

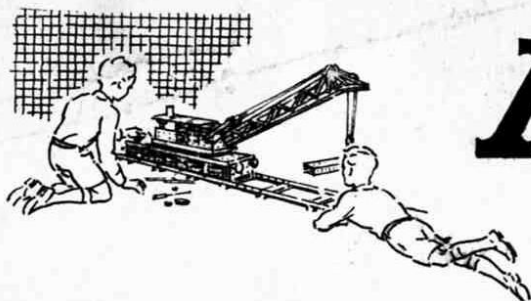
MECCANO



INSTRUCTIONS for OUTFITS Nos. 7 and 8

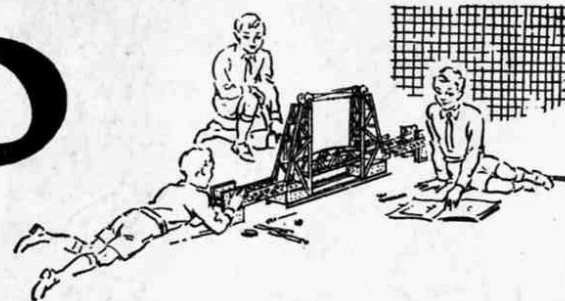
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52.7/8 *



MECCANO

Real Engineering in Miniature



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 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 feel the real thrill of the engineer and the inventor.

HOW TO BUILD UP YOUR OUTFIT

Meccano is sold in 11 different Outfits, ranging from No. 0 to No. 10. Each Outfit can be converted into the next larger by the purchase of an Accessory Outfit. Thus Meccano No. 0 Outfit can be converted into No. 1 Outfit by adding to it a No. 0a Accessory Outfit. No. 1a Outfit would then convert it into a No. 2 and so on. In this way, no matter with which Outfit you begin, you can build it up by degrees until you have a 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.

If you are not already a reader write to the Editor 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. Write for full particulars and an application form to the Secretary, Meccano Guild, Binns Road, Liverpool 13.

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*.

FOR ALL KEEN BOYS



MECCANO MAGAZINE

The happiest and most successful boys are those who take a keen interest in the world around them. The **'MECCANO MAGAZINE'** is the ideal paper for these boys. Month by month its pages are filled with attractively-written articles, splendidly illustrated from actual photographs.

The subjects include Engineering in all its branches, Railways, Road Transport, Aeroplanes and Shipping. Inventions and Scientific Discoveries are described in simple language. Everything is dealt with in an attractive and straightforward style, and with an accuracy that has won for the Magazine the enthusiastic approval of the engineering, technical and scientific world. Special sections are devoted to Model-building with Meccano, and to the operation of realistic Miniature Railways; and Stamp Collecting articles are another important feature. Competitions of all kinds, and of a variety to suit every reader, are announced each month.

The 'Meccano Magazine' is now 1/- monthly, not 9d. as stated overleaf.
The subscription rate is now 7/- for 6 months and 14/- for a year, inclusive of postage.

The '**MECCANO MAGAZINE**' is on sale at all bookstalls, newsagents and Meccano dealers, price 9d. It is best to place a regular order with your Meccano dealer or newsagent, to make sure that you do not miss any copies.

If you prefer to have each issue sent direct, all that is necessary is to fill in the order form below and to send this to the Editor at the address given, with a Postal Order to cover the cost, which is 11/- for a year, or 5/6 for six months, inclusive of postage in each case.

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CANADA: Meccano Ltd, 675 King Street West, Toronto.
AUSTRALIA: E. G. Page and Co. (Sales) Pty. Ltd, (P.O. Box 1832), Danks Building, 324 Pitt St., Sydney, N.S.W.
NEW ZEALAND: Models Ltd, (P.O. Box 129), 53 Fort Street, Auckland, C.1.
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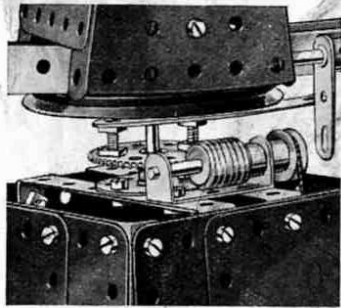
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HOW TO BEGIN THE FUN



A Worm and a 57-tooth Gear give a useful drive ratio for many models

THE MOST FASCINATING OF ALL HOBBIES

Meccano model-building is the most fascinating of all hobbies, because it never becomes dull. There is always something new to be done. First of all there is the fun of building a new model, and watching it take shape as part after part is added. Then, when the model is complete, comes the thrill of setting it to work just like the real structure it represents, by means of a Meccano Motor.

A FEW USEFUL HINTS

Beginners sometimes wonder which section of a model should be built first. There cannot be any definite rule for this, as it depends on the design of the model. In stationary models the base usually should be built first. In most of the smaller models a $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate forms an important part of the structure, and often the best plan is to start building by bolting parts to this Plate. For other models a good general rule is that the sections that form supports for a number of other parts should be built first.

Flexible Plates are sometimes used for forming curved surfaces in models, but they are not intended to be bent at right angles. With careful handling a Plate can be bent to the required curve and after use straightened again.

All Outfits from No. 2 upward include a Cord Anchoring Spring, Part No. 176. This part provides a neat and positive method of fastening a length of Cord to a Rod. When pushing the Spring on to a Rod or Crank Handle, turn left so that its coils tend to unwind; turn it in the same direction when pulling it off the Rod.

THE IMPORTANCE OF "LOCK-NUTTING"

In some models it is necessary to join certain parts together so that, although they cannot come apart, they are free to pivot or move in relation to one another. To do this the parts are bolted together as usual but the nut is not screwed up tightly, so that the parts are not gripped. Then, to prevent the nut from unscrewing, a second nut is screwed up tightly against it, the first nut being held with a spanner. This method of using a second nut is known as **Lock-nutting**.

A Rod is usually mounted in a support or bearing, such as a hole in a Strip, so that it is free to revolve. The Rod is then said to be **journalled** in the Strip.

During the construction of a model it is best to screw up the nuts with the fingers, followed by just a light turn with the screwdriver, leaving the final tightening with spanner and screwdriver until all the parts are connected up.

DRIVING YOUR MODELS

Models can be driven by means of either Clockwork or Electric Motors.

Small and light models may be driven direct from the driving pulley of the Motor or through a belt running over two pulleys of the same size, giving what is known as a 1 : 1 (one-to-one) ratio. For large models it is necessary to take the drive from a small pulley on the Motor shaft to a larger pulley on the driving shaft of the model. In most cases a 1" Pulley on the Motor shaft and a 3" Pulley on the model shaft will be found satisfactory. This provides a reduction ratio of approximately 3 : 1.

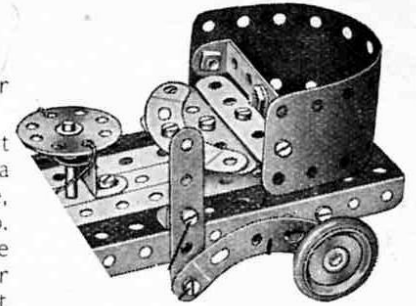
Rubber bands are very convenient for driving belts. Sometimes, however, a rubber band of the right length is not available, and then Meccano Cord or thin string is used. To tie the Cord to form an endless belt, use the familiar reef knot.

With the larger Outfits, belt drive can be replaced with advantage by gearing. To operate a slow-moving model demanding great power, such as a traction engine, gears that will provide a considerable reduction must be used. For example, a Worm meshed with a $\frac{1}{2}''$ Pinion will give a 19 : 1 reduction; a Worm meshed with a 57-tooth Gear will give a 57 : 1 reduction.

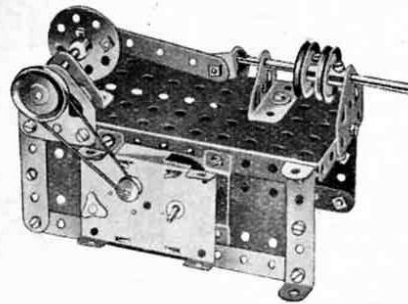
All the models in this Book were built up and tested in our model-building department. Some of them are shown fitted with a Motor, and provided that they are properly constructed the Motor will drive them satisfactorily.

If the Motor is to operate successfully however, there must be no excessive friction in the mechanism of the model. This can be caused by shafts and their bearings being slightly out of line, or by a belt or Cord drive being too tight. Before condemning the Motor therefore, first make sure that every revolving shaft moves quite freely in its bearings, and that the bearings are in line with one another. The bearings can be brought into line by pushing through them a Drift (Part No. 36c) or a Rod, before the bolts holding the various parts are tightened up. To make the running perfectly smooth, apply a little light machine oil to every bearing or pivot on which moving parts are mounted.

The models included in this Book give a good idea of the various types of Meccano construction, and provide a guide to the building of a large number of other models with this Outfit. If any difficulty should arise in planning a new model, write to Information Service, Meccano Ltd., Binns Road, Liverpool 13, and all possible help will be given.

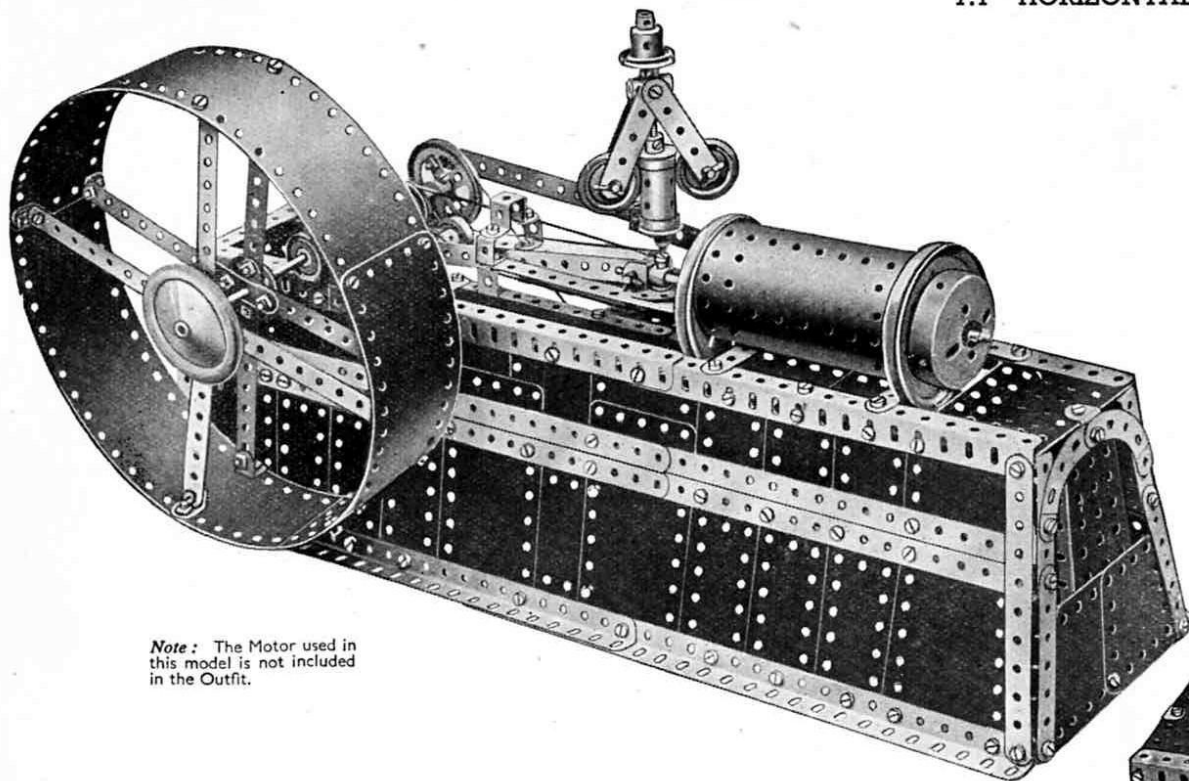


A Flexible Plate used to form a curved surface.



A Magic Motor fitted to drive a Steam Engine.

7.1 HORIZONTAL STEAM ENGINE



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

Each web of the crankshaft consists of three $2\frac{1}{2}$ " Strips fastened together in the form of a triangle and bolted to a Crank, the bolt holding also a $1\frac{1}{2}$ " Strip. The Cranks are secured on the ends of a 2" Rod and a 5" Rod respectively, and a 2" Rod is passed through the end holes of the $1\frac{1}{2}$ " Strips and retained in place by Collars and $\frac{3}{8}$ " Flanged Wheels. Bearings for the crankshaft are supplied by Trunnions and Flat Trunnions. The 2" member of the crankshaft carries a 1" Pulley and a 2" Pulley, while the 5" member is fitted with a 1" Pulley, the built-up fly-wheel and a Road Wheel.

The crosshead 1 consists of two Wheel Discs spaced apart by two Washers and mounted on a $\frac{3}{8}$ " Bolt. Three other Washers are used to space the Wheel Discs from the boss of the large Fork Piece. The connecting rod is pivoted on a 1" Rod that has eight Washers placed on it for spacing purposes. Bolt 3 on the slide valve connecting rod is lock-nutted.

The governor shaft is a $6\frac{1}{2}$ " Rod. The $2\frac{1}{2}$ " Strips are pivoted on bolts screwed into a Coupling, and the $\frac{1}{2}$ " Bolts 2 are lock-nutted. Bearings for the governor shaft are supplied by a Double Bent Strip and the $3\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flanged Plate.

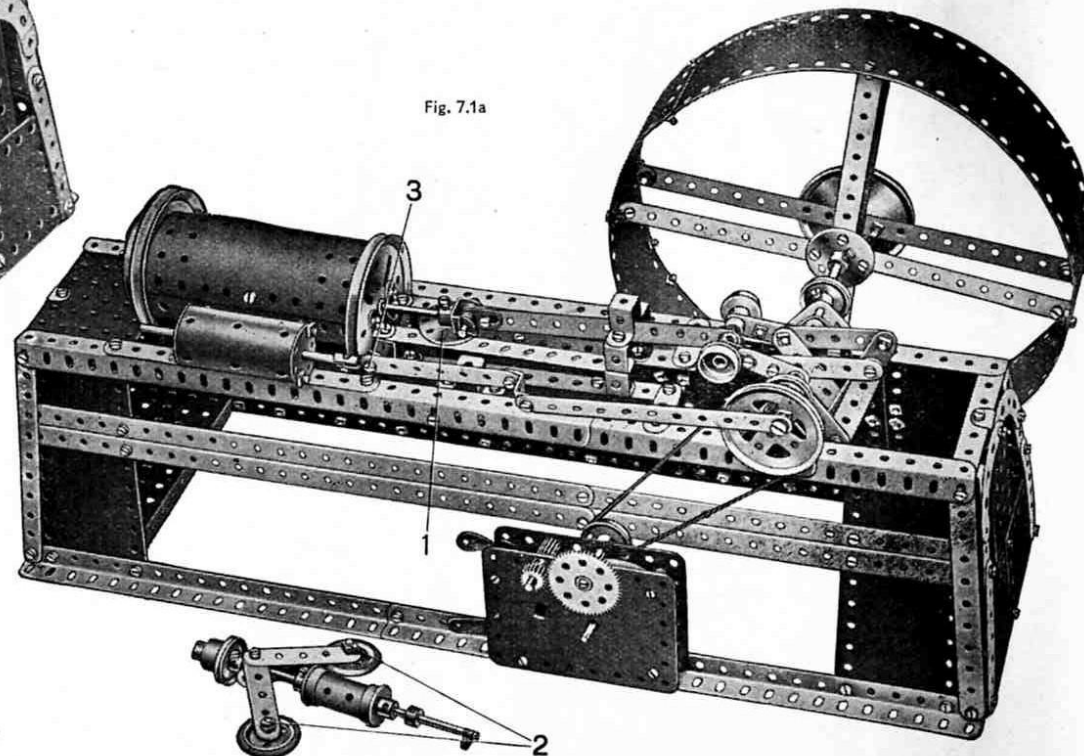
The model is driven by a No. 1 Clockwork Motor. The drive is taken from a 1" Pulley on a $1\frac{1}{2}$ " Rod in the Motor side plates to the 2" Pulley on the crankshaft. The drive to the governor is taken from the 1" Pulley on the crankshaft to the shaft of the governor.

The base should first be constructed as shown in the illustrations. The lower Angle Girders are spaced by two $5\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flanged Plates, and the upper Angle Girders are joined by two $3\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flanged Plates placed one at each end of the cylinder and spaced 11 holes apart. The other ends of the Angle Girders are spaced by a $3\frac{1}{2}$ " Strip. The inner $3\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flanged Plate is extended on each side of the connecting rod by compound plates, which are made from two $2\frac{1}{2}$ " \times $1\frac{1}{2}$ " Flexible Plates overlapped two holes, and are reinforced round the edges with $5\frac{1}{2}$ " and $1\frac{1}{2}$ " Strips. This forms the bed-plate.

The boiler that represents the cylinder of the engine is opened out slightly and its edges are joined together by an Obtuse Angle Bracket. The $2\frac{1}{2}$ " Cylinder representing the valve chest is carried on two Bolts, which have two Washers on their shanks for spacing purposes. The cylinder is bolted to a $3\frac{1}{2}$ " Strip and a compound strip consisting of two 3" Strips overlapped five holes. The ends of these Strips are clamped between the Angle Girder and $2\frac{1}{2}$ " Strips below the valve chest. The rear end of the cylinder is represented by a 3" Pulley and a Boiler End, both of which are carried on a 2" Rod that is held by Spring Clips in a $1\frac{1}{2}$ " \times $\frac{1}{2}$ " Double Angle Strip bolted inside the cylinder.

The other end of the cylinder is carried by two Angle Brackets bolted to Reversed Angle Brackets, which in turn are fastened to the $3\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flanged Plate. Each bolt holding the Angle Brackets carries also a $5\frac{1}{2}$ " Strip and a Washer. The free ends of the $5\frac{1}{2}$ " Strips are bolted between Double Brackets (see Fig. 7.1a), the lower two of which are bolted to the bed-plate, while the upper two are joined by a Double Bent Strip. This construction forms the slide for the crosshead.

Fig. 7.1a



7.2 STEAM ROLLER

The construction of the model is commenced by opening out a Boiler to such an extent that two Semi-Circular Plates bolted together overlapping one hole will just fit inside its end. An Angle Girder is then bolted along each side of the Boiler and a $3\frac{1}{2} \times 2\frac{1}{2}$ " Flanged Plate is fastened to them by a $2\frac{1}{2} \times \frac{1}{2}$ " Double Angle Strip, placed directly behind the Boiler.

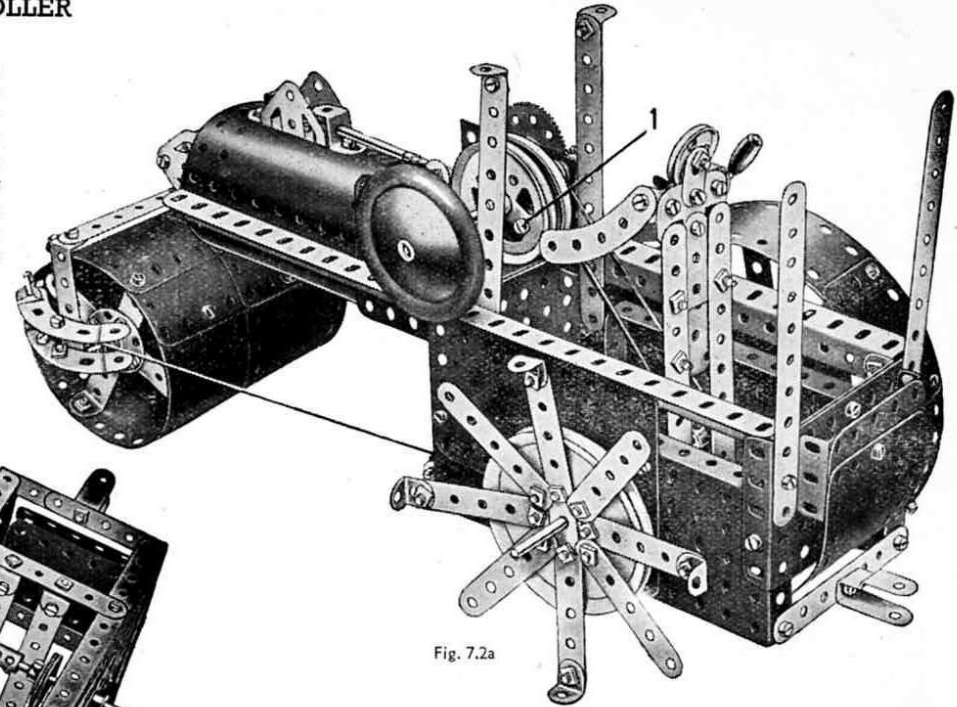


Fig. 7.2a

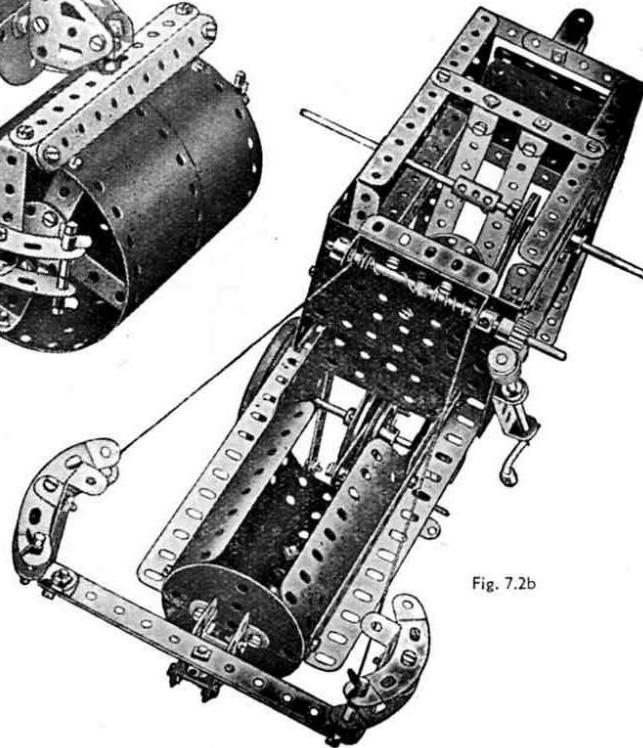


Fig. 7.2b

A second $3\frac{1}{2} \times 2\frac{1}{2}$ " Flanged Plate is secured lengthways across the bottom of the first, and to the flanges of the second Plate are bolted the halves of a Hinged Plate that form the sides of the cab. Another $3\frac{1}{2} \times 2\frac{1}{2}$ " Flanged Plate is bolted to the rear ends of the two Angle Girders, to form the back of the cab. A $2\frac{1}{2} \times 1\frac{1}{2}$ " Flanged Plate carrying a $1\frac{1}{8}$ " radius Curved Plate is fastened to the back of the cab by a $\frac{3}{8}$ " Bolt, as shown in Fig. 7.2a.

The construction and arrangement of the crankshaft and cylinder is clear from the illustration. The $\frac{1}{2}$ " fast Pulley on the crankshaft is driven from a 1" fast Pulley on the back axle by means of a Driving Band. The connecting rod is a $2\frac{1}{2}$ " Strip pivoted on a $\frac{3}{8}$ " Bolt 1.

The back axle consists of two $3\frac{1}{2}$ " Rods joined by a Coupling, and each of the rear wheels is built up by bolting $5\frac{1}{2}$ " and $2\frac{1}{2}$ " Strips across a 3" Pulley to form spokes.

The rim, which consists of three $5\frac{1}{2} \times 1\frac{1}{2}$ " Flexible Plates and two $2\frac{1}{2} \times 1\frac{1}{2}$ " Flexible Plates bolted end to end, is then fastened to the ends of the $5\frac{1}{2}$ " Strips by Angle Brackets. One of the back wheels with rim removed is shown in Fig. 7.2a.

The roller is constructed 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 and is mounted on an axle passed through the centres of two Wheel Discs, which are secured inside the roller by $3\frac{1}{2} \times \frac{1}{2}$ " Double Angle Strips. The axle is supported by two Double Angle Strips, that are secured at their upper ends to a $5\frac{1}{2}$ " Strip. The $5\frac{1}{2}$ " Strip is held by a lock-nutted Pivot Bolt passed through the boss of the large Fork Piece. This latter is secured by a Double Bent Strip and two Flat Trunnions to the Semi-Circular Plates, which are fastened in the front of the Boiler by a $2\frac{1}{2} \times \frac{1}{2}$ " Double Angle Strip.

The canopy consists of two $12\frac{1}{2}$ " Strip Plates and two Angle Girders and is supported from the cab by $5\frac{1}{2}$ " Strips. The chimney is represented by two Sleeve Pieces joined by a Chimney Adaptor and is held in position by a 5" Rod passed through their centres. The Rod carries also a $\frac{3}{8}$ " Flanged Wheel and a 1" Pulley above the canopy.

7.3 RAILWAY BREAKDOWN CRANE

Each side of the crane truck is made by bolting two $2\frac{1}{2}$ " Strips to a $2\frac{1}{2}$ " \times $1\frac{1}{2}$ " and two $5\frac{1}{2}$ " \times $1\frac{1}{2}$ " Flexible Plates. A third $12\frac{1}{2}$ " Strip 2 is attached to the side by Angle Brackets. The sides are fastened to the $5\frac{1}{2}$ " Strips 3 by $1"$ \times $1"$ Angle Brackets 4 (Fig. 7.3a), and are connected at each end by a compound strip 5 and two $2\frac{1}{2}$ " \times $1\frac{1}{2}$ " Flexible Plates. The strip 5 consists of two $2\frac{1}{2}$ " Strips bolted together.

A $5\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flanged Plate 6 and five $5\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flexible Plates fill in the top of the truck. A $12\frac{1}{2}$ " Angle Girder is bolted to the edges of the Flexible Plates and is fixed to the Strips 3.

The truck runs on our $\frac{3}{4}$ " Flanged Wheels. These are locked in pairs on 5" Rods journaled in Curved Strips fastened to the sides. The buffers are represented by 1" Pulleys locked on Rods fixed in the Cranks 7.

A $1\frac{1}{2}$ " Rod is locked in a 3" Pulley 8 (Fig. 7.3b). This Pulley is attached to the Flanged Plate 6 by four Double Brackets.

The superstructure of the crane is formed by two $12\frac{1}{2}$ " Strips held together at each end by $3\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flanged Plates 9, and in the centre by a similar Plate 10 (Fig. 7.3c). The sides of the cab consist of one half of a Hinged Flat Plate and a $2\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flexible Plate bolted to the $12\frac{1}{2}$ " Strips. The roof is formed by two $4\frac{1}{2}$ " \times $2\frac{1}{2}$ " and two $2\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flexible Plates bolted together and strengthened along their edges by a $5\frac{1}{2}$ " and a $2\frac{1}{2}$ " Strip overlapped three holes. It is attached to Formed Slotted Strips bolted to four $5\frac{1}{2}$ " Strips 11.

A 3" Pulley is bolted to the Flanged Plate 10 and to a $3\frac{1}{2}$ " \times $\frac{1}{2}$ " Double Angle Strip attached to the $12\frac{1}{2}$ " Strips forming the side of the superstructure. The $1\frac{1}{2}$ " Rod locked in the Pulley 8 is passed through the boss of the 3" Pulley, and a Collar is used to hold the superstructure in position.

The housing for the winding mechanism is built up from Flanged Sector Plates bolted to the Flanged Plates 9 and 10.

Each side of the jib consists of two $12\frac{1}{2}$ " Angle Girders bolted at their lower ends to a Flat Trunnion, and at their upper ends to a $2\frac{1}{2}$ " Strip. The jib head is shaped by extending the Angle Girders by a Curved Strip 12 and a $1\frac{1}{2}$ " Strip 13.

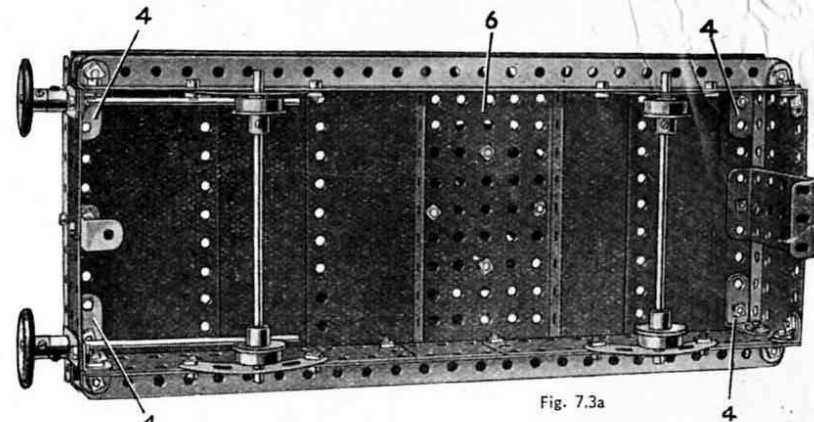
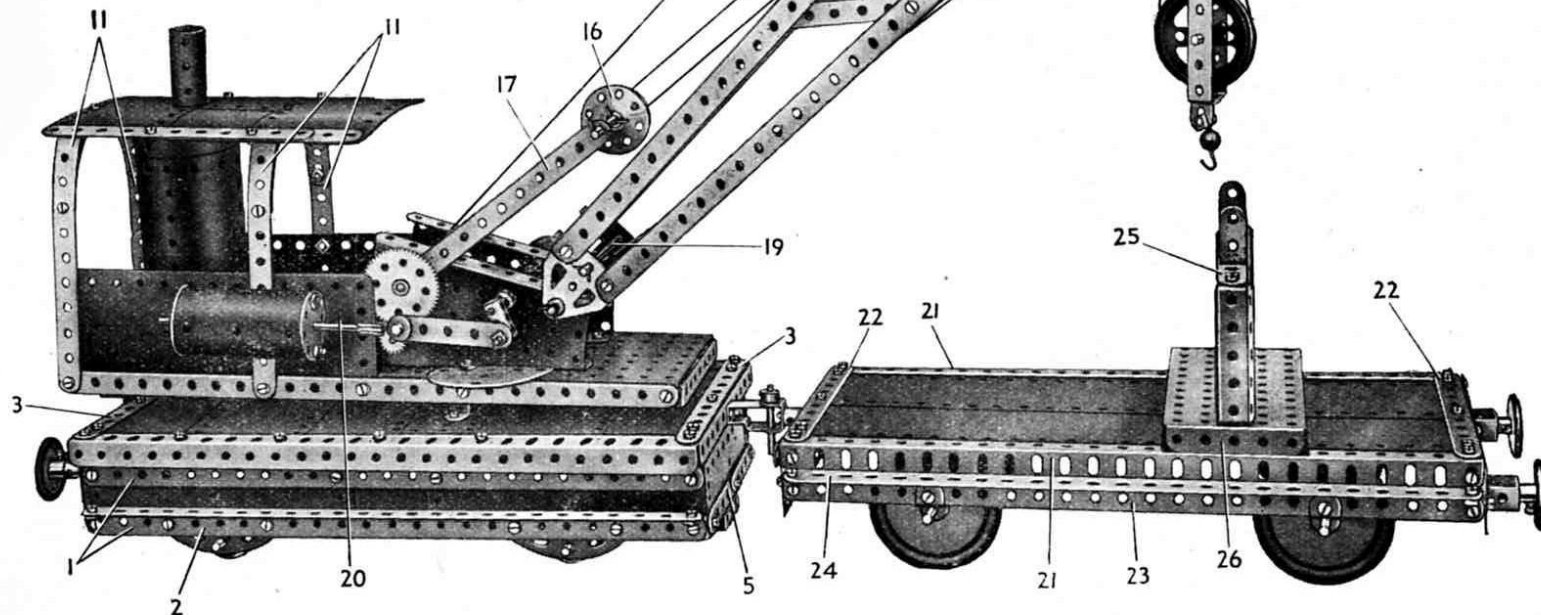


Fig. 7.3a

A $3\frac{1}{2}$ " Strip attached to the Curved Strip 12 is connected by a Fishplate to a $2\frac{1}{2}$ " Strip bolted to the Strip 13. The sides of the jib are joined at their lower ends by a $2\frac{1}{2}$ " Strip, and are bolted at the jib head to a $1\frac{1}{2}$ " \times $\frac{1}{2}$ " Double Angle Strip.

The jib pivots about a $3\frac{1}{2}$ " Rod passed through the Flat Trunnions and the Flanged Sector Plates. It is luffed by means of the Crank Handle 14. A $\frac{1}{2}$ " Pinion locked on the Crank Handle meshes with a 57-tooth Gear on a $3\frac{1}{2}$ " Rod 15. A length of Cord extending from this Rod passes around a 2" Pulley mounted between Trunnions bolted to the jib. The Cord is then passed around a built up pulley 16 and is tied to the upper end of the jib. The built-up pulley is a $\frac{1}{2}$ " loose Pulley held by Spring Clips between two Wheel Discs. It is free to turn on a $3\frac{1}{2}$ " Rod journaled in $5\frac{1}{2}$ " Strips 17. These Strips are pivoted about the Rod 15.

Movement of the load is controlled by a 5" Crank Handle 18 journaled in the Flanged Sector Plates. A length of Cord from this Crank Handle is passed under a $3\frac{1}{2}$ " Rod 19 and over a 1" loose Pulley in the jib head. It is then passed around a 2" Pulley in the pulley block and a second 1" loose Pulley in the jib head, and tied to the top of the pulley block.

The pulley block assembly consists of two $2\frac{1}{2}$ " \times $\frac{1}{2}$ " Double Angle Strips bolted together. A 2" Pulley is fixed on a 1" Rod journaled in the Double Angle Strips, and a Loaded Hook is attached by an Angle Bracket.

A Coupling is locked at the end of the Crank Handle 18. A $2\frac{1}{2}$ " Strip is pivoted to this by a Threaded Pin. The $2\frac{1}{2}$ " Strip is then lock-nutted to a Rod and Strip Connector fixed to a $4\frac{1}{2}$ " Rod 20. This Rod passes through the centre holes of two Wheel Discs, which are held by Screwed Rods at the ends of a $2\frac{1}{2}$ " Cylinder. The Cylinder is bolted to the side of the cab.

The match truck is made by bolting $12\frac{1}{2}$ " Angle Girders 21 to $5\frac{1}{2}$ " Strips 22. The top of the truck is filled in by two $12\frac{1}{2}$ " Strip Plates. A $12\frac{1}{2}$ " Strip 23 on each side is attached by Fishplates to the Angle Girders 21, and a similar Strip 24 is held in place by Angle Brackets. The ends of the truck are formed by $5\frac{1}{2}$ " \times $1\frac{1}{2}$ " Flexible Plates strengthened by $5\frac{1}{2}$ " Strips and fastened to the sides and top by Angle Brackets.

(Continued on next page)

7.3 BREAKDOWN CRANE—Continued

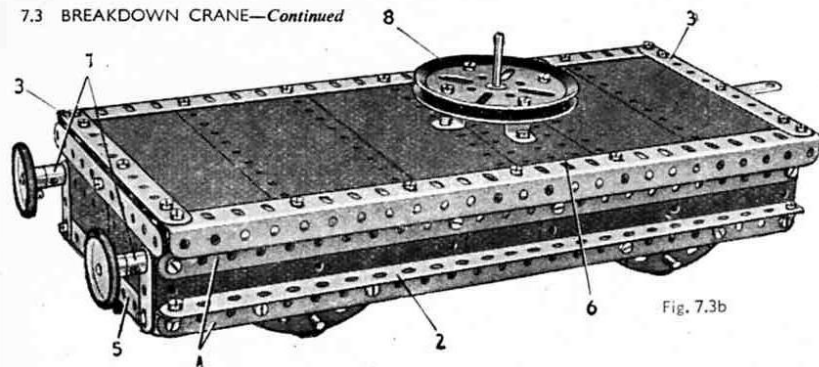


Fig. 7.3b

The truck runs on four Road Wheels locked on compound rods, each of which is made by joining a 3" and a 2" Rod together by a Rod Connector. The rods are journaled in Reversed Angle Brackets bolted to the Strips 23.

The jib is supported by a $2\frac{1}{2}$ " \times 1" Double Angle Strip bolted to a $5\frac{1}{2}$ " Strip 25. This Strip is carried at each end by three $2\frac{1}{2}$ " \times $\frac{1}{2}$ " Double Angle Strips held by a $\frac{3}{4}$ " Bolt. The $\frac{3}{4}$ " Bolts are passed through a $5\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flanged Plate 26 and held by a nut to the Angle Girders 21.

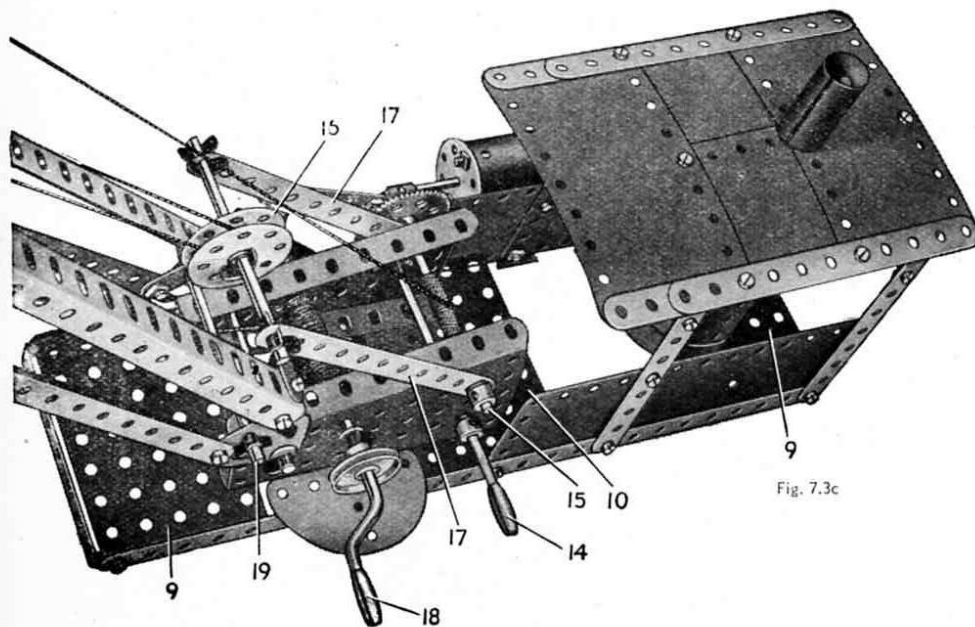
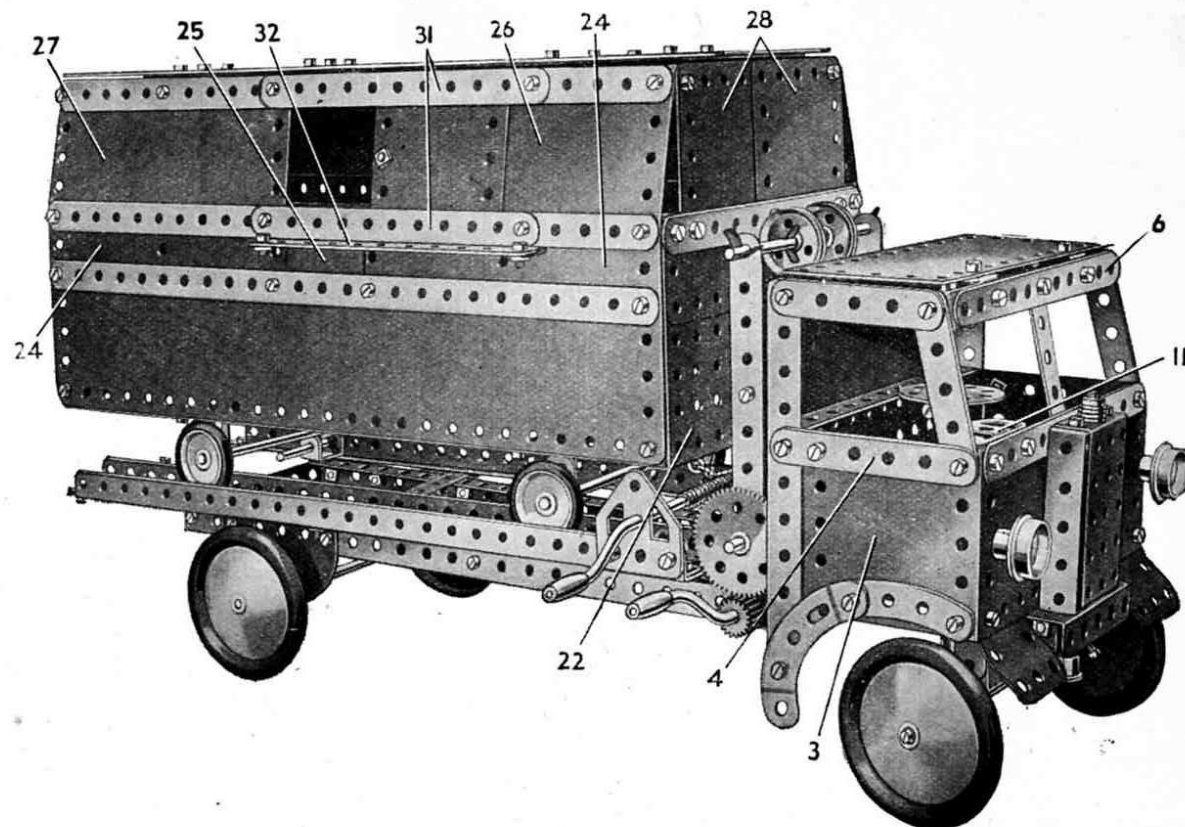


Fig. 7.3c

7.4 REFUSE VEHICLE



It is best to commence construction of the lorry by building the chassis, which consists of two $12\frac{1}{2}$ " Angle Girders joined at the rear by a $3\frac{1}{2}$ " \times $\frac{1}{2}$ " Double Angle Strip and bolted at the front to a $5\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flanged Plate 1 (Fig. 7.4b). The chassis is extended by a $3\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flanged Plate 2 (Fig. 7.4a) bolted to the Plate 1.

The cab is made by attaching $5\frac{1}{2}$ " Strips to the sides of the Flanged Plate 1. Each side consists of a $2\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flexible Plate 3 bolted to a 3" Strip 4. The front is formed by a $5\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flexible Plate attached to the Strips 4 and Flexible Plates 3 by Angle Brackets. The back of the cab consists of a $5\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flexible Plate fastened to the Flanged Plate 1 and to two $2\frac{1}{2}$ " \times $\frac{1}{2}$ " Double Angle Strips, one of which is seen at 5. The $5\frac{1}{2}$ " Strip 6 is also attached to two $2\frac{1}{2}$ " \times $\frac{1}{2}$ " Double Angle Strips, and the roof is formed by a $5\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flexible Plate bolted to two similar Double Angle Strips 7.

To represent the radiator $2\frac{1}{2}$ " \times $\frac{1}{2}$ " Double Angle Strips are attached to each side of a $2\frac{1}{2}$ " \times $1\frac{1}{2}$ " Flanged Plate bolted to the Flanged Plate 2.

The front axle is formed by two $3\frac{1}{2}$ " Strips overlapped five holes and fastened to a $2\frac{1}{2}$ " \times $\frac{1}{2}$ " Double Angle Strip 8 (Fig. 7.4a). This Strip is attached to a $2\frac{1}{2}$ " \times 1" Double Angle Strip bolted to the Flanged Plate 2. The front wheels are free to turn on $\frac{3}{4}$ " Bolts held in the Collars

(Continued on next page)

7.4 REFUSE VAN—Continued

9 and 10. A Washer is placed on each Bolt for spacing purposes. The Collar 9 is locked on a 5" Rod mounted in a Trunnion 11, a Reversed Angle Bracket 12 and in the end of the axle beam. The end of this Rod is fitted with a Crank 14. The Collar 10 is locked on a 1½" Rod journalled in a Reversed Angle Bracket 15 and in the end of the axle beam. A Crank 16 is fixed on the 1½" Rod and connected to the Crank 14 by a compound strip consisting of two 3½" Strips overlapped five holes. The bolts securing this strip to the Cranks are lock-nutted.

The rear axle is a 3½" Rod joined to a 2" Rod by a Rod Connector, and is mounted in Semi-Circular Plates bolted to the chassis.

The channel girders forming the tipping platform are each made from two 12½" Angle Girders bolted together. A Washer is placed on each bolt between the Angle Girders to space them slightly and allow the sliding extension to move freely. The channel girders are connected by two compound strips, each consisting of two 2½" Strips bolted together. The sliding extension is formed by two 5½" Strips joined together at their ends by two 2½" Strips.

The platform is pivotally mounted on the chassis by 1½" Rods journalled in the Double Brackets 17 (Fig. 7.4b). The tipping mechanism consists of 5½" Strips 18 bolted to Flat Trunnions attached to the chassis. The Strips 18 are connected by a 3½" × 2½" Flanged Plate. Tipping is controlled by a Crank Handle journalled in the chassis and a 1" × 1" Angle Bracket 19. A ½" Pinion on the Crank Handle meshes with a 57-tooth Gear on a 4½" Rod 20. This Rod is mounted in the Strips 18 and is fitted with a winding drum formed by a Sleeve Piece and two ¾" Flanged Wheels. Two lengths of Cord from the drum pass over the 1" loose Pulleys 21 and are tied to the end of the platform.

To build the chassis of the refuse container two 12½" Angle Girders are joined by a 5½" × 2½" Flanged Plate 22 and three 5½" Strips 23. Each side of the container consists of a 12½" Strip Plate, two 5½" × 1½" Flexible Plates 24, a 2½" × 1½" Flexible Plate 25, a 4½" × 2½" Flexible Plate 26 and a 5½" × 2½" Flexible Plate 27. The sides are strengthened by three 12½" Strips and attached by Angle Brackets to the 2½" × 2½" Flexible Plates 28 and a Hinged Flat Plate 29. The top is filled in by six 12½" Strips and a 5½" × 2½", a 5½" × 1½" and a 2½" × 2½" Flexible Plate bolted together. These Strips and Flexible Plates are attached to two Flanged Sector Plates, fastened to the sides by Obtuse Angle Brackets.

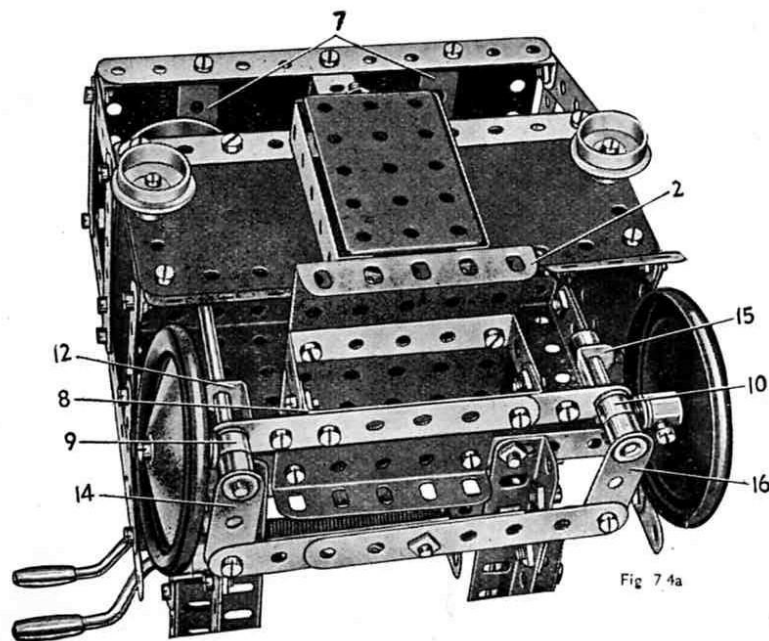


Fig. 7.4a

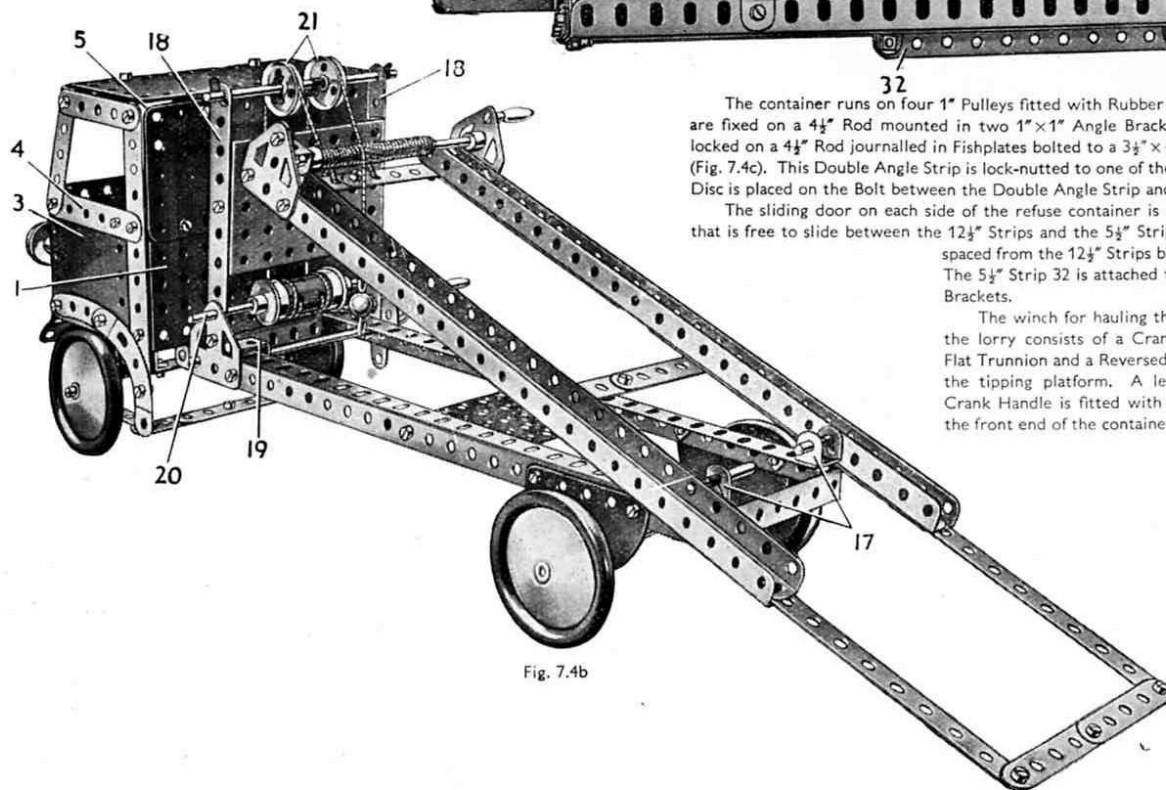


Fig. 7.4b

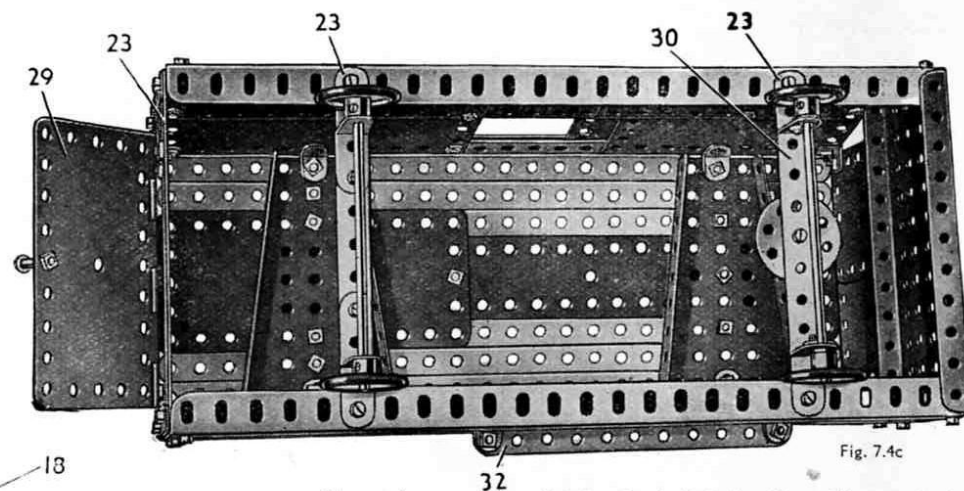


Fig. 7.4c

The container runs on four 1" Pulleys fitted with Rubber Rings. The rear wheels are fixed on a 4½" Rod mounted in two 1" × 1" Angle Brackets. The front pair are locked on a 4½" Rod journalled in Fishplates bolted to a 3½" × ½" Double Angle Strip 30 (Fig. 7.4c). This Double Angle Strip is lock-nutted to one of the 5½" Strips 23. A Wheel Disc is placed on the Bolt between the Double Angle Strip and the 5½" Strips.

The sliding door on each side of the refuse container is a 2½" × 2½" Flexible Plate that is free to slide between the 12½" Strips and the 5½" Strips 31. The Strips 31 are spaced from the 12½" Strips by a Washer on each bolt. The 5½" Strip 32 is attached to the side by two Angle Brackets.

The winch for hauling the refuse container on to the lorry consists of a Crank Handle mounted in a Flat Trunnion and a Reversed Angle Bracket bolted to the tipping platform. A length of Cord from the Crank Handle is fitted with a Hook and attached to the front end of the container.

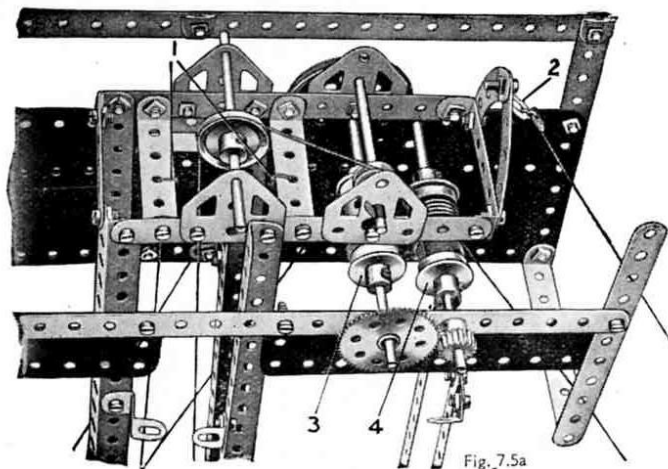


Fig. 7.5a

The roof consists of a Hinged Flat Plate extended on each side by $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plates, each of these overlapping the Hinged Flat Plate by two holes. The roof is attached to the sides by Obtuse Angle Brackets, and the back of the cabin, which consists of a $5\frac{1}{2}'' \times 2\frac{1}{2}''$ and a $5\frac{1}{2}'' \times 1\frac{1}{2}''$ Flexible Plate, is attached by two $1'' \times 1''$ Angle Brackets.

The $5\frac{1}{2}''$ Strips carrying the $1''$ Pulleys of the carriage are pivoted on a locknutt $\frac{3}{4}''$ Bolt, which carries a Collar and two Washers for spacing purposes and is supported by a Stepped Bent Strip. The $\frac{3}{4}''$ Bolt at the junction of the $2\frac{1}{2}''$ Strips carries five Washers on its shank, to space the Strips apart.

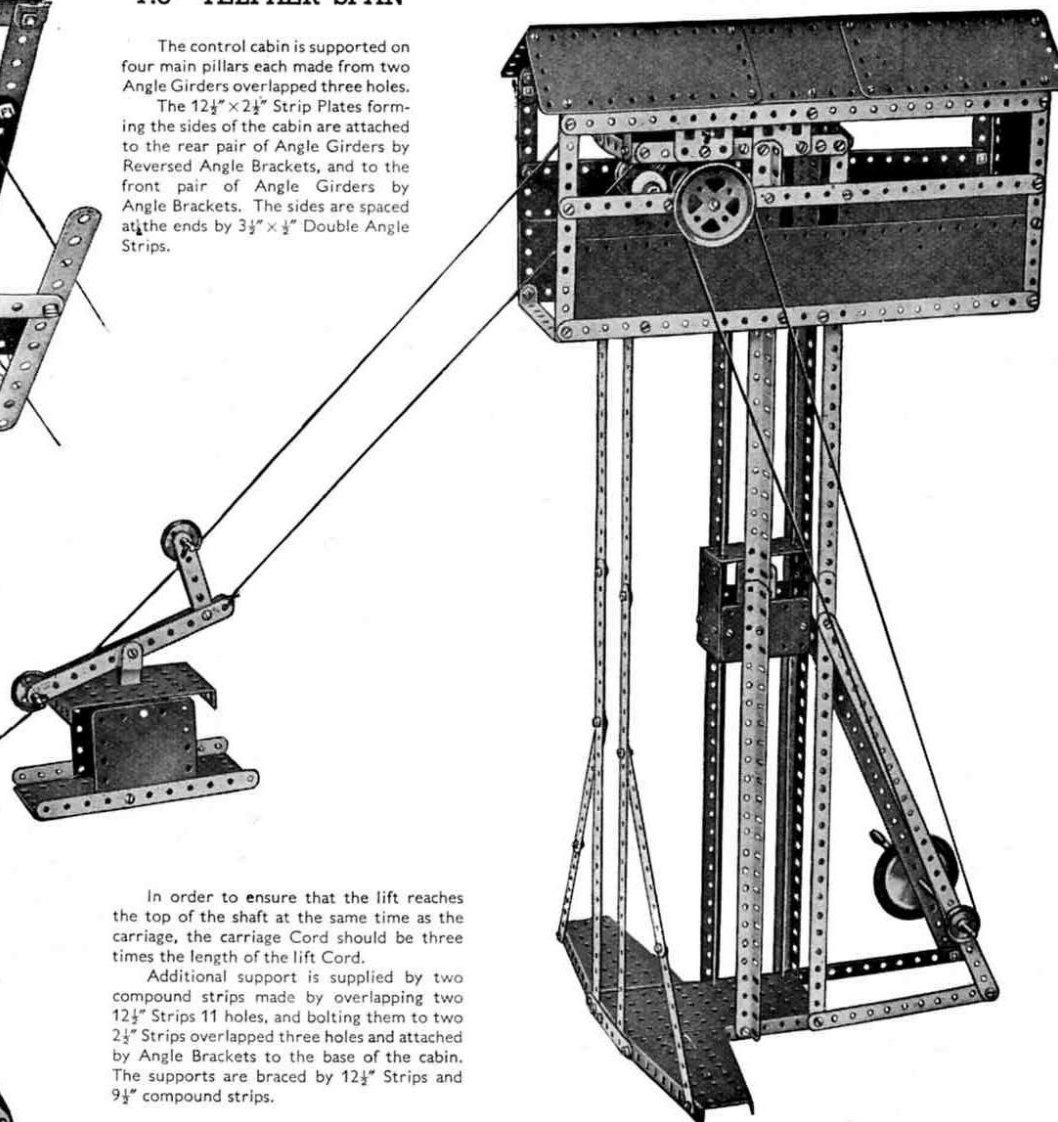
Fig. 7.5a shows the cab with the roof removed to reveal the arrangement of the hoisting drums. The guide Cords for the elevator are tied at 1, and the guide Cord for the carriage is tied to an Obtuse Angle Bracket 2. Cord is tied around a $\frac{1}{2}''$ loose Pulley fastened to a $1'' \times 1''$ Angle Bracket on the lift, and then passes over a $1''$ fast Pulley and a $\frac{1}{2}''$ fast Pulley at the top of the shaft and finally is wound around hoisting drum 3. A second Cord is tied to the carriage and is wound around hoisting drum 4.

A Crank Handle passed through holes in the $12\frac{1}{2}''$ Strips bracing the Angle Girders carries a $1''$ fast Pulley that is connected by a belt of Cord to a $2''$ Pulley fastened on the $5''$ Rod carrying hoisting drum 3. A 57-tooth Gear on this Rod meshes with a $\frac{1}{2}''$ Pinion on the $5''$ Rod of hoisting drum 4.

7.5 TELPHER SPAN

The control cabin is supported on four main pillars each made from two Angle Girders overlapped three holes.

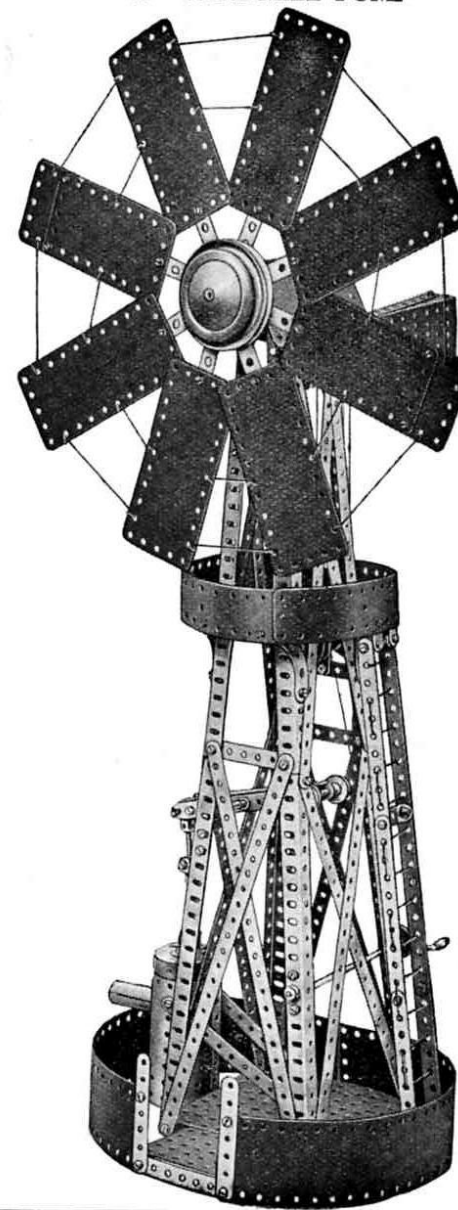
The $12\frac{1}{2}'' \times 2\frac{1}{2}''$ Strip Plates forming the sides of the cabin are attached to the rear pair of Angle Girders by Reversed Angle Brackets, and to the front pair of Angle Girders by Angle Brackets. The sides are spaced at the ends by $3\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips.



In order to ensure that the lift reaches the top of the shaft at the same time as the carriage, the carriage Cord should be three times the length of the lift Cord.

Additional support is supplied by two compound strips made by overlapping two $12\frac{1}{2}''$ Strips 11 holes, and bolting them to two $2\frac{1}{2}''$ Strips overlapped three holes and attached by Angle Brackets to the base of the cabin. The supports are braced by $12\frac{1}{2}''$ Strips and $9\frac{1}{2}''$ compound strips.

7.6 WINDMILL PUMP



7.6 WINDMILL PUMP—Continued

The base for the windmill is constructed by bolting two $5\frac{1}{2}" \times 2\frac{1}{2}"$ Flanged Plates together by their long flanges. The four compound girders forming the tower each consist of two $12\frac{1}{2}"$ Angle Girders overlapped two holes and are bolted one at each corner of the base and braced across by $12\frac{1}{2}"$ Strips. The roof of the windmill is represented by a Hinged Flat Plate, and is secured by Angle Brackets to the ends of two $2\frac{1}{2}"$ Strips, each of which is bolted across a pair of Angle Girders.

In Fig. 7.6a, one half of the Hinged Flat Plate is thrown back to show the bearing for the main shaft. The latter is a 5" Rod and at one end it carries a $\frac{1}{2}"$ Pinion, and at its other end a 3" Pulley that supports the sails. The $\frac{1}{2}"$ Pinion meshes with a 57-tooth Gear on a $4\frac{1}{2}"$ Rod journalled directly below the 5" Rod. The $4\frac{1}{2}"$ Rod carries also two 1" Pulleys, which are connected by Cord to two more 1" Pulleys on a $3\frac{1}{2}"$ Rod journalled midway up the tower. A 2" Pulley on the $3\frac{1}{2}"$ Rod is driven by Cord from a 1" Pulley on a large Crank Handle. The Crank Handle is extended by a $1\frac{1}{2}"$ Rod, using a Rod Connector, and is journalled in the two right-hand Angle Girders. The $3\frac{1}{2}"$ Rod journalled midway up the tower carries at its inner end a Bush Wheel, to which a $5\frac{1}{2}"$ Strip is connected by a Threaded Pin, the other end of the Strip being pivotally attached to a beam consisting of three $5\frac{1}{2}"$ Strips secured together by Double Brackets. The other end of the beam is connected to a pump as shown in Fig. 7.6a.

Six of the sails are represented by $5\frac{1}{2}" \times 2\frac{1}{2}"$ Flexible Plates and the remaining two sails are each constructed by bolting a $2\frac{1}{2}" \times 2\frac{1}{2}"$ Flexible Plate to a $4\frac{1}{2}" \times 2\frac{1}{2}"$ Flexible Plate overlapping three holes. The sails are attached to the 3" Pulley by six $2\frac{1}{2}"$ and two $3\frac{1}{2}"$ Strips.

The inspection platform is formed by four $5\frac{1}{2}" \times 1\frac{1}{2}"$ Flexible Plates and is secured to the framework by small radius Curved Strips and Angle Brackets. The steps are represented by Cord threaded through compound strips, each of which consists of three $5\frac{1}{2}"$ Strips.

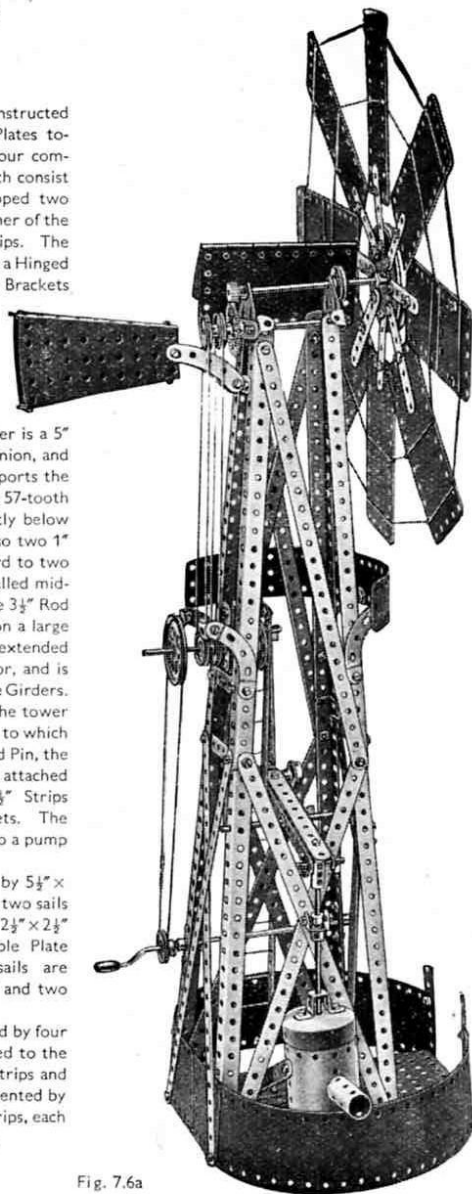


Fig. 7.6a

7.7 PITHEAD GEAR

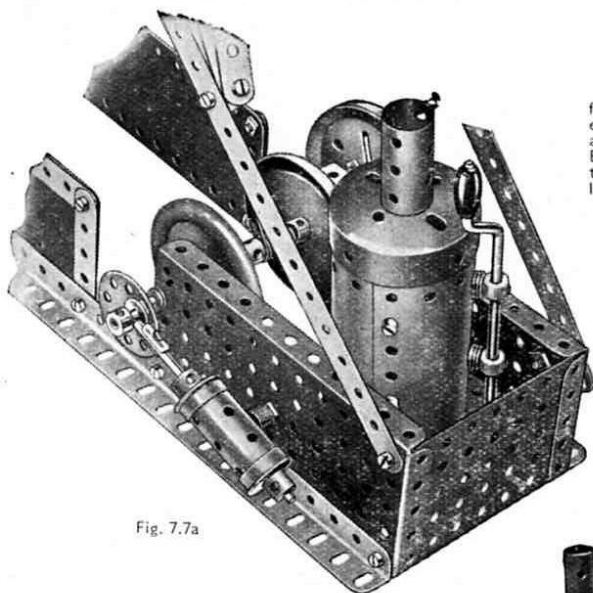


Fig. 7.7a

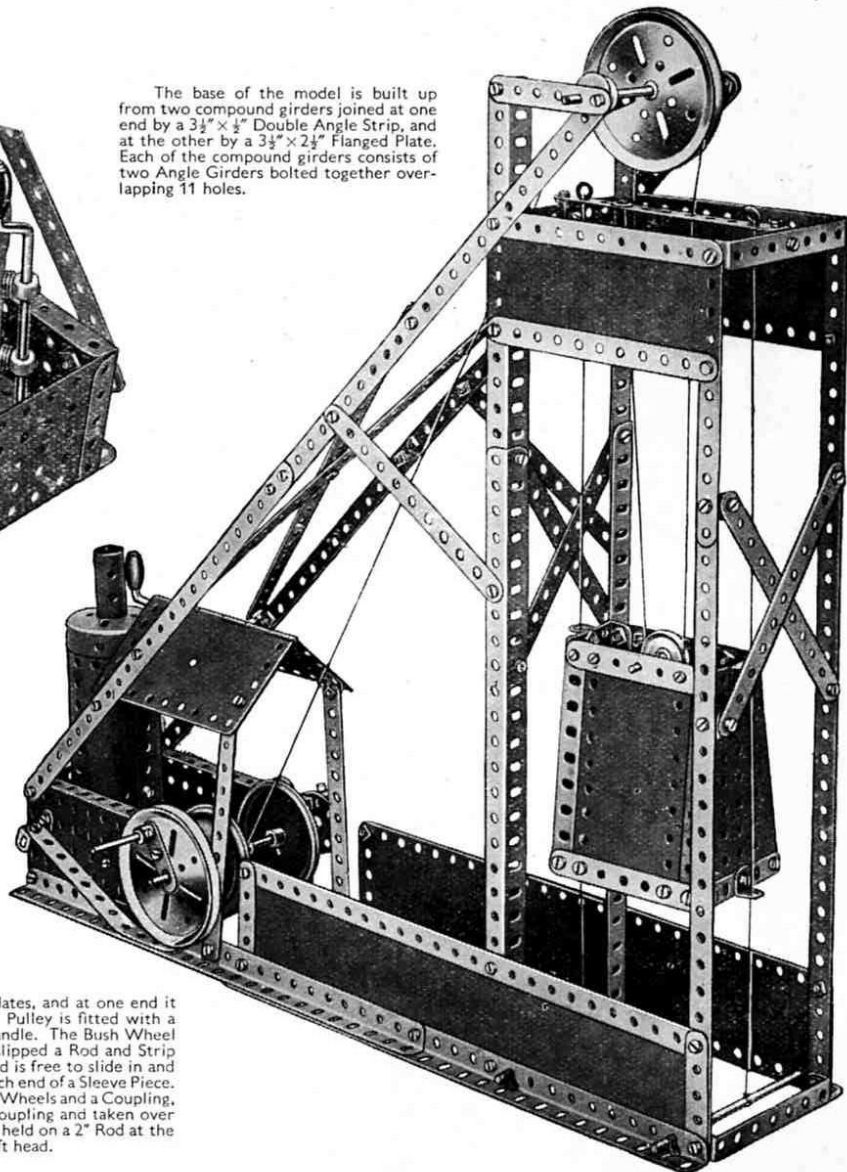
The corners of the pit shaft nearest to the control cabin are each formed by two Angle Girders, which are secured together but overlapped 11 holes. The lower ends of these compound girders are bolted to the base. Each of the other two corners of the pit shaft is formed by a $12\frac{1}{2}"$ Strip, bolted to the base and extended upwards by a $5\frac{1}{2}"$ Strip. The Angle Girders and Strips are secured together at the top by $5\frac{1}{2}"$ Strips and $3\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strips.

The cage is constructed by bolting a Flanged Sector Plate to each flange of a $3\frac{1}{2}" \times 2\frac{1}{2}"$ Flanged Plate. The open sides of the cage are filled in by $4\frac{1}{2}" \times 2\frac{1}{2}"$ Flexible Plates, which are bolted to $3\frac{1}{2}"$ Strips secured across the flanges of the Flanged Sector Plates. Two Angle Brackets are bolted to the outer side of each Flanged Sector Plate to receive the guide Cord.

Each guide Cord is tied to a 5" Rod journalled in the sides of the base, then led through a hole in the $5\frac{1}{2}"$ Strip secured across the top of the pit shaft, and tied to a Washer. The sides of the control cabin are formed by two $5\frac{1}{2}" \times 2\frac{1}{2}"$ Flanged Plates bolted to the base. A Hinged Flat Plate is used for the roof, and at each side is fastened by an Obtuse Angle Bracket to a $5\frac{1}{2}"$ Strip bolted to the base.

A $4\frac{1}{2}"$ Rod is journalled in the two $5\frac{1}{2}" \times 2\frac{1}{2}"$ Flanged Plates, and at one end it carries a 3" Pulley and at the other a Bush Wheel. The 3" Pulley is fitted with a Crank, in the boss of which a $1\frac{1}{2}"$ Rod is locked to form a handle. The Bush Wheel carries a Threaded Pin in one of its holes, and over this is slipped a Rod and Strip Connector, in the other end of which is a $3\frac{1}{2}"$ Rod. This Rod is free to slide in and out of a cylinder made by pressing a $\frac{1}{2}"$ Flanged Wheel over each end of a Sleeve Piece. Between the two Flanged Plates the $4\frac{1}{2}"$ Rod carries two Road Wheels and a Coupling, the latter forming the winding drum. Cord is tied to the Coupling and taken over a 3" Pulley at the top of the shaft, then led around a 1" Pulley held on a 2" Rod at the top of the cage, and finally is tied to the $5\frac{1}{2}"$ Strip at the shaft head.

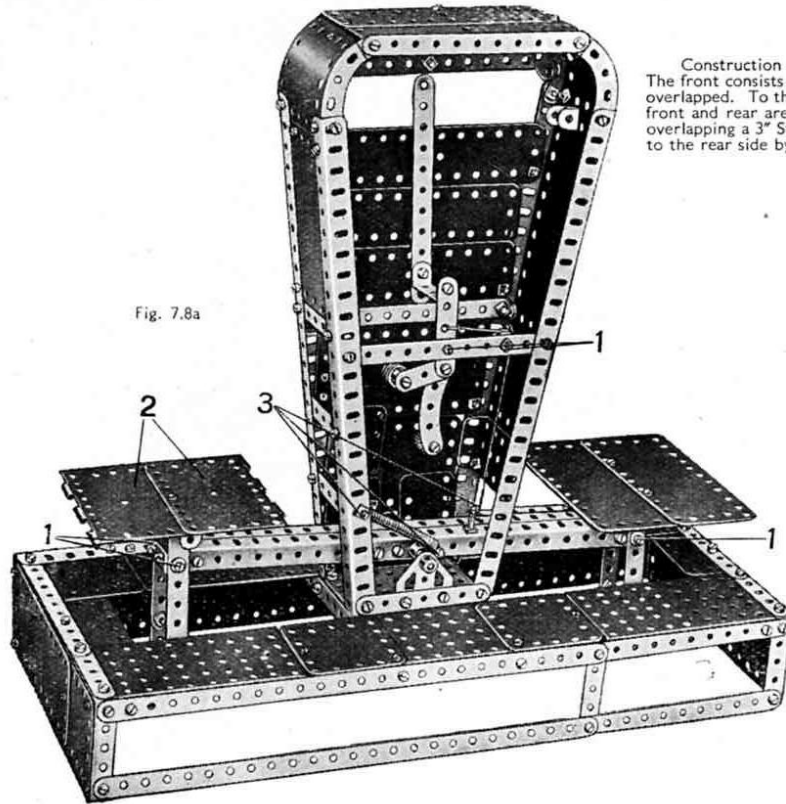
The base of the model is built up from two compound girders joined at one end by a $3\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strip, and at the other by a $3\frac{1}{2}" \times 2\frac{1}{2}"$ Flanged Plate. Each of the compound girders consists of two Angle Girders bolted together overlapping 11 holes.



7.8 SCALES

Construction should be commenced with the base as shown in Figs. 7.8a and 7.8b. The front consists of two Angle Girders overlapped 15 holes and two $12\frac{1}{2}''$ Strips similarly overlapped. To these are bolted a $12\frac{1}{2}'' \times 2\frac{1}{2}''$ Strip Plate and a $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plate. The front and rear are joined at each end by compound strips, each consisting of a $5\frac{1}{2}''$ Strip overlapping a $3''$ Strip two holes. The strips are bolted to the Angle Girders and attached to the rear side by Angle Brackets.

Fig. 7.8a



The two sides of the base are $5\frac{1}{2}'' \times 2\frac{1}{2}''$ and $2\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plates, which are bolted together and attached to the front and rear by four Angle Brackets. At the centre, three $3\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plates are joined together by bolting their flanges to two $5\frac{1}{2}''$ Strips (Fig. 7.8b), and the compound plate is then bolted to the Angle Girders and to Angle Brackets fastened to the rear side. The top of the base is made by bolting a $12\frac{1}{2}'' \times 2\frac{1}{2}''$ Strip Plate, two $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plates and Flexible Plates of various sizes in the positions shown in Fig. 7.8a.

