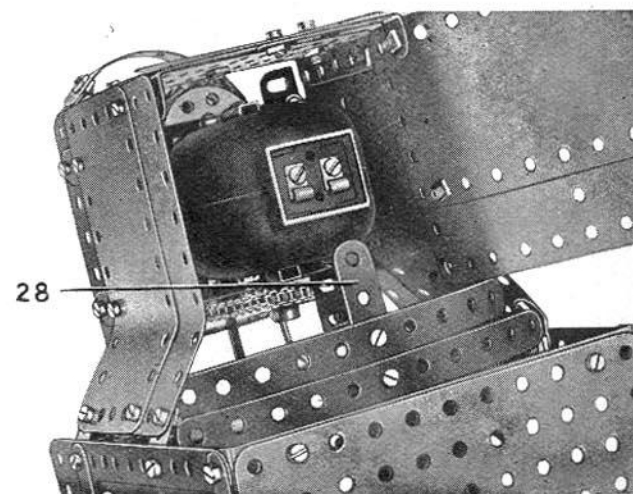


Fig. 9.18e



## 9.18 MECHANICAL HORSE AND TRAILER—Continued

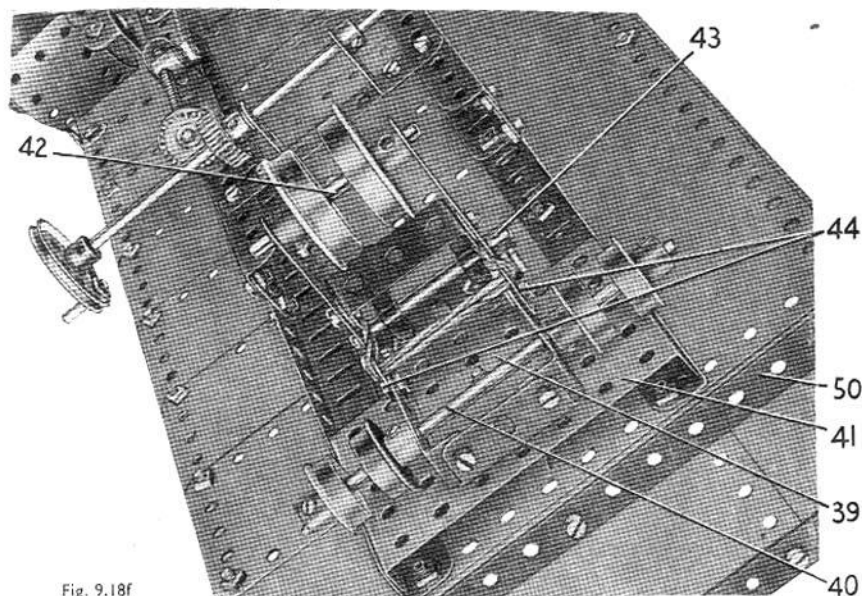


Fig. 9.18f

When it is disconnected from the motor unit, the trailer is supported on two  $1\frac{1}{2}$ " Flanged Wheels on a 2" Rod 42 carried in the end holes of two 3" Strips lock-nutted as shown in Fig. 9.18f. A Driving Band passed over a 2" Rod 43 and through Fishplates 44 is used to bring the 3" Strips into a vertical position as the trailer is uncoupled.

**TRAILER BRAKE**

The brake is operated by turning a  $1\frac{1}{2}$ " Pulley on a 5" Rod 45 (Fig. 9.18g). This Rod is mounted in  $1"$   $\times$   $1"$  Angle Brackets bolted to the Girders 37 and connected together by a  $2\frac{1}{2}"$  Strip. Rod 45 carries a  $\frac{3}{8}"$  Pinion, and this meshes with a  $\frac{3}{8}"$  Contrate on a 3" Screwed Rod 46. The Screwed Rod is mounted in a  $2\frac{1}{2}"$   $\times$   $1"$  Double Angle Strip, and carries a Rod Socket 47. A length of Chain fixed to the Rod Socket is passed over a 2" Rod 48 and around the drum 38. It is then tied to a  $3\frac{1}{2}"$   $\times$   $\frac{1}{2}"$  Double Angle Strip bolted to the Girders 37. Rod 48 is mounted in a  $1\frac{1}{2}"$   $\times$   $\frac{1}{2}"$  Double Angle Strip bolted to a compound  $3\frac{1}{2}"$  Strip 49.

**TRAILER PLATFORM AND SLIDES**

The edges of the trailer platform are  $18\frac{1}{2}"$  Angle Girders joined at the front by a  $7\frac{1}{2}"$  Angle Girder 50 (Fig. 9.18a) and at the rear by a  $7\frac{1}{2}"$  Strip. The platform is filled in by two  $12\frac{1}{2}"$   $\times$   $2\frac{1}{2}"$  strip Plates and nine  $5\frac{1}{2}"$   $\times$   $2\frac{1}{2}"$  Flexible Plates arranged as shown in Fig. 9.18g.

The sides are  $12\frac{1}{2}"$   $\times$   $2\frac{1}{2}"$  Strip Plates, and the front is made from two  $5\frac{1}{2}"$   $\times$   $2\frac{1}{2}"$  Flexible Plates.

The tailboard consists of two  $5\frac{1}{2}"$   $\times$   $2\frac{1}{2}"$  Flat Plates overlapped and pivoted on a compound rod 51 (Fig. 9.18g). It is held in position by  $1"$  Rods passed through Corner Angle Brackets bolted to the sides.

**COUPLING UNIT**

The guide rails on the motor unit are each formed by two  $5\frac{1}{2}"$  Curved Strips attached to the Flanged Plates 3 (Fig. 9.18b) by Double Brackets. A 3" Screwed Rod 30 is mounted in the inner pair of Curved Strips and is held in place by lock-nuts. The Screwed Rod carries between the Curved Strips the Fishplates 31 and 32, each held between two nuts.

A Driving Band 33 is attached to the Fishplate 31 and is held on a bolt fixed in the chassis. An Angle Bracket 34 is used to support the Fishplates in a vertical position. They can be lowered for uncoupling by a Crank fixed on a 4" Rod 35 mounted in Angle Brackets. A Coupling on this Rod is connected by Cord to Fishplate 31.

**THE TRAILER**

The chassis of the trailer is formed by two compound girders 36 (Fig. 9.18g) each consisting of two  $12\frac{1}{2}"$  Angle Girders overlapped 13 holes. A  $12\frac{1}{2}"$  Angle Girder 37 is attached to each girder 36, and these provide supports for the spring mountings. The rear mountings are Semi-Circular Plates and the front mountings are Trunnions. Each spring consists of a  $5\frac{1}{2}"$ , a  $4\frac{1}{2}"$ , a  $3\frac{1}{2}"$ , a  $2\frac{1}{2}"$  and a  $1\frac{1}{2}"$  Strip, held together by a  $\frac{3}{8}"$  Bolt and attached to the mountings by Angle Brackets.

The rear axle is an 8" Rod mounted in Double Brackets bolted to the springs. It carries a brake drum formed by two  $1\frac{1}{2}"$  Flanged Wheels 38.

The trailer part of the coupling unit is a  $2\frac{1}{2}"$   $\times$   $1\frac{1}{2}"$  Flanged Plate 39 (Figs. 9.18f and 9.18g) fitted at each side with a  $2\frac{1}{2}"$   $\times$   $\frac{1}{2}"$  Double Angle Strip. Four  $\frac{3}{4}"$  Flanged Wheels fixed on a  $4\frac{1}{2}"$  Rod 40 are spaced so that they fit over the guide rails on the motor unit. The Fishplates 32 (Fig. 9.18c) of the coupling unit engage between the flange of Plate 39 and Rod 40. The Flanged Plate 39 is lock-nutted to a  $3\frac{1}{2}"$   $\times$   $2\frac{1}{2}"$  Flanged Plate 41.

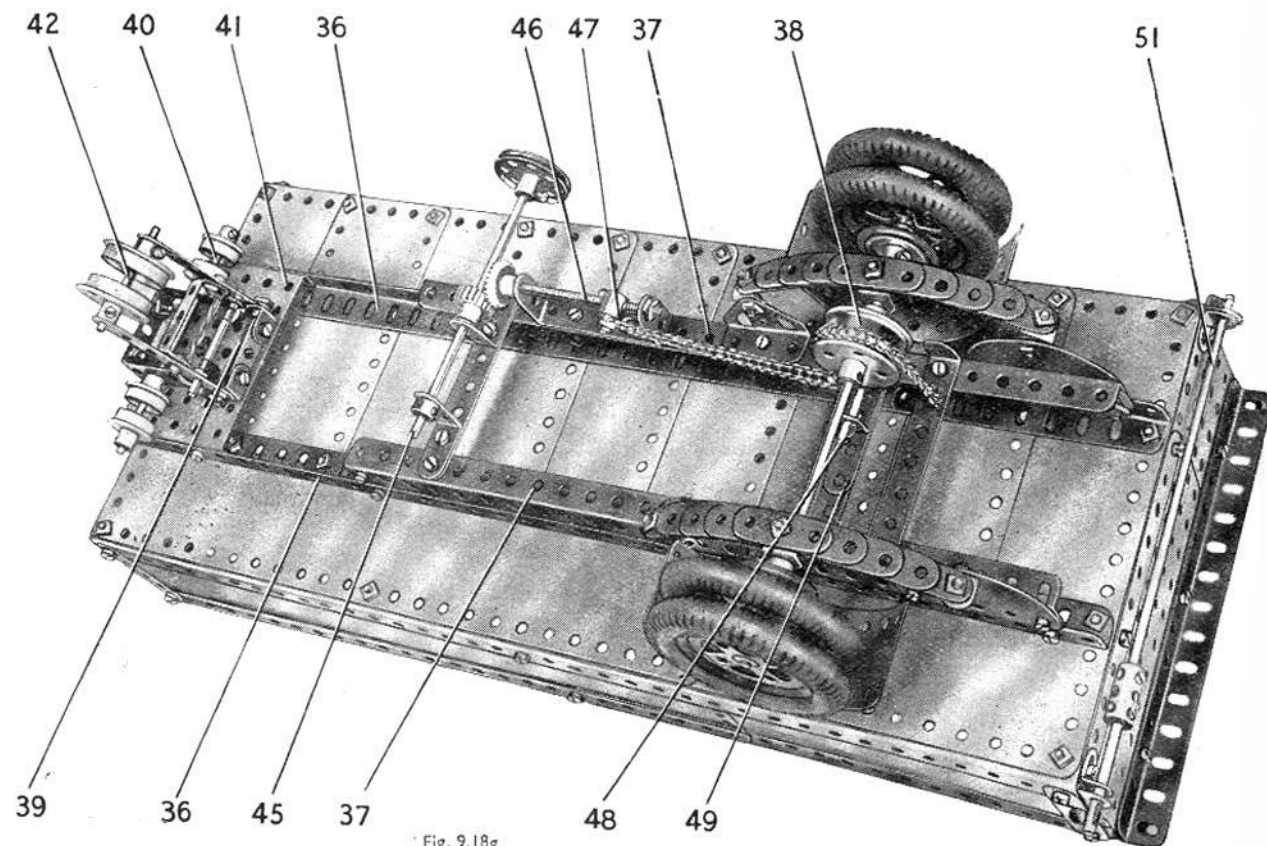


Fig. 9.18g

## 9.19 LOCOMOTIVE COALING PLANT

## THE BASE

The tower is built up on a square base formed by  $12\frac{1}{2}$ " Angle Girders. The top of the base is filled in by six  $12\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Strip Plates, and  $12\frac{1}{2}$ " Angle Girders 1 and 2 are bolted across in the positions shown in Fig. 9.19a.

## TOWER AND STORAGE HOPPER

The main girders of the tower are made from  $12\frac{1}{2}$ " Strips joined to form built-up angle girders 3 (see general view). One of the Strips of each girder is attached to the base by a  $1"$   $\times$   $1"$  Angle Bracket, and the other is bolted direct to one of the Girders 2. The girders 3 are extended upwards by  $5\frac{1}{2}"$  Angle Girders 4 that form the corners of the storage hopper, and these are connected across by  $9\frac{1}{2}"$  Angle Girders 5.

Each side of the hopper is formed by two  $5\frac{1}{2}"$   $\times$   $3\frac{1}{2}"$  Flat Plates, a  $5\frac{1}{2}"$   $\times$   $2\frac{1}{2}"$  Flexible Plate and two  $5\frac{1}{2}"$   $\times$   $1\frac{1}{2}"$  Flexible Plates. One of the smaller Plates is arranged at an angle to provide a slope to the roof, and the sides are braced by the Girders 4 and by  $5\frac{1}{2}"$  and  $7\frac{1}{2}"$  Strips. The rear of the hopper is filled in by Flexible Plates arranged as shown in Fig. 9.19a.

The hopper front is filled in by Flexible Plates bolted to the Angle Girders 5 and to compound strips made from  $5\frac{1}{2}"$  Strips overlapped.

*Note:* The Motor used in this model is not included in the Outfit.

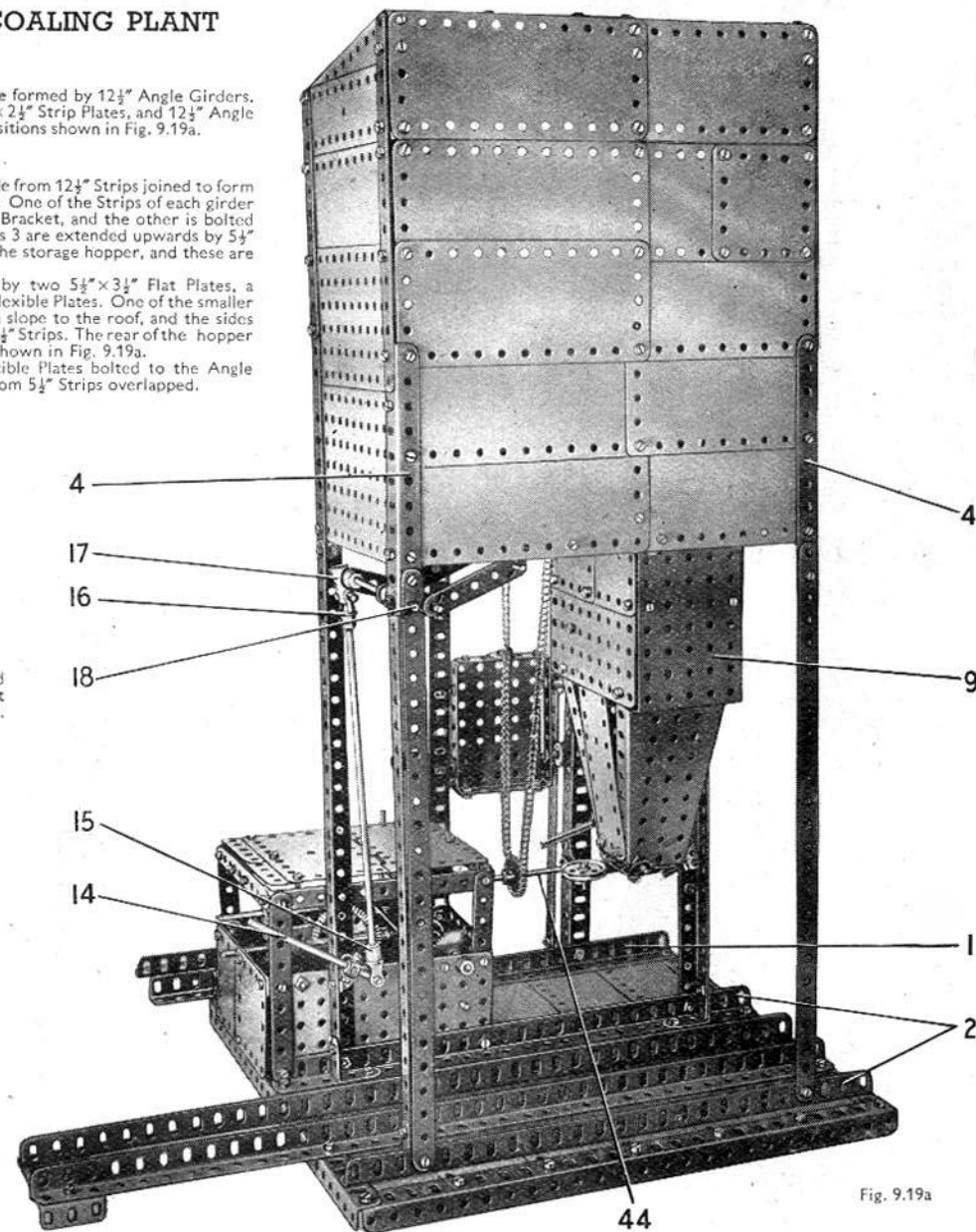
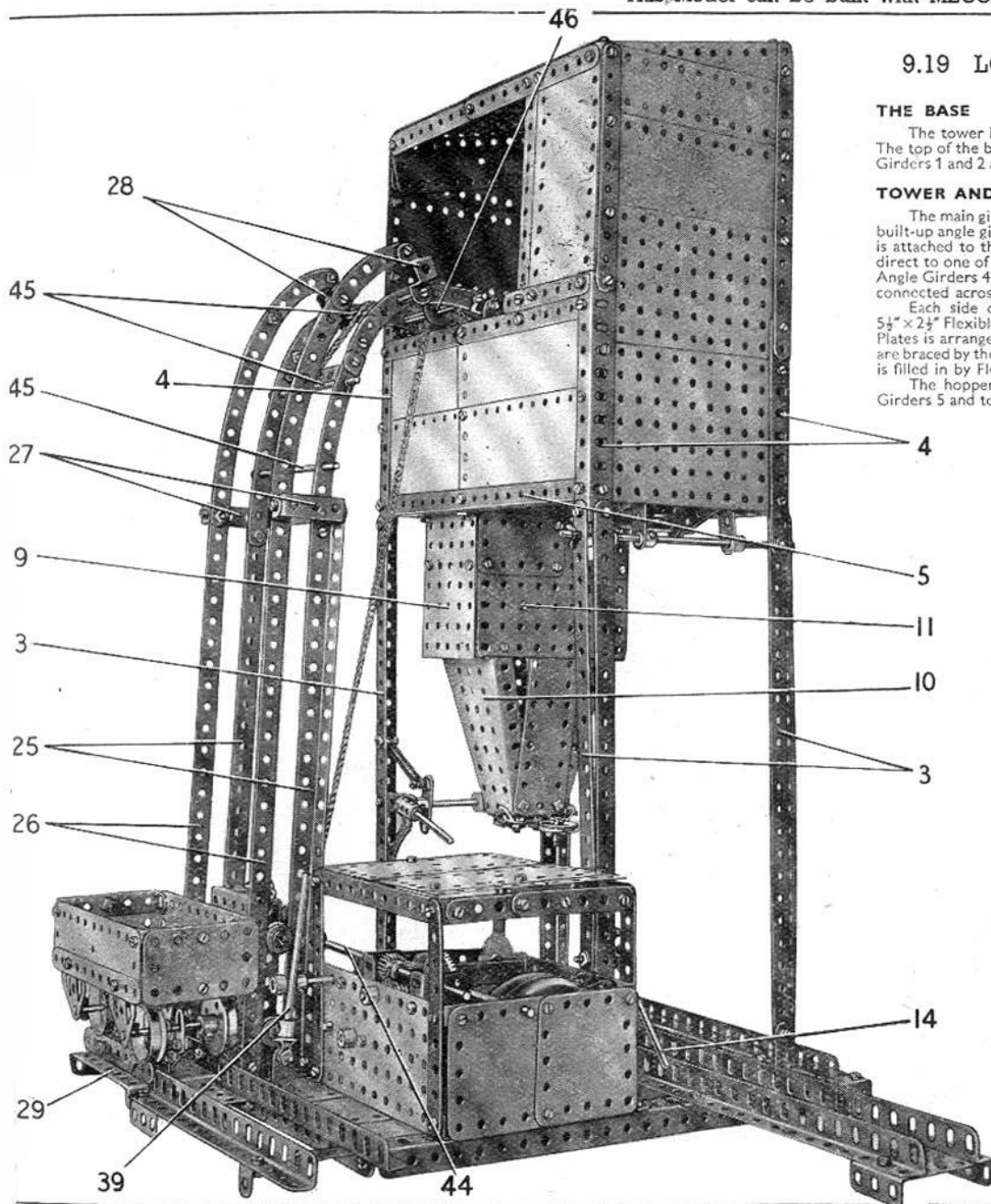


Fig. 9.19a

## 9.19 LOCOMOTIVE COALING PLANT—Continued

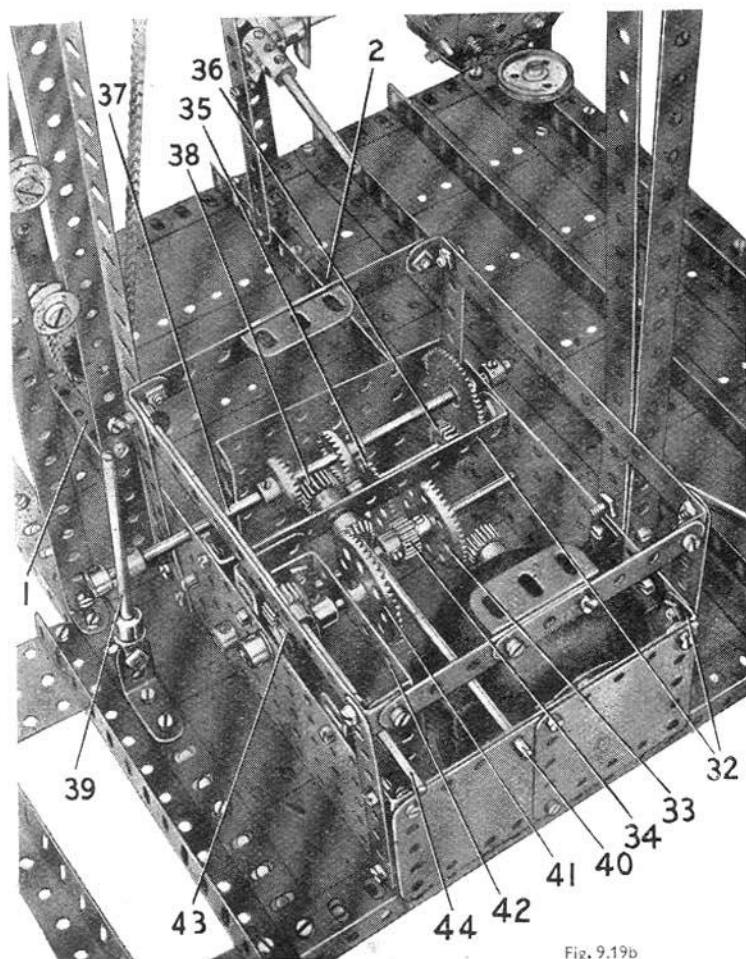


Fig. 9.19b

The hopper has a sloping base 6 (Fig. 9.19h) formed by  $5\frac{1}{2}'' \times 2\frac{1}{2}''$  Flexible Plates bolted together. This is attached by Obtuse Angle Brackets to one side, and to a  $5\frac{1}{2}''$  Strip bolted across the Girders 5 at the position indicated by Bolt 7 (Fig. 9.19d). A second  $5\frac{1}{2}''$  Strip is fixed in position by Bolt 8, and a small sloping base is attached to this by Obtuse Angle Brackets so that it fills in the gap between the Strip and the side of the hopper. The sloping base consists of two  $5\frac{1}{2}'' \times 1\frac{1}{2}''$  Flexible Plates overlapped two holes.

## THE UNLOADING CHUTE

The ends of the chute are  $3\frac{1}{2}'' \times 2\frac{1}{2}''$  Flanged Plates 9 (Fig. 9.19d) bolted to the  $5\frac{1}{2}''$  Strips held by Bolts 7 and 8. The sides are  $4\frac{1}{2}'' \times 2\frac{1}{2}''$  Flat Plates and  $2\frac{1}{2}'' \times 1\frac{1}{2}''$  Flexible Plates attached to the Flanged Plates 9 by Angle Brackets.

The chute is extended downward by two Flanged Sector Plates 10 joined at their lower ends by  $5\frac{1}{2}'' \times 1\frac{1}{2}''$  Flexible Plates. The upper ends of the Flexible Plates are clamped between the  $4\frac{1}{2}'' \times 2\frac{1}{2}''$  Flat Plates and  $2\frac{1}{2}''$  Strips held by the Bolts 11.

The chute is fitted with two traps for controlling the unloading. The upper trap is formed by two  $4\frac{1}{2}'' \times 2\frac{1}{2}''$  Flexible Plates 12 overlapped three holes along their longer edges. The assembly slides between guides bolted to the  $5\frac{1}{2}''$  Strips held by Bolts 7 and 8. The lower part of each guide consists of a  $2\frac{1}{2}''$  Strip bolted across the  $5\frac{1}{2}''$  Strips at the position indicated at 13. A  $1\frac{1}{2}''$  Strip is fixed to the centre hole of each  $2\frac{1}{2}''$  Strip, but is separated from the latter by a Washer placed on the Bolt. The edges of the Flexible Plates 12 slide between the  $2\frac{1}{2}''$  and  $1\frac{1}{2}''$  Strips.

The trap is controlled by a lever 14 (Fig. 9.19a) fixed in a Swivel Bearing lock-nutted to the tower. A second Swivel Bearing 15 is fixed to the lever and is connected by an 8" Rod to a Fork Piece 16. The latter pivots on a 1" Rod held in a Coupling 17 that is fixed on a Rod 18. Rod 18 carries also two Cranks, and these are connected by  $2\frac{1}{2}''$  Strips to a  $2\frac{1}{2}'' \times \frac{1}{2}''$  Double Angle Strip bolted to the Flexible Plates 12 (Fig. 9.19d).