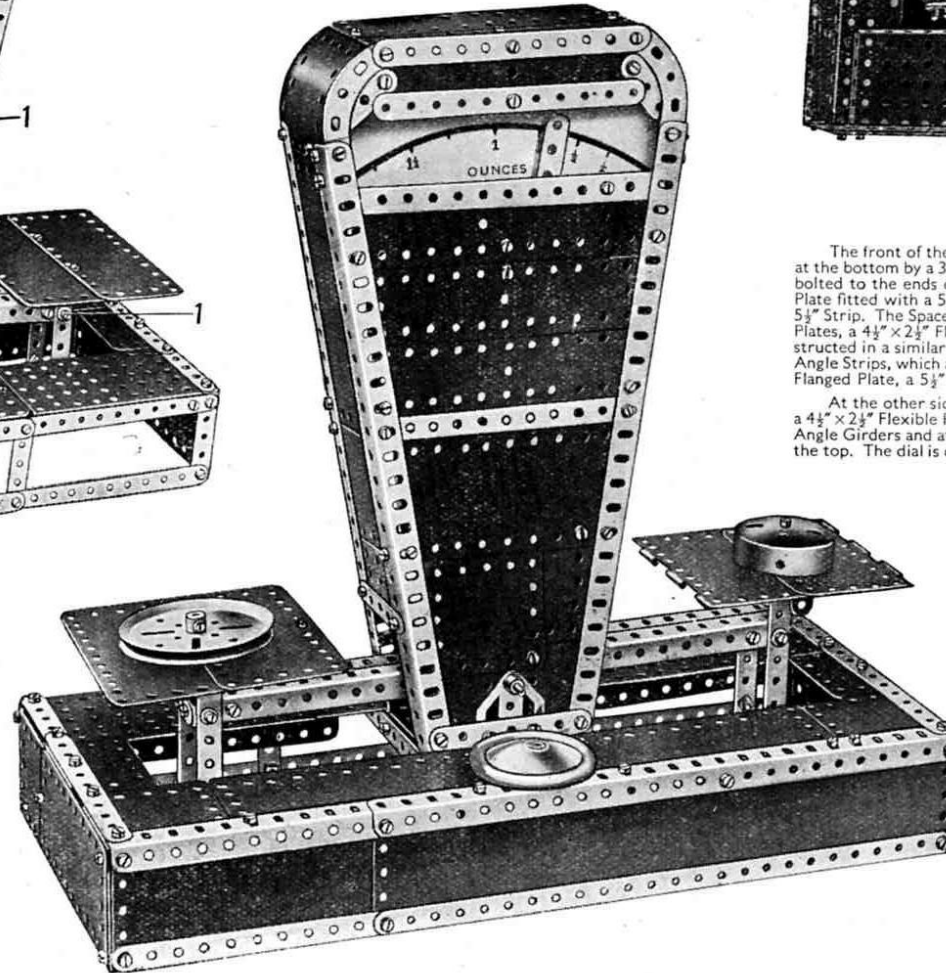


Fig. 7.8b

The front of the housing for the dial and mechanism consists of two Angle Girders joined across at the bottom by a $3\frac{1}{2}''$ Strip and in the middle by a $5\frac{1}{2}''$ Strip. Two $2\frac{1}{2}''$ small radius Curved Strips are bolted to the ends of the Angle Girders and are joined across by a $5\frac{1}{2}''$ Strip. A $5\frac{1}{2}'' \times 1\frac{1}{2}''$ Flexible Plate fitted with a $5\frac{1}{2}''$ Strip and two $1\frac{1}{2}''$ Strips as shown, is held by the securing bolts of the upper $5\frac{1}{2}''$ Strip. The space between the Angle Girders is filled in by three $5\frac{1}{2}'' \times 1\frac{1}{2}''$, four $2\frac{1}{2}'' \times 1\frac{1}{2}''$ Flexible Plates, a $4\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plate and a $2\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plate. The rear of the dial housing is constructed in a similar manner, and is then joined to the front, at the bottom, by two $2\frac{1}{2}'' \times 1\frac{1}{2}''$ Double Angle Strips, which also attach the housing to the base. One side is filled in by a $2\frac{1}{2}''$ Strip, a $2\frac{1}{2}'' \times 1\frac{1}{2}''$ Flanged Plate, a $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plate and a $2\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plate.

At the other side the front and rear of the housing are joined across by three $2\frac{1}{2}''$ Strips and by a $4\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plate. The top corners are made by bolting two $1\frac{1}{2}''$ radius Curved Plates to the Angle Girders and attaching them by Obtuse Angle Brackets to two $5\frac{1}{2}'' \times 1\frac{1}{2}''$ Flexible Plates forming the top. The dial is carried on two Double Brackets (see Fig. 7.8a).

The beam connecting the two scale pans is shown in Figs. 7.8a and 7.8b. Two Angle Girders are joined across at each end by two $1'' \times 1''$ Angle Brackets. A Crank is bolted at the centre of the Angle Girders and four compound strips each consisting of a $2\frac{1}{2}''$ Strip overlapping a $3\frac{1}{2}''$ Strip four holes, are pivoted to the Angle Girders in the third hole from the top ends of the compound strips. Two $12\frac{1}{2}''$ Strips are then pivoted to the ends of the compound strips by $2''$ Rods held in place by Spring Clips. The Angle Girders are pivoted on a $3\frac{1}{2}''$ Rod that is held in the boss of the Crank and is passed through holes in two Flat Trunnions bolted to the base of the dial casing.

The $12\frac{1}{2}''$ Strips are pivoted on a $4''$ Rod that is passed through holes in Fishplates bolted to Trunnions. The Trunnions in turn are bolted to the centre $3\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate of the base. The left-hand scale pan is attached by Angle Brackets and the right-hand scale pan 2 which consists of the halves of a Hinged Flat Plate is fastened to a $3\frac{1}{2}'' \times \frac{1}{2}''$ and a $1\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip. The method of making the pointer is shown in Fig. 7.8a. A Worm fixed on the $1\frac{1}{2}''$ Strip, and a $\frac{1}{2}''$ Pinion secured on the $2\frac{1}{2}''$ large radius Curved Strip act as counterweights. The pointer is pivotally mounted on a $\frac{1}{2}''$ Bolt. Cord is tied to the pointer, led over a $\frac{1}{2}''$ loose Pulley on a $\frac{1}{2}''$ Bolt, and finally is tied to a $\frac{1}{2}''$ Bolt fastened to the Angle Girder of the beam. One end of a Spring is fastened to the dial casing and its other end is attached to the beam at the point shown in Fig. 7.8a.

Bolts 1 and 3 should all be lock-nutted. The dial can be made of white card and can be calibrated by placing objects of known weight on the left-hand scale pan, and marking on the dial the position taken up by the pointer. The $3''$ Pulley, Road Wheel and Boiler End represent weights and are not fastened to the model.

7.9 PENNY-IN-THE-SLOT MACHINE

The framework of the model consists of four Angle Girders joined at the top and bottom by $5\frac{1}{2}$ " Strips. Each of the Angle Girders is extended downwards by a $2\frac{1}{2}$ " Strip. The sides are covered in by Flexible Plates of various sizes and the back by $12\frac{1}{2}$ " Strips. A $5\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flanged Plate is secured across the top (Fig. 7.9c) and the remaining space at each side is filled in by $5\frac{1}{2}$ " \times $1\frac{1}{2}$ " Flexible Plates. The latter are fastened to the sides by $1"$ \times $1"$ Angle Brackets.

The front of the model is fitted with an inspection door 3. This consists of one half of the Hinged Flat Plate 4, extended upward by a $4\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flexible Plate. When closed the door can be locked by means of a Fishplate lock-nutted to the end of the $\frac{1}{2}"$ Bolt 5.

The drawer is constructed as shown in Fig. 7.9a. It consists essentially of two $3\frac{1}{2}"$ \times $2\frac{1}{2}"$ Flanged Plates, which are fastened together by two $2\frac{1}{2}"$ \times $\frac{1}{2}"$ Double Angle Strips. A $2\frac{1}{2}"$ Strip and a $2\frac{1}{2}"$ \times $\frac{1}{2}"$ Double Angle Strip, secured together by Obtuse Angle Brackets, are bolted to the front ends of the two $2\frac{1}{2}"$ \times $\frac{1}{2}"$ Double Angle Strips. A knob is provided by a $\frac{3}{4}"$ Flanged Wheel, which is held on the shank of a $\frac{3}{4}"$ Bolt. To the free flange of the rear $3\frac{1}{2}"$ \times $2\frac{1}{2}"$ Flanged Plate is bolted a $1\frac{1}{2}"$ \times $\frac{1}{2}"$ Double Angle Strip carrying a Fishplate at its lower end.

Each of the flanges of the rear Flanged Plate carries also a $3\frac{1}{2}"$ Strip, and through the end holes of these Strips pass the two shafts on which the drawer slides. One of these shafts is formed by a $6\frac{1}{2}"$ Rod and the other by a compound rod consisting of two $3\frac{1}{2}"$ Rods, and their ends can be seen protruding from the back of the model in Fig. 7.9c. The two $3\frac{1}{2}"$ Rods forming one of the shafts are joined by a Rod Connector.

When pushed in, the drawer is locked owing to the Fishplate that is attached to the rear end of the drawer by the $1\frac{1}{2}"$ \times $\frac{1}{2}"$ Double Angle Strip catching against the Fishplates on the end of a $3\frac{1}{2}"$ \times $\frac{1}{2}"$ Double Angle Strip. The latter carries also a $1\frac{1}{2}"$ Strip that forms a stop, and is bolted at its centre to a $2\frac{1}{2}"$ \times $\frac{1}{2}"$ Double Angle Strip that is pivoted on a Rod. When a penny is dropped down the chute provided, it falls on to the free end of the $3\frac{1}{2}"$ \times $\frac{1}{2}"$ Double Angle Strip. The Fishplates on the other end of the latter are thus raised clear of the Fishplate attached to the drawer.

The chute is shown in Fig. 7.9c and consists of two compound girders joined by $1\frac{1}{2}"$ Strips and Angle Brackets. Each of the compound girders is constructed from two Angle Girders, which are bolted together by their elongated holes in such a manner that a space wide enough to receive a penny is left between the sides perforated with round holes. At the top the chute is held in position by a $\frac{3}{8}"$ Bolt, and at the bottom by a $1\frac{1}{2}"$ \times $\frac{1}{2}"$ Double Angle Strip.

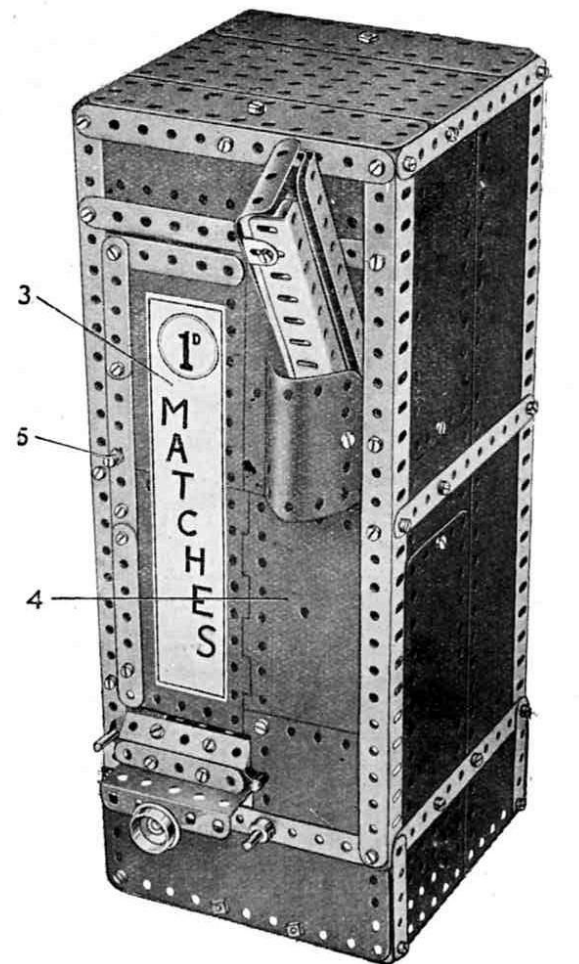


Fig. 7.9a

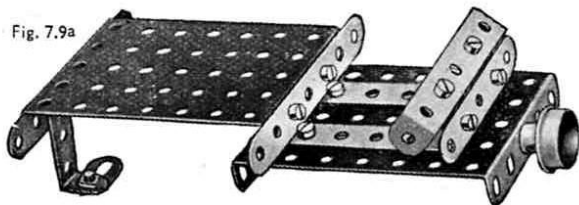


Fig. 7.9b

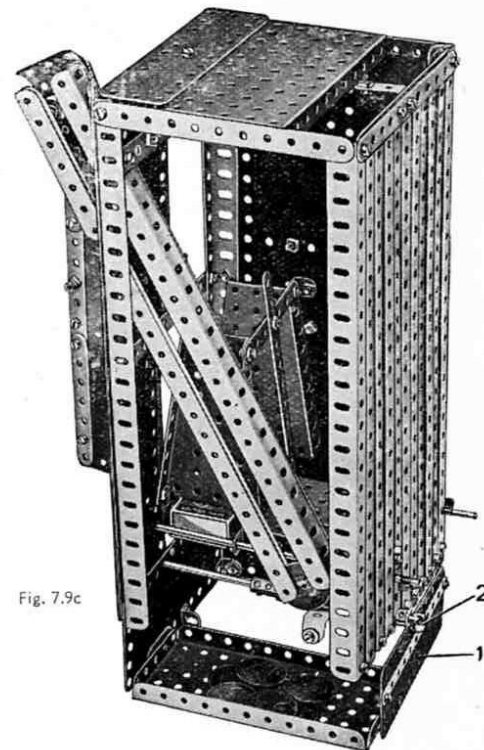


Fig. 7.9c

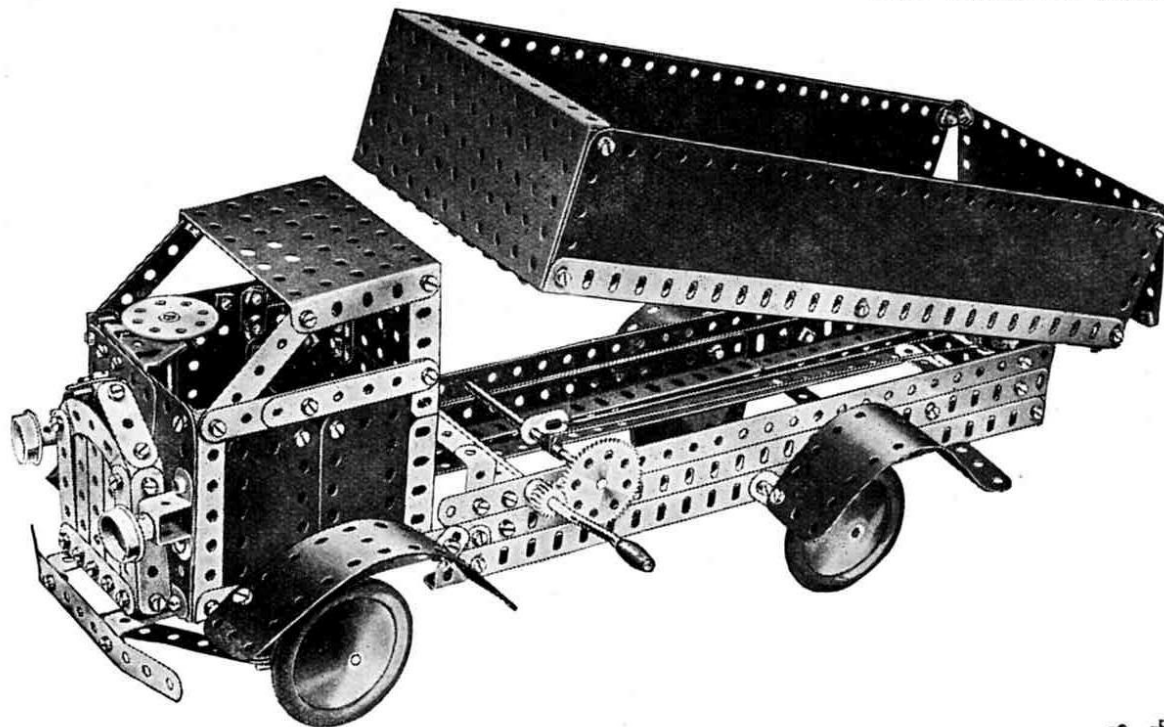
The pennies are collected in a tray formed by a $5\frac{1}{2}"$ \times $2\frac{1}{2}"$ Flanged Plate (Fig. 7.9c), which is reached by means of the door 1. This is constructed from two $5\frac{1}{2}"$ \times $1\frac{1}{2}"$ Flexible Plates overlapped two holes, and is suspended from a $\frac{3}{8}"$ Bolt that is fastened through a Fishplate bolted to the back of the model. The door is prevented from slipping off the Bolt by a Collar.

The $5\frac{1}{2}"$ \times $2\frac{1}{2}"$ Flanged Plate is supported at its forward end by a Trunnion bolted to the casing, and at its rear end by a $5\frac{1}{2}"$ Strip. The Strip is secured in position by a Trunnion and an Angle Bracket, as shown in Fig. 7.9b.

The match boxes are stacked between two Flanged Sector Plates, which can be seen in Fig. 7.9c, and when the drawer is pushed inwards, a box automatically falls into position.

The Sector Plates are joined by $3\frac{1}{2}"$ Strips and are bolted by their flanges to the front and side of the machine. The match boxes are prevented from falling out of the slide by two $5\frac{1}{2}"$ Strips fastened to the centres of the $3\frac{1}{2}"$ Strips.

7.10 BUILDERS' LORRY



The back axle is a 5" Rod journalled in holes in two Flat Trunnions. The front stub axles are 2" Rods carried in Double Brackets 2. A 1½" Strip is held between the ends of each Double Bracket on a ⅜" Bolt, which is lock-nutted to a Reversed Angle Bracket bolted to the chassis in the sixth hole from the front. The tie rod is a 3½" Strip, connected to a Crank by a 3" Strip. The Crank is carried on a 5" Rod fitted with a Bush Wheel to represent the steering wheel.

Bolts 1 (Fig. 7.10a) are lock-nutted. The construction of the truck body is shown clearly in the illustrations. The 5½" x 2½" Flexible Plates at the rear end is fitted with Angle Brackets, which are fastened by lock-nuts to ⅜" Bolts passed through the sides of the body. The body is pivoted on a 4" Rod passed through holes in Flat Trunnions and a 2½" x ½" Double Angle Strip bolted underneath the body. The Rod is held in place by four Spring Clips.

Tipping is carried out by turning the Crank Handle. The Cord is tied to a Cord Anchoring Spring on the 4½" Rod carrying the 57-tooth Gear, and is then led around a ½" loose Pulley on a 1½" Rod in a Stepped Bent Strip, and finally is tied to a Fishplate on the 4½" Rod.

The main side members of the chassis consist of two 16½" Angle Girders built up from 12½" Angle Girders. Each member has a further 12½" Angle Girder attached below it by two Fishplates, one of which is bolted in the second hole from the front end of the Angle Girder, and the other in the tenth hole from the rear end. The side members are further deepened by 12½" Strips attached to them by Fishplates, 1" x 1" Angle Brackets and 1½" x ½" Double Angle Strips. The Flat Trunnions are bolted at the rear end of the chassis and the 1½" x ½" Double Angle Strips are bolted in the second hole from the front end of the chassis. A 1" x 1" Angle Bracket is bolted next to each Double Angle Strip, and two are also fixed in a position six holes from the rear end of the chassis. The lower Angle Girders of the side members are joined across by a 3½" x ½" Double Angle Strip, and a 3½" Strip. A 2½" x ½" Double Angle Strip is bolted to the ends of the front pair of 1" x 1" Angle Brackets. The side members are also spanned by a 3½" x 2½" Flanged Plate forming the back of the cab, and by a 3½" Strip and a 3½" x ½" Double Angle Strip at the front end.

The back of the cab is completed by a second 3½" x 2½" Flanged Plate, which is attached to the first by two Fishplates, and the roof also is a 3½" x 2½" Flanged Plate. A 2½" x 1½" Flanged Plate bolted to the lower 3½" x 2½" Flanged Plate of the back of the cab represents the driving seat. Each side of the cab is filled in by three 2½" x 1½" Flexible Plates, two of which are butted together, and the third is bolted behind to reinforce the joint. The Flexible Plates are attached to the cab by two Fishplates. The front of the cab is made by overlapping four 2½" x 2½" Flexible Plates and bolting them at the bottom to the 3½" x ½" Double Angle Strip spacing the chassis, and at the top to Angle Brackets. The radiator is carried on two Reversed Angle Brackets joined across by a 2½" Strip. A 5½" Strip represents the front bumper and is carried on the ends of two 2½" x ½" Double Angle Strips.

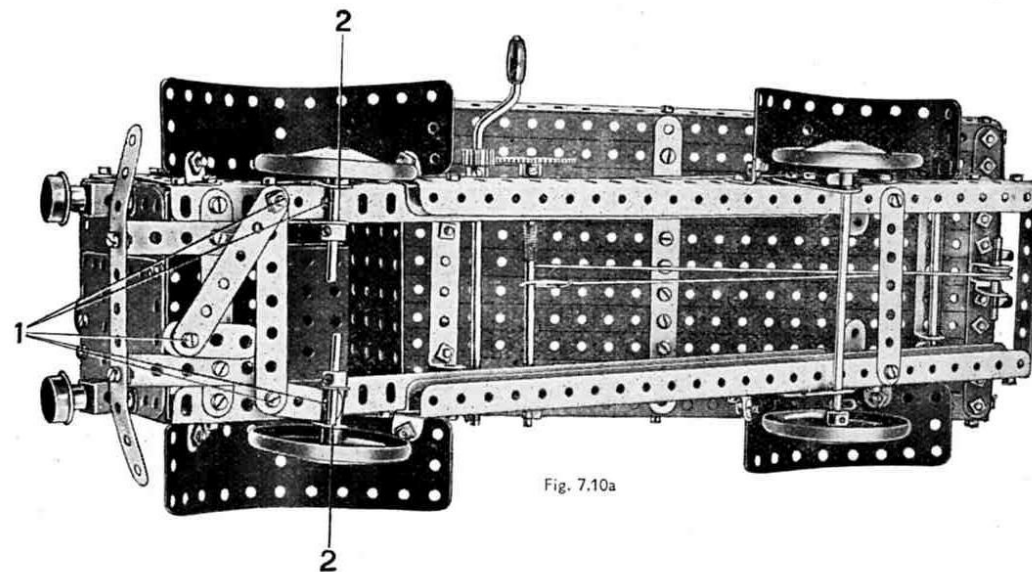
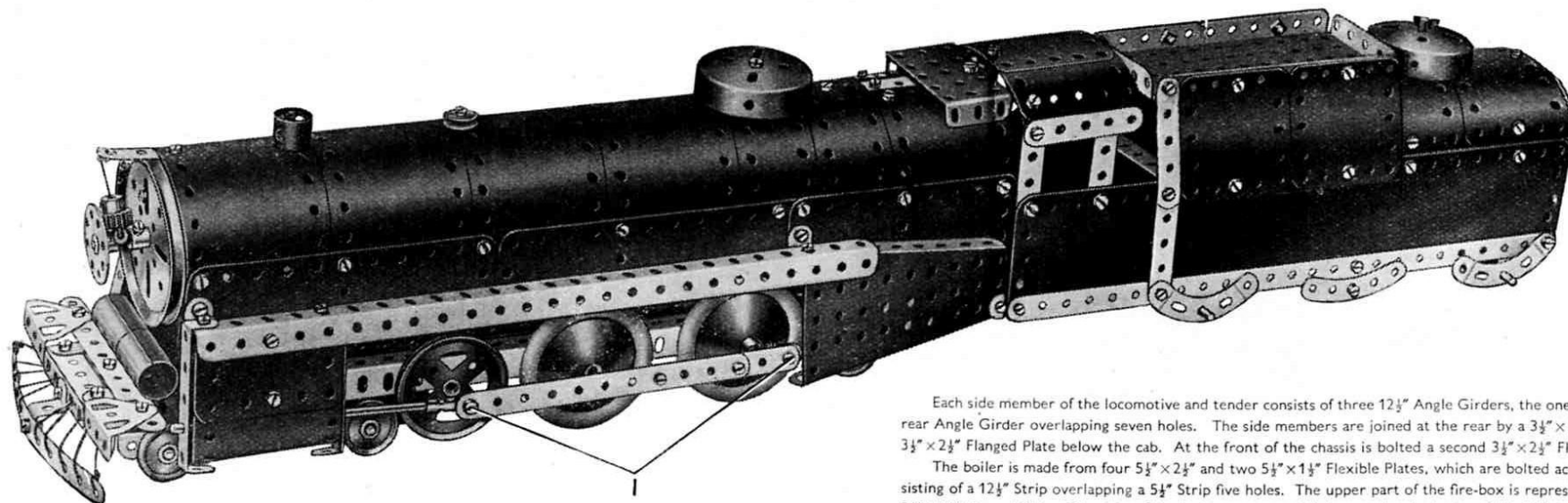


Fig. 7.10a

7.11 CANADIAN PACIFIC RAILWAY LOCOMOTIVE



The coal bunker is represented by a $5\frac{1}{2}" \times 2\frac{1}{2}"$ Flanged Plate bolted flanges upward to four $2\frac{1}{2}" \times 2\frac{1}{2}"$ Flexible Plates, and two compound strips consisting of two $2\frac{1}{2}"$ Strips joined together. Two $4\frac{1}{2}" \times 2\frac{1}{2}"$ Flexible Plates attached to the sides and back of the tender by Fishplates and a $2\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strip respectively, represent the water tank.

The $1\frac{1}{2}"$ Rod that holds the Boiler End to the tender passes through one of the Flexible Plates, and through a hole in a Fishplate bolted to the rear $4\frac{1}{2}" \times 2\frac{1}{2}"$ Flexible Plate. A ladder giving access to the coal bunker (Fig. 7.11a) consists of two $3\frac{1}{2}"$ Strips, which are joined across at the top by two Angle Brackets. Six Angle Brackets provide the rungs.

The front bogie carriage is a $5\frac{1}{2}" \times 2\frac{1}{2}"$ Flanged Plate attached to the chassis by two Flat Trunnions and the 1" Pulleys are mounted on two $3\frac{1}{2}"$ Rods. The 2" Pulleys are fastened on a compound rod consisting of a 2" Rod and a $1\frac{1}{2}"$ Rod joined together by a Coupling. Axles for the front and rear Road Wheels are provided by a 4" Rod and a $4\frac{1}{2}"$ Rod respectively. A Collar is fixed on each end of the $4\frac{1}{2}"$ Rod and a bolt carrying an Angle Bracket and three Washers is screwed into its tapped hole. Each connecting rod is lock-nutted to the Angle Bracket as shown at 1, and also to a Rod and Strip Connector carrying a 5" Rod. The 5" Rods represent the piston rods and are free to slide in holes in $2\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strips forming the ends of the cylinders. The $\frac{1}{2}"$ fast Pulley on the axle of the Road Wheels is connected by a Driving Band to the Coupling on the compound rod.

The rear bogie wheels below the cab are 1" loose Pulleys lock-nutted to Fishplates. The Bolts 1 are $\frac{3}{8}"$ long and carry two Washers on their shanks.

Each side member of the locomotive and tender consists of three $12\frac{1}{2}"$ Angle Girders, the one at the front overlapping nine holes and the rear Angle Girder overlapping seven holes. The side members are joined at the rear by a $3\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strip and a $2\frac{1}{2}"$ Strip and a $3\frac{1}{2}" \times 2\frac{1}{2}"$ Flanged Plate below the cab. At the front of the chassis is bolted a second $3\frac{1}{2}" \times 2\frac{1}{2}"$ Flanged Plate.

The boiler is made from four $5\frac{1}{2}" \times 2\frac{1}{2}"$ and two $5\frac{1}{2}" \times 1\frac{1}{2}"$ Flexible Plates, which are bolted across their centres to a compound strip consisting of a $12\frac{1}{2}"$ Strip overlapping a $5\frac{1}{2}"$ Strip five holes. The upper part of the fire-box is represented by two $2\frac{1}{2}" \times 2\frac{1}{2}"$ Flexible Plates and a $2\frac{1}{2}" \times 1\frac{1}{2}"$ Flanged Plate. The sides of the boiler are extended along each edge by two $5\frac{1}{2}" \times 1\frac{1}{2}"$ and two $2\frac{1}{2}" \times 1\frac{1}{2}"$ Flexible Plates, the securing Bolts holding also a $12\frac{1}{2}"$ and a $5\frac{1}{2}"$ Strip overlapped five holes. The lower edges of the Flexible Plates are then bolted to further compound strips, each consisting of a $12\frac{1}{2}"$ and a $3\frac{1}{2}"$ Strip overlapped one hole. A $1\frac{1}{2}"$ Strip is bolted to the compound strips at the front end of the boiler, another $1\frac{1}{2}"$ Strip is bolted at a distance of 20 holes from it, and a Fishplate is placed midway between them. The front of the boiler is a 3" Pulley bolted to a $2\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strip. Two compound strips comprising $5\frac{1}{2}"$ Strips and $12\frac{1}{2}"$ Strips overlapped five holes, extend the boiler on each side. The complete unit is attached to the chassis by four Obtuse Angle Brackets.

The sides of the tender and cab are made by $12\frac{1}{2}" \times 2\frac{1}{2}"$ Strip Plates bolted to the $3\frac{1}{2}" \times 2\frac{1}{2}"$ Flanged Plate in the centre of the chassis. At the rear end the Strip Plates are attached to a $3\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strip and a $3\frac{1}{2}" \times 2\frac{1}{2}"$ Flanged Plate that forms the back of the tender. Two $1\frac{1}{8}"$ radius Curved Plates overlapped three holes form the roof of the cab, and they are attached by a $\frac{3}{8}"$ Bolt that carries three Washers on its shank, to a Fishplate fixed to the fire-box. The roof is attached by Obtuse Angle Brackets to the $2\frac{1}{2}"$ Strips forming the sides.

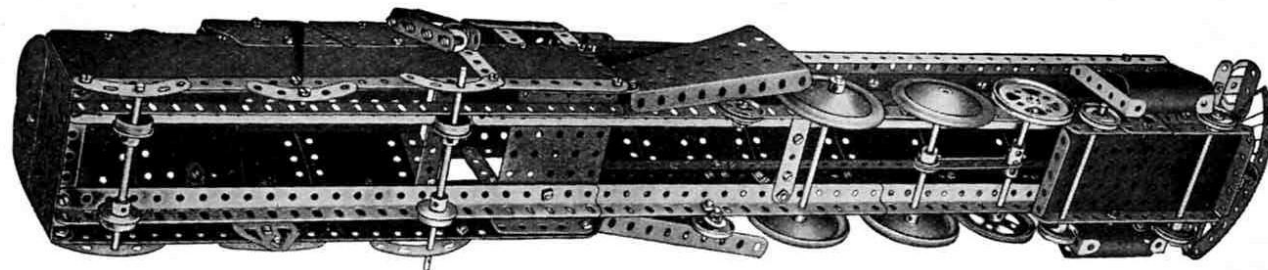
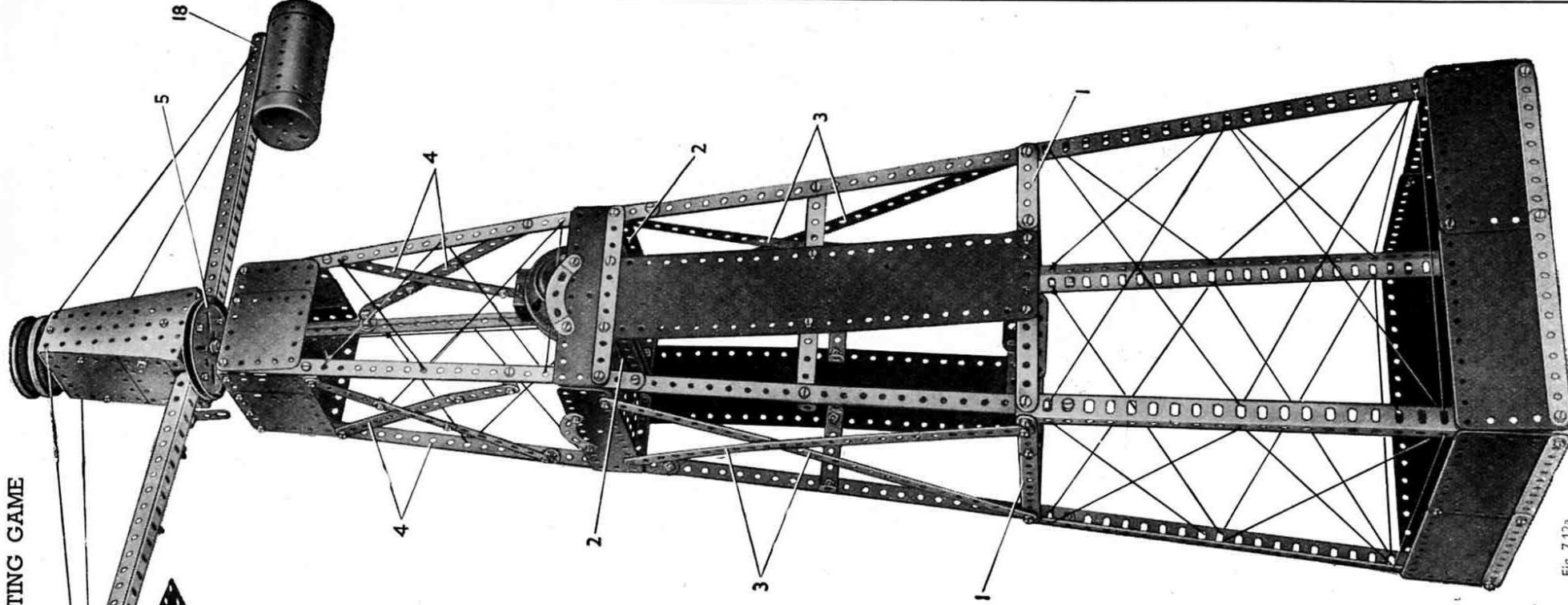


Fig. 7.11a

7.12 AERIAL TARGET SPOTTING GAME



First build the four girders of the tower. Each of these consists of a 12½" Angle Girder and two 12½" Strips overlapped three holes and bolted together. The Angle Girders are joined at their lower ends by compound strips, each consisting of two 5½" Strips, and by 4½"×2½" and 5½"×2½" Flexible Plates. The upper ends of the Angle Girders are connected by the strips 1, made by joining together a 5½" and a 2½" Strip.

Two 5½"×2½" Flanged Plates 2, joined by 5½" Strips and 5½"×1½" Flexible Plates, are bolted to the main girders, and form a platform for an EO20 Electric Motor. The Motor is attached to one of the Flanged Plates.

The upper ends of the main girders are connected by four 3½" Strips bolted to Angle Brackets, and by six 2½"×2½" Flexible Plates and two 2½"×1½" Flexible Plates bolted together to form four compound 3½"×2½" plates.

The tower is braced by the 12½" Strips 3, and by compound strips 4 consisting of a 5½" and a 2½" Strip bolted together. The strips 4 are attached to the main girders by Angle Brackets.

The arms supporting the aeroplane and balance weight are four 12½" Angle Girders bolted in pairs to form two U-Section girders, and they are fixed to a 3" Pulley 5. Two Flanged Sector Plates are attached to Trunnions fastened to the Pulley 5, and a 2½"×1½" Flanged Plate is bolted across the top of the Sector Plates. A 1" Pulley and two Road Wheels are held on a 3½" Rod locked in a Bush Wheel bolted to the 2½"×1½" Flanged Plate. A 2½"×2½" Flexible Plate is bolted to each side of the Flanged Sector Plates, and two 2½"×1½" Flexible Plates are held in place by 3" Screwed Rods passed through the Sector Plates.

The drive from the EO20 Motor is taken by a belt of Cord to a ½" Pulley 6 (Fig. 7.12a). This Pulley is locked on a 2" Rod fitted with a Worm Gear. The Rod is mounted in a 1½"×½" Double Angle Strip bolted to the 3½"×½" Double Angle Strips 7.

The Worm Gear is in constant mesh with a 57-tooth Gear locked on a 4" Rod 20. This Rod is journaled in a Wheel Disc and a Double Bent Strip bolted to the Double Angle Strips 7. The 57-tooth Gear is fitted with a 3" Strip 8. This Strip is held in place by two ½" Bolts, and is raised from the face of the Gear as shown so that it will clear the Pulley 6 as it rotates. The Pulley 5 is free to turn on the Rod 7, and is spaced from the Strip 8 by three Washers. A Collar fixed on the Rod 20 is used to retain the Pulley 5 in position.

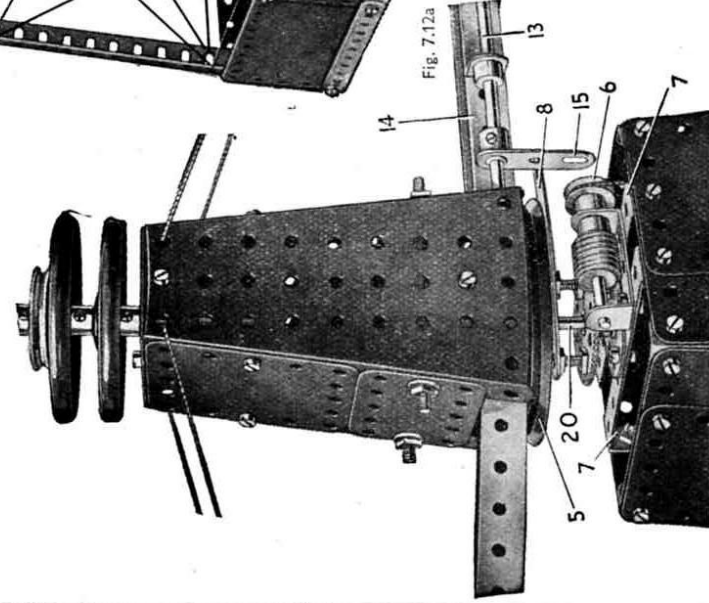


Fig. 7.12a

The fuselage of the aeroplane is a 5½" Strip bolted to each side of a Sleeve Piece and a U-Section Curved Plate. The 5½" Strips are joined together at the rear by a ½" Bolt 9 (Fig. 7.12b). The tail plane is a 2½"×1½" Flexible Plate and is attached to Angle Brackets held by the Bolt 9. Two Flat Trunnions bolted together represent the tail fin, and are fastened to Angle Brackets secured to the tail plane. The wings are formed by two 5½"×1½" Flexible Plates overlapped five holes and bolted to the Sleeve Piece.

(Continued on next page)

7.12 AERIAL TARGET SPOTTING GAME—Continued

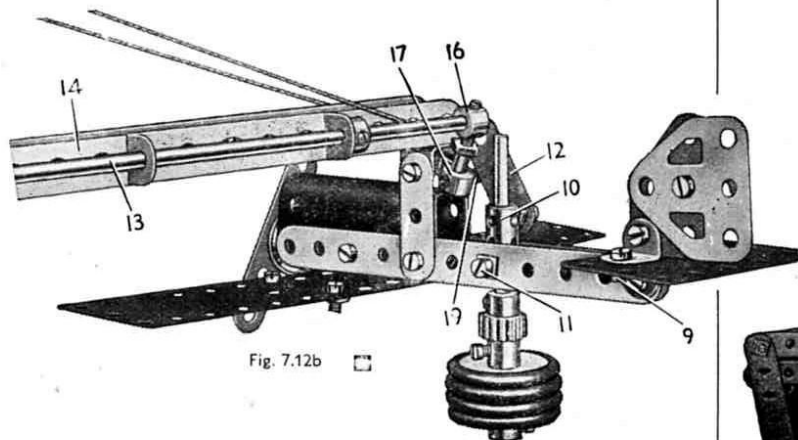


Fig. 7.12b

Details of the bomb release are seen in Fig. 7.12b. The bomb consists of two 1" Pulleys, two 1" loose Pulleys and a $\frac{1}{2}$ " Pinion held on a $\frac{3}{4}$ " Rod. This Rod is passed through a Coupling 10. The Coupling is attached to the fuselage by two $\frac{3}{8}$ " Bolts, one of which is seen at 11. These Bolts are fitted with nuts, and screwed into the tapped holes of the Coupling. The nuts are then tightened to hold the Coupling in position.

A $1\frac{1}{2}$ " Strip 12 is held by a nut on a $\frac{3}{8}$ " Bolt. This Bolt is screwed into the Coupling 10 so that when the Strip 12 is in the position shown in Fig. 7.12b, the $\frac{3}{8}$ " Bolt grips the bomb tightly in the Coupling. When the Strip 12 is moved towards the tail of the aeroplane the bomb is released.

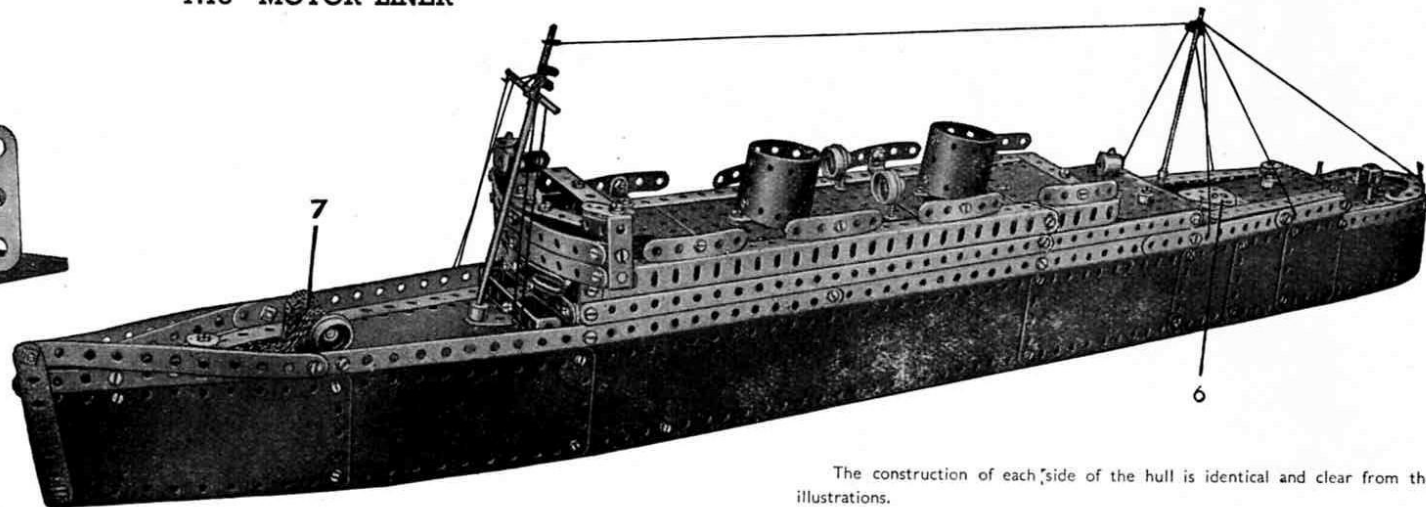
An $11\frac{1}{2}$ " Rod 13 (Fig. 7.12b) is mounted in two $2\frac{1}{2}$ " x $\frac{1}{2}$ " Double Angle Strips bolted to the $12\frac{1}{2}$ " Angle Girder 14. The Rod 13 is fitted at one end with a Crank 15, so that the Crank is brought into contact with the Strip 8 as the arms revolve. A Collar 16, fitted with a Threaded Pin and a second Collar 17, is locked at the opposite end of the Rod 13. A Bolt 19 is screwed into the Collar 17 so that it will engage the Strip 12.

A Boiler fastened to the Angle Girders 18 is weighted so that the rotating arms are balanced.

To operate the model the Motor should be allowed to run until the rotating arms have picked up speed. When the Strip 8 is judged to be in the correct position to release the bomb so that it will fall on the target, the Motor is switched off. The Crank 15 will then be forced upwards by the Strip 8, thus moving the Strip 12 backward and releasing the bomb.

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

7.13 MOTOR LINER



The construction of each side of the hull is identical and clear from the illustrations.

The superstructure is attached to the hull by Strips at the bridge end and a $2\frac{1}{2}$ " x $\frac{1}{2}$ " and a $2\frac{1}{2}$ " x 1" Double Angle Strip is used at the other end. The boat deck comprises two $3\frac{1}{2}$ " x $2\frac{1}{2}$ " Flanged Plates, a $5\frac{1}{2}$ " x $2\frac{1}{2}$ " Flanged Plate and a $2\frac{1}{2}$ " x $2\frac{1}{2}$ " Flexible Plate, all of which are fixed end to end by their flanges and bolted at one end under a $3\frac{1}{2}$ " Strip and at the other to the bridge structure.

In assembling the bridge, a $3\frac{1}{2}$ " Strip is attached by Angle Brackets to the ends of the $12\frac{1}{2}$ " Strips that form the sides of the superstructure, and a $2\frac{1}{2}$ " Strip bolted vertically connects the $3\frac{1}{2}$ " Strip to the flange of the $3\frac{1}{2}$ " x $2\frac{1}{2}$ " Flanged Plate forming part of the boat deck. Next, two $5\frac{1}{2}$ " Strips and a Formed Slotted Strip are connected together by Fishplates at their ends and centres and the front of the bridge so formed is bolted to the Flanged Plate by a $\frac{3}{4}$ " Bolt, a Collar being used for spacing purposes.

The chart house is a $2\frac{1}{2}$ " x $1\frac{1}{2}$ " Flanged Plate with a Double Angle Strip fitted to its flanges, and it is attached to the boat deck by a Double Bracket. Two Double Angle Strips bolted to a Double Bracket are also attached to the Flanged Plate. Half of a Hinged Flat Plate 1 is used in the construction of the forecastle deck and is extended by a $2\frac{1}{2}$ " x $1\frac{1}{2}$ " Flexible Plate 2, a Flat Trunnion 3 and two $2\frac{1}{2}$ " Curved Strips 4. The end of the Flexible Plate is bolted under the $2\frac{1}{2}$ " x $\frac{1}{2}$ " Double Angle Strip 5.

The two Flat Trunnions 6 bolted on the aft deck represent a hatch cover. A Large Fork Piece 7 fastened to the deck by a $\frac{1}{2}$ " Bolt forms part of a winch.

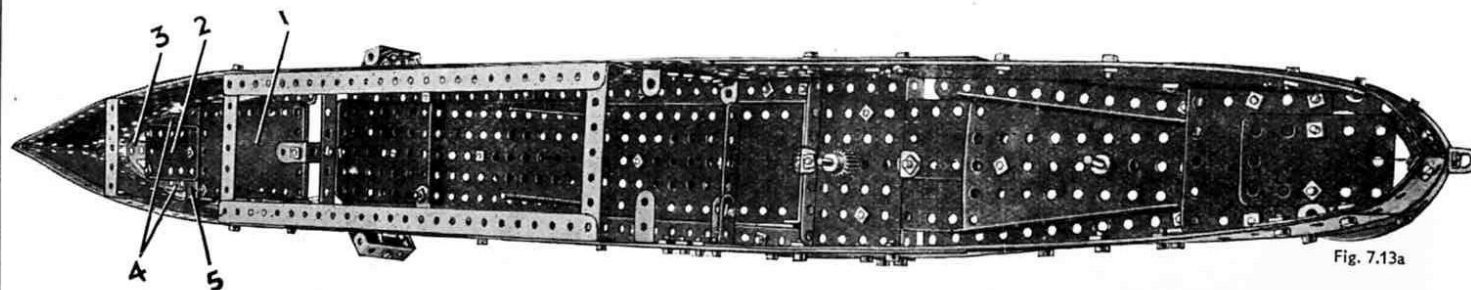
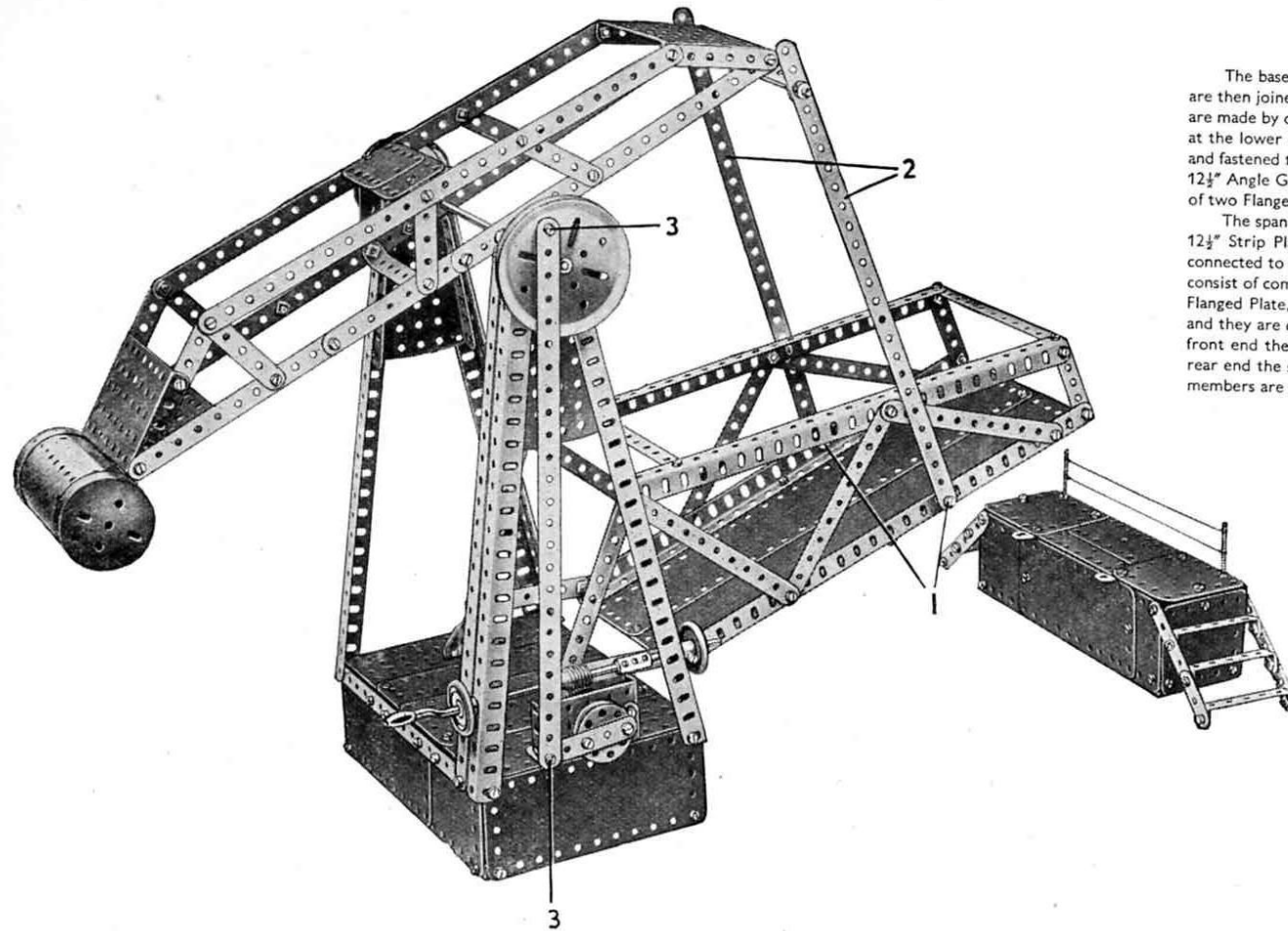


Fig. 7.13a



The counterweight at the rear of the beam is a Boiler attached to the lower $3\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate by Angle Brackets. Cranks bolted to the beam have an $11\frac{1}{2}''$ Rod locked in their bosses. The Rod passes through the centre holes in the Flanged Sector Plates of the beam supports and it carries two Road Wheels and the 3" Pulley. The beam is connected to the span by two $12\frac{1}{2}''$ Strips 2, the upper ends of which are pivoted in the third holes on a $6\frac{1}{2}''$ Rod passed through two $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips bolted to the front end of the beam. The lower ends of $12\frac{1}{2}''$ Strips 2 are pivoted on $\frac{3}{4}''$ Bolts 1, which are lock-nutted

to the span and carry Collars on their shanks to hold the $12\frac{1}{2}''$ Strips in position.

The landing jetty consists of Flexible Plates of various sizes joined together by Double Angle Strips and Angle Brackets. The stairways are built up from Strips and Double Angle Strips and are bolted to the jetty. Two 3" Screwed Rods lock-nutted to the $2\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plates forming part of the platform, have Cord tied between them to represent rails. Two Fishplates are bolted to the edge of the jetty to act as stops when the bridge reaches a horizontal position.

7.14 BEAM BRIDGE

The base is built by bolting two $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plates to two $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plates. The ends of the Flanged Plates are then joined across by compound strips consisting of two $5\frac{1}{2}''$ Strips overlapped five holes. The remaining sides of the base are made by overlapping a $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plate and a $4\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plate by three holes. The sides are joined together at the lower corners by Angle Brackets. Two $5\frac{1}{2}'' \times 1\frac{1}{2}''$, two $2\frac{1}{2}'' \times 2\frac{1}{2}''$ and one $2\frac{1}{2}'' \times 1\frac{1}{2}''$ Flexible Plate are bolted together and fastened to the $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plates in the positions shown in Fig. 7.14a. Supports for the beam are provided by four $12\frac{1}{2}''$ Angle Girders bolted to each corner of the base. At their upper ends pairs of Angle Girders are bolted to the flanges of two Flanged Sector Plates as shown, and three $12\frac{1}{2}''$ Strips are also attached to the Angle Girders by Fishplates.

The span of the bridge is made by joining two $12\frac{1}{2}''$ Angle Girders at their ends and centres by three $5\frac{1}{2}''$ Strips, and two $12\frac{1}{2}''$ Strip Plates for the roadway. The upper Angle Girders of the span are joined across by two $5\frac{1}{2}''$ Strips, and are connected to the lower Angle Girders by three $5\frac{1}{2}''$ Strips, a $2\frac{1}{2}''$ Strip and a $3\frac{1}{2}''$ Strip. The lower side members of the beam consist of compound strips made by overlapping two $12\frac{1}{2}''$ Strips by 15 holes, and joining them at the rear end by a $3\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate, and at the front end and middle by $3\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips. The upper side members are $12\frac{1}{2}''$ Strips, and they are connected at their centres by two $2\frac{1}{2}'' \times 1\frac{1}{2}''$ Flexible Plates overlapped three holes, and Angle Brackets. At the front end the upper and lower side members are joined by 3" Strips, to which is bolted a $3\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate. At the rear end the side members are joined by $3\frac{1}{2}''$ Strips extended one hole by the flanges of a $3\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate. The side members are connected also by a series of $2\frac{1}{2}''$ Strips.

On one side the span is pivoted by a $\frac{3}{4}''$ lock-nutted Bolt to a Trunnion, and on the other side it is pivoted on a $3\frac{1}{2}''$ Rod, which passes through a second Trunnion and the centre hole in a $2\frac{1}{2}'' \times 1\frac{1}{2}''$ Flanged Plate attached to the base by two $1'' \times 1''$ Angle Brackets. The Rod carries a 57-tooth Gear a 1" Pulley fitted with Rubber Ring, and a Bush Wheel. The Bush Wheel has a $2\frac{1}{2}''$ Strip bolted across it, and a $12\frac{1}{2}''$ Strip is connected to the end of the $2\frac{1}{2}''$ Strip and the 3" Pulley by lock-nutted Bolts 3. A large Crank Handle connected by a Coupling to a 2" Rod, carries a Worm and two 1" Pulleys fitted with Rubber Rings. The Crank Handle is passed through holes in the Angle Girders forming the beam supports, and the Worm meshes with the 57-tooth Gear. By turning the Crank Handle the span can be raised or lowered.

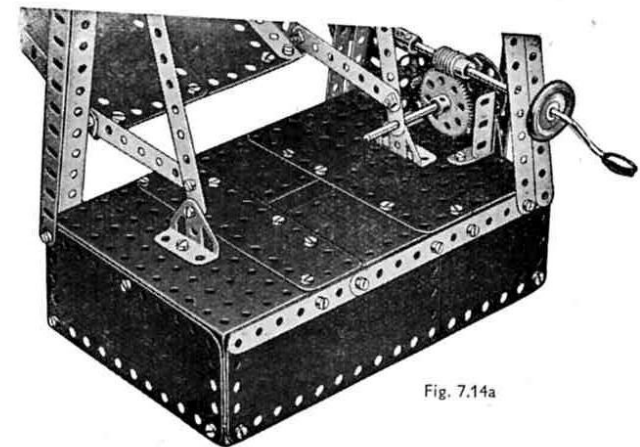


Fig. 7.14a

7.15 COAL ELEVATOR

The frame of the shaft consists of four compound angle girders, spaced apart at their ends by $5\frac{1}{2}$ " Strips. Each compound girder is made from two $12\frac{1}{4}$ " Angle Girders bolted together, overlapping 14 holes. The base of the shaft is extended as shown by two $12\frac{1}{4}$ " Strips, between the outer ends of which is bolted a $5\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flanged Plate. Two more $12\frac{1}{4}$ " Strips forming rails on which the coal trucks run, are secured to the centre of the Flanged Plate by Angle Brackets. At their other ends the rails are supported by Fishplates and Angle Brackets attached to a $3\frac{1}{2}$ " Strip, which is fixed to the base by Reversed Angle Brackets.

The extension of the base on one side of the shaft is made by two $3\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flanged Plates. These support a third $3\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flanged Plate in which a Crank Handle is journaled as shown. The other bearing for the Crank Handle is provided by a $2\frac{1}{2}$ " \times $1\frac{1}{2}$ " Double Angle Strip, which is secured to the $12\frac{1}{4}$ " Strip Plates by a $2\frac{1}{2}$ " \times $\frac{1}{2}$ " Double Angle Strip.

Between the two Double Angle Strips, the Crank Handle carries a 2" Pulley, which is connected by Cord to a 1" Pulley on a compound rod consisting of a $4\frac{1}{2}$ " and a 2" Rod joined by a Coupling. This rod is journaled in the $5\frac{1}{2}$ " Strips at the top of the shaft. A $6\frac{1}{2}$ " Rod journaled in two Flat Trunnions as shown, carries a 57-tooth Gear, which meshes with a $\frac{1}{2}$ " Pinion on the compound rod. The $6\frac{1}{2}$ " Rod carries at its centre a Cord Anchoring Spring, to which a length of Cord is tied. The Cord is then wound around the Rod several times and secured to the top of the truck platform, the constructional details of which are shown in Fig. 7.15a. The Bolts 1 are lock-nutted, and when the projecting $2\frac{1}{2}$ " Strips make contact with the $5\frac{1}{2}$ " Strip that is secured to the elevator shaft just below the chute, the rails and wagon tip up and the coal is fed on to the chute.

The chute is a Flanged Sector Plate, and it is pivoted on a 5" Rod supported by two Reversed Angle Brackets. The angle at which the chute rests is controlled by a large Crank Handle journaled in two of the $5\frac{1}{2}$ " Strips at the top of the shaft. Cord is tied to the shaft of the Crank Handle, taken over the $\frac{1}{2}$ " loose Pulley at the top of the elevator shaft and finally is tied to the front of the Flanged Sector Plate. The $\frac{1}{2}$ " loose Pulley is held on a $1\frac{1}{2}$ " Rod journaled in the end holes of two $2\frac{1}{2}$ " Strips fixed to the top of the shaft by a Double Bracket. The motor is represented by two Boiler Ends, which are bolted to a $2\frac{1}{2}$ " \times $1\frac{1}{2}$ " Flanged Plate that can be seen in Fig. 7.15b. A $3\frac{1}{2}$ " Rod is passed through the centres of the Boiler Ends, and is held in position by a $\frac{1}{2}$ " fast Pulley and a $\frac{3}{4}$ " Flanged Wheel. A Driving Band connects the $\frac{1}{2}$ " fast Pulley to a 1" Pulley on the $6\frac{1}{2}$ " Rod.

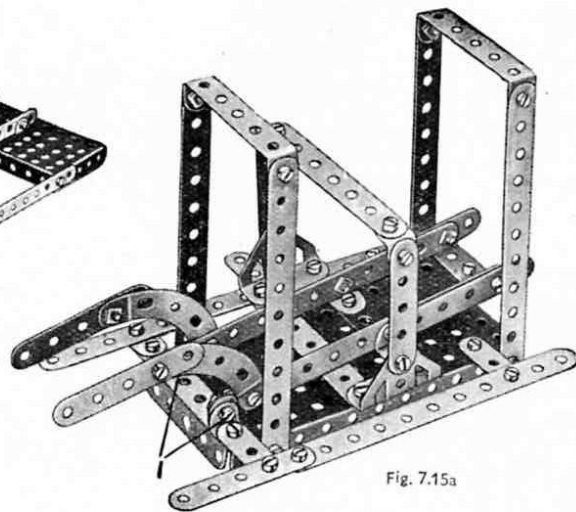
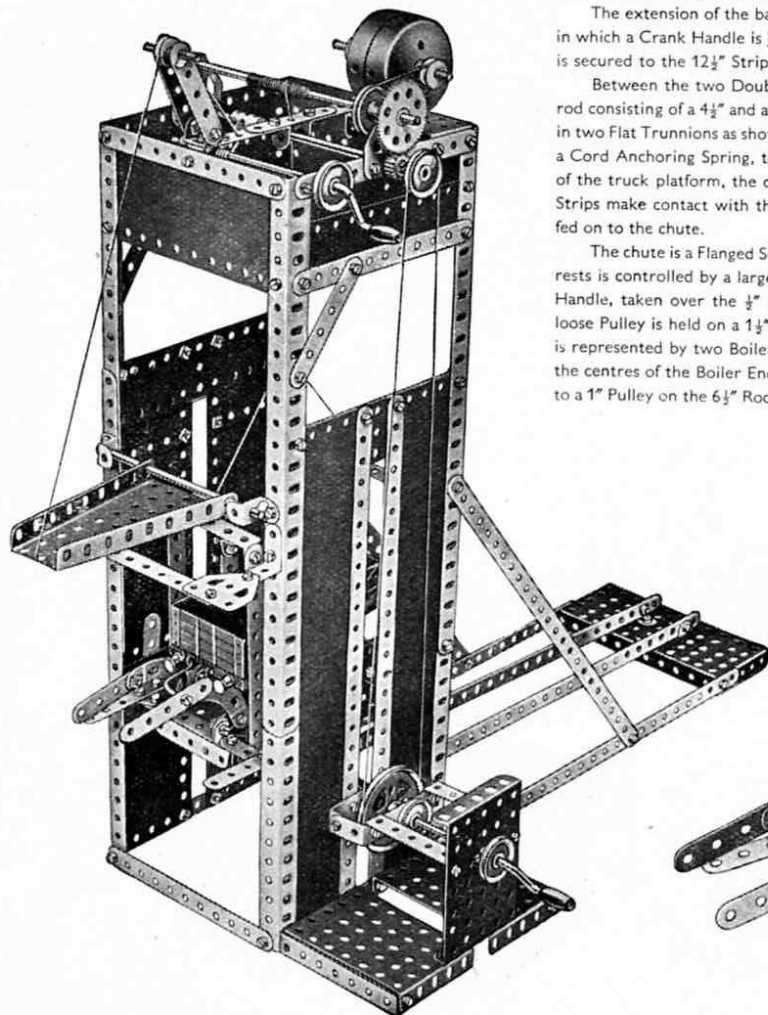


Fig. 7.15a

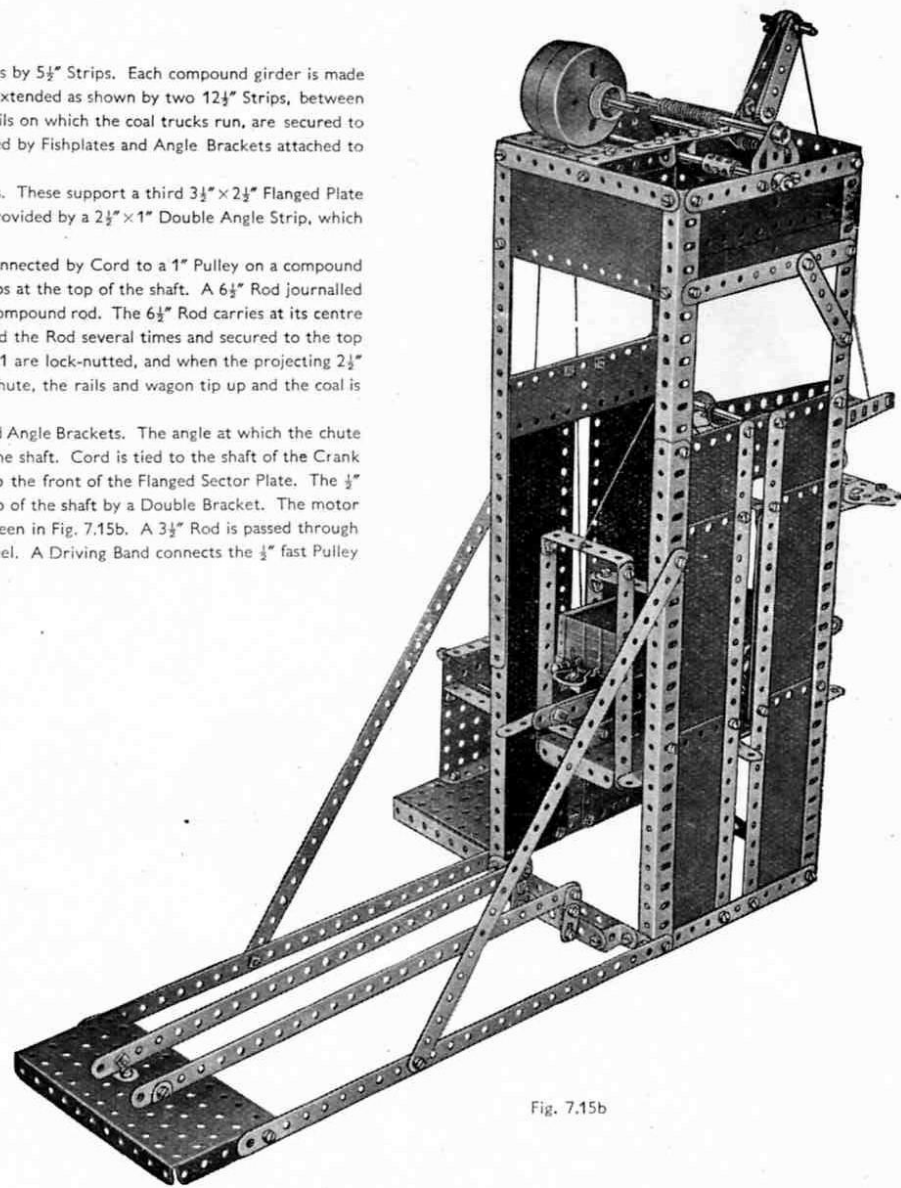
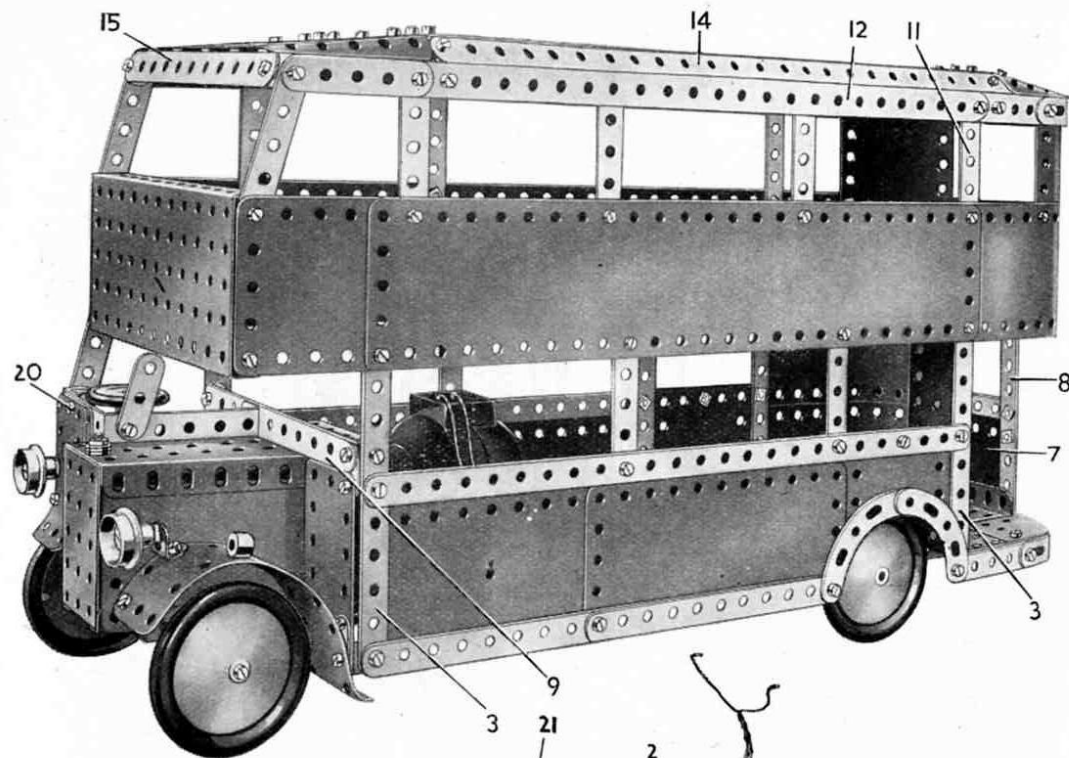


Fig. 7.15b



The sides are joined together at the front by a $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate and a $5\frac{1}{2}''$ Strip 9, and in the centre by a second $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate.

The roof is supported by $2\frac{1}{2}''$ Strips 10 and two $5\frac{1}{2}''$ Strips 11. A $12\frac{1}{2}''$ Strip 12 on each side of the model is extended at the front by a $2\frac{1}{2}''$ Strip, and at the rear by a $2\frac{1}{2}''$ Strip and a Formed Slotted Strip. The Formed Slotted Strips are joined by a $2\frac{1}{2}''$ Strip, and two $2\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plates 13 are bolted in position. The $12\frac{1}{2}''$ Strips 14 are attached by Obtuse Angle Brackets to the Strips 12, and the $5\frac{1}{2}''$ Strip 15 is secured to the Strips 10 by Angle Brackets.

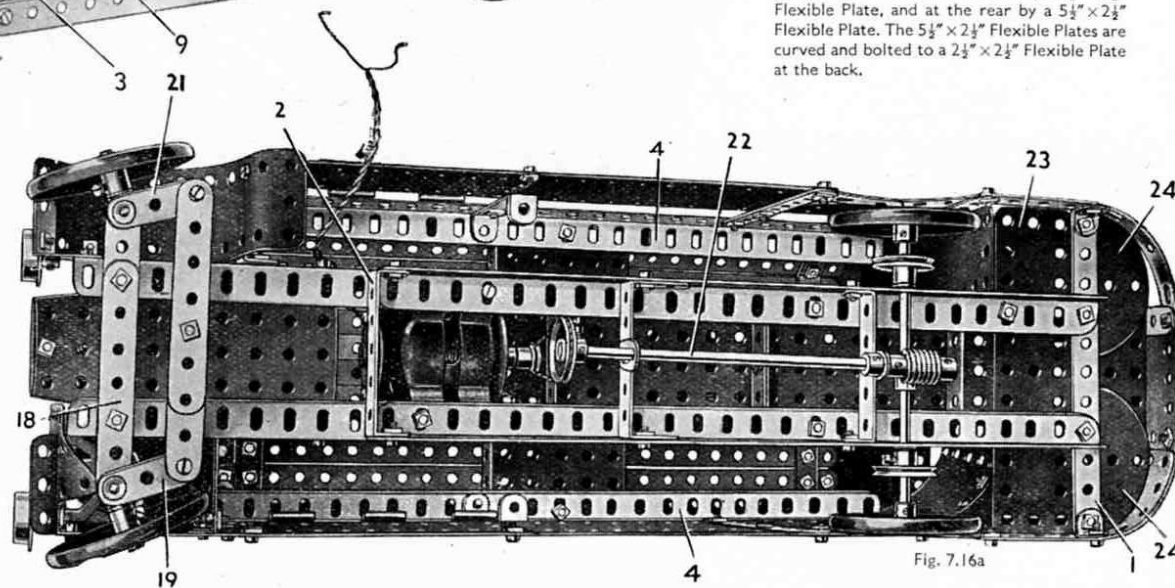


Fig. 7.16a

7.16 DOUBLE DECK BUS

The model is commenced by assembling the chassis members, each of which consists of two $12\frac{1}{2}''$ Angle Girders overlapped 16 holes. These are connected by a $5\frac{1}{2}''$ Strip 1 and a $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip 2 (Fig. 7.16a). The bonnet uses two Flanged Sector Plates joined by two $4\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plates, and the radiator is represented by a $2\frac{1}{2}'' \times 1\frac{1}{2}''$ Flanged Plate.

The framework of the rear side of the lower saloon is built up on two $5\frac{1}{2}''$ Strips 3. These are bolted at their lower ends to two $5\frac{1}{2}''$ Strips, at their centres to a $12\frac{1}{2}''$ Strip, and at their upper ends to a $12\frac{1}{2}''$ Angle Girder 4. The side is filled in by half of a Hinged 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 above the rear wheel. The off side of the saloon is made in a similar manner, and is extended by $2\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plates 5 (Fig. 7.16c) bolted to $2\frac{1}{2}''$ Strips.

The rear panelling of the lower saloon consists of two $1\frac{1}{2}''$ radius Curved Plates 6 and a $2\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plate 7. The Flexible Plate 7 is bolted to a $5\frac{1}{2}''$ Strip 8 and the Curved Plates are strengthened by Formed Slotted Strips.

The sides of the upper saloon are identical in construction, and are formed by a $12\frac{1}{2}''$ Strip Plate extended at the front by a $2\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plate, and at the rear by a $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plate. The $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plates are curved and bolted to a $2\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plate at the back.

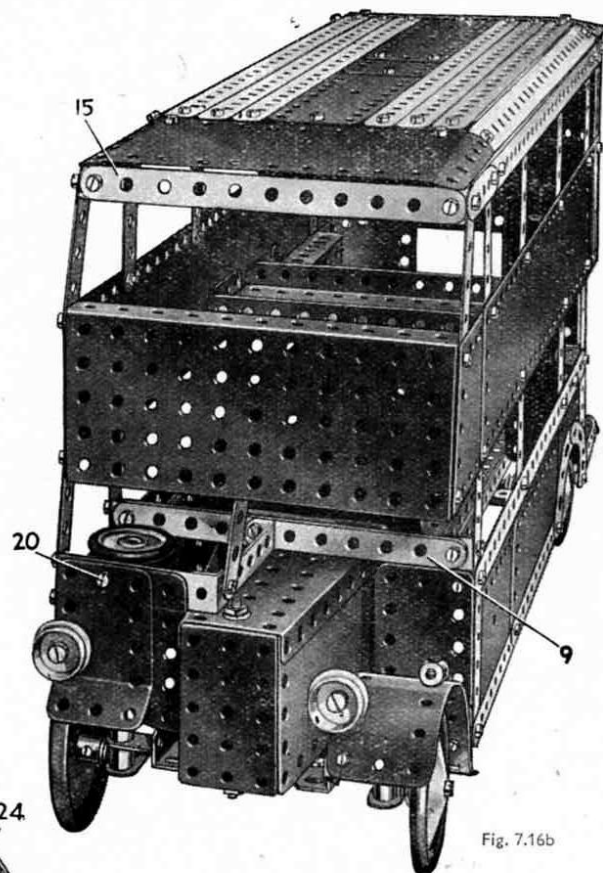


Fig. 7.16b

The centre of the roof is filled in by six $12\frac{1}{2}''$ Strips and three $5\frac{1}{2}'' \times 1\frac{1}{2}''$ Flexible Plates bolted together. These are attached at each end to a $3\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip and a $2\frac{1}{2}''$ Strip overlapped three holes. The compound strips are attached by Angle Brackets to the Strips 14. The front and rear of the roof are $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plates.

The driver's cab is made by fixing a $2\frac{1}{2}'' \times 1\frac{1}{2}''$ Flexible Plate 16 (Fig. 7.16c) to a Fishplate bolted to the side of the lower saloon. The front of the cab consists of two $2\frac{1}{2}'' \times 1\frac{1}{2}''$ Flexible Plates overlapped two holes and bolted to a $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip 17, and attached by an Angle Bracket to the Flexible Plate 16. The $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip 17 is joined to the Strip 9 by a similar Double Angle Strip.

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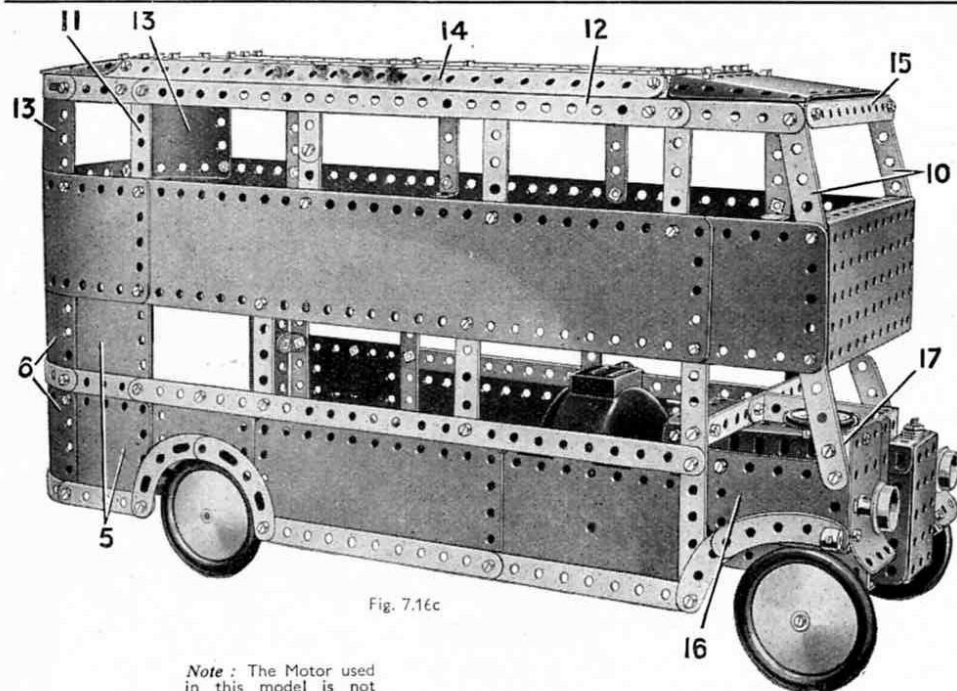


Fig. 7.16c

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

7.16 DOUBLE DECK BUS—Continued

The front axle is a compound strip 18 (Fig. 7.16a), bolted to the chassis, and is made by overlapping two $3\frac{1}{2}$ " Strips five holes. The Crank 19 is locked on a $3\frac{1}{2}$ " Rod journalled in the end hole of the strip 18 and in a Trunnion held by the Bolt 20. The Crank 21 is fixed on a $1\frac{1}{2}$ " Rod mounted in the end of the Strip 18 and is held in place by a Collar. The Cranks 19 and 21 are connected by two $3\frac{1}{2}$ " Strips, which are overlapped five holes and fastened to the Cranks by lock-nuts. The front wheels are free to turn on $\frac{3}{8}$ " Bolts screwed into the tapped holes of the Cranks 19 and 21, two Washers on each Bolt being used to space the Road Wheels from the Cranks.

An EO20 Electric Motor is bolted to the chassis members. The pulley on the Motor armature shaft is connected by a belt of Cord to a 1" Pulley on a $6\frac{1}{2}$ " Rod 22. This Rod is journalled in Fishplates bolted to two $2\frac{1}{2}$ " \times $\frac{1}{2}$ " Double Angle Strips attached to the chassis. A Worm Gear on the same Rod meshes with a $\frac{1}{2}$ " Pinion on the rear axle. The rear axle is a 5" Rod mounted in the chassis members.

The centre of the chassis is filled in by three $3\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flanged Plates, and the rear platform is formed by a $5\frac{1}{2}$ " \times $1\frac{1}{2}$ " Flexible Plate 23 and two Semi-Circular Plates 24.

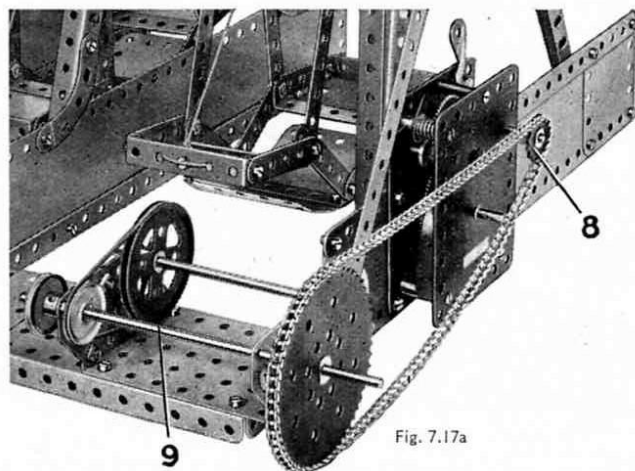
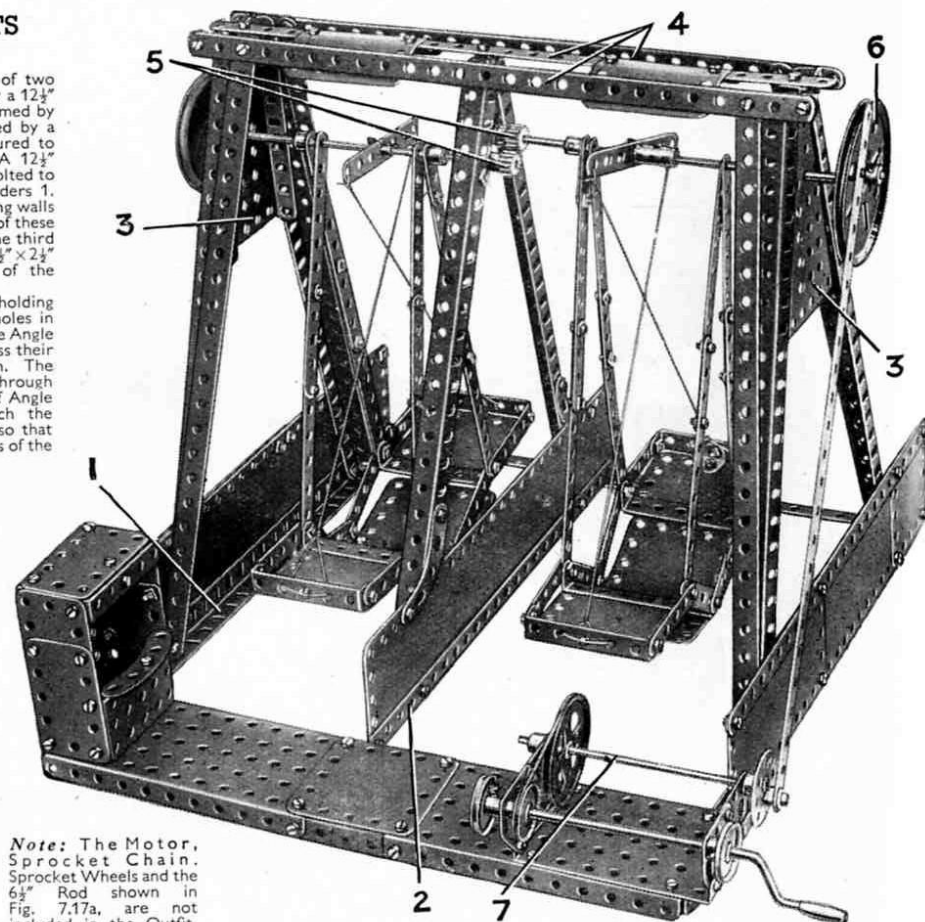


Fig. 7.17a

7.17 SWING BOATS

The base of the model consists of two Angle Girders 1 joined at each end by a $12\frac{1}{2}$ " Strip. The platform at the front is formed by two $5\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flanged Plates connected by a $2\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flexible Plate, and it is secured to the base by four Angle Brackets. A $12\frac{1}{2}$ " Strip 2 is attached to Angle Brackets bolted to the $12\frac{1}{2}$ " Strips used to join the Girders 1. The base is completed by bolting dividing walls to the Girders 1 and the Strip 2. Two of these walls are $12\frac{1}{2}$ " \times $2\frac{1}{2}$ " Strip Plates, and the third is made from one $2\frac{1}{2}$ " \times $2\frac{1}{2}$ " and two $5\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flexible Plates. The upper edges of the outer walls are edged by $12\frac{1}{2}$ " Strips.

The outer ends of the two shafts holding the swing boats are passed through holes in the Flanged Sector Plates 3 bolted to the Angle Girder uprights, which are joined across their upper ends by $12\frac{1}{2}$ " Strips 4 as shown. The inner ends of the Rods are passed through Fishplates bolted to the centre pair of Angle Girder uprights. The angle at which the Fishplates are set should be adjusted so that two $\frac{1}{2}$ " Pinions 5 fixed on the inner ends of the Rods mesh together accurately.



Note: The Motor, Sprocket Chain, Sprocket Wheels and the $6\frac{1}{2}$ " Rod shown in Fig. 7.17a, are not included in the Outfit.

The right-hand Rod carries outside the Flanged Sector Plate a 3" Pulley 6, and to this is fastened a Threaded Pin that is connected by a $12\frac{1}{2}$ " Strip to a $\frac{1}{8}$ " Bolt secured by lock-nuts to a Bush Wheel. The Bush Wheel is held on a $4\frac{1}{2}$ " Rod 7 passed through two Flat Trunnions, which are fastened to the flanges of a $3\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flanged Plate bolted to the base. A 2" Pulley on the $4\frac{1}{2}$ " Rod is connected by a Driving Band to a 1" Pulley on a Crank Handle, which is mounted in two Flat Trunnions bolted to the flanges of the $3\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flanged Plate.

The back of the pay-box is formed by a $3\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flanged Plate, and its front by a $2\frac{1}{2}$ " \times $1\frac{1}{2}$ " Flanged Plate. The sides and top are filled in with $2\frac{1}{2}$ " \times $1\frac{1}{2}$ " Flexible Plates.

Fig. 7.17a shows the model fitted with a No. 1 Clockwork Motor. The Motor is bolted to the side of the base, and a $\frac{1}{2}$ " Sprocket Wheel 8 fixed on its driving shaft is connected by Sprocket Chain to a 3" Sprocket Wheel on a $6\frac{1}{2}$ " Rod 9, which takes the place of the Crank Handle shown in the hand-driven model.

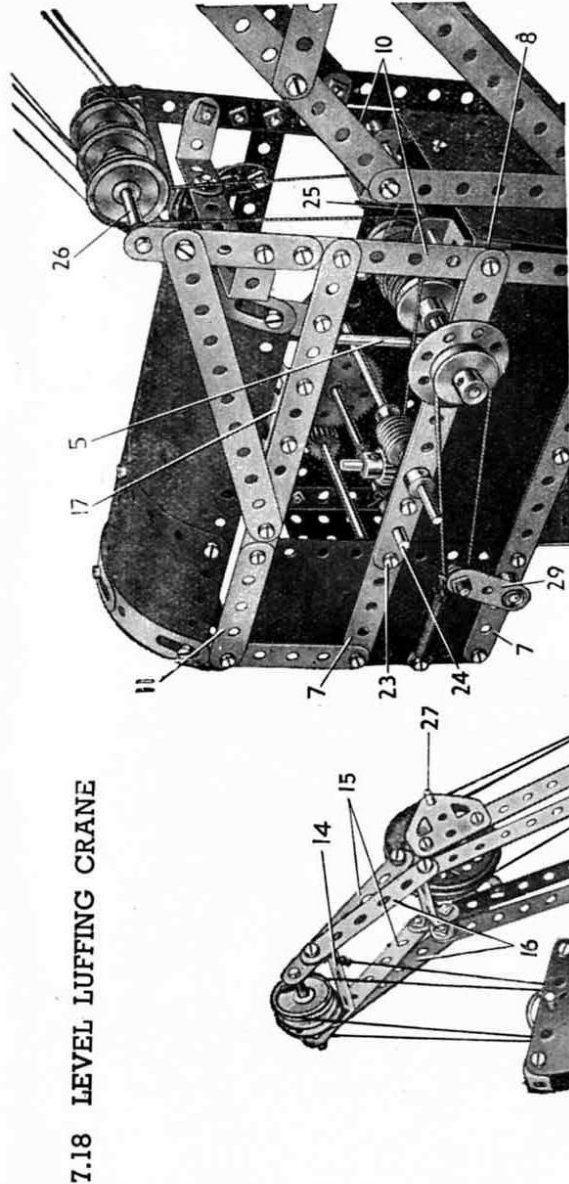
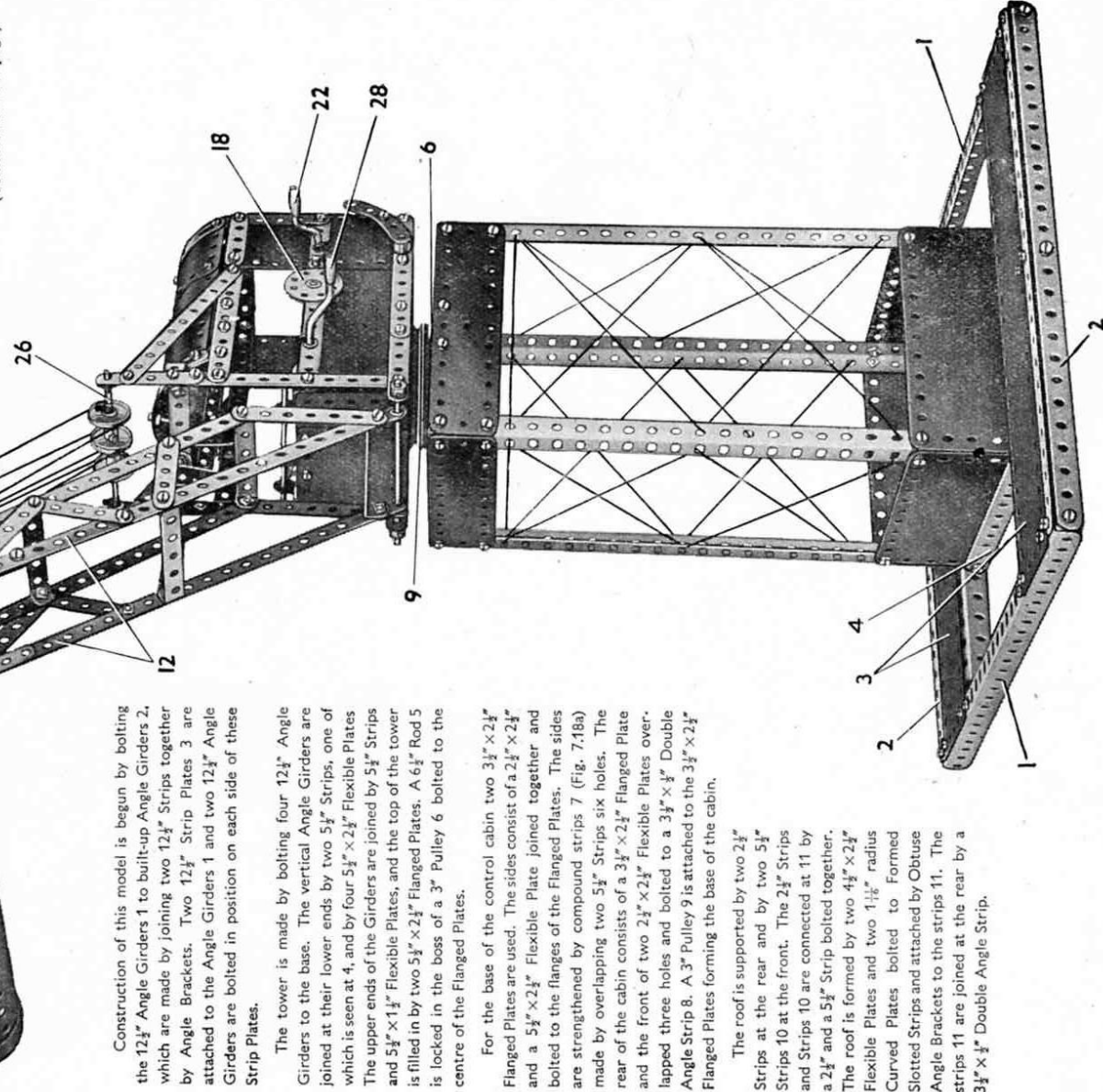


Fig. 7.18a

The main girders of the jib are two pairs of compound strips. The strips 12 consist of two $12\frac{1}{2}$ " Strips overlapped six holes, and the strips 13 are two $12\frac{1}{2}$ " Strips overlapped 11 holes. The strips 12 and 13 are bolted at their lower ends to $3\frac{1}{2}$ " Strips and joined by eight $2\frac{1}{2}$ " \times $\frac{1}{2}$ " Double Angle Strips. The upper ends of the strips 12 and 13 are connected by Fishplates and extended by the $3\frac{1}{2}$ " Strips 15 and 3" Strips 16. The last named Strips are joined by a $1\frac{1}{2}$ " \times $\frac{1}{2}$ " Double Angle Strip 14.

(Continued on next page)



Construction of this model is begun by bolting the $12\frac{1}{2}$ " Angle Girders 1 to built-up Angle Girders 2, which are made by joining two $12\frac{1}{2}$ " Strips together by Angle Brackets. Two $12\frac{1}{2}$ " Strip Plates 3 are attached to the Angle Girders 1 and two $12\frac{1}{2}$ " Angle Girders are bolted in position on each side of these Strip Plates.

The tower is made by bolting four $12\frac{1}{2}$ " Angle Girders to the base. The vertical Angle Girders are joined at their lower ends by two $5\frac{1}{2}$ " Strips, one of which is seen at 4, and by four $5\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flexible Plates. The upper ends of the Girders are joined by $5\frac{1}{2}$ " Strips and $5\frac{1}{2}$ " \times $1\frac{1}{2}$ " Flexible Plates, and the top of the tower is filled in by two $5\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flanged Plates. A $6\frac{1}{2}$ " Rod 5 is locked in the boss of a 3" Pulley 6 bolted to the centre of the Flanged Plates.

For the base of the control cabin two $3\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flanged Plates are used. The sides consist of a $2\frac{1}{2}$ " \times $2\frac{1}{2}$ " and a $5\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flexible Plate joined together and bolted to the flanges of the Flanged Plates. The sides are strengthened by compound strips 7 (Fig. 7.18a) made by overlapping two $5\frac{1}{2}$ " Strips six holes. The rear of the cabin consists of a $3\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flanged Plate and the front of two $2\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flexible Plates overlapped three holes and bolted to a $3\frac{1}{2}$ " \times $\frac{1}{2}$ " Double Angle Strip 8. A 3" Pulley 9 is attached to the $3\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flanged Plates forming the base of the cabin.

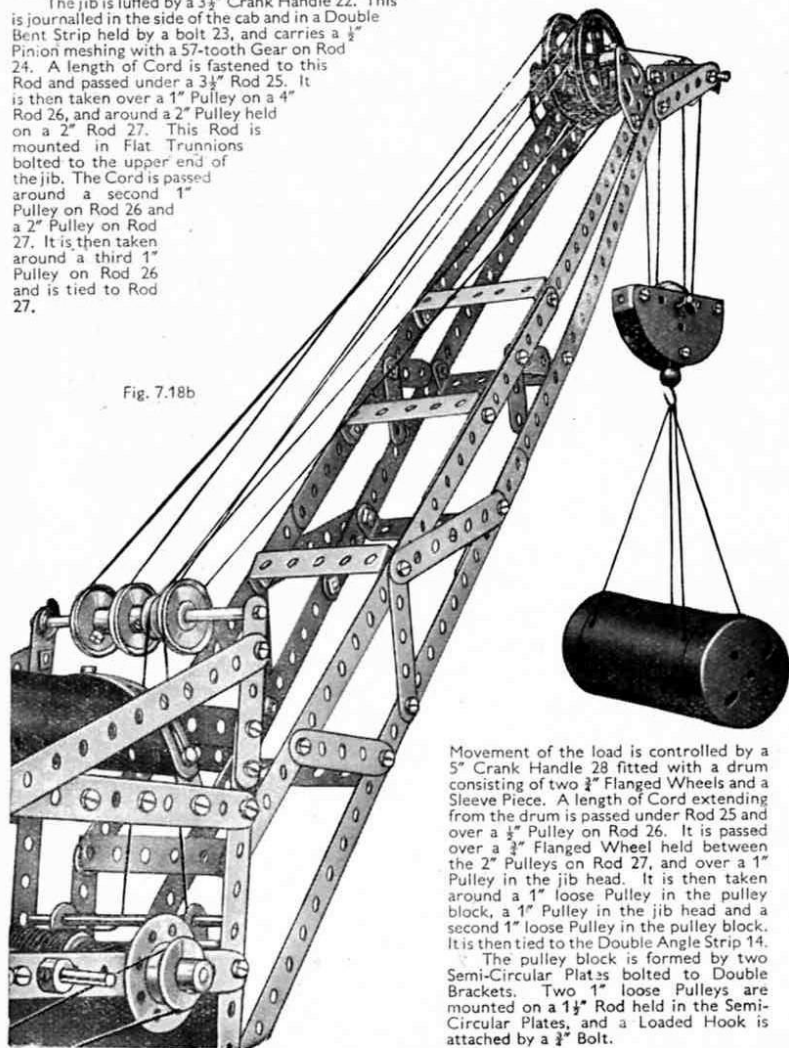
The roof is supported by two $2\frac{1}{2}$ " Strips at the rear and by two $5\frac{1}{2}$ " Strips 10 at the front. The $2\frac{1}{2}$ " Strips and Strips 10 are connected at 11 by a $2\frac{1}{2}$ " and a $5\frac{1}{2}$ " Strip bolted together. The roof is formed by two $4\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flexible Plates and two $1\frac{1}{16}$ " radius Curved Plates bolted to Formed Slotted Strips and attached by Obtuse Angle Brackets to the strips 11. The strips 11 are joined at the rear by a $3\frac{1}{2}$ " \times $\frac{1}{2}$ " Double Angle Strip.

7.18 LEVEL-LUFFING CRANE—Continued

The Rod 5 (Fig. 7.18a) is passed through the Pulley 9 and the centre hole of a $2\frac{1}{2}$ " Strip attached by Trunnions to the strips 11. One of the Trunnions can be seen at 17. The jib and cab are slewed by turning the Bush Wheel 18. This is locked on a 5" Rod carrying a Worm, which meshes with a $\frac{1}{2}$ " Pinion fixed on a vertical $3\frac{1}{2}$ " Rod. This Rod is mounted in the base of the strips 7. A $\frac{1}{2}$ " Pulley locked on the lower end of the $3\frac{1}{2}$ " Rod is connected by a Driving Band to the 3" Pulley 6.

The jib is luffed by a $3\frac{1}{2}$ " Crank Handle 22. This is journalled in the side of the cab and in a Double Bent Strip held by a bolt 23, and carries a $\frac{1}{2}$ " Pinion meshing with a 57-tooth Gear on Rod 24. A length of Cord is fastened to this Rod and passed under a $3\frac{1}{2}$ " Rod 25. It is then taken over a 1" Pulley on a 4" Rod 26, and around a 2" Pulley held on a 2" Rod 27. This Rod is mounted in Flat Trunnions bolted to the upper end of the jib. The Cord is passed around a second 1" Pulley on Rod 26 and a 2" Pulley on Rod 27. It is then taken around a third 1" Pulley on Rod 26 and is tied to Rod 27.

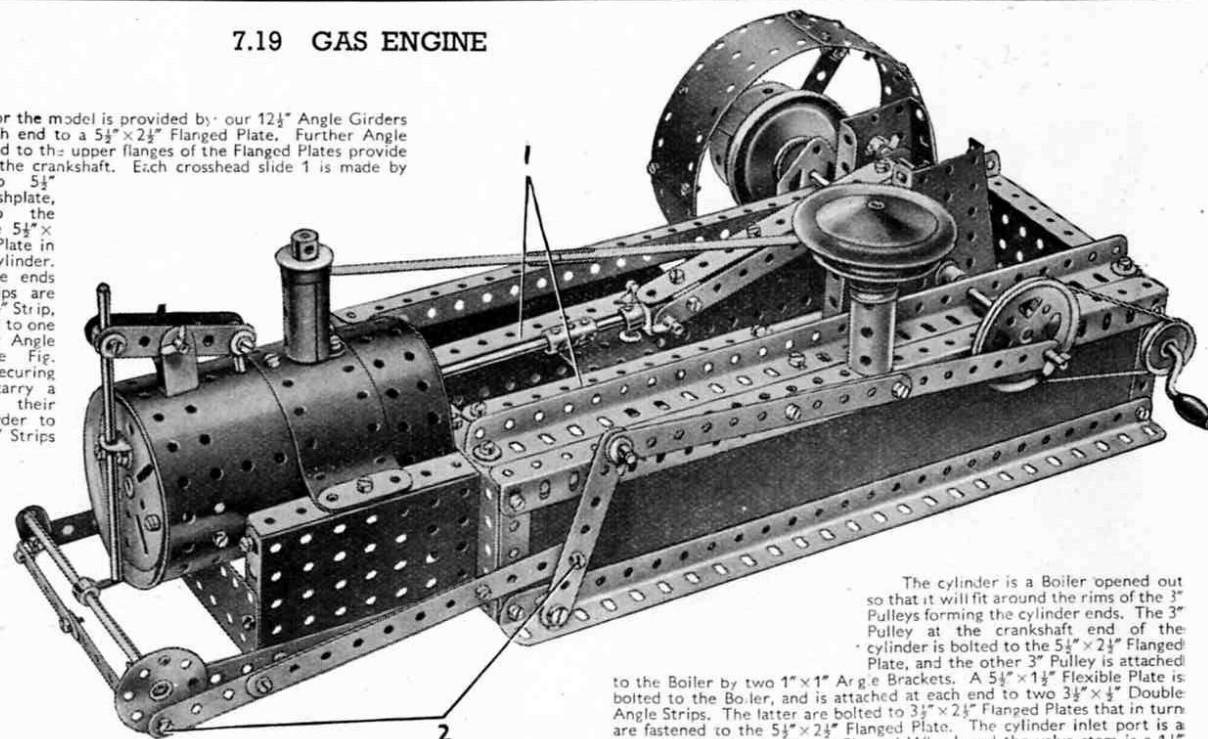
Fig. 7.18b



Movement of the load is controlled by a 5" Crank Handle 28 fitted with a drum consisting of two $\frac{1}{2}$ " Flanged Wheels and a Sleeve Piece. A length of Cord extending from the drum is passed under Rod 25 and over a $\frac{1}{2}$ " Pulley on Rod 26. It is passed over a $\frac{1}{2}$ " Flanged Wheel held between the 2" Pulleys on Rod 27, and over a 1" Pulley in the jib head. It is then taken around a 1" loose Pulley in the pulley block, a 1" Pulley in the jib head and a second 1" loose Pulley in the pulley block. It is then tied to the Double Angle Strip 14. The pulley block is formed by two Semi-Circular Plates bolted to Double Brackets. Two 1" loose Pulleys are mounted on a $1\frac{1}{2}$ " Rod held in the Semi-Circular Plates, and a Loaded Hook is attached by a $\frac{1}{2}$ " Bolt.

7.19 GAS ENGINE

A base for the model is provided by our 12 $\frac{1}{2}$ " Angle Girders bolted at each end to a $5\frac{1}{2}$ " x $2\frac{1}{2}$ " Flanged Plate. Further Angle Girders bolted to the upper flanges of the Flanged Plates provide bearings for the crankshaft. Each crosshead slide 1 is made by bolting two $5\frac{1}{2}$ " Strips to a Fishplate, attached to the flange of the $5\frac{1}{2}$ " x $2\frac{1}{2}$ " Flanged Plate in front of the cylinder. At their free ends the $5\frac{1}{2}$ " Strips are bolted to a $1\frac{1}{2}$ " Strip, which is fixed to one of the upper Angle Girders (see Fig. 7.19a). The securing bolts each carry a Washer in order to space the $5\frac{1}{2}$ " Strips apart.



The cylinder is a Boiler opened out so that it will fit around the rims of the 3" Pulleys forming the cylinder ends. The 3" Pulley at the crankshaft end of the cylinder is bolted to the $5\frac{1}{2}$ " x $2\frac{1}{2}$ " Flanged Plate, and the other 3" Pulley is attached to the Boiler by two 1" x 1" Angle Brackets. A $5\frac{1}{2}$ " x $1\frac{1}{2}$ " Flexible Plate is bolted to the Boiler, and is attached at each end to two $3\frac{1}{2}$ " x $\frac{1}{2}$ " Double Angle Strips. The latter are bolted to $3\frac{1}{2}$ " x $2\frac{1}{2}$ " Flanged Plates that in turn are fastened to the $5\frac{1}{2}$ " x $2\frac{1}{2}$ " Flanged Plate. The cylinder inlet port is a Sleeve Piece fitted with a $\frac{1}{2}$ " Flanged Wheel, and the valve stem is a $1\frac{1}{2}$ " Rod held in a Collar pivoted between 2 $\frac{1}{2}$ " Strips. The valve tappet is a $\frac{1}{2}$ " Rod also held in a Collar.

The crankshaft consists of a 2" Rod and a 5" Rod fitted with Flanged Sector Plates to represent the crank webs. The 2" Rod is held in the boss of a Crank bolted on the outside of one of the Flanged Sector Plates, and the 5" Rod is held in the boss of a 57-tooth Gear bolted on the inside of the other Flanged Sector Plate. The Flanged Sector Plates are connected by a 2" Rod, which is passed through the boss of a Crank and is held in place by a Collar and a $\frac{1}{2}$ " Flanged Wheel. The connecting rod is made by bolting two $5\frac{1}{2}$ " Strips and two 3" Strips overlapped two holes to two Double Brackets. The large Fork Piece, to which the $2\frac{1}{2}$ " x $1\frac{1}{2}$ " Flanged Plate forming the crosshead is bolted, is spaced from the crosshead by three Washers.

The piston rod consists of a $4\frac{1}{2}$ " Rod joined to a $1\frac{1}{2}$ " Rod by a Coupling, and the flywheel is made by bolting two compound strips, consisting of two $2\frac{1}{2}$ " Strips overlapped one hole, to a 2" Pulley. Three $5\frac{1}{2}$ " x $1\frac{1}{2}$ " Flexible Plates are bolted together and attached by Angle Brackets to the ends of the $2\frac{1}{2}$ " Strips.

The Bolts 2 are lock-nutted. The Collar on the 5" Rod carrying the Bush Wheel is fitted with a $\frac{1}{2}$ " Bolt that actuates the valve tappet.

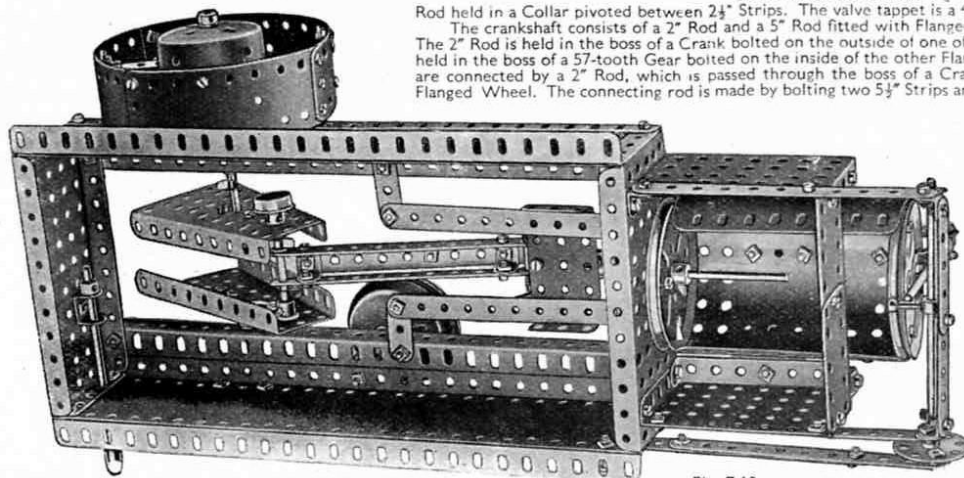


Fig. 7.19a

7.20 TRAVELLING GANTRY CRANE

Each of the vertical towers is built from two $12\frac{1}{2}"$ Angle Girders 1 and two $12\frac{1}{2}"$ Strips 2. These are bolted at their upper ends to a $3\frac{1}{2}" \times 2\frac{1}{2}"$ Flanged Plate 3. The Angle Girders are fastened to a $12\frac{1}{2}"$ Strip Plate strengthened by a $12\frac{1}{2}"$ Strip 4 and two $5\frac{1}{2}"$ Strips 5. The Strips 2 are attached by Angle Brackets to a $12\frac{1}{2}"$ flexible plate made by bolting together three $5\frac{1}{2}" \times 2\frac{1}{2}"$ Flexible Plates. This plate is strengthened by a $12\frac{1}{2}"$ Strip 6 and is connected to the Strips 4 and 5 by two $2\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strips at each end.

A $2\frac{1}{2}" \times 2\frac{1}{2}"$ Flexible Plate is attached to one of the Double Angle Strips at each end, and the top is filled in by a $4\frac{1}{2}" \times 2\frac{1}{2}"$ Flexible Plate 7 and half of a Hinged Flat Plate 8.

The towers are connected by two compound girders 9 and two compound strips 10. The girders 9 are formed by two $12\frac{1}{2}"$ Angle Girders joined together by a $2\frac{1}{2}"$ Strip, and the strips 10 are made by bolting two $12\frac{1}{2}"$ Strips to a $3\frac{1}{2}" \times 2\frac{1}{2}"$ Flanged Plate 11.

The sides of the control cabin are made by attaching two $5\frac{1}{2}" \times 2\frac{1}{2}"$ Flanged Plates to the Flanged Plate 3. The roof is supported by four $2\frac{1}{2}"$ Strips bolted to the sides and connected at their upper ends by $5\frac{1}{2}"$ Strips 12 and $3\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strips 13 (Fig. 7.20a). The roof consists of four $5\frac{1}{2}" \times 1\frac{1}{2}"$ Flexible Plates joined together and attached to the Strips 12 by Obtuse Angle Brackets.

To make the travelling carriage (Fig. 7.20b), two Trunnions 14 are bolted to a $1\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strip. The carriage runs on four $\frac{3}{4}"$ Flanged Wheels locked in pairs on $3"$ Screwed Rods. The Screwed Rods are journaled in the $2\frac{1}{2}"$ Strips 15. These Strips are fastened to the ends of the $1\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strip. Two $1"$ loose Pulleys are held on a $1"$ Rod mounted in the end holes of the Trunnions 14.

Movement of the carriage is controlled by a $3\frac{1}{2}"$ Crank Handle journaled in the side of the cabin and in a $1\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strip 16 (Fig. 7.20b). A $\frac{1}{2}"$ Pinion on the Crank Handle meshes with a 57-tooth Gear on a $4\frac{1}{2}"$ Rod 17. A length of Cord extending from the rear of the carriage is passed under the Rod 18 and lapped twice around a $\frac{1}{2}"$ Pulley 19 on the Rod 17. It is then passed under the Rod 18 and around a $1"$ Pulley on a $4\frac{1}{2}"$ Rod 20, and finally fastened to the opposite end of the carriage.

Raising and lowering of the load is controlled by a $5"$ Crank Handle journaled in the sides of the cabin. A length of Cord fastened to a Cord Anchoring Spring on the Crank Handle is passed under the Rod 18 and over one of the $1"$ loose Pulleys on the travelling carriage. It is then passed around a $1"$ Pulley in the pulley block and over the second loose Pulley on the carriage, and tied to the Rod 20.

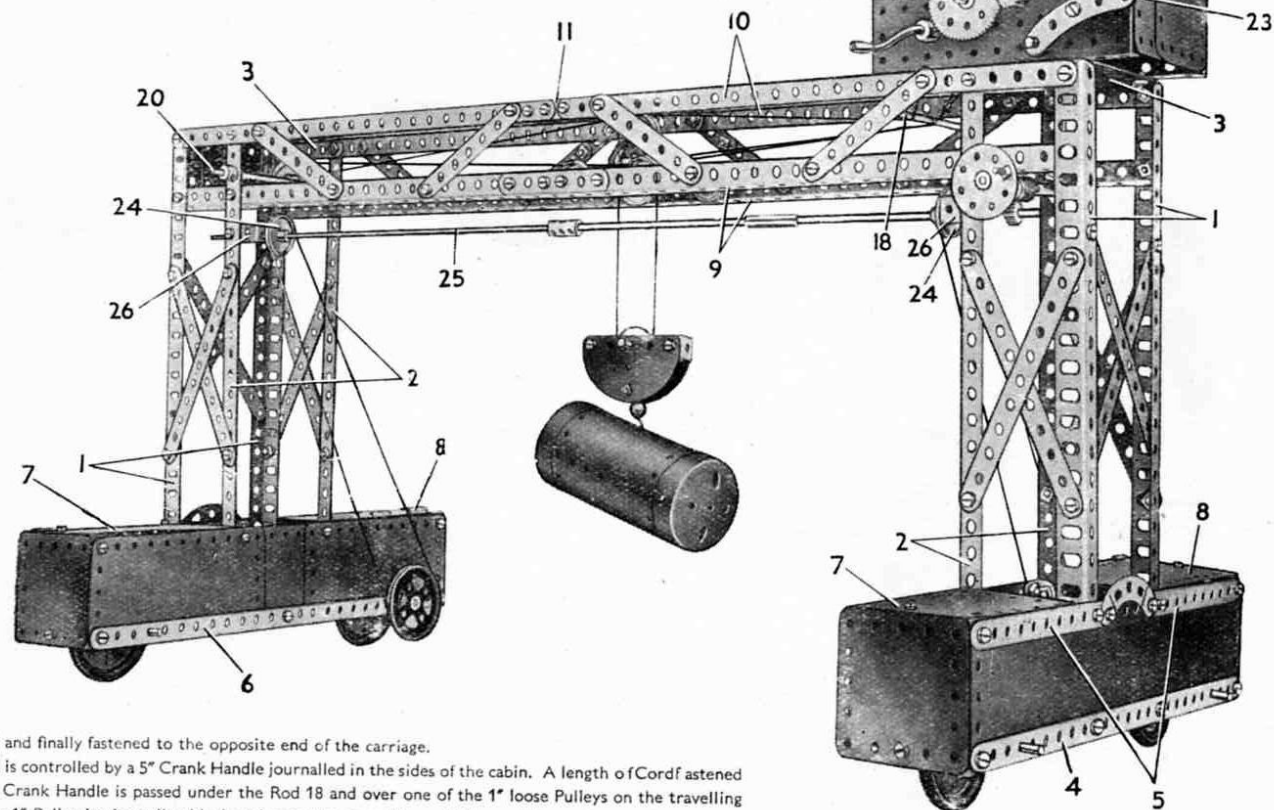
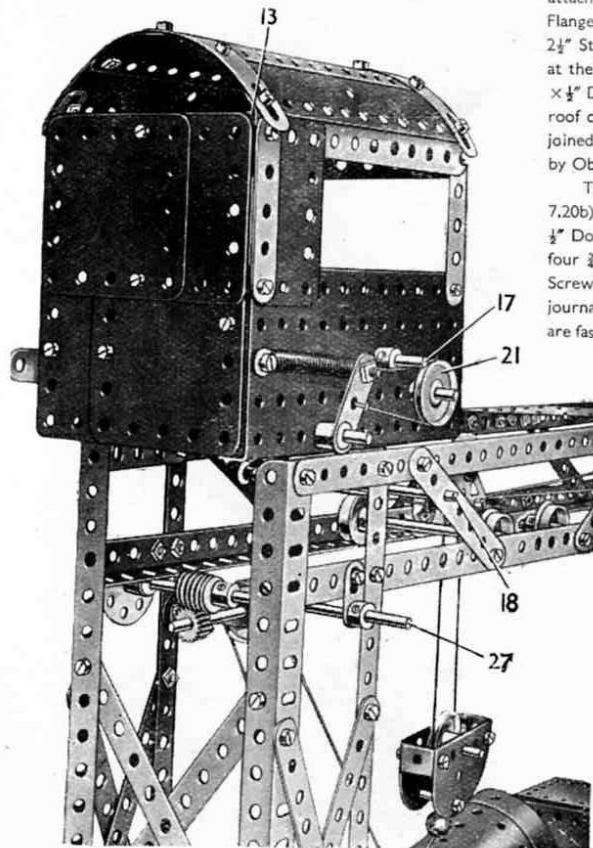


Fig. 7.20a

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7.20 TRAVELLING GANTRY CRANE—Continued

A brake on the 5" Crank Handle is provided by a length of Cord around a 1" Pulley 21 (Fig. 7.20b). This Cord is attached to a Crank 22 locked on a 5" Rod passed through the sides of the cabin. A 2½" Curved Strip 23 bolted to a second Crank fixed on this Rod acts as the brake lever.

The pulley block is formed by two Semi-Circular Plates joined by two Double Brackets. The Hook is held on a ½" Bolt passed through the Semi-Circular Plates.

The crane travels on four Road Wheels locked on 3½" Rods mounted in the Strips 4 and 5. Two 2" Pulleys fixed to the rear pair of 3½" Rods are connected by belts of Cord to 1" Pulleys 24. These Pulleys are locked on a long rod 25 made by joining together an 11½", a 6½" and a 5" Rod by a Coupling and a Rod Connector. This rod is journaled in 1"×1" Angle Brackets 26 bolted to each of the towers. A ½" Pinion on the rod 25 meshes with a Worm Gear on a 4½" Rod 27. This Rod is mounted in Fishplates bolted to the Girders 9 and is fitted with a Bush Wheel.

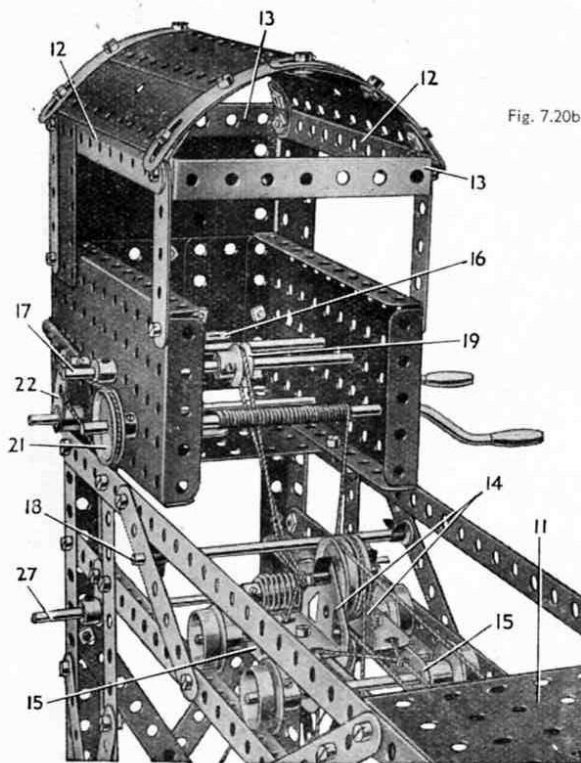
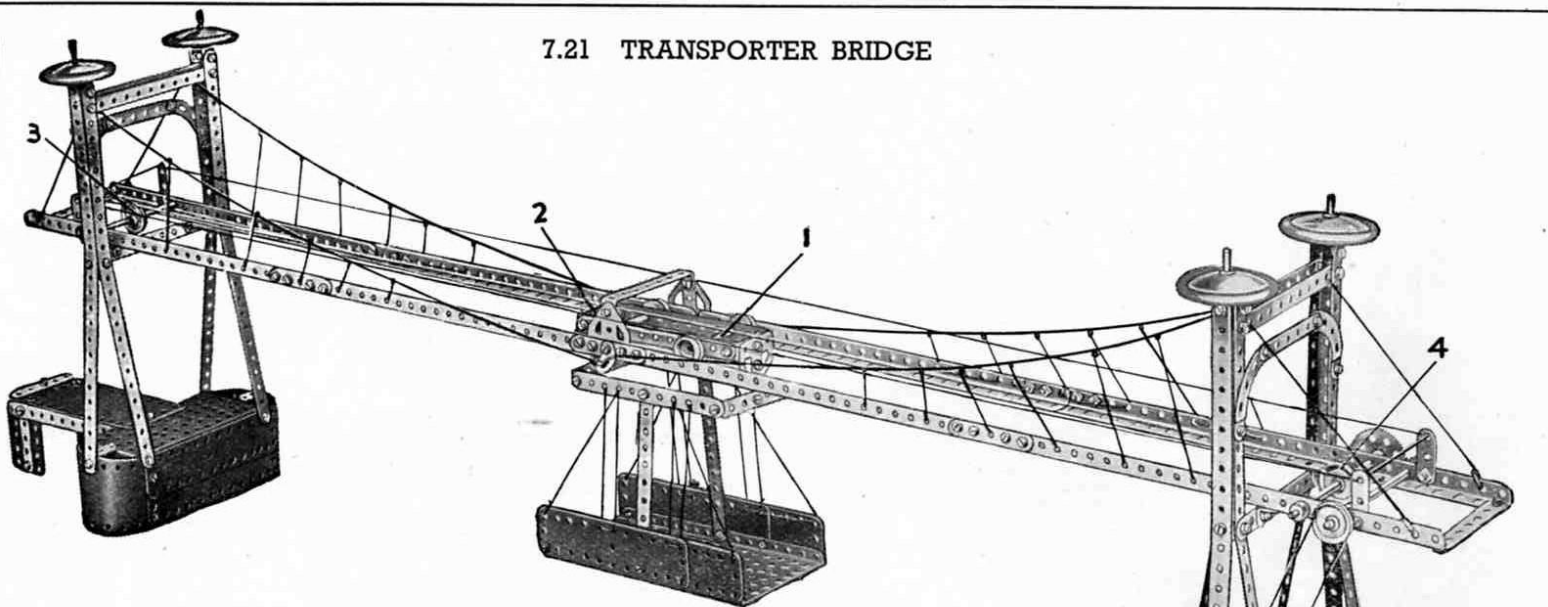


Fig. 7.20b

7.21 TRANSPORTER BRIDGE



Construction should be commenced with the two towers supporting the span. The bases of the towers are identical, and an underneath view of one is shown in Fig. 7.21a. Two 5½"×2½" Flexible Plates are curved to shape and the ends are overlapped by two holes along the flanges of a 5½"×2½" Flanged Plate. The shore side of the base is made by extending a 4½"×2½" Flexible Plate two holes with a 2½"×2½" Flexible Plate. The other side consists of two 5½"×1½" Flexible Plates overlapped lengthways, and the lower edges of the base are braced by two 2½"×1½" Double Angle Strips.

Each approach roadway is a 5½"×2½" Flexible Plate extended one hole by a 2½"×1½" Flexible Plate, the securing bolts carrying also a 2½"×½" Double Angle Strip. A second 2½"×½" Double Angle Strip is bolted near the inner end of the 5½"×2½" Flexible Plate, and is connected to the other Double Angle Strip by 5½" Strips. The approach roadways are supported at the shore ends by 2½"×1½" Flexible Plates reinforced by 2½" Strips.

Each tower is made as follows. Two 12½" Strips are bolted at the top ends to a Double Bracket, and a third 12½" Strip is attached to them by an Angle Bracket. In a position 12 holes from the top, the 12½" Strips are bolted to a Double Bracket made from two Angle Brackets, and their lower ends are splayed out and bolted to the base. The towers at each end of the bridge are joined across by three 5½" Strips, and an archway made from two 2½" small radius Curved Strips and a 3" Strip, is added. At the top of each tower a Road Wheel is carried on a 1½" Rod, which is held in place by a Spring Clip.

Each side of the span consists of four 12½" Angle Girders joined together with 2½" Strips, and they are connected at each end by 3½" Strips, and at the centre by a 3½"×½" Double Angle Strip bolted to Flat Trunnions. Angle Brackets connect the span to the lower 5½" Strips in the towers.

The bogie supporting the carriage consists of two 5½" Strips joined across at each end by 1½"×½" Double Angle Strips which are fitted with Flat Trunnions. Fishplates bolted to the Flat Trunnions support the carriage. A Crank Handle carrying a 1" Pulley is journaled in the right-hand tower, and the drive is taken from the Pulley to a second 1" Pulley fastened on a 5" Rod in the span. A ½" Pinion on this Rod meshes with a 57-tooth Gear secured to a second 5" Rod. The operating Cord 1 for the carriage is tied to Flat Trunnion 2, led around 1" loose Pulley 3 on a 4½" Rod, and around 1" fast Pulley 4 on a 5" Rod. Finally it is tied to one end of a Spring, the other end of which is carried on a Pivot Bolt lock-nutted to a Reversed Angle Bracket bolted to the travelling bogie. The Spring is used to tension the operating Cord 1.

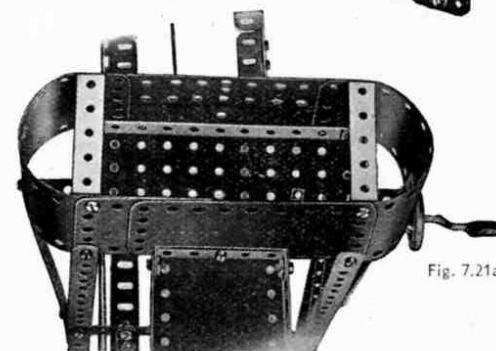


Fig. 7.21a

7.22 SHEERLEGS

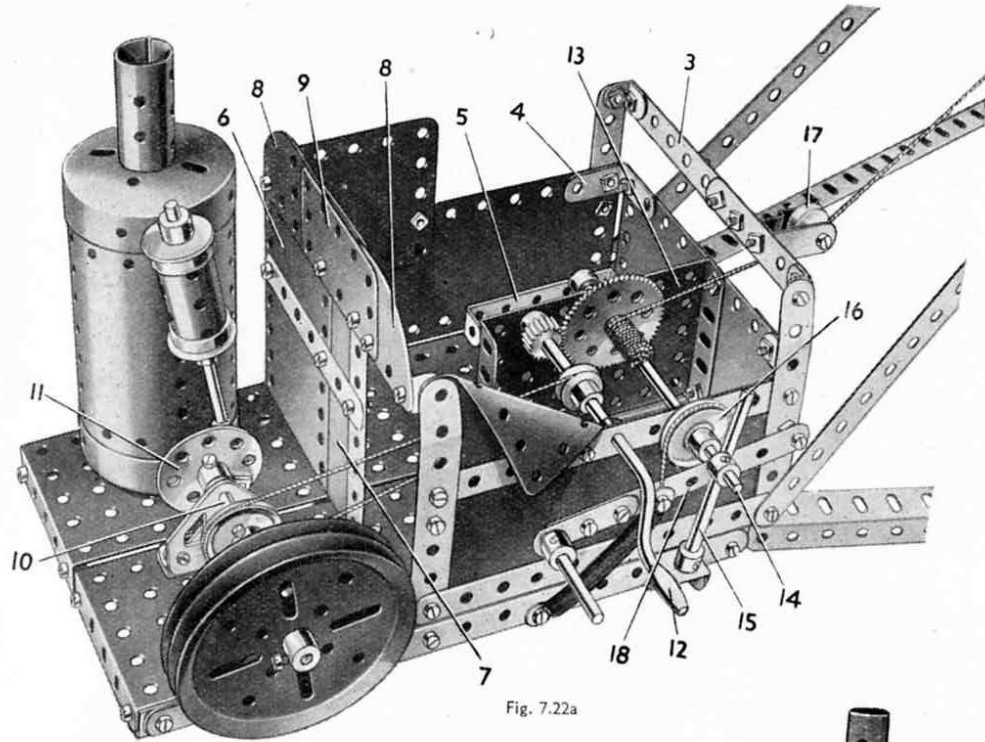


Fig. 7.22a

The piston rod is a 4" Rod, and it is connected to the Pivot Bolt on the Bush Wheel by a Rod and Strip Connector. Bearings for the crankshaft are provided by Flat Trunnions attached to Trunnions bolted to the base, and the flywheel consists of two 3" Pulleys.

The model is operated by a 3½" Crank Handle 12. This is journaled in the side of the cab and in a 3½" x 2½" Flanged Bracket to the base. A ½" Pulley on the Crank Handle is connected by a belt of Cord to a 1" Pulley on Rod 10. The Crank Handle is also fitted with a ½" Pinion, which can be meshed with a 57-tooth Gear on a 5" Rod 14. This Rod is free to slide in its bearings, and is controlled by a lever 15, consisting of a 3½" Rod fixed in a large Fork Piece. The Fork Piece is pivoted by a ½" Bolt to a Double Bracket bolted to the base. The lever 15 engages between a 1" Pulley 16 and a Collar locked on the Rod 14.

The fixed pulley block at the crane head (Fig. 7.22b) is formed by 1½" Strips attached to two Flat Trunnions bolted to the legs. A 2" Pulley and a 1" loose Pulley are free to turn on a 1½" Rod mounted in the 1½" Strips and held in place by Collars.

The hoisting pulley block consists of two 2½" x ½" Double Angle Strips bolted together, and the Hook is attached by an Angle Bracket. A 2" Pulley is locked on a 1" Rod mounted in the Double Angle Strips.

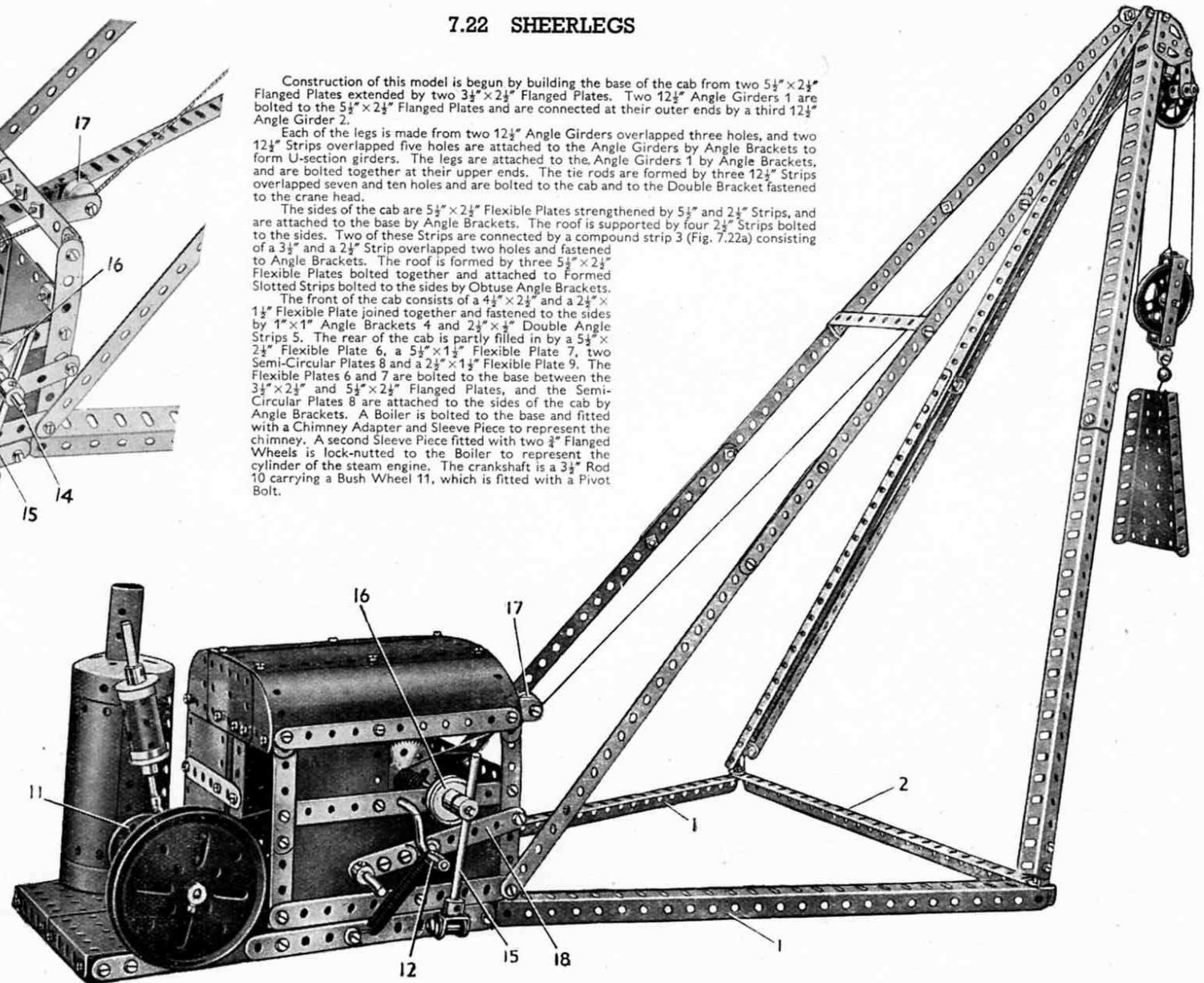
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Construction of this model is begun by building the base of the cab from two 5½" x 2½" Flanged Plates extended by two 3½" x 2½" Flanged Plates. Two 12½" Angle Girders 1 are bolted to the 5½" x 2½" Flanged Plates and are connected at their outer ends by a third 12½" Angle Girder 2.

Each of the legs is made from two 12½" Angle Girders overlapped three holes, and two 12½" Strips overlapped five holes are attached to the Angle Girders by Angle Brackets to form U-section girders. The legs are attached to the Angle Girders 1 by Angle Brackets, and are bolted together at their upper ends. The tie rods are formed by three 12½" Strips overlapped seven and ten holes and are bolted to the cab and to the Double Bracket fastened to the crane head.

The sides of the cab are 5½" x 2½" Flexible Plates strengthened by 5½" and 2½" Strips, and are attached to the base by Angle Brackets. The roof is supported by four 2½" Strips bolted to the sides. Two of these Strips are connected by a compound strip 3 (Fig. 7.22a) consisting of a 3½" and a 2½" Strip overlapped two holes and fastened to Angle Brackets. The roof is formed by three 5½" x 2½" Flexible Plates bolted together and attached to Formed Slotted Strips bolted to the sides by Obtuse Angle Brackets.

The front of the cab consists of a 4½" x 2½" and a 2½" x 1½" Flexible Plate joined together and fastened to the sides by 1" x 1" Angle Brackets 4 and 2½" x ½" Double Angle Strips 5. The rear of the cab is partly filled in by a 5½" x 2½" Flexible Plate 6, a 5½" x 1½" Flexible Plate 7, two Semi-Circular Plates 8 and a 2½" x 1½" Flexible Plate 9. The Flexible Plates 6 and 7 are bolted to the base between the 3½" x 2½" and 5½" x 2½" Flanged Plates, and the Semi-Circular Plates 8 are attached to the sides of the cab by Angle Brackets. A Boiler is bolted to the base and fitted with a Chimney Adapter and Sleeve Piece to represent the chimney. A second Sleeve Piece fitted with two 2" Flanged Wheels is lock-nutted to the Boiler to represent the cylinder of the steam engine. The crankshaft is a 3½" Rod 10 carrying a Bush Wheel 11, which is fitted with a Pivot Bolt.



7.22 SHEERLEGS—Continued



Fig. 7.22b

A length of Cord is fastened to a Cord Anchoring Spring on Rod 14, and is led under a $\frac{1}{2}$ " loose Pulley 17. It is then passed over the 2" Pulley in the crane head, and around a similar Pulley in the pulley block. It is passed around the 1" loose Pulley at the crane head and is tied to the hoisting pulley block.

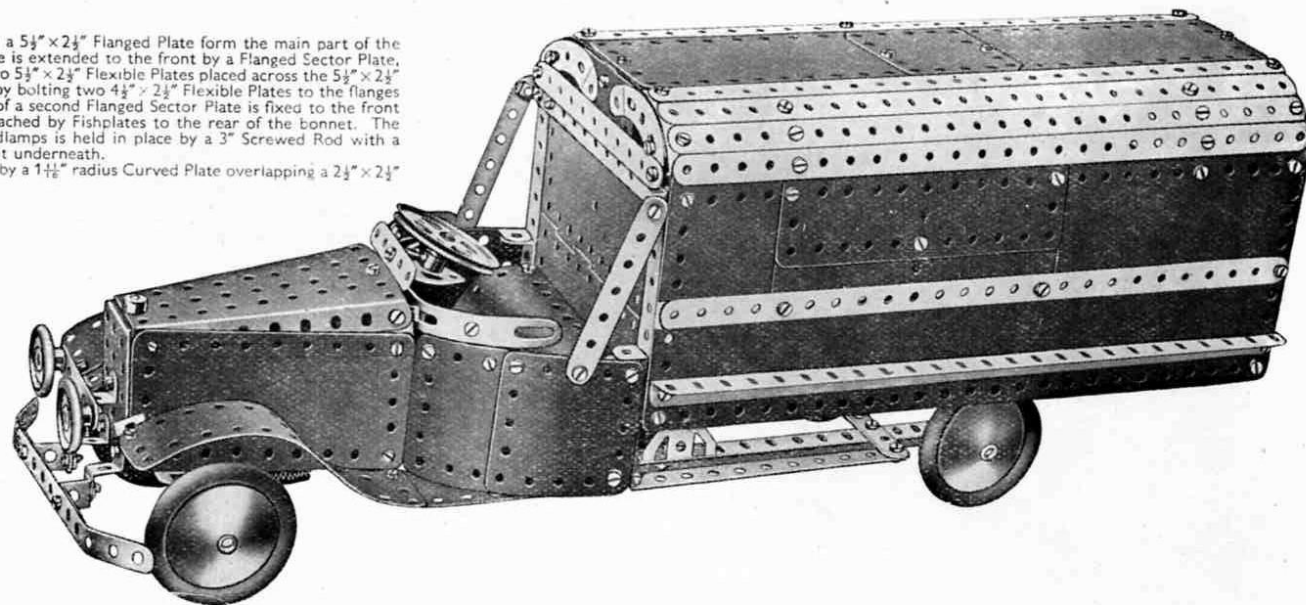
A brake consisting of a belt of Cord passed around the Pulley 16, is fitted to the winding shaft. The ends of this Cord are fastened to a $3\frac{1}{2}$ " Strip 18, which is lock-nutted to the side of the cab. The brake is normally held in the "on" position by a Spring bolted to the base and to the Strip 18.

7.23 ARMY LORRY

Two $12\frac{1}{2}$ " Angle Girders bolted to a $5\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flanged Plate form the main part of the chassis of the model. The Flanged Plate is extended to the front by a Flanged Sector Plate, and the floor of the cab is formed by two $5\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flexible Plates placed across the $5\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flanged Plate. The bonnet is built up by bolting two $4\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flexible Plates to the flanges of the Flanged Sector Plate. One end of a second Flanged Sector Plate is fixed to the front of the bonnet, and its other end is attached by Fishplates to the rear of the bonnet. The radiator carrying the bumper and headlamps is held in place by a 3" Screwed Rod with a Collar locked to the top of it, and a nut underneath.

Each side of the cab is represented by a $1\frac{1}{8}$ " radius Curved Plate overlapping a $2\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flexible Plate by two holes. The $1\frac{1}{8}$ " radius Curved Plate is attached to the bonnet by an Obtuse Angle Bracket, and the $2\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flexible Plate is bolted to a $2\frac{1}{2}$ " \times $\frac{1}{2}$ " Double Angle Strip, which in turn is fastened to the floor of the cab. Formed Slotted Strips are bolted to a $2\frac{1}{2}$ " \times $1\frac{1}{2}$ " Flexible Plate and then attached by Fishplates to the sides of the cab. A $2\frac{1}{2}$ " Strip is bolted to an Obtuse Angle Bracket to form a wind-shield and a Flat Trunnion attached by an Angle Bracket to the $2\frac{1}{2}$ " Strip, provides a bearing for the steering column.

Each side of the body consists of a $12\frac{1}{2}$ " \times $2\frac{1}{2}$ " Strip Plate, to which are bolted two Angle Girders and a $12\frac{1}{2}$ " Strip. Flexible Plates of various sizes extend the sides upward, and the upper edge of each side is reinforced by a further $12\frac{1}{2}$ " Angle Girder. The sides are joined across by three $5\frac{1}{2}$ " Strips at the lower edge, by a $5\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flanged Plate at the rear, and by Formed Slotted Strips joined by $3\frac{1}{2}$ " Strips at the upper corners.



The body is attached to the rear of the chassis by $1\frac{1}{2}$ " \times $\frac{1}{2}$ " Double Angle Strips, and at the front it is held by a $3\frac{1}{2}$ " \times $\frac{1}{2}$ " Double Angle Strip and Trunnions. The back of the cab is filled in by a Hinged Flat Plate and the seat is made by bolting two U-Section Curved Plates together and attaching them to the Hinged Flat Plate by Angle Brackets.

Fig. 7.23a shows the steering mechanism. The upper $\frac{3}{8}$ " Bolt forming the wheel pivot carries a $1\frac{1}{2}$ " Strip, a Double Bracket, and a second $1\frac{1}{2}$ " Strip at right angles to the first, on its shank. All these parts are locked in place by a nut, and the Bolt is then passed through a hole in a Flat Trunnion and fitted with lock-nuts. The lower $\frac{3}{8}$ " Bolt carries a $1\frac{1}{2}$ " Strip and a Double Bracket. The tie rod is a $3\frac{1}{2}$ " Strip pivotally attached to the $1\frac{1}{2}$ " Strips by lock-nutted bolts 1.

Steering is obtained by meshing a $\frac{1}{4}$ " Pinion on the steering column with a 57-tooth Gear carried on a Pivot Bolt. The 57-tooth Gear is connected by a $2\frac{1}{2}$ " Strip to the second $1\frac{1}{2}$ " Strip on the upper $\frac{3}{8}$ " Bolt. The Bolts 2 are lock-nutted.

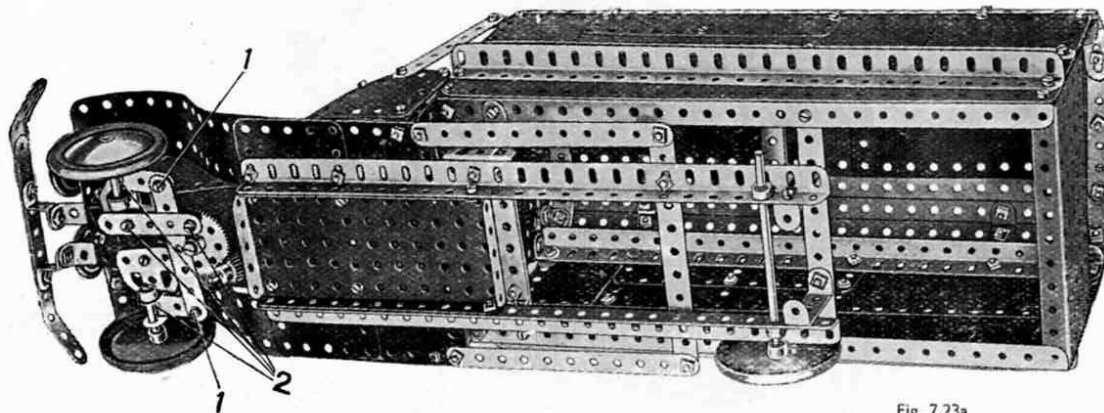


Fig. 7.23a

This Model can be built

with MECCANO No. 7 Outfit (or No. 6 and No. 6a Outfits)

7.24 EXPLODING SHIP

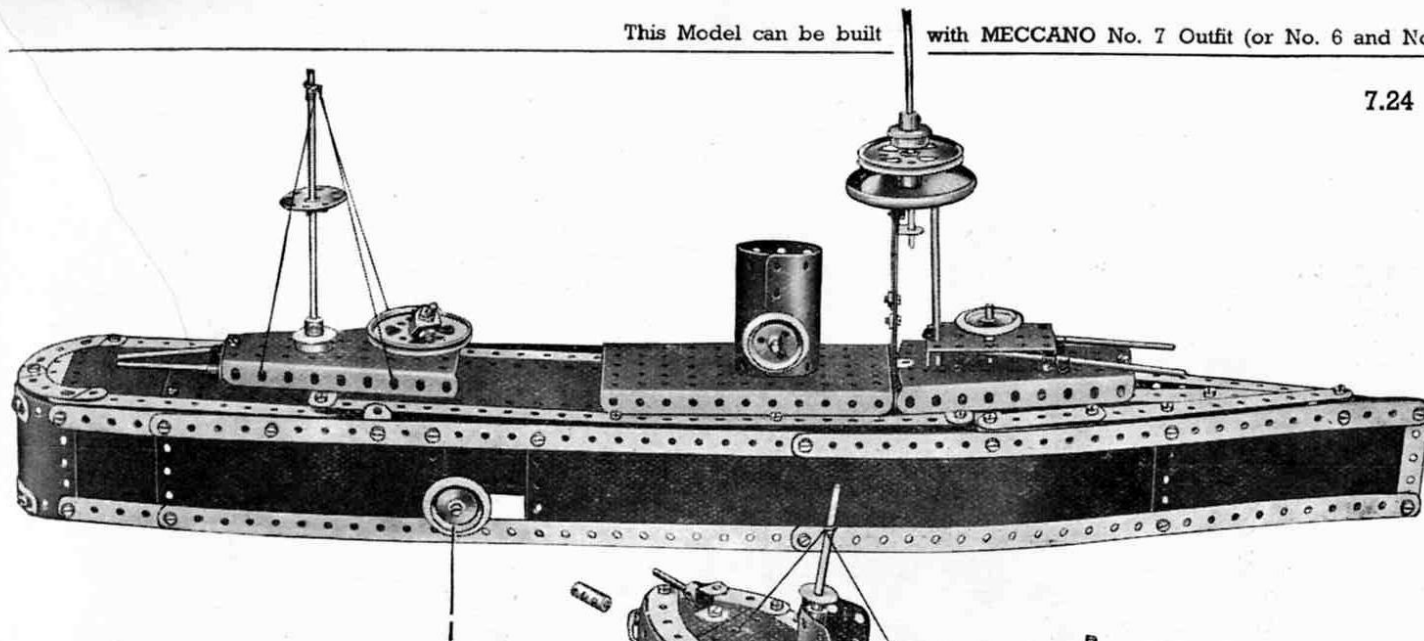


Fig. 7.24a

This is an amusing model with which great fun can be obtained. It includes a battleship and a small submarine. The battleship is caused to "explode" by firing a torpedo from the submarine so that it strikes a 1" Pulley set in the side of the ship. The torpedo is represented by a Coupling and is ejected from a tube passing through the centre of the submarine. When the "torpedo" strikes the 1" Pulley on the battleship an arm is released inside the ship, and this springs upward and throws off the superstructure, thus providing the effect of an explosion.

The hull of the vessel is first constructed as shown in Figs. 7.24c and 7.24d. The sides, which are formed by Strips and Flexible Plates, are spaced apart at the stern by a $3\frac{1}{2}" \times 2\frac{1}{2}"$ Flanged Plate, and at the front by a $2\frac{1}{2}"$ Strip. The rounded stern is formed by two $1\frac{1}{16}"$ radius Curved Plates overlapped one hole and strengthened by two Formed Slotted Strips.

Two Angle Girders are secured inside the ship by means of $3\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strips, and on these is carried the mechanism for "exploding" the ship. This consists essentially of an arm 2 (Fig. 7.24d) pivoted at one end and actuated by a Driving Band 4.

The arm 2 consists of two $5\frac{1}{2}"$ Strips, which are joined at one end by a $2\frac{1}{2}" \times \frac{1}{2}"$ and a $2\frac{1}{2}" \times 1"$ Double Angle Strip, and pivoted at the other end on a $3\frac{1}{2}"$ Rod. The Rod is journaled at each end in a Double Bracket bolted to one of the Angle Girders. The arm 2 carries also a $\frac{1}{2}"$ fast Pulley 9, which is secured on a $\frac{3}{8}"$ Bolt passed through the centre hole of the $2\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strip. A Double Bent Strip is bolted to the $2\frac{1}{2}" \times 1"$ Double Angle Strip to form a handle.

The Driving Band 4 is first fastened through one of the holes at the end of the arm 2 and its other end is slipped between a Fishplate and the $5\frac{1}{2}"$ Strip 5. The Fishplate is held by the Bolt 6, and is spaced from the Strip 5 by two Washers. The Flat Trunnion 8 is fastened to the centre of one of the $3\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strips joining the two Angle Girders, and it serves as a stop for the arm 2.

When set ready for "exploding" the ship the arm 2 is held by a catch, which can be seen in Fig. 7.24c, consisting of an Angle Bracket bolted to the centre hole of a Crank. The Crank is secured on a $3\frac{1}{2}"$ Rod 3, journaled in a Trunnion and a Reversed Angle Bracket and it is capable of about $\frac{1}{4}"$ lateral movement. This movement allows the Angle Bracket on the Crank to be slipped over one of the $5\frac{1}{2}"$ Strips forming the arm 2, to hold it in position. When the 1" Pulley 1 on the outer end of the Rod 3 is struck, however, the arm is released.

The superstructure is carried on a frame formed by securing two $12\frac{1}{2}"$ Strips together at each end by a $3\frac{1}{2}"$ Strip. The rear half of the frame is filled in by a $5\frac{1}{2}" \times 2\frac{1}{2}"$ Flexible Plate supported by means of Fishplates. Two Fishplates, projecting inwards, are also bolted to the front part of the frame, to form a support for part of the superstructure. The frame is supported at the rear on two $5\frac{1}{2}"$ Strips projecting from the stern deck, and at the front by a $1\frac{1}{2}"$ Strip, which is bolted to the $3\frac{1}{2}"$ Strip spacing the sides. The bolt holding the $1\frac{1}{2}"$ Strip carries also an Angle Bracket, which prevents the frame slipping out of position. In assembling the various units the first part of the superstructure to be placed in position is the forward gun turret. This consists of a Flanged Sector Plate, to which a $2\frac{1}{2}" \times 1\frac{1}{2}"$ Flanged Plate is attached by means of a $1\frac{1}{2}"$ Rod. The Rod carries at its upper end a 1" Pulley complete with Rubber Ring, and at its lower end a Spring Clip. Each of the guns is represented by a $3\frac{1}{2}"$ Rod, and is secured in position through the front flange of the $2\frac{1}{2}" \times 1\frac{1}{2}"$ Flanged Plate by two Spring Clips. The gun turret is placed so that it rests partly on the frame and partly on the forward deck.

Directly behind the gun turret there is a $5\frac{1}{2}" \times 2\frac{1}{2}"$ Flanged Plate, to the front flange of which is fastened a $2\frac{1}{2}" \times 1\frac{1}{2}"$ Flexible Plate. Each of the bolts holding the Flexible Plate carries also a compound strip consisting of two $2\frac{1}{2}"$ Strips overlapped two holes. The compound strips are joined at their upper ends, a double bracket, consisting of two $\frac{1}{2}" \times \frac{1}{2}"$ Angle Brackets, being held by the same bolt. The two free holes of the double bracket for the bearings for the 5" Rod representing the forward mast, which carries, above the double bracket, a Road Wheel, a 2" Pulley and a $\frac{3}{4}"$ Flanged Wheel.

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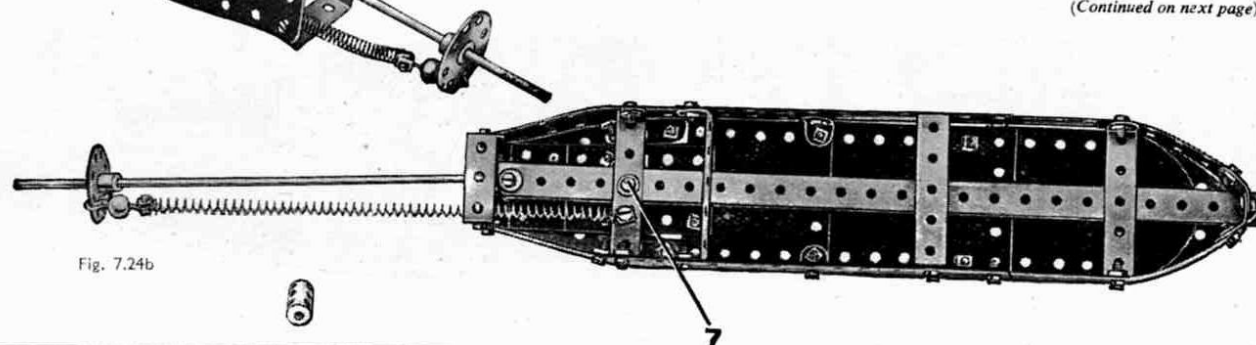


Fig. 7.24b

7.24 EXPLODING SHIP—Continued

The funnel is constructed from two U-Section Curved Plates, the ends of which overlap one hole, and it stands at the centre of the $5\frac{1}{2}" \times 2\frac{1}{2}"$ Flanged Plate. A $1\frac{1}{2}"$ Rod passing through the lower end of the funnel carries at each end a $1"$ loose Pulley complete with Rubber Ring, the Pulleys being prevented from slipping off the Rod by two Spring Clips. These Pulleys represent rafts.

The rear gun turret consists of a Flanged Sector Plate, across the narrow end of which a $1\frac{1}{2}"$ Strip is secured by an Angle Bracket. The two $4"$ Rods forming the guns are passed through the end holes of the $1\frac{1}{2}"$ Strip, and locked in position by Spring Clips. The barrel of the anti-aircraft gun is a $\frac{3}{4}"$ Bolt, which is mounted on an Angle Bracket fixed to a $1\frac{1}{2}"$ Rod by an Obtuse Angle Bracket. The $1\frac{1}{2}"$ Rod passes through the Flanged Sector Plate and carries a $2"$ Pulley that forms the base for the gun. The mizzen mast is a $6\frac{1}{2}"$ Rod, rigidly secured to the Flanged Sector Plate by a Collar and a $\frac{3}{4}"$ Flanged Wheel.

The main deck of the submarine, an underneath view of which is shown in Fig. 7.24b, consists of three $2\frac{1}{2}" \times 2\frac{1}{2}"$ Flexible Plate, and one $2\frac{1}{2}" \times 1\frac{1}{2}"$ Flexible Plate, bolted end to end. The deck is extended to the rear by two $2\frac{1}{2}" \times 1\frac{1}{2}"$ Flexible Plates and to the front by a Semi-Circular Plate. Strips of various sizes are bolted round the edge of the deck.