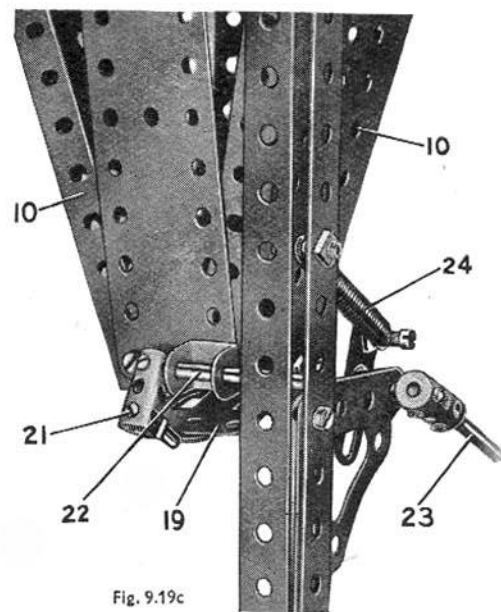


Fig. 9.19c

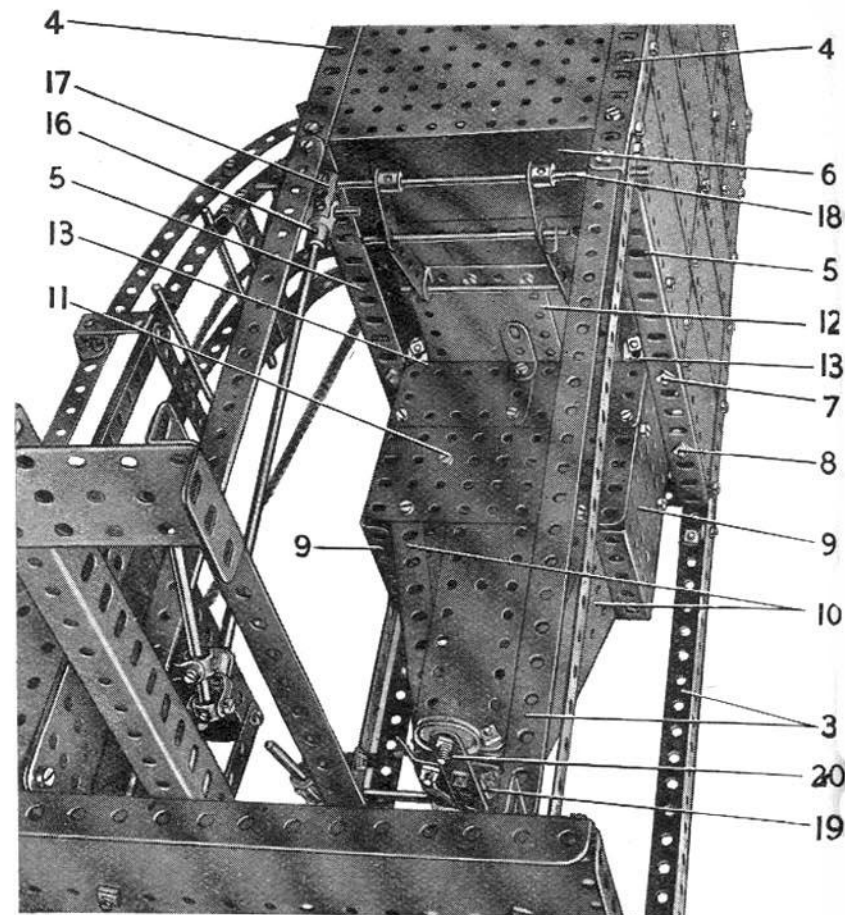


Fig. 9.19d

The lower trap is balance operated, and consists of two Flat Trunnions 19 (Fig. 9.19d) fitted at each side with an Angle Bracket. These are pivoted on  $\frac{3}{8}''$  Bolts fixed to the lower corners of the Flanged Sector Plates 10. A  $2\frac{1}{2}''$  Strip 20 is bolted to the Flat Trunnions, and a 1" loose Pulley attached to the outer end of Strip 20 acts as a balance weight.

The trap is normally locked by a catch formed by a Threaded Pin fixed in a Coupling 21 (Fig. 9.19c). The Coupling is fixed on a  $3\frac{1}{2}''$  Rod 22 mounted in a Double Bracket attached to the chute, and in a Corner Gusset bolted to the tower. The catch can be released by a lever 23 fixed in a Coupling locked on Rod 22. A Spring 24 maintains the catch in the closed position until the lever 23 is depressed.



## 9.19 LOCOMOTIVE COALING PLANT—Continued

## GUIDE RAILS AND HOIST

The guide rails on each side are formed by a  $12\frac{1}{2}$ " Angle Girder 25 and a  $12\frac{1}{2}$ " Strip 26 (see general view) attached to the base as shown. Strip 26 is extended by a  $5\frac{1}{2}$ " and a  $2\frac{1}{2}$ " Curved Strip, and Angle Girder 25 by one  $5\frac{1}{2}$ " and two  $2\frac{1}{2}$ " Curved Strips. The upper ends of the Girder 25 and Strip 26 are connected by a  $1\frac{1}{2}$ "  $\times$   $\frac{1}{2}$ " Double Angle Strip 27, bolted to the Girder 25 and attached to Strip 26 by an Angle Bracket. The Curved Strips are connected by a Double Bent Strip 28 held by  $\frac{3}{8}$ " Bolts. Washers are placed on the Bolts as shown in Fig. 9.19h to allow clearance for the wheels of the hoisting platform.

The back plate of the hoisting platform (Fig. 9.19e) is a  $3\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flanged Plate fitted at each side with a  $3\frac{1}{2}$ "  $\times$   $\frac{1}{2}$ " Double Angle Strip. The wheels are three  $\frac{1}{2}$ " loose Pulleys and a  $\frac{1}{2}$ " Pulley with boss, and they are free to turn on Pivot Bolts and a  $\frac{3}{4}$ " Bolt fixed in the Double Angle Strips.

The rails for the coal wagon are  $4\frac{1}{2}$ " Strips attached by Angle Brackets to a  $3\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flanged Plate 29. This is bolted to  $3\frac{1}{2}$ " Strips attached to the back plate of the hoist. The coal wagon is held in position by two catches engaging its axles (see Fig. 9.19f). Each catch consists of a  $1\frac{1}{2}$ " Strip 30 lock-nutted to an Angle Bracket bolted to the Flanged Plate 29.

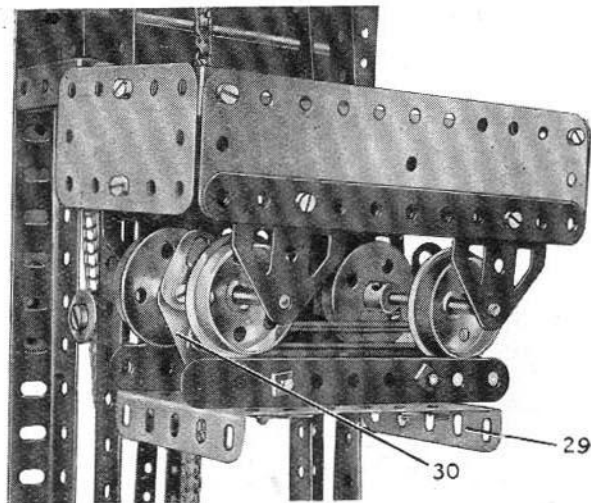


Fig. 9.19f

The catches are sprung in position by a Driving Band placed between the Bolts 31 (Fig. 9.19e). The Driving Band is removed in this illustration to show the construction of the hoist, but is seen in Fig. 9.19f.

## THE COAL WAGON

The base of the wagon (Fig. 9.19g) is a  $5\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flanged Plate, and the sides and ends are  $5\frac{1}{2}$ "  $\times$   $1\frac{1}{2}$ " and  $2\frac{1}{2}$ "  $\times$   $1\frac{1}{2}$ " Flexible Plates. The wheels are fixed on  $2\frac{1}{2}$ " Rods mounted in Flat Trunnions.

## OPERATING CABIN AND MECHANISM

The sides of the cabin (see Fig. 9.19b) are  $5\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flat Plates bolted to the Girder 1 and one of the Girders 2. They are connected together by  $4\frac{1}{2}$ "  $\times$   $\frac{1}{2}$ " Double Angle Strips 32. The roof is a Hinged Flat Plate extended by  $2\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flexible Plates, and it is supported by  $4\frac{1}{2}$ " Strips fixed to the sides.

An EO20 Electric Motor is bolted to one of the side plates of the cabin, and a  $\frac{1}{2}$ " Pinion on its armature shaft meshes with a  $1\frac{1}{2}$ " Contrate 33. The Contrate is fixed on a 5" Rod mounted in the sides, and carries also a  $\frac{1}{2}$ " Pinion 34 that meshes with a 57-teeth Gear 35 on a 5" Rod. A  $\frac{3}{4}$ " Pinion 36 on the same Rod meshes with a 50-teeth Gear on a  $6\frac{1}{2}$ " Rod 37. Rod 37 is free to slide about  $\frac{1}{4}$ " in its bearings, and it carries two

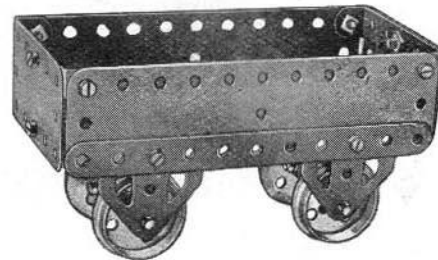


Fig. 9.19g

$\frac{3}{4}$ " Contrates. Either of these can be moved into mesh with a  $\frac{1}{2}$ " Pinion 38, thus providing a simple reversing mechanism. A control lever 39 for Rod 37 is arranged as shown.

The Pinion 38 is fixed on a 5" Rod 40 that carries a  $\frac{1}{2}$ " Bevel Gear. This meshes with a  $1\frac{1}{2}$ " Bevel Gear 41 on a 2" Rod. The 2" Rod is mounted in the sideplate and in a  $2\frac{1}{2}$ "  $\times$  1" Double Angle Strip 42 attached to Girder Brackets bolted to the side. The 2" Rod is fitted with a Worm 43, and this meshes with a  $\frac{1}{2}$ " Pinion on an  $11\frac{1}{2}$ " Rod 44. Rod 44 is mounted in 1" Corner Brackets bolted to the Girders 25 (see general view), and in the Girder Brackets supporting Double Angle Strip 42.

A length of Sprocket Chain is passed round a 1" Sprocket fixed on Rod 44, over Rods 45 and 46 (see general view), and round a 1" Sprocket 47 (Fig. 9.19h). It is then led again over Rod 46 and its ends are joined to form an endless Chain. The Chain is tied at 48 (Fig. 9.19e) to a Fishplate bolted to the hoisting platform.

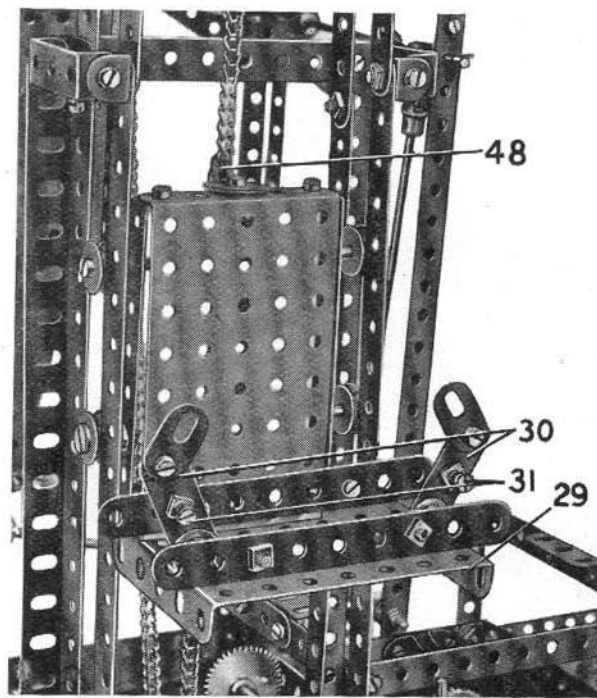


Fig. 9.19e

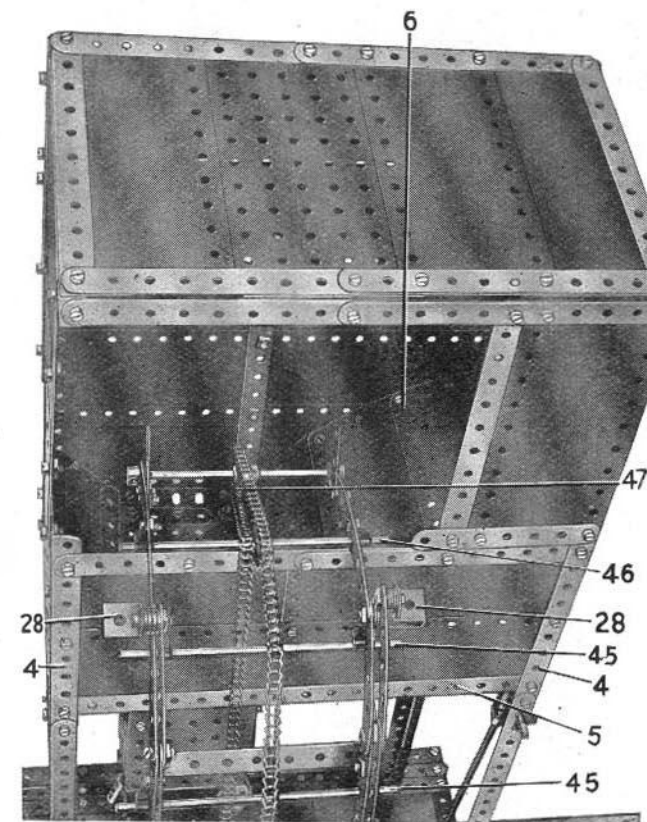
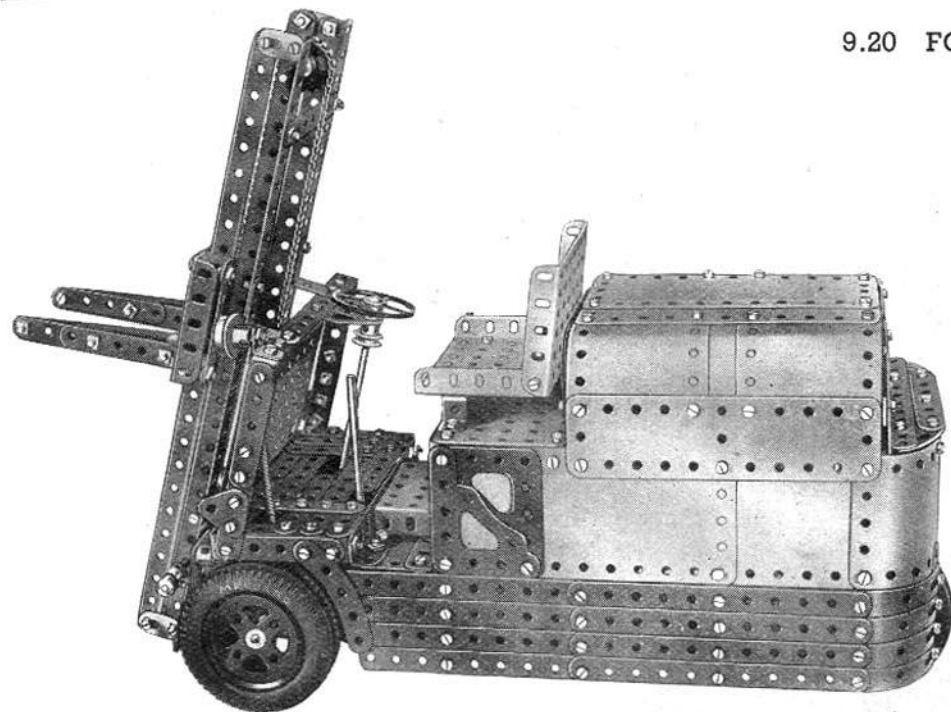


Fig. 9.19h

## 9.20 FORK LIFT TRUCK



## THE CHASSIS

Each of the chassis girders consists of two  $1\frac{1}{2}$ " Angle Girders joined by Fishplates to form a channel girder 1 (Fig. 9.20b). These are connected together at the front by a  $3\frac{1}{2}$ "  $\times$   $\frac{1}{2}$ " Double Angle Strip, and at the rear by a  $5\frac{1}{2}$ " Angle Girder 2. The girders 1 are also connected by two  $5\frac{1}{2}$ " Angle Girders 3 bolted in the positions shown (Fig. 9.20e), and the space between these Girders is filled in with a  $5\frac{1}{2}$ "  $\times$   $1\frac{1}{2}$ " Flexible Plate.

The front wheels of the model are 2" Pulleys fixed on a  $6\frac{1}{2}$ " Rod 4 (Fig. 9.20b). This Rod is mounted in 1" Corner Brackets bolted to the chassis, and carries a  $1\frac{1}{4}$ " Bevel 5 and a Coupling 6. The Coupling is free on the Rod and is held in position by a Collar.

The rear wheels are free to turn on a  $2\frac{1}{2}$ " Rod mounted in a caster unit as shown in Fig. 9.20a. A  $1\frac{1}{2}$ " Rod is locked in the boss of a  $1\frac{1}{4}$ " Pulley 7 and is journaled in a  $2\frac{1}{2}$ "  $\times$  1" Double Angle Strip 8 and in a Double Bent Strip. Double Angle Strip 8 is fixed to  $1\frac{1}{2}$ "  $\times$   $\frac{1}{2}$ " Angle Brackets bolted to the chassis.

## POWER UNIT

An E20R Electric Motor is fixed to the chassis in the position shown. The rear end of the Motor is supported by  $1\frac{1}{2}$ " Strips bolted to the Girder 2 and attached to the Motor side-plate by Angle Brackets. A  $1\frac{1}{2}$ " Strip 9 (Fig. 9.20e) is bolted to the flange of the Motor at the front and is fixed to the chassis by an Angle Bracket.

The Motor switch is controlled by a lever 10 fixed on a 4" Rod mounted as shown. A Crank fixed on this Rod is connected to the switch by a 3" Strip 11 held by lock-nutted bolts.

## DETAILS OF THE GEAR-BOX

A  $\frac{1}{2}$ " Pinion on the Motor armature shaft meshes with a  $1\frac{1}{2}$ " Contrate 12 fixed on a 5" Rod 13 which is mounted in two  $3\frac{1}{2}$ " Strips 14 attached to the chassis by Angle Brackets. The Rod carries also two  $\frac{1}{2}$ " Pinions 15 and 16 arranged as shown (Figs. 9.20b and 9.20c).

A 57-teeth gear 17 is fixed on a  $2\frac{1}{2}$ " Rod 18 mounted in a Flat Trunnion bolted to one of the Strips 14, and in a second Flat Trunnion 19. The Flat Trunnion 19 is attached by Angle Brackets to two  $2\frac{1}{2}$ "  $\times$   $\frac{1}{2}$ " Double Angle Strips 20 bolted between Strips 14. Rod 18 carries also a Bush Wheel

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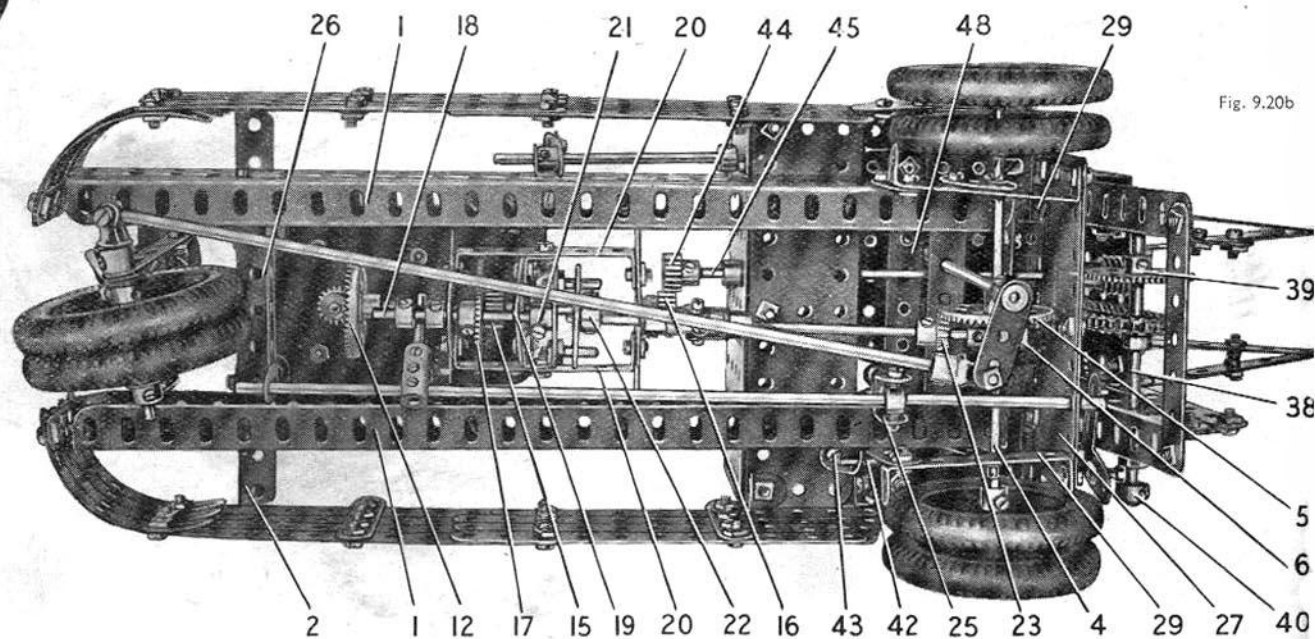


Fig. 9.20b

## 9.20 FORK LIFT TRUCK—Continued

21 fitted with two Threaded Pins that engage in holes in a second Bush Wheel 22. The Bush Wheel is fixed on a  $1\frac{1}{2}$ " Rod mounted in a Flat Trunnion bolted to one of the Strips 14. The outer end of the  $1\frac{1}{2}$ " Rod is fitted with a universal coupling built up from a Swivel Bearing and a small Fork Piece. The universal coupling carries a  $3\frac{1}{2}$ " Rod fitted with a  $\frac{1}{2}$ " Bevel 23. The Rod is free to turn in the Coupling 6 on the front axle, and the  $\frac{1}{2}$ " Bevel meshes with the  $1\frac{1}{2}$ " Bevel 5.

The drive to the front axle is engaged by sliding Rod 18 so that Gear 17 engages with Pinion 15. Movement of Rod 18 is controlled by a lever 24, consisting of a 5" Rod. The 5" Rod is passed through a Handrail Support lock-nutted to an Angle Bracket bolted to the chassis. The lower end of the Rod carries a large Fork Piece 25, fitted with a Collar. An  $11\frac{1}{2}$ " Rod fixed in the Collar is mounted in the front plate 27 of the chassis and in a Fishplate bolted to a  $3\frac{1}{2}$ " x  $\frac{1}{2}$ " Double Angle Strip 26. A  $1\frac{1}{2}$ " Rod is fixed in a Coupling locked on the  $11\frac{1}{2}$ " Rod, and the  $1\frac{1}{2}$ " Rod engages between Collars on Rod 18.

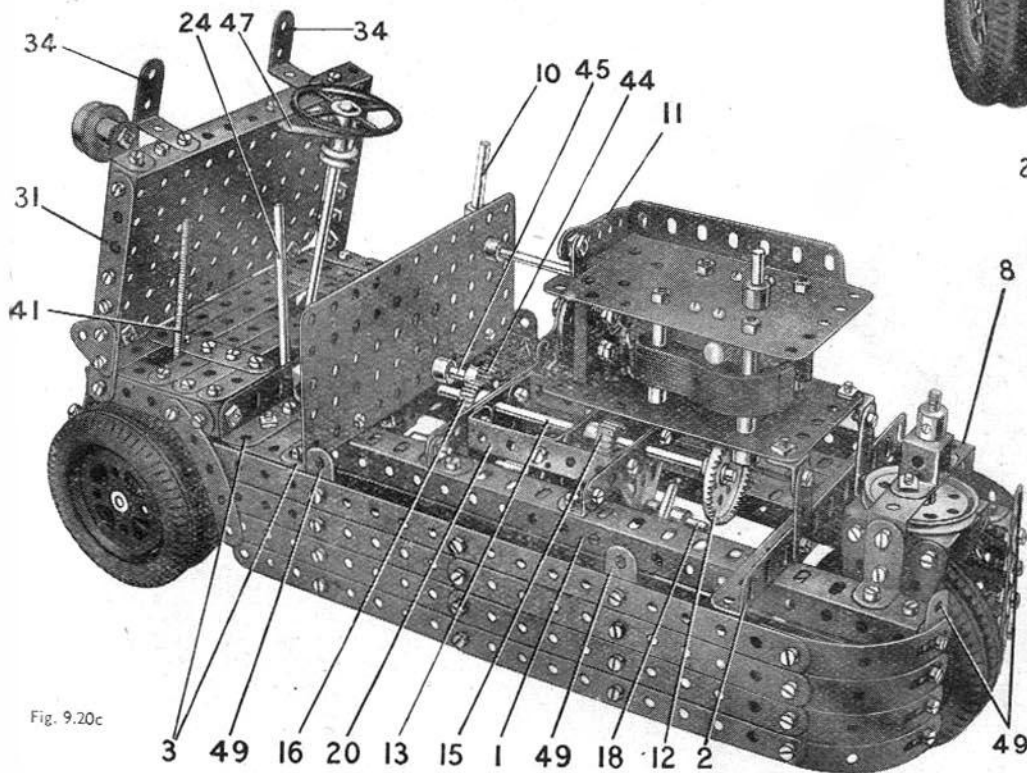


Fig. 9.20c

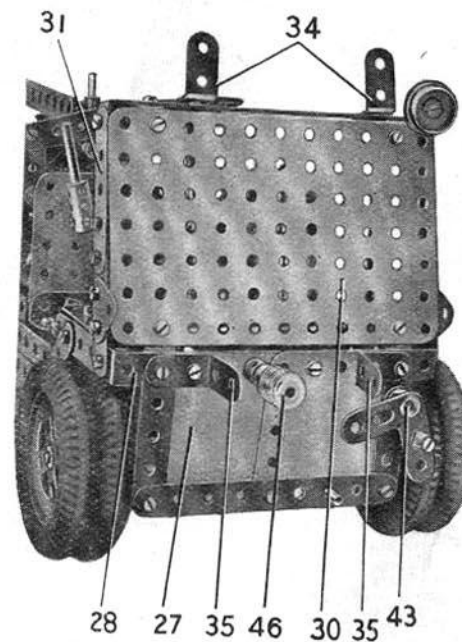


Fig. 9.20d

## THE FRONT OF THE CHASSIS

The front of the chassis with slide frame removed is shown in Fig. 9.20d. A compound plate 27, consisting of two  $2\frac{1}{2}$ " x  $2\frac{1}{2}$ " Flexible Plates, is attached by Reversed Angle Brackets to the  $3\frac{1}{2}$ " x  $\frac{1}{2}$ " Double Angle Strip connecting the chassis girders. The plate is braced by a  $5\frac{1}{2}$ " x  $\frac{1}{2}$ " Double Angle Strip 28, and by  $4\frac{1}{2}$ " and  $2\frac{1}{2}$ " Strips as shown. The lower edge of the plate is fitted with two  $2\frac{1}{2}$ " x  $\frac{1}{2}$ " Double Angle Strips 29, and these are connected to the chassis by  $1\frac{1}{2}$ " Strips. Double Angle Strip 28 is joined to one of the Angle Girders 3 by  $2\frac{1}{2}$ " Strips and  $1\frac{1}{2}$ " x  $1\frac{1}{2}$ " Angle Brackets.