The conning tower is a $2\frac{1}{2}" \times 1\frac{1}{2}"$ Flexible Plate bent to shape and secured to the deck by two $2\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strips and a Reversed Angle Bracket. A $3\frac{1}{2}"$ Rod used for the periscope is fastened inside the conning tower by a Collar. At its upper end the Rod carries a second Collar, upon which rests a $\frac{3}{4}"$ Washer. The latter is prevented from coming off the Rod by Cord. The quick-firer in the bows is formed by a $1"$ Rod, which is held in the boss of a large Fork Piece bolted to the deck.

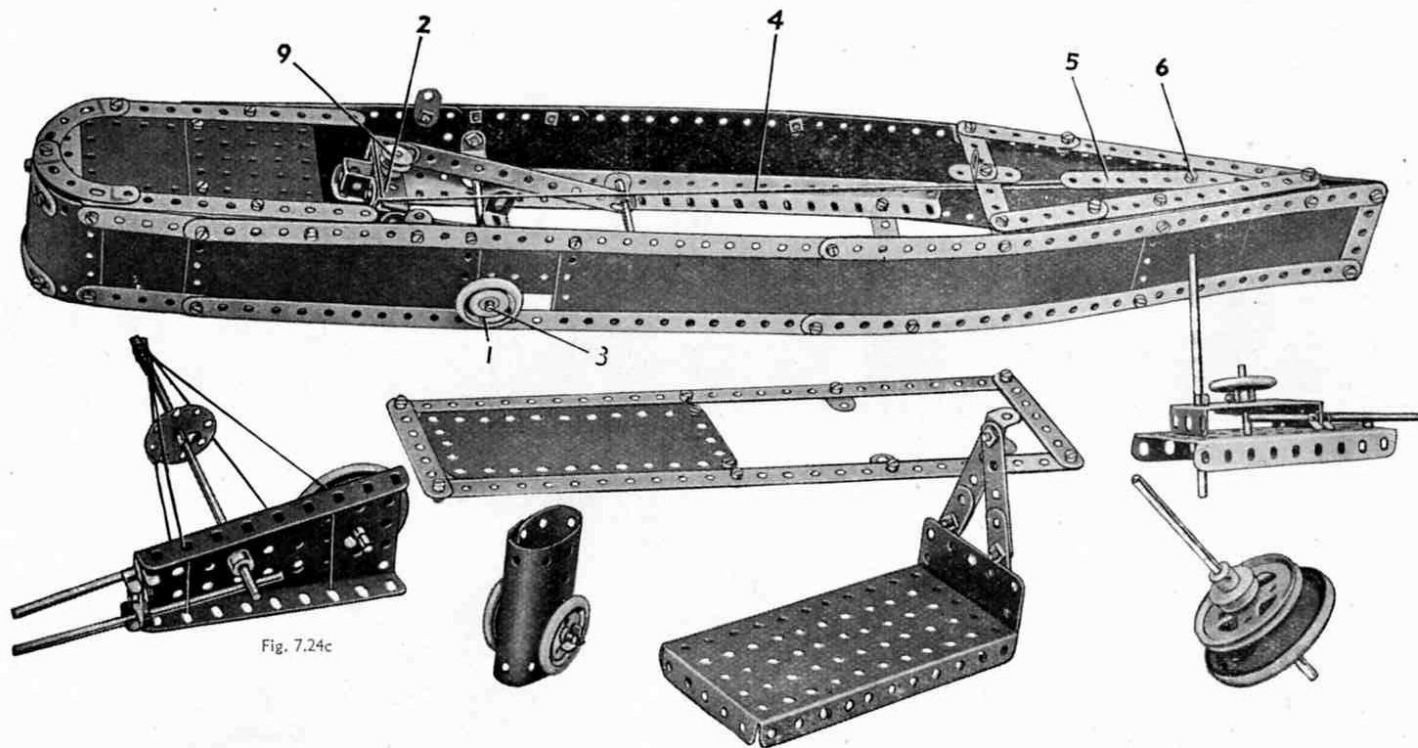


Fig. 7.24c

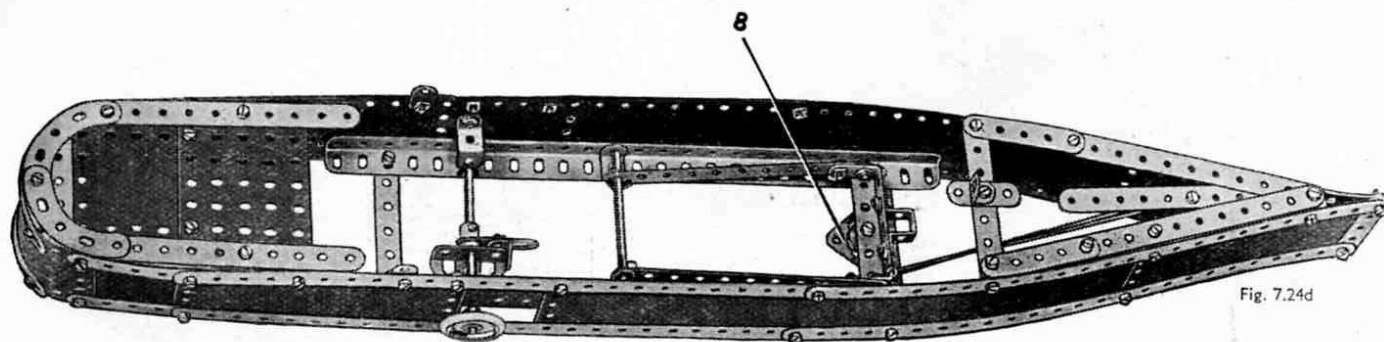


Fig. 7.24d

The sides of the submarine are constructed from $5\frac{1}{2}" \times 1\frac{1}{2}"$ and $2\frac{1}{2}" \times 1\frac{1}{2}"$ Flexible Plates braced across the bottom by $2\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strips as shown in Fig. 7.24b and secured in position by Angle Brackets. Angle Girders joined by Double Brackets form the torpedo tube, and are secured in position by the Bolt 7. An $11\frac{1}{2}"$ Rod slides in the centre holes of the two Double Brackets joining the Angle Girders and carries a Collar at its inner end. At the outer end of the $11\frac{1}{2}"$ Rod a Bush Wheel is fastened, and this is secured by a small loaded Hook to one end of a Spring, the other end of which is bolted under the submarine.

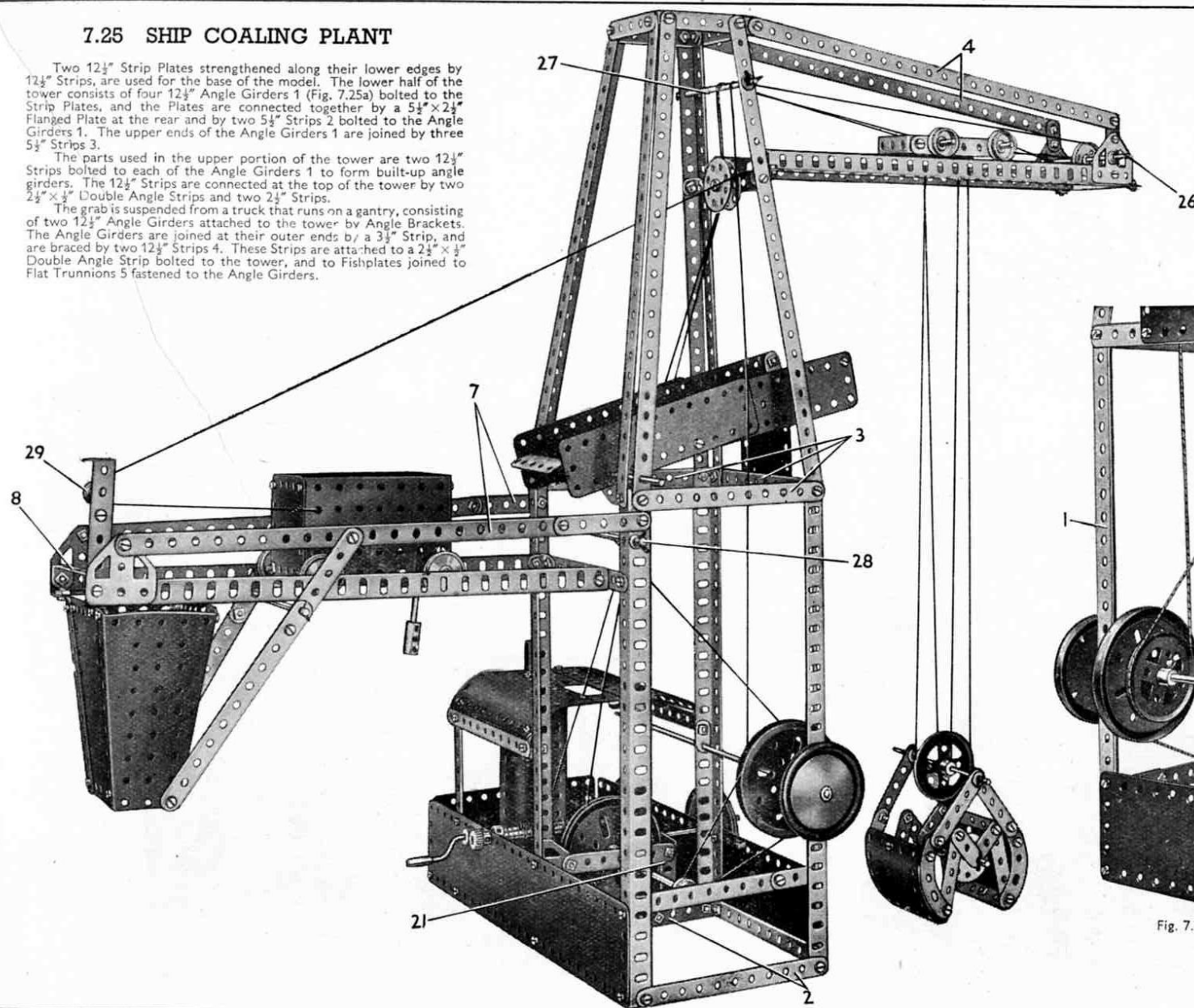
When the $11\frac{1}{2}"$ Rod is pulled out to its fullest extent it is prevented from shooting back under the action of the Spring by a $3\frac{1}{2}"$ Rod, which slips down in front of it. The $3\frac{1}{2}"$ Rod is secured through a $2\frac{1}{2}"$ Strip by two Collars as shown in the illustration, and can be lifted out of the path of the $11\frac{1}{2}"$ Rod by depressing the $\frac{1}{2}"$ Pulley at the other end of the $2\frac{1}{2}"$ Strip.

7.25 SHIP COALING PLANT

Two 12½" Strip Plates strengthened along their lower edges by 12½" Strips, are used for the base of the model. The lower half of the tower consists of four 12½" Angle Girders 1 (Fig. 7.25a) bolted to the Strip Plates, and the Plates are connected together by a 5½" x 2½" Flanged Plate at the rear and by two 5½" Strips 2 bolted to the Angle Girders 1. The upper ends of the Angle Girders 1 are joined by three 5½" Strips 3.

The parts used in the upper portion of the tower are two 12½" Strips bolted to each of the Angle Girders 1 to form built-up angle girders. The 12½" Strips are connected at the top of the tower by two 2½" x ½" Double Angle Strips and two 2½" Strips.

The grab is suspended from a truck that runs on a gantry, consisting of two 12½" Angle Girders attached to the tower by Angle Brackets. The Angle Girders are joined at their outer ends by a 3½" Strip, and are braced by two 12½" Strips 4. These Strips are attached to a 2½" x ½" Double Angle Strip bolted to the tower, and to Fishplates joined to Flat Trunnions 5 fastened to the Angle Girders.



The truck carrying the grab consists of two 3½" Strips bolted at each end to a 1½" x ½" Double Angle Strip. Four ¾" Flanged Wheels are locked in pairs on 3½" Rods journalled in the 3½" Strips, and travel along the upper edges of the Angle Girders.

The next stage is to build the gantry supporting the hopper wagon. This is built up by bolting two 12½" Angle Girders to Angle Brackets attached to a 5½" Strip 6 (Fig. 7.25a). This Strip is bolted to the lower half of the tower. The Angle Girders are braced by two compound strips 7, each consisting of a 2½" and two 5½" Strips bolted together. The Strips 7 are attached to Flat Trunnions fastened to the outer end of the gantry, and are bolted to the tower. The Angle Girders are connected by a 3½" x ½" Double Angle Strip 8.

Unloading is effected down a chute formed by two Flanged Sector Plates bolted at the bottom to 4½" x 2½" Flexible Plates and attached to these Plates at the top by Fishplates. The chute is attached to Angle Brackets bolted to the end of the gantry, and is supported by compound strips 9. These strips comprise a 3" and a 5½" Strip overlapped two holes, and are bolted to the Strips 7 and to the bottom of the Flanged Sector Plates.

(Continued on next page)

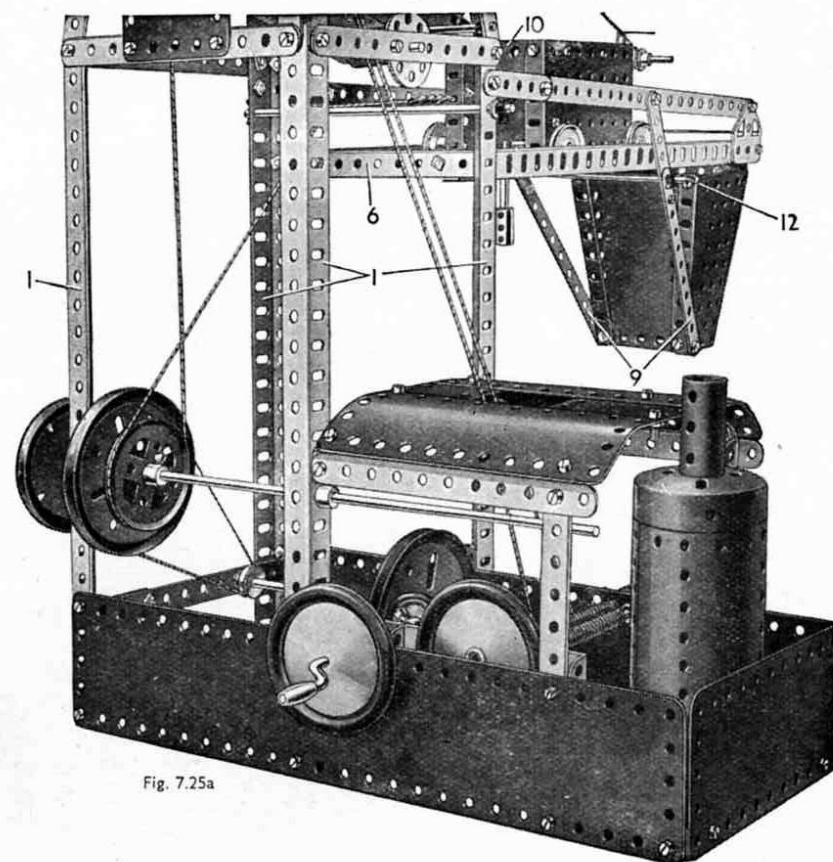


Fig. 7.25a

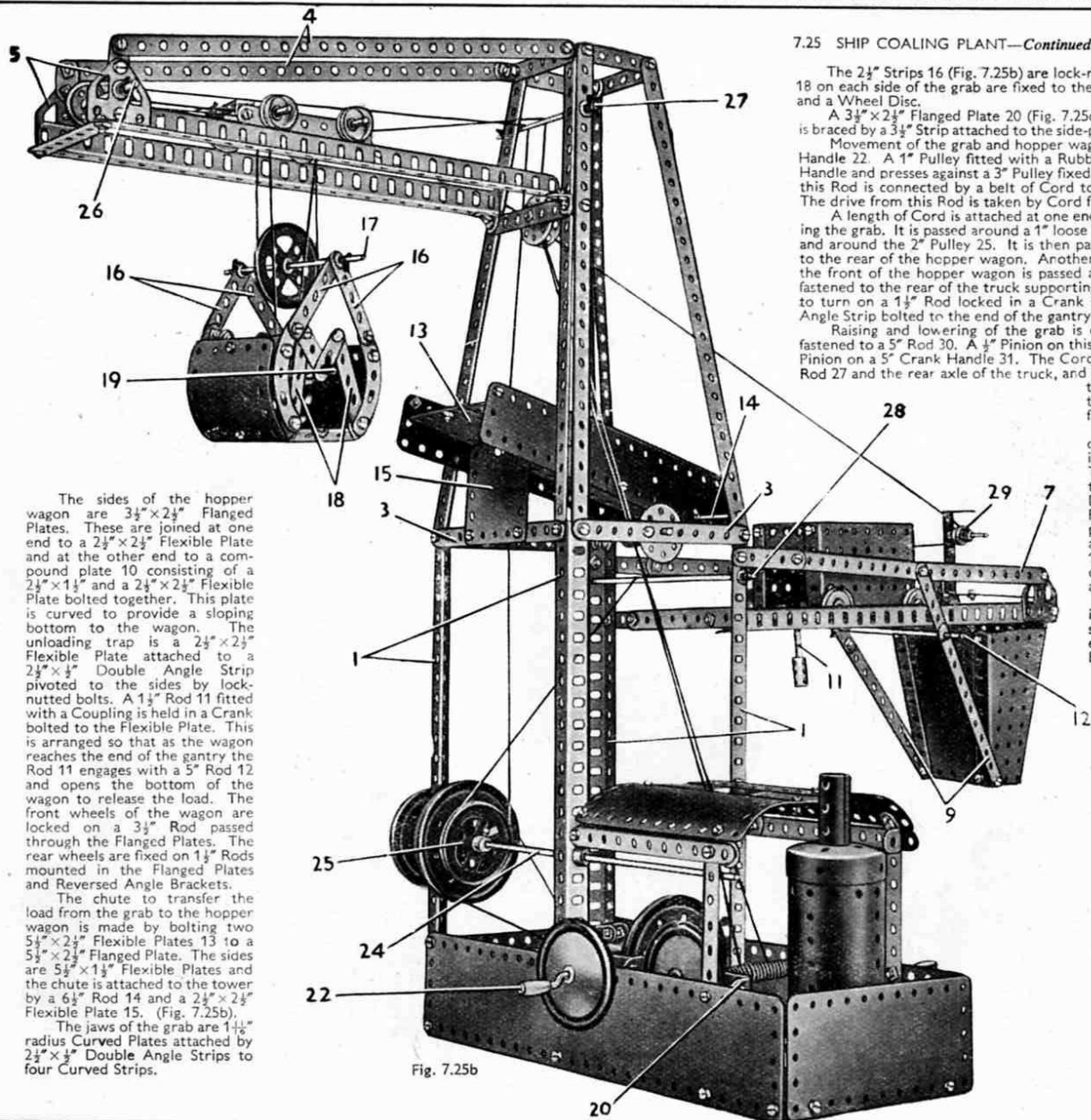


Fig. 7.25b

7.25 SHIP COALING PLANT—Continued

The $2\frac{1}{2}$ " Strips 16 (Fig. 7.25b) are lock-nutted to the Curved Strips, and pivoted at their upper ends about a $\frac{1}{4}$ " Rod 17 carrying a 2" Pulley. Two $2\frac{1}{2}$ " Strips 18 on each side of the grab are fixed to the jaws, and lock-nutted to $1\frac{1}{2}$ " Strips. A $3\frac{1}{2}$ " Rod 19 passed through the $1\frac{1}{2}$ " Strips is weighted by a Worm Gear and a Wheel Disc.

A $3\frac{1}{2}$ " x $2\frac{1}{2}$ " Flanged Plate 20 (Fig. 7.25c) is bolted to the $5\frac{1}{2}$ " x $2\frac{1}{2}$ " Flanged Plate in the base, and is extended by a $2\frac{1}{2}$ " x $1\frac{1}{2}$ " Flanged Plate 21. The Plate 21

is braced by a $3\frac{1}{2}$ " Strip attached to the side-plate of the model by a Trunnion. Movement of the grab and hopper wagon is controlled by a $3\frac{1}{2}$ " Crank Handle 22. A 1" Pulley fitted with a Rubber Ring is locked on the Crank Handle and presses against a 3" Pulley fixed on a $\frac{1}{4}$ " Rod 23. A 1" Pulley on this Rod is connected by a belt of Cord to a 3" Pulley on an $1\frac{1}{2}$ " Rod 24. The drive from this Rod is taken by Cord from a 2" Pulley 25.

A length of Cord is attached at one end to the front of the truck carrying the grab. It is passed around a 1" loose Pulley on a Rod 26, over Rod 27, and around the 2" Pulley 25. It is then passed over a $6\frac{1}{2}$ " Rod 28 and tied to the rear of the hopper wagon. Another length of Cord extending from the front of the hopper wagon is passed around a $\frac{1}{2}$ " loose Pulley 29 and fastened to the rear of the truck supporting the grab. The Pulley 29 is free to turn on a $1\frac{1}{2}$ " Rod locked in a Crank supported by a $2\frac{1}{2}$ " x 1" Double Angle Strip bolted to the end of the gantry.

Raising and lowering of the grab is controlled by a length of Cord fastened to a 5" Rod 30. A $\frac{1}{2}$ " Pinion on this Rod can be engaged by a second Pinion on a 5" Crank Handle 31. The Cord from Rod 30 is passed over the Rod 27 and the rear axle of the truck, and around the 2" Pulley mounted in the grab. It is then passed over the second axle of the truck and finally is tied to the Rod 26.

The jaws are opened and closed by a length of Cord extending from the Crank Handle 31. The Crank Handle is journaled in the side-plate of the model and a Double Bent Strip bolted to the Flanged Plate 20. The Cord is passed over Rod 27 and the rear axle of the truck, and around Rod 19 in the grab. It is then passed over the leading axle of the truck and fastened to Rod 26.

A slight amount of end play is allowed the Crank Handle 31 so that its Pinion can be disengaged from the Pinion on Rod 30.

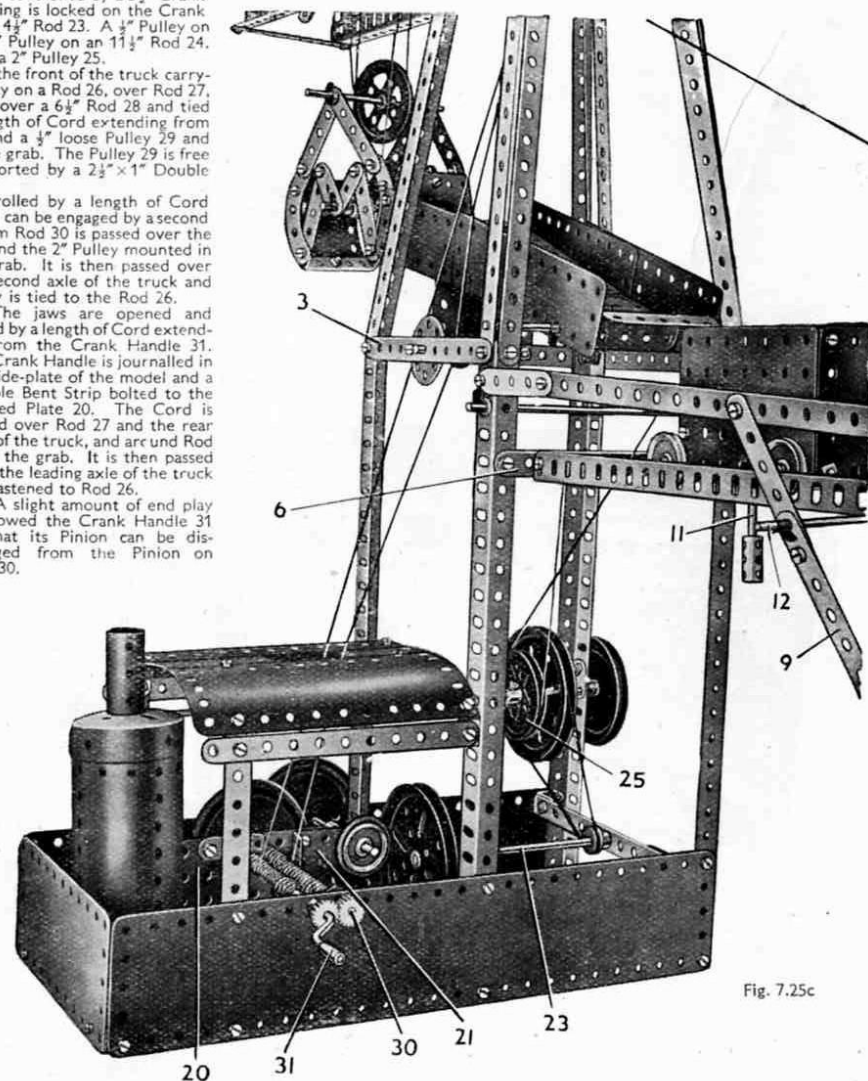


Fig. 7.25c

8.1 GIANT SWING BOAT

The floor of the boat is formed by four $12\frac{1}{2}" \times 2\frac{1}{2}"$ Strip Plates, which are supported by a compound strip made from two 3" Strips. The boat is pivotally mounted on an $11\frac{1}{2}"$ Rod locked in the bosses of two Cranks bolted to the roof supports as shown. The $11\frac{1}{2}"$ Rod is journaled in the centre holes of Wheel Discs, which are bolted to the $12\frac{1}{2}"$ Angle Girders that act as supports. The 3" stepped Curved Strips shown in the illustrations should be replaced by $2\frac{1}{2}"$ small radius Curved Strips.

The back of the pay-box is formed by a $2\frac{1}{2}" \times 2\frac{1}{2}"$ and a $2\frac{1}{2}" \times 1\frac{1}{2}"$ Flexible Plate joined by a Flat Trunnion.

The operating mechanism is housed between two Flanged Sector Plates, which are attached to the base by two $1\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strips and are bolted to two $2\frac{1}{2}" \times 1\frac{1}{2}"$ Flexible Plates. Sprocket Chain connects the $\frac{3}{4}"$ Sprocket Wheel on the driving shaft of the No. 1 Clockwork Motor to a 2" Sprocket Wheel fastened on a 4" Rod, which

carries two Collars and a $\frac{1}{2}"$ Pinion between the Flanged Sector Plates. Above this Rod is a 2" Rod, on which is a $\frac{1}{2}"$ Pinion that meshes with the first $\frac{1}{2}"$ Pinion, and a Collar. Outside the Flanged Sector Plates on the same Rod is a Bush Wheel fitted with a Threaded Pin to which the piston rod is connected.

A second 2" Rod carries a 57-tooth Gear and a Face Plate as shown. A Coupling, in the longitudinal bore of which is a $6\frac{1}{2}"$ Rod, is carried on a $\frac{3}{4}"$ Bolt lock-nutted to one of the inner holes of the Face Plate. A 5" Rod fitted with three Couplings and a Collar is pivoted to a Pivot Bolt on a

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

second Face Plate. The lower Couplings carry Double Brackets, which slide between two Collars on the $6\frac{1}{2}"$ Rod. A Compression Spring is placed between the upper Double Bracket and Collar, and the Collar on the 5" Rod is connected to the upper Collar on the $6\frac{1}{2}"$ Rod by a Spring. When the model is in operation the Spring and Compression Spring absorb the jerky reciprocating movements of the Rods.

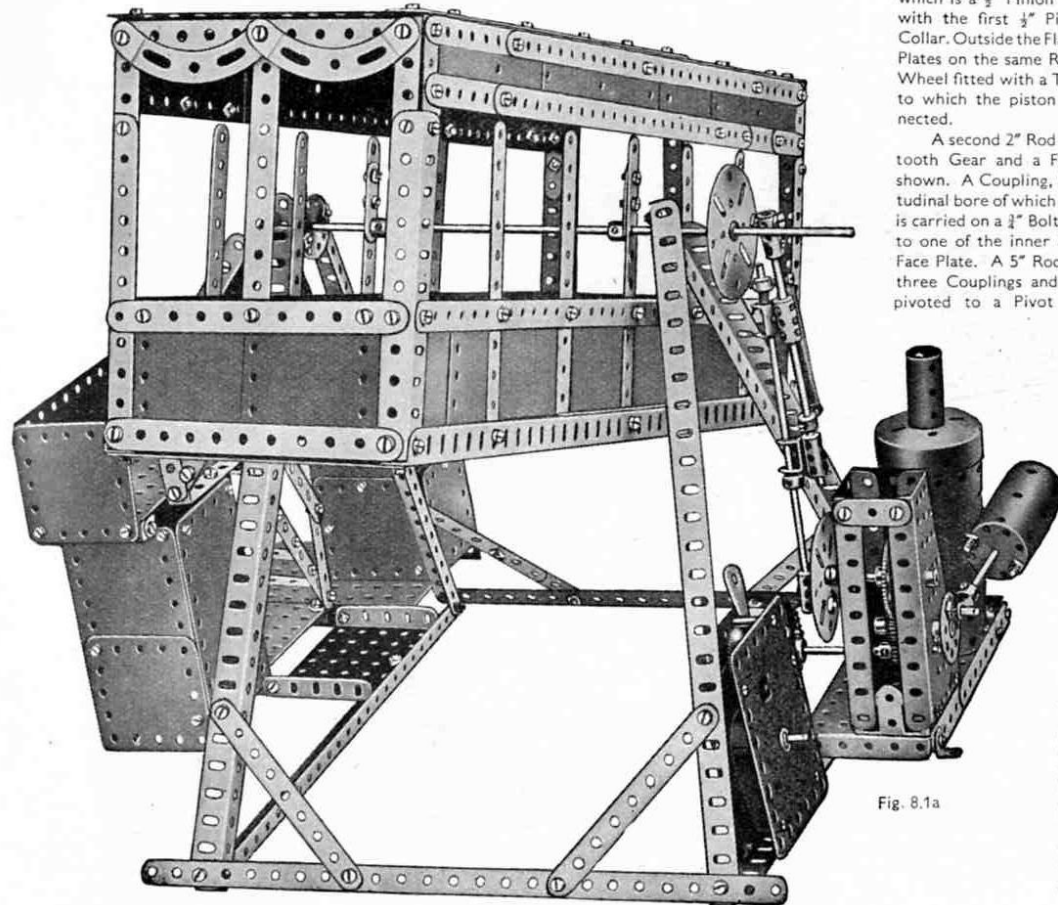
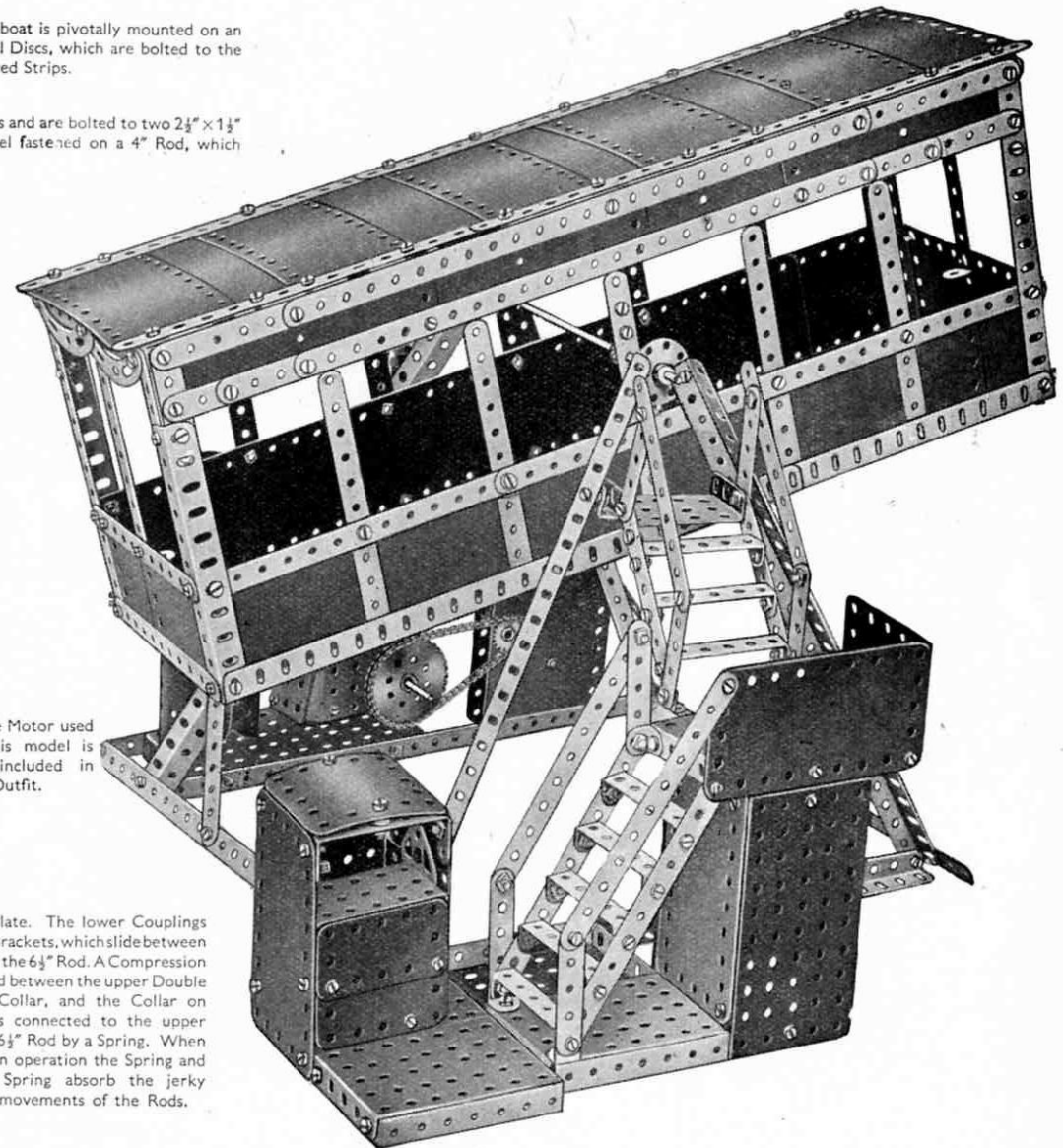
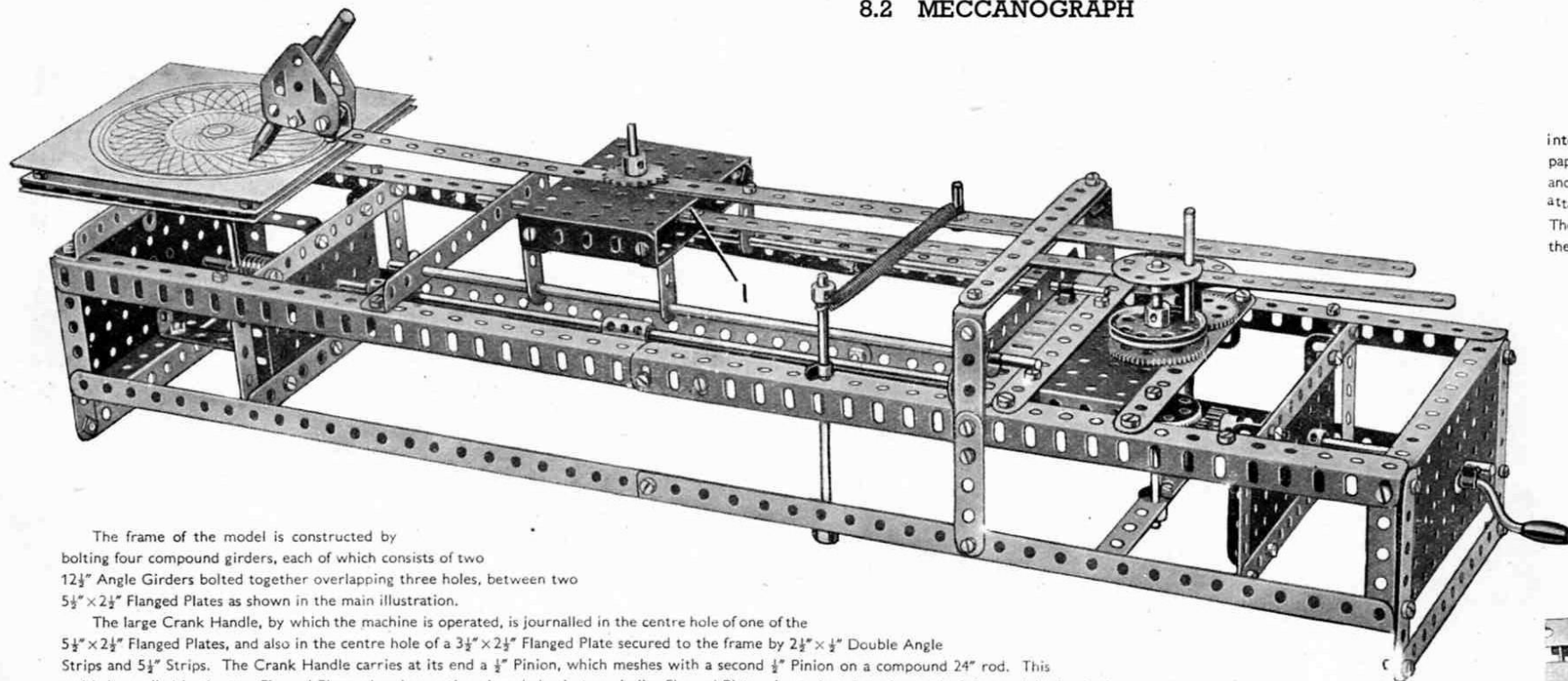


Fig. 8.1a



8.2 MECCANOGRAPH



The frame of the model is constructed by bolting four compound girders, each of which consists of two $12\frac{1}{2}$ " Angle Girders bolted together overlapping three holes, between two $5\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flanged Plates as shown in the main illustration.

The large Crank Handle, by which the machine is operated, is journaled in the centre hole of one of the $5\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flanged Plates, and also in the centre hole of a $3\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flanged Plate secured to the frame by $2\frac{1}{2}$ " \times $\frac{1}{2}$ " Double Angle Strips and $5\frac{1}{2}$ " Strips. The Crank Handle carries at its end a $\frac{1}{2}$ " Pinion, which meshes with a second $\frac{1}{2}$ " Pinion on a compound 24" rod. This rod is journaled in the two Flanged Plates already mentioned, and also in two similar Flanged Plates situated at the other end of the model. At the latter end the compound rod carries a Worm that meshes with a $\frac{1}{2}$ " Pinion on a vertical 4" Rod, the bearings for which are provided by the centre holes of two $3\frac{1}{2}$ " \times $\frac{1}{2}$ " Double Angle Strips bolted between the two Flanged Plates. A Face Plate is locked on the upper end of the Rod and to it are bolted the two $5\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flexible Plates forming the table.

The $\frac{1}{2}$ " Pinion on the Crank Handle meshes also with a $1\frac{1}{2}$ " Contrate Wheel on a $4\frac{1}{2}$ " Rod, which is journaled in a $5\frac{1}{2}$ " Strip bolted to the lower members of the frame and in a $3\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flanged Plate secured between the upper members of the frame by two $5\frac{1}{2}$ " Strips. The $4\frac{1}{2}$ " Rod carries, above the Flanged Plate, a 57-tooth Gear 2, a $1\frac{1}{2}$ " Pulley and a Bush Wheel. A $3\frac{1}{2}$ " Rod 5 passes through holes in the Bush Wheel and the $1\frac{1}{2}$ " Pulley, and the rear end of the pencil arm is held against the rod by a Spring as shown in the illustration above.

The pencil arm is formed by two $12\frac{1}{2}$ " Strips overlapped 13 holes, and it is pivoted 12 holes from its forward end on a 2" Rod that passes through the centre holes of two $3\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flanged Plates. The two Plates are fastened together by their flanges, and to their undersides are bolted two $2\frac{1}{2}$ " \times 1" Double Angle Strips that slide on two $11\frac{1}{2}$ " Rods journaled at each end in a $5\frac{1}{2}$ " Angle Girder bolted to the sides of the frame. The pencil is gripped between two Flat Trunnions secured to the end of the arm by a Double Bracket. The $5\frac{1}{2}$ " Strips 6 (Fig. 8.2a) through which the pencil arm passes, are bent apart so that the arm does not jam.

The 57-tooth Gear 2 meshes with a second 57-tooth Gear 3 on a $3\frac{1}{2}$ " Rod journaled in a similar fashion to the $4\frac{1}{2}$ " Rods and carrying a Bush Wheel at its upper end.

A Threaded Pin 4 is fastened through one of the holes of the Bush Wheel, and its plain shank carries a $12\frac{1}{2}$ " Strip, the forward end of which is lock-nutted at 1 (see general view of model) to the sliding carriage.

The pattern obtained may be varied by altering the hole of the $12\frac{1}{2}$ " Strip through which the Threaded Pin passes, or by using two or more Rods at 5. A few experiments with the Rods and arms in different positions will show the combinations that produce the most interesting and beautiful designs.

With this model hundreds of beautiful and interesting designs can be produced on a sheet of paper. The paper is pinned to a revolving table, and the designs are traced on it by a pencil attached to a mechanically operated moving arm. The type of design produced is varied by adjusting the movements of the pencil arm.

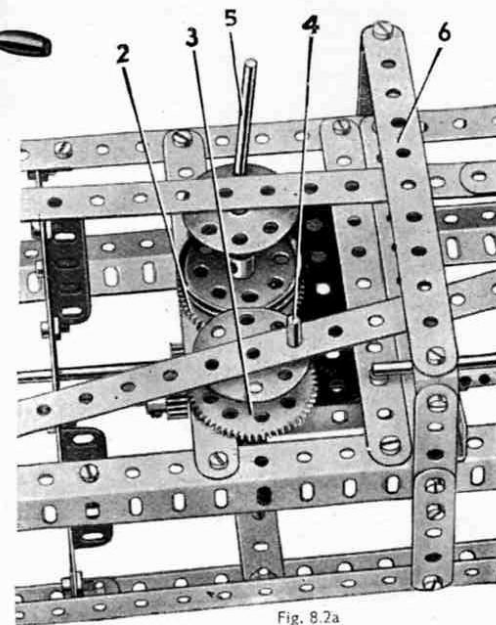


Fig. 8.2a

8.3 SWING BRIDGE

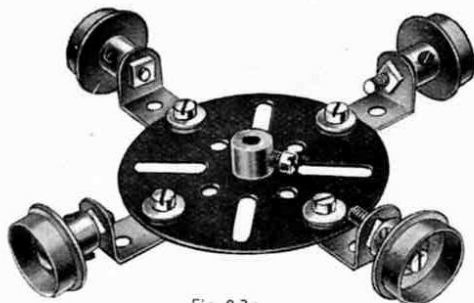


Fig. 8.3a

The centre pier of the bridge is made by connecting together the 12½" Angle Girders 1 by two 5½" Angle Girders 2. One side of the pier is formed by a 5½" × 2½" Flexible Plate 3 (Fig. 8.3b), braced at each end by a 3" Strip. The opposite side is filled in by a 4½" × 2½" Flexible Plate 4, braced by two 3" Strips 5. The top of the pier consists of two 5½" × 2½" Flanged Plates, joined at the centre by a 5½" × 1½" Flexible Plate 6. The Flanged Plates are bolted to a 5½" Strip 7 on each side, and these Strips are supported by the 3" Strips 5 and by the similar strips on the opposite side of the pier.

A No. 1 Clockwork Motor is bolted to one of the Angle Girders 2, and to the flange of one of the 5½" × 2½" Flanged Plates. The remaining part of this side of the pier is filled in by a 2½" × 1½" Flexible Plate. The driving shaft of the Motor is removed and is replaced by a 2" Rod fitted with a ¼" Pinion 8. This Pinion meshes with a 57-tooth Gear fixed on a 5" Rod 9, which carries also a ¼" Pinion 11 that engages a 57-tooth Gear on a 5" Rod 11, and a Worm on this Rod meshes with a ½" Pinion on a vertical 4" Rod 12.

Bearings for Rods 9 and 11 are provided by a 3½" × 2½" Flanged Plate 13, bolted to the flanges of one of the 5½" × 2½" Flanged Plates, and by two 2½" × 1½" Flanged Plates 14. The Plates 14 are bolted to the top of the pier, and joined together at their lower ends by a 2½" Strip. The brake lever of the Motor is extended by a 2" Strip, and the reversing lever by a 2" Strip attached to a Fishplate bolted to the lever. The Rod 12 is passed through the centre hole of the Flexible Plate 6, and into the centre hole of a 5½" Strip bolted across the Girders 1. It is held in place by Collars.

The Girders 1 are extended by 12½" Strips overlapping the ends of the Girders by six holes. A 3½" × 2½" Flanged Plate is bolted to the free end of each of the 12½" Strips, and the Flanged Plates on each side are connected by a 5½" Angle girder 15. These Flanged Plates provide the inner supports for the approach roadways. A diagonal 12½" Strip is bolted between the Angle Girders 1 and a Flanged Plate on each side for bracing purposes.

The approaches on each side are identical in construction and are formed by 12½" Angle Girders 16 bolted to the 3½" × 2½" Flanged Plates. The outer ends of these Girders are connected by 5½" × ½" Double Angle Strips, and each carries a Flat Trunnion 17. The Flat Trunnions are attached to 2½" Strips bolted to Trunnions fixed to 12½" Strips 18. Three of the sides of the approaches on each side are filled in by a 5½" × 2½", two 4½" × 2½", a 2½" × 1½" and two 2½" × 2½" Flexible Plates.

The roadway of one approach is formed by two 12½" Strip Plates bolted to the Angle Girder 15 and to the 5½" × ½" Double Angle Strip connecting the Angle Girders 16. The roadway of the other approach consists of six 5½" × 2½" Flexible Plates bolted to the Angle Girders 16.

Each of the main girders of the central span consists of two 12½" Angle Girders joined together at the centre by a 2½" Strip to form a 25½" girder. These girders are joined at each end by a 5½" Strip, and in the centre by a 5½" × 1½" Flexible Plate braced along each of its edges by a 5½" Strip. Each side of the roadway of the span is formed by two 12½" Strip Plates. A Face Plate is bolted in the centre so that its boss coincides with the centre hole of the 5½" × 1½" Flexible Plate.

Each of the arch girders is formed by two 12½" Strips bolted together. These are attached by Angle Brackets to a 5½" Strip 19, and at each end to a 3½" Strip 20. At the sides the Girders are braced by Strips of various lengths as shown, and they are connected together at the centre and at each end by a 5½" Strip.

The span revolves about a simple built-up roller bearing seen in Fig. 8.3a. This is formed by bolting two 3½" × ½" Double Angle Strips across a Face Plate, two Washers being placed under the head of each securing Bolt. A ¾" Flanged Wheel is pivoted at each end of the Double Angle Strips, two ¾" Bolts and Two Pivot Bolts being used for this purpose. The Face Plate is free to turn on the Rod 12. The Face Plate bolted to the centre of the moving span is fixed on the upper end of Rod 12, so that the span is opened or closed as the Rod revolves. A 2½" Strip 21 bolted to one of the approaches prevents the span from revolving too far.

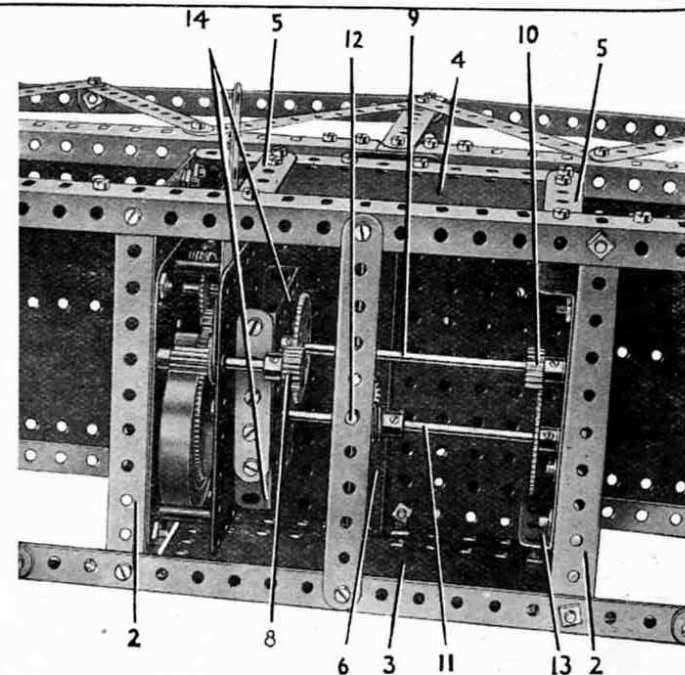
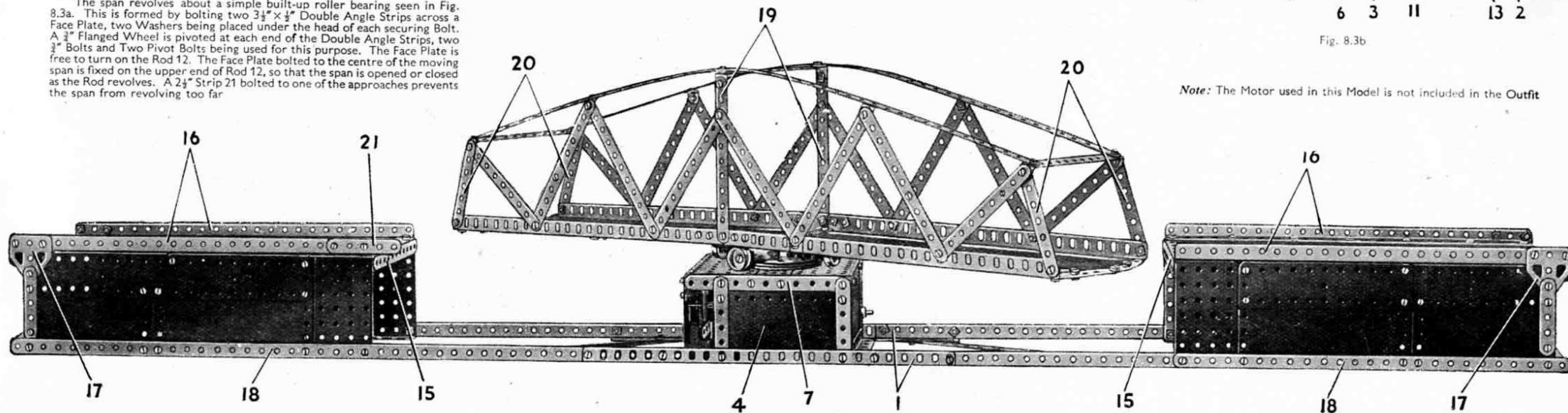


Fig. 8.3b

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



8.4 GRABBING CRANE

The axles of the bogy consist of $5\frac{1}{2}$ " and $1\frac{1}{2}$ " Rods, joined by Couplings, and are journaled in Flat Trunnions. The floor of the cab is made from a $5\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flanged Plate, two $5\frac{1}{2}$ " \times $2\frac{1}{2}$ " and two $2\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flexible Plates and one half of a Hinged Flat Plate.

The Boiler is carried on a $5\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flexible Plate, fixed to the sides of the cab by a $5\frac{1}{2}$ " \times $\frac{1}{2}$ " Double Angle Strip. The front edge of the Flexible Plate is fastened by a $5\frac{1}{2}$ " Angle Girder to the second half of the Hinged Flat Plate. A Boiler End is bolted underneath the roof by the same Bolt that holds the Chimney Adaptor carrying the Sleeve Piece.

The Bolts holding the 3" Pulleys, which form a bearing for the control platform, carry Collars on their shanks between the faces of the Pulleys and the Plates.

The upper ends of the sides of the jib are joined by a $1\frac{1}{2}$ " Strip. Two $\frac{1}{2}$ " Pulleys are each fastened by a $\frac{1}{2}$ " Bolt to a Coupling, which carries a $4\frac{1}{2}$ " Rod in its longitudinal bore, and the upper ends of the two Rods are secured by Collars to a $3\frac{1}{2}$ " Screwed Rod passing through the sides of the jib. A 5" Rod journaled in the lower transverse bores of the two Couplings, carries a 2" Pulley at each end. The Pulleys are retained in position by Spring Clips. The jib is pivoted at its base on a $6\frac{1}{2}$ " Rod, which passes through the $12\frac{1}{2}$ " Strip Plates of the sides. Four 1" Pulleys fitted with Rubber Rings retain the Rod in position.

Luffing is controlled by a large Crank Handle, the shaft of which is extended by a 2" Rod. This Rod is controlled by a band brake, the lever of which is pivoted on a Bolt 3 that carries also a Collar. Cord is tied to the Crank Handle, then taken over one of two 2" Pulleys attached to the jib as shown, around a 1" loose Pulley on the $6\frac{1}{2}$ " Rod in the cab, and then around the two $\frac{1}{2}$ " loose Pulleys in the jib. From here it is taken around the second 1" loose Pulley in the cab, back around the remaining 2" Pulley in the jib and finally is tied to a Fishplate on the same Rod as the 1" loose Pulleys.

Hoisting is controlled by a small Crank Handle journaled at the centre of the cab, the shaft of the Crank Handle being extended by a $3\frac{1}{2}$ " Rod. Two Cords are tied to the Crank Handle, and after passing around 1" loose Pulleys on a 2" Rod at the top of the jib, they are attached to a $2\frac{1}{2}$ " \times $\frac{1}{2}$ " Double Angle Strip on the grab. A $6\frac{1}{2}$ " Rod is journaled

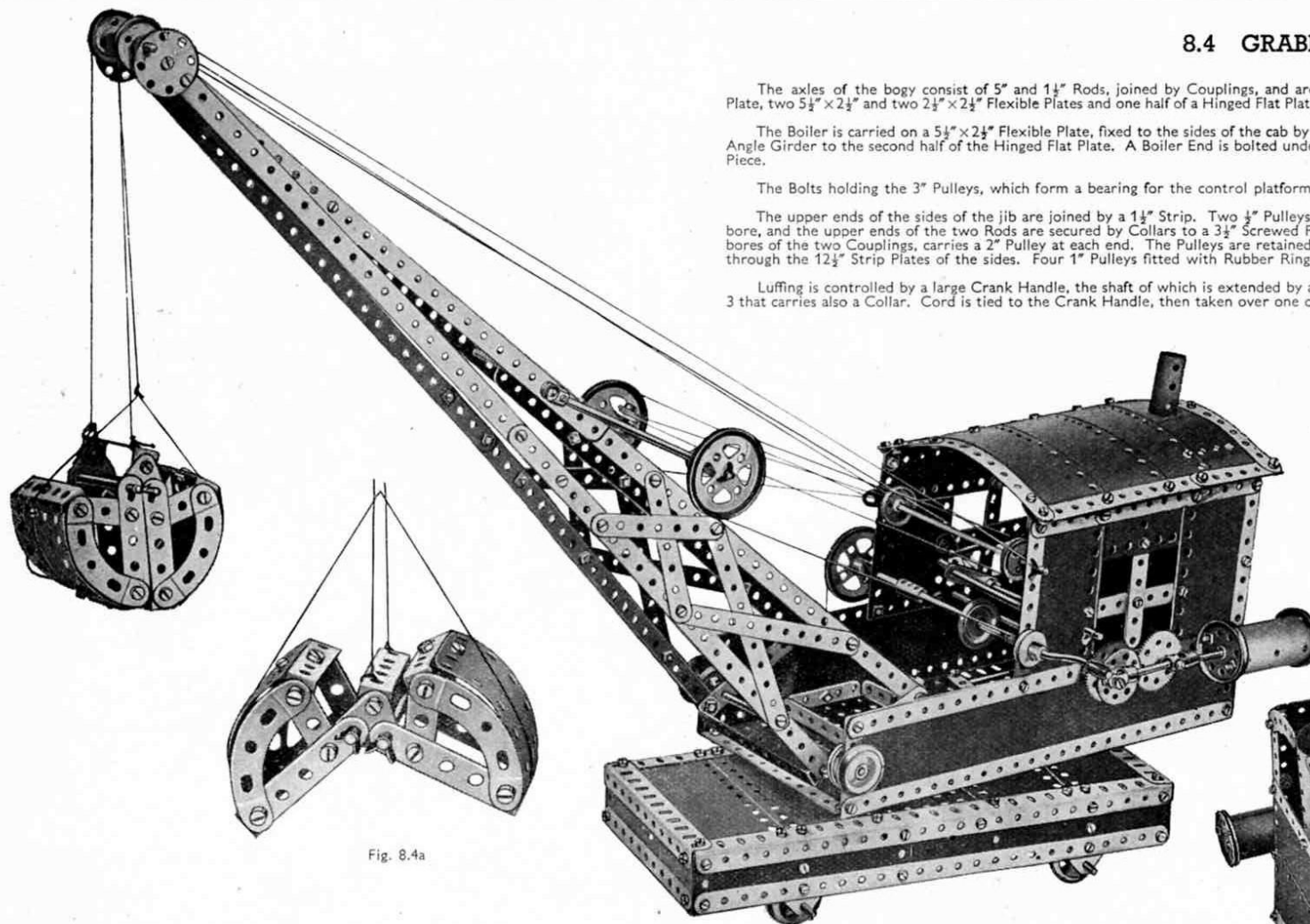


Fig. 8.4a

in front of the small Crank Handle and it is geared to it through two 57-tooth Gears. Grabbing is controlled by a $5\frac{1}{2}$ " Strip 4. The Strip is pivoted at its lower end and is connected by two Rod and Strip Connectors 2 and a 5" Rod to a Bush Wheel, which is locked on the end of a $6\frac{1}{2}$ " compound rod. Two Cranks are fixed on this rod and they carry a $3\frac{1}{2}$ " Rod in their end holes. The Cord controlling the jaws of the grab is tied to the $6\frac{1}{2}$ " Rod previously mentioned, and then is threaded over the $6\frac{1}{2}$ " compound rod and under the $3\frac{1}{2}$ " Rod. It is then taken over a $\frac{1}{2}$ " loose Pulley on the 2" Rod at the jib-head and tied to the two Cords fastened to the jaws of the grab. When the Strip 4 is moved backwards the grab operating Cord is depressed by the $3\frac{1}{2}$ " Rod, and as a result, the grab opens.

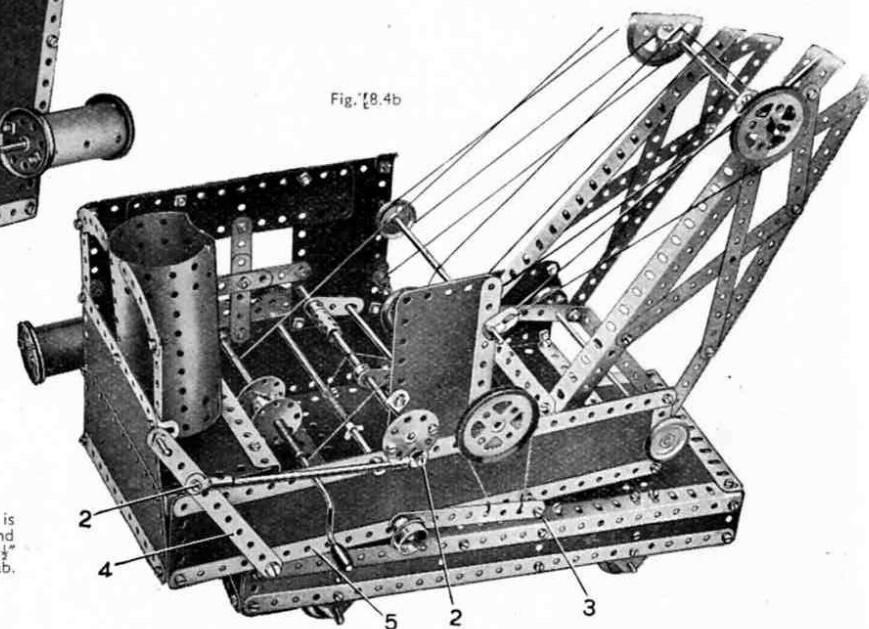


Fig. 8.4b

8.5 TIPPING MOTOR LORRY

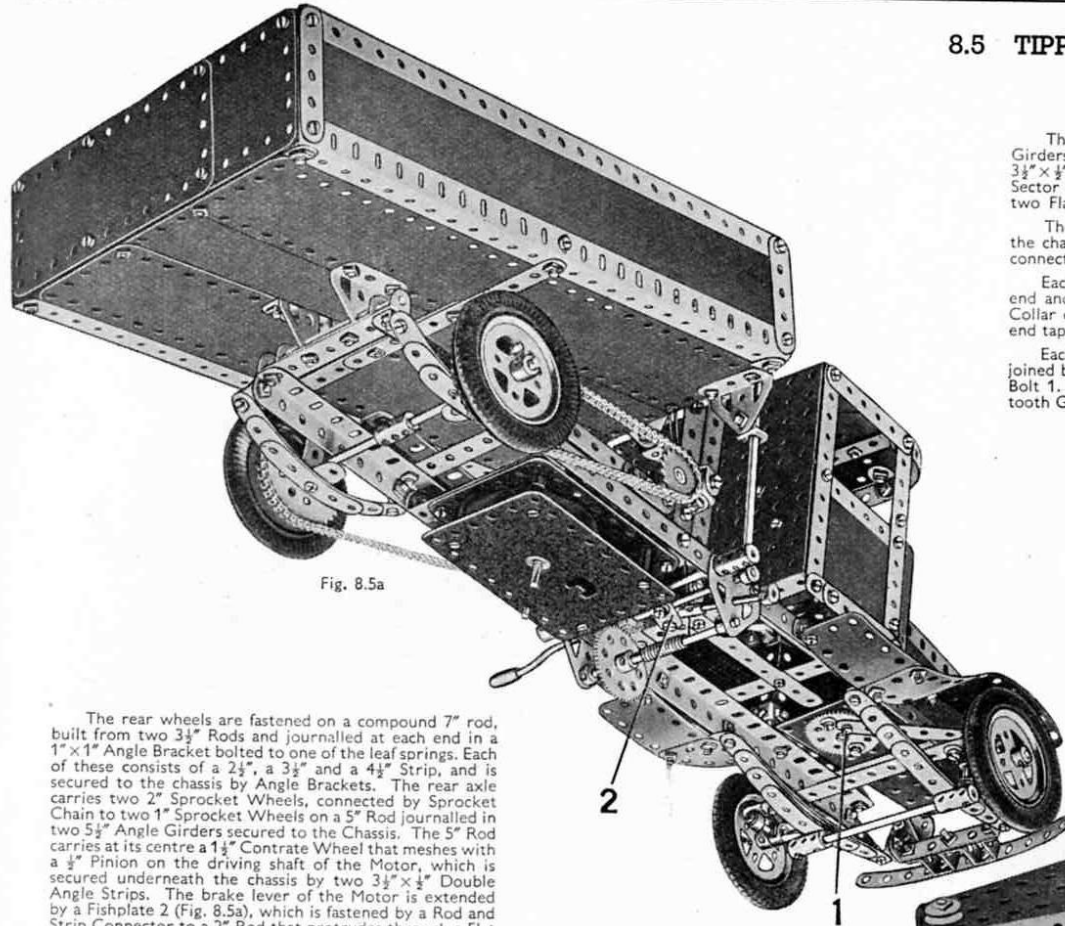


Fig. 8.5a

The rear wheels are fastened on a compound 7" rod, built from two 3½" Rods and journalled at each end in a 1" x 1" Angle Bracket bolted to one of the leaf springs. Each of these consists of a 2½", a 3½" and a 4½" Strip, and is secured to the chassis by Angle Brackets. The rear axle carries two 2" Sprocket Wheels, connected by Sprocket Chain to two 1" Sprocket Wheels on a 5" Rod journalled in two 5½" Angle Girders secured to the Chassis. The 5" Rod carries at its centre a 1½" Contrate Wheel that meshes with a ½" Pinion on the driving shaft of the Motor, which is secured underneath the chassis by two 3½" x ½" Double Angle Strips. The brake lever of the Motor is extended by a Fishplate 2 (Fig. 8.5a), which is fastened by a Rod and Strip Connector to a 2" Rod that protrudes through a Flat Trunnion bolted to the side of the chassis. The body of the lorry is constructed on a frame consisting of two 12½" Angle Girders joined at each end by a compound 7½" Strip made by bolting two 5½" Strips together overlapping seven holes. The frame is filled in by three 12½" x 2½" Strip Plates, two more of which are bolted to the Angle Girders to form the sides. Two guide Rods are fixed behind the cab as shown in the illustrations, and Angle Brackets secured to the body by Trunnions are used for the slides. The bolts holding the tailboard in position are lock-nutted.

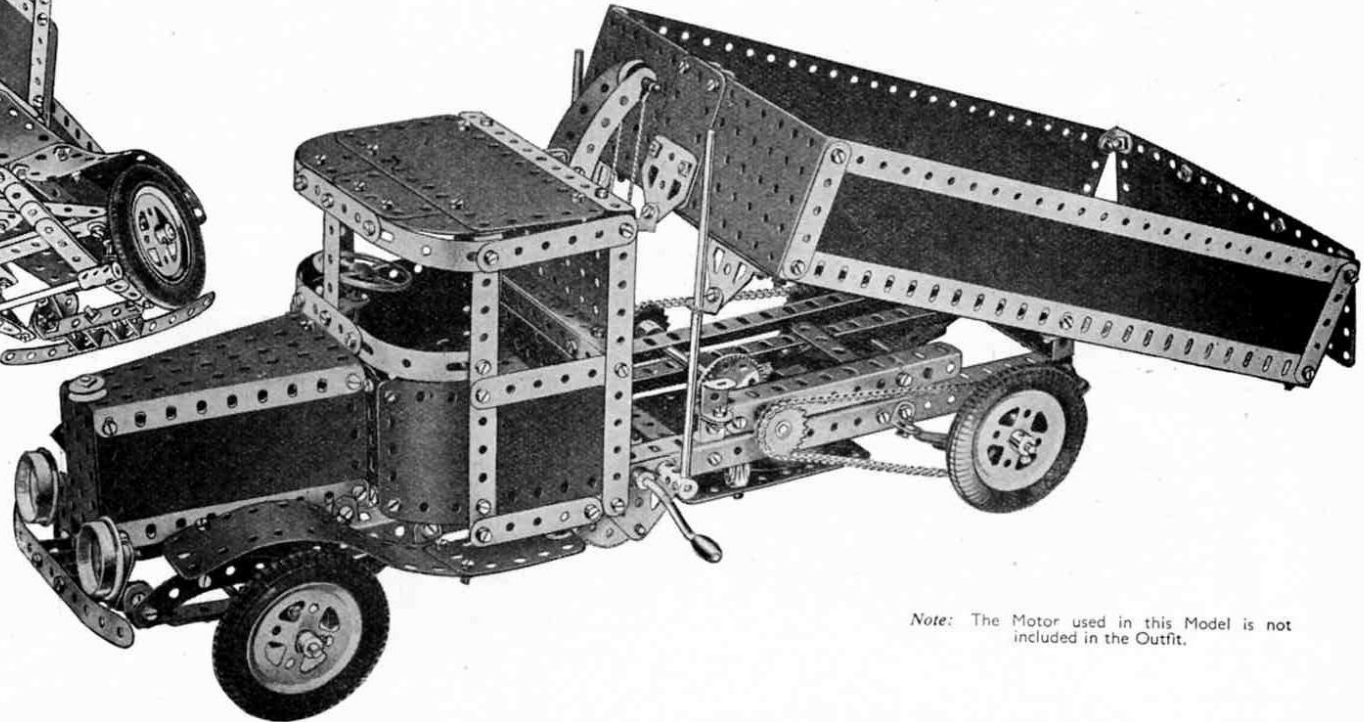
The Crank Handle that controls the raising and lowering of the body of the wagon is journalled in two Flat Trunnions bolted to the sides of the chassis, and is prevented from turning freely by a Compression Spring. A ½" Pinion on the Shaft of the Crank Handle meshes with a 57-tooth Gear on a 5" Rod that also is journalled in the two Flat Trunnions. Cord is tied to a Cord Anchoring Spring on this Rod and wound around it several times. The Cord is then led over a ½" Pulley at the head of a small jib behind the cab, and finally is tied to the front of the body of the lorry.

The construction of the model is commenced with the chassis, which consists of two compound girders, each made by bolting two 12½" Angle Girders together overlapping fifteen holes. The two compound girders are joined at the forward end by a 3½" Strip and at the rear end by a 3½" x ½" Double Angle Strip. The bonnet is built up by joining the flanges of two Flanged Sector Plates by 4½" x 2½" Flexible Plates. The lower Sector Plate is bolted to the 3½" Strips joining the side members of the chassis. A 2½" x 1½" Flanged Plate is fixed between the narrow ends of the two Flanged Sector Plates by a 3" Screwed Rod to represent the radiator.

The back of the cab is formed by two 5½" x 2½" Flanged Plates fastened together by their longer flanges, the lower one being bolted direct to the chassis. A 4½" x 2½" Flexible Plate is used for each side of the cab. It is bolted at the rear to the lower Flanged Plate, and at the front is connected by a 2½" x 1½" Flexible Plate to the bonnet.

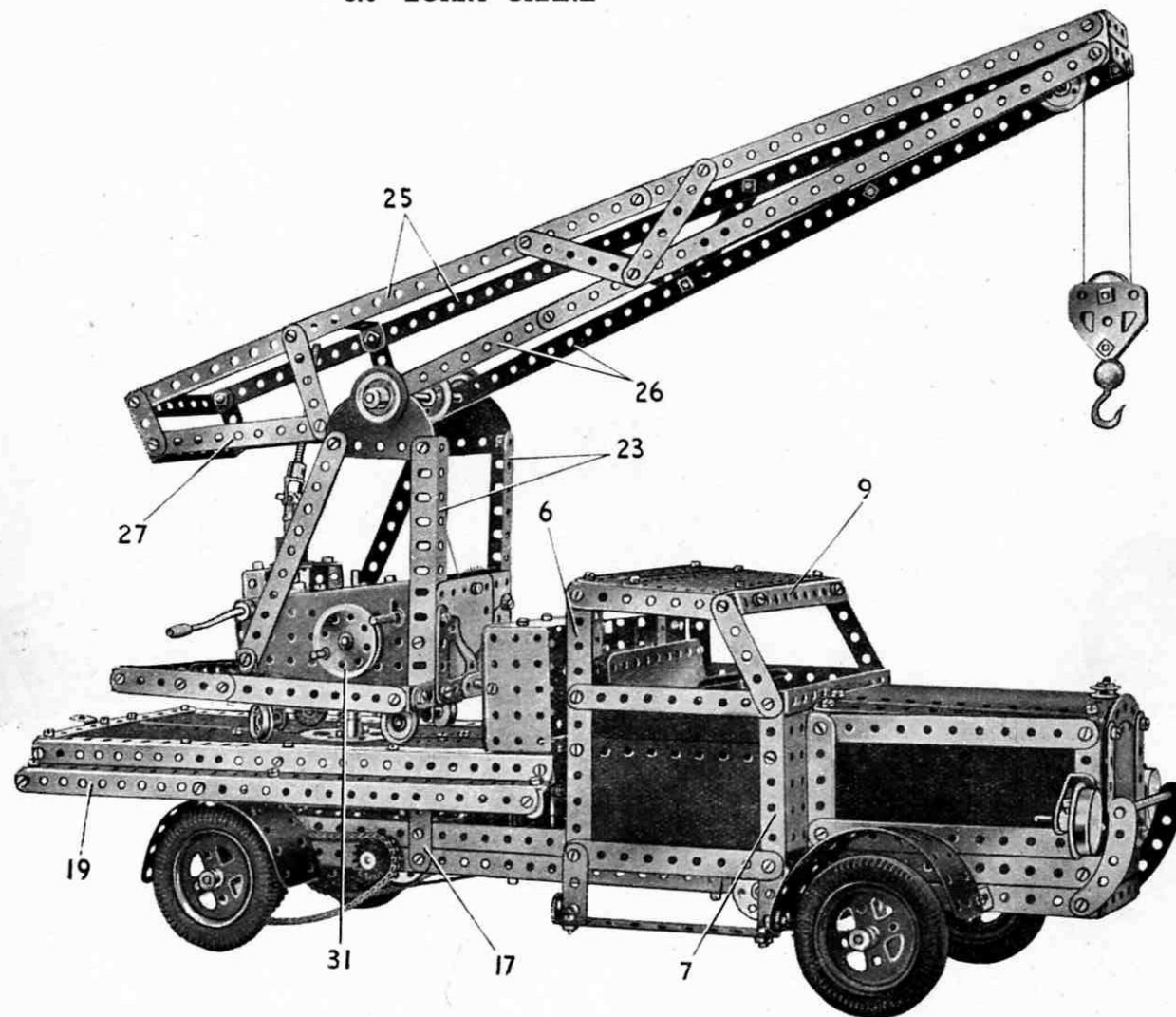
Each of the front leaf springs is constructed from a 2½", 3½", 4½", and a 5½" strip, and is fastened to the chassis by Double Bracket at its front end and by an Angle Bracket at the rear. Two 2" Pulleys fitted with Rubber Tyres are used for the front wheels, and each is loosely held by a Collar on a 1½" Rod, which is fastened by a ¾" Bolt in the boss of a Small Fork Piece. The Small Fork Piece is connected by a Pivot Bolt to the end tapped hole of a Coupling, which is secured by its other end to one of the leaf springs. One of the Fork Pieces is taken from a Swivel Bearing.

Each of the ¾" Bolts used for fastening the 1½" Rods to the small Fork Pieces carries a Collar locked against its head. The two Collars are joined by a compound 6" strip, one of the bolts holding also a 3½" Strip, which is secured at its other end to the 57-tooth Gear by the lock-nutted Bolt 1. This Gear meshes with a ½" Pinion on the lower end of the 3½" Rod representing the steering column. The bolts fastened to the 57-tooth Gear allow it to turn only half a revolution.



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

8.6 LORRY CRANE



Each of the chassis members is built up from four $12\frac{1}{2}$ " Angle Girders, bolted together in pairs to form compound $20\frac{1}{2}$ " girders. The compound girders are connected together by Fishplates, and the sides of the chassis are joined at each end by two $2\frac{1}{2} \times \frac{1}{2}$ " Double Angle Strips.

The front axle consists of two $5\frac{1}{2}$ " Strips bolted to the chassis. A $1\frac{1}{2}$ " Rod fitted with a Coupling 1 (Fig. 8.6a) is passed through each of the end holes of the $5\frac{1}{2}$ " Strips, and is held in place by a Crank 2. One of the $1\frac{1}{2}$ " Rods is fitted with a second Coupling 3. The front wheels are free to turn on $1\frac{1}{2}$ " Rods fixed in the Couplings 1, and the Cranks 2 are connected by a $5\frac{1}{2}$ " Strip held in place by lock-nuts.

The rear axle consists of a $6\frac{1}{2}$ " Rod, and is mounted in Curved Strips bolted to the chassis. It is fitted at each side with a $2\frac{1}{2}$ " Sprocket Wheel 3 (Fig. 8.6c).

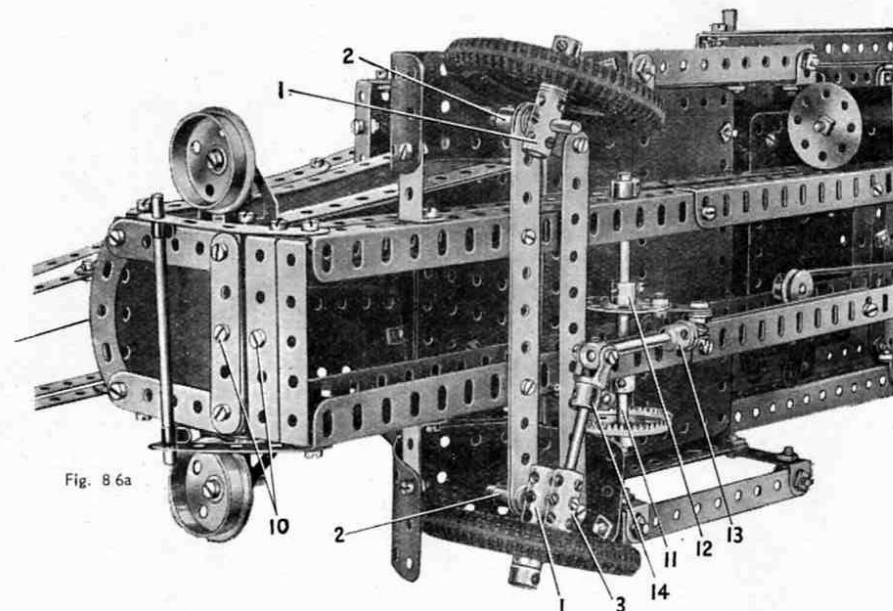


Fig. 8.6a

The front and rear of the driving cab each consists of a $5\frac{1}{2} \times 2\frac{1}{2}$ " Flanged Plate bolted to the chassis. One of the Flanged Plates is seen at 5. The sides of the cab are each formed by two $4\frac{1}{2} \times 2\frac{1}{2}$ " Flexible Plates overlapped three holes and attached to the $5\frac{1}{2} \times 2\frac{1}{2}$ " Flanged Plates. The Flexible Plates are fitted with a $5\frac{1}{2}$ " Strip 6 and a $3\frac{1}{2}$ " Strip 7. The Strips 7 on each side are connected by a $5\frac{1}{2} \times \frac{1}{2}$ " Double Angle Strip.

The rear of the cab is extended by a $5\frac{1}{2} \times 2\frac{1}{2}$ " Flexible Plate overlapping the Flanged Plate by three holes, and by two $2\frac{1}{2} \times 1\frac{1}{2}$ " Flexible Plates 8 (Fig. 8.6b). These Flexible Plates are braced by $5\frac{1}{2}$ " and $1\frac{1}{2}$ " Strips, and are connected to the Strips 6 by Angle Brackets. The roof consists of two $5\frac{1}{2} \times 2\frac{1}{2}$ " Flexible Plates overlapped three holes, and is attached by Angle Brackets to the Strips 6 and to a $5\frac{1}{2} \times \frac{1}{2}$ " Double Angle Strip 9. The floor is filled in by two $5\frac{1}{2} \times 2\frac{1}{2}$ " Flexible Plates. The seat is made from two $4\frac{1}{2} \times 2\frac{1}{2}$ " Flexible Plates joined together at right angles by Angle Brackets. The unit is then attached to Reversed Angle Brackets bolted to the rear of the cab.

(Continued on next page)

8.6 LORRY CRANE—Continued

The steering column is a 4" Rod mounted in a Trunnion bolted to the upper flange of the Plate 5 and in a Fishplate fixed to the lower flange of this Plate. A $\frac{1}{2}$ " Pinion fixed to the lower end of the steering column meshes with a $\frac{1}{4}$ " Contrate on a $\frac{3}{4}$ " Rod 11. This Rod is passed through the chassis members and carries a Bush Wheel 12. An End Bearing 13 is attached by a lock-nutted $\frac{1}{2}$ " Bolt to a Fishplate bolted to the Bush Wheel, and is connected by a 2" Rod to a Swivel Bearing 14. The Swivel Bearing is fixed on a $\frac{1}{4}$ " Rod held in the Coupling 3.

A No. 1 Clockwork Motor is bolted to the Chassis as shown in Fig. 8.6c, and a $\frac{1}{2}$ " Pulley on its driving shaft is connected by a Driving Band to a $\frac{1}{2}$ " Pulley on a $\frac{3}{4}$ " Rod 15. This rod is fitted at each end with a 1" Sprocket Wheel, and these are connected by Sprocket Chain to the Sprockets 4 on the rear axle.

The crane platform consists of two $12\frac{1}{2}$ " Angle Girders joined at each end by a $5\frac{1}{2}$ " Strip and in the centre by two $5\frac{1}{2}$ " Angle Girders 16 (Fig. 8.6c). The platform is attached to the chassis by four $2\frac{1}{2}$ " Strips fixed to Angle Brackets bolted to the Angle Girders 16. One of the $2\frac{1}{2}$ " Strips is seen at 17. The platform is filled in by a $12\frac{1}{2}$ " Strip Plate at each side and by three $5\frac{1}{2}$ " x $1\frac{1}{2}$ " Flexible Plates in the centre. A $12\frac{1}{2}$ " Strip 18 is attached to each side of the platform by Angle Brackets, and a further $12\frac{1}{2}$ " Strip 19 is attached to the Strip 18 in the same manner.

A Face Plate is held in position in the centre of the platform by the Bolts 20. A $3\frac{1}{2}$ " Rod 21 is fixed in the Face Plate (Fig. 8.6b). The crane pivots about a roller bearing formed by bolting two $3\frac{1}{2}$ " x $\frac{1}{2}$ " Double Angle Strips at right angles to each other across the centre of a Face Plate. Four $\frac{1}{2}$ " Flanged Wheels free to turn on Pivot Bolts and $\frac{3}{4}$ " Bolts are fixed at each end of the Double Angle Strips. The Face Plate is pivoted on the Rod 21.

The base of the crane superstructure is made by four $3\frac{1}{2}$ " x $2\frac{1}{2}$ " Flanged Plates bolted together to form two compound $7\frac{1}{2}$ " x $2\frac{1}{2}$ " flanged plates, these are then joined at each end by a $5\frac{1}{2}$ " Strip 22, and a compound strip consisting of a $5\frac{1}{2}$ " and a 3" Strip is attached to each side by $1\frac{1}{2}$ " x $1\frac{1}{2}$ " and $\frac{1}{2}$ " x $\frac{1}{2}$ " Angle Brackets. The space between the Flanged Plates is filled in by a $5\frac{1}{2}$ " and a 2" Strip joined together and attached to the Strips 22 by Angle Brackets. The complete platform is passed over the Rod 21 so that it rests on the roller bearing.

The housing for the winding mechanism is formed by two Flanged Sector Plates. These are bolted to the $5\frac{1}{2}$ " Angle Girders 23, and attached to the centre flanges of the $3\frac{1}{2}$ " x $2\frac{1}{2}$ " Flanged Plates by Angle Brackets. The Flanged Sector Plates are connected by a $3\frac{1}{2}$ " Strip 24. A Semi-Circular Plate is bolted to each of the Angle Girders 23, and to $5\frac{1}{2}$ " Strips attached to the rear ends of the Flanged Sector Plates.

The strips 25 of the jib are formed by two $12\frac{1}{2}$ " Strips overlapped six holes, and the strips 26 by two $12\frac{1}{2}$ " Strips overlapped 14 holes. The strips 26 are extended by two $4\frac{1}{2}$ " Strips 27. Strips 25 and 26 are joined together at the jib head by Fishplates, and the sides are connected by $3\frac{1}{2}$ " x $\frac{1}{2}$ " Double Angle Strips at the rear and by $1\frac{1}{2}$ " x $\frac{1}{2}$ " Double Angle Strips at the jib head. The jib pivots about a 4" Rod passed through the Semi-Circular Plates of the superstructure and held in place by 1" Pulleys.

The jib is luffed by turning a Crank Handle 28. A $\frac{1}{2}$ " Pinion on this Crank Handle meshes with a 2" Contrate Wheel on the $1\frac{1}{2}$ " Rod 29. This Rod is mounted in a Double Bent Strip and a Swivel Bearing. A 3" Screwed Rod fixed in the universal coupling is screwed into the centre tapped hole of a Coupling 30. A 2" Rod is held in each side of this Coupling and is passed through one of the Strips 27.

The crane is slewed by turning the $1\frac{1}{2}$ " Pulley 31. This is fixed on a 4" Rod mounted in the Flanged Sector Plates, and carries a Worm that meshes with a 57-tooth Gear on Rod 21.

The hoisting movement is controlled by a Crank Handle 32, mounted in a Flanged Sector Plate and a Double Bent Strip bolted to this Plate. A $\frac{1}{2}$ " Pinion on the Crank Handle meshes with a 57-tooth Gear on a 5" Rod 33. A length of Cord fastened to a Cord Anchoring Spring on this Rod is passed over a 1" loose Pulley on the Rod supporting the jib. It is then passed over a similar Pulley on a 2" Rod in the jib head and around a 1" loose Pulley in the pulley block. It is tied at the jib head.

The pulley block is formed by two Flat Trunnions spaced $\frac{1}{2}$ " apart by nuts on $\frac{3}{4}$ " Bolts. The Loaded Hook is passed over the lower Bolt. The tool compartment at the front of the crane platform is formed by a $2\frac{1}{2}$ " x $1\frac{1}{2}$ " Flanged Plate fixed to each side of the platform. A $5\frac{1}{2}$ " x $2\frac{1}{2}$ " Flexible Plate is fastened to these by two Trunnions, and three $2\frac{1}{2}$ " x $1\frac{1}{2}$ " Flexible Plates are bolted together and fastened to the upper flanges of the Flanged Plates.

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

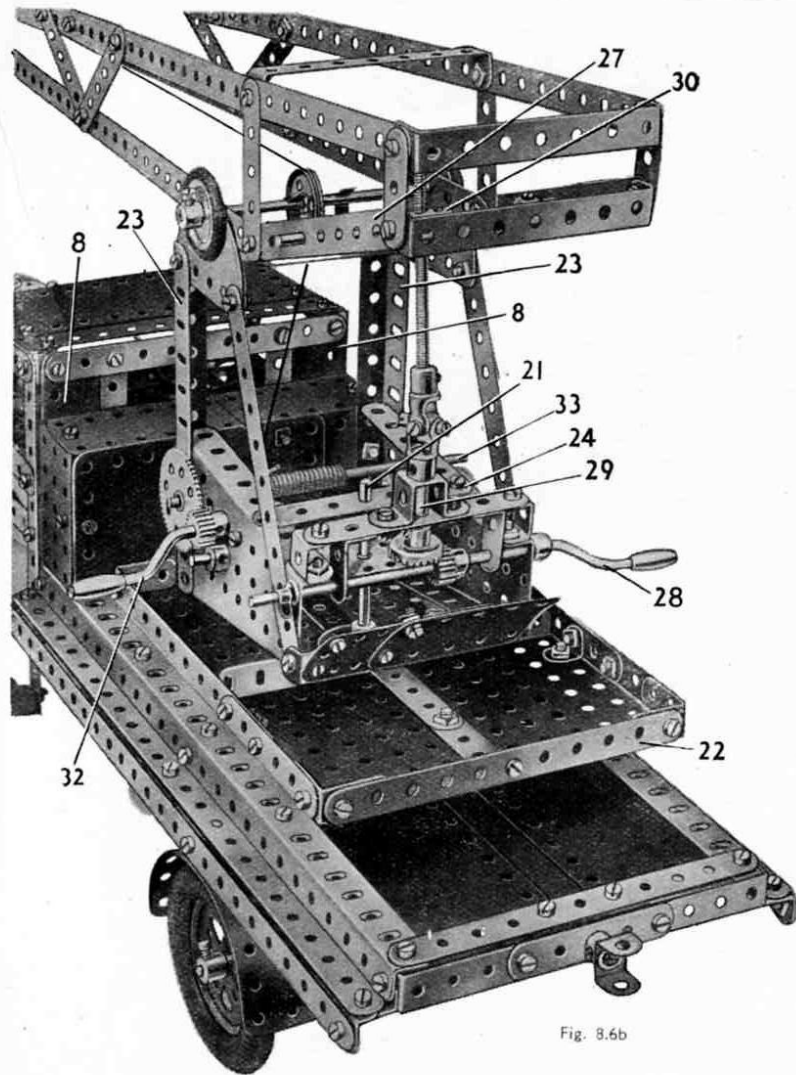
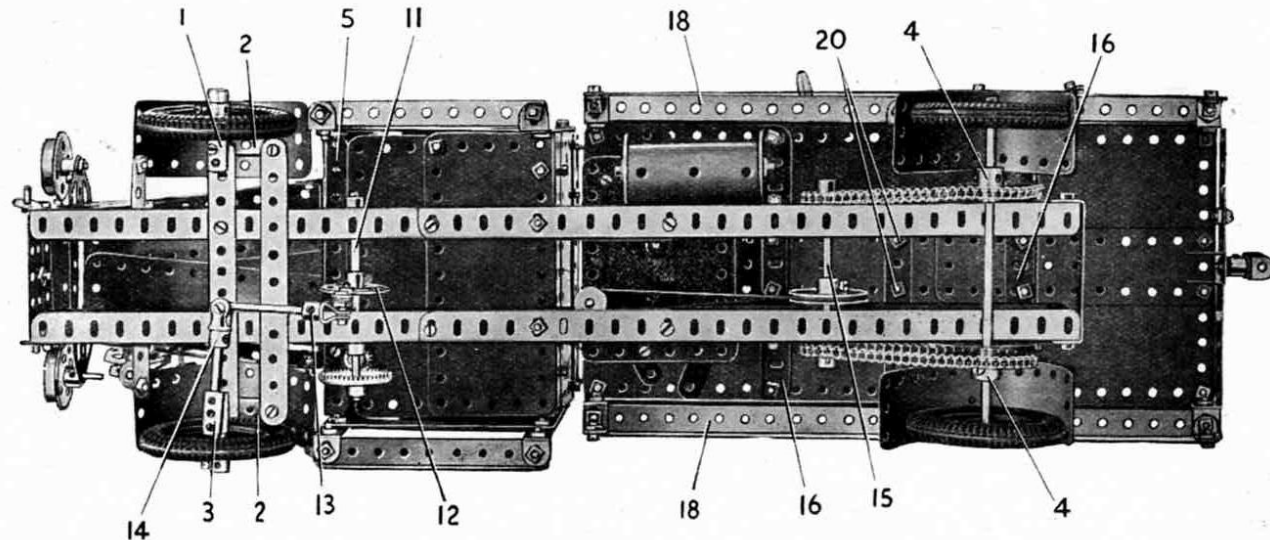


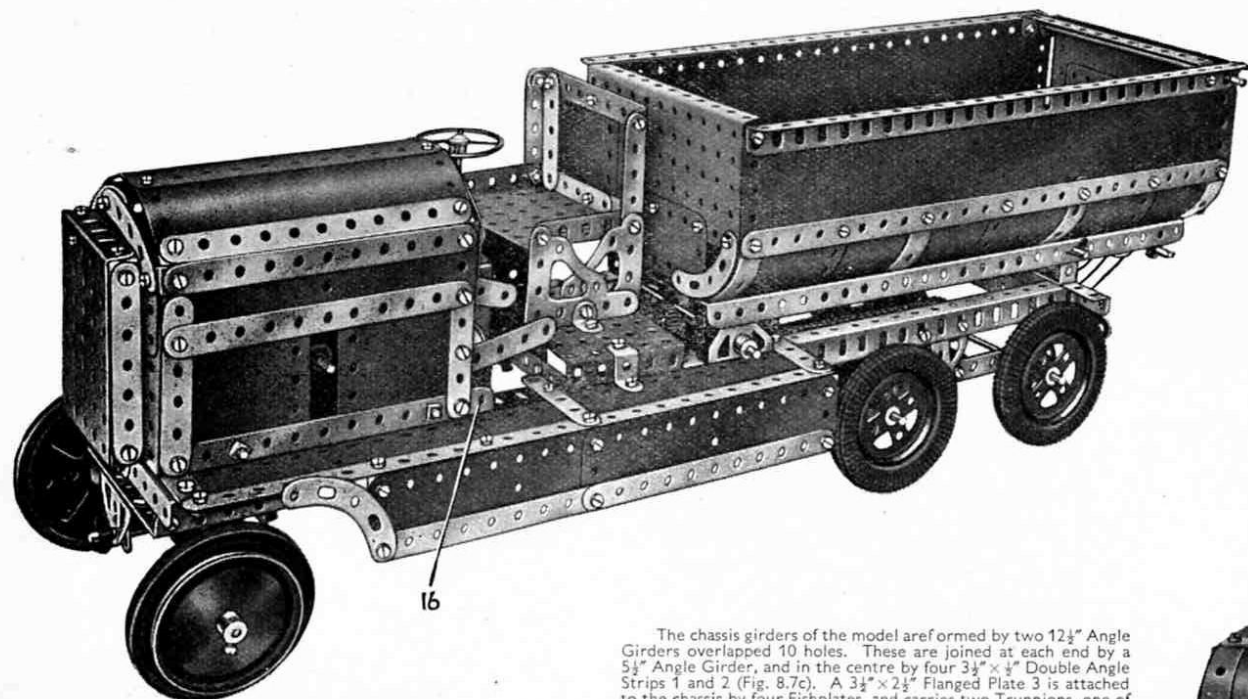
Fig. 8.6b

The sides of the bonnet are formed by $5\frac{1}{2}$ " x $2\frac{1}{2}$ " Flexible Plates strengthened by $2\frac{1}{2}$ " x $5\frac{1}{2}$ " Strips. These are fixed at the rear to a $3\frac{1}{2}$ " x $2\frac{1}{2}$ " Flanged Plate bolted to the Flanged Plate 5, and are connected at the front by two $2\frac{1}{2}$ " x $\frac{1}{2}$ " Double Angle Strips. A Fishplate held by the Bolts 10 is used to secure the front of the bonnet to the chassis.

The radiator consists of a $2\frac{1}{2}$ " x $2\frac{1}{2}$ " Flexible Plate, and the top of the bonnet is formed by a $5\frac{1}{2}$ " x $2\frac{1}{2}$ " and two $5\frac{1}{2}$ " x $1\frac{1}{2}$ " Flexible Plates. The $5\frac{1}{2}$ " x $1\frac{1}{2}$ " Plates overlap the $5\frac{1}{2}$ " x $2\frac{1}{2}$ " Plate three holes at the front and two at the rear. The top is attached to the sides by Obtuse Angle Brackets.



8.7 LARGE CAPACITY MOTOR DUMPER



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The chassis girders of the model are formed by two $12\frac{1}{2}$ " Angle Girders overlapped 10 holes. These are joined at each end by a $5\frac{1}{2}$ " Angle Girder, and in the centre by four $3\frac{1}{2}$ " \times $\frac{1}{2}$ " Double Angle Strips 1 and 2 (Fig. 8.7c). A $3\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flanged Plate 3 is attached to the chassis by four Fishplates, and carries two Trunnions, one of which is seen at 4. The front axle is formed by three $5\frac{1}{2}$ " Strips 5, bolted to a $2\frac{1}{2}$ " \times $1\frac{1}{2}$ " Flanged Plate, which pivots about a $3\frac{1}{2}$ " Rod passed through the Trunnions 4 and held in place by Spring Clips.

The front wheels are fixed on $1\frac{1}{2}$ " Rods mounted in Double Brackets 6 and 7. A $\frac{3}{8}$ " Bolt is passed through a $1\frac{1}{2}$ " Strip and the Double Bracket 6, and is held in the end hole of the strips 5 by lock-nuts. A second $\frac{3}{8}$ " Bolt is passed through a $1\frac{1}{2}$ " Strip and the Double Bracket 7, and a $1\frac{1}{2}$ " Strip 8 is held tightly on this Bolt by a nut. The shank of the Bolt is then passed through the end hole of the Strips 5 and held by lock-nuts. The $1\frac{1}{2}$ " Strips are joined by a $5\frac{1}{2}$ " Strip 9, which is held in place by lock-nutted bolts.

The steering box is formed by two $1\frac{1}{2}$ " \times $\frac{1}{2}$ " Double Angle Strips 10 (Fig. 8.7e), which are bolted to the chassis and fitted with a Fishplate 11. The steering column is a 4 " Rod mounted in the Fishplate 11 and the chassis. This Rod carries a Worm, which meshes with a $\frac{3}{4}$ " Pinion fixed on a $1\frac{1}{2}$ " Rod passed through the centre holes of the Double Angle Strips 10. The $1\frac{1}{2}$ " Rod carries a Crank at its outer end. The Crank is extended by a $2\frac{1}{2}$ " Strip fitted with an Angle Bracket 12. The Angle Bracket is connected to the Strip 8 by two $4\frac{1}{2}$ " Strips overlapped four holes.

The rear wheels are locked on $6\frac{1}{2}$ " Rods mounted in the next-to-end holes of the $5\frac{1}{2}$ " Strips 13 (Fig. 8.7b). These Strips are free to pivot on a $4\frac{1}{2}$ " Rod 14, which is passed through the end holes of Flat Trunnions bolted to the chassis. The rear axles are connected by a length of Sprocket Chain passed over a 1 " Sprocket on each axle, and the leading axle carries a 2 " Sprocket 15.

One side of the bonnet is formed by two $5\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flexible Plates overlapped three holes, and the other side consists of two $2\frac{1}{2}$ " \times $2\frac{1}{2}$ " and a $5\frac{1}{2}$ " \times $1\frac{1}{2}$ " Flexible Plate. The sides are fixed to $5\frac{1}{2}$ " Angle Girders 16 bolted to the chassis, and are connected at the front by a $3\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flanged Plate. A No. 1 Clockwork Motor is bolted to one of the $5\frac{1}{2}$ " Angle Girders 16 so that its winding spindle projects through the side between the $2\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flexible Plates. The sides are joined at the rear by two $2\frac{1}{2}$ " Strips overlapped three holes and attached to them by Angle Brackets. The $3\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flanged Plate at the front of the bonnet is extended at the top by two $2\frac{1}{2}$ " \times $1\frac{1}{2}$ " Flexible Plates, connected to the sides by Angle Brackets. The brake and reversing Levers of the Motor are extended by Strips so that they project through the rear of the bonnet.

The radiator consists of a $3\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flanged Plate, fitted at each side with a $3\frac{1}{2}$ " Strip attached to Angle Brackets. It is bolted to Angle Brackets fixed to the front of the chassis, and is held by a $\frac{3}{8}$ " Bolt at its upper end. The top of the bonnet is formed by two $5\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flexible Plates attached to Obtuse Angle Brackets bolted to the sides.

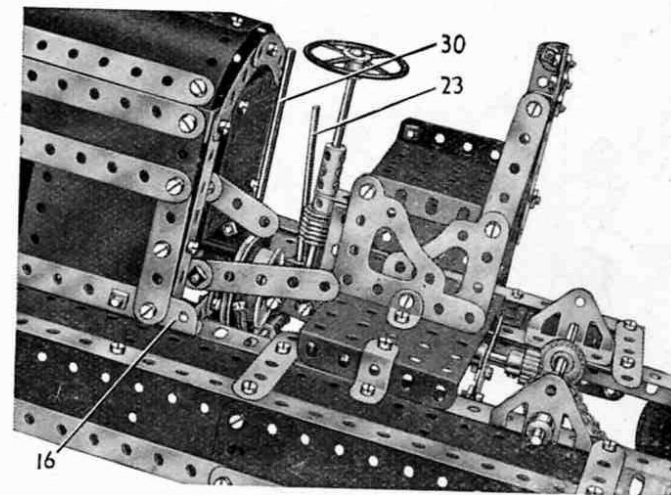


Fig. 8.7a

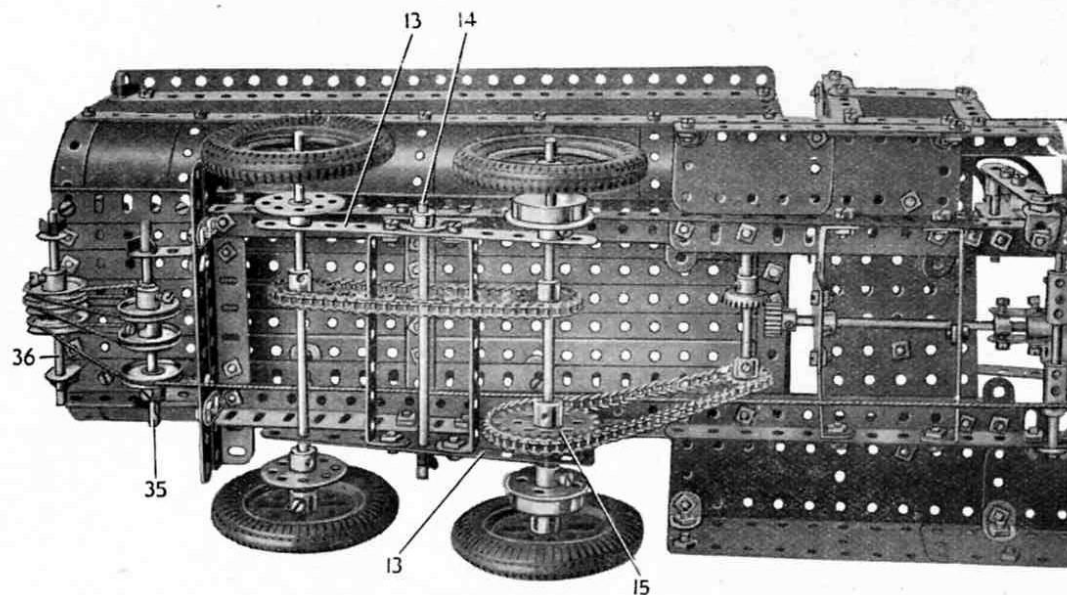


Fig. 8.7b

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8.7 LARGE CAPACITY MOTOR OR DUMPER—Continued

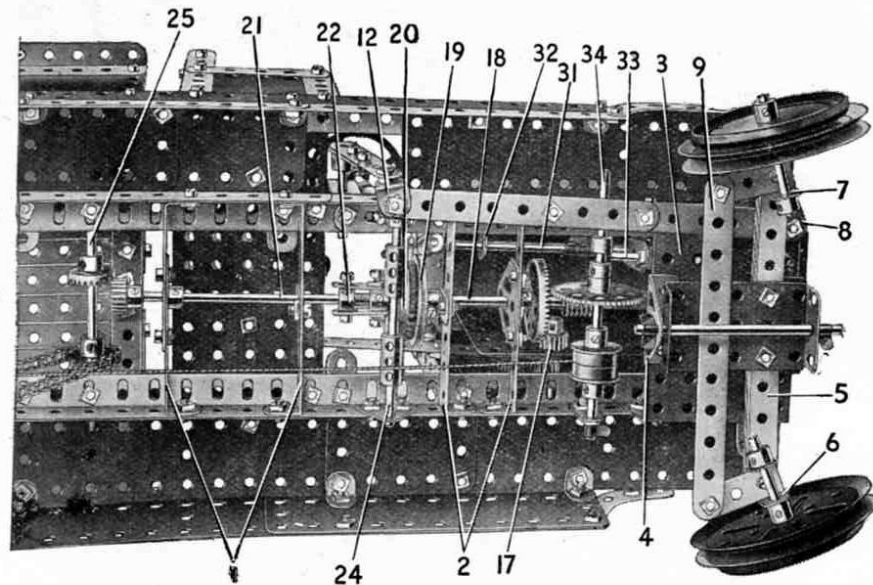


Fig. 8.7c

A $\frac{1}{2}$ " Pinion fixed to Rod 21 meshes with a $\frac{3}{4}$ " Contrate Wheel on a 4" Rod 25, which is passed through two Trunnions bolted to the chassis. A $\frac{3}{4}$ " Sprocket on Rod 25 is connected by Sprocket Chain to the 2" Sprocket 15 on the rear axle.

The sides of the hopper are formed by 12 $\frac{1}{2}$ " Strip Plates braced by 12 $\frac{1}{2}$ " Angle Girders and Strips. The sides are bolted at the front to a 5 $\frac{1}{2}$ " x 2 $\frac{1}{2}$ " Flanged Plate 26 (Fig. 8.7e), and are connected at the rear by a 5 $\frac{1}{2}$ " x $\frac{1}{2}$ " Double Angle Strip. The curved part of the sides is built up from 1 $\frac{1}{2}$ " radius Curved Plates and 2 $\frac{1}{2}$ " x 2 $\frac{1}{2}$ " Flexible Plates. These are bolted at their lower ends to 12 $\frac{1}{2}$ " Angle Girders 27. The Angle Girders 27 are joined at each end and in the centre by 3 $\frac{1}{2}$ " Strips, and the bottom of the hopper is filled in by 12 $\frac{1}{2}$ " Strips. The unloading trap is formed by a 5 $\frac{1}{2}$ " x 2 $\frac{1}{2}$ " and a 4 $\frac{1}{2}$ " x 2 $\frac{1}{2}$ " Flexible Plate, and two Semi-Circular Plates. These are bolted together as shown in Fig. 8.7d and are pivotally attached to the hopper by a 6 $\frac{1}{2}$ " Rod passed through a 5 $\frac{1}{2}$ " x $\frac{1}{2}$ " Double Angle Strip 28. The hopper tips about a 4 $\frac{1}{2}$ " Rod 29 mounted in 1" x 1" Angle Brackets bolted to the chassis.

The tipping mechanism is brought into operation by moving a lever 30 (Fig. 8.7a). This is held in a Coupling fixed to a 4 $\frac{1}{2}$ " Rod 31. This Rod is mounted in 1" x $\frac{1}{2}$ " Angle Brackets bolted to the chassis, one of which is seen at 32. The Angle Brackets are fitted with Fishplates so that the Rod 31 is unable to slide in their slotted holes. A Crank is fixed on the end of Rod 31, and it carries a Threaded Pin 33 that engages between Collars on a 4 $\frac{1}{2}$ " Rod 34. This Rod is free to slide in Fishplates and carries a 57-tooth Gear and two $\frac{3}{4}$ " Flanged Wheels. The 57-tooth Gear is arranged so that it can be moved by the lever 30 into engagement with a Worm fixed on Rod 18.

A length of Cord is tied to Rod 34 and clamped between the 3" Flanged Wheels. It is then led under a 1" Pulley mounted on a 3 $\frac{1}{2}$ " Rod 35, and around a similar Pulley on Rod 36. It passes around further 1" Pulleys on Rods 35 and 36 and it is tied to Rod 35.

Rods 35 and 36 are mounted in 2 $\frac{1}{2}$ " x $\frac{1}{2}$ " Double Angle Strips bolted to the chassis and the rear of the hopper respectively.

The running boards at the front of the dumper are formed by 5 $\frac{1}{2}$ " x 1 $\frac{1}{2}$ " and 2 $\frac{1}{2}$ " x 1 $\frac{1}{2}$ " Flexible Plates strengthened by Strips as shown. The seat consists of a 3 $\frac{1}{2}$ " x 2 $\frac{1}{2}$ " Flanged Plate and it is bolted to a 5 $\frac{1}{2}$ " and a 3" Strip on one side and to two Corner Gussets on the other. The Corner Gussets are fixed by an Angle Bracket to a second 3 $\frac{1}{2}$ " x 2 $\frac{1}{2}$ " Flanged Plate, which is attached to the running boards by Reversed Angle Brackets.

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

A $\frac{1}{2}$ " Pinion 17 (Fig. 8.7c) fixed on the Motor driving shaft meshes with a 1 $\frac{1}{2}$ " Contrate Wheel locked on a 3 $\frac{1}{2}$ " Rod 18. This Rod is mounted in a Flat Trunnion and a Fishplate bolted to the Double Angle Strips 2, and carries a 1 $\frac{1}{2}$ " Pulley 19. The Rod projects slightly through the boss of the Pulley 19 and carries a 1" loose Pulley fitted with a Rubber Ring. A 1 $\frac{1}{2}$ " Flanged Wheel 20 is loose on a 4 $\frac{1}{2}$ " Rod 21, which is mounted in a Flat Trunnion and a Fishplate bolted to the Double Angle Strips 1. Two Fishplates are attached to the tapped holes of the Flanged Wheel by nuts and bolts, and a Collar 22 is held in the slotted holes of the Fishplates by two Bolts. The Collar is locked on Rod 21, and a Compression Spring is fitted between the Collar and the Flanged Wheel, so that the Flanged Wheel is pressed firmly against the 1" loose Pulley and Rubber Ring. This forms a friction disc, which can be disengaged by means of the lever 23.

The lever 23 is held in a Coupling fixed on a 4" Rod 24 mounted in 1" Triangular Plates bolted to the chassis. Two Couplings are locked on this Rod, and each carries a $\frac{3}{4}$ " Bolt in its centre tapped hole. The Bolts engage the rim of the Flanged Wheel 20 so that as the lever 23 is pulled, the Flanged Wheel is moved away from the 1" loose Pulley, thus disconnecting the drive to the front wheels.

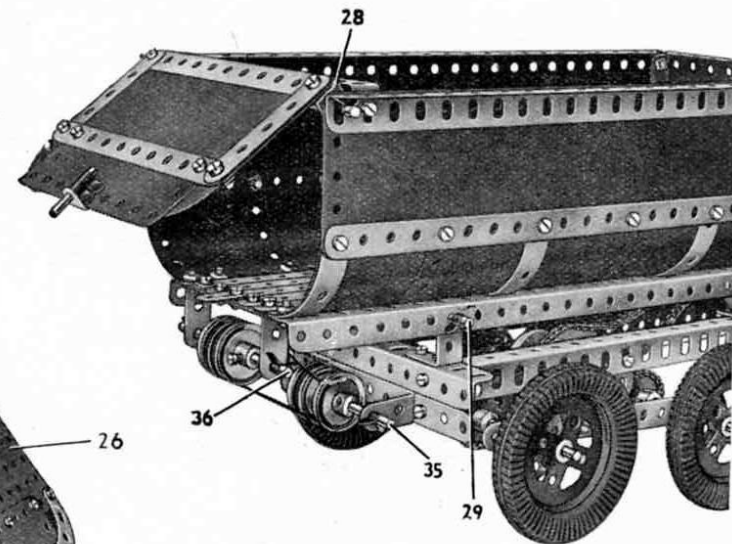


Fig. 8.7d

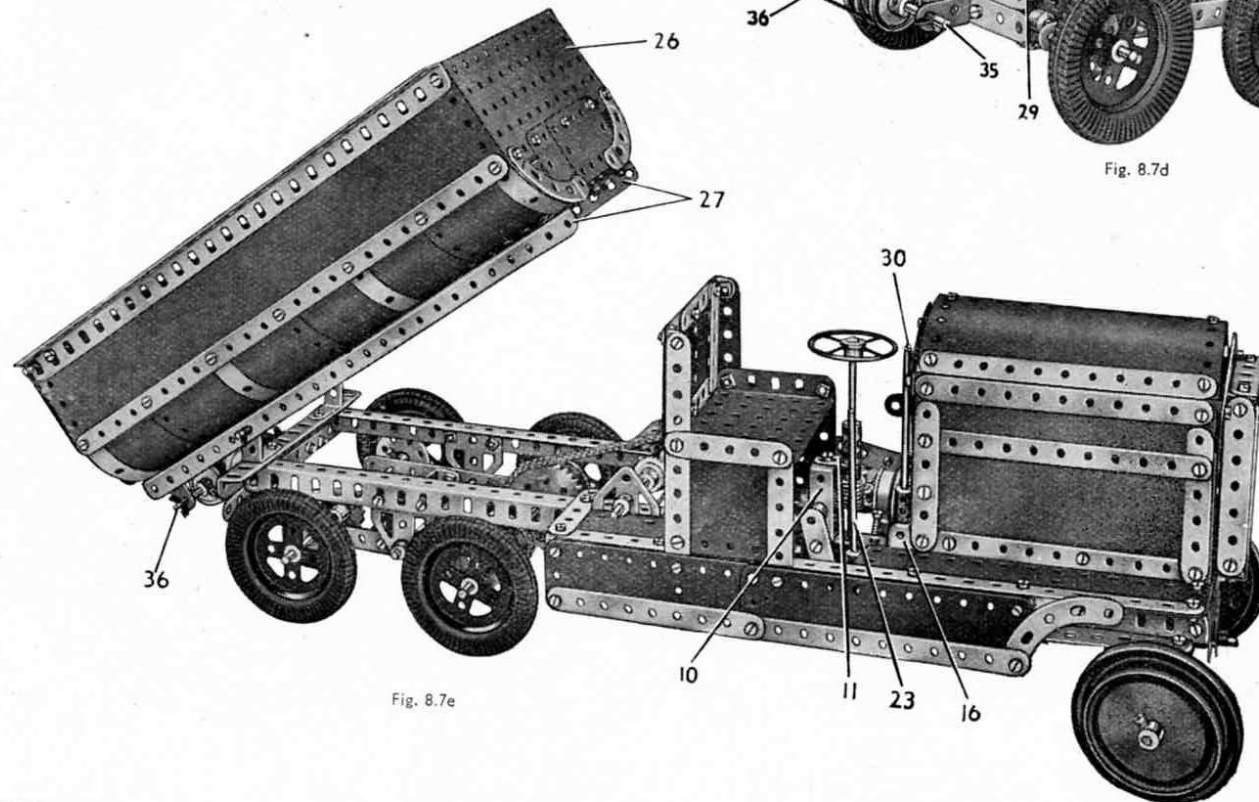


Fig. 8.7e

8.8 SHIPYARD CRANE

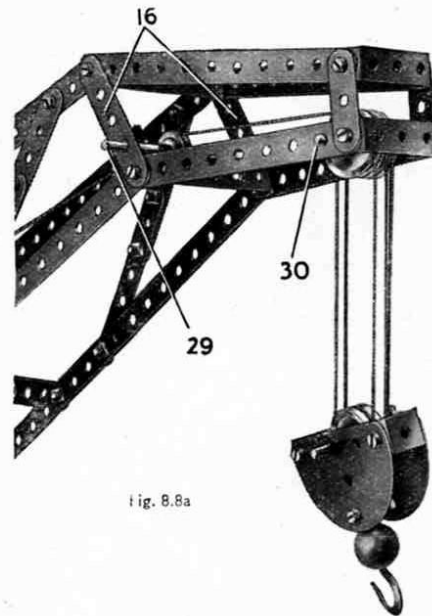
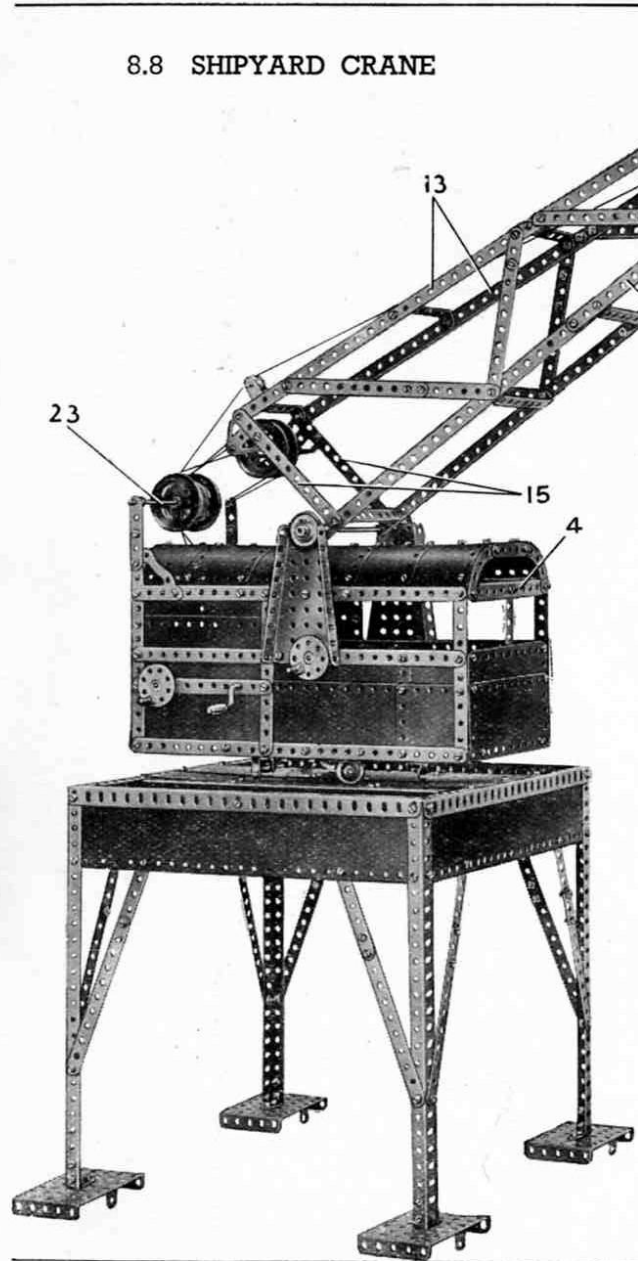


Fig. 8.8a

The top of the base is made from four $12\frac{1}{2}$ " Angle Girders and four $12\frac{1}{2}$ " Strip Plates bolted together to form a square. Two $12\frac{1}{2}$ " Angle Girders 1 (Fig. 8.8d), and two $12\frac{1}{2}$ " Strip Plates are then fixed in position, and are braced by two $5\frac{1}{2}$ " Angle Girders 2. A Face Plate 3 is bolted in the centre of the $12\frac{1}{2}$ " Strip Plates. Each of the legs of the base is formed by a $12\frac{1}{2}$ " Angle Girder attached by a $1" \times 1"$ Angle Bracket to a $3\frac{1}{2}" \times 2\frac{1}{2}"$ Flanged Plate and a $2\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strip. Each leg is braced by two compound strips as shown in Fig. 8.8d.

Four $5\frac{1}{2}" \times 2\frac{1}{2}"$, a $2\frac{1}{2}" \times 2\frac{1}{2}"$ and three $5\frac{1}{2}" \times 1\frac{1}{2}"$ Flexible Plates are used for each side of the cab. These are bolted to $12\frac{1}{2}"$ and $5\frac{1}{2}"$ Strips as shown in Fig. 8.8e, and the sides are joined at each end by a $5\frac{1}{2}"$ Angle Girder 4 and a $5\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strip 5. Two $5\frac{1}{2}" \times 2\frac{1}{2}"$ Flanged Plates, one of which is marked 6 (Fig. 8.8c), are attached to the centre of the cab and they are connected by a $5\frac{1}{2}" \times 1\frac{1}{2}"$ Flexible Plate 7. A Double Bent Strip is attached to the Flanged Plates, so that its centre hole coincides with the centre hole of the Flexible Plate 7. A $4\frac{1}{2}"$ Rod 8 is passed through the Double Bent Strip and the Flexible Plate 7, and through a $5\frac{1}{2}"$ Strip, 9 attached to the sides by Angle Brackets. The Rod 8 is fitted at its upper end with a 57-tooth Gear 10.

The cab pivots on a roller bearing made by bolting two $4\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strips to a Face Plate. Four $\frac{3}{4}"$ Flanged Wheels are attached to the Double Angle Strips by Pivot Bolts and $\frac{3}{4}"$ Bolts, and the Face Plate is passed over the Rod 8. The Rod 8 is then locked in the Face Plate 3 attached to the base.

The cab can be slewed by turning a Bush Wheel 11. This is fixed on a $6\frac{1}{2}"$ Rod mounted in the sides of the cab and fitted with a Worm 12. The Worm is arranged so that it meshes with the 57-tooth Gear on Rod 8.

The strips 13 of the jib are formed by two $12\frac{1}{2}"$ Strips overlapped two holes, and the strips 14 by two $12\frac{1}{2}"$ Strips overlapped three holes. Strips 13 and 14 are bolted at their lower ends to $5\frac{1}{2}"$ Strips 15, and they are joined together by $3\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strips. They are attached at their outer ends to $2\frac{1}{2}"$ Strips 16, and are connected by $2\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strips.

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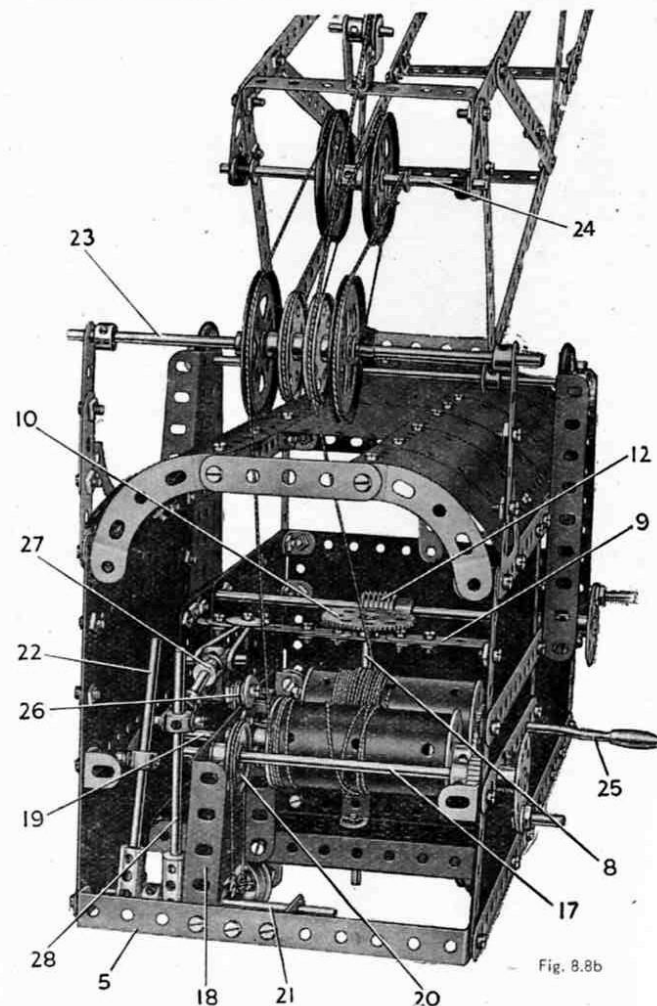


Fig. 8.8b

8.8 SHIPYARD CRANE—Continued

The Strips 13 are extended by $5\frac{1}{2}$ " Strips, and the Strips 14 by $4\frac{1}{2}$ " Strips (Fig. 8.8a). These are bolted to $1\frac{1}{2}$ " Strips and are connected by $1\frac{1}{2}$ " \times $\frac{1}{2}$ " Double Angle Strips. The jib pivots about a $6\frac{1}{2}$ " Rod mounted in Flanged Sector Plates bolted to the sides of the cab.

The jib is luffed by turning a Bush Wheel fixed on a 5" Rod 17. This Rod is mounted in one side of the cab, and in a $3\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flanged Plate 18 attached to the Flanged Plate 6 and to the Double Angle Strip 5. A $\frac{1}{2}$ " Pinion on Rod 17 meshes with a 57-tooth Gear on a 5" Rod 19. This Rod is also mounted in the side of the cab and the Flanged Plate 18, and it is fitted with a winding drum consisting of a Cylinder and two $1\frac{1}{2}$ " Flanged Wheels. A simple band brake is fitted to Rod 17. It is made by passing a length of Cord around a 1" Pulley 20, and fastening the Cord to a Crank on a $3\frac{1}{2}$ " Rod 21, mounted in the Flanged Plate 18 and in a $1"$ \times $1"$ Angle Bracket bolted to the Double Angle Strip 5. The brake can be released by a $3\frac{1}{2}$ " Rod 22. This is held in a Coupling fixed on Rod 21, and is fitted with a Collar. A Spring held by a Bolt screwed into this Collar is fixed to the side of the cab, and normally holds the brake in the "on" position.

A length of Cord tied to the winding drum on Rod 19 is passed over a 2" Pulley on Rod 23, and around a similar Pulley on Rod 24. It is then passed around a $1\frac{1}{2}$ " Pulley on Rod 23, and around further 2" Pulleys on Rods 24 and 23. It is then tied to Rod 24.

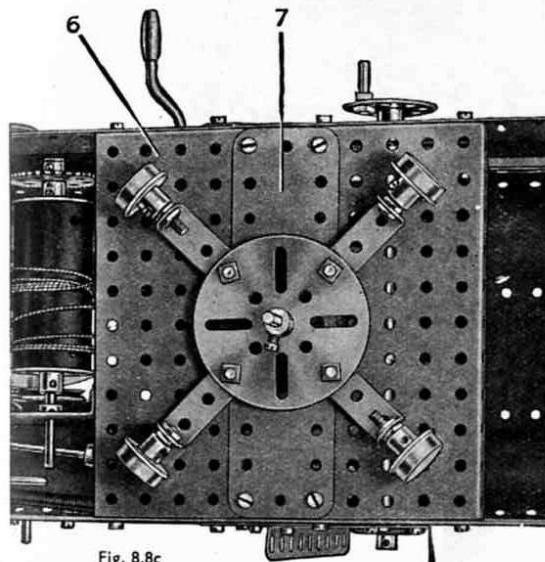


Fig. 8.8c

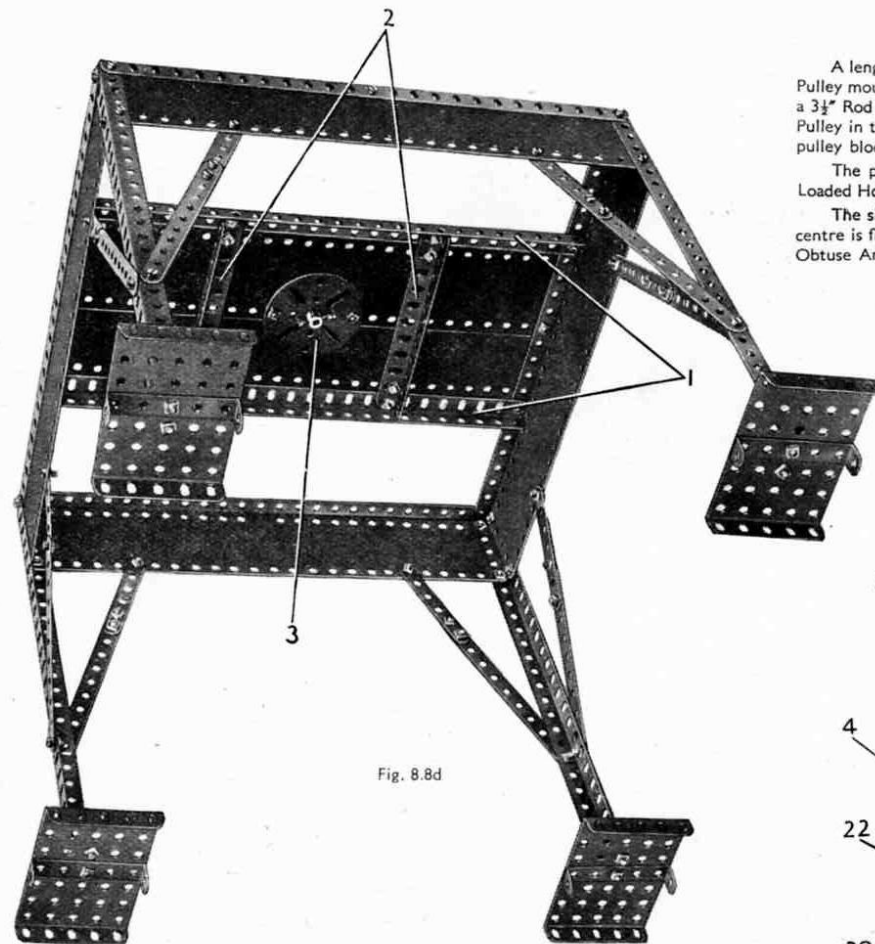


Fig. 8.8d

The hoisting movement is controlled by a 5" Crank Handle 25, fitted with a drum formed by a Cylinder and two $1\frac{1}{2}$ " Flanged Wheels. The Crank Handle is mounted in the side of the cab and in a $2\frac{1}{2}$ " \times $1\frac{1}{2}$ " Flanged Plate that is bolted to the Flanged Plate 18 and attached to the Flanged Plate 6 by a $2\frac{1}{2}$ " Strip. A $\frac{1}{2}$ " Pinion is fixed on the Crank Handle between the drum and the $2\frac{1}{2}$ " \times $1\frac{1}{2}$ " Flanged Plate. A Pawl 26 is fixed on a $\frac{3}{4}$ " Bolt and engages the teeth of the $\frac{1}{2}$ " Pinion. The $\frac{3}{4}$ " Bolt is passed through a Fishplate bolted to the Flanged Plate 18, and carries a Coupling fixed on its shank. A Fork Piece 27 is pivotally attached to the Coupling by a 1" Rod, and is connected to a $3\frac{1}{2}$ " Rod 28 by a 2" Rod and a Swivel Bearing. The Rod is held in a Coupling freely pivoted on the Rod 21. A Driving Band passed around the Fork Piece 27 is attached to the Strip 9 and holds the Pawl against the $\frac{1}{2}$ " Pinion on the Crank Handle.

A length of Cord tied to a drum on the Crank Handle passes over a $1\frac{1}{2}$ " Pulley on Rod 23 and over a $\frac{1}{2}$ " Pulley mounted in a Stepped Bent Strip attached to the jib. It passes over a second $\frac{1}{2}$ " Pulley free to turn on a $3\frac{1}{2}$ " Rod 29, and over a 1" loose Pulley on a 2" Rod 30 in the jib head. It is then taken around a 1" loose Pulley in the pulley block, and a similar Pulley on Rod 30. It passes around a second 1" loose Pulley in the pulley block and a 1" fixed Pulley on Rod 30, and is tied to the pulley block.

The pulley block is made by joining two Semi-Circular Plates together by two Double Brackets. A Loaded Hook is attached to one of the Semi-Circular Plates by a $\frac{1}{2}$ " Bolt.

The sides of the cab roof are formed by $1\frac{1}{2}$ " radius Curved Plates and $2\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flexible Plates. The centre is filled in by $4\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flexible Plates and the complete roof is held in place by Angle Brackets and Obtuse Angle Brackets.

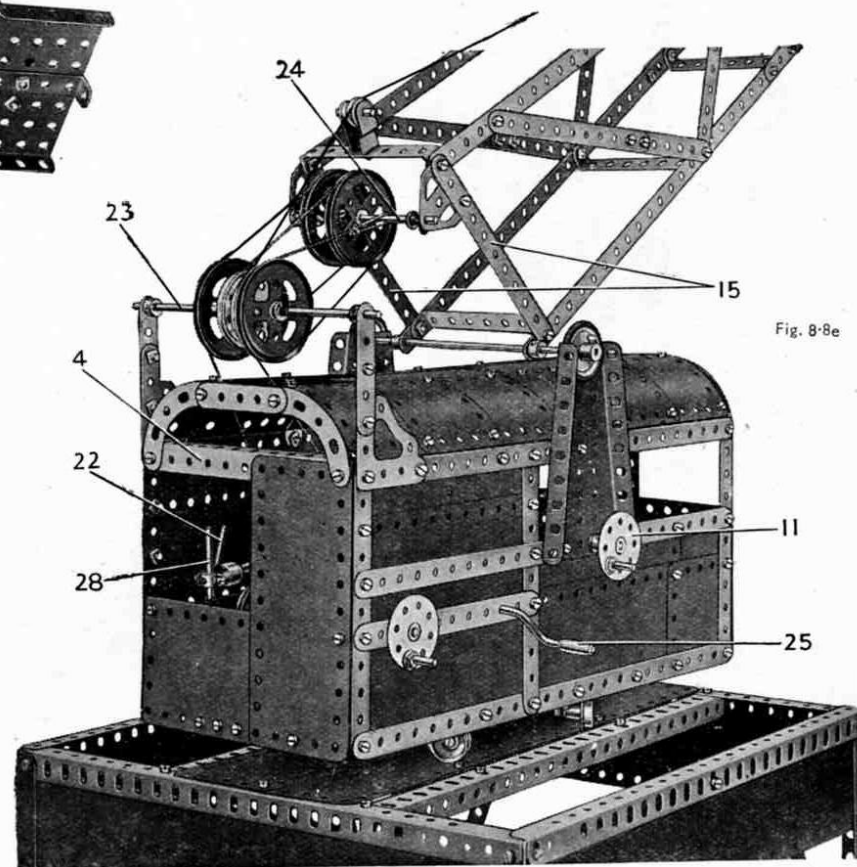
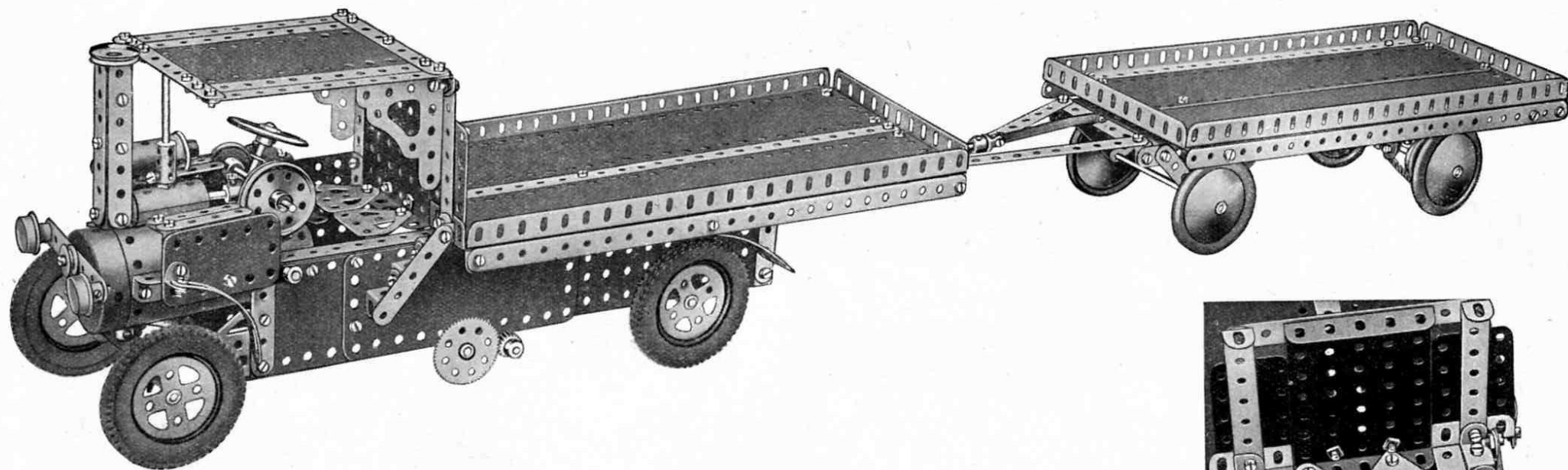


Fig. 8.8e

8.9 STEAM TRACTOR AND TRAILER



The chassis of the model consists of two compound girders each comprising two $12\frac{1}{2}$ " Angle Girders overlapped 20 holes. These are spaced apart at the rear by a $2\frac{1}{2}$ " \times $\frac{1}{2}$ " Double Angle Strip, and at the front by a Boiler. The side members of the chassis are extended downward by two $5\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flanged Plates, along the lower Flanges of which are bolted two $12\frac{1}{2}$ " Strips as shown in Fig. 8.9d. The space between the $12\frac{1}{2}$ " Strips and Angle Girders is filled in with $5\frac{1}{2}$ " \times $2\frac{1}{2}$ " and $2\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flexible Plates.

A $3\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flanged Plate and two $2\frac{1}{2}$ " \times $1\frac{1}{2}$ " Flexible Plates are used for the back of the cab, and it is secured to the chassis by a $5\frac{1}{2}$ " Angle Girder. For the roof, a $4\frac{1}{2}$ " Strip is bolted across each end of a $5\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flexible Plate and the ends of the Strips are joined by four $5\frac{1}{2}$ " Strips. The roof is fixed in position by Angle Brackets and two Corner Gussets, and is supported at the front by a 2" Rod secured at its lower end in a Coupling fastened by a Bolt to the cylinder. The cylinder is represented by a Sleeve Piece bolted to the top of the Boiler, and a $1\frac{1}{2}$ " Rod is used for the piston rod. The Rod is connected by a small Fork Piece to a $3\frac{1}{2}$ " Rod journalled in a Double Bracket bolted to the Boiler. The $3\frac{1}{2}$ " Rod carries at one end a 1" fast Pulley, and at its other end two $1\frac{1}{2}$ " Pulleys represent the fly-wheel.

The water tanks at each side of the Boiler are constructed by securing 2" Strips on one side and $2\frac{1}{2}$ " Strips on the other to $2\frac{1}{2}$ " \times $1\frac{1}{2}$ " Flexible Plates by 1" \times 1" Angle Brackets, and they are attached to the Chassis by $\frac{1}{2}$ " \times $\frac{1}{2}$ " Angle Brackets. The chimney, removed from the Boiler, is shown in Fig. 8.9b. It consists of four $3\frac{1}{2}$ " Strips joined by Double Brackets and Angle Brackets and it carries a 1" fast Pulley at its upper end. The Pulley is locked on the end of a 2" Rod fixed inside the chimney by a Collar. The chimney is held in place by a Chimney Adaptor, which is bolted to the lower end of the chimney and then pushed into the end of the cylinder.

One side of the cab is left open, and is fitted with three Reversed Angle Brackets to represent steps; the other side is closed in by a $3\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flanged Plate. The Plate is fastened by an Angle Bracket to the right-hand water tank, and one of its flanges is bolted to the back of the cab. The platform of the wagon is built up by joining a $12\frac{1}{2}$ " Angle Girder to each end of the $5\frac{1}{2}$ " Angle Girder holding the back of the cab in position. The free ends of the two $12\frac{1}{2}$ " Angle Girders are connected by a second $5\frac{1}{2}$ " Angle Girder and the space between them is filled by two $12\frac{1}{2}$ " \times $2\frac{1}{2}$ " Strip Plates and a $12\frac{1}{2}$ " Strip. Each side of the platform is extended downward by a $12\frac{1}{2}$ " Strip and the rear is extended by a $5\frac{1}{2}$ " \times $\frac{1}{2}$ " Double Angle Strip.

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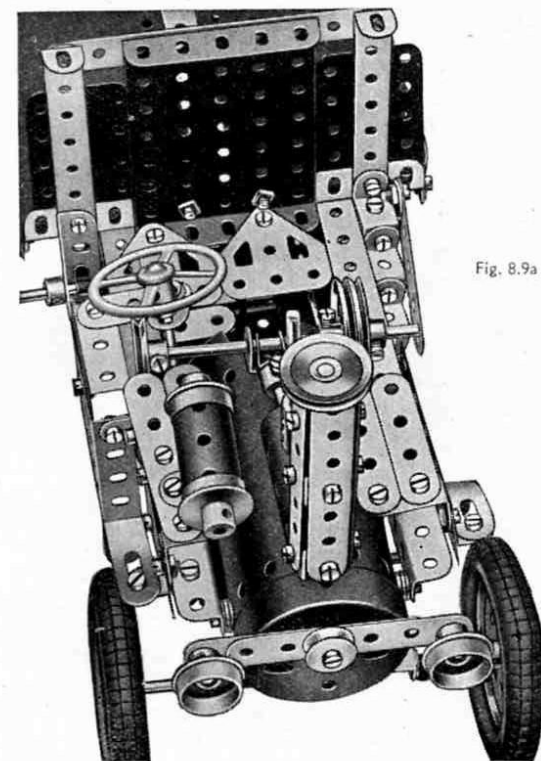


Fig. 8.9a

8.9 STEAM TRACTOR AND TRAILER—Continued

The front wheels are secured on the ends of a 5" Rod journalled in the ends of a $2\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strip, which is attached by a Pivot Bolt to the underside of the Boiler. The steering column, a 5" Rod, is journalled at its upper end in a Fishplate secured to the side of the cab by a $1\frac{1}{2}"$ Strip and a Channel Bearing, and at its lower end in an Angle Bracket, and it carries a Worm (see Fig. 8.9d). The Worm meshes with a $\frac{1}{2}"$ Pinion on a $3\frac{1}{2}"$ Rod journalled in two Flat Trunnions bolted to the chassis, the Rod carrying also two Couplings. Cord is wound around the two Couplings and each of its ends is tied to the Double Angle Strip supporting the front axle.

The Clockwork Motor is suspended by Angle Brackets underneath the tractor in the position shown, and its driving shaft is removed and replaced by a $3\frac{1}{2}"$ Rod. A $\frac{1}{2}"$ Pinion on the end of the Rod meshes with a 57-tooth Gear on a second $3\frac{1}{2}"$ Rod journalled in the Motor side plates. A $\frac{3}{4}"$ Sprocket Wheel on the last mentioned $3\frac{1}{2}"$ Rod is connected by Chain to a 2" Sprocket Wheel on the rear axle. The axle is a $4\frac{1}{2}"$ Rod journalled in the sides of the chassis, and it carries at each end a 2" Pulley fitted with a Rubber Tyre.

The trailer is built up on a frame consisting of two $12\frac{1}{2}"$ Angle Girders joined at each end by $5\frac{1}{2}"$ Angle Girders. The floor of the trailer is formed by two $12\frac{1}{2}" \times 2\frac{1}{2}"$ Strip Plates, overlapped one hole along their sides and bolted between the two $5\frac{1}{2}"$ Angle Girders. The two $12\frac{1}{2}"$ Angle Girders are extended downwards by two $12\frac{1}{2}"$ Strips, which are fastened in position by Angle Brackets and joined at the rear by a $5\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strip.

The rear axle, a 5" Rod, is journalled at each end in the end holes of two $2\frac{1}{2}"$ Strips fastened under-

neath the trailer, and is fitted with a band brake. A $2\frac{1}{2}" \times 1"$ Double Angle Strip is fastened by Angle Brackets to the $2\frac{1}{2}"$ Strips forming the left-hand bearing for the axle, and a $1\frac{1}{2}"$ Strip is bolted to its forward end. A Coupling is next screwed through its central tapped hole on to the centre of a $3\frac{1}{2}"$ Screwed Rod, which is then journalled in the ends of the Double Angle Strip and fitted with lock-nuts at 1. Another Coupling carrying a Threaded Pin for a handle is then locked on the other end of the Screwed Rod. A length of Sprocket Chain is fastened by a Bolt to one of the end holes of the first Coupling, passed over the brake drum on the axle and finally is fastened to the upper end of the $1\frac{1}{2}"$ Strip. The brake drum is constructed by fastening a Bush Wheel and a $1\frac{1}{2}"$ Flanged Wheel on the axle so that they press against each other.

The bearings for the front axle are provided by the end holes of $2\frac{1}{2}"$ Strips, bolted at their upper ends to a frame consisting of two $4\frac{1}{2}"$ Strips joined at their ends by a $3\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strip. A $3\frac{1}{2}"$ Strip, to the centre of which is bolted a Boiler End, is secured by $\frac{1}{2}"$ Bolts between the two Double Angle Strips, but is spaced from each of them by a Collar and three Washers. A 1" Rod locked in the boss of a Face Plate bolted under the trailer, passes through the centre hole of the Boiler End, and is secured in position by a Collar.

Two $5\frac{1}{2}"$ Strips are fastened to the front of the wheel frame by a $3\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strip, and their forward ends are bolted together, the Bolt holding also an Angle Bracket. A 2" Rod carrying at its end a large Fork Piece, is passed through the Angle Bracket and secured by an End Bearing and a Spring to the $3\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strip. The large Fork Piece is connected at the rear of the steam wagon by a Rod and Spring Clip.

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

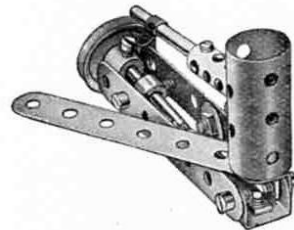


Fig. 8.9b

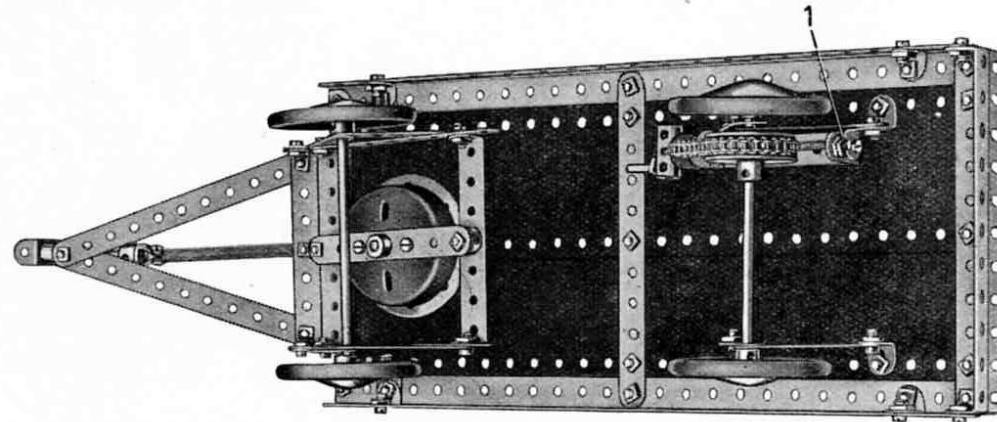


Fig. 8.9c

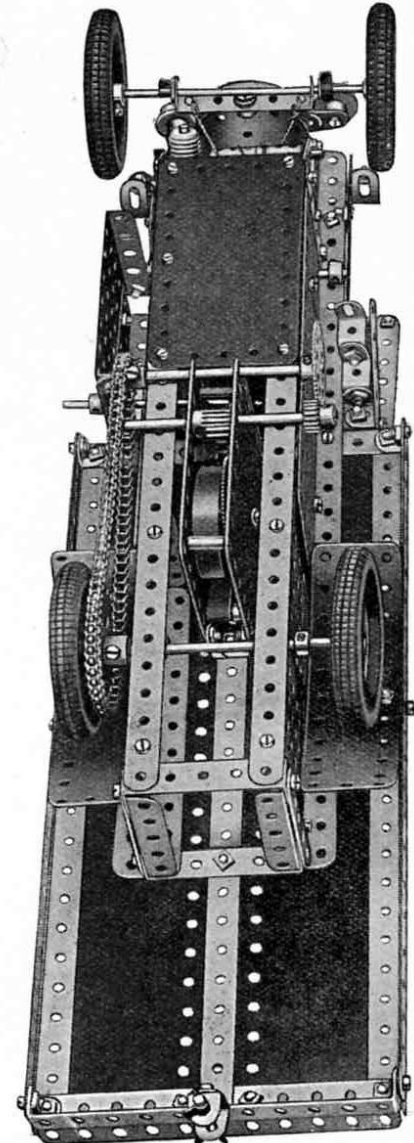


Fig. 8.9d

This Model can be built with MECCANO No. 8 Outfit (or No. 7 and No. 7a Outfits)

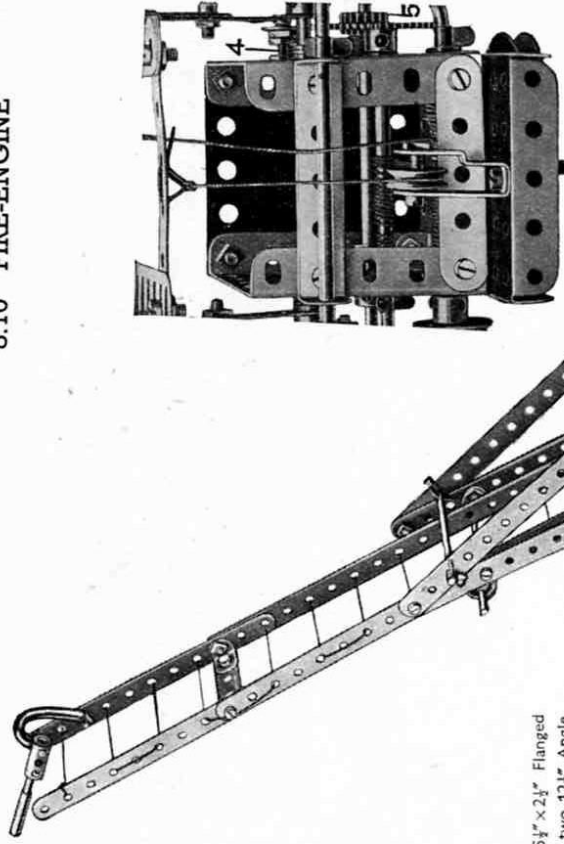
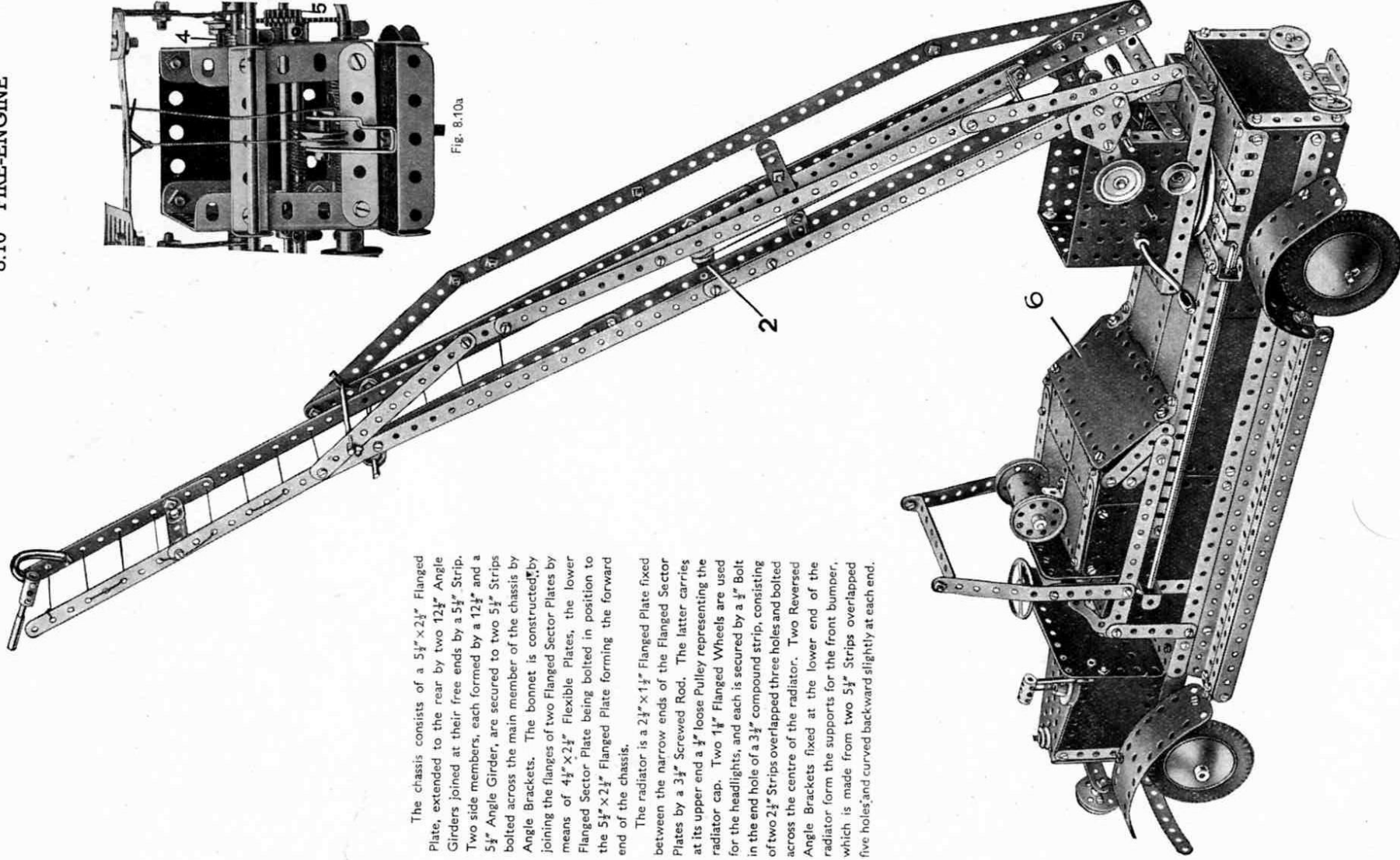


Fig. 8.10a

The chassis consists of a $5\frac{1}{2}'' \times 2\frac{1}{4}''$ Flanged Plate, extended to the rear by two $12\frac{1}{2}''$ Angle Girders joined at their free ends by a $5\frac{1}{2}''$ Strip. Two side members, each formed by a $12\frac{1}{2}''$ and a $5\frac{1}{2}''$ Angle Girder, are secured to two $5\frac{1}{2}''$ Strips bolted across the main member of the chassis by Angle Brackets. The bonnet is constructed by joining the flanges of two Flanged Sector Plates by means of $4\frac{1}{2}'' \times 2\frac{1}{4}''$ Flexible Plates, the lower Flanged Sector Plate being bolted in position to the $5\frac{1}{2}'' \times 2\frac{1}{4}''$ Flanged Plate forming the forward end of the chassis.

The radiator is a $2\frac{1}{4}'' \times 1\frac{1}{2}''$ Flanged Plate fixed between the narrow ends of the Flanged Sector Plates by a $3\frac{1}{2}''$ Screwed Rod. The latter carries at its upper end a $\frac{1}{2}''$ loose Pulley representing the radiator cap. Two $1\frac{1}{2}''$ Flanged Wheels are used for the headlights, and each is secured by a $\frac{1}{2}''$ Bolt in the end hole of a $3\frac{1}{2}''$ compound strip, consisting of two $2\frac{1}{2}''$ Strips overlapped three holes and bolted across the centre of the radiator. Two Reversed Angle Brackets fixed at the lower end of the radiator form the supports for the front bumper, which is made from two $5\frac{1}{2}''$ Strips overlapped five holes and curved backward slightly at each end.



Two $4\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plates overlapped three holes are used for the front of the cab and are secured to the sides of the bonnet by two $1'' \times 1''$ Angle Brackets. A Rod and Strip Connector carrying a $1\frac{1}{2}''$ Rod is bolted to the upper Flexible Plate in the position shown in Fig. 8.10b, the $1\frac{1}{2}''$ Rod having a Coupling locked on its end. A $\frac{3}{4}''$ Flanged Wheel representing a gong is suspended by Cord from the free end of the Coupling. The floor is formed by two $2\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plates fastened between the side members of the chassis.

Each side of the body of the fire-engine consists of three $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plates bolted to a side member of the chassis. Two $12\frac{1}{2}''$ Angle Girders are bolted along the upper edges of the sides, and the space between them is filled in by two $12\frac{1}{2}''$ Strip Plates. The pump behind the driving seat is built up from Flexible Plates of various sizes held in position by Angle Brackets. The flat plate 6 is obtained by removing the centre pin from a Hinged Flat Plate.

The front wheel leaf springs are each constructed from a $2\frac{1}{2}''$, a $3\frac{1}{2}''$ and a $4\frac{1}{2}''$ Strip, secured together by a bolt and fastened to the $5\frac{1}{2}'' \times 2\frac{1}{4}''$ Flanged Plate of the chassis by Angle Brackets. The $2''$ Pulleys are held loosely on $1\frac{1}{2}''$ Rods fastened in the bosses of two small Fork Pieces, one of which is obtained by loosening the set-screws of a swivel Bearing and removing the "spider". The Pulleys are fitted with Rubber Tyres, and Conical Discs are secured against their outer faces by Collars. The two Fork Pieces are fastened by Pivot Bolts to two Couplings, which in turn are fastened to the leaf springs.