A  $5\frac{1}{2}$ " x  $3\frac{1}{2}$ " Flat Plate 30 is attached to plate 27 by Obtuse Angle Brackets, and is braced on each side by a compound strip 31. Strips 31 are joined at their upper ends by a  $5\frac{1}{2}$ " x  $\frac{1}{2}$ " Double Angle Strip, which is attached to Plate 30 by Angle Brackets.

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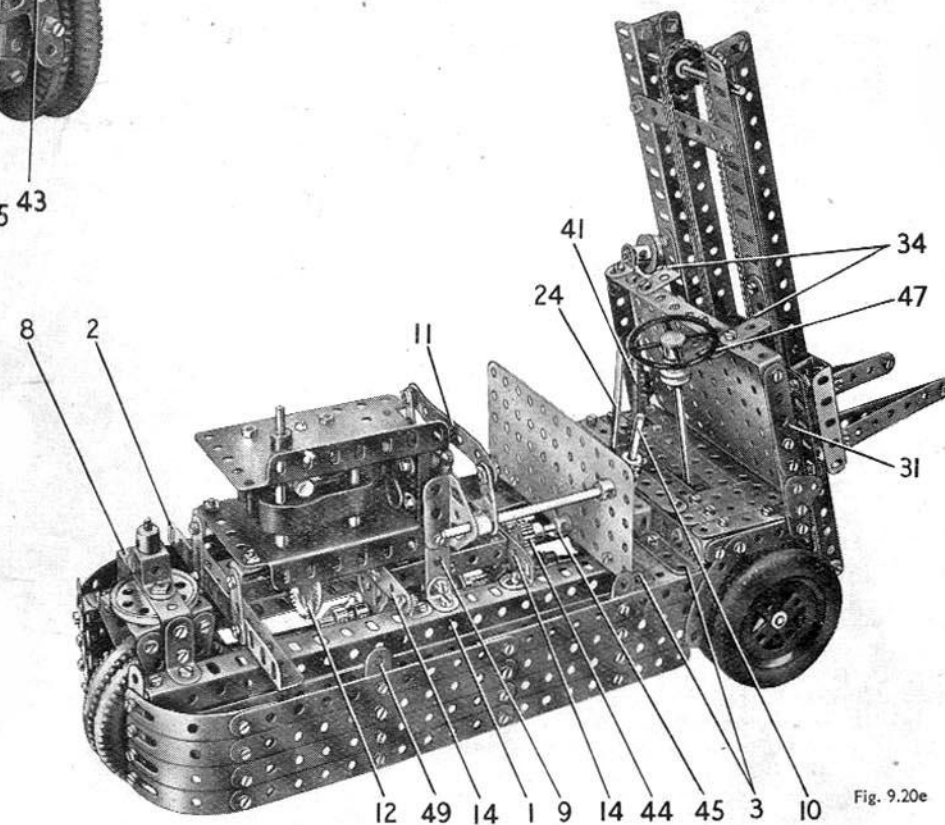


Fig. 9.20e



## 9.20 FORK LIFT TRUCK—Continued

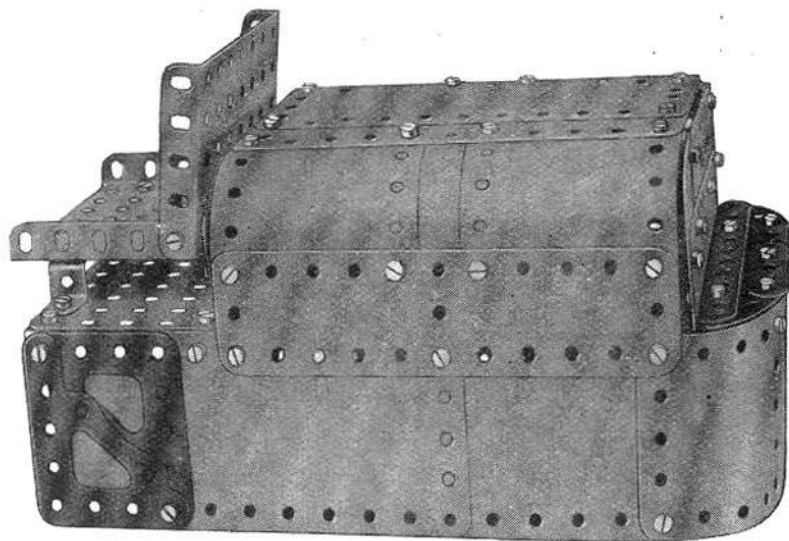


Fig. 9.20f

**HOISTING MECHANISM**

A  $\frac{1}{2}$ " Pinion 44 fixed on a  $6\frac{1}{2}$ " Rod 45 is in constant mesh with Pinion 16 (Fig. 9.20b). Rod 45 is mounted in plate 27 and in the Girders 3, and is fitted with a Worm 46. The hoisting movement is engaged by sliding Rod 38 so that the Gear 39 engages with Worm 46.

**STEERING MECHANISM**

The steering column is a  $6\frac{1}{2}$ " Rod mounted in a Flat Trunnion 47, and in a  $3\frac{1}{2}$ " Strip 48 bolted to the chassis (Fig. 9.20b). The Rod is fitted with a Crank at its lower end, and this is connected by an End Bearing and an  $11\frac{1}{2}$ " Rod to a Swivel Bearing on the rear axle.

**BODYWORK**

The lower part of the bodywork is built up from  $5\frac{1}{2}$ " Strips and Formed Slotted Strips connected together by  $2\frac{1}{2}$ " Strips 49. The Strips are attached to one of the Girders 3 by Corner Angle Brackets, and to the rear of the chassis by Angle Brackets.

The engine casing is built up as shown in Figs. 9.20f and 9.20g and is bolted to the  $2\frac{1}{2}$ " Strips 49.

The floor of the driving compartment is filled in by Strips of various sizes bolted together but allowing clearance for the control levers.

**SLIDE BARS AND HOIST**

Each of the slide bars is formed by a  $12\frac{1}{2}$ " Strip 32 and a  $12\frac{1}{2}$ " Angle Girder 33 joined by Fishplates (Fig. 9.20i). The slide bars on each side are connected together by two  $3\frac{1}{2}$ " Strips, and the assembly is then attached to the chassis by the  $1" \times 1"$  Angle Brackets 34 and 35.

The back plate of the hoist is a  $3\frac{1}{2}" \times 2\frac{1}{2}"$  Flanged Plate, and a  $2\frac{1}{2}"$  Angle Girder 36 (Fig. 9.20h) is attached to each side of this by Double Brackets, two of which are seen at 37. A slight gap is allowed between the Girders and Double Brackets, and the  $12\frac{1}{2}"$  Strips 32 of the slide bars pass freely through this gap.

A length of Sprocket Chain is attached by Cord to the Flanged Plate of the hoist, and passes over  $1"$  Sprockets at each end of the slide bars. The upper Sprocket is free on a  $3\frac{1}{2}"$  Rod held in place by Spring Clips, and the lower Sprocket is fixed on a  $4"$  Rod 38. Rod 38 carries also a 57-teeth Gear 39, and two Collars 40, and is allowed about  $\frac{1}{2}"$  lateral movement, which is controlled by a lever 41. This lever consists of a Screwed Rod fixed by a nut in the tapped hole of a Collar. The Collar is locked on a  $3\frac{1}{2}"$  Rod 42 (Fig. 9.20b), mounted in an Angle Bracket 43 and the plate 27. A Bell Crank with boss is fixed on the front of Rod 42, and a  $\frac{5}{8}"$  Bolt held by nuts in the Bell Crank engages between the Collars 40.

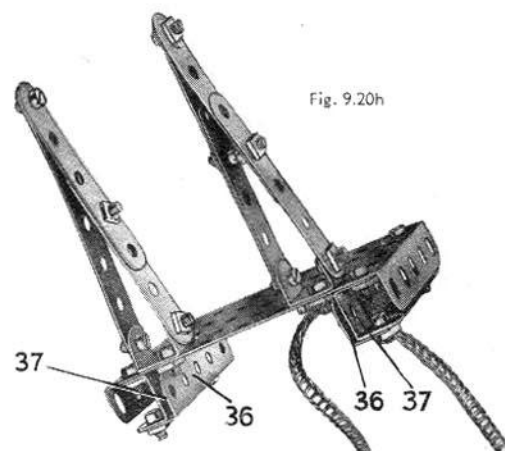


Fig. 9.20h

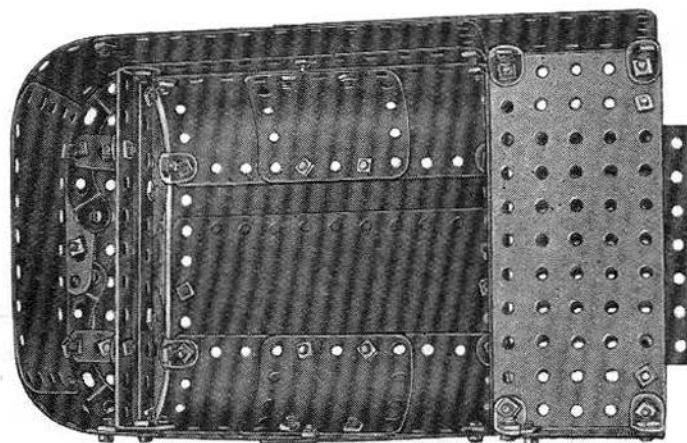


Fig. 9.20g

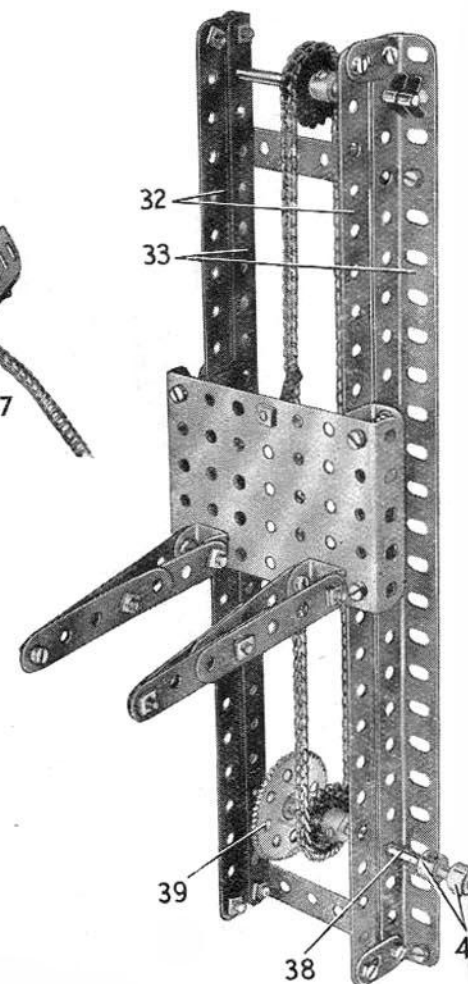


Fig. 9.20

*Note:* The Motor used in this model is not included in the Outfit.

The construction of the cab is begun by bolting a 12½" Angle Girder 1 to each of the shorter flanges of two 5½" x 2½" Flanged Plates 2. The first Flanged Plate is bolted at a point four holes from the front of the cab, and a ½" gap is left between it and the second Flanged Plate. The gap is filled in by a 5½" x 2½" Flat Plate 3. The Girders 1 are attached so that their flanges project outward, and further 12½" Angle Girders 4 are fixed to them as shown. The sides of the cab are built up on the Girders 4. The rear floor is filled in by two 5½" x 3½" Flat Plates 5, bolted between Girders 1 and 4. The Girders 1 are joined at each end by 7½" Angle Girders 6 and 7.

The side seen in Fig. 9.21c is made on a framework formed by one of the Girders 4, two 5½" Angle Girders 8 and a 12½" Angle Girder 9. It consists of a 5½" x 3½" Flat Plate 10, a vertical 5½" x 2½" Flat Plate 11, two 5½" x 2½" Flexible Plates and one 5½" x 1½" Flexible Plate.

The side seen in the general view is built on one of the Girders 4, two 5½" Angle Girders 12 and a 12½" Angle Girder 13. The side is filled in by a 5½" x 3½" Flat Plate 14, two 4½" x 2½" Flat Plates 15 and Flexible Plates, arranged to provide a slot for the Motor winding key. Both sides are braced inside the cab by 12½" Angle Girders 16.

The sides are connected across by compound strips 17, each consisting of two 5½" Strips overlapped nine holes.

A framework supporting the jib Cords is bolted in position. It consists of two vertical 12½" Angle Girders 18 bolted to the Girders 1 and connected at their upper ends by a 4½" Strip 19. The vertical Girders are braced by compound strips fixed to 2½" Triangular Plates bolted to the Girders 9 and 13.

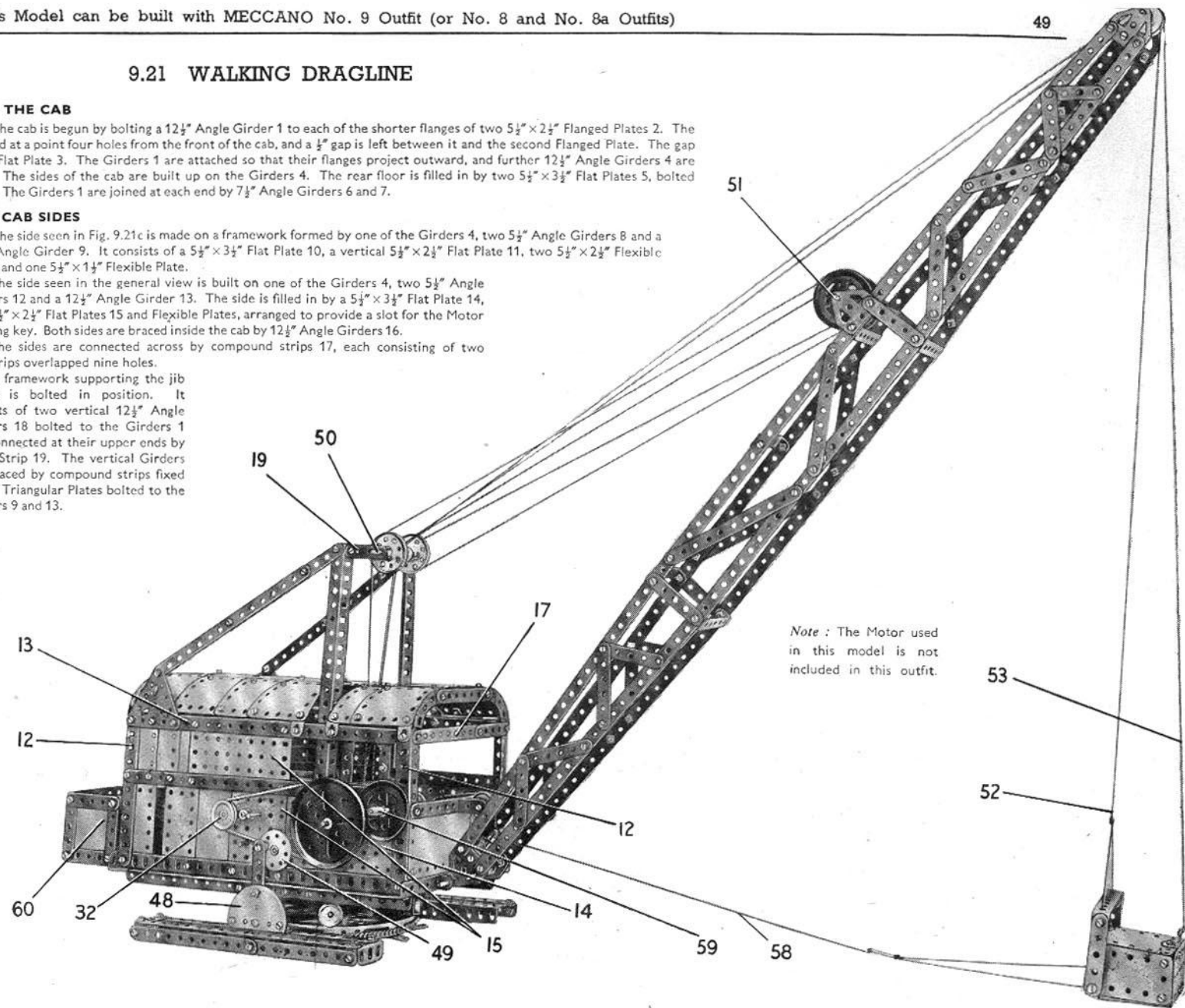


The construction of the base and its bearing is seen in Fig. 9.21h. The Flanged Wheels of the bearing run on the edge of the Circular Girder and on the underside of the Flanged Plates 2 and the Flat Plate 3.

A 2½" Rod is fixed in the Face Plate 20 and passes through the Face Plate 21, and through the centre hole of Flat Plate 3 and a Double Bent Strip attached to the Flanged Plates 2. The cab is then held on the base by a 1" Pulley fixed on the Rod.

The cab is slewed by turning a Steering Wheel on a 2" Rod mounted as shown in Fig. 9.21c. The Rod carries a  $\frac{1}{2}$ " Bevel 22 meshed with a  $1\frac{1}{2}$ " Bevel on a 2 $\frac{1}{2}$ " Rod 24. This Rod is mounted in one of the Flat Plates 5 and the rear Flanged Plate 2, and carries at its lower end a  $\frac{3}{4}$ " Sprocket 25. A length of Chain is passed round the Sprocket 25 and the circular base.

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**Note :** The Motor used in this model is not included in this outfit.

## 9.21 WALKING DRAGLINE—Continued

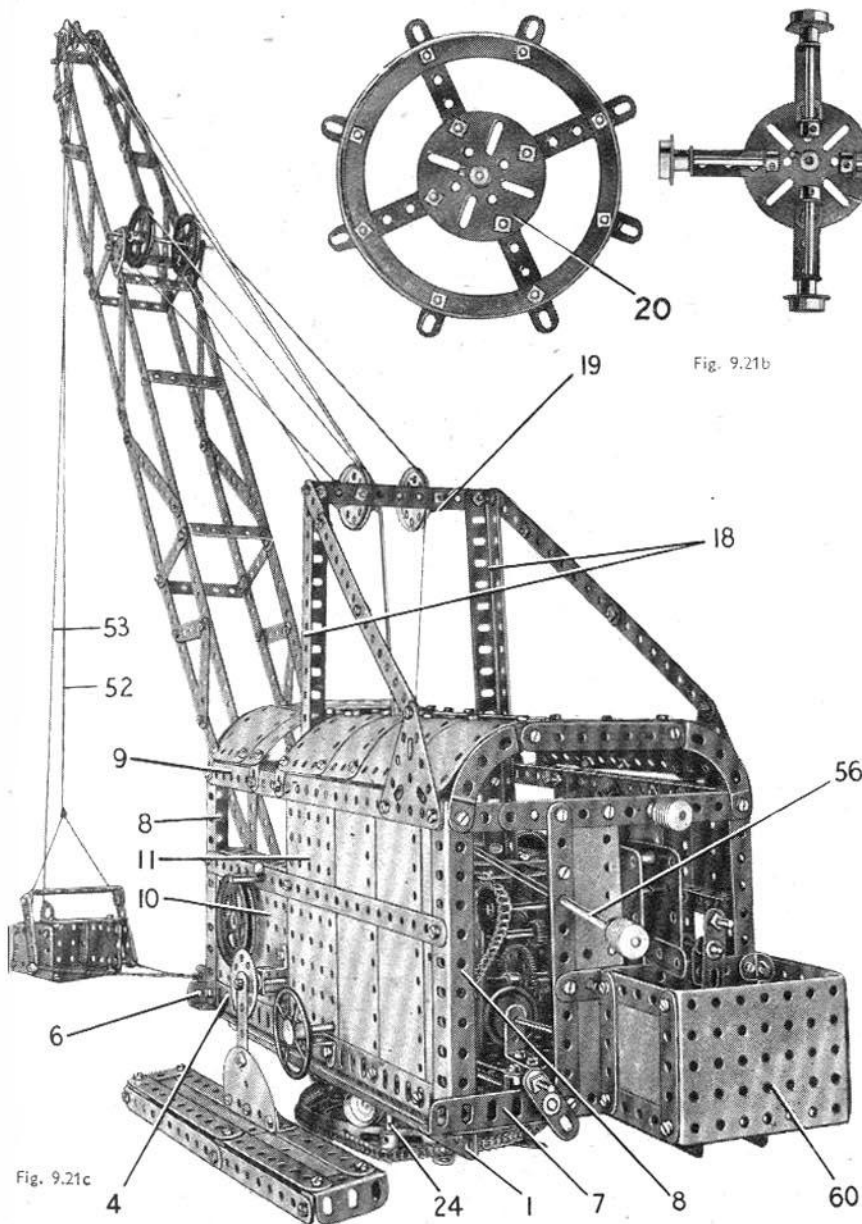


Fig. 9.21c

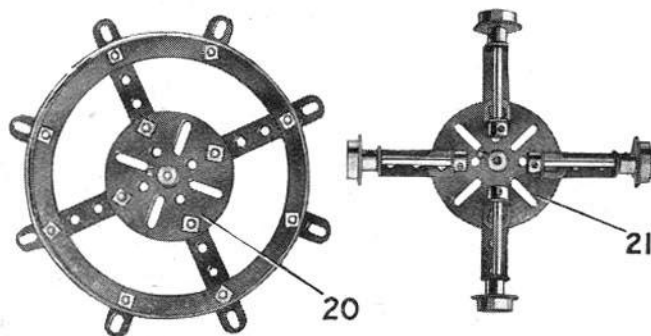


Fig. 9.21b

## POWER UNIT AND MECHANISM

A No. 2 Clockwork Motor is bolted to four Angle Brackets fixed to the Flat Plates 5, and its driving shaft is removed and replaced by a  $3\frac{1}{2}$ " Rod 26. The brake lever of the Motor is extended as shown in Fig. 9.21d.

A 1" Sprocket on Rod 26 is connected by Chain to a 3" Sprocket on a Rod 27. This Rod is mounted in a  $3\frac{1}{2}$ " x  $2\frac{1}{2}$ " Flanged Plate 28 and in the side of the cab, and it carries a  $\frac{1}{2}$ " Pinion 29. The Flanged Plate 28 is connected to the side by two  $3\frac{1}{2}$ " Strips 37, one of which is moved to one side in Fig. 9.21d. The power to the luffing and hoisting movements is transmitted by sliding Pinions 31 and 30 into mesh with Pinion 29.

Pinion 30 is fixed on a  $4\frac{1}{2}$ " Rod that carries at its outer end a 1" Pulley 32. This is connected by a Driving Band to a 1" Pulley on Rod 36; this Rod is mounted in Corner Angle Brackets bolted to the Girders 18 (Fig. 9.21g).

Movement of both Pinions 30 and 31 is controlled by a Double Arm Crank fixed on a compound rod 38. This rod is mounted in a  $2\frac{1}{2}$ " x 1" Double Angle Strip bolted to the Strips 37, and is fitted with two Couplings. One of these is seen at 39, and it carries a 1" Rod that engages between Pinion 30 and a Collar on the same Rod. The second Coupling cannot be seen in the illustrations, but it carries a 1" Rod that engages between Pulley 35 and a Collar. Thus movement of the Double Arm Crank to either left or right results in one of the Pinions 30 or 31 being moved into mesh with Pinion 29.

The drive to the travelling movement is taken from Pinion 29 to a 57-teeth Gear 40. This is fixed on a 4" Rod 41 that carries also a  $\frac{3}{4}$ " Pinion 42. Rod 41 is free to slide about  $\frac{1}{2}$ " in its bearings, and the Pinion 42 is arranged so that it can be moved in or out of mesh with a 50-teeth Gear carried on a 4" Rod. This Rod is mounted two holes to the front of the cab from Rod 41, and it carries a  $\frac{1}{2}$ " Pinion that meshes with a 57-teeth Gear 43. The Gear is fixed on a compound rod 44 consisting of a  $6\frac{1}{2}$ " and a 2" Rod joined by a Coupling, and it carries the "feet" used for the walking movement.

Movement of Rod 41 is controlled by a lever 45 (Fig. 9.21g). This is connected by a Coupling to a Rod 46 mounted in 1" x 1" Angle Brackets bolted to the Flat Plates 5. A Coupling 47 on this Rod carries a  $\frac{3}{4}$ " Bolt, and this engages between two Collars on Rod 41. A 1" Pulley fitted with a Rubber Ring presses against one of the 1" x 1" Angle Brackets and maintains Rod 41 in any desired position.