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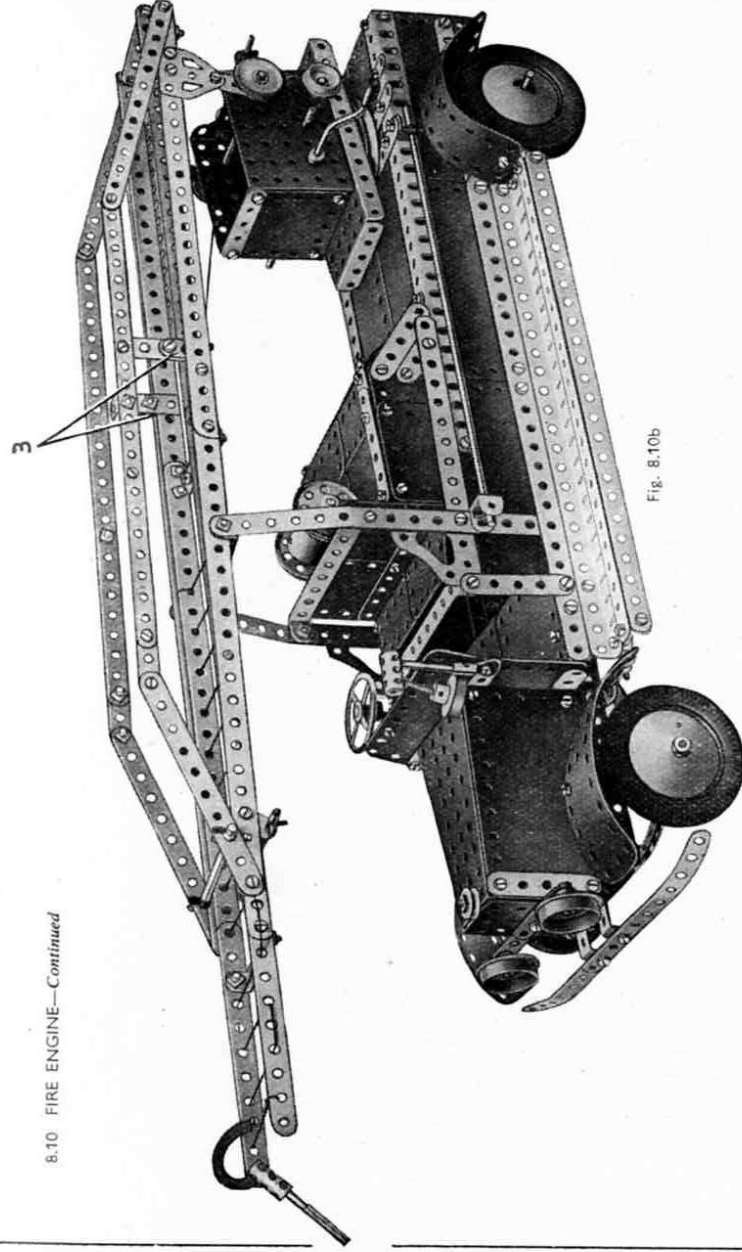


Fig. 8.10b

Each of the Fork Pieces carries also a $\frac{3}{8}$ " Bolt fitted with a Collar, in one of the tapped holes of its boss. The two Collars are joined by a compound strip, consisting of a $5\frac{1}{2}$ " Strip and a Fishplate, the lower Bolt (see Fig. 8.10c) carrying also a 4" strip formed by a 2" and a $2\frac{1}{2}$ " Strip. The free end of the 3" Strip is secured by a lock-nutted Bolt 1 to a 57-tooth Gear, loosely held on a $\frac{3}{8}$ " Bolt fastened to the $5\frac{1}{2}$ " x $2\frac{1}{2}$ " Flanged Plate. The 57-tooth Gear meshes with a $\frac{1}{2}$ " Pinion at the lower end of the 5" Rod representing the steering column. At its upper end this Rod carries a Steering Wheel, and it is journaled in an Angle Bracket bolted to the front of the cab.

The rear axle, an 8" Rod, is journaled in the holes at the narrow ends of two Trunnions bolted to the sides of the body. It carries at each end a 2" Pulley fitted with Rubber Tyre and Conical Disc, and in the centre a Collar. A Threaded Pin, on the plain shank of which is locked a $\frac{3}{8}$ " Flanged Wheel 8, is screwed into each tapped hole of the Collar. A $3\frac{1}{2}$ " x $2\frac{1}{2}$ " Flanged Plate 7 is suspended by Cord in such a position that as the rear axle revolves, the two Flanged Wheels 8 strike the centre of it, thus providing an automatic gong.

A view of the ladder base is shown in Fig. 8.10a. This is built up by fastening two $3\frac{1}{2}$ " x $2\frac{1}{2}$ " Flanged Plates to a $5\frac{1}{2}$ " x $2\frac{1}{2}$ " Flanged Plate by $3\frac{1}{2}$ " x $\frac{1}{4}$ " Double Angle Strips. The front flanges of the two smaller plates are joined by a $2\frac{1}{2}$ " x $2\frac{1}{2}$ " Flexible Plate, and the rear flanges by a $2\frac{1}{2}$ " Strip and a $2\frac{1}{2}$ " x $\frac{1}{4}$ " Double Angle Strip. A 3" Pulley fastened underneath the base by two $\frac{1}{2}$ " Bolts, carries in its boss a Rod, which passes through the platform of the fire-engine and is secured below it by a Collar.

The fixed ladder consists of two $12\frac{1}{2}$ " Angle Girders joined at each end by a 3" Strip, and extended upwards by two $12\frac{1}{2}$ " Strips. The guard rails for the fixed ladder each consist of a $12\frac{1}{2}$ " Strip and three $5\frac{1}{2}$ " Strips secured at each end to the sides of the ladder. Two $1\frac{1}{2}$ " x $\frac{1}{4}$ " Double Angle Strips are placed midway up the fixed ladder, and two Fishplates 3 are bolted to them, but spaced from them by two Washers.

The extending ladder, which slides between the Double Angle Strips and the Fishplates, consists of two compound strips joined at the top and bottom by 2" Strips and Angle Brackets. Each of the Compound Strips is formed by two $12\frac{1}{2}$ " Strips and one $5\frac{1}{2}$ " Strip bolted end to end. The rungs of the extending ladder are represented by Cord threaded through the holes in the Strips forming the sides of the ladder. The nozzle at the top of the ladder is constructed by fastening a 1" Rod in the central bore of a Coupling. The Rod carries a Rod Connector at its end, and a Spring, secured in position as shown in Fig. 8.10b, is used for the hosepipe.

The mechanism for controlling the angle of the ladder, and also the raising and lowering of the extension ladder, is situated in the base. A large Crank Handle journaled in the forward end of the two $3\frac{1}{2}$ " x $2\frac{1}{2}$ " Flanged Plates carries at its end a $\frac{1}{2}$ " Pinion 5. This meshes with a 57-tooth Gear on a $3\frac{1}{2}$ " Rod also journaled in the side plates of the base. Cord is attached to the $3\frac{1}{2}$ " Rod by means of a Cord Anchoring Spring, then taken around a $\frac{1}{2}$ " loose Pulley, and finally tied to the 3" Strip at the bottom of the fixed ladder (Fig. 8.10a). The $\frac{1}{2}$ " loose Pulley is held on a $\frac{1}{2}$ " Bolt passed through the arms of a Stepped Bent Strip bolted to the base.

To prevent the ladder slipping back when raised, a Pawl engages the $\frac{1}{2}$ " Pinion 5. The Pawl is held loosely by lock-nuts at the end of the $\frac{1}{2}$ " Bolt 4, which is fastened to the right-hand side of the base, in such a position that the end of the Pawl just rests on the top of the pinion.

The extending ladder is controlled by a small Crank Handle journaled in the rear of the base side plates and carrying at its end a $\frac{3}{8}$ " Flanged Wheel, which is seen in Fig. 8.10b. Cord is tied to the shaft of the Crank Handle, wound around it several times and then taken over the $\frac{1}{2}$ " loose Pulley 2 and tied to the bottom of the extending ladder.

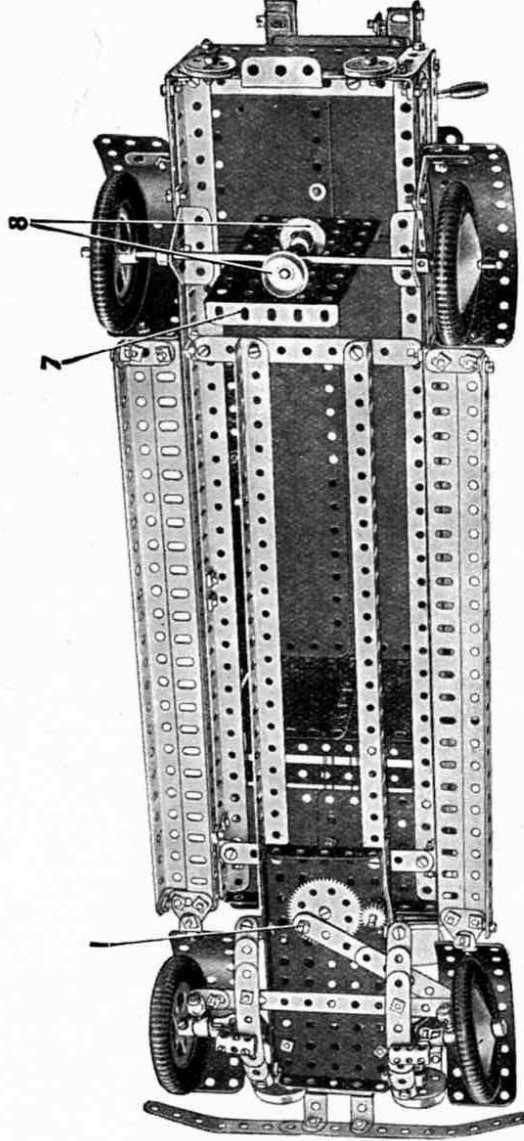
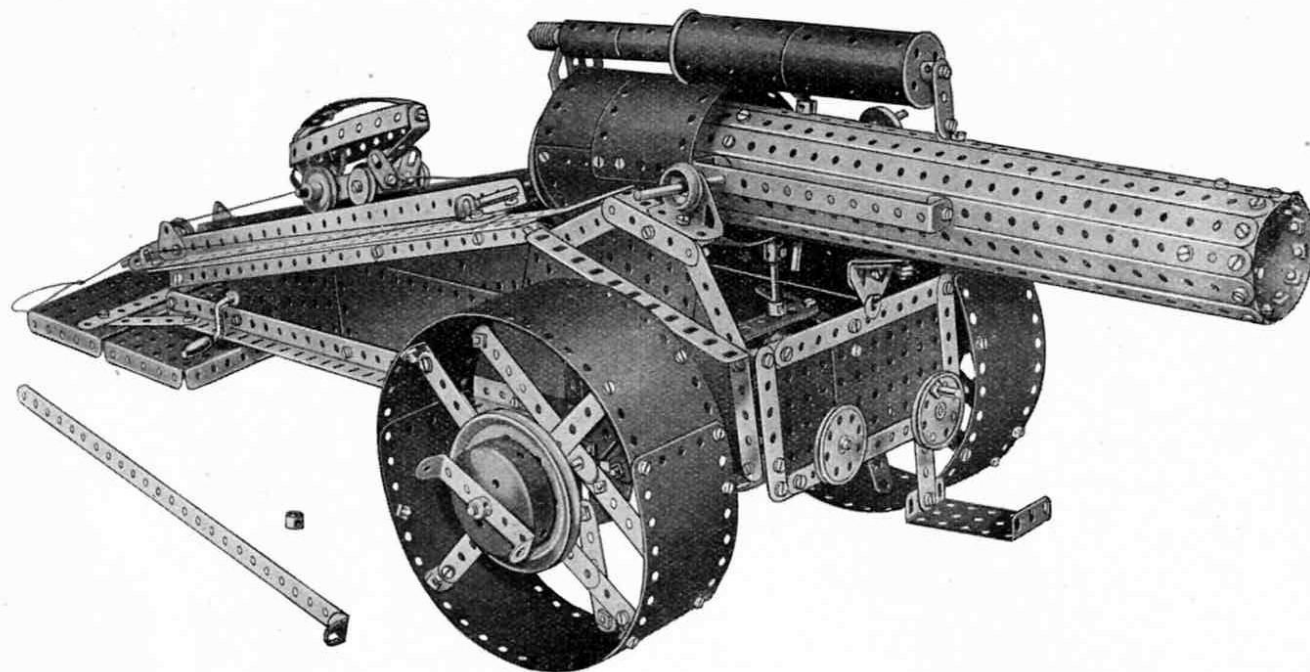


Fig. 8.10c

8.11 BIG GUN



This model is a realistic miniature reproduction of a modern big gun, and will actually fire Collars, Washers or similar Meccano missiles. The model is commenced by building the chassis, which consists of two side members each made as follows. Two $12\frac{1}{2}$ " Angle Girders are overlapped 12 holes, and are bolted to a $12\frac{1}{2}$ " \times $2\frac{1}{2}$ " Strip Plate and a $2\frac{1}{2}$ " Strip at the front end, and to a Flanged Sector Plate five holes from the rear end. A second compound angle girder is made by overlapping a $12\frac{1}{2}$ " Angle Girder and a $5\frac{1}{2}$ " Angle Girder by eight holes. This is joined to the rear end of the first compound angle girder and is sloped upward.

A $5\frac{1}{2}$ " Angle Girder is bolted to the upper front corner of the $12\frac{1}{2}$ " \times $2\frac{1}{2}$ " Strip Plate and is sloped upward, finally being joined to the upper compound angle girder by a Fishplate. Two $5\frac{1}{2}$ " \times $1\frac{1}{2}$ " Flexible Plates are bolted to the $5\frac{1}{2}$ " Angle Girders of the side members as shown. The supports for the gun barrel are each made by bolting a $3\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flanged Plate and two $2\frac{1}{2}$ " \times $1\frac{1}{2}$ " Flexible Plates to the front $5\frac{1}{2}$ " Angle Girder. Two $2\frac{1}{2}$ " Strips, also bolted to the $5\frac{1}{2}$ " Angle Girders, are sloped up to the $3\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flanged Plate, and their ends are clamped between another $2\frac{1}{2}$ " Strip and the Flanged Plate. A Trunnion is then bolted to the upper flange of the Flanged Plate. The side members are further strengthened by bolting a $12\frac{1}{2}$ " Angle Girder to the upper $12\frac{1}{2}$ " Angle Girder. The inner Angle Girder is then extended to the $3\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flanged Plate by a $5\frac{1}{2}$ " Strip suitably shaped.

The side members are now connected together. At the front a framework of two compound strips joined by 3" Strips is made. The compound strips consist of two $5\frac{1}{2}$ " Strips overlapped 10 holes. A $3\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flanged Plate and a $2\frac{1}{2}$ " \times $1\frac{1}{2}$ " Flanged Plate fill in the framework, which is then attached to the Angle Girders of the side members by Angle Brackets. The two $3\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flanged Plates of the sides are joined at the centre holes of their lower flanges by two $5\frac{1}{2}$ " Strips, placed one at each side of the flanges. Two $3\frac{1}{2}$ " Strips overlapped by five holes are bolted across the inner pair of $12\frac{1}{2}$ " Angle Girders in the positions shown in Fig. 8.11c. At the rear end the sides are joined by a $1\frac{1}{2}$ " Strip.

The two $5\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flanged Plates that form the bed-plate are bolted together and fastened to the sides by $2\frac{1}{2}$ " Strips. The carriage that carries the shell up the chassis to the breech runs on rails made of two Angle Girders, which are bolted as shown in Fig. 8.11c. Stops at the rear end of the rails are provided by two 1" Triangular Plates. Two $1\frac{1}{2}$ " \times $\frac{1}{2}$ " Double Angle Strips joined by a 3" Strip are bolted to the $3\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flanged Plate at the front of the gun chassis the 3" Strip being used to provide bearings for the barrel elevating mechanism.

The hubs of the wheels are formed by a Face Plate and a 3" Pulley. On the right-hand wheel (Fig. 8.11c) two compound strips, consisting of a $3\frac{1}{2}$ " Strip overlapping a $4\frac{1}{2}$ " Strip by three holes, are bolted across the Face Plate. The other spokes are formed by four $2\frac{1}{2}$ " Strips also bolted to the Face Plate. In the left-hand wheel, $4\frac{1}{2}$ " Strips overlapped five holes form the main spokes. The spokes bolted to the 3" Pulleys are formed by $5\frac{1}{2}$ " Strips overlapped nine holes. The rim of each wheel is made by curving two $12\frac{1}{2}$ " \times $2\frac{1}{2}$ " Strip Plates and overlapping them by four holes at each end. The main spokes are then attached to the rim by Angle Brackets.

The wheels are carried on an axle journalled in the seventh hole from the front end of the shell over compound girders of the sides. The axle is formed by joining a $6\frac{1}{2}$ " Rod to an 8" Rod by a Coupling.

The axle is prevented from moving from side to side in its bearings by Collars. The Boiler Ends, representing the hub caps and the $2\frac{1}{2}$ " \times $\frac{1}{2}$ " Double Angle Strips representing the drag links, are held in place by Collars.

The shell carriage is made from a $2\frac{1}{2}$ " \times $\frac{1}{2}$ " and a $2\frac{1}{2}$ " \times 1" Double Angle Strip bolted together, and Fishplates form a rest for the shell. The 1" Pulleys are carried on an axle made by joining a $1\frac{1}{2}$ " Rod and a 1" Rod with a Rod Connector. The Pulleys are held on the axle by Spring Clips. The $\frac{1}{2}$ " loose Pulleys are carried on $\frac{1}{2}$ " Bolts, which are lock-nutted to the Double Angle Strips.

The carriage is operated by the small Crank Handle journalled in the Flanged Sector Plates of the chassis. Cord is tied to the front end of the carriage, and is then led around a compound rod at the front end of the rails. This Rod consists of a $1\frac{1}{2}$ " Rod and a 2" Rod joined by a Rod Connector. The Cord is then wound several times around the Crank Handle and is passed around the 1" Loose Pulley on the $3\frac{1}{2}$ " Rod at the rear end of the rails. Finally it is tied to the rear end of the carriage. The shell shown in Fig. 8.11c consists of four $3\frac{1}{2}$ " \times $\frac{1}{2}$ " Double Angle Strips bolted to a $1\frac{1}{2}$ " Flanged Wheel.

The gun barrel is next constructed and is shown partly assembled in Fig. 8.11a in order to show its details. First of all the $12\frac{1}{2}$ " Strips carrying the recoil shock absorber, the Trunnions 3 and the two $5\frac{1}{2}$ " \times $\frac{1}{2}$ " Double Angle Strips, are bolted to the Boiler, overlapping it by three holes. The $12\frac{1}{2}$ " Strip carrying Trunnion 3 is duplicated for strength. The $12\frac{1}{2}$ " Strips at the sides carry Reversed Angle Brackets, and the Bolt holding the Reversed Angle Bracket on the rear side of the gun barrel carries also a Crank. A $3\frac{1}{2}$ " Rod is held in the boss of the Crank and its end passes through the end transverse bore of a Coupling. In a position five holes from the $3\frac{1}{2}$ " Rod, but at right-angles to it, is a $3\frac{1}{2}$ " compound rod, held in place by Collars. This Rod consists of two $1\frac{1}{2}$ " Rods held in the longitudinal bore of a Coupling. The central transverse bore of this Coupling is left free, and the $11\frac{1}{2}$ " Rod is passed through it and into the longitudinal bore of the rear Coupling. The set screws in both Couplings are then tightened to hold the $11\frac{1}{2}$ " Rod rigidly in place. A $5\frac{1}{2}$ " Strip is bolted in a position eight holes from the front end of the barrel and is bent upward slightly at one end as shown.

The Pivot Bolt 1 passes through the third hole from the free end of the $5\frac{1}{2}$ " Strip and through the two $12\frac{1}{2}$ " Strips. It carries the Trunnions 3. The $5\frac{1}{2}$ " \times $\frac{1}{2}$ " Double Angle Strips are attached to the side $12\frac{1}{2}$ " Strips, and the 1" \times 1" Angle Bracket carrying the $1\frac{1}{2}$ " Strip also is added.

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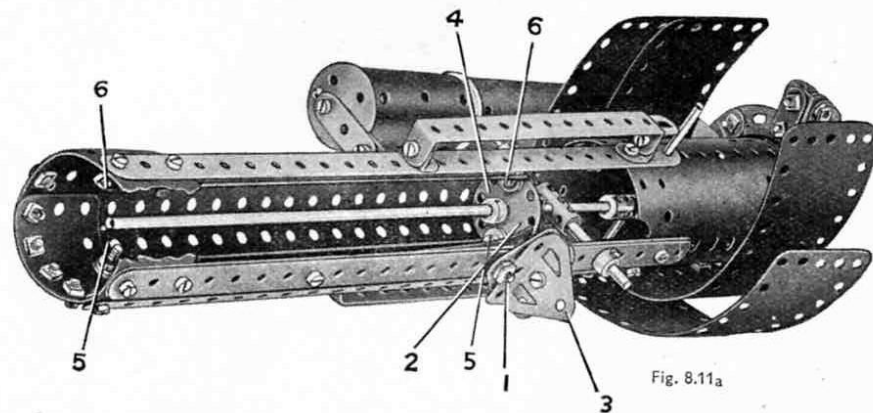


Fig. 8.11a

8.11 BIG GUN—Continued

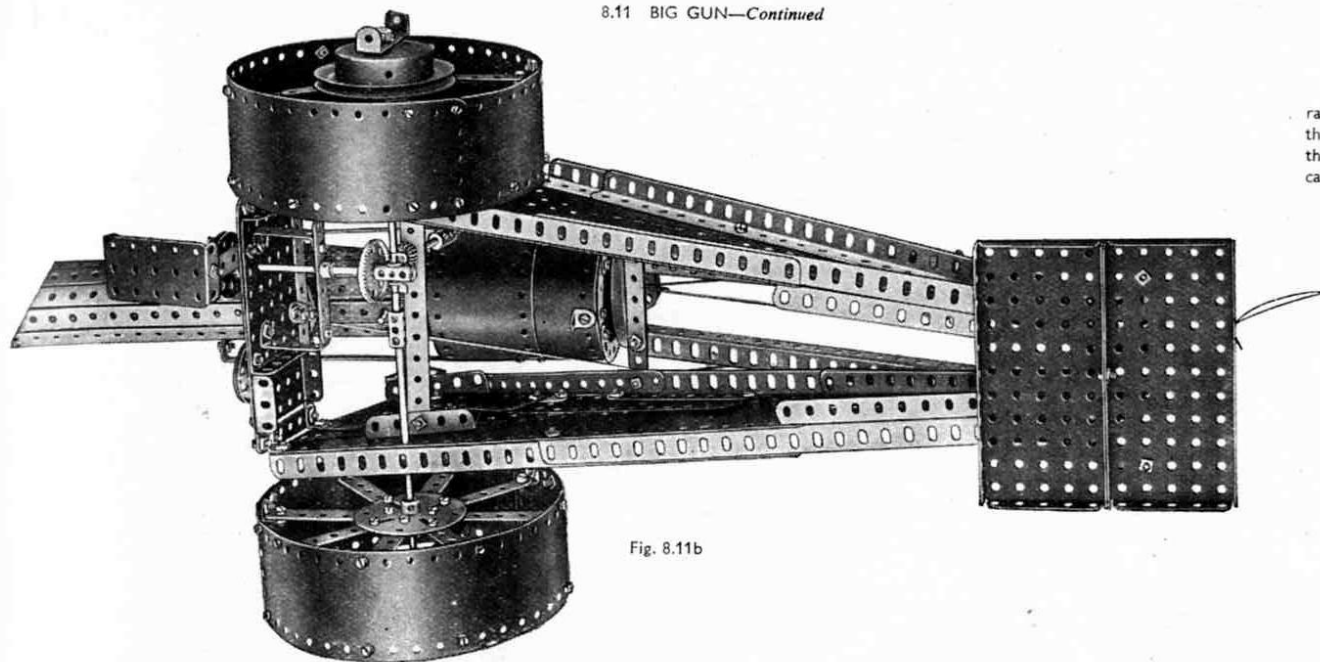


Fig. 8.11b

Two $5\frac{1}{2}'' \times 1\frac{1}{2}''$ Flexible Plates are overlapped one hole at one end. They are then curved round and the ends overlapped by nine holes. The cylinder thus formed is bolted to the front ends of the $12\frac{1}{2}''$ Strips. The $\frac{3}{8}''$ Bolts 5 and 6 carry $10''$ Driving Bands clamped between Washers on these Bolts at the back of the Disc. The other ends of the Driving Bands are clamped at the front end of the barrel between the Flexible Plates and the $12\frac{1}{2}''$ Strips, one on each side of the barrel. The Wheel Disc is kept steady on the $11\frac{1}{2}''$ Rod by a Double Bent Strip held by the $\frac{3}{8}''$ Bolts. The remaining $12\frac{1}{2}''$ Strips are then added to complete the barrel.

The breech is built up as a separate unit and bolted in position when complete. Two pairs of $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plates are overlapped two holes on their long edges. The two compound plates so formed are curved to form a cylinder, and are bolted together so that they overlap each other one hole at each end. Four $2\frac{1}{4}''$ small radius Curved Strips bolted together in a circle are attached to the cylinder by two Angle Brackets. The Bolt holding the upper Angle Bracket carries also a Flat Trunnion. The door is a Road Wheel fastened to a Double Bracket by a $\frac{1}{2}''$ Bolt locked in the Boss of the Road Wheel, and is carried on two $2''$ Strips, one of which is made from two $1\frac{1}{2}''$ Strips. The $2''$ Strips are extended by Fishplates, which are pivotally attached to another Double Bracket by a lock-nutted $\frac{3}{8}''$ Bolt. The breech is slid into position over the Boiler so that the horizontal $3\frac{1}{4}''$ Rod passes through holes in the Flexible Plates. Bolts secure the breech to the Reversed Angle Brackets.

The recoil shock absorbing unit is built as follows. A $1\frac{1}{4}''$ Flanged Wheel is fastened to the top hole of the $1\frac{1}{2}''$ Strip by a $\frac{3}{8}''$ Bolt locked in the boss of the Flanged Wheel. A $2\frac{1}{2}''$ Cylinder is then pushed on the flange of this Wheel and another $1\frac{1}{4}''$ Flanged Wheel is pushed in the other end of the Cylinder. A $3''$ Screwed Rod is then locked in the boss of this second Flanged Wheel and another $2\frac{1}{2}''$ Cylinder is passed over this Rod, then a third Flanged Wheel (flange first), and finally a Collar is screwed on the protruding portion of the Screwed Rod by its tapped hole. This Collar tightens the Flanged Wheels up against the Cylinder. The Screwed Rod is then further fastened by another $3''$ Screwed Rod that is screwed in the remaining part of the tapped hole of the Collar. Two Sleeve Pieces joined together by a Chimney Adaptor are passed over this second Screwed Rod, which then passes through the top hole of the Flat Trunnion at the rear of the gun barrel. A Worm is then locked on the remaining portion of the Screwed Rod and holds the whole assembly in place.

The gun barrel is pivotally mounted on the chassis by passing Rods fitted with $\frac{3}{8}''$ Flanged Wheels through the Trunnions and into the sides of the gun barrel as shown.

The elevation of the barrel is controlled by a screw mechanism. A "spider" from a Swivel Bearing is pivotally attached by a lock-nutted Bolt to the breech and carries a $3\frac{3}{8}''$ Screwed Rod, which is joined by a Coupling to a $2''$ Rod, journaled in the double $5\frac{1}{2}''$ Strips. A $\frac{1}{2}''$ Pinion on the Rod meshes with a $1\frac{1}{2}''$ Contrate Wheel operated by a hand wheel. The $4''$ Rod carrying the Contrate Wheel is free to turn in the longitudinal bore of a Coupling, which is held in place on the wheel axle by two Spring Clips and Washers.

The gun is loaded by pushing the Wheel Disc 2 and the missile 4 down the gun barrel with the ramrod until it catches the $5\frac{1}{2}''$ Strip. The gun is fired by pulling the firing lanyard tied to one of the Trunnions 3. Pivot Bolt 1 pulls the $5\frac{1}{2}''$ Strip out of contact with Wheel Disc 4, which ejects the missile with considerable force. The $5\frac{1}{2}''$ Strip should not be bent up enough for the end to catch in the holes of the Wheel Disc, otherwise the firing mechanism will be difficult to release.

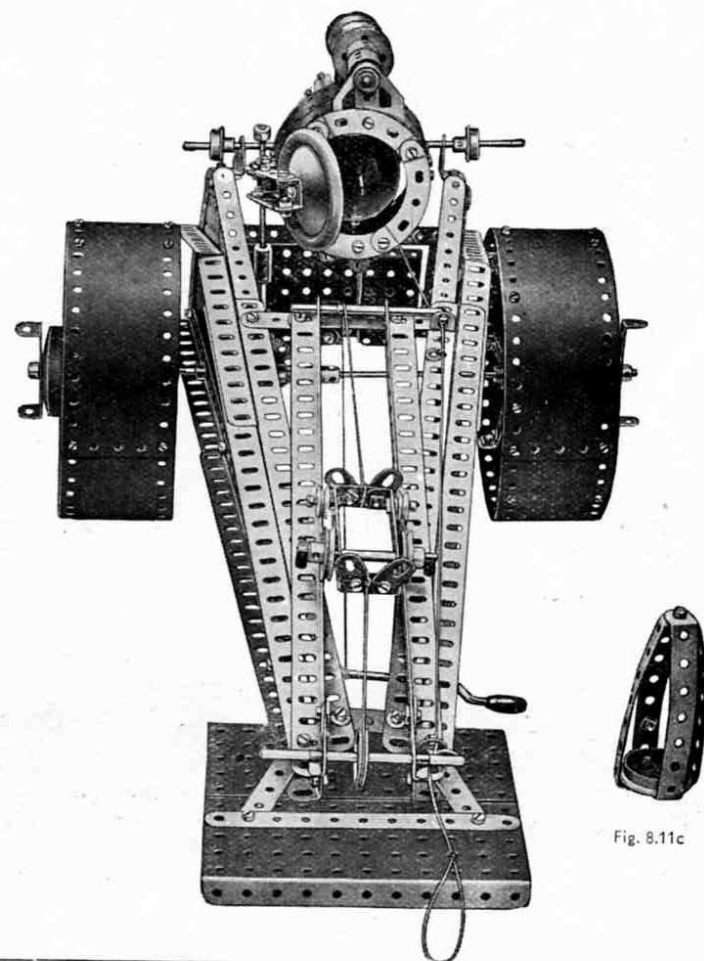


Fig. 8.11c

8.12 LIFEBOAT AND TRACTOR

The construction of the model is commenced with the tractor, the chassis of which is built up as follows. Two girders, each consisting of two $5\frac{1}{2}$ " Angle Girders overlapped three holes, are joined at their forward ends by a $3\frac{1}{2}$ " Strip, and at the rear ends by a $3\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flanged Plate and a $3\frac{1}{2}$ " \times $\frac{1}{2}$ " Double Angle Strip. Each side member of the chassis is extended upwards by a $5\frac{1}{2}$ " Strip, and to these are bolted the sides of the bonnet. The Clockwork Motor together with a $2\frac{1}{2}$ " \times $1\frac{1}{2}$ " Flexible Plate forms one side of the bonnet, and 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 form the other side. Three $1\frac{1}{8}$ " radius Curved Plates bolted end to end are used for the top of the bonnet. At the rear end the Curved Plates are supported by a $3\frac{1}{2}$ " \times $\frac{1}{2}$ " Double Angle Strip from a $3\frac{1}{2}$ " Strip bolted across the chassis, and at the front they are secured by a $1"$ \times $1"$ Angle Bracket to the radiator. The last-mentioned is represented by a $2\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flexible Plate, the lower end of which is secured by an Angle Bracket to a $3\frac{1}{2}$ " Strip bolted across the chassis.

The headlamps, $\frac{3}{4}"$ Flanged Wheels, are fastened by $\frac{3}{4}"$ Bolts to Fishplates fixed to the radiator. The bumper in

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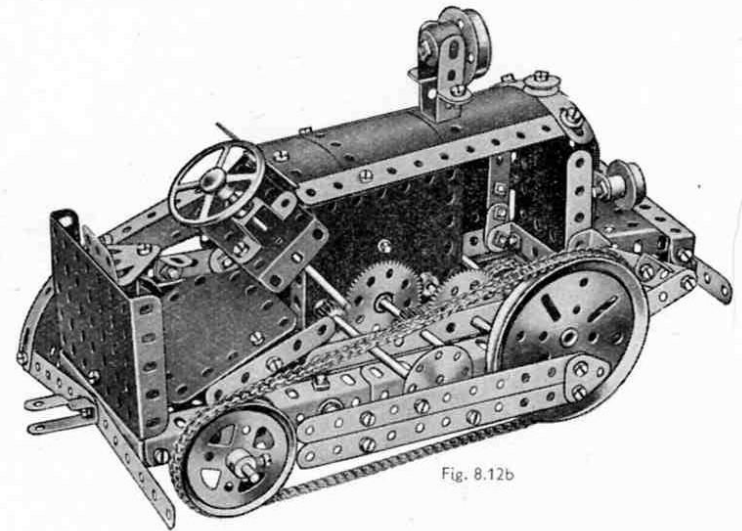


Fig. 8.12b

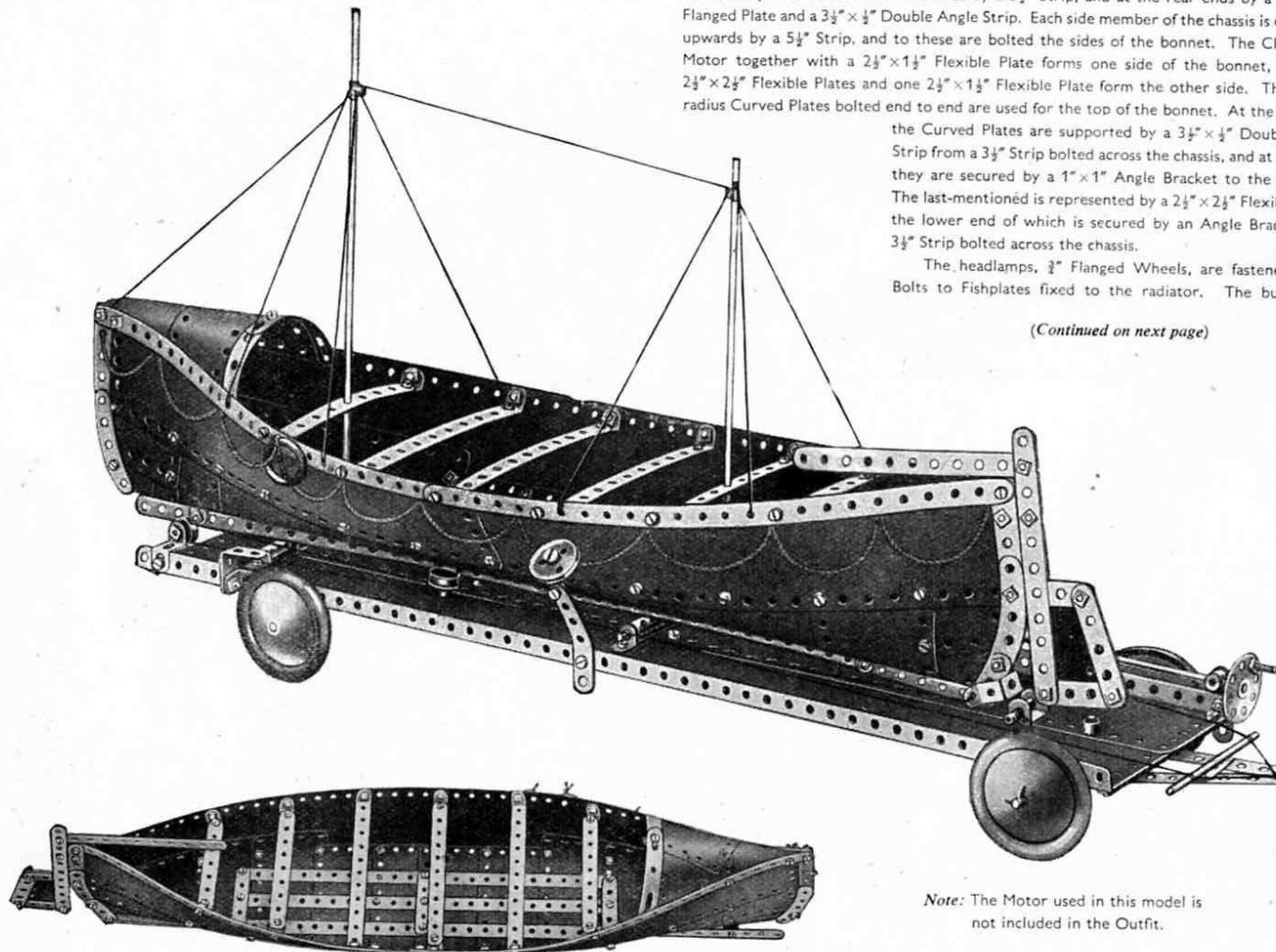
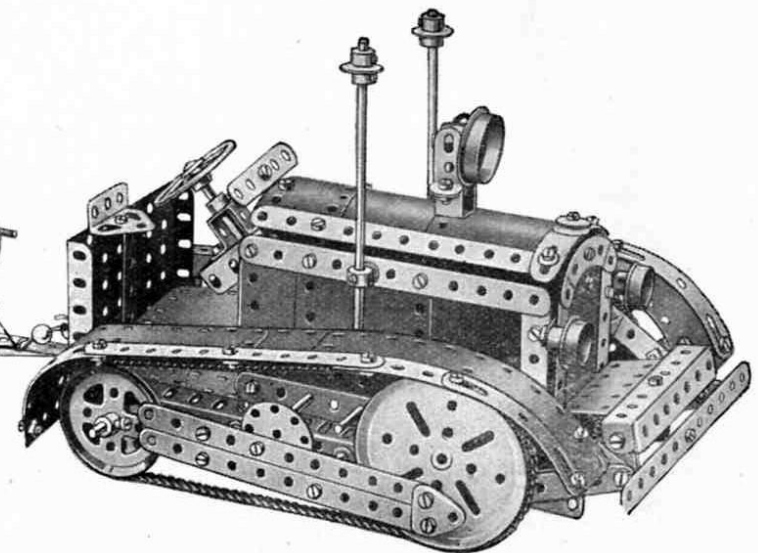


Fig. 8.12a

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



8.12 LIFEBOAT AND TRACTOR—Continued

front of the radiator is constructed by securing two $3\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strips to a $2\frac{1}{2}" \times 1\frac{1}{2}"$ Flanged Plate and fastening them to the chassis and to Double Brackets attached to the side of the bonnet by $2\frac{1}{2}"$ Strips. The front of the bumper is extended downwards by a $5\frac{1}{2}"$ Strip curved slightly at the ends.

The searchlight on the top of the bonnet is represented by a $1\frac{1}{2}"$ Flanged Wheel secured by a $\frac{3}{4}"$ Bolt to a Chimney Adaptor. The Chimney Adaptor is held between two $1" \times \frac{1}{2}"$ Angle Brackets bolted to the ends of a Double Bent Strip fastened to the top of the bonnet. The exhaust pipe and air intake valve for use when the tractor is partially submerged in the sea are formed by a $5"$ and a $4"$ Rod respectively. The Rods are secured by Collars to the sides of the bonnet, and at its upper end each Rod carries a $\frac{3}{4}"$ Washer locked between two Collars. A $3\frac{1}{2}" \times 2\frac{1}{2}"$ Flanged Plate is used for the back of the cab and is fastened to the chassis by an Angle Bracket. Just in front of the Flanged Plate is bolted a $2\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strip, which supports at its upper end the Trunnion forming the driver's seat.

The Steering Wheel is locked on the upper end of a $4"$ Rod held in the centre hole of a Double Bent Strip and also in a $2\frac{1}{2}" \times 1\frac{1}{2}"$ Flanged Plate to which the Double Bent Strip is bolted. The Flanged Plate is fastened in position between the sides of the bonnet. The brake lever of the motor is extended by a $1\frac{1}{2}"$ Strip, at the end of which an Angle Bracket is fixed to represent a pedal.

The driving shaft of the Motor is removed and a $3\frac{1}{2}"$ Rod carrying a $\frac{1}{2}"$ Pinion is inserted in its place. The Pinion meshes with a 57-tooth Gear on a $3\frac{1}{2}"$ Rod journaled in the Motor side plate and the right-hand side of the bonnet. The drive is then taken through a second $\frac{1}{2}"$ Pinion and a 57-tooth Gear to a Rod carrying at its centre a $\frac{3}{4}"$ Sprocket Wheel, which is connected by Sprocket Chain to a $1"$ Sprocket Wheel on the front axle.

The $3"$ Pulleys on the front axle, and the $2"$ Pulleys on the rear axle are joined by Sprocket Chain, which represents the creeper track. The tracks are covered in on each side by a mudguard built up from two $5\frac{1}{2}" \times 1\frac{1}{2}"$ Flexible Plates and a $2\frac{1}{2}" \times 1\frac{1}{2}"$ Flexible Plate. The mudguards are braced by $5\frac{1}{2}"$ and $2\frac{1}{2}"$ Strips, and are shaped at the ends by Formed Slotted Strips. They are bolted at the rear to two $3\frac{1}{2}"$ Strips secured to the chassis and at the front they are fastened by Angle Brackets to the bumper supports.

The chassis for the lifeboat carriage is built up by joining two compound girders made by bolting two $12\frac{1}{2}"$ Angle Girders end to end, by a $5\frac{1}{2}"$ Strip at each end. The floor of the carriage is filled in by two $12\frac{1}{2}"$ Strip Plates and four $5\frac{1}{2}" \times 2\frac{1}{2}"$ Flexible Plates, and along its centre are fixed four supports or rollers for the lifeboat. The first of these consists of a $1\frac{1}{2}"$ Rod secured by two Spring Clips in a Double Bracket bolted to the floor of the carriage. The second and fourth are identical and consist of a Coupling that is supported between two Angle Brackets, by a $1\frac{1}{2}"$

Rod. The third roller is of different construction and is formed by two $\frac{3}{4}"$ Flanged Wheels secured to the carriage by lock-nutted $\frac{1}{2}"$ Bolts, at a distance of $1"$ apart. The lifeboat is prevented from falling over sideways by two $1"$ loose Pulleys, which are fastened by Pivot Bolts to two Angle Brackets fixed to the sides of the carriage by $3"$ Strips. The $3"$ Strips are curved outwards slightly to allow the boat to rest on the rollers.

The front Road Wheels of the carriage are held by Spring Clips on the ends of $2"$ Rods fastened by Rod and Strip Connectors to a $4\frac{1}{2}"$ Strip bolted to a Face Plate. A $1"$ Rod locked in the boss of the Face Plate passes through the floor of the carriage and is secured by a Collar. Two $5\frac{1}{2}"$ Strips bolted to the Face Plate are fastened by a $1\frac{1}{2}"$ Rod to a Stepped Bent Strip bolted at the rear of the tractor.

The rear Road Wheels of the carriage are held on the ends of a $6\frac{1}{2}"$ Rod, bearings for which are provided by two Trunnions bolted under the carriage. The left-hand rear wheel is fitted with a brake of the screw-on type constructed as follows. A $3\frac{1}{2}"$ Screwed Rod fitted with Lock-nuts at 1, is connected by a Swivel Bearing to a compound $18\frac{1}{2}"$ rod, consisting of a $2"$, $5"$ and an $11\frac{1}{2}"$ Rod joined by Couplings. The Screwed Rod passes through the tapped hole of the boss of a Crank bolted to the carriage, and the compound rod is journaled at its rear end in a $1" \times 1"$ Angle Bracket secured to the chassis of the carriage by an Angle Bracket. The rod is prevented from slipping by a Collar, and is fitted with a Compression Spring between the $1" \times 1"$ Angle Bracket and the Collar. The compound rod also is fitted with a Crank, so that when the built-up handle at the end of the Screwed Rod is turned in an anti-clockwise direction the Crank presses against the rim of the Road Wheel, and prevents it from turning.

The construction of the lifeboat itself is clear from the various illustrations.

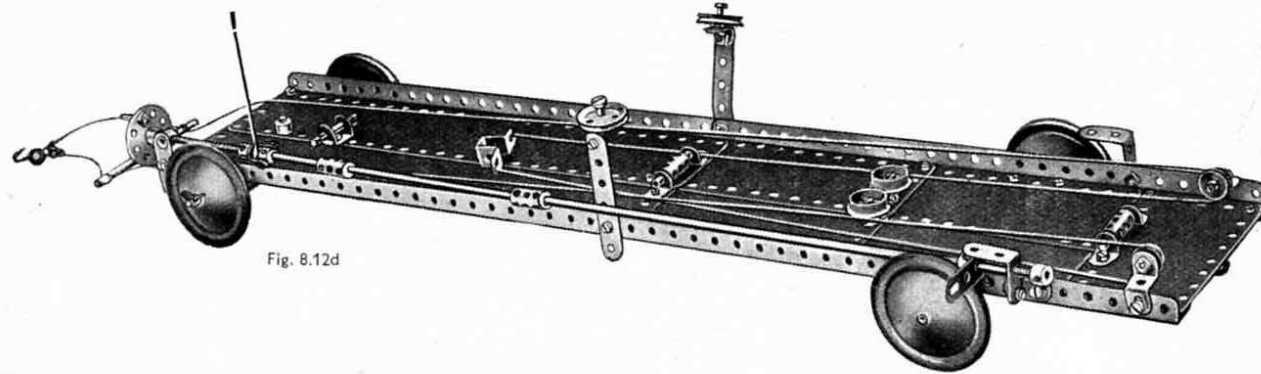


Fig. 8.12d

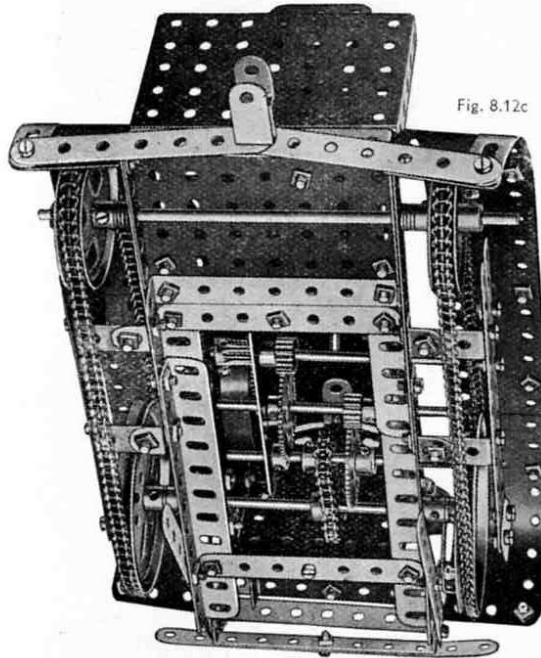


Fig. 8.12c

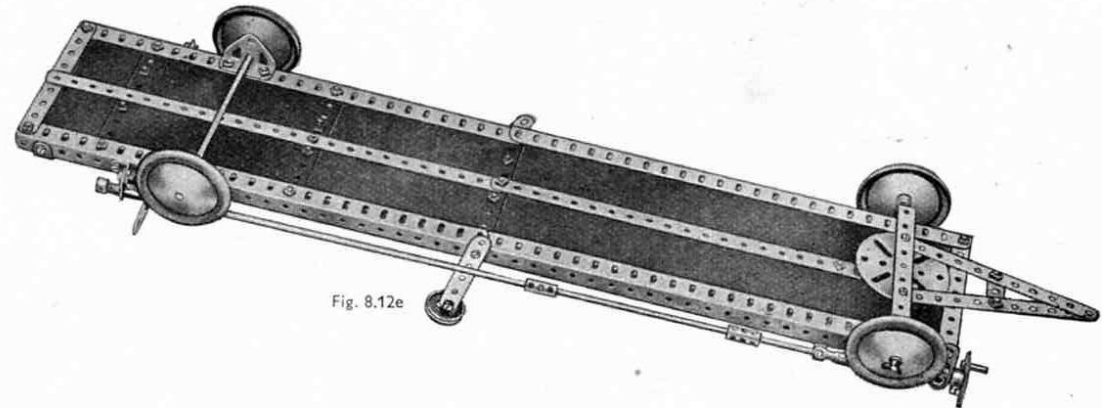


Fig. 8.12e

8.13 MECHANICAL MAN

This striking model of a mechanical man walks at a good speed and swings its arms in a most realistic manner. It is driven by an EO20 Electric Motor, which is housed inside the body.

The construction of the body is clearly shown in the illustrations and therefore needs no explanation. The gearing that operates the limbs is contained between two $3\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flanged Plates 2, which are bolted to two $5\frac{1}{2}$ " Angle Girders 1. The latter are connected by $2\frac{1}{2}$ " \times $1\frac{1}{2}$ " Flanged Plates, the end flanges of which are bolted to the body. The upper flanges of the Flanged Plates 2 are connected to a compound strip 3 by $2\frac{1}{2}$ " \times $\frac{1}{2}$ " Double Angle Strips. Strip 3 comprises duplicate $5\frac{1}{2}$ " and $4\frac{1}{2}$ " Strips overlapped seven holes.

An EO20 Electric Motor is bolted inside the body in the position shown in Fig. 8.13c and it drives through a 10" Driving Band a 3" Pulley 5 fixed on a $6\frac{1}{2}$ " Rod 4. Bearings for Rod 4 are provided by a Double Bent Strip and a $12\frac{1}{2}$ " Strip that forms part of the side of the body. A $\frac{3}{4}$ " Sprocket Wheel on Rod 4 drives a 2" Sprocket Wheel on a 2" Rod 6 that carries also a $\frac{1}{2}$ " Pinion. The latter drives a 57-tooth Gear on a second 2" Rod 7, which in turn carries a $\frac{1}{2}$ " Pinion driving a 57-tooth Gear on $3\frac{1}{2}$ " Rod 8. Rod 8 is held in its bearings by two Collars and is fitted at each end with a Face Plate (Fig. 8.13c).

The Face Plates form cranks, which operate the arms and legs of the model. A Pivot Bolt 13 is locked in one of the inner holes of each Face Plate, the latter parts being so arranged on their shafts that the Pivot Bolts are at 180° to each other.

The legs are each constructed from three $12\frac{1}{2}$ " Angle Girders and a fourth girder built up from two $12\frac{1}{2}$ " Strips, and they are connected at their upper ends by $2\frac{1}{2}$ " Strips and Flat Trunnions. They are pivoted on Rods 9, which pass through the $12\frac{1}{2}$ " Strips 10 (Fig. 8.13c) bent to shape and arranged as shown. A Collar and a $\frac{3}{4}$ " Flanged Wheel prevent the legs from moving sideways on the Rods. The Strips 10 are pivotally connected to a 3" Strip 12 by $\frac{1}{2}$ " Bolt 11, which passes through the third hole from one end of the Strip. The other end of Strip 12 is pivoted on the Pivot Bolt 13, a Spring Clip being used to prevent side play in the Strip. The inner ends of Rods 9 are journaled in the centre holes of $5\frac{1}{2}$ " Angle Girders 1, and their outer ends in the centre holes of the $5\frac{1}{2}$ " Strips at the bottom of the body.

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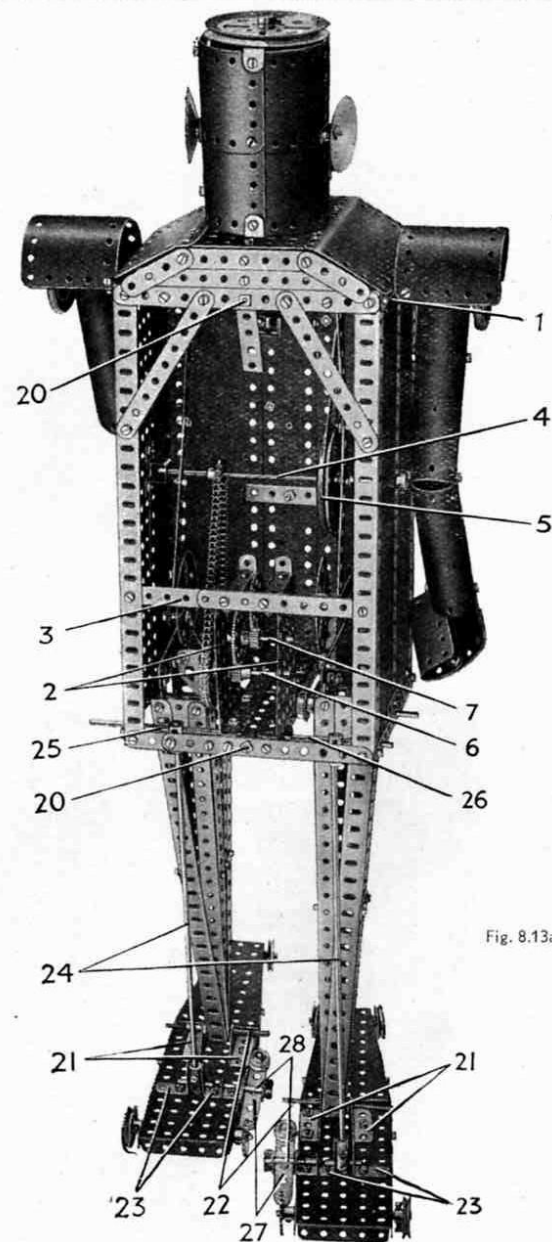
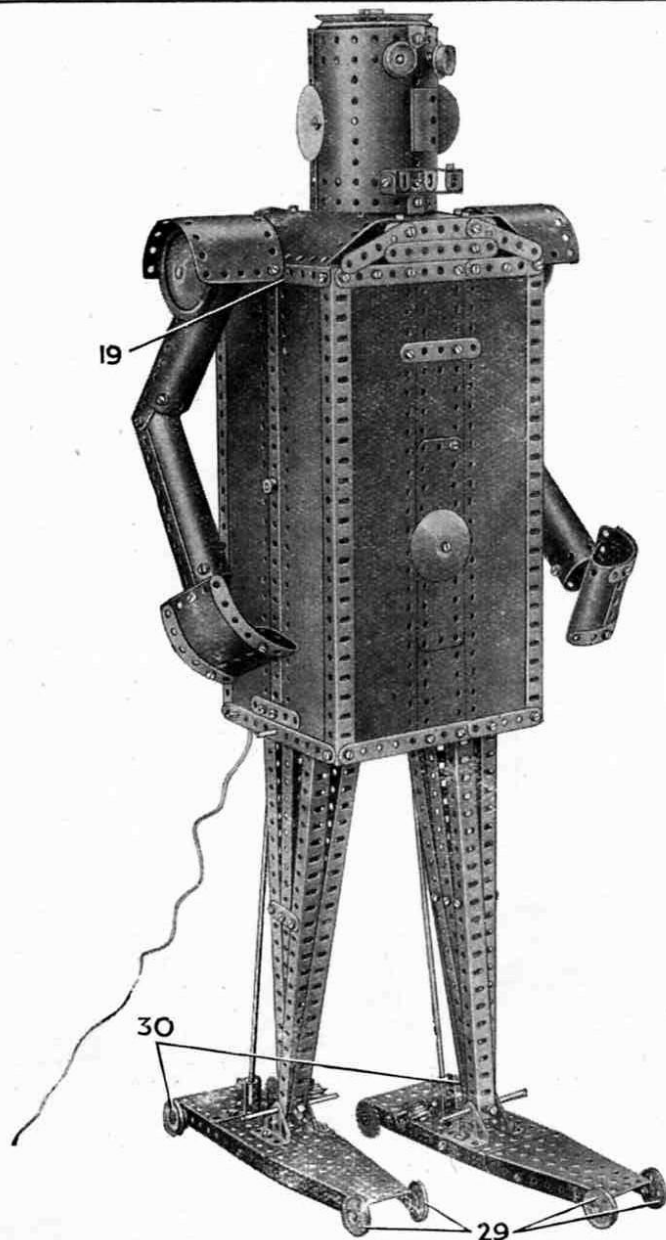


Fig. 8.13a

8.13 MECHANICAL MAN—Continued

The lower ends of the legs are fitted with 3" Screwed Rods 22, on which the feet are pivoted. These consist of a $5\frac{1}{2}" \times 2\frac{1}{2}"$ Flanged Plate connected to a Flanged Sector Plate by $5\frac{1}{2}"$ Strips. Trunnions 21 bolted to the Flanged Plates connect the feet to the legs, and behind them are fixed 1" \times 1" Angle Brackets 23. Between the latter are 1" Rods, to which are fixed Couplings that are connected by $11\frac{1}{2}"$ Rods 24 to further Couplings on Rods 25 and 26 (Fig. 8.13a). The Rods 24, which must be adjusted correctly, keep the body of the mechanical man vertical while he is walking. If the model tends to fall forward the Rods should be shortened by sliding them further into the Couplings, but if the tendency is to fall backward the Rods should be moved out of the Couplings.

The feet are fitted with wheels, the front pair of which are 1" loose Pulleys 29 carried on lock-nutted $\frac{3}{8}"$ Bolts. The rear wheels are 1" Pulleys 30 and 1" Sprocket Wheels. The Sprocket Wheels are fitted with pawls made from $2\frac{1}{2}"$ Strips 27 weighted at one end with $\frac{1}{2}"$ loose Pulleys. The Strips are fitted at their centres with Double Brackets, which are pivoted on $1\frac{1}{2}"$ Rods 28. The latter are journaled in further Double Brackets bolted to the feet. The purpose of these ratchets is to prevent the feet of the model from moving backward at the end of each forward step. On a very smooth surface the feet may slip and slide backward, but this can be prevented by fitting 1" Rubber Rings on the 1" Pulleys 30.

The arms of the man should now be assembled. They are constructed from three $5\frac{1}{2}" \times 2\frac{1}{2}"$ Flexible Plates and one $4\frac{1}{2}" \times 2\frac{1}{2}"$ Flexible Plate, which are rolled into U-section and bolted together in the manner shown in Fig. 8.13b. The hands are $1\frac{1}{4}"$ radius Curved Plates and U-Section Curved Plates. Cranks are bolted to the upper ends of the arms, which are then locked on Rods 16 and 17, and a Road Wheel is fastened on the end of each Rod.

Rods 16 and 17 are journaled in bearings provided by the $5\frac{1}{2}"$ Angle Girders 19 at the sides of the body and the $5\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strips 18 bolted inside. Rod 16 carries a Bush Wheel and Rod 17 carries a $1\frac{1}{2}"$ Pulley, and across each of these parts is bolted a $2\frac{1}{2}"$ Strip 15. The ends of the Strips point in opposite directions, and they are connected to the Pivot Bolts 13 on the Face Plates by compound strips 14, each consisting of two $5\frac{1}{2}"$ Strips overlapped four holes.

The $2\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strips are bolted to the $5\frac{1}{2}"$ Angle Girders 19 previously mentioned, and $4\frac{1}{2}" \times 2\frac{1}{2}"$ Flexible Plates are bolted between their turned-up ends. The back of the body is closed by the panel shown in Fig. 8.13b. In fitting this panel it is placed over the shanks of the Bolts 20 (Fig. 8.13a) and nuts are screwed on to hold it in place.

The head of the model can be seen in the various illustrations. It consists of a Boiler opened out and the ends joined by four $1\frac{1}{16}"$ radius Curved Plates. Eyes are represented by $\frac{3}{4}"$ Flanged Wheels, a nose by a Sleeve Piece, and a mouth by two $2\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strips and Angle Brackets. Ears are represented by Conical Discs, which are attached to the head by Fishplates. Two $3\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strips are bolted across the top and bottom of the head which is then attached to the two $3\frac{1}{2}" \times 2\frac{1}{2}"$ Flanged Plates that form the top of the body. The head is capped by a 3" Pulley.

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

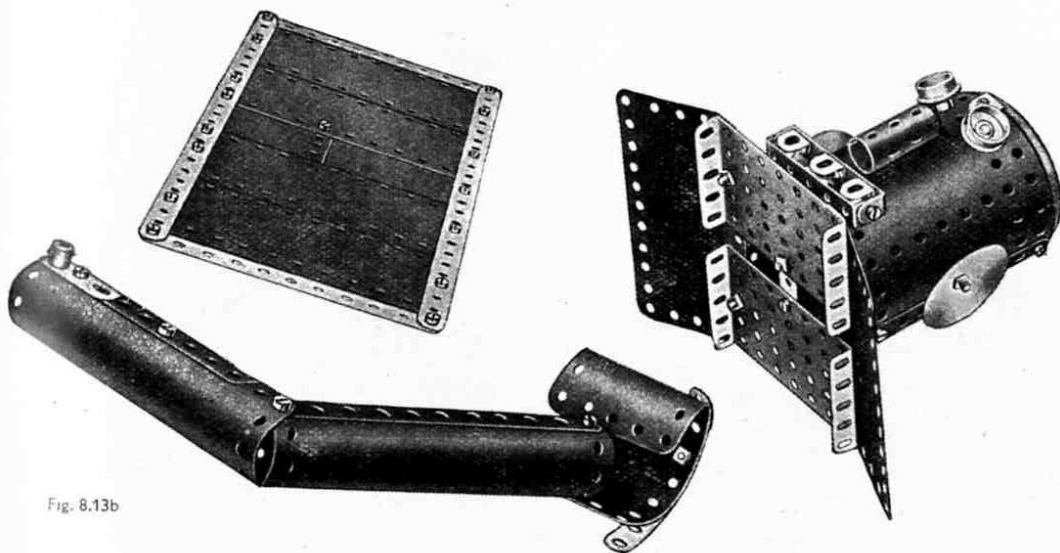


Fig. 8.13b

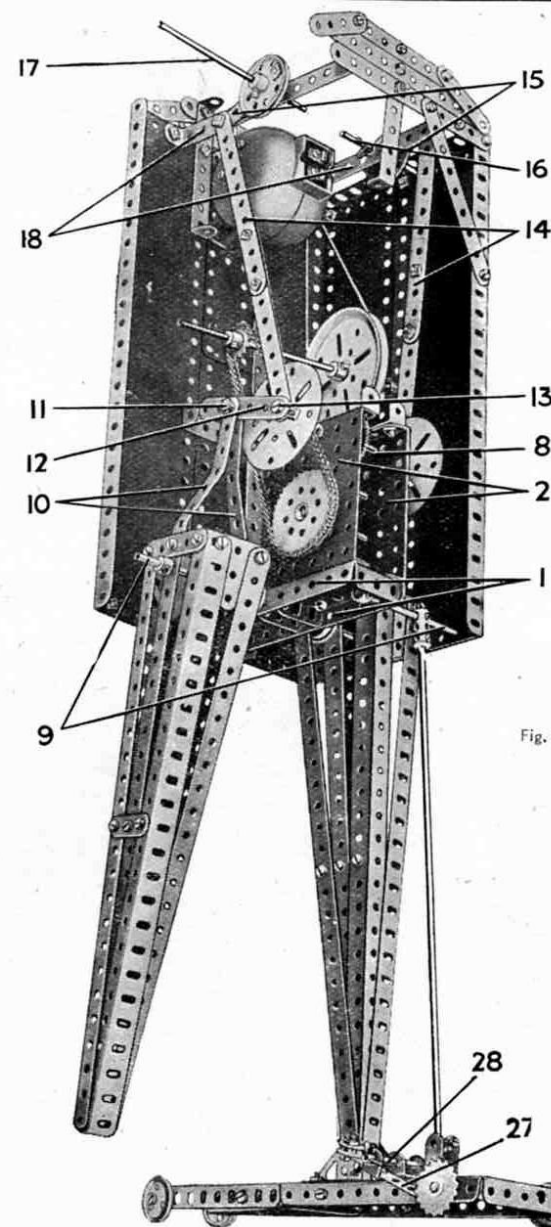


Fig. 8.13c

8.14 ARTICULATED LORRY

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

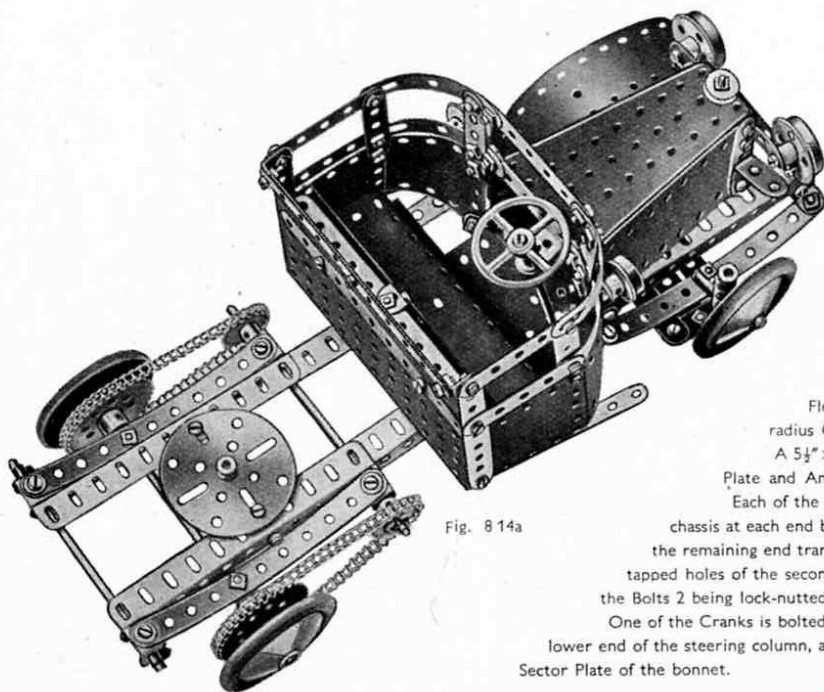
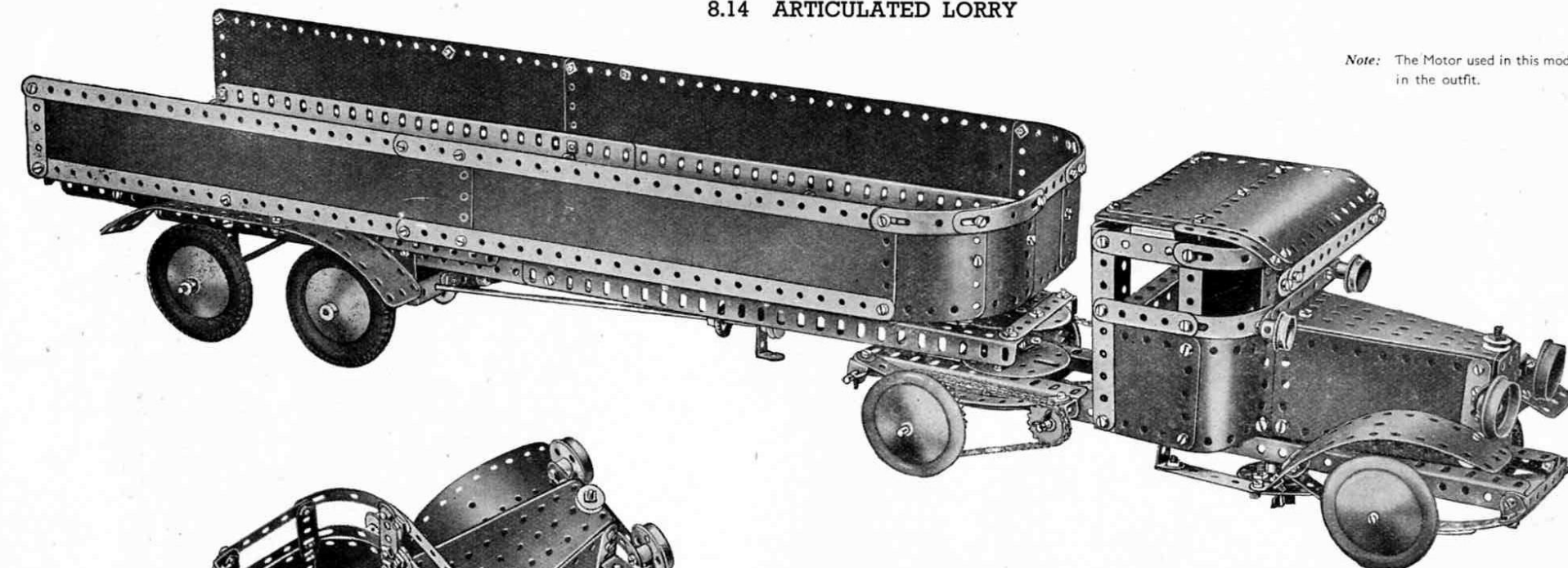


Fig. 8.14a

The power unit of the lorry is first constructed. The chassis for this consists of two $12\frac{1}{2}$ " Angle Girders joined at the front by a $2\frac{1}{2}$ " \times $\frac{1}{2}$ " Double Angle Strip and extended to the rear by two $5\frac{1}{2}$ " Angle Girders. The bonnet is built up by joining the flanges of two Flanged Sector Plates by $4\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flexible Plates, the lower Flanged Sector Plate being bolted to the chassis as shown. The radiator is formed by a $2\frac{1}{2}$ " \times $1\frac{1}{2}$ " Flanged Plate secured between the Flanged Sector Plates by a $3\frac{1}{2}$ " Screwed Rod. The headlights are represented by two $1\frac{1}{2}$ " Flanged Wheels, each of which is secured to a $1"$ \times $1"$ Angle Bracket by a $\frac{3}{8}$ " Bolt. The Angle Brackets are bolted to the sides of the bonnet so that the headlights protrude outwards.

The back of the cab is formed by a $5\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flanged Plate bolted by one of its longer flanges to the $12\frac{1}{2}$ " Angle Girders and extended upwards at each end by a $2\frac{1}{2}$ " \times $1\frac{1}{2}$ " Flexible Plate. The upper ends of the Flexible Plates are joined by a $5\frac{1}{2}$ " Strip to which the roof of the cab is fastened by two Angle Brackets.

The roof consists of two $5\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flexible Plates bolted together and extended to one side by two $2\frac{1}{2}$ " \times $1\frac{1}{2}$ " Flexible Plates, which overlap two holes with the larger Flexible Plates. Two $5\frac{1}{2}$ " Strips overlapped 10 holes are secured to the front of the roof by two Obtuse Angle Brackets. The sides of the cab are each formed by a $1\frac{1}{8}$ " radius Curved Plate and a $2\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flexible Plate bolted together overlapping one hole.

A $5\frac{1}{2}$ " \times $1\frac{1}{2}$ " Flexible Plate curved slightly is used for the seat inside the cab, and it is fastened to the upper flange of the $5\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flanged Plate by a second $5\frac{1}{2}$ " \times $1\frac{1}{2}$ " Flexible Plate and Angle Brackets.

Each of the leaf springs by which the front Road Wheels are supported consists of a $5\frac{1}{2}$ ", $3\frac{1}{2}$ " and a $2\frac{1}{2}$ " Strip secured together by a centre Bolt. The springs are fastened to the chassis at each end by Angle Brackets. Each of the centre Bolts of the leaf springs passes at its upper end through the end transverse bore of a Coupling. A $1\frac{1}{2}$ " Rod that is slipped through the remaining end transverse bore of the Coupling is connected by means of a second Coupling to the Road Wheel. The Road Wheel is held on the shank of a $\frac{3}{8}$ " Bolt screwed into one of the tapped holes of the second Coupling. Each of the $1\frac{1}{2}$ " Rods carries also a Crank at its lower end, and these are joined by a compound strip consisting of two $2\frac{1}{2}$ " Strips bolted end to end, the Bolts 2 being lock-nutted.

One of the Cranks is bolted to a 2" Strip, the other end of which is attached to a 3" Strip by a lock-nutted Bolt 1. The 3" Strip is connected by a Threaded Pin to a $1\frac{1}{2}$ " Pulley secured at the lower end of the steering column, as shown in Fig. 8.14c. The steering column is a 4" Rod journaled in one of the $12\frac{1}{2}$ " Angle Girders and also in the end hole of a $1\frac{1}{2}$ " Strip bolted to the upper Flanged Sector Plate of the bonnet.

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8.14 ARTICULATED LORRY—Continued

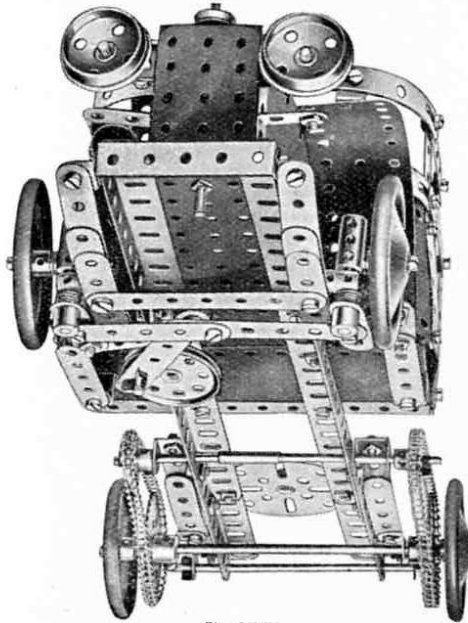


Fig. 8.14b

Each of the rear leaf springs is formed by a $5\frac{1}{2}$ " and a $3\frac{1}{2}$ " Strip secured together by a centre Bolt, which holds also an Angle Bracket. The two Angle Brackets form the bearings for the rear axle, a $6\frac{1}{2}$ " Rod. The springs are joined to the chassis by two Rods pushed through the sides of the Angle Girders and also through Double Brackets bolted to the ends of the springs, as shown in the illustrations. Two 2" Sprocket Wheels on the rear axle are connected to two 1" Sprocket Wheels on the forward rod fastening the springs to the chassis. The rod consists of a $3\frac{1}{2}$ " and a 2" Rod joined by a Rod Connector.

A Face Plate is bolted between the two side members of the chassis in the position shown in Fig. 8.14a to form part of the swivel for the trailer.

The trailer is built up on a base consisting of two Angle Girders joined at each end and also in the centre by compound strips. Each of the angle girders consists of two $12\frac{1}{2}$ " Angle Girders bolted end to end overlapping four holes. The end compound strips joining the girders are connected across the centre by $12\frac{1}{2}$ " Strips (see Fig. 8.14d). The floor of the trailer is then filled in with Flexible Plates of various sizes and a $5\frac{1}{2}$ " x $2\frac{1}{2}$ " Flanged Plate.

Two $12\frac{1}{2}$ " Strip Plates, overlapped four holes and bolted to the sides of the $12\frac{1}{2}$ " Angle Girders are used for each side of the trailer, and the front is formed by one $2\frac{1}{2}$ " x $2\frac{1}{2}$ " Flexible Plate and four $1\frac{1}{2}$ " radius Curved Plates.

The No. 1 Clockwork Motor is secured under the trailer with its winding spindle protruding upwards, and a 4" Rod is attached to the brake lever by a small Fork Piece. The Rod passes through an Angle Bracket fastened underneath the trailer and carries at its end a Collar in the tapped hole of which is screwed a Threaded Pin.

Two $12\frac{1}{2}$ " Angle Girders are fastened underneath the trailer by Reversed Angle Brackets and are joined at the front by a $3\frac{1}{2}$ " Strip. A Face Plate is bolted underneath the $3\frac{1}{2}$ " Strip to form the upper part of the trailer swivel and in its boss a $1\frac{1}{2}$ " Rod is locked.

The two $12\frac{1}{2}$ " Angle Girders are each extended to the rear by a $12\frac{1}{2}$ " Strip, the two Strips being secured to the floor of the trailer by Double Angle Strips and $5\frac{1}{2}$ " Angle Girders. The front axle, which consists of a $4\frac{1}{2}$ " and a $3\frac{1}{2}$ " Rod joined by a Coupling, is journaled in holes at the narrow ends of two Flat Trunnions supported by the $12\frac{1}{2}$ " Strips, and it carries a $1\frac{1}{2}$ " Contrate Wheel at its centre. The Contrate meshes with a $\frac{1}{2}$ " Pinion held on a 2" Rod journaled as shown in Fig. 8.14c. The 2" Rod carries also a 57-tooth Gear that meshes with a second $\frac{1}{2}$ " Pinion on the end of an $11\frac{1}{2}$ " Rod driven from the Motor through a $\frac{3}{4}$ " Contrate Wheel and a $\frac{1}{2}$ " Pinion. The $11\frac{1}{2}$ " Rod is journaled at its forward end in the centre hole of a $1\frac{1}{2}$ " x $\frac{1}{2}$ " Double Angle Strip bolted to the Motor side plate, and is prevented from slipping out of position by a $\frac{1}{2}$ " fast Pulley.

The rear axle is an 8" Rod, and is journaled at each end in a $1\frac{1}{2}$ " strip bolted to the $12\frac{1}{2}$ " Strip. Each $1\frac{1}{2}$ " strip is built up from two Fishplates bolted end to end. The rear mudguards consist of two $5\frac{1}{2}$ " x $1\frac{1}{2}$ " Flexible Plates overlapped four holes and bolted underneath the trailer, their ends being curved down slightly.

The coupling hook consists of a Channel Bearing bolted underneath the back of the trailer and extended to the rear by an Angle Bracket.