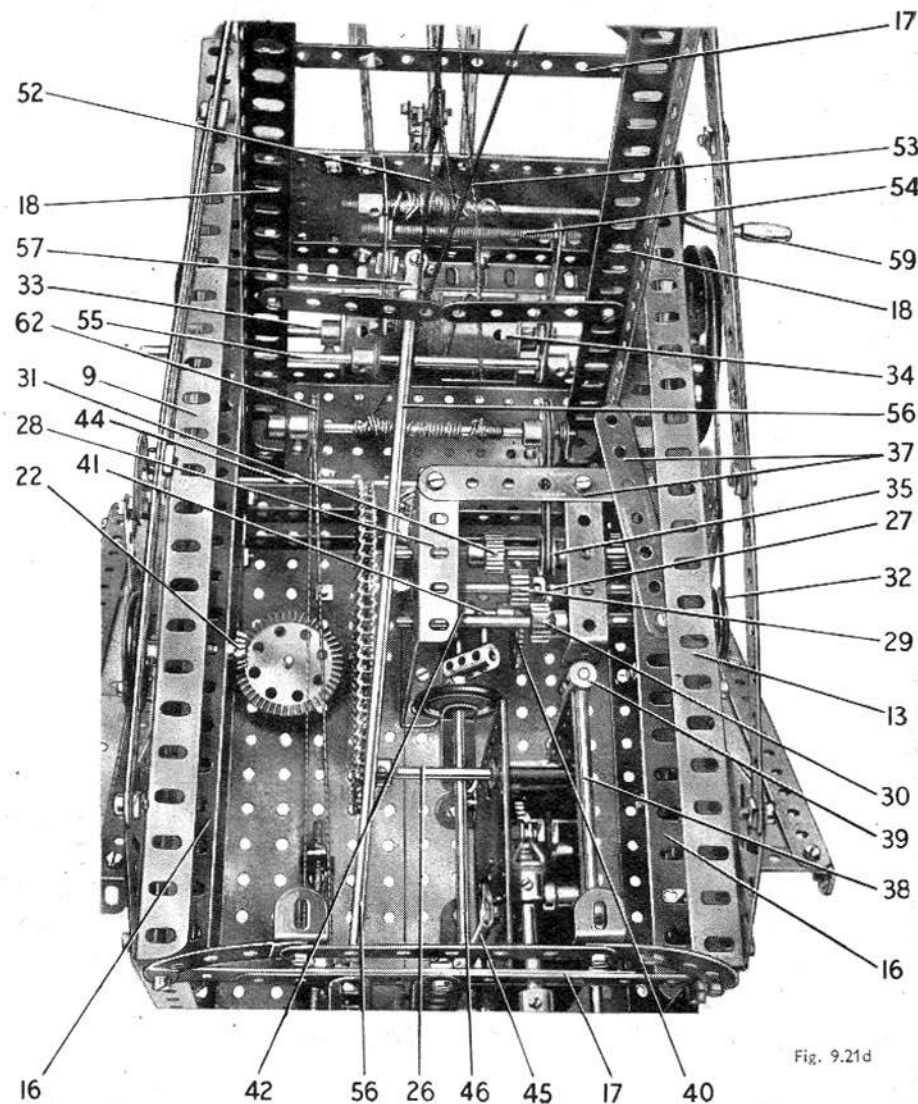


Fig. 9.21d

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## THE TRAVELLING SHOES

One side of each shoe is a  $9\frac{1}{2}$ " Angle Girder, and the other is a built up girder formed by compound strips. The sides are joined at one end by a  $1\frac{1}{2}$ " Angle Girder, and at the other by  $1\frac{1}{2}$ " Strips. The top is filled in by two  $5\frac{1}{2}$ " $\times$  $1\frac{1}{2}$ " Flexible Plates, and a Semi-Circular Plate 48 is attached to the shoe by a  $2\frac{1}{2}$ " Angle Girder. A  $3\frac{1}{2}$ " Strip fixed to the Semi-Circular Plate is attached by a lock-nutted  $\frac{3}{4}$ " Bolt to a Bush Wheel 49. The Bush Wheel is fixed to the end of Rod 44.

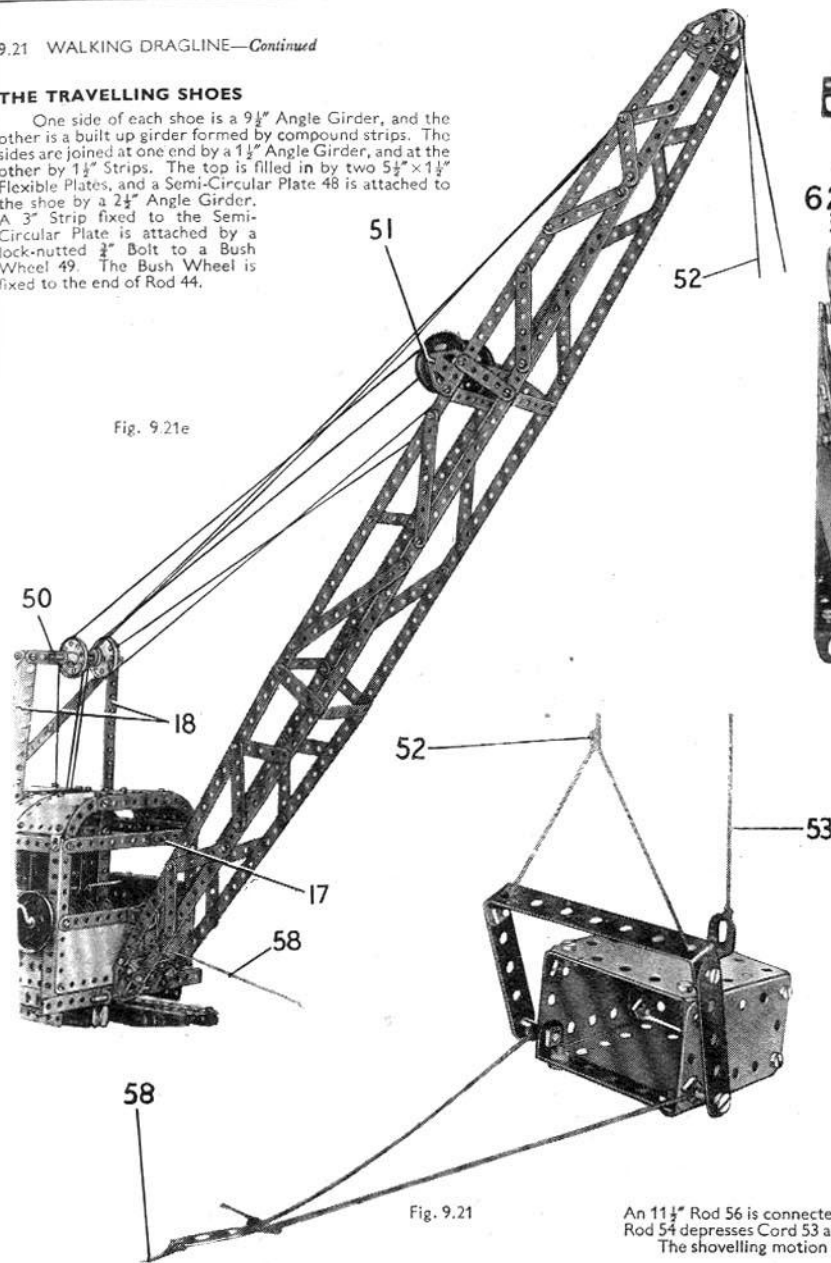


Fig. 9.21

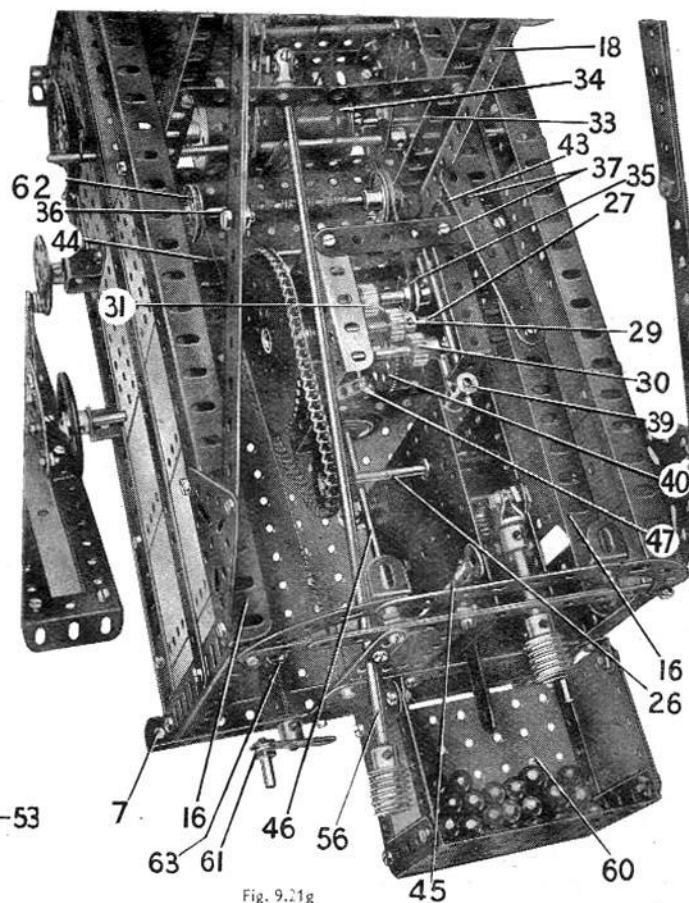


Fig. 9.21g

## THE JIB

The construction of the jib is shown in the general view of the model. It is pivoted on a Rod mounted in a  $2\frac{1}{2}'' \times \frac{1}{2}''$  Double Angle Strip bolted to the Girder 6 at the front of the cab.

### ARRANGEMENT OF THE CORDS

A Cord extending from Rod 36 is passed over a 1½" Pulley on a Rod 50, and round a 2" Pulley on Rod 51. It passes round a second 1½" Pulley on Rod 50 and a 2" Pulley on Rod 51, and finally is tied to Rod 50. Rod 50 is mounted in a 2½" x ½" Double Angle Strip bolted to Strip 19.

The bucket is supported by a Cord 52 passed over a 1" Pulley at the jib head and a 3" Pulley on Rod 50, and is tied to the drum 34. A second Cord 53 is tied to the rear of the bucket and taken over a 1" Pulley at the jib-head. This Cord passes over the same 3" Pulley on Rod 50 as Cord 52, and it is also tied to the drum 34, but passes in front of a 3" Screwed Rod 54 fixed in the end holes of 2 1/2" Strips attached to Cranks on a Rod 55. and to one of the Cranks by a Swivel Bearing 57, and when Rod 56 is pushed in, the Screwed Rod raises the rear of the bucket for unloading.

The shovelling motion of the bucket is operated by a Cord 58 fastened to a Crank Handle 59.

## THE JIB BRAKE

A simple strap and screw brake operated by a Double Arm Crank 61 is fitted to Rod 3. A length of Cord is passed round a 1" Pulley 62 on this Rod, and is tied to a Rod Socket 6. This is screwed on to a 3½" Screwed Rod mounted in a 2½" x ½" Double Angle Strip (Fig.9.23).

## THE ROOF

The roof is built up from Flexible and Curved Plates and is attached to the sides by Obtuse Angle Brackets. A gap is left in the centre so that the operating Cords can be let into the cab.

**BALANCE WEIGHT**

A box structure 60 is built on to the rear of the cab as shown. It should be suitably weighted so that the model remains stable when the jib is fully lowered.

**Note :** The Motor used in this model is not included in the Outfit.

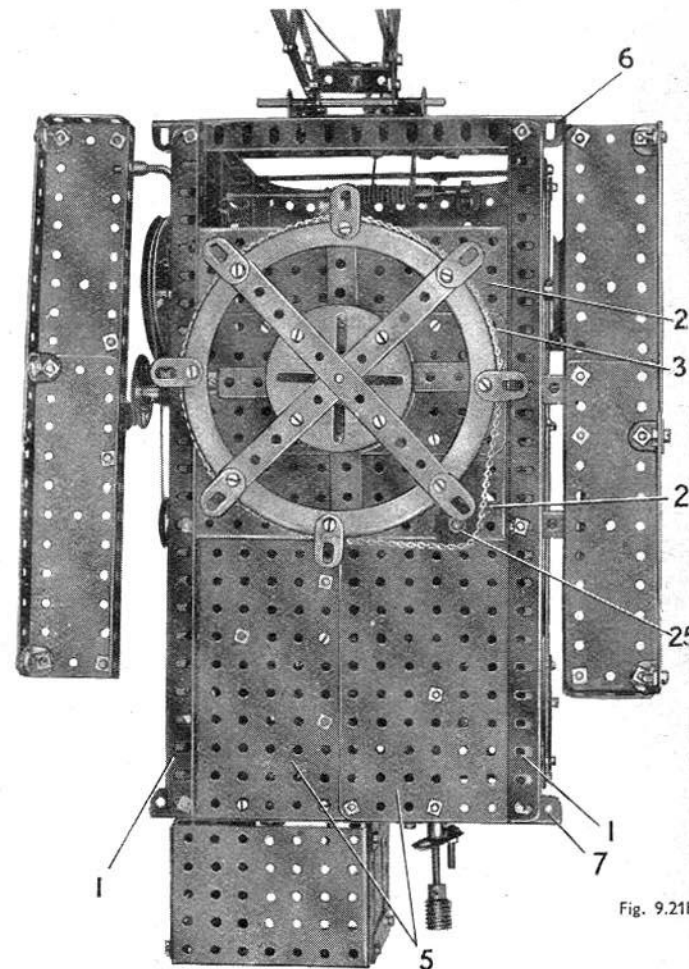


Fig. 9.211

## 9.22 SPORTS CAR AND CARAVAN

## THE CHASSIS

The chassis of the car is constructed by joining two  $12\frac{1}{2}$ " Angle Girders 1 by two  $2\frac{1}{2}$ " Strips 5 overlapped two holes. A  $12\frac{1}{2}$ " Strip 2 is then fastened to each of the Angle Girders 1 by Angle Brackets and extended to the rear by a  $2\frac{1}{2}$ " Strip. The two  $2\frac{1}{2}$ " Strips are joined as shown in Fig. 9.22c, by two  $3\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flanged Plates 9 and 10 and a  $2\frac{1}{2}$ "  $\times$   $1\frac{1}{2}$ " Flanged Plate 11.

## BUILDING THE BODY

The sides of the bonnet, each of which is formed by a  $5\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " and a  $2\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flexible Plate overlapped one hole, are next bolted to the Strips 2. The top of the bonnet consists of two  $7\frac{1}{2}$ " Strips 7, joined at one end by a  $5\frac{1}{2}$ " Strip and at the other by a  $3\frac{1}{2}$ " Strip. The space between the two  $7\frac{1}{2}$ " Strips is then filled by two  $5\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ ", a  $2\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " and a  $2\frac{1}{2}$ "  $\times$   $1\frac{1}{2}$ " Flexible Plate arranged as shown in Fig. 9.22a, and the unit is fastened by Angle Brackets to the upper edges of the sides of the bonnet. The radiator is built up by bolting 3" and 2" Strips round a compound plate consisting of two  $2\frac{1}{2}$ "  $\times$   $1\frac{1}{2}$ " Flexible Plates overlapped one hole, and it is fastened by Angle Brackets to the sides of the bonnet.

The front bumper consists of two  $5\frac{1}{2}$ " Strips overlapped seven holes and curved slightly, and is connected to the forward ends of the member 1 of the chassis by Double Brackets and  $2\frac{1}{2}$ " Strips. The space between the  $2\frac{1}{2}$ " Strips is filled by two  $2\frac{1}{2}$ "  $\times$   $1\frac{1}{2}$ " Flexible Plates. The sides of the Angle Girders 1 are also extended forward by  $2\frac{1}{2}$ " Strips, and from these the head-lamps, which are represented by  $1\frac{1}{2}$ " Flanged Wheels, are supported by a further two  $2\frac{1}{2}$ " Strips and Angle Brackets.

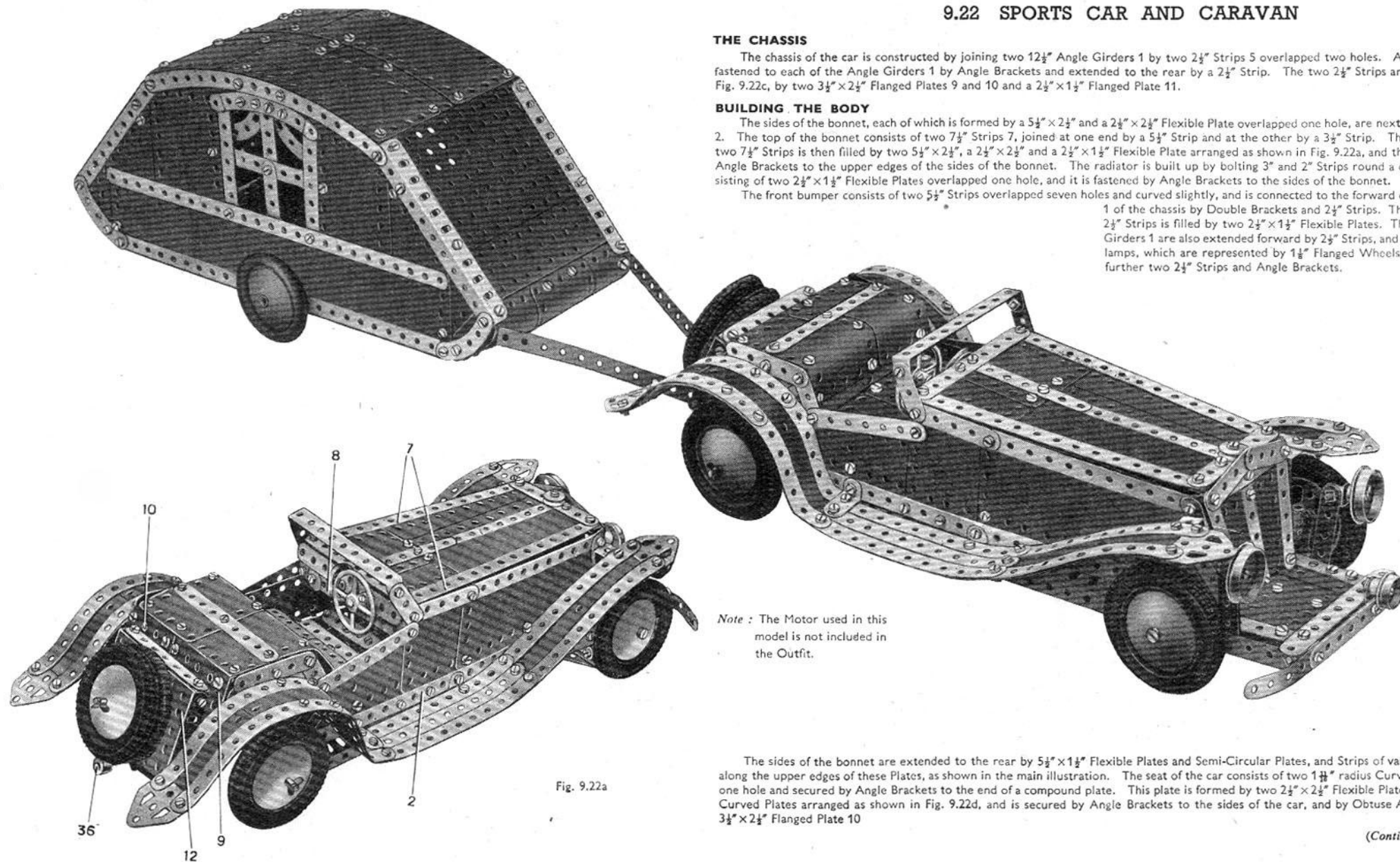


Fig. 9.22a

Note : The Motor used in this model is not included in the Outfit.

The sides of the bonnet are extended to the rear by  $5\frac{1}{2}$ "  $\times$   $1\frac{1}{2}$ " Flexible Plates and Semi-Circular Plates, and Strips of various sizes are bolted along the upper edges of these Plates, as shown in the main illustration. The seat of the car consists of two  $1\frac{1}{2}$ " radius Curved Plates overlapped one hole and secured by Angle Brackets to the end of a compound plate. This plate is formed by two  $2\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flexible Plates and two U-Section Curved Plates arranged as shown in Fig. 9.22d, and is secured by Angle Brackets to the sides of the car, and by Obtuse Angle Brackets to the  $3\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flanged Plate 10

(Continued on next page)

## 9.22 SPORTS CAR AND CARAVAN—Continued

The luggage carrier is represented by a  $3\frac{1}{2}" \times 2\frac{1}{2}"$  Flanged Plate 12 that is fastened to the Plates 9 and 10 by two  $3\frac{1}{2}" \times \frac{1}{2}"$  Double Angle Strips. The upper flangeless edge of Flanged Plate 12 is filled in by a  $3\frac{1}{2}"$  Strip, and the spare wheels, two 2" Pulleys fitted with Tyres, are secured to its centre by a  $2\frac{1}{2}"$  Rod and Spring Clips.

**STEERING MECHANISM**

The steering gear is next fitted to the car. This consists of a  $4\frac{1}{2}"$  Rod 20, fastened in the side members of the chassis by a Double Arm Crank 21 and carrying a Coupling at each end. A 1" Rod passes through the end transverse bore of each Coupling and is fixed in position by a Collar 22 and a second Coupling. The 2" Pulley representing the road wheel is fastened to the second Coupling by a Pivot Bolt. Each of the Collars 22 carries in one of its tapped holes a  $\frac{3}{8}"$  Bolt, against the head of which is locked a further Collar.

The tie-rod is formed by a 3" and a  $3\frac{1}{2}"$  Strip overlapped two holes, and it is fastened by the Bolts 23 and 24 to the Collars on the  $\frac{3}{8}"$  Bolts. The Bolt 24 carries also a 3" Strip 25, which is connected by a lock-nutted Bolt 26 to the end of a Crank. The Crank is locked on the lower end of a  $3\frac{1}{2}"$  Rod 27, which is journalled in a compound 4" strip 5 bolted across the chassis, and in a Reversed Angle Bracket 28 fixed inside the bonnet.

A  $\frac{1}{2}"$  Pinion on Rod 27 meshes with a Worm 29 on the 8" Rod 30. The Rod 30 is journalled at the forward end in a Reversed Angle Bracket 31 bolted to the inside of the radiator, and at the rear end in a  $4\frac{1}{2}"$  Strip. The  $4\frac{1}{2}"$  Strip is fixed by an Obtuse Angle Bracket to the  $4\frac{1}{2}"$  Strip 8, which is fastened between the sides of the car by Angle Brackets. The Strip 8 carries two  $\frac{3}{8}"$  Washers to represent dashboard instruments.

**THE POWER UNIT**

A No. 1 Clockwork Motor 6 is secured by Angle Brackets to the side of the bonnet, and by Obtuse Angle Brackets to a compound  $4\frac{1}{2}"$  Strip 4, which is fastened to the  $12\frac{1}{2}"$  Strips 2 by Angle Brackets. A  $\frac{1}{2}"$  Pinion on the driving shaft of the Motor meshes with a 57-teeth Gear on a  $2\frac{1}{2}"$  Rod journalled in the Motor side plates and carrying a  $\frac{1}{2}"$  Pinion 13. This latter Pinion meshes with a  $\frac{3}{4}"$  Contrate on the  $4\frac{1}{2}"$  Rod 14, the bearings for which are provided by two  $1" \times 1"$  Angle Brackets bolted to the Motor. The Rod 14 is connected by a universal coupling 15, built up from a Swivel Bearing and a Small Fork Piece, to a 5" Rod 16, the end of which is journalled in a Coupling on the back axle 19. The Coupling is prevented from slipping by a Collar, and a  $1\frac{1}{2}"$  Bevel Gear 18 is arranged so that it meshes with  $\frac{3}{4}"$  Bevel 17 on the cardan shaft 16.

The back axle 19 consists of a  $3\frac{1}{2}"$  and a  $4\frac{1}{2}"$  Rod joined by a Coupling, and it is journalled in the  $2\frac{1}{2}"$  Strips of the chassis. The two rear wheels are formed by 2" Pulleys fitted with Conical Discs and Tyres. The mudguards and running boards on each side of the car are formed by four  $5\frac{1}{2}" \times 1\frac{1}{2}"$  Flexible Plates bolted end to end. They are curved to shape and fastened in position by Angle Brackets. To the  $5\frac{1}{2}" \times 1\frac{1}{2}"$  Flexible Plates  $5\frac{1}{2}"$  Strips are bolted as shown in Fig. 9.22a, and each of the mudguards is extended by a Flat Trunnion.