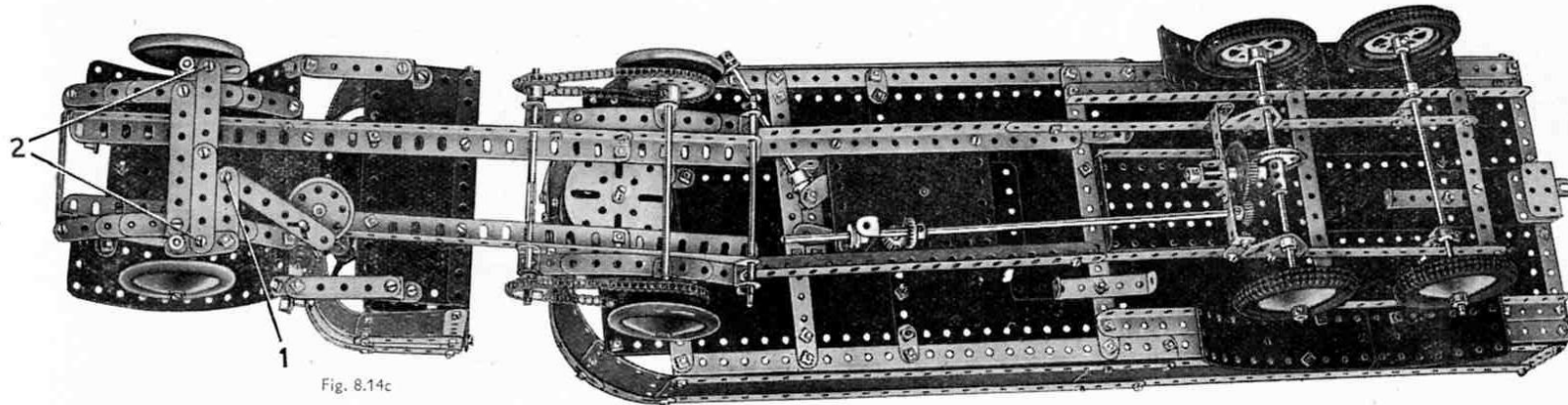


Fig. 8.14c

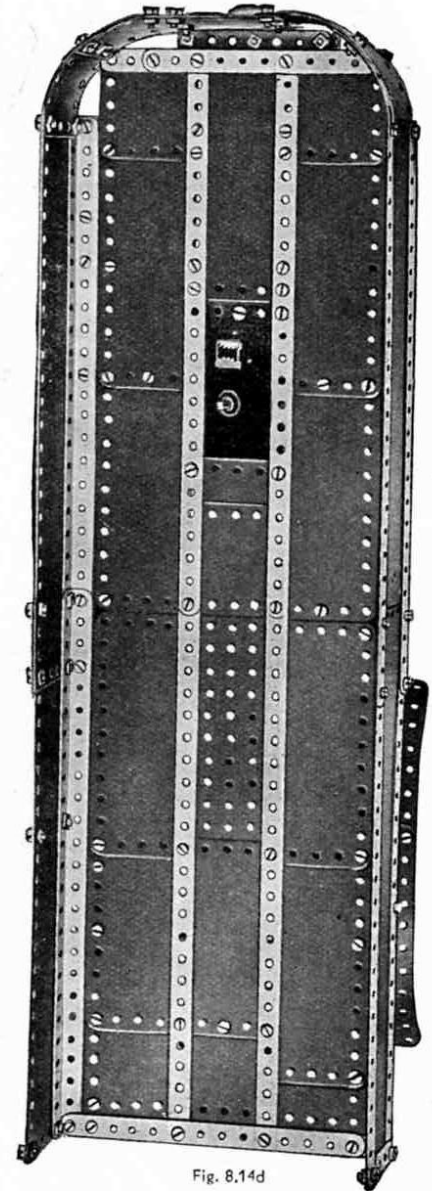
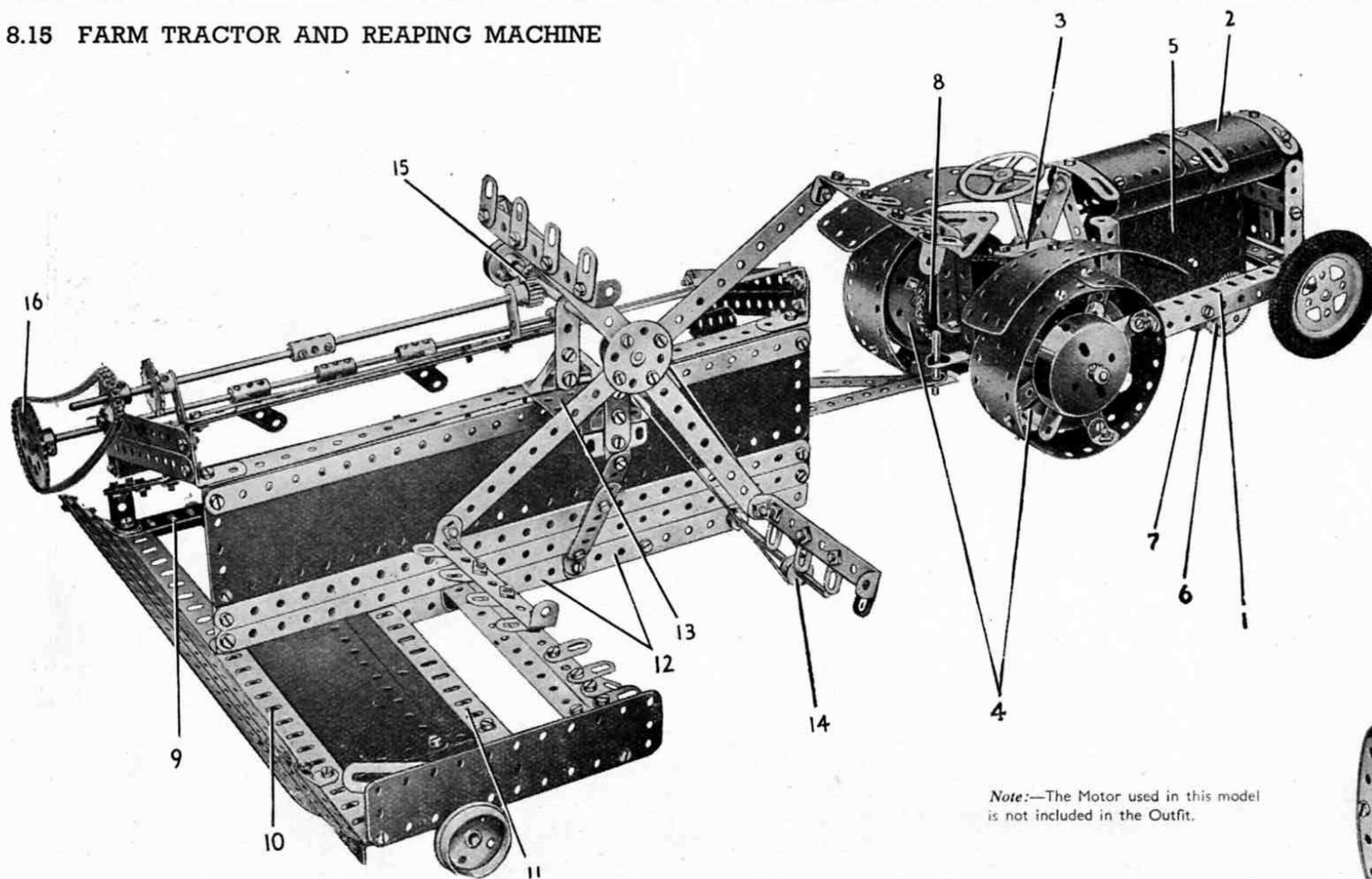


Fig. 8.14d

8.15 FARM TRACTOR AND REAPING MACHINE



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

The Clockwork Motor, which is indicated at 5, is secured to the left-hand side member of the chassis by a $1'' \times \frac{1}{2}''$ and a $\frac{1}{2}'' \times \frac{1}{2}''$ Angle Bracket, the brake lever being at the rear. A $\frac{1}{2}''$ Pinion on the driving shaft of the Motor meshes with a 57-tooth Gear carried on a $1\frac{1}{2}''$ Rod journalled in the Motor side plates. A second $\frac{1}{2}''$ Pinion 7, on the other end of the $1\frac{1}{2}''$ Rod meshes with a 57-tooth Gear 6 on a 2" Rod also journalled in the side plates of the Motor. The drive is taken from a $\frac{3}{4}''$ Sprocket Wheel on the free end of the 2" Rod, to a 2" Sprocket Wheel on the rear axle by means of Sprocket Chain.

A $6\frac{1}{2}''$ Rod is used for the rear axle, and its bearings are provided by the holes in the turned up ends of a $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip bolted across the $3\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate. The rim of each of the rear wheels is formed by two $5\frac{1}{2}'' \times 1\frac{1}{2}''$ and one $2\frac{1}{2}'' \times 1\frac{1}{2}''$ Flexible Plate, each overlapped one hole and secured to a 3" Pulley 4 by 2 $\frac{1}{2}''$ Strips and Angle Brackets.

On its outer side each 3" Pulley carries a Crank, in the boss of which is locked a 1" Rod. A Boiler End representing a hub cap is slipped on the end of this Rod and fastened in position by a Collar.

One of the most ingenious machines now available for agricultural work is the reaping and binding machine. This machine automatically reaps and binds the corn into sheaves and is capable of doing in one hour an amount of work that would occupy a man working with ordinary tools for several days.

The illustration to the left shows the Meccano model reaper and binder complete with farm tractor. The tractor, an underneath view of which is shown in Fig. 8.15a is constructed first. The chassis for this consists of two $5\frac{1}{2}''$ Angle Girders 1, joined at the front by a $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip and at the rear by a $3\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate. The Flanged Plate overlaps the Angle Girders two holes.

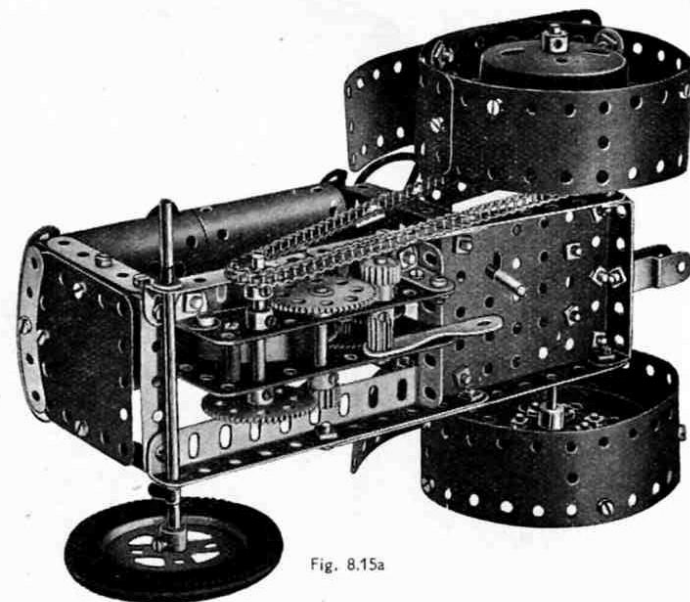


Fig. 8.15a

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8.15 FARM TRACTOR AND REAPING MACHINE

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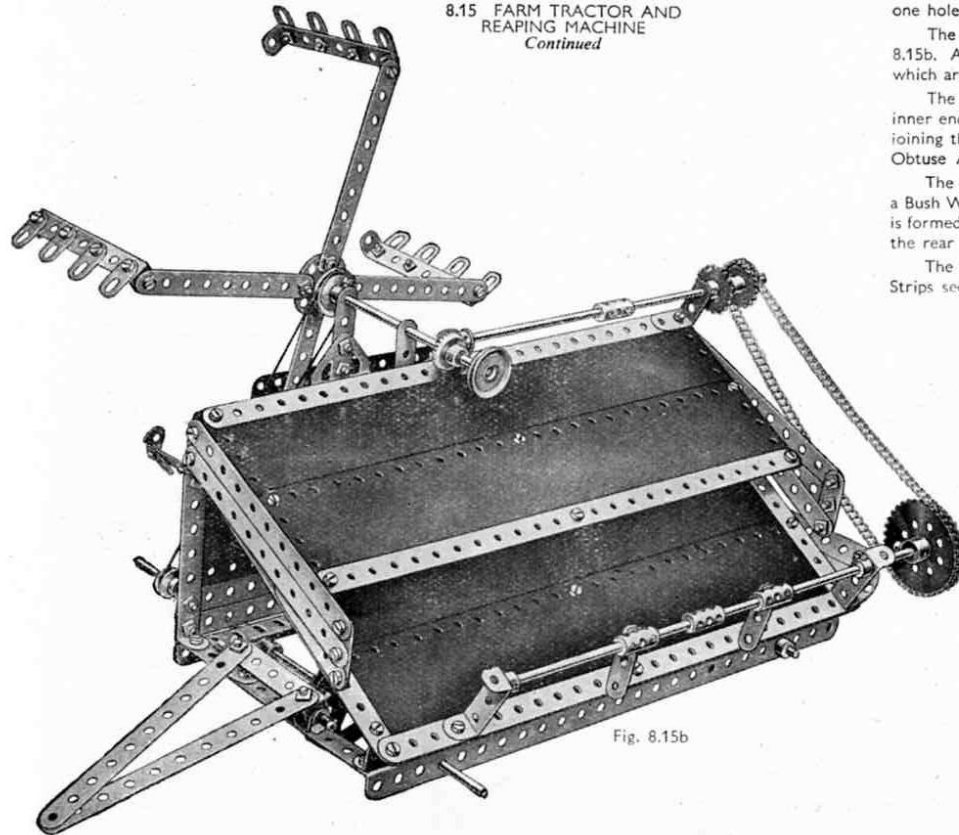


Fig. 8.15b

The radiator is formed by a $2\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plate, which is secured by a $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip and two $2\frac{1}{2}''$ Strips to the Double Angle Strip connecting the side members of the chassis. The bonnet is formed by three $1\frac{1}{2}''$ radius Curved Plates, bolted over a $5\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip, and extended round each side by two U-section Curved Plates. The $5\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip is fixed by one of its ends to the radiator and by its other end to two $2\frac{1}{2}''$ Strips, which are supported from the chassis by Angle Brackets and $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips.

The construction of the reaper is commenced by joining two $12\frac{1}{2}''$ Angle Girders 10 and 11 by a $3\frac{1}{2}''$ Strip at one end, and at the other end by another $12\frac{1}{2}''$ Angle Girder 9. A compound Girder consisting of two $5\frac{1}{2}''$ Angle Girders 12 is fastened to the two $12\frac{1}{2}''$ Angle Girders 10 and 11 by a $2\frac{1}{2}''$ Strip. The forward $5\frac{1}{2}''$ Angle Girder 12 and the $12\frac{1}{2}''$ Angle Girder 9 are joined at their free ends by a $5\frac{1}{2}''$ Strip. Three $12\frac{1}{2}''$ Strips, which are fixed together by two Wheel Discs, are fastened to the Angle Girder 10 by Obtuse Angle Brackets.

The $12\frac{1}{2}''$ Strip and the $12\frac{1}{2}''$ Strip Plate, which are shown in the main illustration forming the side of the enclosed part of the machine, are supported at each end by a $3\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip. The upper ends of the Double Angle Strips are joined by a $12\frac{1}{2}''$ Strip, the Bolts holding also two Obtuse Angle Brackets, which are secured by compound strips to two Double Brackets, fixed one at each end of the Angle Girder 9. Each of the compound strips consists of a $5\frac{1}{2}''$ and a $1\frac{1}{2}''$ Strip secured end to end, and the space between them is filled by three $12\frac{1}{2}''$ Strip Plates.

The flap, from under which the sheaves of corn are ejected, is represented by two $12\frac{1}{2}''$ Strip Plates bolted together with their long edges overlapping, one hole. The flap is held in place by $1'' \times 1''$ Angle Brackets, and $12\frac{1}{2}''$ Strips are bolted along its edges.

The $\frac{1}{2}''$ Pinion 15 is fixed on the end of a compound rod, built up from two $4''$ Rods journalled in the end holes of two $1'' \times 1''$ Angle Brackets seen in Fig. 8.15b. A $1''$ Sprocket Wheel on the end of the compound rod is connected by Sprocket Chain to a $2''$ Sprocket Wheel on the Rod carrying the ejectors which are each constructed by bolting a $1\frac{1}{2}''$ Strip to a Coupling.

The Pinion 15 meshes with a $\frac{3}{4}''$ Contrate Wheel on the $5''$ Rod carrying the reaping blades. The bearings for the Rod are provided by a $2''$ Strip at the inner end, and a $2\frac{1}{2}''$ Strip at the outer end. Each of the strips is secured by a Trunnion to the $2\frac{1}{2}'' \times 1\frac{1}{2}''$ Flanged Plate 13, which is bolted to the $12\frac{1}{2}''$ Strip joining the upper ends of the $3\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips. The Flanged Plate 13 is also braced from the Angle Girder 12 by a $4''$ compound strip and two Obtuse Angle Brackets.

The rotating arms are $3\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips, to each of which four Fishplates are bolted. The Double Angle Strips are attached by $4\frac{1}{2}''$ Strips to a Bush Wheel on the end of the $5''$ Rod. A $1''$ fast Pulley on this Rod is connected by a Driving Band to a $\frac{1}{2}''$ Pulley on the front axle of the reaper. This axle is formed by an $11\frac{1}{2}''$ Rod journalled in the Angle Girders 12 and 9, and it carries at its centre a $2''$ Pulley. A $1\frac{1}{2}''$ Flanged Wheel and a $2''$ Pulley are used for the rear wheels, and they are fixed on separate Rods as shown in Fig. 8.15c.

The reaper is attached to the tractor by passing a Rod through a Stepped Bent Strip at the back of the tractor, and also through the end holes of two $5\frac{1}{2}''$ Strips secured to the reaper.

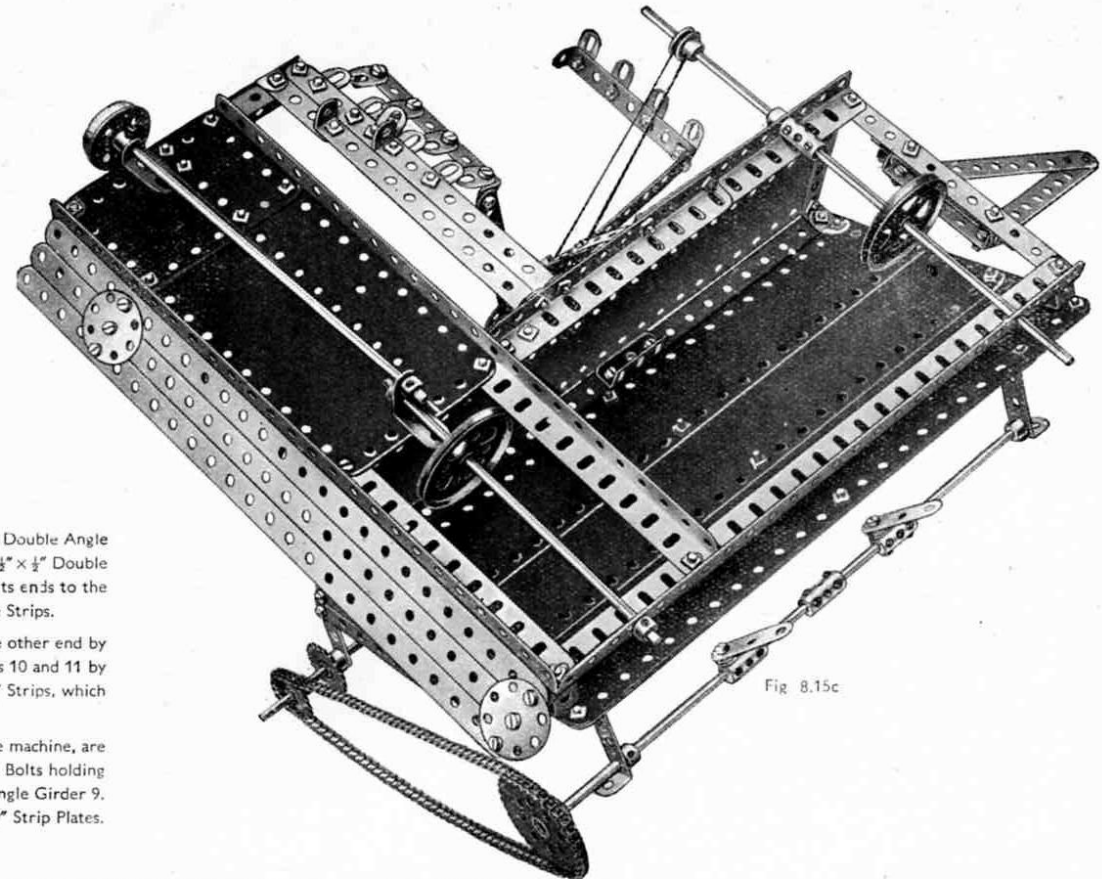
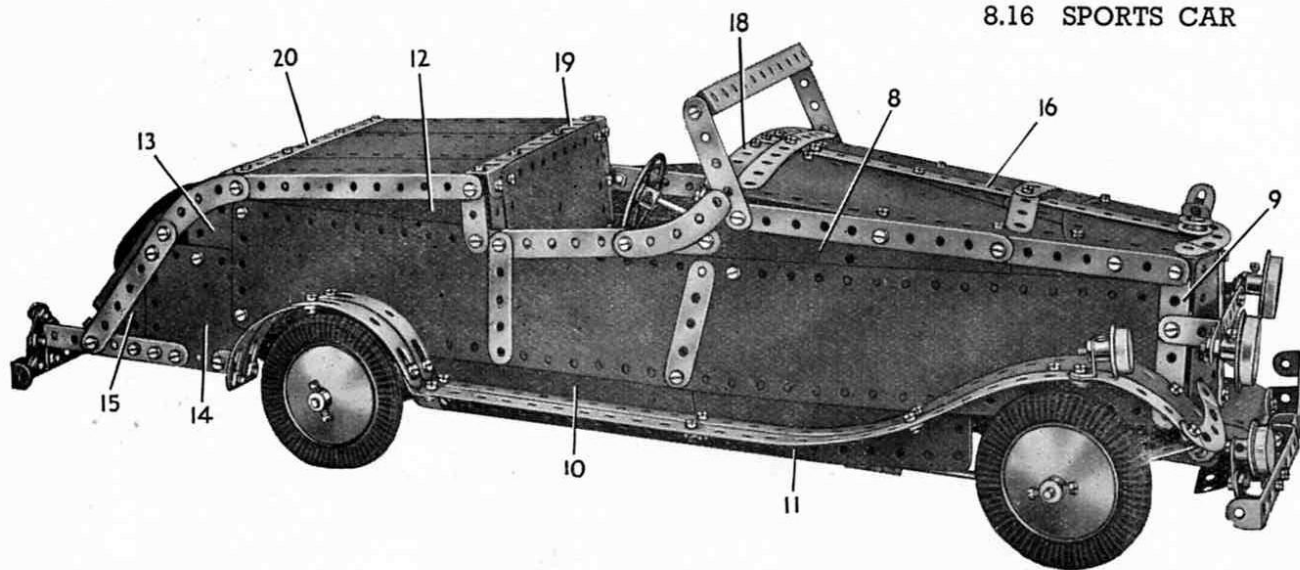


Fig. 8.15c

8.16 SPORTS CAR



Each side of the body is similar in construction and consists of two $12\frac{1}{2}$ " Strip Plates, four $5\frac{1}{2} \times 1\frac{1}{2}$ " Flexible Plates, three $2\frac{1}{2} \times 1\frac{1}{2}$ " Flexible Plates, two $2\frac{1}{2} \times 2\frac{1}{2}$ " Flexible Plates and four $5\frac{1}{2} \times 2\frac{1}{2}$ " Flexible Plates.

The $12\frac{1}{2}$ " Strip Plates are overlapped 14 holes and are attached to $5\frac{1}{2} \times 2\frac{1}{2}$ " Flanged Plates 6 and 7 (Fig. 8.16a). They are braced in their inside surfaces by four $12\frac{1}{2}$ " Strips. The Flanged Plates are bolted to the chassis members. A $5\frac{1}{2} \times 1\frac{1}{2}$ " Flexible Plate 8 (Fig. 8.16d), extended by a $2\frac{1}{2} \times 1\frac{1}{2}$ " Flexible Plate, is bolted to the Strip Plates and strengthened along its upper edge by a compound strip consisting of two $5\frac{1}{2}$ " Strips overlapped five holes. This strip is bolted at the front to a 3" Strip 9 and is attached at the rear to the instrument panel by a 1×1 " Angle Bracket.

The instrument panel consists of a $5\frac{1}{2} \times 1\frac{1}{2}$ " Flexible Plate strengthened by two $5\frac{1}{2}$ " Strips and is fastened to the Flanged Plate 6 by two Reversed Angle Brackets. The lower edges of the Strip Plate are extended by a $5\frac{1}{2} \times 2\frac{1}{2}$ " Flexible Plate 10 and a $5\frac{1}{2} \times 1\frac{1}{2}$ " Flexible Plate 11. The sides of the body are connected at the front by two $2\frac{1}{2} \times \frac{1}{2}$ " Double Angle Strips. The rear portion of the side is filled in by a $5\frac{1}{2} \times 2\frac{1}{2}$ " Flexible Plate 12, a $2\frac{1}{2} \times 1\frac{1}{2}$ " Flexible Plate 13, a $2\frac{1}{2} \times 2\frac{1}{2}$ " Flexible Plate 14 and a $2\frac{1}{2} \times 1\frac{1}{2}$ " Flexible Plate 15. The edges of these Plates are fitted with Strips and Curved Strips as shown in Fig. 8.16d.

The radiator consists of two $1\frac{1}{8}$ " radius Curved Plates overlapped four holes. These are attached to the Double Angle Strips connecting the sides of the bonnet. Washers are placed on the bolts in order to reproduce the curved surface of the radiator.

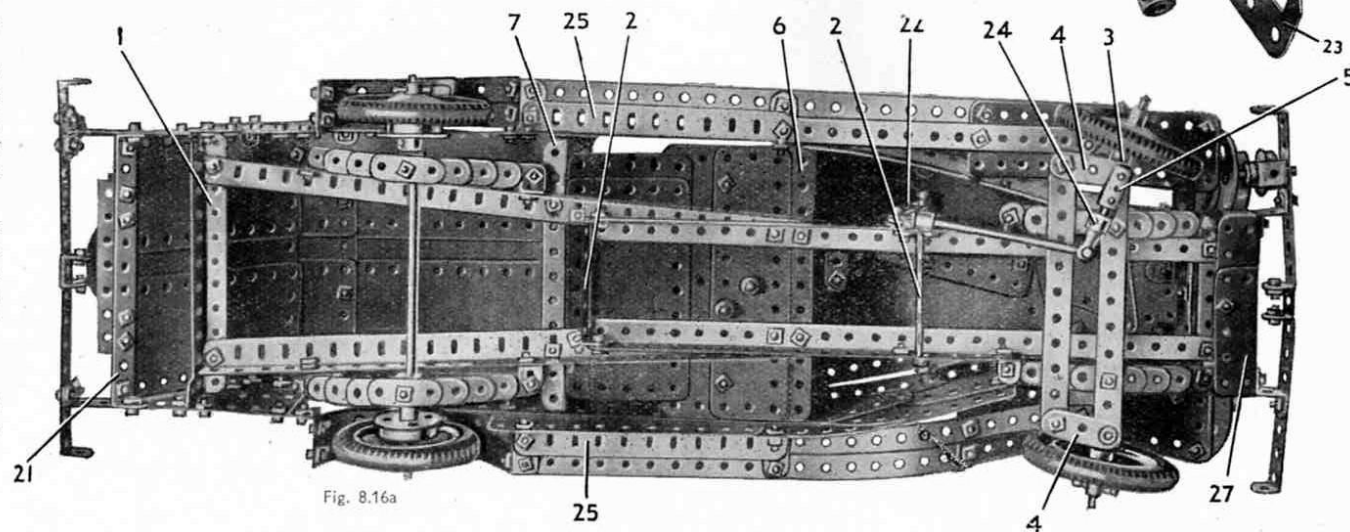


Fig. 8.16a

Fig. 8.16b

Each of the main chassis members is formed by two $12\frac{1}{2}$ " Angle Girders overlapped nine holes. These are joined at the front by a $2\frac{1}{2} \times 1$ " Double Angle Strip, and are connected at the rear by a $5\frac{1}{2}$ " Angle Girder 1 (Fig. 8.16a). Two $2\frac{1}{2} \times \frac{1}{2}$ " Double Angle Strips 2 are bolted to the centre of the chassis.

The road springs consist of $4\frac{1}{2}$ ", $3\frac{1}{2}$ ", $2\frac{1}{2}$ " and $1\frac{1}{2}$ " Strips bolted together at their centre holes, and they are attached to the chassis by Angle Brackets fixed in the end holes of the $4\frac{1}{2}$ " Strips. The rear axle consists of an 8" Rod and is mounted in Double Brackets fastened to the rear springs. The front axle beam is formed by three $5\frac{1}{2}$ " Strips bolted to the front springs. The front wheels are free to turn on $1\frac{1}{2}$ " Rods fixed in Couplings, and are held in place by Collars. One of the Couplings is seen at 3 (Fig. 8.16a). A $1\frac{1}{2}$ " Rod is held in the centre transverse hole of each Coupling and is passed through the end hole of the axle beam. The Cranks 4 are then fixed in position on these Rods, and the off-side $1\frac{1}{2}$ " Rod is fitted with a second Coupling 5.

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8.16 SPORTS CAR—Continued

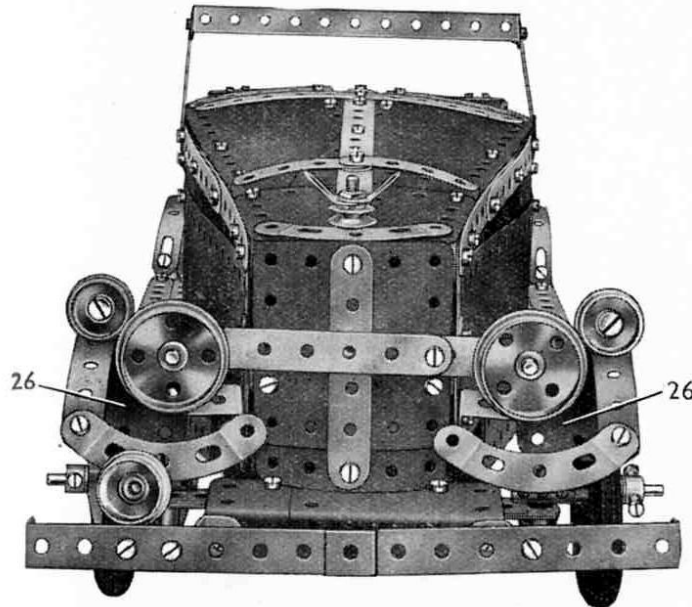


Fig. 8.16c

The top of the bonnet is made by bolting two $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plates at an angle to Fishplates attached to a compound strip 16 consisting of two $5\frac{1}{2}''$ Strips overlapped five holes. This strip is attached by Angle Brackets to the radiator, and to the $3''$ strips 17 bolted to the instrument panel. A $5\frac{1}{2}''$ Strip and two $2\frac{1}{2}''$ Strips, one of which is seen at 18, are fixed to the rear of the bonnet, and the front is filled in by two $2\frac{1}{2}'' \times 2\frac{1}{2}''$ and two $2\frac{1}{2}'' \times 1\frac{1}{2}''$ Flexible Plates bolted to the strip 16. The Flexible Plates are also attached to Angle Brackets bolted to the sides of the bonnet.

A $5\frac{1}{2}''$ Angle Girder 19 is bolted to a $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plate attached to the Flanged Plate 7. Three $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plates are fastened to the Angle Girder 19, and to a $5\frac{1}{2}''$ Strip 20, which is attached to the sides by Angle Brackets. Three $1\frac{1}{2}''$ radius curved Plates are also bolted to the Strip 20 as shown, and three $4\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plates are attached to a $5\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip 21 fixed to the rear of the body. The luggage grid consists of a $3\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate attached by lock-nutted bolts to a $3\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip bolted to the Double Angle Strip 21.

The construction of the steering box is shown in Fig. 8.16b. Two $1\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips are bolted together and fitted at each end with a Fishplate. The steering column is a $6\frac{1}{2}''$ Rod, and this is passed through the lower edge of the instrument panel and the top of the Flanged Plate 6, and through the Fishplates bolted to the $1\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips.

The steering column is fitted with a Worm, which meshes with a $\frac{1}{2}''$ Pinion fixed on a $1\frac{1}{2}''$ Rod mounted in the Double Angle Strips. The outer end of this Rod carries a Coupling and a $2\frac{1}{2}''$ Strip 22 is attached to this by a $\frac{3}{8}''$ Bolt passed through the Coupling and held by a grub screw. The lower end of the Strip 22 is fitted with an End Bearing held by lock-nuts, and this is connected by a $3\frac{1}{2}''$ Rod to a Swivel Bearing 24. The Swivel Bearing is fixed on a $1''$ Rod held in the Coupling 5. The steering box is attached to the chassis by the Flat Trunnion 23.

The front mudguards and running boards on each side of the model are two $12\frac{1}{2}''$ Strips. The inner Strip is bolted to a $5\frac{1}{2}''$ Angle Girder 25, and the outer Strip is attached to this Angle Girder by Fishplates. The Strips are curved at the front to accommodate the front wheels, and a $5\frac{1}{2}'' \times 1\frac{1}{2}''$ Flexible Plate 26 (Fig. 8.16c) is attached to them. This Plate is also connected to the Strip 9 by a $1'' \times \frac{1}{2}''$ Angle Bracket. The rear mudguards consist of Formed Slotted Strips attached to Obtuse Angle Brackets bolted to the $12\frac{1}{2}''$ Strips, and to $1'' \times 1''$ Angle Brackets at the rear.

The rear bumper makes use of two $3\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips joined by a Double Bracket, and it is attached by Fishplates to two $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips.

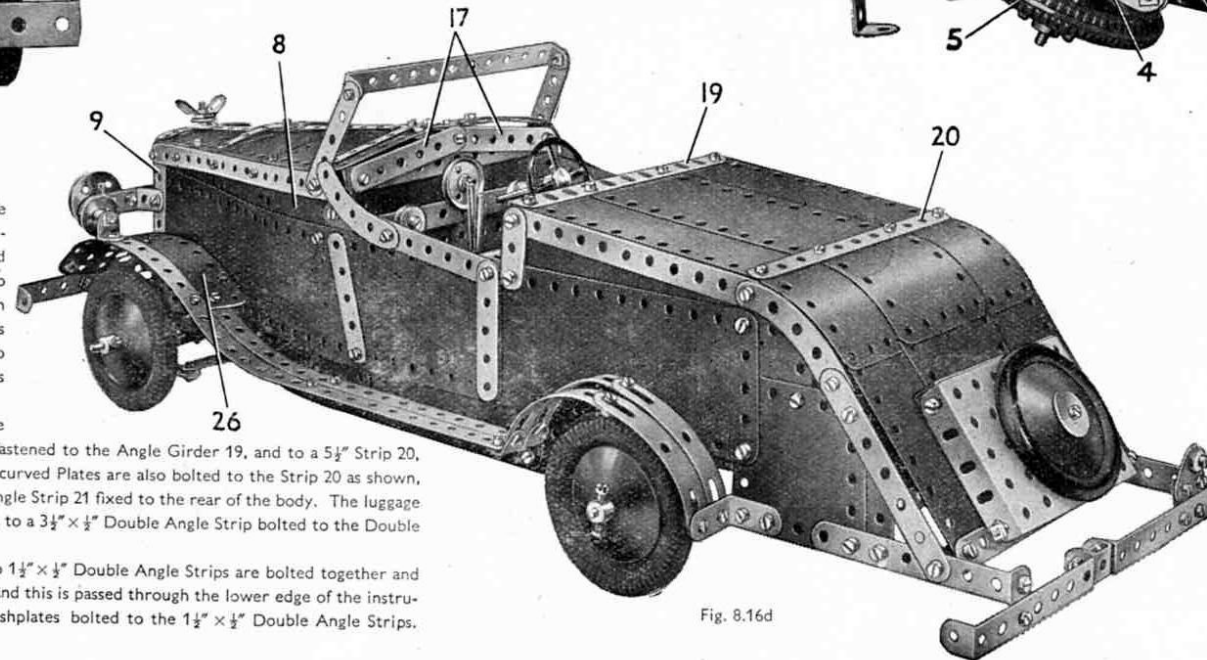


Fig. 8.16d

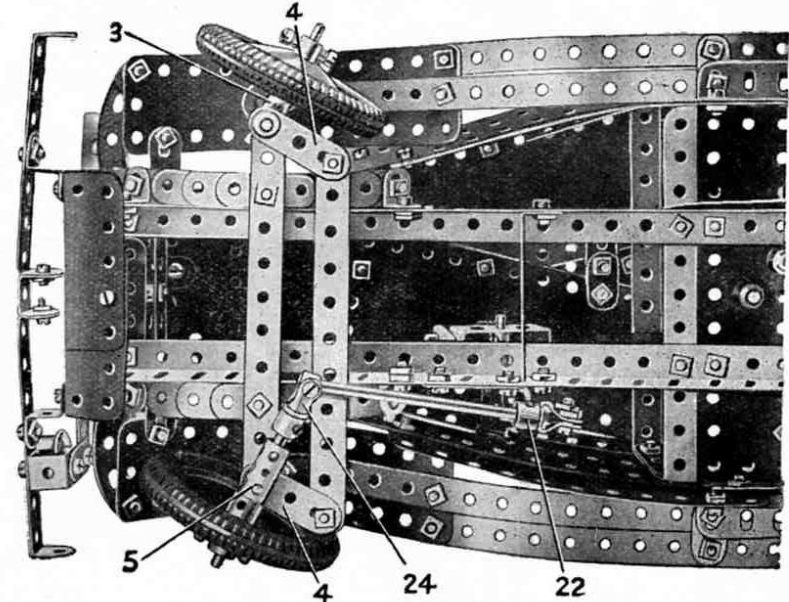


Fig. 8.16e

The front bumper also consists of two $3\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips and a Double Bracket, and it is attached by Reversed Angle Brackets to two U-Section Curved Plates 27 bolted to the front of the chassis.

The seat consists of a Hinged Flat Plate bolted to the Angle Girder 19. The lower half of the Hinged Flat Plate is held in a horizontal position by two $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips fixed to the opposite half of the Plate. The floor of the driving compartment is formed by two $4\frac{1}{2}'' \times 2\frac{1}{2}''$ and two $5\frac{1}{2}'' \times 1\frac{1}{2}''$ Flexible Plates.

8.17 MECHANICAL DIGGER

The side members of the tractor unit are $12\frac{1}{2}$ " Strip Plates strengthened along their edges by $12\frac{1}{2}$ " Angle Girders 1 and 2. The sides are joined at each end by a $5\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flexible Plate braced by $5\frac{1}{2}$ " Strips and attached by Angle Brackets to the Angle Girders 1 and 2. The top of the chassis is filled in by two $5\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flanged Plates 3 (Fig. 8.17a) and by two $5\frac{1}{2}$ " \times $1\frac{1}{2}$ " and two $5\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flexible Plates bolted to the Angle Girders 1.

The wheel covers are made by joining together a $2\frac{1}{2}$ " \times $1\frac{1}{2}$ " and three $5\frac{1}{2}$ " \times $1\frac{1}{2}$ " Flexible Plates and attaching these to Angle Brackets fixed to the Angle Girders 1. The Flexible Plates are strengthened at their outer edges by $12\frac{1}{2}$ " Strips 4 extended at each end by Formed Slotted Strips, and $12\frac{1}{2}$ " Strip Plates are attached by Angle Brackets to the Strips 4. The Strip Plates are braced by $12\frac{1}{2}$ " Strips and are fitted at each end with Curved Strips and $2\frac{1}{2}$ " Strips as shown.

The tractor unit travels on four pairs of wheels, each formed by a 2" Pulley fitted with a Motor Tyre, and a Road Wheel. These are mounted on $1\frac{1}{2}$ " and 2" Rods passed through holes in $5\frac{1}{2}$ " Strips 5. The Strips 5 are connected by a Reversed Angle Bracket and are pivoted at their centre holes on Rods passed through Trunnions bolted to the Angle Girders 2. Four 1" loose Pulleys fitted with Rubber Rings are placed between the Strips 5 and the Trunnions, and Double Brackets are held on the Rods between the Strips 5.

Each side of the cab is a $12\frac{1}{2}$ " Strip Plate, a $2\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flexible Plate and three $5\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flexible Plates. These are bolted to a $12\frac{1}{2}$ " Angle Girder 6, a $5\frac{1}{2}$ " Angle Girder 7 and a $5\frac{1}{2}$ " Strip 8. The Strip 8 and Angle Girder 7 are joined by two $12\frac{1}{2}$ " Strips. The sides are connected at the rear by two $5\frac{1}{2}$ " \times $\frac{1}{2}$ " Double Angle Strips, and at the front by a $5\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flexible Plate and three $5\frac{1}{2}$ " Strips bolted to the Angle Girders 7.

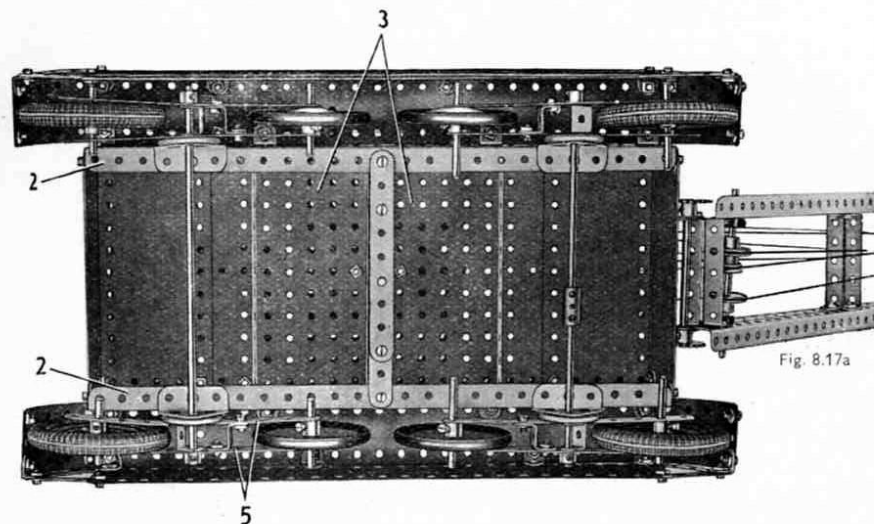
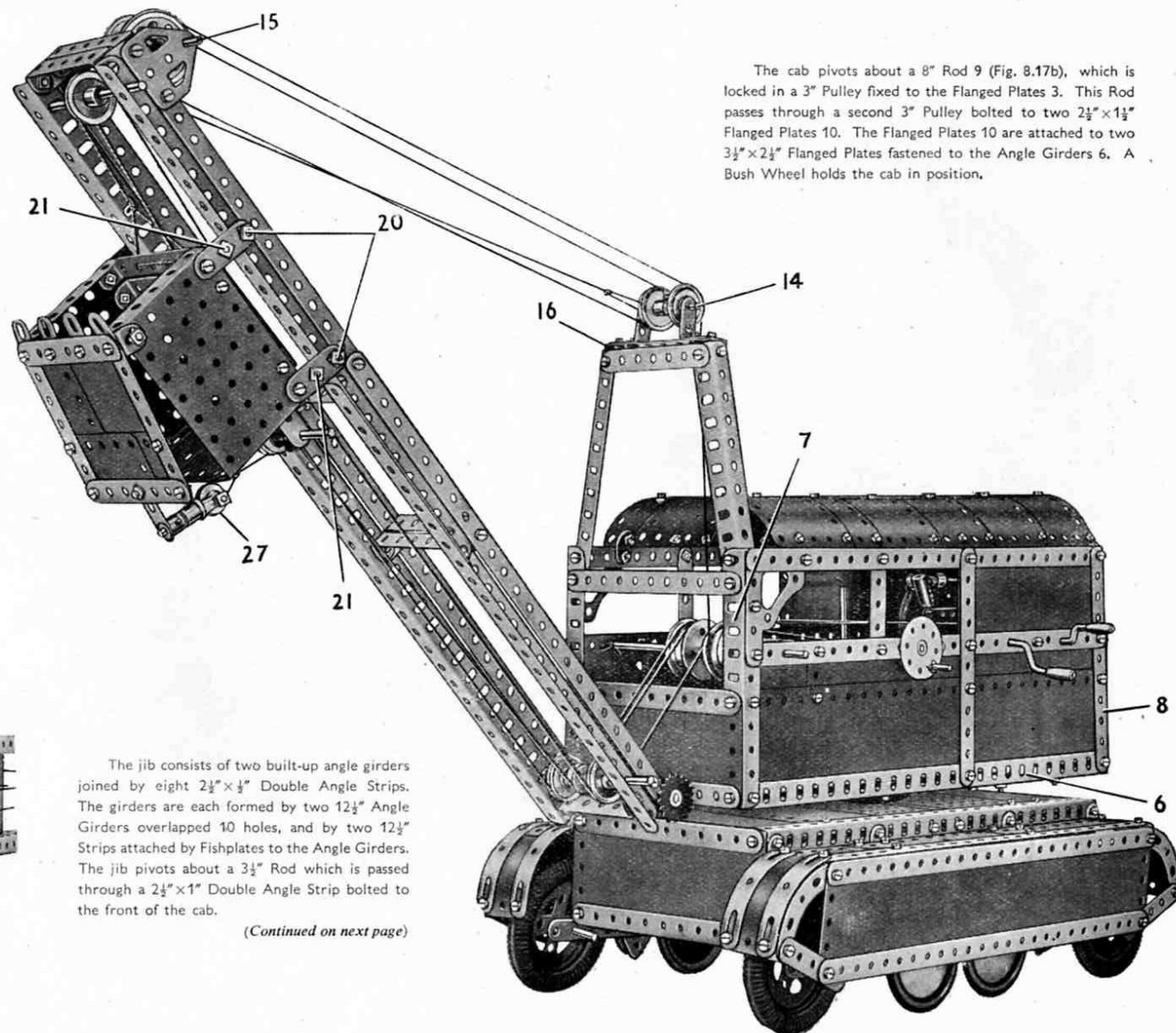


Fig. 8.17a



The cab pivots about a 8" Rod 9 (Fig. 8.17b), which is locked in a 3" Pulley fixed to the Flanged Plates 3. This Rod passes through a second 3" Pulley bolted to two $2\frac{1}{2}$ " \times $1\frac{1}{2}$ " Flanged Plates 10. The Flanged Plates 10 are attached to two $3\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flanged Plates fastened to the Angle Girders 6. A Bush Wheel holds the cab in position.

The jib consists of two built-up angle girders joined by eight $2\frac{1}{2}$ " \times $\frac{1}{2}$ " Double Angle Strips. The girders are each formed by two $12\frac{1}{2}$ " Angle Girders overlapped 10 holes, and by two $12\frac{1}{2}$ " Strips attached by Fishplates to the Angle Girders. The jib pivots about a $3\frac{1}{2}$ " Rod which is passed through a $2\frac{1}{2}$ " \times 1 " Double Angle Strip bolted to the front of the cab.

(Continued on next page)

8.17 MECHANICAL DIGGER—Continued

Luffing of the jib is operated by a 5" Crank Handle 11. This is passed through the side of the cab and through a $3\frac{1}{2}" \times 2\frac{1}{2}"$ Flanged Plate 12 fastened to the cab by two $2\frac{1}{2}" \times \frac{1}{2}"$ and one $2\frac{1}{2}" \times 1"$ Double Angle Strip. The Crank Handle is fitted with a drum consisting of a Sleeve Piece and two $\frac{3}{4}"$ Flanged Wheels. A length of Cord is tied to the drum and passed under the Flanged Wheels 13. It is then taken over a 1" Pulley mounted on a 2" Rod 14, and around a $1\frac{1}{2}"$ Pulley on a $3\frac{1}{2}"$ Rod 15. It is then taken around a second 1" Pulley on Rod 14 and a $1\frac{1}{2}"$ Pulley on Rod 15 and is tied to Rod 14. The Rod 14 is passed through $1" \times 1"$ Angle Brackets bolted to a $3\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strip 16 and the Rod 15 is held by Spring Clips in Flat Trunnions bolted to the jib.

A ratchet brake is fitted to the Crank Handle 11. This consists of a Pawl fixed by a nut on a $\frac{3}{4}"$ Bolt which is passed through a 1" Triangular Plate and fitted with a Coupling 17. The Triangular plate is attached to the Flanged Plate 12 by an Angle Bracket and the Pawl engages the teeth of a $\frac{1}{2}"$ Pinion fixed on the Crank Handle. The brake can be released by the Rod 18. This is passed through a Fishplate bolted to the rear of the cab and is held in a Fork Piece pivotally attached to the Coupling 17. The brake is normally in the "on" position, being held by a Compression Spring forced against the Fishplate by a Collar on the Rod 18.

The construction of the bucket can be seen in Fig. 8.17c. The sides are formed by two $3\frac{1}{2}" \times 2\frac{1}{2}"$ Flanged Plates which are held together at the top by four $3\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strips. The top is filled in by a $2\frac{1}{2}" \times 2\frac{1}{2}"$ and a $2\frac{1}{2}" \times 1\frac{1}{2}"$ Flexible Plate bolted to the inner pair of Double Angle Strips. The back also consists of a $2\frac{1}{2}" \times 2\frac{1}{2}"$ and a $2\frac{1}{2}" \times 1\frac{1}{2}"$ Flexible Plate. For the bottom of the bucket a $2\frac{1}{2}" \times 2\frac{1}{2}"$ and three $2\frac{1}{2}" \times 1\frac{1}{2}"$ Flexible Plates are used, and it is pivotally attached to the sides by Angle Brackets and lock-nutted bolts. A Crank 19 supports a 1" Rod fitted with a fork piece obtained by removing the spider from a Swivel Bearing. A $\frac{1}{2}"$ loose Pulley 27 is held in the fork piece by a Pivot Bolt. The bucket is free to slide on the jib between Collars held by lock-nutted bolts 20, and Washers fixed on the Bolts 21. The Bolts 20 and 21 are attached to $1\frac{1}{2}"$ Strips fixed to the sides of the bracket.

Movement of the bucket is controlled by a Crank Handle 22 fitted with a drum consisting of a Sleeve Piece and two $\frac{3}{4}"$ Flanged Wheels. A length of Cord is given several turns around the drum and is led over the Flanged Wheels 13 and under a 1" Pulley mounted on a Rod 23. It is then passed around a 1" Pulley held on a $3\frac{1}{2}"$ Rod in the jib head and is tied to the front of the bucket. A second length of Cord is tied to the back of the bucket and passed under a 1" Pulley on Rod 23. It is led over the Flanged Wheels 24 and is tied to the winding drum in such a way that as the first Cord is unwound the second is wound in.

The bottom of the bucket is released or unloading by turning a Bush Wheel fixed on a Rod 25. A length of Cord fastened to a Cord Anchoring Spring on this Rod is passed over the Flanged Wheels 24, and under a $\frac{1}{2}"$ Pulley on Rod 23. It is then taken around one of the $\frac{1}{2}"$ Pulleys 26 and the $\frac{1}{2}"$ Pulley 27, and over the other Pulley 26. It is tied to a $3\frac{1}{2}"$ Rod mounted at the end of the jib. The Pulleys 26 are free to turn on a $3\frac{1}{2}"$ Rod passed through $1" \times 1"$ Angle Brackets bolted to the back of the bucket.

The sides of the roof are formed by $1\frac{1}{4}"$ radius Curved Plates and $2\frac{1}{2}" \times 2\frac{1}{2}"$ Flexible Plates. The centre is filled in by $4\frac{1}{2}" \times 2\frac{1}{2}"$ Flexible Plates and the complete roof is attached to Obtuse Angle Brackets fixed to the sides of the cab.

A Boiler is bolted at the rear of the cab, and is suitably weighted to act as a counter-balance.

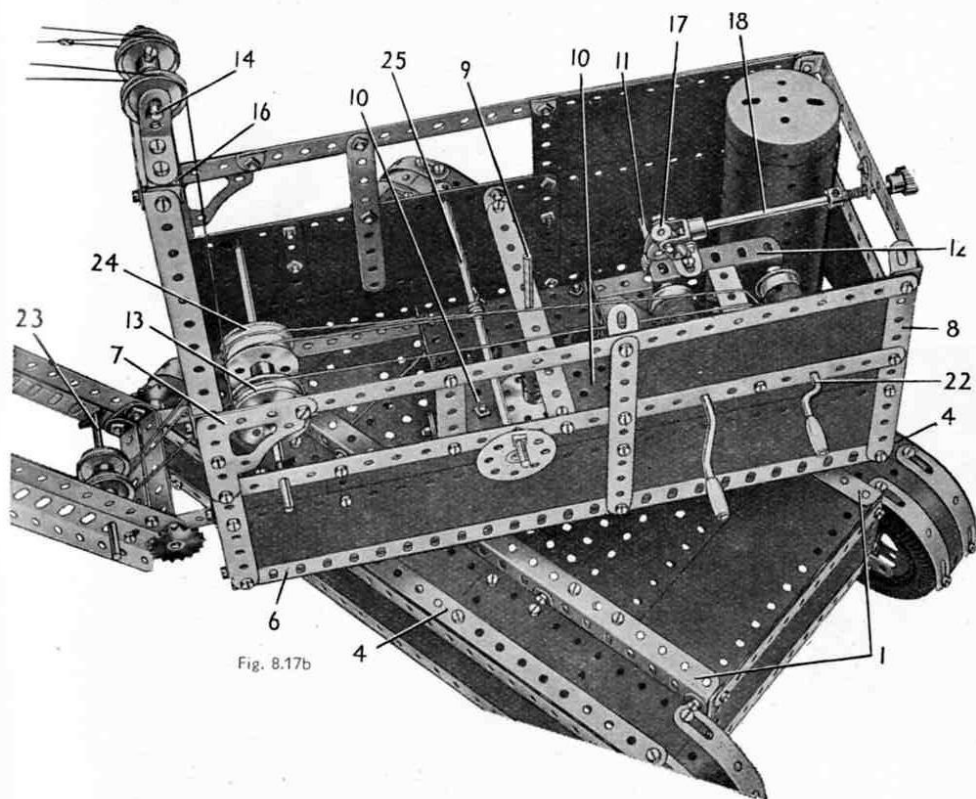


Fig. 8.17b

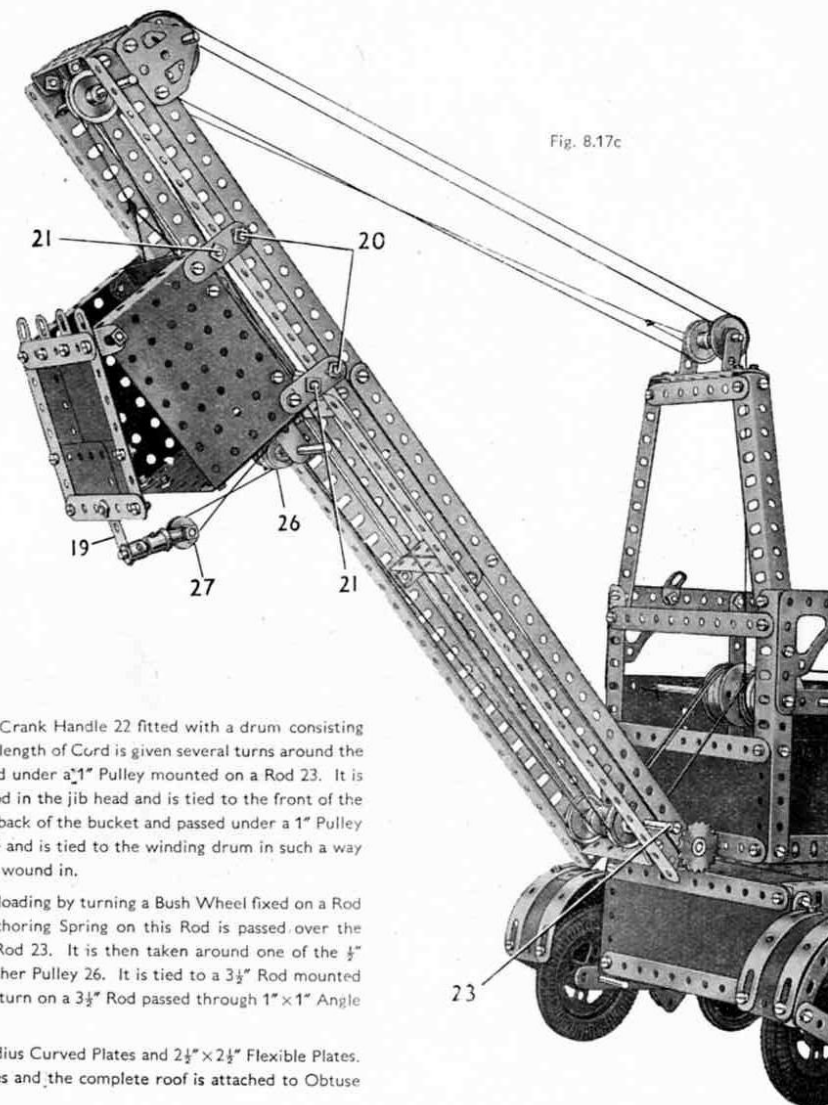
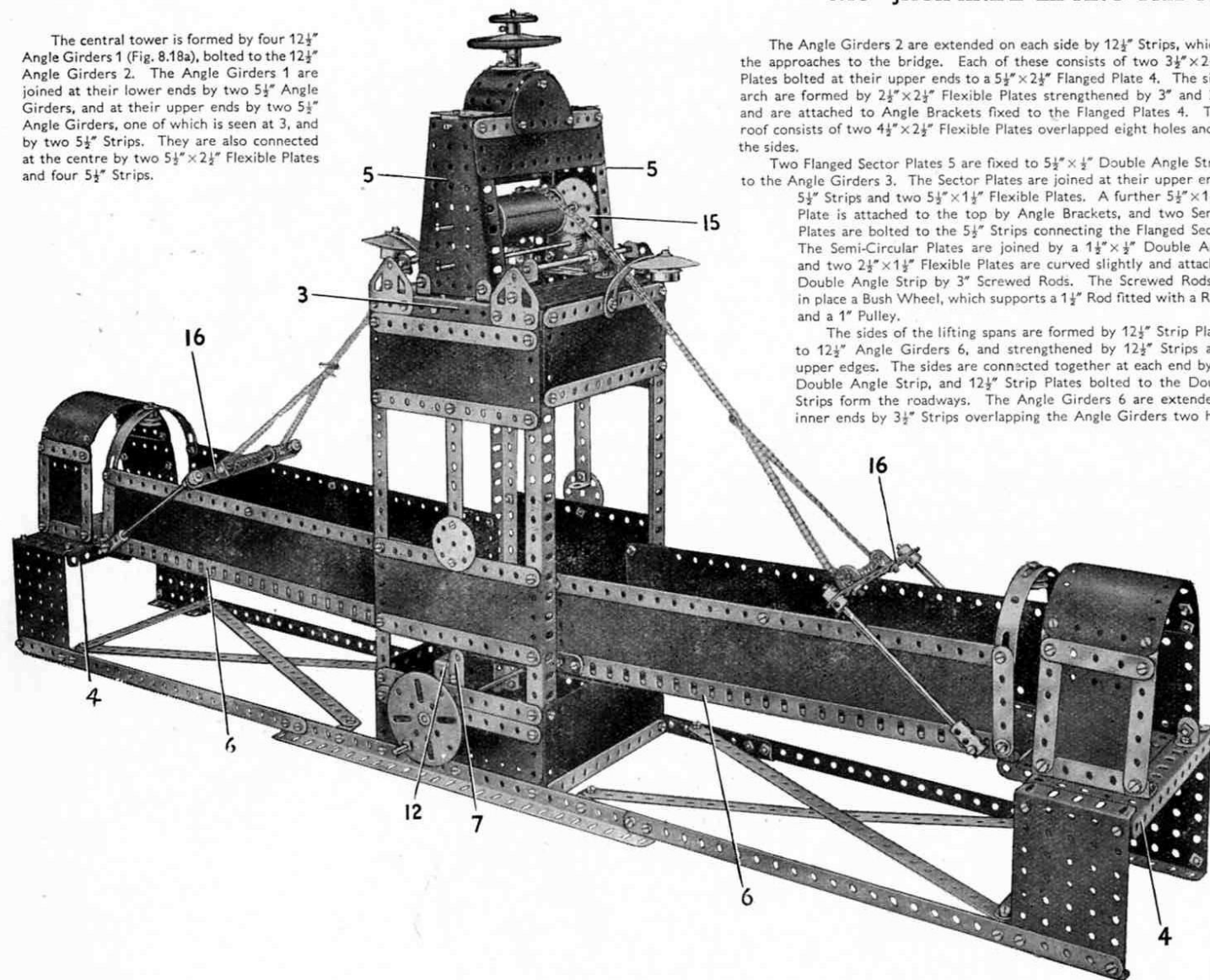


Fig. 8.17c

8.18 JACK-KNIFE LIFTING BRIDGE

The central tower is formed by four $12\frac{1}{2}"$ Angle Girders 1 (Fig. 8.18a), bolted to the $12\frac{1}{2}"$ Angle Girders 2. The Angle Girders 1 are joined at their lower ends by two $5\frac{1}{2}"$ Angle Girders, and at their upper ends by two $5\frac{1}{2}"$ Angle Girders, one of which is seen at 3, and by two $5\frac{1}{2}"$ Strips. They are also connected at the centre by two $5\frac{1}{2}" \times 2\frac{1}{2}"$ Flexible Plates and four $5\frac{1}{2}"$ Strips.



The Angle Girders 2 are extended on each side by $12\frac{1}{2}"$ Strips, which support the approaches to the bridge. Each of these consists of two $3\frac{1}{2}" \times 2\frac{1}{2}"$ Flanged Plates bolted at their upper ends to a $5\frac{1}{2}" \times 2\frac{1}{2}"$ Flanged Plate 4. The sides of the arch are formed by $2\frac{1}{2}" \times 2\frac{1}{2}"$ Flexible Plates strengthened by $3"$ and $2\frac{1}{2}"$ Strips, and are attached to Angle Brackets fixed to the Flanged Plates 4. The curved roof consists of two $4\frac{1}{2}" \times 2\frac{1}{2}"$ Flexible Plates overlapped eight holes and joined to the sides.

Two Flanged Sector Plates 5 are fixed to $5\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strips bolted to the Angle Girders 3. The Sector Plates are joined at their upper ends by two $5\frac{1}{2}"$ Strips and two $5\frac{1}{2}" \times 1\frac{1}{2}"$ Flexible Plates. A further $5\frac{1}{2}" \times 1\frac{1}{2}"$ Flexible Plate is attached to the top by Angle Brackets, and two Semi-Circular Plates are bolted to the $5\frac{1}{2}"$ Strips connecting the Flanged Sector Plates. The Semi-Circular Plates are joined by a $1\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strip, and two $2\frac{1}{2}" \times 1\frac{1}{2}"$ Flexible Plates are curved slightly and attached to the Double Angle Strip by $3"$ Screwed Rods. The Screwed Rods also hold in place a Bush Wheel, which supports a $1\frac{1}{2}"$ Rod fitted with a Road Wheel and a $1"$ Pulley.

The sides of the lifting spans are formed by $12\frac{1}{2}"$ Strip Plates bolted to $12\frac{1}{2}"$ Angle Girders 6, and strengthened by $12\frac{1}{2}"$ Strips along their upper edges. The sides are connected together at each end by a $3\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strip, and $12\frac{1}{2}"$ Strip Plates bolted to the Double Angle Strips form the roadways. The Angle Girders 6 are extended at their inner ends by $3\frac{1}{2}"$ Strips overlapping the Angle Girders two holes. The

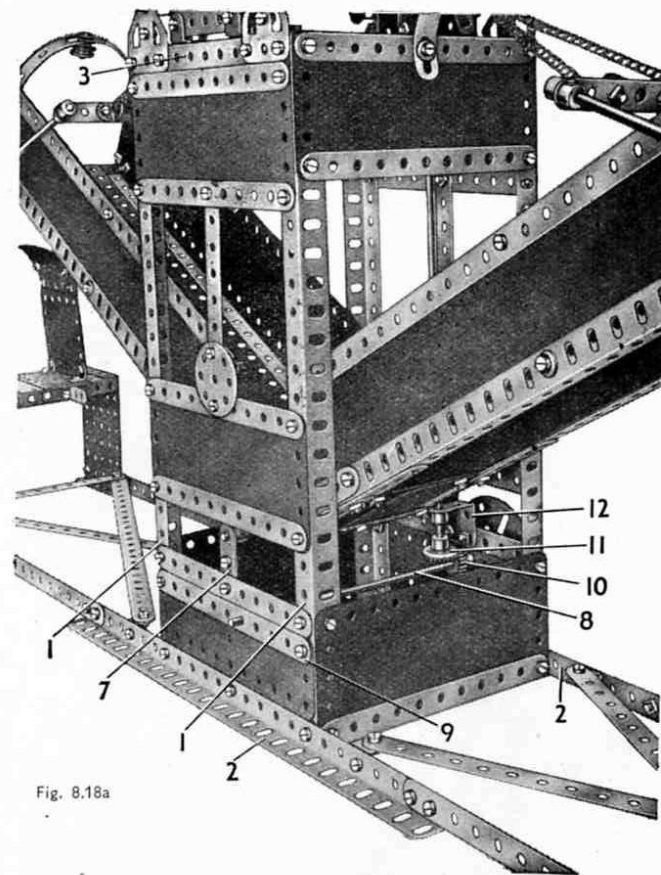


Fig. 8.18a

roadway of each span is extended by two $2\frac{1}{2}" \times 2\frac{1}{2}"$ Flexible Plates overlapped three holes and fixed to the Angle Girders 6. The Flexible Plates are braced by $4\frac{1}{2}"$ and $2\frac{1}{2}"$ Strips.

The spans pivot on $1\frac{1}{2}"$ Rods passed through the end holes of the $3\frac{1}{2}"$ Strips bolted to the Angle Girders 6. These Rods are fixed in Cranks, which are supported by a $3\frac{1}{2}"$ Strip 7 on each side of the tower.

The spans are raised by turning a Face Plate fixed on a $6\frac{1}{2}"$ Rod 8, which is mounted in a $5\frac{1}{2}"$ Strip 9 on each side of the tower. This Rod is fitted with a $\frac{1}{2}"$ Pinion that meshes with a $\frac{3}{4}"$ Contrate Wheel 11 fixed on an $11\frac{1}{2}"$ Rod mounted in a $1" \times 1"$ Angle Bracket 12 and in a Fishplate bolted to one of the Angle Girders 3. It carries a Worm 13 (Fig. 8.18b), which meshes with a $\frac{1}{2}"$ Pinion locked on a $6\frac{1}{2}"$ Rod 14 passed through the Flanged Sector Plates 5. The Rod 14 carries a second $\frac{1}{2}"$ Pinion meshed with a 57-tooth Gear 15. The Gear 15 is fixed on a $6\frac{1}{2}"$ Rod, which is fitted with a winding

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8.18 JACK-KNIFE LIFTING BRIDGE—Continued

drum formed by a $2\frac{1}{2}$ " Cylinder and two $1\frac{1}{2}$ " Flanged Wheels. Two lengths of Sprocket Chain are attached by short pieces of Cord to this drum and arranged so that both are wound in as the drum rotates. The Sprocket Chain is passed through the slotted holes of Angle Brackets bolted to $4\frac{1}{2}$ " Strips 16. These Strips are attached to $4\frac{1}{2}$ " Rods by Collars fixed on the Rods, and the ends of the Rods are held in Couplings. The Couplings are pivotally attached to the lifting spans, two Pivot Bolts and two $\frac{3}{8}$ " Bolts being used for this purpose. The Sprocket Chain runs over idler Sprockets carried on 5" Rods. These Rods are mounted in Reversed Angle Brackets fixed to Flat Trunnions bolted to the Angle Girders 3.

When the bridge is in the lowered position, the spans rest on $1" \times 1"$ Angle Brackets bolted to the Flanged Plates 4.

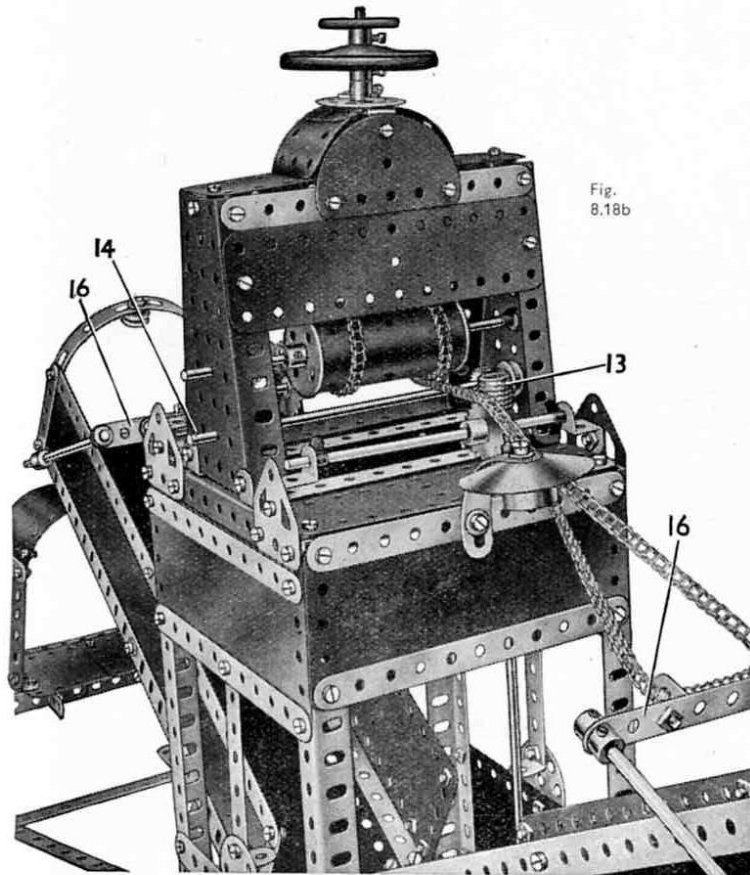


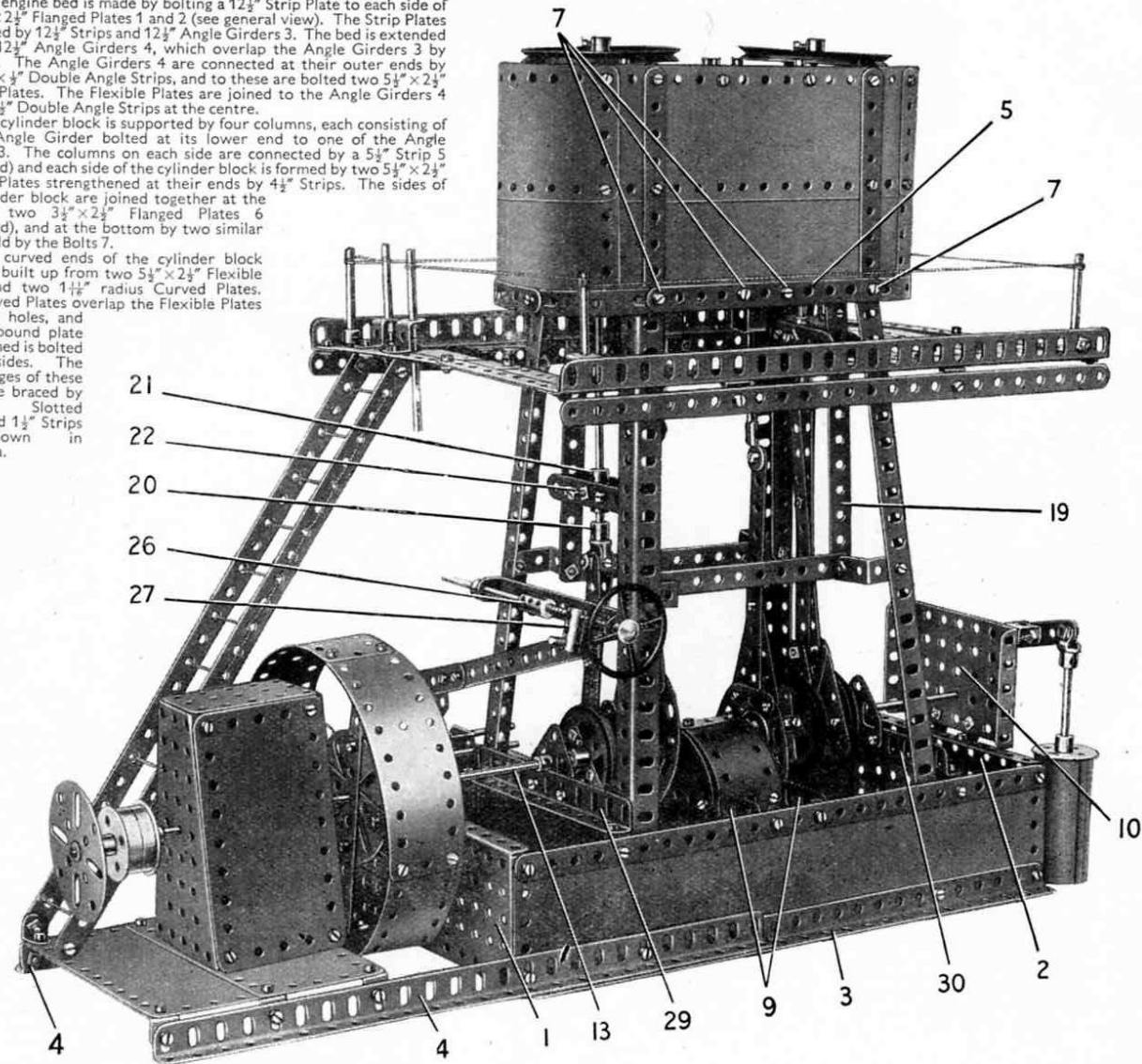
Fig. 8.18b

8.19 MARINE STEAM ENGINE

The engine bed is made by bolting a $12\frac{1}{2}$ " Strip Plate to each side of the $5\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flanged Plates 1 and 2 (see general view). The Strip Plates are braced by $12\frac{1}{2}$ " Strips and $12\frac{1}{2}$ " Angle Girders 3. The bed is extended by two $12\frac{1}{2}$ " Angle Girders 4, which overlap the Angle Girders 3 by 11 holes. The Angle Girders 4 are connected at their outer ends by two $5\frac{1}{2}$ " \times $\frac{1}{2}$ " Double Angle Strips, and to these are bolted two $5\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flexible Plates. The Flexible Plates are joined to the Angle Girders 4 by $2\frac{1}{2}$ " \times $\frac{1}{2}$ " Double Angle Strips at the centre.

The cylinder block is supported by four columns, each consisting of a $12\frac{1}{2}$ " Angle Girder bolted at its lower end to one of the Angle Girders 3. The columns on each side are connected by a $5\frac{1}{2}$ " Strip 5 (Fig. 8.19d) and each side of the cylinder block is formed by two $5\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flexible Plates strengthened at their ends by $4\frac{1}{2}$ " Strips. The sides of the cylinder block are joined together at the top by two $3\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flanged Plates 6 (Fig. 8.19d), and at the bottom by two similar Plates held by the Bolts 7.

The curved ends of the cylinder block are each built up from two $5\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flexible Plates and two $1\frac{1}{2}$ " radius Curved Plates. The Curved Plates overlap the Flexible Plates by three holes, and the compound plate thus formed is bolted to the sides. The lower edges of these Plates are braced by Formed Slotted Strips and $1\frac{1}{2}$ " Strips as shown in Fig. 8.19a.