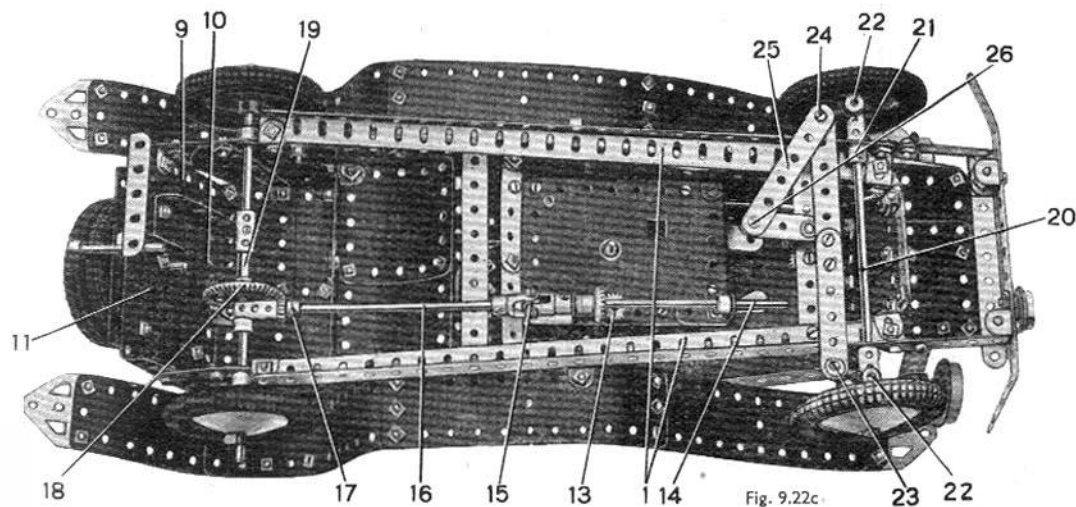


Fig. 9.22c

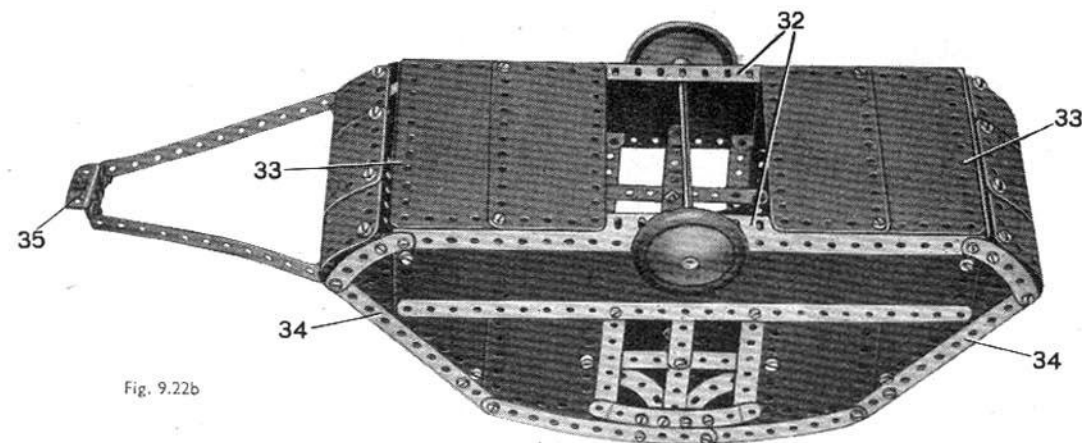


Fig. 9.22b

**DETAILS OF THE CARAVAN**

The caravan is built up by joining two  $12\frac{1}{2}"$  Angle Girders 32 at each end by a  $5\frac{1}{2}" \times \frac{1}{2}"$  Double Angle Strip 33. The Girders are further joined by four  $5\frac{1}{2}" \times 2\frac{1}{2}"$  Flexible Plates as shown in Fig. 9.22b, and a  $5\frac{1}{2}"$  Angle Girder 34 is connected to each end of the Girders 32 by a  $2\frac{1}{2}"$  Curved Strip. The  $5\frac{1}{2}"$  Angle Girders are joined at their upper ends by  $5\frac{1}{2}"$  Curved Strips, and the space between them is filled by  $5\frac{1}{2}" \times 3\frac{1}{2}"$  Flat Plates and Flexible Plates of various sizes (see main illustration).

Two  $5\frac{1}{2}" \times \frac{1}{2}"$  Double Angle Strips are fastened to the front of the trailer and are joined at their forward ends by a  $1\frac{1}{2}"$  Angle Girder 35. The Angle Girder 35 forms part of the coupling unit and can be fastened to a Rod by Collar 36. This Rod is secured to the back of the car by two more Collars placed one on each side of Flanged Plate 11.

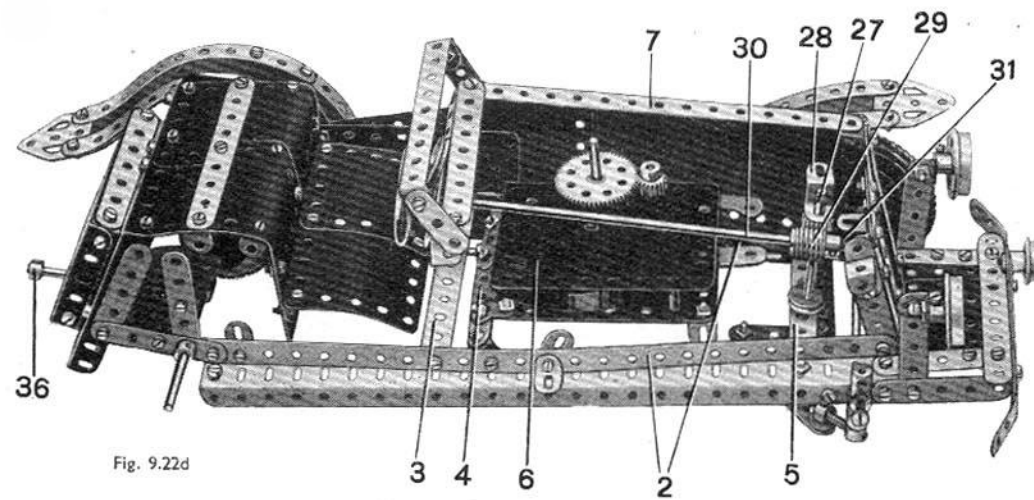
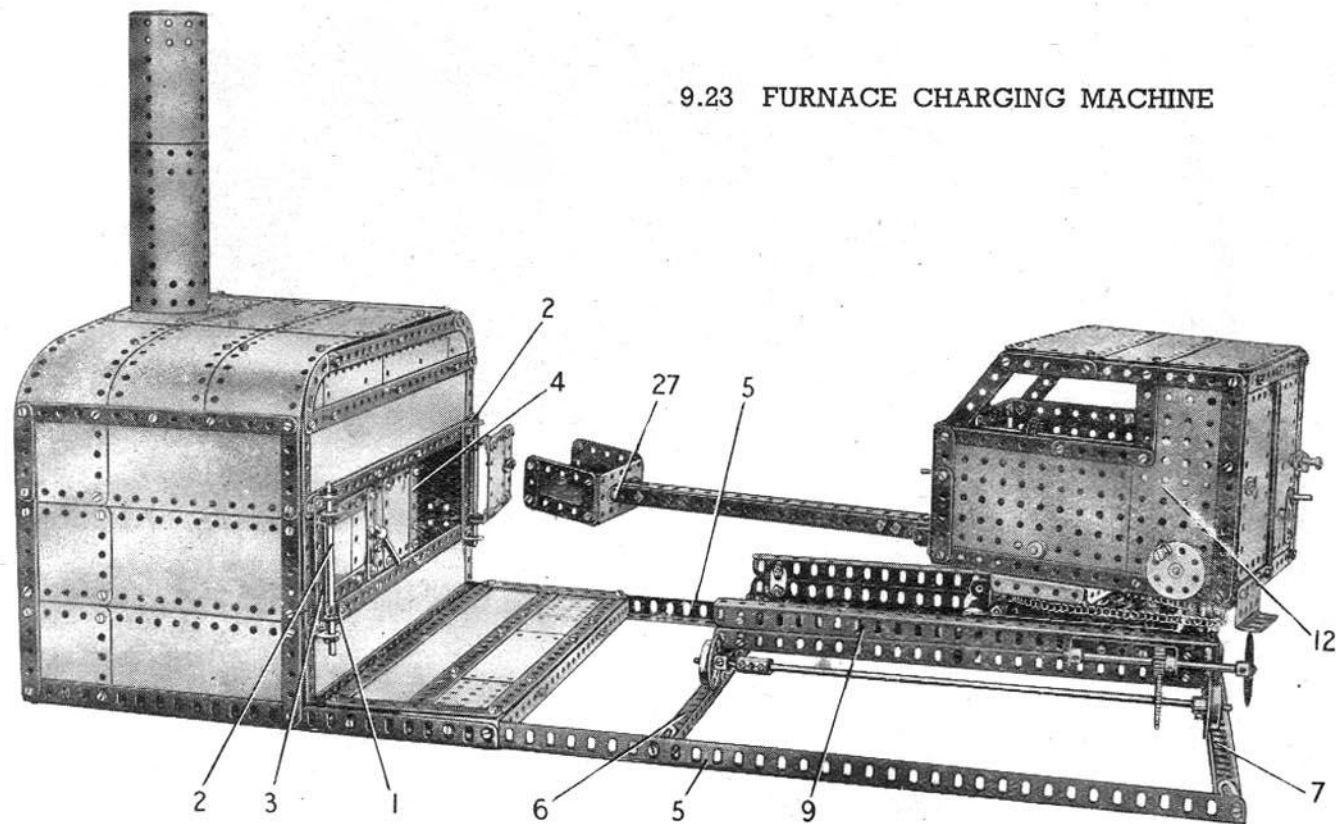


Fig. 9.22d



### 9.23 FURNACE CHARGING MACHINE



The door handles each consist of a Handrail Support carrying a 2" Rod. The Handrail Support is passed through the centre hole of the 2½" Strip of the door, and on its shank is held a Fishplate that serves as a catch. The Fishplate is locked between two nuts, one of the nuts serving to space it from the door sufficiently to allow the Fishplate to engage behind the Strip and Plate 4 of the furnace front, when the door is closed.

Three 12½" Angle Girders are bolted across the base frame and one of these, indicated at 6 in Fig. 9.23f, acts as a running rail for the front wheels of the charging machine. The rear wheels of the charging machine run on the edge of the Angle Girder 7.

Fishplates 8 are bolted to the base frame in the positions indicated to serve as stops.

(Continued on next page)

#### CONSTRUCTION OF THE FURNACE

The base frame on which the furnace is built up consists of two 18½" Angle Girders 5 (Fig. 9.23f) and two 12½" Angle Girders overlapped three holes and bolted together. The ends of the frame are 12½" Angle Girders.

The construction of the furnace sides, roof and back will be clear from the illustrations. The roof is supported on the inside by three ribs each consisting of a 5½" Strip and a 2½" Strip overlapped one hole and bolted under the Flexible Plates. The chimney consists of two Boilers without Ends. The lower Boiler is attached to Angle Brackets fixed to the roof of the furnace.

The furnace doors each consist of a 2½" × 2½" and a 2½" × 1½" Flexible Plate overlapped one hole, and bolted to a frame consisting of two 3½" Strips, one 2½" Strip and one 2½" × ½" Double Angle Strip. To each lug of the Double Angle Strip a Fishplate 1 (see general view) is bolted, to serve as a lug by which the door pivots on a 4" Rod 2 passed through the free holes of the Fishplates and through the lugs of a 3½" × ½" Double Angle Strip 3 bolted to the front of the furnace, in the position indicated.

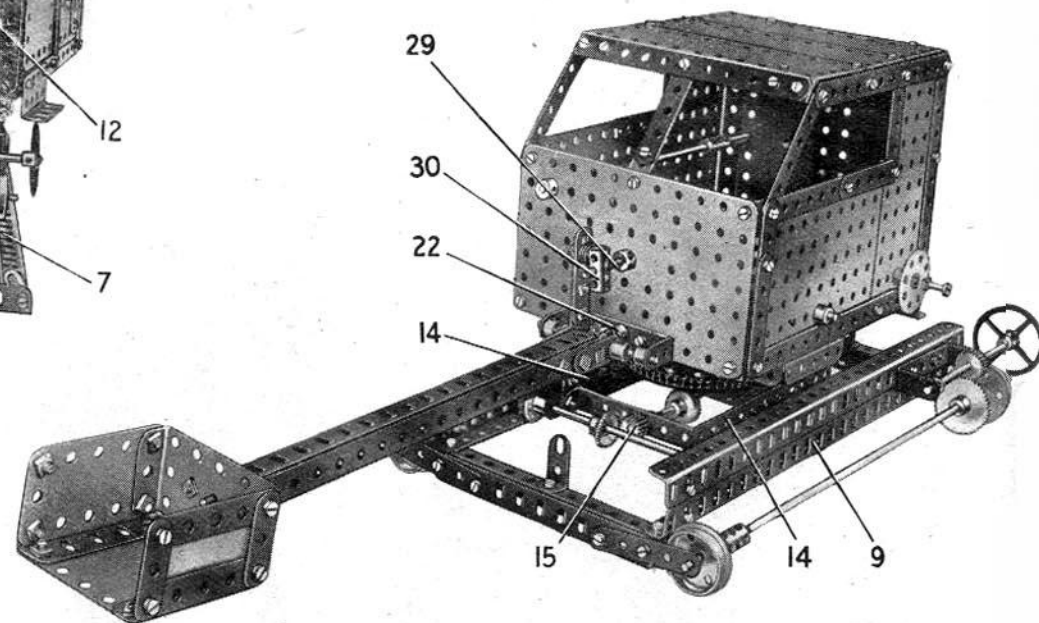


Fig. 9.23a

## 9.23 FURNACE CHARGING MACHINE—Continued

## THE TRAVELLING CARRIAGE

The travelling base 9 on which the charger traverses is shown in Figs. 9.23a and 9.23e. It is set in motion by turning the Steering Wheel 10 mounted on a  $4\frac{1}{2}$ " Rod journalled in a  $2\frac{1}{2}$ "  $\times$  1" Double Angle Strip bolted to the frame. The Rod is held in place by Collars and carries a  $\frac{3}{4}$ " Pinion meshed with a 50-teeth Gear on the compound rod 11 that forms one of the two axles for the travelling wheels. Each of these rods consists of an  $11\frac{1}{2}$ " Rod and a  $1\frac{1}{2}$ " Rod, joined by a Coupling.

## THE CHARGING MACHINE

The charging machine 12 is seen in the general view and in Figs. 9.23a, 9.23b, 9.23c and 9.23d. The carriage on which the charger travels is made by bolting a  $5\frac{1}{2}$ " Strip 14 to each flange of a  $3\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flanged Plate 13. Further  $5\frac{1}{2}$ " Strips are attached to Fishplates bolted to the Strips 14.

The travelling wheels are fixed on 5" Rods mounted in the  $5\frac{1}{2}$ " Strips and a  $\frac{3}{4}$ " Contrate is fixed to one of the Rods. This meshes with a  $\frac{3}{4}$ " Pinion 15 (Fig. 9.23b) locked on a 4" Rod journalled in two  $3\frac{1}{2}$ "  $\times$   $\frac{1}{2}$ " Double Angle Strips. This Rod carries also a second  $\frac{3}{4}$ " Contrate Wheel.

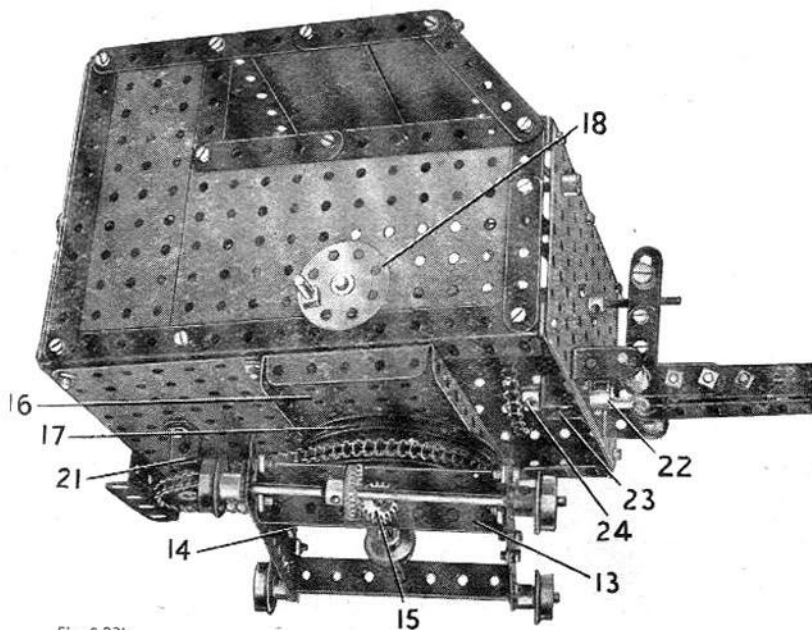


Fig. 9.23b

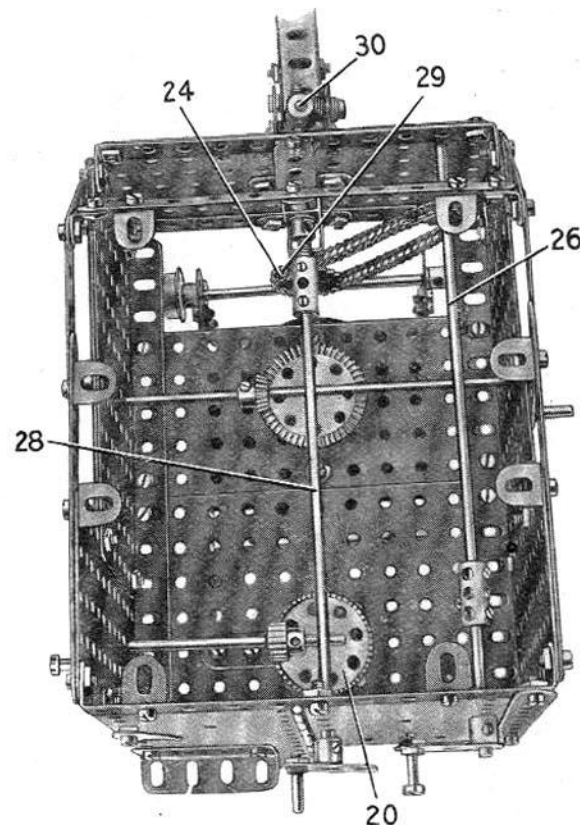


Fig. 9.23c

A  $5\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flanged Plate 16 (Fig. 9.23b) is bolted to the  $7\frac{1}{2}$ " Angle Girders, and a 3" Pulley 17 is attached to the Flanged Plate by  $\frac{1}{2}$ " Bolts. This Pulley turns on the Rod mounted in the roller bearing, and the cab is held in position by a  $1\frac{1}{2}$ " Bevel Gear inside the cab. The Bevel Gear is spaced from the Flanged Plate 16 by three Washers. A  $6\frac{1}{2}$ " Rod mounted in the sides of the cab carries a  $\frac{1}{2}$ " Bevel Gear meshed with the  $1\frac{1}{2}$ " Gear already mentioned. The lower end of the  $2\frac{1}{2}$ " Rod passing through the roller bearing is fitted with a  $\frac{1}{2}$ " Pinion meshing with the  $\frac{3}{4}$ " Contrate. Thus by turning Bush Wheel 18 movement of the  $6\frac{1}{2}$ " Rod is transmitted through the Gears to the wheels of the travelling carriage.

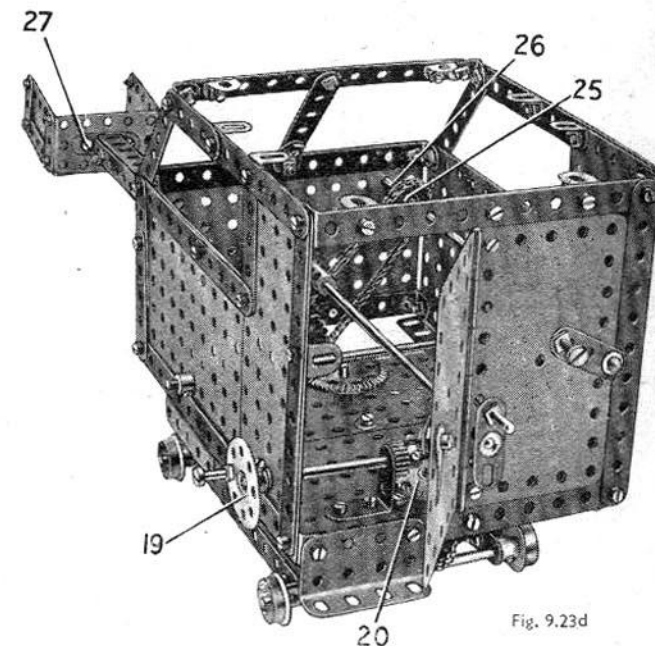


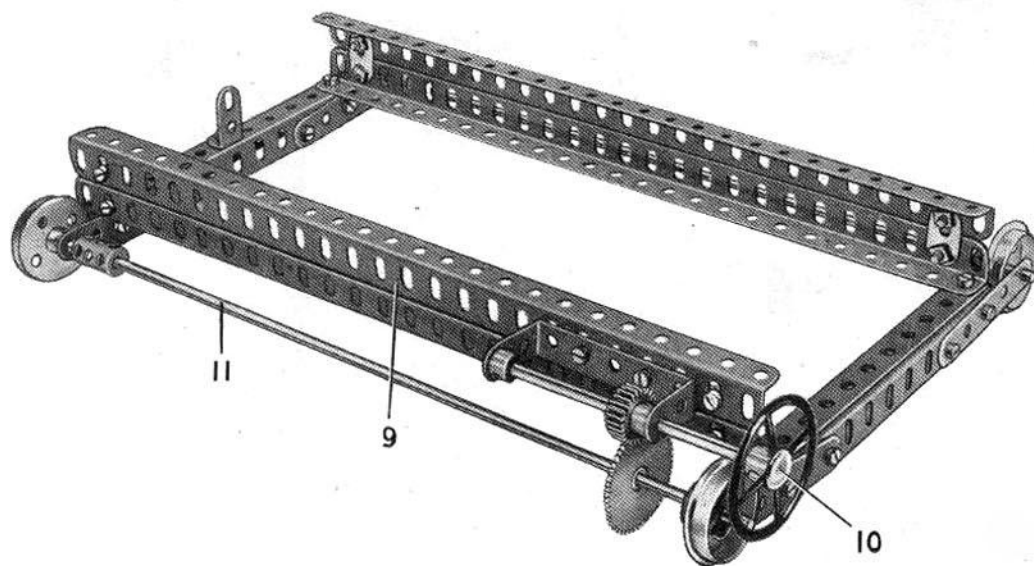
Fig. 9.23d

A 3" Pulley is attached to the Flanged Plate 13 by  $\frac{1}{2}$ " Bolts, which also hold in position a Wheel Flange. Metal balls are placed between the Wheel Flange and the rim of the Pulley to form the lower part of a built-up roller bearing. A  $2\frac{1}{2}$ " Rod is free to turn in the boss of the 3" Pulley.

The charging machine cab is assembled on a framework formed by two  $7\frac{1}{2}$ " Angle Girders joined by  $5\frac{1}{2}$ "  $\times$   $\frac{1}{2}$ " Double Angle Strips. The sides are  $5\frac{1}{2}$ "  $\times$   $3\frac{1}{2}$ " and  $5\frac{1}{2}$ "  $\times$   $2\frac{1}{2}$ " Flat Plates edged by Strips of various sizes. The front is also a  $5\frac{1}{2}$ "  $\times$   $3\frac{1}{2}$ " Flat Plate, and the back is a Hinged Flat Plate attached to the framework by a  $5\frac{1}{2}$ " Strip. One half of the Hinged Flat Plate serves as a door.

(Continued on next page)

## 9.23 FURNACE CHARGING MACHINE—Continued



## THE CHARGING MACHINE MECHANISM

The cab can be slewed by turning a Bush Wheel 19 (Fig. 9.23d), fixed to a  $3\frac{1}{2}$ " Rod mounted in one side of the cab and in a  $1" \times 1"$  Angle Bracket bolted to the floor. The Rod carries a  $\frac{1}{2}"$  Pinion meshing with a  $1\frac{1}{2}"$  Contrate 20 fixed on a 2" Rod. This Rod passes through the floor of the cab and through a Double Bent Strip 21 and carries a 1" Sprocket Wheel at its lower end. The Sprocket Wheel is connected to the lower 3" Pulley of the roller bearing by Sprocket Chain.

The shovel arm is made from two  $9\frac{1}{2}"$  Angle Girders joined together by Double Brackets to form a built-up box girder. A Crank is attached to one side of the girder, and a Bell Crank to the opposite side. Both Cranks are fixed by two bolts, the bolt heads being inside the girder, and the Cranks are spaced from the girder by a nut on each Bolt. In the bosses of the Crank and the Bell Crank 1" Rods are fixed, and the ends of these Rods are mounted in a  $2\frac{1}{2}" \times 1"$  Double Angle Strip bolted to the cab. A compound rod, consisting of an 8" and a  $1\frac{1}{2}"$  Rod joined by a Coupling, passes through the centre of the girder. The Rod is mounted at each end in the centre holes of the Double Brackets holding the  $9\frac{1}{2}"$  Angle Girders together. At the cab end this Rod is fitted with a built-up universal coupling 22 (Figs. 9.23a and 9.23b)

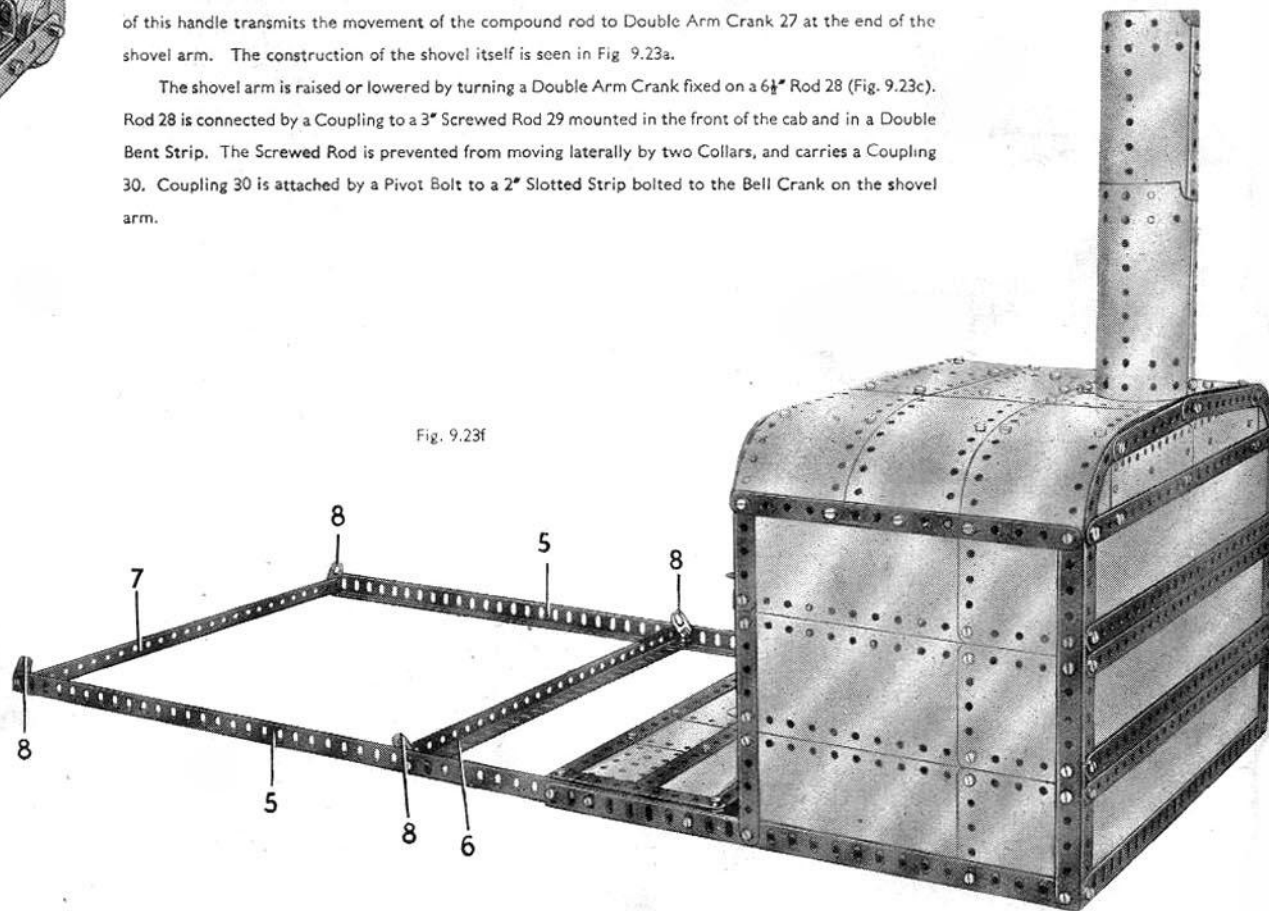
consisting of a Fork Piece and Swivel Bearing joined together by two bolts. At its outer end the Rod carries a Double Arm Crank 27.

A  $1\frac{1}{2}"$  Rod mounted in the front of the cab and in a Double Bent Strip 23 is fixed in the universal coupling 22 and carries a 1" Sprocket 24.

Sprocket 24 is connected by Chain to  $\frac{3}{4}"$  Sprocket 25 locked on a compound rod 26 (Fig. 9.23c). Rod 26 is a  $5\frac{1}{2}"$  and a  $1\frac{1}{2}"$  Rod joined by a Coupling. It is fitted with a Crank for a handle. Rotation of this handle transmits the movement of the compound rod to Double Arm Crank 27 at the end of the shovel arm. The construction of the shovel itself is seen in Fig. 9.23a.

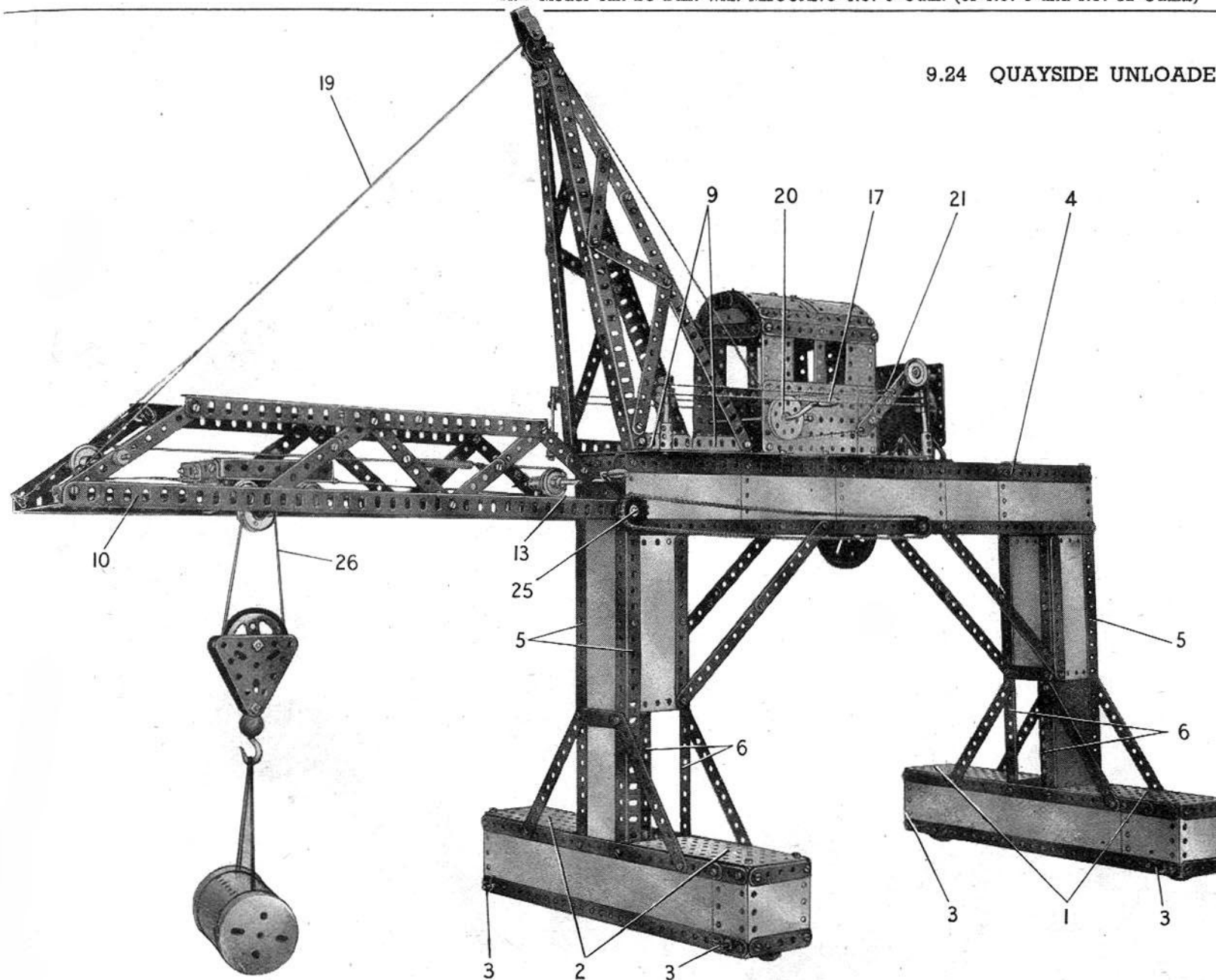
The shovel arm is raised or lowered by turning a Double Arm Crank fixed on a  $6\frac{1}{2}"$  Rod 28 (Fig. 9.23c). Rod 28 is connected by a Coupling to a 3" Screwed Rod 29 mounted in the front of the cab and in a Double Bent Strip. The Screwed Rod is prevented from moving laterally by two Collars, and carries a Coupling 30. Coupling 30 is attached by a Pivot Bolt to a 2" Slotted Strip bolted to the Bell Crank on the shovel arm.

Fig. 9.23f





## 9.24 QUAYSIDE UNLOADER

**BASE AND SPAN**

Each side of the rear base consists of a  $12\frac{1}{2}'' \times 2\frac{1}{2}''$  Strip Plate and a  $2\frac{1}{2}'' \times 1\frac{1}{4}''$  Flexible Plate overlapped one hole and braced by  $12\frac{1}{2}''$  and  $2\frac{1}{2}''$  Strips. The sides are joined at each end by a  $2\frac{1}{2}'' \times 2\frac{1}{2}''$  Flexible Plate and Angle Brackets. The top of the base is filled in by the two  $5\frac{1}{2}'' \times 2\frac{1}{2}''$  Flat Plates 1.

The front base is similar except that  $2\frac{1}{2}'' \times 2\frac{1}{2}''$  Flexible Plates are used in place of the  $2\frac{1}{2}'' \times 1\frac{1}{4}''$  Plates, and  $5\frac{1}{2}'' \times 2\frac{1}{2}''$  Flanged Plates 2 instead of  $5\frac{1}{2}'' \times 2\frac{1}{2}''$  Flat Plates. The travelling wheels are  $1\frac{1}{2}''$  Flanged Wheels fixed on  $3\frac{1}{2}''$  Rods 3.

The span is built up by joining the ends of two compound girders 4, each consisting of two  $12\frac{1}{2}''$  Angle Girders overlapped three holes, by  $2\frac{1}{2}''$  Angle Girders. The sides of the compound girders are each extended downward by four  $5\frac{1}{2}'' \times 2\frac{1}{2}''$  Flexible Plates and one  $4\frac{1}{2}'' \times 2\frac{1}{2}''$  Flexible Plate, and are braced along their lower edges by  $12\frac{1}{2}''$  Strips.

The span is supported from the bases by  $12\frac{1}{2}''$  Angle Girders 5 and also by  $12\frac{1}{2}''$  Strips 6. The  $12\frac{1}{2}''$  Angle Girders and Strips are joined by  $12\frac{1}{2}''$  Strip Plates and Flexible Plates.

**CAB**

The cab and jib are mounted on a platform formed by four  $5\frac{1}{2}'' \times 3\frac{1}{2}''$  Flat Plates 7 and 8 (Fig. 9.24c) and two  $2\frac{1}{2}'' \times 2\frac{1}{2}''$  Flexible Plates. The construction of the sides and back of the cabin is seen in Fig. 9.24b. It is attached to the platform by  $1'' \times 1''$  Angle Brackets. The roof consists of six  $1\frac{1}{8}''$  radius Curved Plates bolted together as shown and fastened to the sides by Obtuse Angle Brackets.

**JIB**

The base for the jib consists of two  $3\frac{1}{2}'' \times 2\frac{1}{2}''$  Flanged Plates 9 bolted to the platform flanges upward. The jib itself is shown in Fig. 9.24c.

The gantry arm consists of two  $18\frac{1}{2}''$  Angle Girders 10 (Fig. 9.24a) joined at their forward ends by a  $3\frac{1}{2}'' \times \frac{1}{2}''$  Double Angle Strip and pivoted at the rear end on a  $4\frac{1}{2}''$  Rod 25, which passes also through the ends of a  $3\frac{1}{2}'' \times \frac{1}{2}''$  Double Angle Strip and forms the winding drum for the Cord operating the pulley block.

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## 24 QUAYSIDE UNLOADER—Continued

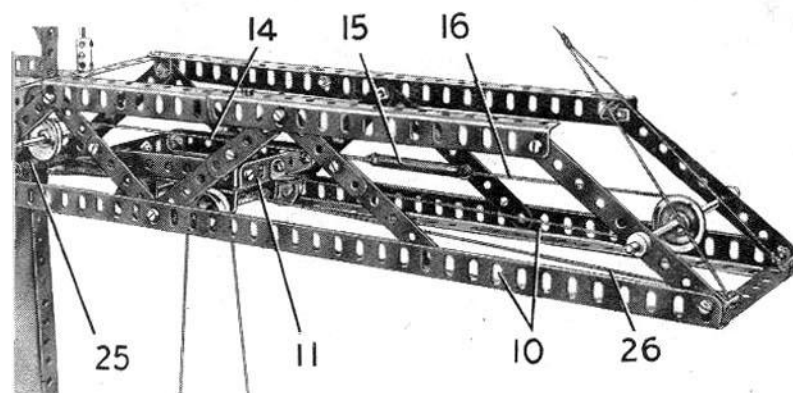


Fig. 9.24a

**HOISTING CARRIAGE**

The hoisting carriage is shown in Fig. 9.24d. It runs between the two Girders 10, and it is made by bolting two  $1\frac{1}{2} \times \frac{1}{2}$ " Double Angle Strips to the underside of the  $3\frac{1}{2} \times 2\frac{1}{2}$ " Flanged Plate 11. The Double Angle Strips are spaced from the Flanged Plate by two Washers, and the Flanged Wheels are fixed on  $2\frac{1}{2}$ " Rods. A 2" Rod journaled in the ends of a  $1 \times \frac{1}{2}$ " Angle Bracket and a Trunnion bolted to the Flanged Plate 11 carries two 1" loose Pulleys.

**CONTROLS**

Movement of the hoisting carriage is controlled by the Crank Handle 13. One end of a length of Cord 14 (Fig. 9.24a) is tied to Spring 15 and then is led over a 1" Pulley on the Crank Handle 13 and finally fastened to the rear end of the hoisting carriage.

Cord 16 is attached to the forward end of the hoisting carriage, led over a 1" Pulley at the front of the gantry arm, and then tied to the Spring 15.

The angle of the gantry arm is controlled by the Crank Handle 17 (Fig. 9.24c) in the sides of the cab. A  $\frac{1}{4}$ " Pinion 18 on the Crank Handle meshes with a 57-teeth Gear on a  $4\frac{1}{2}$ " Rod journaled behind the Crank Handle. Cord 19 is tied to the  $4\frac{1}{2}$ " Rod, wound around it several times, and then led over a 1" Pulley at the top of the jib and finally tied to the forward end of the gantry arm. The Crank Handle 17 is fitted with a band brake. A short length of Cord is passed round

a  $1\frac{1}{2}$ " Pulley 20 and tied to a lever 21. The lever 21 consists of two  $2\frac{1}{2}$ " Strips overlapped two holes, and is pivoted on a Pivot Bolt and weighted by a 1" Pulley.

(Continued on next page)

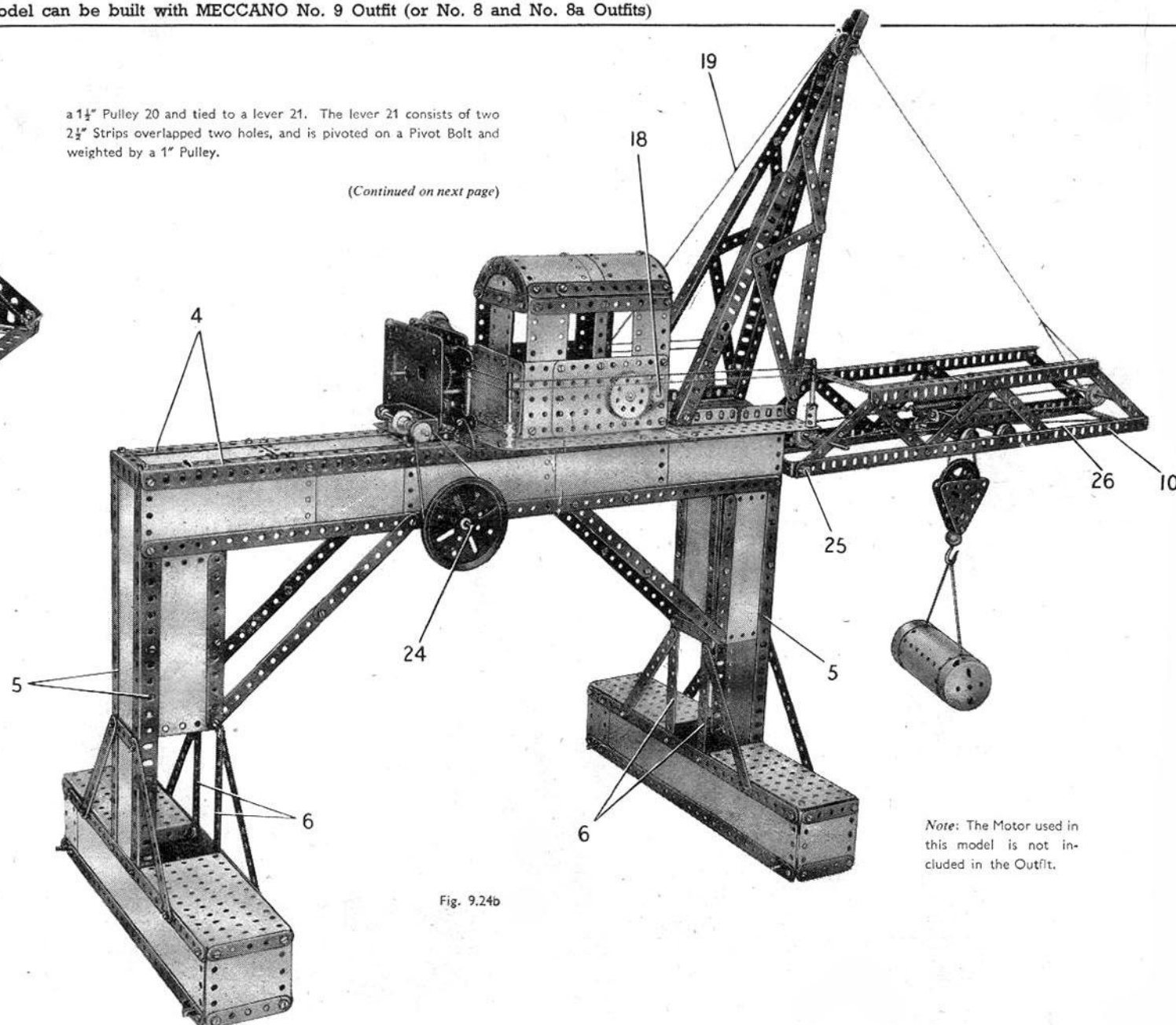


Fig. 9.24b

Note: The Motor used in this model is not included in the Outfit.

## 9.24 QUAYSIDE UNLOADER—Continued

A No. 1 Clockwork Motor is fastened in position by three Trunnions directly behind the cabin platform. A  $\frac{1}{2}$ " Pinion on the Motor driving shaft meshes with a  $\frac{3}{4}$ " Contrate 22 fixed on a  $\frac{1}{2}$ " Rod mounted on a  $2\frac{1}{2}$ " x 1" Double Angle Strip bolted to the Motor. A  $\frac{1}{2}$ " Pulley 23 on the  $\frac{1}{2}$ " Rod is connected by a Driving Band to a 3" Pulley on a similar Rod 24. This Rod is connected by Sprocket

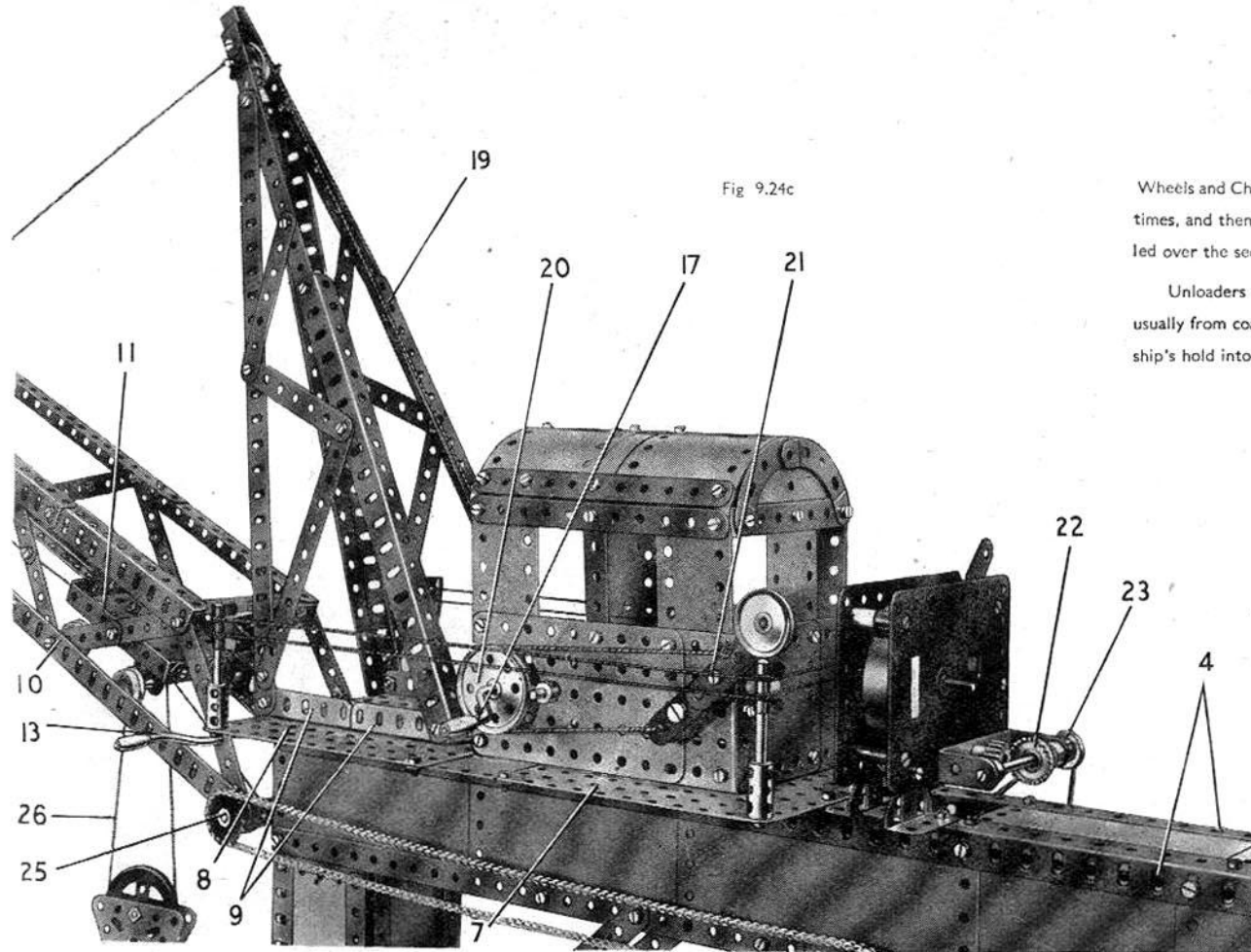
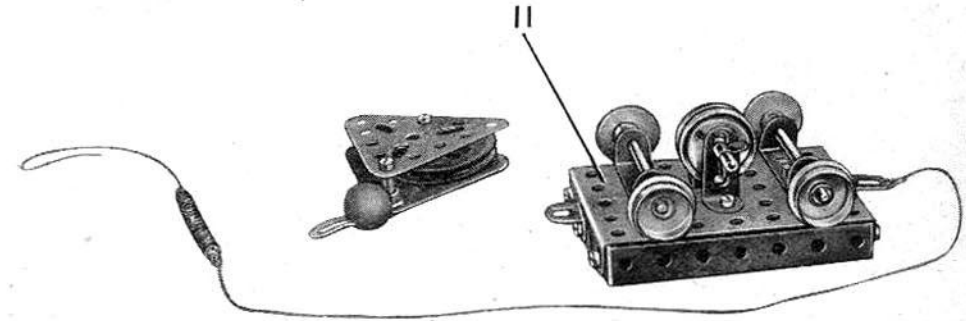


Fig 9.24c



Wheels and Chain to the Rod 25 on which the gantry arm pivots. The hoisting Cord 26 is tied to the Rod 25, wound round it several times, and then led over one of the 1" Pulleys under the hoisting carriage and around the 2" Pulley in the pulley block. It is then led over the second 1" Pulley of the hoisting carriage and finally is tied to the front of the gantry arm.

Unloaders of the kind represented by this Meccano model are sometimes used at ports for the rapid handling of light cargoes usually from coastal trading vessels. The machines travel on rails laid along the quayside, and the cargo can be hoisted direct from a ship's hold into waiting railway wagons or road transport vehicles.

Every owner of a Meccano Outfit should join the Meccano Guild. This is a world-wide guild for boys, started at the request of boys and as far as possible conducted by boys. Write for full particulars and an application form to the Meccano Guild Secretary, Binns Road, Liverpool, 13.



## 9.25 VERTICAL LIFTING BRIDGE

### THE TOWERS AND APPROACHES

The towers are identical in construction. The sides of each base consist of three  $5\frac{1}{2}" \times 2\frac{1}{2}"$  Flexible Plates and a  $5\frac{1}{2}" \times 2\frac{1}{2}"$  Flanged Plate. The Flexible Plates are joined together by  $5\frac{1}{2}" \times \frac{1}{2}"$  Double Angle Strips. The road surface comprises three  $5\frac{1}{2}" \times 2\frac{1}{2}"$  Flexible Plates, each overlapped two holes. They are supported by a  $1\frac{1}{2}"$  Angle Girder.

Each tower consists of an  $18\frac{1}{2}"$  Angle Girder, and three compound girders made by overlapping two  $12\frac{1}{2}"$  Angle Girders 13 holes, a  $12\frac{1}{2}"$  and a  $9\frac{1}{2}"$  Angle Girder overlapped eight holes, and a  $12\frac{1}{2}"$  and a  $7\frac{1}{2}"$  Angle Girder overlapped four holes.

The approach roadways are  $12\frac{1}{2}" \times 2\frac{1}{2}"$  Strip Plates overlapped lengthways three holes. The buttresses are built from  $3\frac{1}{2}" \times 2\frac{1}{2}"$  Flanged Plates joined at each end by  $1\frac{1}{4}"$  radius Curved Plates, and are attached to the roadway by Angle Brackets. Semi-Circular Plates complete the tops of the buttresses.

Rails along the sides of the roadway are formed by  $12\frac{1}{2}"$  Strips joined by  $1\frac{1}{2}"$  Strips, and they are attached to the Strip Plates by Angle Brackets.

### THE LIFTING SPAN

The two side members of the span are made by overlapping two  $5\frac{1}{2}"$  Angle Girders one hole with a  $2\frac{1}{2}"$  Angle Girder, and they are joined by three  $5\frac{1}{2}"$  Strips. Two  $12\frac{1}{2}" \times 2\frac{1}{2}"$  Strip Plates, separated by a  $12\frac{1}{2}"$  Strip, form the roadway. The arch is fitted with Angle Brackets in the positions shown, and these are connected to the Angle Girders of the roadway by a series of Strips and compound strips. The compound strips comprise  $2\frac{1}{2}"$  Strips overlapped two holes, and  $3\frac{1}{2}"$  and  $2\frac{1}{2}"$  Strips overlapped three holes.

(Continued on next page)

At the bridge end each roadway is attached to the tower by  $2\frac{1}{2}" \times \frac{1}{2}"$  Double Angle Strips, and compound strips made from  $2\frac{1}{2}"$  Strips are bolted to Double Brackets to act as stays.

The towers are joined together at the base by compound strips made from  $12\frac{1}{2}"$  Strips overlapped two holes. The compound strips are joined across by a  $5\frac{1}{2}"$  Strip bolted to Double Brackets. Stops, to prevent the span from being lowered below the level of the roadway, are provided by Trunnions bolted to the bases, the Bolts carrying two Washers on their shanks.

Fig. 9.25a

Note: The Motor used in this model is not included in the Outfit.

## 9.25 VERTICAL LIFTING BRIDGE—Continued

## ARRANGEMENT OF OPERATING CORDS AND MECHANISM

Guide Cords are tied to the Trunnions that act as stops for the span on each base. They are passed through holes in the span and are tied to Flat Trunnions 1. The Cords 2 are tied at 3 to the  $5\frac{1}{2}$ " Strip of the span, and are led up between Washers on the  $4\frac{1}{2}$ " Rod 4. They are taken round " Pulleys fastened on  $6\frac{1}{2}$ " Rod 5, and over 2" Pulleys fastened on compound

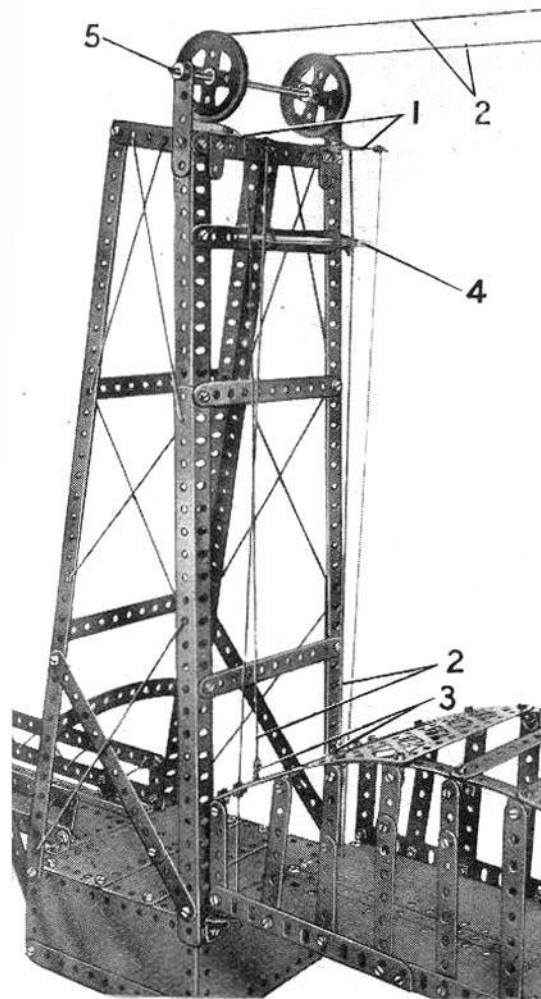


Fig. 9.25b

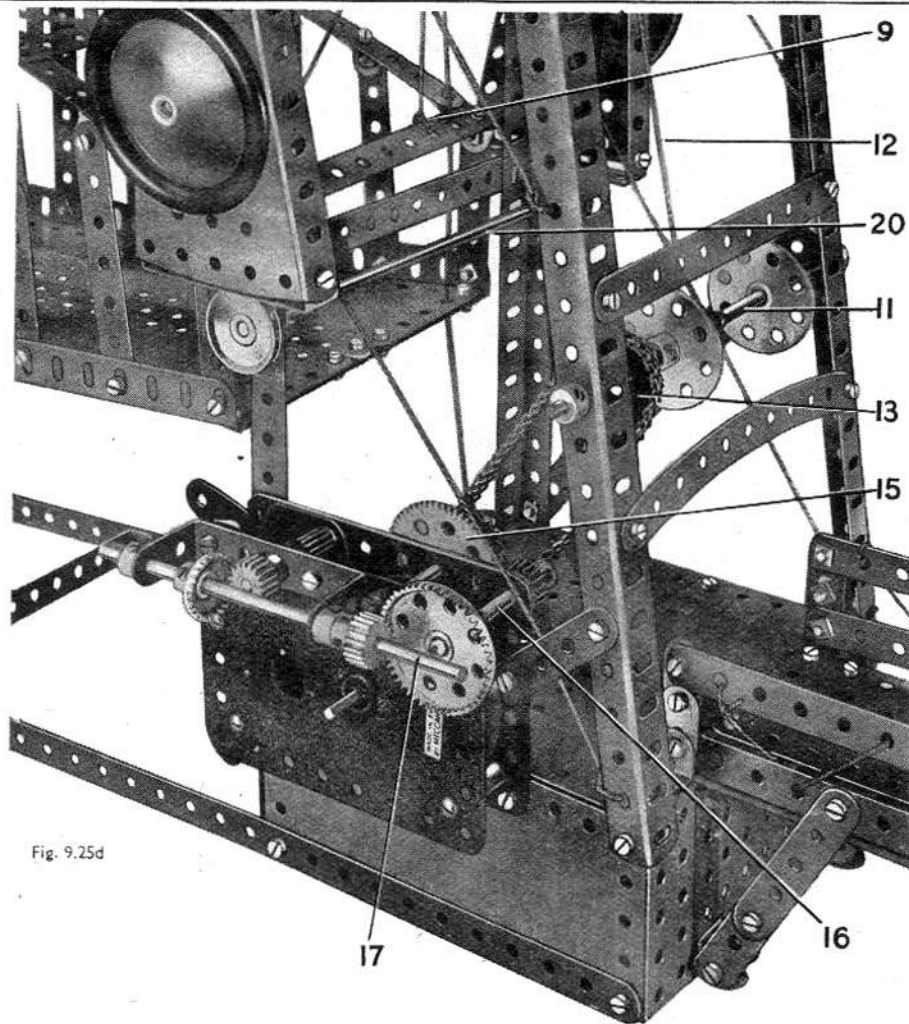


Fig. 9.25d

rod 6. Rod 6 is made up of a  $3\frac{1}{2}$ " Rod and a  $4\frac{1}{2}$ " Rod joined together by a Coupling, and it carries two 1" Pulleys outside the  $2\frac{1}{2}$ " Strips. The Cords are then tied to a  $3\frac{1}{2}$ " x  $\frac{1}{2}$ " Double Angle Strip 14 inside the left-hand tower. Cords 8 are tied to the span at 9 and are led over 5" Rod 10. They are then passed round 2" Pulleys on rod 6 and finally are tied to the  $3\frac{1}{2}$ " x  $\frac{1}{2}$ " Double Angle Strip 14.

A length of Cord 12 attached to the centre of the Double Angle Strip 14 is tied to a Cord Anchoring Spring on a  $6\frac{1}{2}$ " Rod 11. The Cord is wound between two Bush Wheels on this Rod, and the Rod carries also a 1" Sprocket Wheel 13. This Sprocket is connected by Chain to a  $\frac{1}{2}$ " Sprocket on a 2" Rod mounted in the sideplates of a No. 1 Clockwork Motor, fixed to the foot of the tower as shown. A 57-teeth Gear 15 fixed on this Rod meshes with a  $\frac{1}{2}$ " Pinion on a 2" Rod 16 also journaled in the Motor side-plates. A  $1\frac{1}{2}$ " Contrate on Rod 16 meshes with a  $\frac{1}{2}$ " Pinion on a 5" Rod 17, mounted in a  $2\frac{1}{2}$ " x 1" Double Angle Strip bolted to the Motor. A  $\frac{1}{2}$ " Contrate on the 5" Rod meshes with a  $\frac{1}{2}$ " Pinion on the Motor driving shaft.

## THE COUNTERWEIGHTS

The counterweights for the span are formed by the Flanged Sector Plates 18, which are fitted with Road Wheels by passing a  $\frac{1}{2}$ " Bolt through the Flanged Sector Plate and locking it in position in the boss of the Road Wheel. The Cords 19 are tied to the  $1\frac{1}{2}$ " x  $\frac{1}{2}$ " Double Angle Strips at the narrow ends of the Flanged Sector Plates, and are led round the 1" Pulleys on rod 6. The Cords are then led through holes in the Double Angle Strips, round the 1" Pulleys on  $6\frac{1}{2}$ " Rod 20 and finally are tied to the  $2\frac{1}{2}$ " x  $\frac{1}{2}$ " Double Angle Strips bolted to the broad ends of the Flanged Sector Plate.

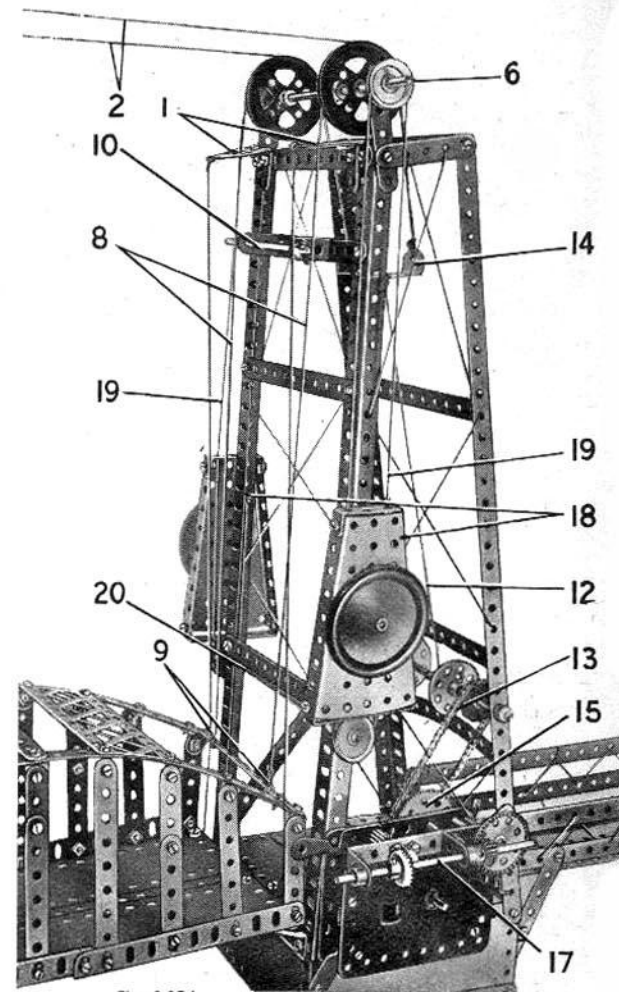
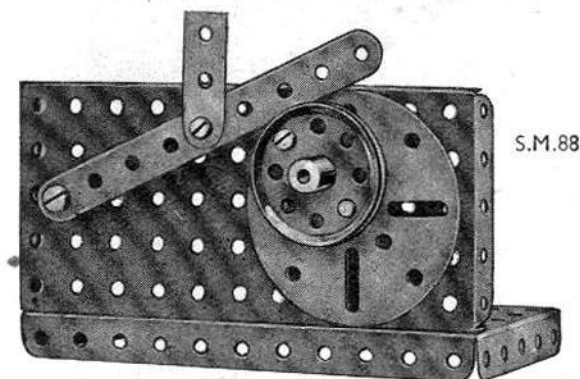


Fig. 9.25d

## More useful Mechanisms made with Meccano parts

## SMOOTH MOVEMENT CAM

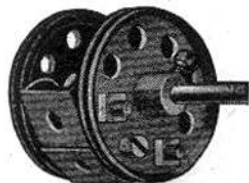


S.M.88

S.M.88. The cam disc consists of a  $1\frac{1}{2}$ " Pulley attached by a nut and bolt to a Face Plate. The Rod on which this Face Plate is fixed is journaled in one of the holes of the vertical Plate, and also in the boss of a Double Arm Crank. The end of the Rod passes for a distance of about  $\frac{1}{8}$ " through the boss of the Face Plate. This shaft extension also passes through the inner hole of the  $1\frac{1}{2}$ " Pulley, and so prevents the part from twisting on its retaining bolt.

The tappet arm is represented by a  $4\frac{1}{2}$ " Strip carrying at its fixed end a Crank. A Pivot Bolt passes through this Crank and is locked to the vertical Plate by two nuts. The edge of the tappet arm rests in the groove of the  $1\frac{1}{2}$ " Pulley, the movement due to the rise and fall of the cam being transmitted to the desired point by a Strip pivotally attached to the tappet as shown.

## USEFUL CAM MECHANISM



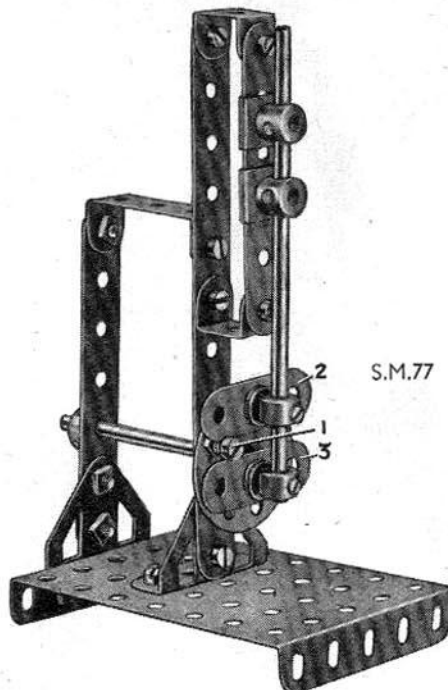
S.M.82

S.M.82. Cams are used for a large number of purposes in Meccano model-building and almost any design is possible. A typical example is shown in S.M.88 on this page. Tappet rods for use with the cam may consist simply of the edge of a Strip, or, for more

accurate work, a small roller carried at one end of a Rod or Strip. A small Flanged Wheel or Pulley can be used for this roller.

The illustration above shows a neat cam designed for use where very rapid action is not required. Each side consists of a  $1\frac{1}{2}$ " Pulley or Bush Wheel and these are connected by three Double Brackets. In order to prevent the rims of the Pulleys from damage, a Washer is placed on the shank of each Bolt between the Pulleys and Double Brackets.

## SLIDE CRANK MOVEMENT



S.M.77

S.M.77. The mechanism shown above is an ingenious device for converting rotary to linear motion without the use of the usual type of crank and connecting rod.

The  $5\frac{1}{2}$ " Strip carries at its upper end a Double Bracket and a second similar part at a point 3" from its lower end. The two outer flanges of these Brackets support a 3" Strip on which two Slide Pieces move.

The two Slide Pieces are arranged about  $\frac{1}{2}$ " apart on a 5" Rod and are fixed in position by grub-screws. The lower end of the Rod carries two Collars fitted with Strips 2 and 3 respectively. Bolts fitted with two Washers each form the necessary connections. The inner edges of the two Strips are arranged so that the shank of a  $\frac{3}{8}$ " Bolt 1 fits snugly between them without jamming. This Bolt is attached to a Bush Wheel by two nuts, the shaft on which the Bush Wheel is fitted forming the crankshaft.

## FRONT AXLE TRACTOR MOUNTING



S.M.179

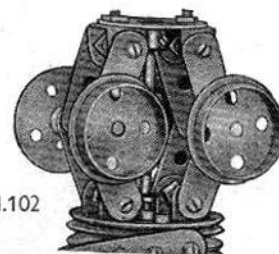
S.M.179. This front axle is built up from two  $3\frac{1}{2}$ " Angle Girders bolted together to form a channel section, the Rods that carry the road wheels being journaled in Double Brackets. The central pivot is in two parts, a Handrail Support secured to the front axle and a Socket Coupling that is attached to the boss of a Double Arm Crank bolted to the underside of the boiler. The Handrail Support rests in the recess in the lower end of the Socket Coupling and is retained in place by two  $\frac{1}{2}$ " x  $\frac{1}{2}$ " Angle Brackets that are fixed to the front axle as shown.

## CENTRIFUGAL GOVERNOR

S.M.102. This governor is designed primarily for use in slow running stationary engines.

The governor rod carries at its upper end a Bush Wheel, to the under side of which two Double Brackets are attached. Each of these Double Brackets is fitted with  $1\frac{1}{2}$ " Strips pivotally attached, the lower holes of these being connected to further  $1\frac{1}{2}$ " Strips.

The Rods linking these Strips, carry  $1\frac{1}{8}$ " Flanged Wheels representing the governor weights. The lower ends of the second set of  $1\frac{1}{2}$ " Strips are lock-nutted to Double Brackets bolted to the upper face of a pair of 2" Pulleys that are free to slide on the Rod. These Pulleys are fixed together by  $\frac{1}{2}$ " Bolts, sufficient space being left between them to allow the shank of a Bolt to pass. This Bolt is secured to one end of the governor arm.



S.M.102



O	1	1a	2	2a	3	3a	4	4a	No.	Description of Parts	5	5a	6	6a	7	7a	8	8a	9	9a	10
1	1	1	1	1	1	1	1	1	1	Perforated Strips, 12"	10	2	12	12	12	2	14	14	14	10	24
1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	" 9"	14	14	14	14	14	3	21	2	10	6	6
1b	1b	1b	1b	1b	1b	1b	1b	1b	1b	" 7"	14	14	14	14	14	3	21	2	10	6	6
2	2	2	2	2	2	2	2	2	2	" 5"	2	2	2	2	2	6	6	2	24	12	36
2a	2a	2a	2a	2a	2a	2a	2a	2a	2a	" 4"	2	2	2	2	2	6	6	2	24	12	36
3	3	3	3	3	3	3	3	3	3	" 3"	2	2	2	2	2	6	6	2	24	12	36
4	4	4	4	4	4	4	4	4	4	" 2"	2	2	2	2	2	6	6	2	24	12	36
5	5	5	5	5	5	5	5	5	5	" 1"	2	2	2	2	2	6	6	2	24	12	36
6	6	6	6	6	6	6	6	6	6	" 1"	2	2	2	2	2	6	6	2	24	12	36
6a	6a	6a	6a	6a	6a	6a	6a	6a	6a	" 1"	2	2	2	2	2	6	6	2	24	12	36
7	7	7	7	7	7	7	7	7	7	Angle Girders, 12"	4	4	4	4	4	8	10	2	10	6	6
7a	7a	7a	7a	7a	7a	7a	7a	7a	7a	" 10"	4	4	4	4	4	8	10	2	10	6	6
8	8	8	8	8	8	8	8	8	8	" 8"	4	4	4	4	4	8	10	2	10	6	6
8a	8a	8a	8a	8a	8a	8a	8a	8a	8a	" 6"	4	4	4	4	4	8	10	2	10	6	6
9	9	9	9	9	9	9	9	9	9	" 5"	4	4	4	4	4	8	10	2	10	6	6
9a	9a	9a	9a	9a	9a	9a	9a	9a	9a	" 4"	4	4	4	4	4	8	10	2	10	6	6
9b	9b	9b	9b	9b	9b	9b	9b	9b	9b	" 3"	4	4	4	4	4	8	10	2	10	6	6
9c	9c	9c	9c	9c	9c	9c	9c	9c	9c	" 2"	4	4	4	4	4	8	10	2	10	6	6
9d	9d	9d	9d	9d	9d	9d	9d	9d	9d	" 1"	4	4	4	4	4	8	10	2	10	6	6
9e	9e	9e	9e	9e	9e	9e	9e	9e	9e	" 1"	4	4	4	4	4	8	10	2	10	6	6
9f	9f	9f	9f	9f	9f	9f	9f	9f	9f	" 1"	4	4	4	4	4	8	10	2	10	6	6
10	10	10	10	10	10	10	10	10	10	Fishplates	8	8	8	8	8	20	23	2	23	12	24
11	11	11	11	11	11	11	11	11	11	Double Brackets, 1"	4	4	4	4	4	16	16	3	36	14	50
12	12	12	12	12	12	12	12	12	12	Angle Brackets, 1"	4	4	4	4	4	16	16	3	36	14	50
12a	12a	12a	12a	12a	12a	12a	12a	12a	12a	" 1"	4	4	4	4	4	16	16	3	36	14	50
12b	12b	12b	12b	12b	12b	12b	12b	12b	12b	" 1"	4	4	4	4	4	16	16	3	36	14	50
12c	12c	12c	12c	12c	12c	12c	12c	12c	12c	Obtuse Angle Brackets, 1"	4	4	4	4	4	16	16	3	36	14	50
13	13	13	13	13	13	13	13	13	13	Axle Rods, 11"	4	4	4	4	4	16	16	3	36	14	50
13a	13a	13a	13a	13a	13a	13a	13a	13a	13a	" 8"	4	4	4	4	4	16	16	3	36	14	50
14	14	14	14	14	14	14	14	14	14	" 6"	4	4	4	4	4	16	16	3	36	14	50
15	15	15	15	15	15	15	15	15	15	" 5"	4	4	4	4	4	16	16	3	36	14	50
15a	15a	15a	15a	15a	15a	15a	15a	15a	15a	" 4"	4	4	4	4	4	16	16	3	36	14	50
15b	15b	15b	15b	15b	15b	15b	15b	15b	15b	" 3"	4	4	4	4	4	16	16	3	36	14	50
16	16	16	16	16	16	16	16	16	16	" 2"	4	4	4	4	4	16	16	3	36	14	50
16a	16a	16a	16a	16a	16a	16a	16a	16a	16a	" 2"	4	4	4	4	4	16	16	3	36	14	50
16b	16b	16b	16b	16b	16b	16b	16b	16b	16b	" 2"	4	4	4	4	4	16	16	3	36	14	50
17	17	17	17	17	17	17	17	17	17	" 1"	4	4	4	4	4	16	16	3	36	14	50
18	18	18	18	18	18	18	18	18	18	" 1"	4	4	4	4	4	16	16	3	36	14	50
18a	18a	18a	18a	18a	18a	18a	18a	18a	18a	" 1"	4	4	4	4	4	16	16	3	36	14	50
18b	18b	18b	18b	18b	18b	18b	18b	18b	18b	" 1"	4	4	4	4	4	16	16	3	36	14	50
19	19	19	19	19	19	19	19	19	19	Pulleys, 3" diam. with boss and screw	4	4	4	4	4	16	16	3	36	14	50
19a	19a	19a	19a	19a	19a	19a	19a	19a	19a	Pulleys, 6" diam. with boss and screw	4	4	4	4	4	16	16	3	36	14	50
19b	19b	19b	19b	19b	19b	19b	19b	19b	19b	Pulleys, 3" diam. with boss and screw	4	4	4	4	4	16	16	3	36	14	50
19c	19c	19c	19c	19c	19c	19c	19c	19c	19c	Cranks, 3" diam. with grip	4	4	4	4	4	16	16	3	36	14	50
19d	19d	19d	19d	19d	19d	19d	19d	19d	19d	" 3"	4	4	4	4	4	16	16	3	36	14	50
19e	19e	19e	19e	19e	19e	19e	19e	19e	19e	" 3"	4	4	4	4	4	16	16	3	36	14	50
20	20	20	20	20	20	20	20	20	20	Flanged Wheels, 1" diam.	4	4	4	4	4	16	16	3	36	14	50
20a	20a	20a	20a	20a	20a	20a	20a	20a	20a	Pulleys, 2" diam. with boss and screw	4	4	4	4	4	16	16	3	36	14	50
20b	20b	20b	20b	20b	20b	20b	20b	20b	20b	Flanged Wheels, 2" diam.	4	4	4	4	4	16	16	3	36	14	50
21	21	21	21	21	21	21	21	21	21	Pulleys, 1" diam. with boss and screw	4	4	4	4	4	16	16	3	36	14	50
22	22	22	22	22	22	22	22	22	22	" 1"	4	4	4	4	4	16	16	3	36	14	50
22a	22a	22a	22a	22a	22a	22a	22a	22a	22a	" 1"	4	4	4	4	4	16	16	3	36	14	50
23	23	23	23	23	23	23	23	23	23	" 1"	4	4	4	4	4	16	16	3	36	14	50
23a	23a	23a	23a	23a	23a	23a	23a	23a	23a	Bush Wheels, 1" diam.	4	4	4	4	4	16	16	3	36	14	50
24	24	24	24	24	24	24	24	24	24	Wheel Discs, 1" diam. without bush	4	4	4	4	4	16	16	3	36	14	50
24a	24a	24a	24a	24a	24a	24a	24a	24a	24a	Pinions, 1" diam. face 25 teeth	4	4	4	4	4	16	16	3	36	14	50
25	25	25	25	25	25	25	25	25	25	" 25	4	4	4	4	4	16	16	3	36	14	50
25a	25a	25a	25a	25a	25a	25a	25a	25a	25a	" 19	4	4	4	4	4	16	16	3	36	14	50
26	26	26	26	26	26	26	26	26	26	" 19	4	4	4	4	4	16	16	3	36	14	50
26a	26a	26a	26a	26a	26a	26a	26a	26a	26a	" 19	4	4	4	4	4	16	16	3	36	14	50
26b	26b	26b	26b	26b	26b	26b	26b	26b	26b	" 19	4	4	4	4	4	16	16	3	36	14	50
27	27	27	27	27	27	27	27	27	27	Gear Wheels, 1" diam., 50 teeth	4	4	4	4	4	16	16	3	36	14	50
27a	27a	27a	27a	27a	27a	27a	27a	27a	27a	" 133	4	4	4	4	4	16	16	3	36	14	50
27b	27b	27b	27b	27b	27b	27b	27b	27b	27b	" 95	4	4	4	4	4	16	16	3	36	14	50
27c	27c	27c	27c	27c	27c	27c	27c	27c	27c	" 21	4	4	4	4	4	16	16	3	36	14	50
28	28	28	28	28	28	28	28	28	28	Concave Wheels, 1" diam., 50 teeth	4	4	4	4	4	16	16	3	36	14	50
29	29	29	29	29	29	29	29	29	29	Bevel Gears, 1" diam., 25 teeth	4	4	4	4	4	16	16	3	36	14	50
30	30	30	30	30	30	30	30	30	30	" 1" diam., 25 teeth	4	4	4	4	4	16	16	3	36	14	50
30a	30a	30a	30a	30a	30a	30a	30a	30a	30a	" 1" diam., 25 teeth	4	4	4	4	4	16	16	3	36	14	50
30b	30b	30b	30b	30b	30b	30b	30b	30b	30b	" 1" diam., 25 teeth	4	4	4	4	4	16	16	3	36	14	50
31	31	31	31	31	31	31	31	31	31	Gear Wheels, 1" diam., 1" face, 38 teeth	4	4	4	4	4	16	16	3	36	14	50
32	32	32	32	32	32	32	32	32	32	Worms, 1" diam.	4	4	4	4	4	16	16	3	36	14	50
33	33	33	33	33	33	33	33	33	33	Spanners	4	4	4	4	4	16	16	3	36	14	50
34	34	34	34	34	34	34	34	34	34	Box Spanners	4	4	4	4	4	16	16	3	36	14	50
35	35	35	35	35	35	35	35	35	35	Spring Clips	4	4	4	4	4	16	16	3	36	14	50
36	36	36	36	36	36	36	36	36	36	Screwdrivers	4	4	4	4	4	16	16	3	36	14	50
36a																					

O	Oa	1	1a	2	2a	3	3a	4	4a	No.	Description of Parts	5	5a	6	6a	7	7a	8	8a	9	9a	10
2		2								89	Curved Strips, 5 $\frac{1}{2}$ "											12
										89a	Stepped, 3"											6
										89b	Stepped, 4"											6
										90	Stepped, 2 $\frac{1}{2}$ "											8
										90a	Stepped, 2 $\frac{1}{2}$ "											2
										94	Sprocket Chain, 40" length											2
										95	Sprocket Chain, 28" length											2
										95a	Sprocket Chain, 28" length											2
										95b	Sprocket Chain, 28" length											2
										96	Sprocket Chain, 28" length											2
										96a	Sprocket Chain, 28" length											2
										100	Braced Girders, 5 $\frac{1}{2}$ "											2
										102	Single Bent Strips											2
										103	Flat Girders, 5 $\frac{1}{2}$ "											2
										103a	" " " " " "											2
										103b	" " " " " "											2
										103c	" " " " " "											2
										103d	" " " " " "											2
										103e	" " " " " "											2
										103f	" " " " " "											2
										103g	" " " " " "											2
										103h	" " " " " "											2
										103i	" " " " " "											2
										103k	" " " " " "											2
										108	Corner Gussets											2
										109	Face Plates, 2 $\frac{1}{2}$ " diam.											2
										110a	Back Strips, 6 $\frac{1}{2}$ "											2
										111	Bolts, 1 $\frac{1}{2}$ "											2
										111a	" " " " " "											2
										111b	" " " " " "											2
										111c	" " " " " "											2
										111d	" " " " " "											2
										114	Hinges, 1 $\frac{1}{2}$ "											2
										115	Threaded Pins											2
										116	Fork Pieces, Large											2
										116a	" " " " " "											2
										117	" " " " " "											2
										118	Metal Balls, 5 $\frac{1}{2}$ " diam.											2
										120b	Hub Discs, 5 $\frac{1}{2}$ " diam.											2
										124	Compression Springs, 1 $\frac{1}{2}$ " long											2
										125	Reversed Angle Brackets, 1 $\frac{1}{2}$ "											2
										126	" " " " " "											2
										126a	" " " " " "											2
										130	Flat Trunnions											2
										130a	Bel Cranks, with boss											2
										133	Eccentrics, Triple Throw, 1 $\frac{1}{2}$ "											2
										133a	Eccentrics, Single Throw, 1 $\frac{1}{2}$ "											2
										134	Corner Brackets, 1 $\frac{1}{2}$ "											2
										136	Crank Shafts, 1 $\frac{1}{2}$ " stroke											2
										136a	Handrail Supports											2
										137	Wheel Flanges											2
										140	Universal Couplings											2
										142a	Motor Tyres to fit 2 $\frac{1}{2}$ " diam. rim											2
										142b	" " " " " "											2
										143	Circular Girders, 5 $\frac{1}{2}$ " diam.											2
										144	Dog Clutches											2
										145	Circular Strips, 7 $\frac{1}{2}$ " diam. overall											2
										146	" " " " " "											2
										146a	" " " " " "											2
										147a	" " " " " "											2
										147b	Pawls											2
										147c	Pivot Bolt with 2 Nuts											2
										148	Pawls without Boss											2
										154a	Ratchet Wheels											2
										154b	Corner Angle Brackets, 1 $\frac{1}{2}$ " R.H.											2
										155	" " " " " "											2
										157	Rubber Rings, for 1 $\frac{1}{2}$ " pulley											2
										160	Fans, 2 $\frac{1}{2}$ " diam.											2
										161	Channel Bearings, 1 $\frac{1}{2}$ " x 1 $\frac{1}{2}$ " x 1 $\frac{1}{2}$ "										2	
										162	Girder Brackets, 2 $\frac{1}{2}$ " x 1 $\frac{1}{2}$ " x 1 $\frac{1}{2}$ "										2	
										162a	Boilers, Complete, 5 $\frac{1}{2}$ " long by 2 $\frac{1}{2}$ " diam.											2
										162b	Boilers without Ends, 4 $\frac{1}{2}$ " long by 2 $\frac{1}{2}$ " diam.											2
										163	Boilers without Ends, 4 $\frac{1}{2}$ " long by 2 $\frac{1}{2}$ " diam.											2
										164	Sleeve Pieces, 1 $\frac{1}{2}$ " long by 1 $\frac{1}{2}$ " diam.											2
										165	Chimney Adaptors, 2 $\frac{1}{2}$ " diam. by 1 $\frac{1}{2}$ " high											2
										166	Swivel Bearings											2
										167b	End Bearings											2
										168	Flanged Ring, 9 $\frac{1}{2}$ " diam.											2
										171	Ball Bearings, 4 $\frac{1}{2}$ " diam.											2
										175	Socket Couplings											2
										176	Flexible Coupling Units											2
										177	Anchoring Springs for Cord											2
										185	Rod Sockets											2
										186	Steering Wheels, 1 $\frac{1}{2}$ " diam.											2
										186a	Driving Bands											2
										186b	" " " " " "											2
										186c	" " " " " "											2
										186d	" " " " " "											2
										186e	" " " " " "											2
										187	Road Wheels, 12 $\frac{1}{2}$ " diam.											2
										187a	Conical Disc, 1 $\frac{1}{2}$ " diam.											2
										188	Flexible Plates, 5 $\frac{1}{2}$ " x 1 $\frac{1}{2}$ "											2
										189	" " " " " "											2
										190	" " " " " "											2
										190a	" " " " " "											2
										191	" " " " " "											2
										192	" " " " " "											2
										196	Strip Plates, 9 $\frac{1}{2}$ " x 2 $\frac{1}{2}$ "											2
										197	" " " " " "											2
										198	Hinged Flat Plates, 12 $\frac{1}{2}$ " x 2 $\frac{1}{2}$ "											2
										199	Curved Plates, U Section, 2 $\frac{1}{2}$ " x 2 $\frac{1}{2}$ " x 2 $\frac{1}{2}$ " radius										2	
										200	Curved Plates, 2 $\frac{1}{2}$ " x 2 $\frac{1}{2}$ " x 1 $\frac{1}{2}$ " radius										2	
										212	Rod and Strip Connectors											2
										213	Rod Connectors											

## MECCANO PARTS

- 3**  
Perforated Strips
- |     |                    |     |                   |
|-----|--------------------|-----|-------------------|
| No. | 12 $\frac{1}{2}$ " | No. | 3 $\frac{1}{2}$ " |
| 1.  | 9 $\frac{1}{2}$ "  | 4.  | 3 $\frac{1}{2}$ " |
| 1a. | 7 $\frac{1}{2}$ "  | 5.  | 2 $\frac{1}{2}$ " |
| 2.  | 5 $\frac{1}{2}$ "  | 6.  | 2 $\frac{1}{2}$ " |
| 2a. | 4 $\frac{1}{2}$ "  | 6a. | 1 $\frac{1}{2}$ " |

- 9**  
Angle Girders
- |     |                    |     |                   |
|-----|--------------------|-----|-------------------|
| 7.  | 24 $\frac{1}{2}$ " | 9a. | 4 $\frac{1}{2}$ " |
| 7a. | 18 $\frac{1}{2}$ " | 9b. | 3 $\frac{1}{2}$ " |
| 8.  | 12 $\frac{1}{2}$ " | 9c. | 3 $\frac{1}{2}$ " |
| 8a. | 9 $\frac{1}{2}$ "  | 9d. | 2 $\frac{1}{2}$ " |
| 8b. | 7 $\frac{1}{2}$ "  | 9e. | 2 $\frac{1}{2}$ " |
| 9.  | 5 $\frac{1}{2}$ "  | 9f. | 1 $\frac{1}{2}$ " |

- 10** Fishplate  
**11** Double Bracket  
**12** Angle Bracket,  $\frac{1}{2}$ " x  $\frac{1}{2}$ "  
**12a.** " "  $\frac{1}{2}$ " x  $\frac{1}{2}$ "  
**12b.** " "  $1$ " x  $\frac{1}{2}$ "  
**12c.** Obtuse Angle Bracket,  $\frac{1}{2}$ " x  $\frac{1}{2}$ "

- 17**  
Axle Rods
- |      |                    |      |                   |
|------|--------------------|------|-------------------|
| 13.  | 11 $\frac{1}{2}$ " | 16.  | 3 $\frac{1}{2}$ " |
| 13a. | 8 $\frac{1}{2}$ "  | 16a. | 2 $\frac{1}{2}$ " |
| 14.  | 6 $\frac{1}{2}$ "  | 16b. | 3 $\frac{1}{2}$ " |
| 15.  | 5 $\frac{1}{2}$ "  | 17.  | 2 $\frac{1}{2}$ " |
| 15a. | 4 $\frac{1}{2}$ "  | 18a. | 1 $\frac{1}{2}$ " |
| 15b. | 4 $\frac{1}{2}$ "  | 18b. | 1 $\frac{1}{2}$ " |

- 19h**  
Crank Handle,  $3\frac{1}{2}$ " Shaft with grip  
**19h.** " "  $3\frac{1}{2}$ " " without grip  
**19s.** " "  $3\frac{1}{2}$ " " without grip

- 20**  
**19a.** Spoked Wheel, 3" diam.  
**20.** Flanged Wheel,  $1\frac{1}{2}$ " diam.  
**20b.** " " " " "

- 22**  
**19c.** Pulleys  
**23a.** 3" diam. with boss and screw  
**20a.** 2" " " " "  
**21.** 1 $\frac{1}{2}$ " " " " "  
**22.** 1" " " " " "  
**22a.** 1" " without " " "  
**23.** 1 $\frac{1}{2}$ " " " " " "  
**23a.** 1 $\frac{1}{2}$ " " with " " "

- 24**  
Bush Wheel,  $1\frac{1}{2}$ " diam.  
**24a.** Wheel Disc,  $1\frac{1}{2}$ " diam., without bush

- 26**  
Pinion,  $\frac{1}{2}$ " diam.,  $\frac{1}{2}$ " face, 25 teeth  
**25a.** " " " " " 25 " "  
**25b.** " " " " " 19 " "  
**26.** " " " " " 19 " "  
**26a.** " " " " " 19 " "  
**26b.** " " " " " 19 " "

- 27**  
Gear Wheels  
**27a.** 1 $\frac{1}{2}$ " diam. 50 teeth,  
**27a.** 1 $\frac{1}{2}$ " " 57 " "  
**27b.** 3 $\frac{1}{2}$ " " 133 " "  
**27c.** 2 $\frac{1}{2}$ " " 95 " "

- 28**  
Contrate Wheel,  $1\frac{1}{2}$ " diam., 50 teeth  
**29.** " " " " 25 "

- 30**  
Bevel Gear,  $\frac{1}{2}$ " diam., 26 teeth (for use in pairs)  
**30a.** " "  $\frac{1}{2}$ " " 16 " " Can only be  
**30c.** " "  $1\frac{1}{2}$ " " 48 " " used together

- 31**  
Gear Wheel, 1" diam.,  $\frac{1}{2}$ " face, 38 teeth  
**32.** Worm,  $\frac{1}{2}$ " diam.

- 34**  
Spanner  
**34b.** Box Spanner

- 35**  
Spring Clip  
**36.** Screwdriver  
**36a.** " " " " "  
**36c.** " " " " "  
**37.** Nut and Bolt,  $\frac{1}{4}$ "  
**37a.** Nut  
**37b.** Bolt,  $\frac{1}{4}$ "  
**38.** Washer  
**38d.** " "  $\frac{1}{2}$ "  
**40.** Hank of Cord

- 41**  
Propeller Blade  
**43**  
Tension Spring, 2" long

- 44**  
Bent Strip, stepped  
**45.** Double Bent Strip  
**46.** Double Angle Strip,  $2\frac{1}{2}$ " x  $1\frac{1}{2}$ "  
**47.** " " " "  $2\frac{1}{2}$ " x  $1\frac{1}{2}$ "  
**47a.** " " " "  $3\frac{1}{2}$ " x  $1\frac{1}{2}$ "  
**48.** " " " "  $1\frac{1}{2}$ " x  $1\frac{1}{2}$ "  
**48a.** " " " "  $2\frac{1}{2}$ " x  $1\frac{1}{2}$ "  
**48b.** " " " "  $3\frac{1}{2}$ " x  $1\frac{1}{2}$ "  
**48c.** " " " "  $4\frac{1}{2}$ " x  $1\frac{1}{2}$ "  
**48d.** " " " "  $5\frac{1}{2}$ " x  $1\frac{1}{2}$ "

- 50**  
Slide Piece  
**52**  
Flanged Plate,  $2\frac{1}{2}$ " x  $1\frac{1}{2}$ "  
**53.** " " " "  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
**52a.** Flat Plate,  $5\frac{1}{2}$ " x  $3\frac{1}{2}$ "  
**53.** Flanged Plate,  $3\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
**53a.** Flat Plate,  $4\frac{1}{2}$ " x  $2\frac{1}{2}$ "

- 54**  
Flanged Sector Plate,  $4\frac{1}{2}$ " long  
**55**  
Perforated Strip, slotted,  $5\frac{1}{2}$ " long  
**55a.** " " " "  $2\frac{1}{2}$ " "

- 57b**  
Hook, Loaded, Large  
**57c.** " " Small

- 58**  
Spring Cord, 40" Length  
**58a.** Coupling Screw for Spring Cord  
**58b.** Hook for Spring Cord

- 59**  
Collar, with screw

- 61**  
Windmill Sail  
**62**  
Crank  
**62a.** Threaded Crank  
**62b.** Double Arm Crank  
**63**  
Coupling  
**63b.** Strip Coupling  
**63c.** Threaded Coupling

- 64**  
Threaded Boss  
**65.** Centre Fork  
**69.** Set Screw,  $\frac{1}{4}$ "  
**69a.** Grub Screw,  $\frac{1}{4}$ "  
**69b.** " "  $\frac{1}{4}$ "  
**69c.** " "  $\frac{1}{4}$ "

- 76**  
Flat Plate,  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
**72.** " "  $2\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
**73.** " "  $3\frac{1}{2}$ " x  $1\frac{1}{2}$ "  
**76.** Triangular Plate,  $2\frac{1}{2}$ "  
**77.** " "  $1\frac{1}{2}$ "

- 80**  
Screwed Rods  
**78.** 11 $\frac{1}{2}$ "  
**79.** 8 $\frac{1}{2}$ "  
**79a.** 6 $\frac{1}{2}$ "  
**80.** 5 $\frac{1}{2}$ "  
**80a.** 3 $\frac{1}{2}$ "  
**80b.** 4 $\frac{1}{2}$ "  
**80c.** 3 $\frac{1}{2}$ "  
**81.** 2 $\frac{1}{2}$ "  
**82.** 1"

- 89**  
Curved Strip,  $5\frac{1}{2}$ ", 10" radius  
**89a.** " " stepped, 3",  $1\frac{1}{2}$ " radius,  
**89b.** " " stepped, 4",  $4\frac{1}{2}$ " radius,  
**90.** Curved Strip,  $2\frac{1}{2}$ ",  $2\frac{1}{2}$ " radius  
**90a.** " " stepped,  $2\frac{1}{2}$ ",  $1\frac{1}{2}$ " radius,

- 94**  
Sprocket Chain, 40" length  
**95.** " Wheel, 2" diam. 36 teeth,  
**95a.** " "  $1\frac{1}{2}$ " " 28 "  
**95b.** " "  $3\frac{1}{2}$ " " 56 "  
**96.** " " 1" " 18 "  
**96a.** " "  $\frac{3}{4}$ " " 14 "

- 99**  
Braced Girders  
**97.** 3 $\frac{1}{2}$ " long  
**97a.** 3 $\frac{1}{2}$ " " **99a.** 9 $\frac{1}{2}$ " long  
**98.** 2 $\frac{1}{2}$ " " **99b.** 7 $\frac{1}{2}$ " "  
**99.** 12 $\frac{1}{2}$ " " **100.** 5 $\frac{1}{2}$ " "  
**100a.** 4 $\frac{1}{2}$ " "

- 101**  
Heald, for looms  
**102.** Single Bent Strip

- 103**  
Flat Girders  
**103.** 5 $\frac{1}{2}$ " long  
**103a.** 9 $\frac{1}{2}$ " " **103e.** 3" long  
**103b.** 12 $\frac{1}{2}$ " " **103f.** 2 $\frac{1}{2}$ " "  
**103c.** 4 $\frac{1}{2}$ " " **103g.** 2" "  
**103d.** 3 $\frac{1}{2}$ " " **103h.** 1 $\frac{1}{2}$ " "  
**103k.** 7 $\frac{1}{2}$ " "

- 104**  
Shuttle, for looms  
**105.** Reed Hook, for looms  
**106**  
Wood Roller  
**106a.** Sand Roller  
**106**  
Corner Gusset  
**109.** Face Plate,  $2\frac{1}{2}$ " diam.

- 110**  
Rack Strip,  $3\frac{1}{2}$ " long  
**110a.** Bolt,  $\frac{3}{4}$ " " **111c.** Bolt,  $\frac{3}{4}$ " "  
**111.** Bolt,  $\frac{1}{2}$ " " **111d.** "  $\frac{1}{8}$ " "  
**111a.** " " " " "

- 113**  
Girder Frame  
**114**  
Hinge  
**115.** Threaded Pin  
**116.** Fork Piece, Large  
**116a.** " " Small  
**117.** Steel Ball,  $\frac{3}{8}$ " diam.

- 118**  
Hub Disc,  $5\frac{1}{2}$ " diam.



No. 120b. Compression Spring,  $\frac{3}{8}$ " long



No. 122. Miniature Loaded Sack



No. 123. Cone Pulley,  $1\frac{1}{2}$ ", 1" and  $\frac{3}{4}$ " diam.  
124. Reversed Angle Bracket, 1"  
125. " " "  $\frac{1}{2}$ "



No. 126. Trunnion 126a. Flat Trunnion



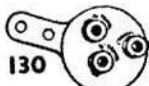
No. 127. Bell Crank  
128. Bell Crank, with Boss



No. 129. Toothed Segment,  $1\frac{1}{2}$ " radius



No. 130. Eccentric, Triple Throw,  $\frac{1}{2}$ ",  $\frac{3}{4}$ " and  $\frac{1}{2}$ "  
130a. Eccentric, Single Throw,  $\frac{1}{2}$ "



No. 131. Dredger Bucket  
132. Flywheel,  $2\frac{1}{2}$ " diam.



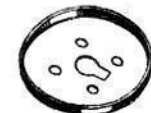
No. 133. Corner Bracket,  $1\frac{1}{2}$ "  
133a. " "  $\frac{1}{2}$ "



No. 134. Crank Shaft, 1" stroke



No. 136. Handrail Support  
136a. Handrail Coupling  
137. Wheel Flange



No. 138a. Ship Funnel



No. 139. Flanged Bracket (right)  
139a. " " (left)



No. 140. Universal Coupling



No. 142. Rubber Ring (to fit 3" diam. rim)  
142a. Motor Tyre (to fit 2" diam. rim)  
142b. " " " 3" " "  
142c. " " " 1" " "  
142d. " " "  $1\frac{1}{2}$ " " "



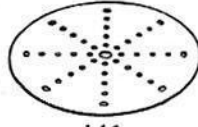
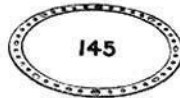
No. 143. Circular Girder,  $5\frac{1}{2}$ " diam.



No. 144. Dog Clutch



No. 145. Circular Strip,  $7\frac{1}{2}$ " diam. overall  
146. " Plate 6" " "  
146a. " " 4" " "



No. 147. Pawl, with Pivot Bolt and Nuts  
147a. Pawl  
147b. Pivot Bolts with 2 Nuts  
147c. Pawl without boss  
148. Ratchet Wheel



No. 151. Pulley Block, Single Sheave  
152. " " Two " "  
153. " " Three " "



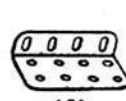
No. 154a. Corner Angle Bracket,  $\frac{1}{2}$ " (right-hand)  
154b. Corner Angle Bracket,  $\frac{1}{2}$ " (left-hand)  
155. Rubber Ring (for 1" Pulleys)



No. 157. Fan, 2" diam.



No. 160. Channel Bearing,  $1\frac{1}{2}$ " x  $1\frac{1}{2}$ " x  $\frac{1}{2}$ "  
161. Girder Bracket, 2" x  $1\frac{1}{2}$ " x  $\frac{1}{2}$ "



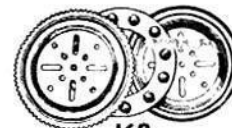
No. 162. Boiler, complete, 5" long x  $2\frac{1}{2}$ " diam.  
162a. " Ends,  $2\frac{1}{2}$ " diam. x  $\frac{1}{2}$ "  
162b. " without ends,  $4\frac{1}{2}$ " long x  $2\frac{1}{2}$ " diam.  
163. Sleeve Piece,  $1\frac{1}{2}$ " long x  $\frac{1}{2}$ " diam.  
164. Chimney Adaptor,  $\frac{3}{8}$ " diam. x  $\frac{1}{2}$ " high



No. 165. Swivel Bearing  
166. End " "  
167b. Flanged Ring,  $9\frac{1}{2}$ " diam.



No. 168. Ball Bearing, 4" diam.  
168a. " Race, flanged disc,  $3\frac{1}{2}$ " diam.  
168b. " " toothed " 4" diam.  
168c. " Cage,  $3\frac{1}{2}$ " diam., complete with balls.



No. 171. Socket Coupling



No. 175. Flexible Coupling Unit



No. 176. Anchoring Spring for Cord



No. 179. Rod Socket  
180. Gear Ring,  $3\frac{1}{2}$ " diam. (133 ext. teeth, 95 int.)



No. 185. Steering Wheel,  $1\frac{1}{2}$ " diam.  
186. Driving Band,  $2\frac{1}{2}$ " (Light)  
186a. " " 10" " "  
186b. " " 10" " "  
186c. " " 10" (Heavy)  
186d. " " 15" " "  
186e. " " 20" " "  
187. Road Wheel,  $2\frac{1}{2}$ " diam.  
187a. Conical Disc,  $1\frac{1}{2}$ " diam.



No. 192. Flexible Plates.  
192a.  $3\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192b.  $5\frac{1}{2}$ " x  $1\frac{1}{2}$ "  
192c.  $5\frac{1}{2}$ " x  $1\frac{1}{2}$ "  
192d.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192e.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192f.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192g.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192h.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192i.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192j.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192k.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192l.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192m.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192n.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192o.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192p.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192q.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192r.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192s.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192t.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192u.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192v.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192w.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192x.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192y.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192z.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192aa.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192ab.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192ac.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192ad.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192ae.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192af.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192ag.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192ah.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192ai.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192aj.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192ak.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192al.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192am.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192an.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192ao.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192ap.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192aq.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192ar.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192as.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192at.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192au.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192av.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192aw.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192ax.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192ay.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192az.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192ba.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192bb.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192bc.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192bd.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192be.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192bf.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192bg.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192bh.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192bi.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192bj.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192bk.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192bl.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192bm.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192bn.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192bo.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192bp.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192bq.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192br.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192bs.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192bt.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192bu.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192bv.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192bw.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192bx.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192by.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192bz.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192ca.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192cb.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192cc.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192cd.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192ce.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192cf.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192cg.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192ch.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192ci.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192cj.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192ck.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192cl.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192cm.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192cn.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192co.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192cp.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192cq.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192cr.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192cs.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192ct.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192cu.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192cv.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192cw.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192cx.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192cy.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192cz.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192da.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192db.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192dc.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192dd.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192de.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192df.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192dg.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192dh.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192di.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192dj.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192dk.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192dl.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192dm.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192dn.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192do.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192dp.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192dq.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192dr.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192ds.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192dt.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192du.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192dv.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192dw.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192dx.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192dy.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192dz.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192ea.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192eb.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192ec.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192ed.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192ee.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192ef.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192eg.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192eh.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192ei.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192ej.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192ek.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192el.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192em.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192en.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192eo.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192ep.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192eq.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192er.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192es.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192et.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192eu.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192ev.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192ew.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192ex.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192ey.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192ez.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192fa.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192fb.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192fc.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192fd.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192fe.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192ff.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192fg.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
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192fi.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192fj.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192fk.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192fl.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192fm.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192fn.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192fo.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192fp.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192fq.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192fr.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192fs.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192ft.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192fu.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192fv.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192fw.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192fx.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192fy.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192fz.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192ga.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192gb.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192gc.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192gd.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192ge.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192gf.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192gg.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192gh.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192gi.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192gj.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192gk.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192gl.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192gm.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192gn.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192go.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192gp.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192gq.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192gr.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192gs.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192gt.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192gu.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192gv.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192gw.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192gx.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192gy.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192gz.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192ha.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192hb.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192hc.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192hd.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192he.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192hf.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192hg.  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ "  
192hh.  $5\frac{1$