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8.19 MARINE STEAM ENGINE—Continued

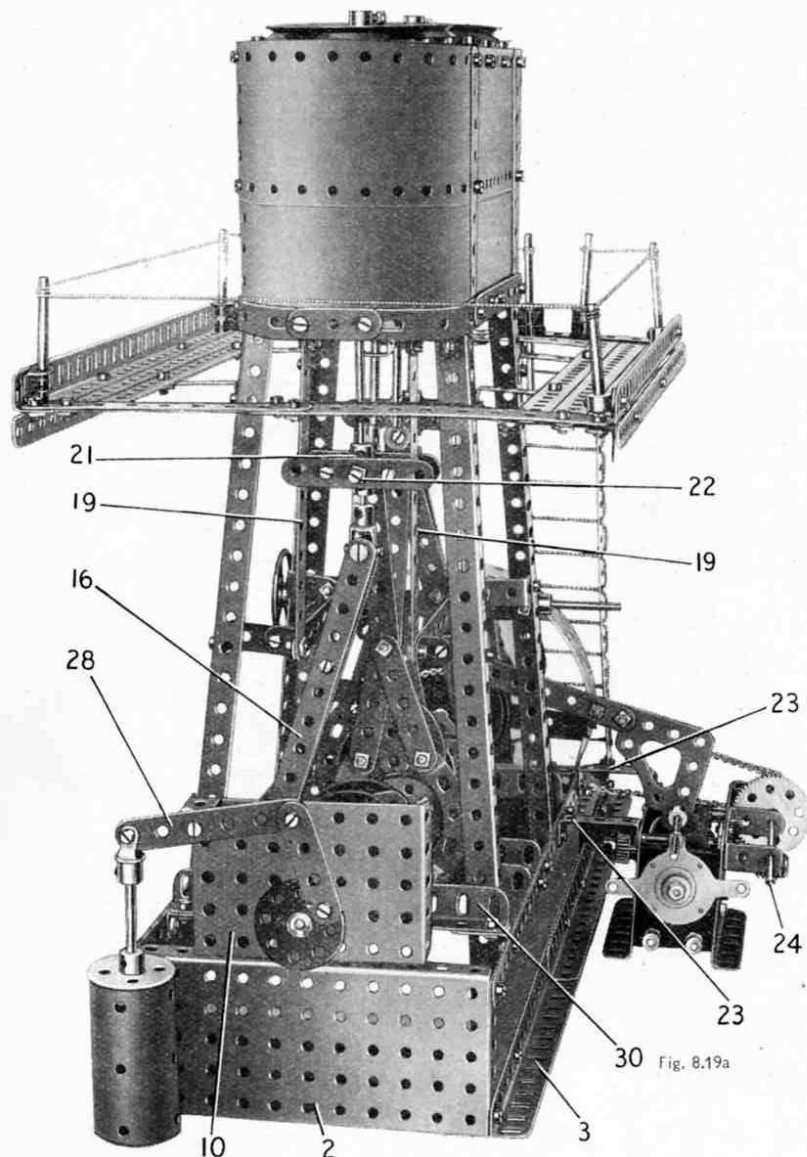


Fig. 8.19a

The top of the cylinder block between the Flanged Plates 6 is filled in by two $2\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plates, and two $2\frac{1}{2}''$ Curved Strips 8 are added at each end. A $3''$ Pulley representing the cylinder head is held on a Bolt passed through each of the Plates 6.

The centre bearing for the crankshaft is provided by two Semi-Circular Plates. These are bolted to $5\frac{1}{2}''$ Angle Girders 9, which are attached to the sides of the engine bed by Angle Brackets. A cover plate consisting of two $2\frac{1}{2}'' \times 1\frac{1}{2}''$ Flexible Plates is also attached to the Girders 9 (Fig. 8.19d) by Angle Brackets. The bearings at one end are formed by a Flat Trunnion bolted to the Flanged Plate 1, and by a second Flat Trunnion attached to a $5\frac{1}{2}''$ Angle Girder 29. At the other end the bearings consist of a Flat Trunnion fixed to a $5\frac{1}{2}''$ Angle Girder 30, and a $3\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate 10 (Fig. 8.19a), bolted to Angle Brackets fixed to Plate 2. The Girder 29 is attached to the base by $1'' \times 1''$ Angle Brackets, and the Girder 30 is bolted to $1'' \times \frac{1}{2}''$ Angle Brackets.

The crankshaft is in three sections, consisting of a $4''$ Rod 11, a $4\frac{1}{2}''$ Rod at the centre, and a $6\frac{1}{2}''$ Rod 13. One of the cranks and eccentrics is seen removed from the engine in Fig. 8.19c. Each web of the crank consists of two $2\frac{1}{2}''$ Strips 14 bolted to a $2''$ Pulley. A $\frac{3}{4}''$ Bolt 15 is passed through one of the webs and held tightly by a nut. Two $5\frac{1}{2}''$ Strips 16 representing the connecting rod are then passed over the Bolt, a Collar being placed between them for spacing purposes. The Bolt is then fixed to the second web of the Crank by two nuts.

The sheave of the eccentric consists of a $1\frac{1}{2}''$ Pulley, and a Crank 17 is bolted across the face of this as shown. The strap is formed by two $2\frac{1}{2}''$ stepped Curved Strips joined together at each end by a $1\frac{1}{2}''$ Strip. This assembly is fitted in the groove of the $1\frac{1}{2}''$ Pulley.

The eccentric is connected to the valve operating rod by a $5\frac{1}{2}''$ Strip 18, which is bolted to $2\frac{1}{2}''$ Strips fixed to the upper ends of the Curved Strips.

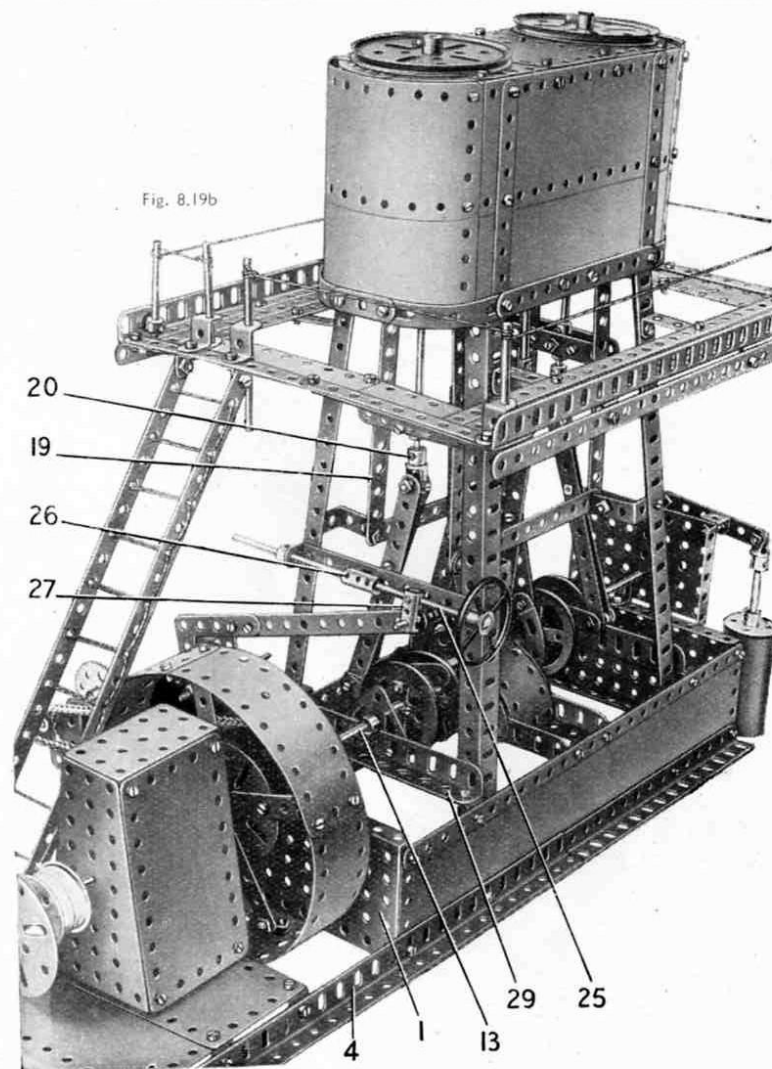
One of the eccentrics is passed over each end of the $4\frac{1}{2}''$ Rod, and one web of each crank is also fixed to each end of this Rod. The other webs of the cranks are fixed to Rods 11 and 13 respectively.

The upper ends of the Strips 18 are connected by Rod and Strip Connectors to $5''$ Rods mounted in the Flanged Plates held by Bolts 7 and in Double Bent Strips bolted to the Plates. The Bolts joining the Strips to the Rod and Strip Connectors are lock-nutted.

The slide bars for the piston rods are $5\frac{1}{2}''$ Strips 19 (Fig. 8.19a) attached by Angle Brackets to the cylinder block. The lower ends of these Strips are also fitted with Angle Brackets, which are joined by $1'' \times 1''$ Angle Brackets to the cylinder block supporting columns. The Strips 19 on each side are also connected together by a horizontal $5\frac{1}{2}''$ Strip.

The crossheads are built up by connecting a Swivel Bearing 20 (Fig. 8.19b) to the ends of the Strips 16 by means of a Pivot Bolt. A $1''$ Rod is held in the Swivel Bearing and also in the end of a Coupling 21 (Fig. 8.19a). This Coupling carries also a $4\frac{1}{2}''$ Rod representing the piston rod. A $\frac{3}{4}''$ Bolt 22 is fitted with a nut and passed through the centre hole of a $2\frac{1}{2}''$ Strip. It is then screwed into the centre tapped hole of the Coupling 21, two Washers being used to space the Strip from the Coupling. The nut is then tightened to hold the Strip firmly in position. A second $2\frac{1}{2}''$ Strip is similarly attached to the opposite side of the Coupling, and the two Strips are connected by Double Brackets.

Fig. 8.19b



(Continued on next page)

8.19 MARINE STEAM ENGINE—Continued

The model is driven by an E20R Electric Motor that is connected to the base by two $1\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strips 23 (Fig. 8.19d), and by a 3" Strip connected to the Motor and to one of the Girders 4 by Angle Brackets. A Worm fixed on the Motor armature shaft meshes with a 57-tooth Gear on a Rod 24 that is fitted also with a $\frac{3}{4}"$ Sprocket linked by Chain to a 2" Sprocket on Rod 13. Rod 24 is mounted in a $2\frac{1}{2}" \times 1"$ Double Angle Strip and a Channel Bearing bolted as shown to one of the Motor side-plates.

The Motor reversing switch is controlled by turning a Steering Wheel fixed on a 3" Screwed Rod 25 (Fig. 8.19b). The inner end of this Rod is fitted with a Coupling 26, and a second Coupling 27 is screwed on to the Rod by one of its threaded holes. The Screwed Rod 25 is extended by a $3\frac{1}{2}"$ Rod held in Coupling 26, and the composite rod thus formed is mounted in a $4\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strip bolted to two of the main cylinder supporting columns.

A $5\frac{1}{2}"$ Strip is pivoted on a $\frac{3}{4}"$ Bolt fixed in Coupling 27, and is extended by a Corner Gusset. The Corner Gusset is passed over a Screwed Rod fixed tightly by two nuts to the upper arm of the Motor control switch. The Corner Gusset is prevented from sliding on the Screwed Rod by a Collar on one side and by two nuts locked together on the other side (see Fig. 8.19d).

The rim of the flywheel consists of four $5\frac{1}{2}" \times 1\frac{1}{2}"$ Flexible Plates bolted together to form a complete circle. It is attached by Angle Brackets to $5\frac{1}{2}"$ Strips bolted across a Face Plate, and the completed wheel is fixed on Rod 13. It is spaced from the 2" Sprocket on this Rod by a Rod Wheel.

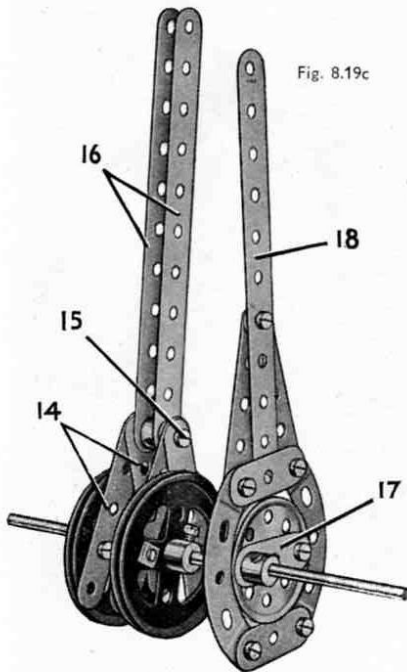


Fig. 8.19c

The thrust block consists of two Flanged Sector Plates attached by Angle Brackets to the base. The sides are filled in by $4\frac{1}{2}" \times 2\frac{1}{2}"$ Flexible Plates, and the top consists of a $2\frac{1}{2}" \times 1\frac{1}{2}"$ Flanged Plate held by a 3" Screwed Rod. The Rod 13 is extended by a 4" Rod joined to it inside the thrust block by a Rod Connector.

The feed pump is represented by a $2\frac{1}{2}"$ Cylinder fitted with a $1\frac{1}{2}"$ Flanged Wheel. It is operated by a crank formed by a Bush Wheel fixed on the end of Rod 11. A 2" Strip is lock-nutted to the Bush Wheel, and to a 3" Strip 28 (Fig. 8.19a). This Strip is pivoted by a lock-nutted Bolt fixed to a Double Bracket bolted to Plate 10. The pump rod consists of a $3\frac{1}{2}"$ Rod attached to the Strip 28 by an End Bearing.

The inspection platform is supported by a $2\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strip bolted to each of the cylinder block supporting columns. The sides of the platform are formed by $12\frac{1}{2}"$ Angle Girders and Strips bolted to the Double Angle Strips, and the ends consist of two $5\frac{1}{2}" \times 1\frac{1}{2}"$ Flexible Plates overlapped four holes. These Plates are braced by a $5\frac{1}{2}"$ and a $4\frac{1}{2}"$ Strip overlapped two holes. The ladder consists of two $12\frac{1}{2}"$ Strips bolted to Angle Brackets attached to the base and to the inspection platform. The rungs are made by threading Cord through the $12\frac{1}{2}"$ Strips. The handrail is represented by Cord tied to Rods held by Spring Clips in an Angle Bracket, three $\frac{1}{2}"$ Reversed Angle Brackets and two Collars, bolted to the platform.

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

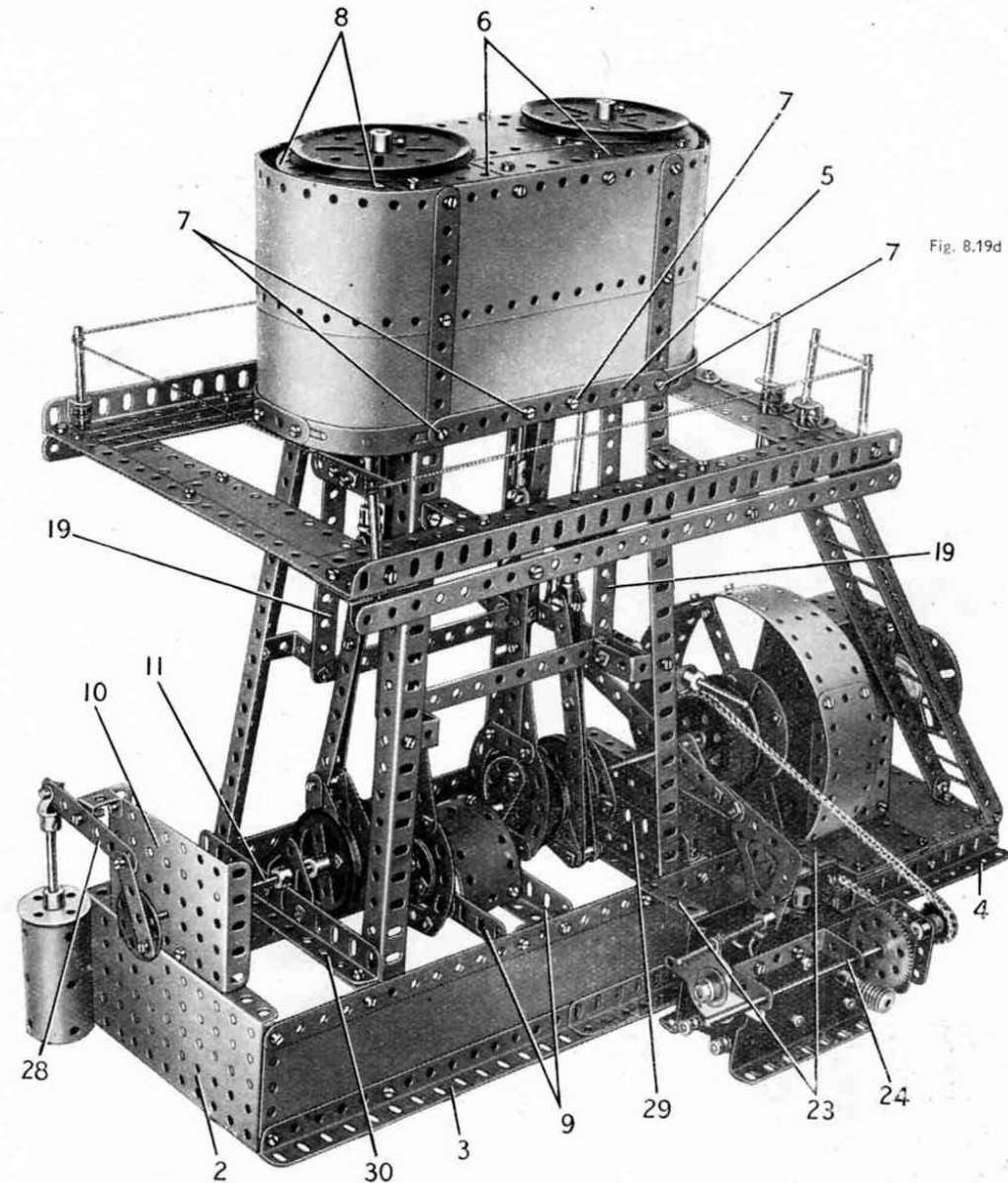


Fig. 8.19d

8.20 TRAVELLING GANTRY CRANE

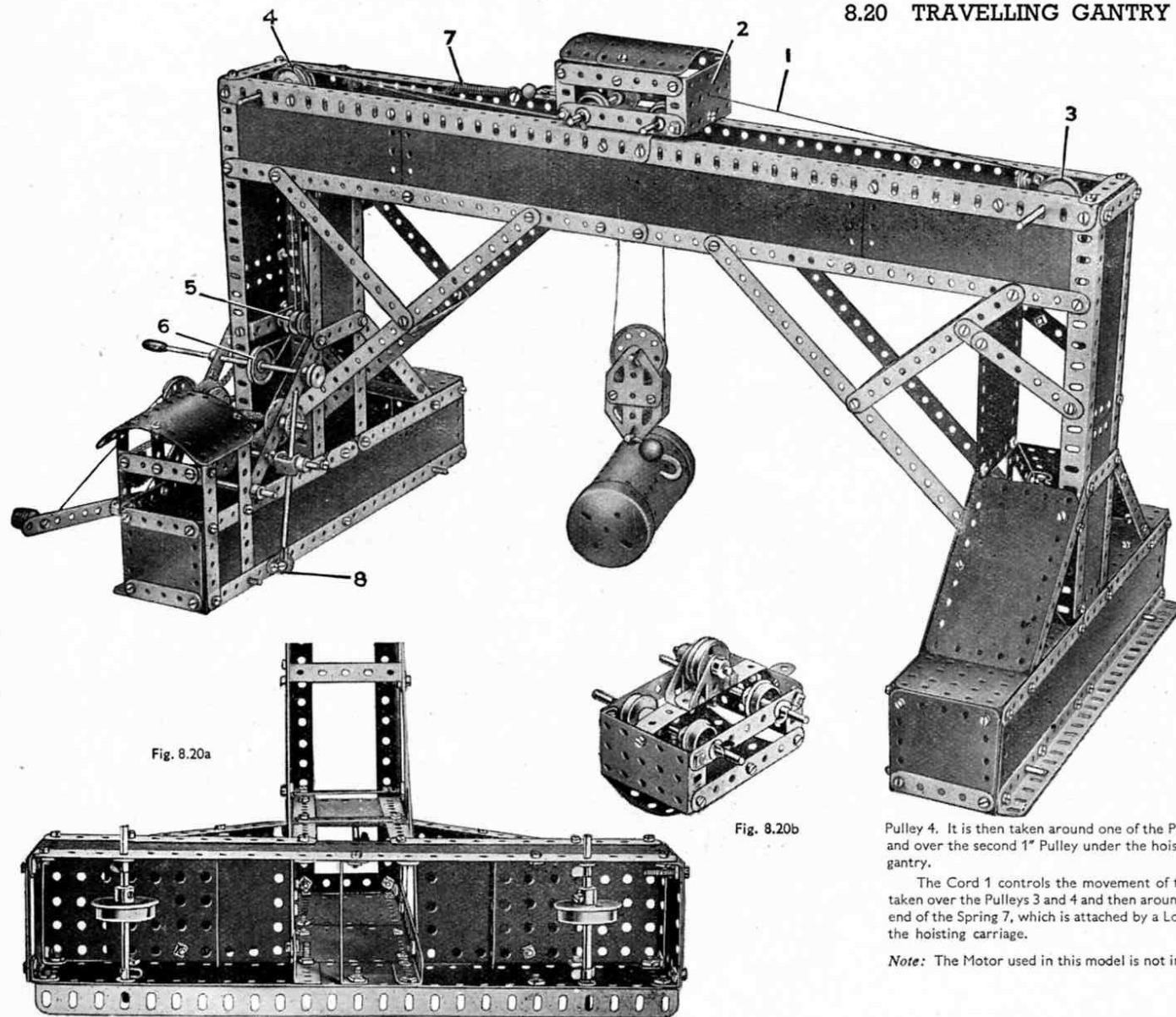


Fig. 8.20a

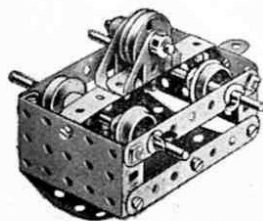


Fig. 8.20b

The rails along which the hoisting carriage runs each consist of two $12\frac{1}{2}$ " Angle Girders bolted together overlapping three holes. The girders are spaced apart by $2\frac{1}{2}$ " Strips and each is extended downward as shown in the illustration by a $12\frac{1}{2}$ " Strip Plate and two $5\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flexible Plates. The rails are supported by $12\frac{1}{2}$ " Angle Girders from the bases, one of which is shown in Fig. 8.20a. It consists of two $12\frac{1}{2}$ " Strip Plates joined at each end by a $2\frac{1}{2}$ " \times $\frac{1}{2}$ " Double Angle Strip and is filled in at the top by two $3\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flanged Plates and two $2\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flexible Plates. The sides of the $12\frac{1}{2}$ " \times $2\frac{1}{2}$ " Strip Plates are reinforced by $12\frac{1}{2}$ " Strips and Angle Girders, the latter forming the bearings for the axles.

The axles are $3\frac{1}{2}$ " Rods, and each carries at its centre a $1\frac{1}{2}$ " Flanged Wheel and is held in position by Spring Clips. The hoisting carriage is built up by joining the flanges of two $2\frac{1}{2}$ " \times $1\frac{1}{2}$ " Flanged Plates by $3\frac{1}{2}$ " Strips. The roof is formed by two $1\frac{1}{2}$ " radius Curved Plates overlapped three holes, and is secured in position by Obtuse Angle Brackets. A $3\frac{1}{2}$ " \times $\frac{1}{2}$ " Double Angle Strip is bolted between the two Flanged Plates as shown in Fig. 8.20b and two Trunnions are fastened to its centre. A $1\frac{1}{2}$ " Rod, which carries two $1"$ loose Pulleys, is secured by Collars in the holes at the narrow ends of the Trunnions.

Fig. 8.20c shows the arrangement of the Motor and gearing. The Motor is bolted to one of the supporting $12\frac{1}{2}$ " Angle Girders and a $\frac{3}{4}"$ Sprocket is locked on the end of its driving shaft. This Sprocket Wheel is connected by Chain to a $1"$ Sprocket Wheel on a $\frac{1}{2}"$ Rod journaled as shown. The Rod carries at its centre a $\frac{1}{2}"$ Pinion, which meshes with a 57-tooth Gear on a $5"$ Rod that can be seen in Fig. 8.20c. The Rod is capable of about $\frac{1}{4}"$ lateral movement, so that the 57-tooth Gear can be moved into or out of mesh with the $\frac{1}{2}"$ Pinion. The position of the Rod carrying the 57-tooth Gear is controlled by a second $5"$ Rod, which is pivoted at 8, and held at its upper end in a Double Bracket, secured on the first $5"$ Rod by two Collars.

In addition to the 57-tooth Gear, the $5"$ Rod carries also a $\frac{1}{2}"$ Pinion that meshes with a 57-tooth Gear on the $\frac{1}{2}"$ Rod that can be seen in Fig. 8.20c carrying a $1\frac{1}{2}"$ Pulley at its end. Cord is tied to a Cord Anchoring Spring on the $\frac{1}{2}"$ Rod, wound around it several times, then passed under one of the $\frac{1}{2}"$ Pulleys 5 and over the centre $1"$

Pulley 4. It is then taken around one of the Pulleys under the hoisting carriage, through the pulley block and over the second $1"$ Pulley under the hoisting carriage. Finally it is tied to the right-hand end of the gantry.

The Cord 1 controls the movement of the carriage and is tied to the $2\frac{1}{2}"$ \times $1\frac{1}{2}"$ Flanged Plate at 2, taken over the Pulleys 3 and 4 and then around the $1"$ Pulley 6 on the Crank Handle. It is then tied to the end of the Spring 7, which is attached by a Loaded Hook to a $1\frac{1}{2}"$ \times $1"$ Angle Bracket bolted to the side of the hoisting carriage.

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

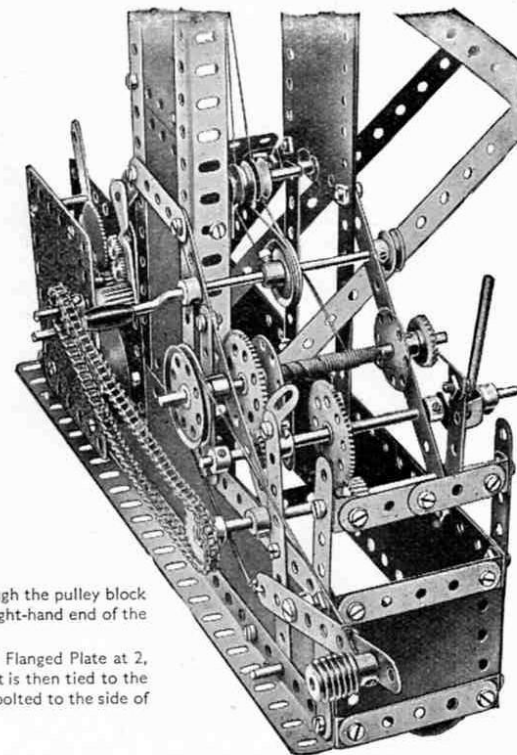


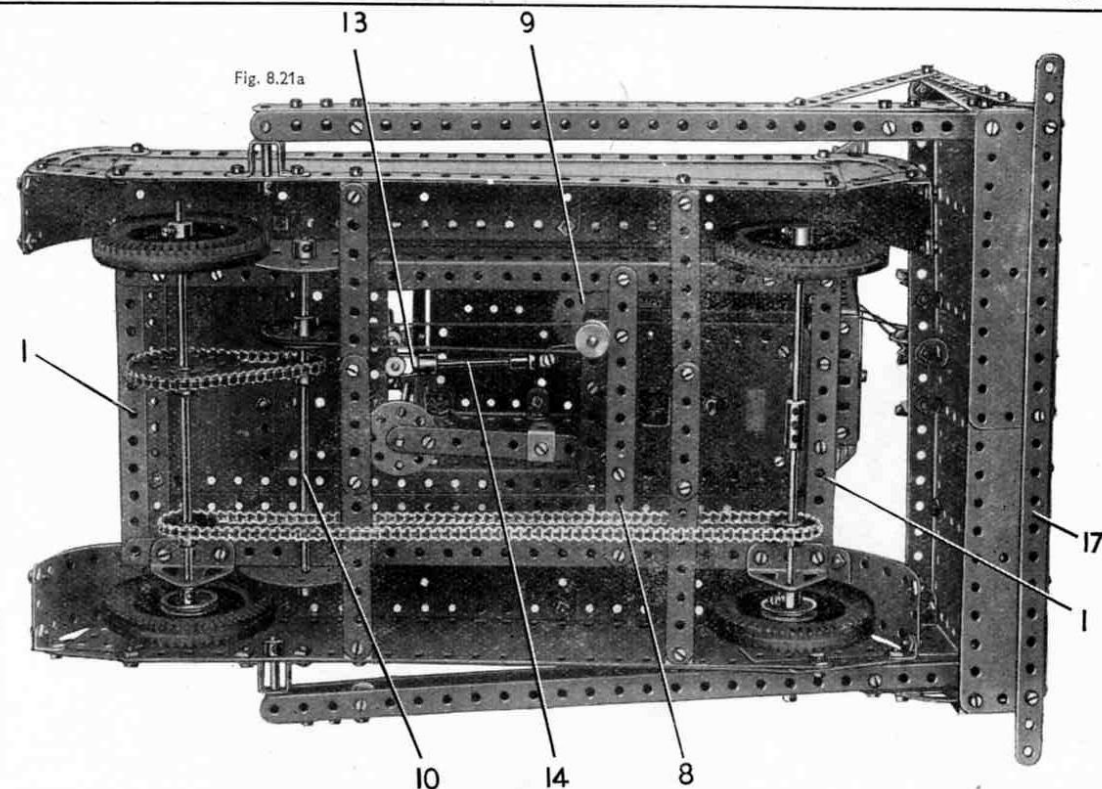
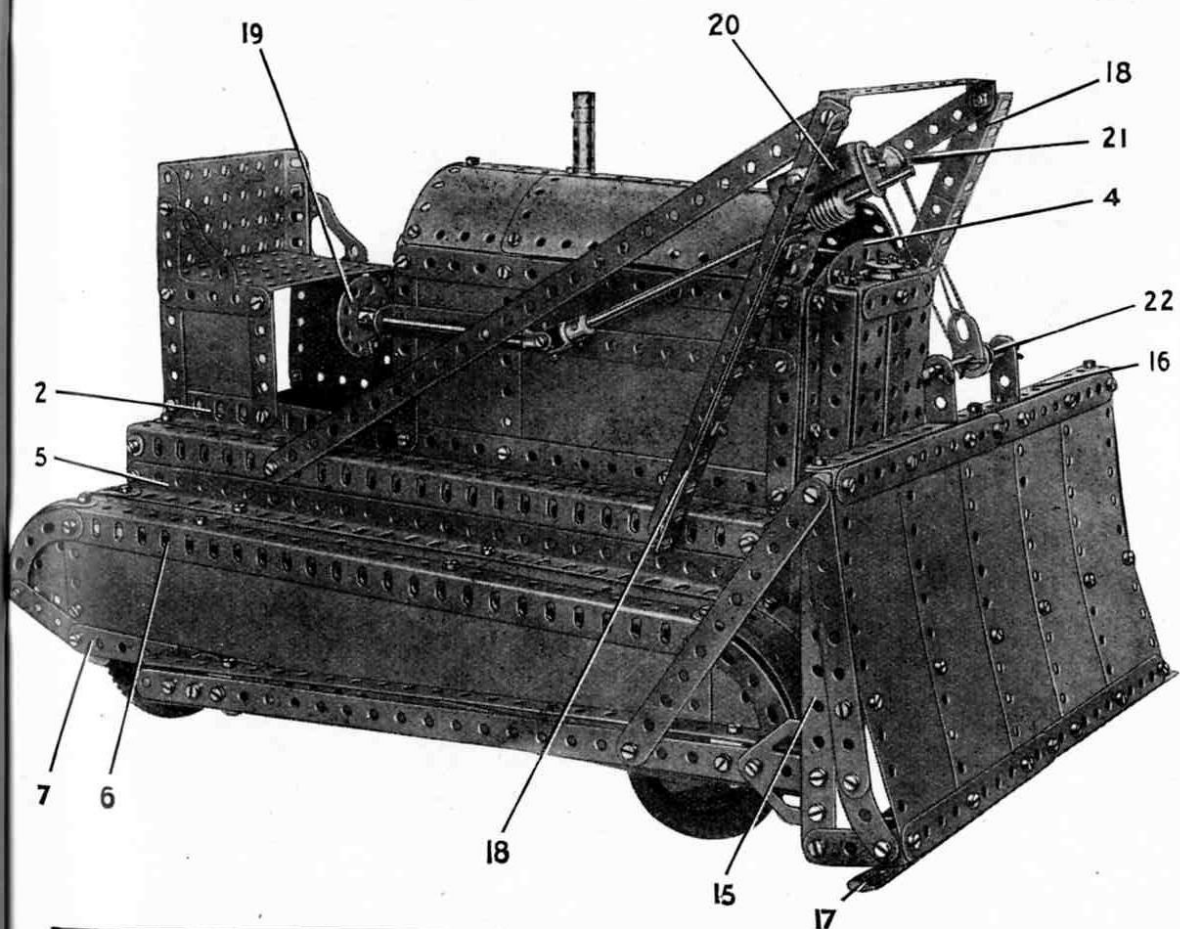
Fig. 8.20c

8.21 BULLDOZER

The main chassis members on each side are formed by $12\frac{1}{2}$ " Angle Girders bolted along the edges of a $12\frac{1}{2}$ " x $2\frac{1}{2}$ " Strip Plate. The sides are connected at each end by $5\frac{1}{2}$ " x $2\frac{1}{2}$ " Flanged Plates 1. Two $12\frac{1}{2}$ " Angle Girders 2 are then bolted to the Flanged Plates as shown in Fig. 8.21b.

The sides of the bonnet consist of built-up $7\frac{1}{2}$ " x $3\frac{1}{2}$ " plates, each made by bolting together two $5\frac{1}{2}$ " x $2\frac{1}{2}$ " and two $2\frac{1}{2}$ " x $2\frac{1}{2}$ " Flexible Plates. The sides are strengthened by $5\frac{1}{2}$ " and $3\frac{1}{2}$ " Strips and are fastened to the Angle Girders 2. The front and rear of the bonnet each consists of a $3\frac{1}{2}$ " x $2\frac{1}{2}$ " Flanged Plate extended by two $2\frac{1}{2}$ " x $2\frac{1}{2}$ " Flexible Plates 3. The radiator is represented by a $3\frac{1}{2}$ " x $2\frac{1}{2}$ " Flanged Plate fitted with a $3\frac{1}{2}$ " x $2\frac{1}{2}$ " Double Angle Strip on each side. It is attached to the front of the bonnet by two $\frac{1}{2}$ " Bolts. The top of the bonnets consists of two $5\frac{1}{2}$ " x $2\frac{1}{2}$ " and two $2\frac{1}{2}$ " x $2\frac{1}{2}$ " Flexible Plates bolted together and attached to the sides by Obtuse Angle Brackets. The Curved Strips 4 are fastened to Fishplates bolted to Angle Brackets fixed to the sides.

The track covers on each side are made by bolting the $12\frac{1}{2}$ " Angle Girders 5 to the sides of the chassis. The top of each cover consists of a $2\frac{1}{2}$ " x $1\frac{1}{2}$ " and three $5\frac{1}{2}$ " x $1\frac{1}{2}$ " Flexible Plates fastened to the Angle Girders 5, and fitted at their outer edges with further $12\frac{1}{2}$ " Angle



Girders 6. The Angle Girders 5 and 6 are extended at each end by Formed Slotted Strips, and $12\frac{1}{2}$ " x $2\frac{1}{2}$ " Strip Plates are fastened to the Angle Girders 6. The Strip Plates are fitted along their lower edges with $12\frac{1}{2}$ " Strips 7, and these are connected by $2\frac{1}{2}$ " Strips to Curved Strips bolted to each end of the Angle Girders 6. The curved ends of the sides are filled by $2\frac{1}{2}$ " x $1\frac{1}{2}$ " Flexible Plates.

The seat is built up from two $3\frac{1}{2}$ " x $2\frac{1}{2}$ " Flanged Plates, fastened to $2\frac{1}{2}$ " Strips fixed to the Angle Girders 2. The floor of the driving compartment consists of two $4\frac{1}{2}$ " x $2\frac{1}{2}$ " and a $2\frac{1}{2}$ " x $1\frac{1}{2}$ " Flexible Plate. These are bolted to the Flanged Plate 1 and to a $3\frac{1}{2}$ " x $\frac{1}{2}$ " Double Angle Strip fixed to the Angle Girders 2.

A No. 1 Clockwork Motor is attached by Fishplates to the Flanged Plate 1 at the front of the chassis, and is bolted at the rear to a $5\frac{1}{2}$ " Strip 8 (Fig. 8.21a). A $\frac{1}{2}$ " Pinion on the Motor driving shaft meshes with a 57-tooth Gear 9 fixed on a 2" Rod passed through the Motor side-plates. A $\frac{1}{2}$ " Pulley on this Rod is connected by a Driving Band to a $1\frac{1}{2}$ " Pulley fixed on a $6\frac{1}{2}$ " Rod 10. This Rod is mounted in Semi-Circular Plates bolted to the chassis, and carries also a 2" Sprocket that drives a 2" Sprocket on the rear axle through a length of Sprocket Chain.

The rear axle is an 8" Rod and is mounted in Trunnions fixed to the chassis. The front axle is made by joining together a 4" and a $3\frac{1}{2}$ " Rod by means of a Coupling, and it also is mounted in Trunnions. The front and rear axles are connected by Sprocket Chain passing over 1" Sprockets.

The brake lever of the Motor is extended by a $3\frac{1}{2}$ " Strip fitted with a Bush Wheel, and a Rod 11 held in the Bush Wheel forms the control lever. Reversing of the Motor is operated by a 5" Rod 12, which is pivotally attached to the rear of the bonnet by a Coupling. The Coupling is mounted on a $\frac{1}{2}$ " Bolt, which is passed through the rear of the bonnet and carries four Washers and a nut to space the Coupling from the Flanged Plate. The end of the Rod is fitted with a Swivel Bearing 13, which is connected to the reversing lever of the Motor by a Rod 14 and an End Bearing.

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8.22 FLYING CHAIRS—Continued

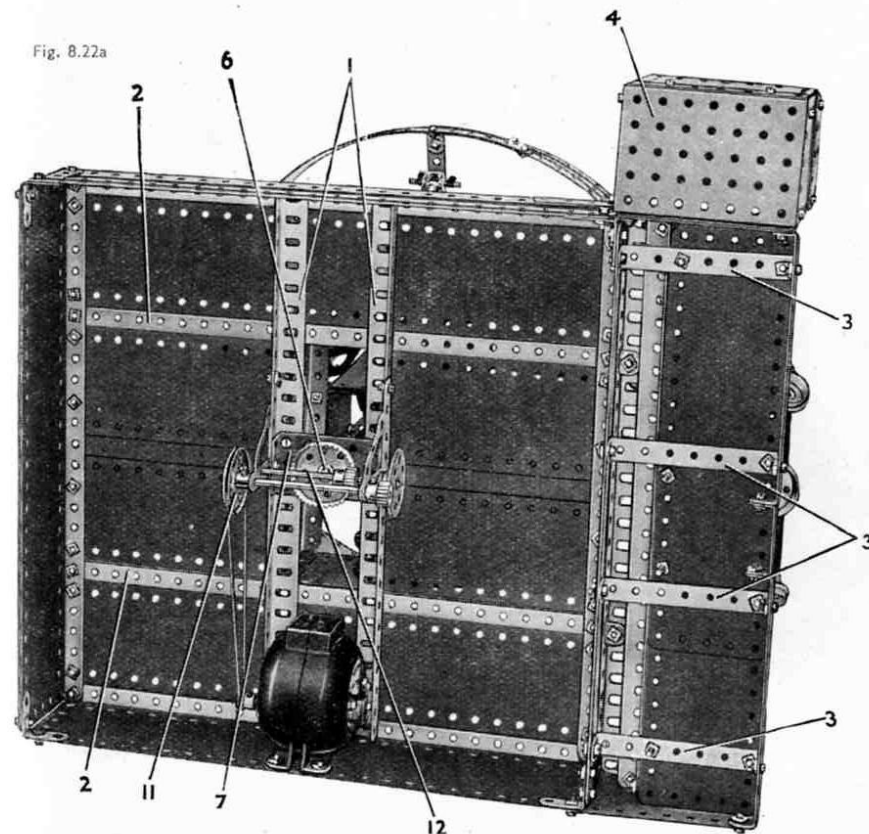
The pay-box is built on to an extension of one of the sides of the base, which is made by extending the $12\frac{1}{2}$ " Angle Girders and Strips by two $5\frac{1}{2}$ " Strips overlapping the base by four holes. The extension is filled in by a $4\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flexible Plate overlapping the base by two holes, and the opposite side of the base is extended in a similar way.

The floor of the pay-box is formed by a $3\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flanged Plate 4. This is attached to a $3\frac{1}{2}$ " \times $\frac{1}{2}$ " Double Angle Strip bolted to the lower $5\frac{1}{2}$ " Strip of the side. Each side of the box consists of two $2\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flexible Plates overlapped three holes and bolted to the flange of the Plate 4. The back of the box is formed by a $3\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flanged Plate attached to the Plate 4 and extended upward by two $2\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flexible Plates overlapping the Flanged Plate by three holes. The front and rear of the box are connected together by two $2\frac{1}{2}$ " \times $\frac{1}{2}$ " Double Angle Strips, and the top is formed by a $3\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flanged Plate bolted to the sides.

The bar carrying the lights over the steps consists of a $12\frac{1}{2}$ " Strip fitted at each end with a $4\frac{1}{2}$ " \times $\frac{1}{2}$ " Double Angle Strip. The Double Angle Strips are bolted to $3\frac{1}{2}$ " Strips attached to the sides of the base. The name board is formed by two $5\frac{1}{2}$ " Strips bolted to Obtuse Angle Brackets, and attached to the bar by further Obtuse Angle Brackets. The centre light is represented by a $1\frac{1}{2}$ " Flanged Wheel held in place by a Pivot Bolt. The side lights consist of $\frac{3}{4}$ " Flanged Wheels, and these are attached to Obtuse Angle Brackets bolted to the $4\frac{1}{2}$ " \times $\frac{1}{2}$ " Double Angle Strips.

The lower part of the central tower consists of a $5\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flanged Plate bolted to each of the Angle Girders 1. The Flanged Plates are joined together by $2\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flexible Plates and $2\frac{1}{2}$ " Strips. The tower is completed by bolting two $5\frac{1}{2}$ " Angle Girders to Angle Brackets fixed to each of the Flanged Plates. The Angle Girders are connected at their upper ends by $2\frac{1}{2}$ " Strips and the sides of the tower are filled in by $5\frac{1}{2}$ " \times $2\frac{1}{2}$ " Flexible Plates. A Face Plate 5 is fixed to $2\frac{1}{2}$ " \times $\frac{1}{2}$ " Double Angle Strips bolted to the top of the tower, and an $11\frac{1}{2}$ " Rod 6 is mounted in the Face Plate and in a $2\frac{1}{2}$ " \times $1\frac{1}{2}$ " Flanged Plate 7 bolted to the Angle Girders 1.

Fig. 8.22a



The tapered support for the revolving canopy is built up from six $4\frac{1}{2}$ " Strips and two compound $4\frac{1}{2}$ " Strips. The compound strips each consist of two $3\frac{1}{2}$ " Strips overlapped three holes. All these are attached by Angle Brackets to a Bush Wheel 8 at their lower ends, and to the outer holes of a Face Plate at their upper ends. The Bush Wheel is passed over the Rod 6, and the Face Plate is free to turn on a 5" Rod joined to Rod 6 by a Coupling. The 5" Rod carries also a 2" Pulley fitted with a Rubber Tyre, a Boiler End, two 1" Pulleys with Rubber Rings, and a $\frac{1}{2}$ " Pulley 10. The $\frac{1}{2}$ " Pulley is fixed on the Rod and presses against the 1" Pulleys to form a simple friction drive.

The rim of the canopy is formed by eight $5\frac{1}{2}$ " \times $1\frac{1}{2}$ " Flexible Plates bolted together to form a circle. These Plates are edged with $12\frac{1}{2}$ " Strips as shown. The rim is attached to the Face Plate on the vertical 5" Rod by eight $5\frac{1}{2}$ " Strips. These Strips are attached to the rim by Angle Brackets, and are bolted to the outer holes of the Face Plate.

An EO20 Electric Motor is bolted to the base as shown in Fig. 8.22a and the drive taken from the Motor pulley to a $1\frac{1}{2}$ " Pulley 11 by a Driving Band. The Pulley 11 is fixed on a $3\frac{1}{2}$ " Rod mounted in Corner Gussets bolted to the Angle Girders 1. This Rod carries also a $\frac{1}{2}$ " Pinion, which meshes with a 57-tooth Gear on a second $3\frac{1}{2}$ " Rod 12. A $\frac{1}{2}$ " Pinion is fixed on Rod 12 between the Corner Gussets, and meshes with a $1\frac{1}{2}$ " Contrate fixed to the lower end of Rod 6.

One chair is supported by an 8" Rod. The others are suspended from compound 8" Rods. All the suspension Rods are pivotally attached to the $5\frac{1}{2}$ " Strips supporting the rim of the canopy, five Double Brackets, a $1\frac{1}{2}$ " \times $1\frac{1}{2}$ " and two $1\frac{1}{2}$ " \times $\frac{1}{2}$ " Angle Brackets being used for this purpose. The upper ends of three of the Rods are fitted with Fork Pieces, two of these being obtained from Swivel Bearings. The Fork Pieces are pivoted on $1\frac{1}{2}$ " Rods passed through the Double Brackets and held by Spring Clips. Two of the Rods are fitted with a Large Fork Piece 13 and an End Bearing 14 (Fig. 8.22b), which are similarly pivoted. The remaining three rods carry Collars 15, which are attached by Bolts to the $1\frac{1}{2}$ " \times $\frac{1}{2}$ " and $1\frac{1}{2}$ " \times $1\frac{1}{2}$ " Angle Brackets.

The seats of the chairs are formed by Trunnions and Flat Trunnions. The Trunnions are extended by a $1\frac{1}{2}$ " Strip attached to a Fishplate. The backs consist of $2\frac{1}{2}$ " \times $1\frac{1}{2}$ " Flexible Plates curved slightly and attached to the seats, six Angle Brackets and two Reversed Angle Brackets being used for this purpose. Six of the chairs are attached to the supporting rods by Collars. The Collars are fixed on the ends of the rods, and a Bolt fitted with a nut is passed through the back of each chair and into the threaded hole of a Collar. The nut is then tightened to lock the chair in position. One of the remaining chairs is attached in a similar way, except that a spider from one of the Swivel Bearings is used in place of a Collar. The remaining chair is attached to its supporting rod by a Rod and Strip Connector.

The organ pipes are represented by Rods of various sizes clamped between two $2\frac{1}{2}$ " Strips. These strips are held by nuts on Screwed Rods, which are then passed through the central column and held in place by nuts.

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

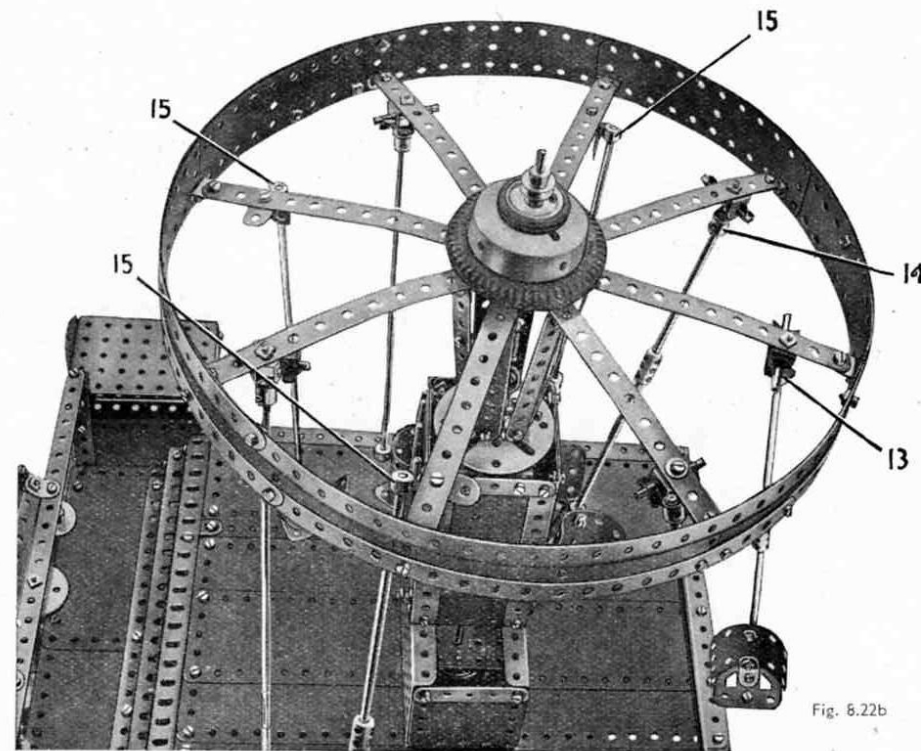


Fig. 8.22b

8.23 BEAM ENGINE

Each side of the base is formed by two $12\frac{1}{2}$ " Strip Plates bolted together and strengthened along their upper edges by two $12\frac{1}{2}$ " Angle Girders. The lower edges of the Plates are braced by two $5\frac{1}{2}$ " Strips, a $12\frac{1}{2}$ " Strip and a $2\frac{1}{2}$ " Strip bolted together. The sides are joined at one end and in the centre by $5\frac{1}{2}$ " x $2\frac{1}{2}$ " Flanged Plates 1 and 2, and at the opposite end by a $5\frac{1}{2}$ " Angle Girder 3. A $5\frac{1}{2}$ " x $\frac{1}{2}$ " Double Angle Strip is also bolted to each end of the base. The top is filled in by $5\frac{1}{2}$ " x $2\frac{1}{2}$ " Flexible Plates.

The central supporting columns consist of $12\frac{1}{2}$ " Strip Plates strengthened by Angle Girders, and are attached to the Flanged Plate 2 by Angle Brackets. The columns at one end are formed by $12\frac{1}{2}$ " Angle Girders fastened to the Angle Girders 3 by $1"$ x $1"$ Angle Brackets, and at the other end four $12\frac{1}{2}$ " Strips are connected by Angle Brackets to form two built-up angle girders which are attached to the Flanged Plate 1 by $1"$ x $\frac{1}{2}"$ Angle Brackets. The end columns on each side are joined by $3\frac{1}{2}"$ x $\frac{1}{2}"$ Double Angle Strips.

The columns are connected on each side by a flat girder extending the entire length of the model. This is formed by four $5\frac{1}{2}"$ x $1\frac{1}{2}"$ and one $2\frac{1}{2}"$ x $1\frac{1}{2}"$ Flexible Plates bolted to $12\frac{1}{2}"$ Strips. A Semi-Circular Plate 4 attached to each side by Fishplates is fitted with a Bush Wheel and a $3\frac{1}{2}"$ Rod 5 is locked in the Bush Wheels and provides a pivot for the beam.

The beam is made in two sections, each consisting of four compound strips 6 made by overlapping two $5\frac{1}{2}"$ Strips two holes. The Strips 6 are bolted in the centre to a $3\frac{1}{2}"$ Strip, and are connected at each end by a Flat Trunnion. The two sections of the beam are joined together at the centre and at each end by Double Brackets. The complete beam is free to pivot about the Rod 5 and is held in position by Collars.

The cylinder is represented by a Boiler bolted to the Flanged Plate 1, and is fitted with a Sleeve Piece and a $\frac{3}{4}"$ Flanged Wheel forming the valve chest. The piston rod is a $5"$ Rod and it is guided into the Boiler by a Double Bent Strip. The connecting rod is a $6\frac{1}{2}"$ Rod and is attached to the piston rod by a Swivel Bearing. It is connected to a $1\frac{1}{2}"$ Rod held at the end of a beam by a Large Fork Piece.

The valve operating rod is represented by a $5"$ Rod 7, which is free to slide in the $\frac{3}{4}"$ Flanged Wheel. The upper end of this Rod is connected to the piston rod by two Couplings and a $1\frac{1}{2}"$ Rod.

The crankshaft (see Fig. 8.23a) is mounted in four bearings. Each of these consists of a Trunnion bolted to a $2\frac{1}{2}"$ x $\frac{1}{2}"$ Double Angle Strip, and they are attached to the base by Angle Brackets. The webs of the crank are made by bolting $2\frac{1}{2}"$ Strips to the slotted holes of Face Plates. The Cranks 8 are also bolted to the Face Plates, and a $1\frac{1}{2}"$ Rod locked in the Cranks forms the big end bearing. The crankshaft is connected to the beam

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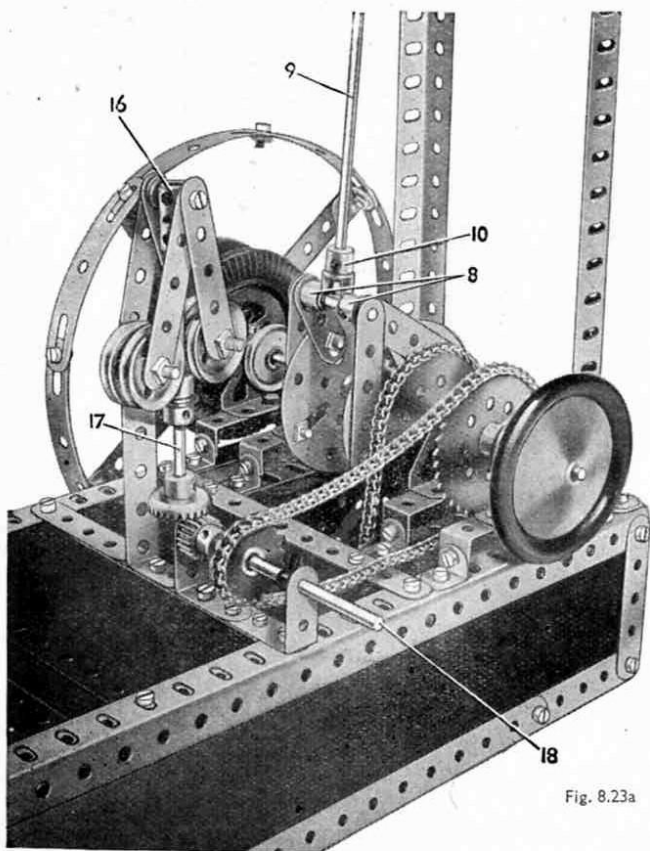
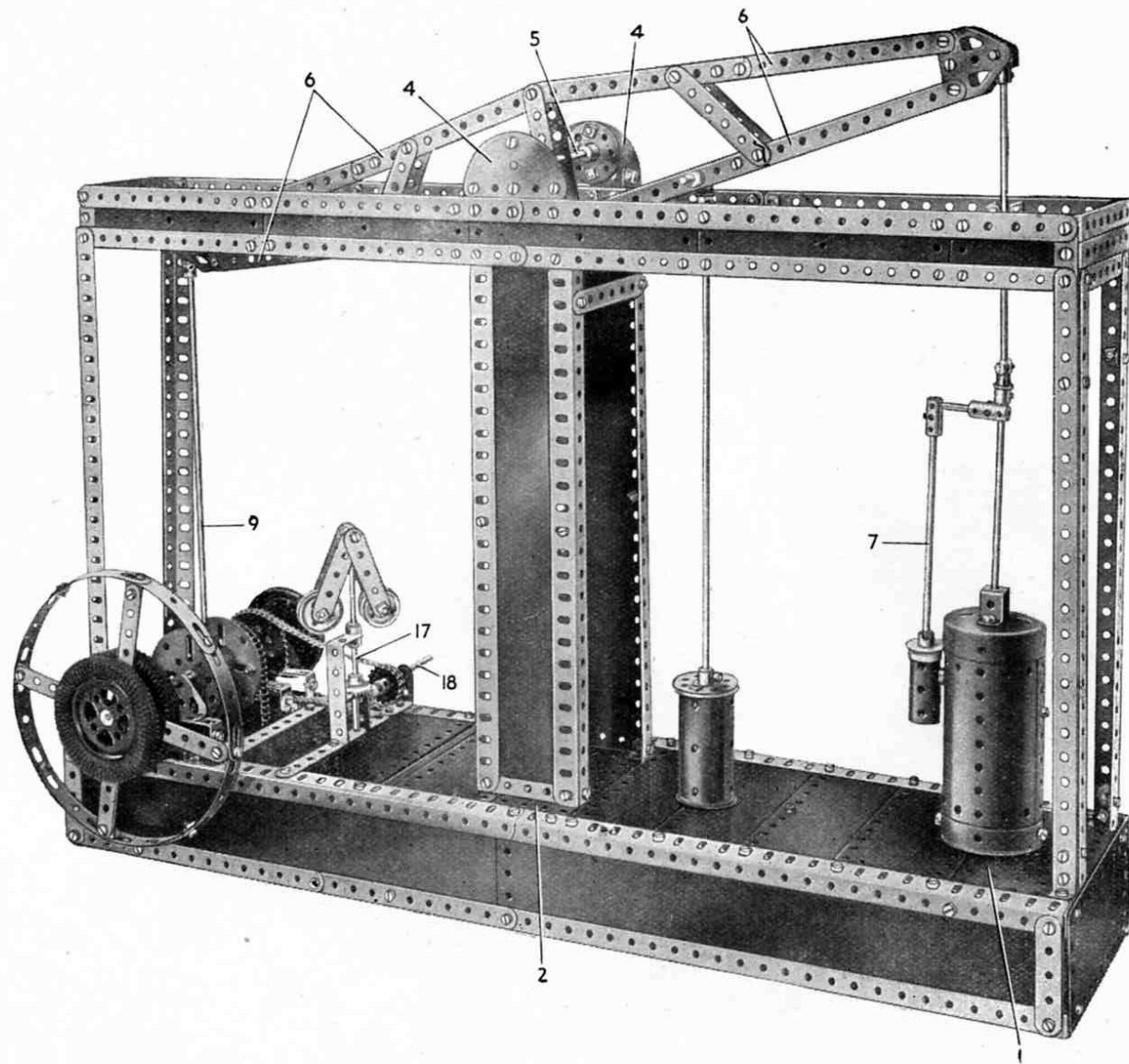


Fig. 8.23a



8.23—BEAM ENGINE—Continued

by an $11\frac{1}{2}$ " Rod 9 and a Swivel Bearing. A $1\frac{1}{2}$ " Rod mounted in the Flat Trunnions at the end of the beam is locked in the spider of the Swivel Bearing. The other end of Rod 9 is fitted with a Small Fork Piece 10, which is held on the $1\frac{1}{2}$ " Rod between the Cranks 9. The Face Plates are fixed on $3\frac{1}{2}$ " Rods, each of which is journaled in two of the main bearings.

A No. 1 Clockwork Motor is fitted in the base. The Motor is attached at one side to a $5\frac{1}{2}$ " Angle Girder 11 (Fig. 8.23b), and is bolted at the other side to a $3\frac{1}{2}$ " x $2\frac{1}{2}$ " Flanged Plate. The drive from the Motor is taken from a $\frac{1}{2}$ " Pulley to a $1\frac{1}{2}$ " Pulley 12. The Pulley 12 is fixed on a $3\frac{1}{2}$ " Rod, which is mounted in two Corner Gussets 13. A $\frac{1}{2}$ " Pinion on this Rod meshes with a 57-tooth Gear on Rod 14. This Rod is also journaled in the Corner Gussets, and is fitted with a $\frac{1}{2}$ " Sprocket 15. The Sprocket 15 is connected by a length of Sprocket Chain to a 2" Sprocket locked on the Crankshaft.

The arms of the governor consist of $2\frac{1}{2}$ " Strips pivotally attached to a Coupling 16. The Coupling is locked on a $4\frac{1}{2}$ " Rod 17, journaled in a $2\frac{1}{2}$ " x $1\frac{1}{2}$ " Double Angle Strip bolted to the base. The Rod 17 is fitted with a $\frac{1}{2}$ " Contrate, which meshes with a $\frac{1}{2}$ " Pinion fixed on a $3\frac{1}{2}$ " Rod 18. This Rod is mounted in two $1\frac{1}{2}$ " x $1\frac{1}{2}$ " Angle Brackets bolted to the base, and carries a 1" Sprocket. The 1" Sprocket is connected to a 2" Sprocket on the Crankshaft by a length of Sprocket Chain.

The rim of the fly-wheel is built up from eight Formed Slotted Strips bolted together. The spokes are formed by two compound strips, each of which are made by two $5\frac{1}{2}$ " Strips overlapped five holes, and these are attached to the rim by Angle Brackets. The flywheel is gripped on the end of the crankshaft between two 2" Pulleys fitted with Motor Tyres.

The feed pump is represented by a $2\frac{1}{2}$ " Cylinder, fitted at one end with a $1\frac{1}{2}$ " Pulley and at the other with a Wheel Disc. These are held in place by 3" Screwed Rods, which are also used to attach the Cylinder to the base. An $11\frac{1}{2}$ " Rod is free to slide in the boss of the $1\frac{1}{2}$ " Pulley, and is connected to a $1\frac{1}{2}$ " Rod in the beam by an End Bearing.

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

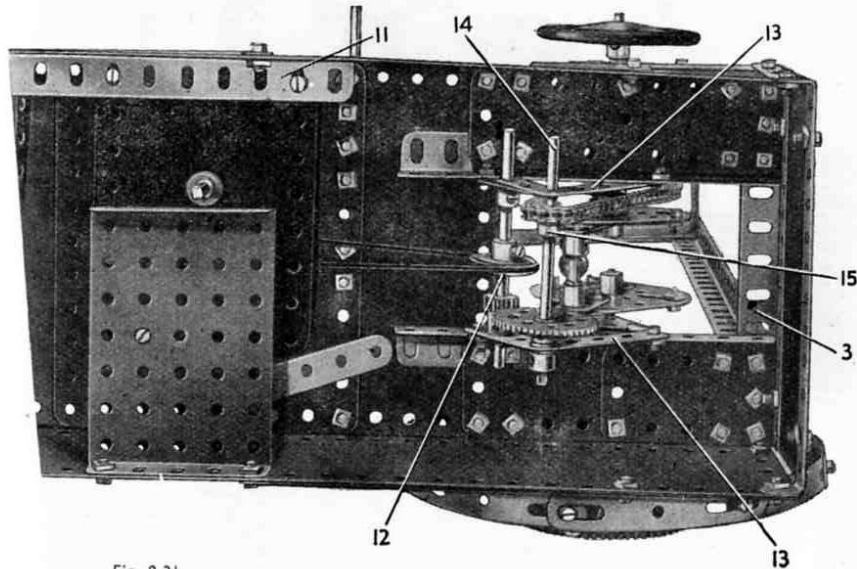
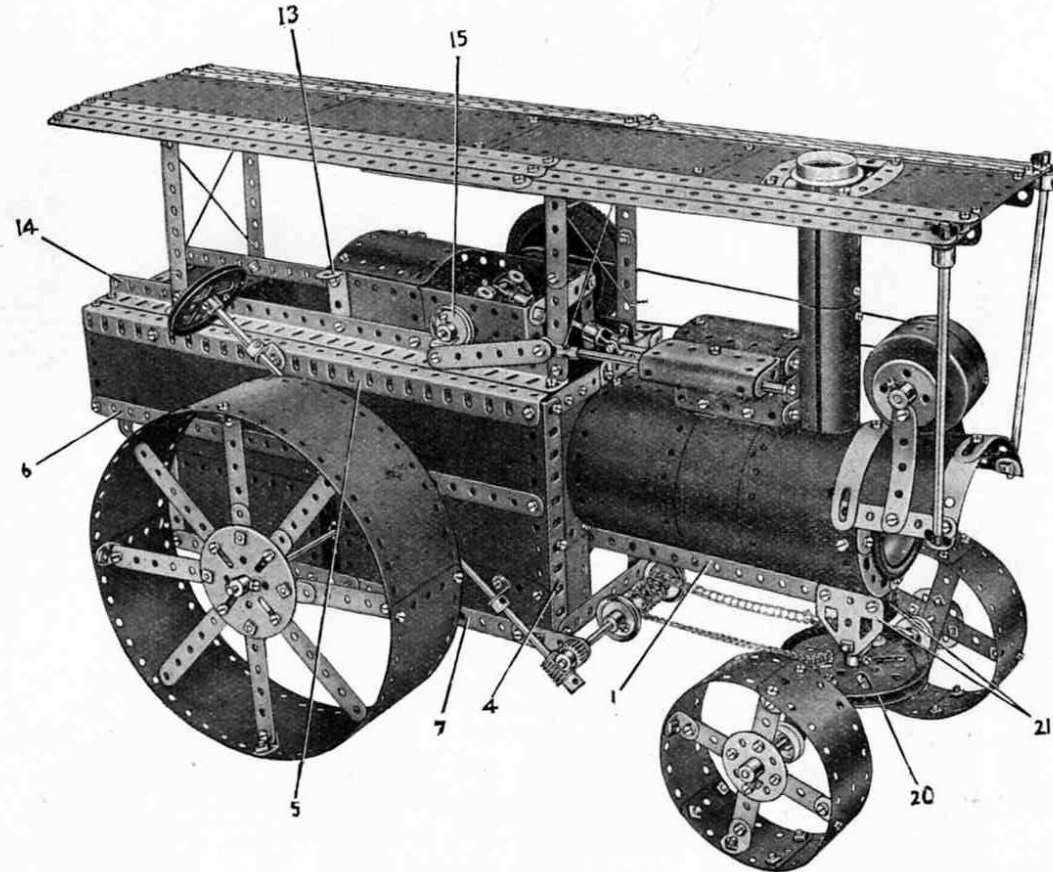


Fig. 8.2b

8.24 SHOWMAN'S TRACTION ENGINE



The boiler of the model should be built up first. The front of this consists of four short radius Curved Strips assembled to form a complete circle. Two $5\frac{1}{2}$ " x $2\frac{1}{2}$ " Flexible Plates are bolted together and attached to the Curved Strips by four Angle Brackets. The boiler is extended by four $5\frac{1}{2}$ " x $2\frac{1}{2}$ " Flexible Plates curved and joined in pairs. The complete boiler is attached to a strong U-section girder formed by two $12\frac{1}{2}$ " Angle Girders 1.

A $3\frac{1}{2}$ " x $2\frac{1}{2}$ " Flanged Plate 2 (Fig. 8.24b) is bolted in a vertical position to the Angle Girders 1, and is attached to the rear of the boiler by an Angle Bracket. Two $4\frac{1}{2}$ " x $2\frac{1}{2}$ " Flexible Plates are overlapped three holes and bolted to the Flanged Plate 2. They are braced by two $4\frac{1}{2}$ " Strips 3, and are fitted at each side with a $5\frac{1}{2}$ " Angle Girder 4. The lower portion of the fire-box is formed by a $12\frac{1}{2}$ " x $1\frac{1}{2}$ " Flexible Plate attached to each of the Angle Girders 4.

Each side of the model is made in the same way, and consists of a $12\frac{1}{2}$ " Angle Girder 5 and a $12\frac{1}{2}$ " Strip 6. These are bolted to the Angle Girder 4 as shown, and a compound strip 7 consisting of two $5\frac{1}{2}$ " Strips joined together is attached to the lower end of the Angle Girders 4. The upper portion of the side is filled in by a $12\frac{1}{2}$ " Strip Plate, while the lower part is enclosed by a $5\frac{1}{2}$ " x $2\frac{1}{2}$ ", a $5\frac{1}{2}$ " x $1\frac{1}{2}$ " and four $2\frac{1}{2}$ " x $2\frac{1}{2}$ " Flexible Plates. These are bolted in position as shown in Fig. 8.24a, so that a gap is left for the rear axle. A $5\frac{1}{2}$ " Angle Girder 8 (Fig. 8.24c), is attached to the rear end of each side, and a Hinged Flat Plate is bolted to the Angle Girders.

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8.24 SHOWMAN'S TRACTION ENGINE—Continued

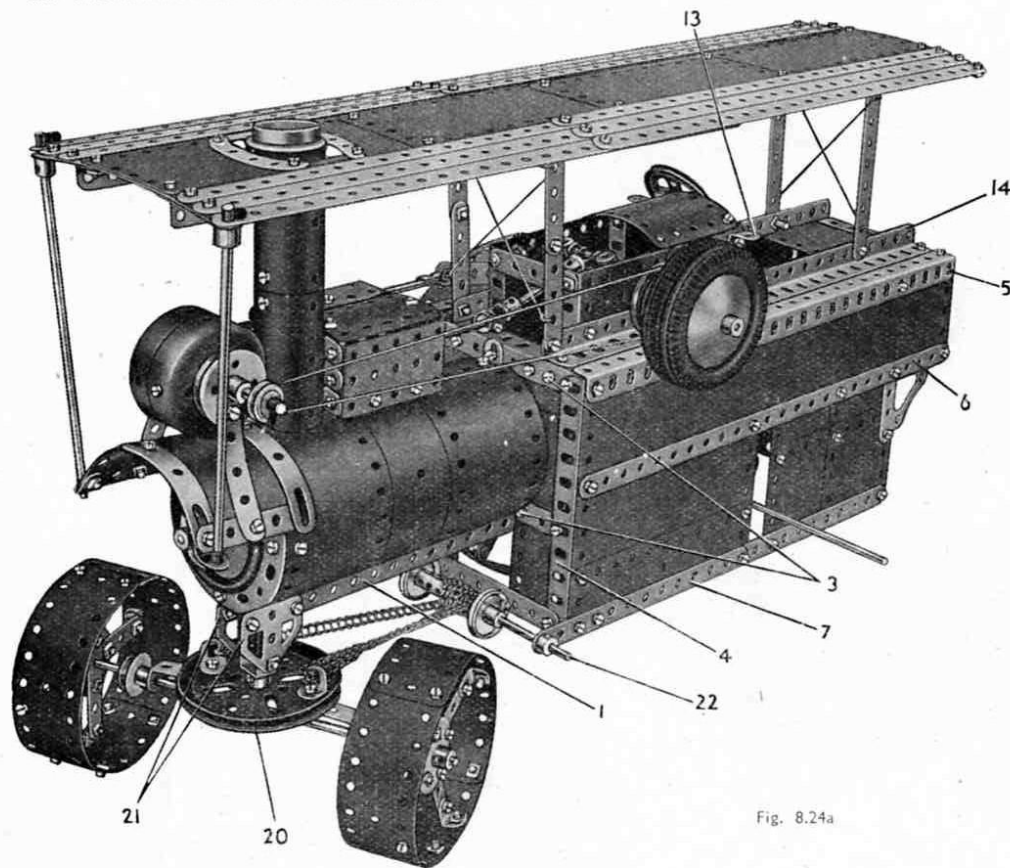


Fig. 8.24a

The EO20 Electric Motor and the reduction gearing are built up as a complete unit. The sides of this unit are two $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plates, which are connected together by three $3\frac{1}{2}''$ Strips 9. The EO20 Electric Motor is bolted to two of the Strips 9 (Fig. 8.24d), and the pulley on its armature shaft is connected by a driving band to a $1\frac{1}{2}''$ Pulley on a $4''$ Rod 10. A $\frac{1}{2}''$ Pinion on this Rod meshes with a 57-tooth Gear on a $4''$ Rod 11, and a second $\frac{1}{2}''$ Pinion on Rod 11 meshes with a 57-tooth Gear on a $4\frac{1}{2}''$ Rod 12. The outer end of this Rod is fitted with a $\frac{1}{2}''$ Sprocket, which is connected by Sprocket Chain to a $2''$ Sprocket fixed on a $4\frac{1}{2}''$ Rod. This Rod is mounted in the Flanged Plates two holes above Rod 10, and carries also a $1''$ Sprocket that is connected by Sprocket Chain to a $2''$ Sprocket on the rear axle. The rear axle is an $11\frac{1}{2}''$ Rod, and is mounted in a Trunnion bolted to each of the $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plates.

The driving unit is bolted to the Angle Girders 1, and is connected by a $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip 13 (Fig. 8.24a), to a $12\frac{1}{2}''$ Angle Girder 14 on each side of the model. The Double Angle Strips 13 are bolted to the upper flanges of the $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plates, and the Angle Girders 14 are fixed to the Flanged Plate 2 and to a $4\frac{1}{2}''$ Strip bolted to the Angle Girders 5.

Bearings for the crankshaft are provided by a $3\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate bolted to each of the Angle Girders 14. A $1\frac{1}{2}''$ Rod fitted with two $1''$ Pulleys 15 and 16 (Fig. 8.24b), is passed through one of the Flanged Plates and held in a Coupling 17. This Coupling is connected by a $1\frac{1}{2}''$ Rod to a second Coupling 18, which is fixed on a $3\frac{1}{2}''$ Rod 19 passed through the second Flanged Plate. The Rod 19 carries a $1\frac{1}{2}''$ Pulley and two $2''$ Pulleys fitted with Motor Tyres representing the fly-wheel. A Driving Band is passed around a $\frac{1}{2}''$ Pulley on Rod 12 and the $1''$ Pulley 16 on the crankshaft.

The cylinder is formed by two $2\frac{1}{2}'' \times 1\frac{1}{2}''$ Flanged Plates connected by $1\frac{1}{2}''$ Strips at each end. It is bolted to two $1\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips attached to the Boiler. The top of the cylinder consists of a $2\frac{1}{2}'' \times 1\frac{1}{2}''$ Flexible Plate, attached to Angle Brackets bolted to the $1\frac{1}{2}''$ Strips. The valve chest is a $2\frac{1}{2}'' \times 1''$ Double Angle Strip bolted to the cylinder. A U-section Curved Plate attached by a $\frac{1}{2}''$ Bolt to a Double Bracket is also bolted to the cylinder.

The piston rod is represented by a $3\frac{1}{2}''$ Rod. It is mounted in one of the $1\frac{1}{2}''$ Strips of the cylinder, and in a Double Bent Strip inside the cylinder. The piston rod is fitted with a Swivel Bearing connected by a $2''$ Rod to a small Fork Piece held on the $1\frac{1}{2}''$ Rod between the Couplings 17 and 18.

The valve gear is operated by a crank formed by an Angle Bracket bolted to the boss of the $1''$ Pulley 15. A $3''$ Strip is attached by lock-nuts to the Angle Bracket, and to a Rod and Strip Connector fitted to a $5''$ Rod. This Rod is passed through the $2\frac{1}{2}'' \times 1''$ Double Angle Strip of the valve chest.

The chimney consists of two Cylinders joined by a Fishplate, and is bolted to the front of the cylinder.

The dynamo is formed by two Boiler Ends clamped together on a $3\frac{1}{2}''$ Rod between two $1\frac{1}{2}''$ Flanged Wheels. The platform supporting the dynamo consists of a $4\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plate curved and bolted to the boiler. The Flexible Plate is braced by Formed Slotted Strips. Two $2\frac{1}{2}''$ Strips are curved slightly and attached to the Flexible Plate, and they are bolted at their upper ends to the $1\frac{1}{2}''$ Flanged Wheels of the dynamo. A $\frac{1}{2}''$ loose Pulley that is free to turn on the dynamo shaft is connected by a belt of Cord to the $1\frac{1}{2}''$ Pulley on Rod 19.

Each of the rear wheels consists of two $12\frac{1}{2}''$ Strip Plates bolted together to form a circle. The hub is formed by a Face Plate and the spokes by $5\frac{1}{2}''$ Strips. The ends of four of the spokes are joined to the rim by Angle Brackets.

(Continued on next page)

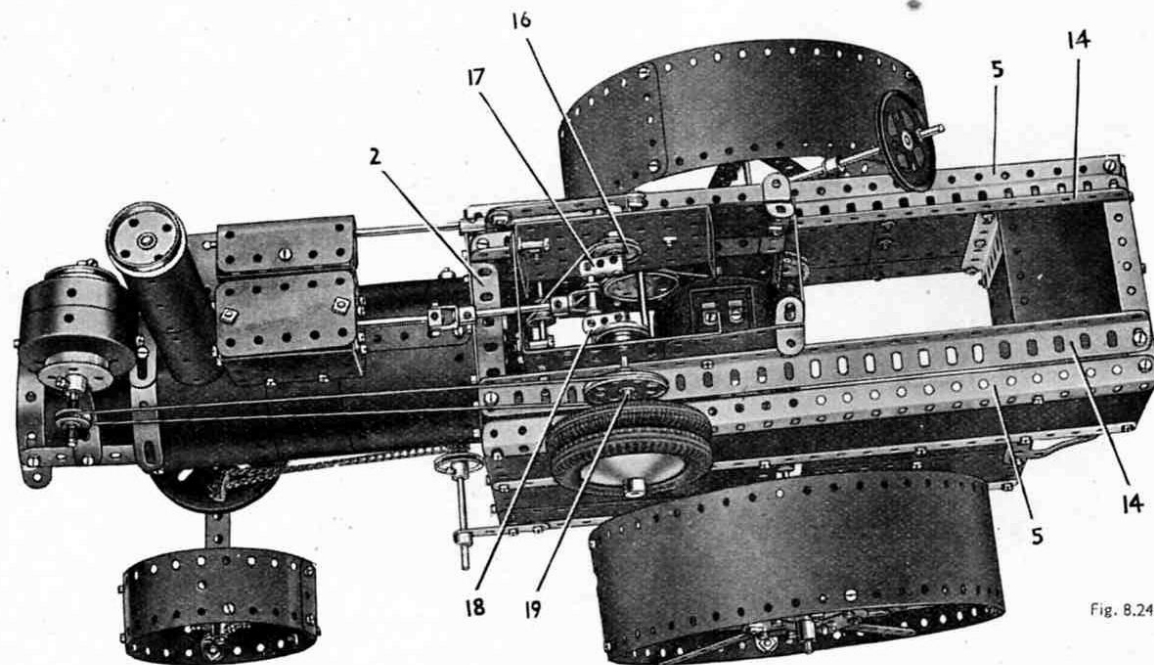


Fig. 8.24b

8.24 SHOWMAN'S TRACTION ENGINE—Continued

Fig. 8.24c

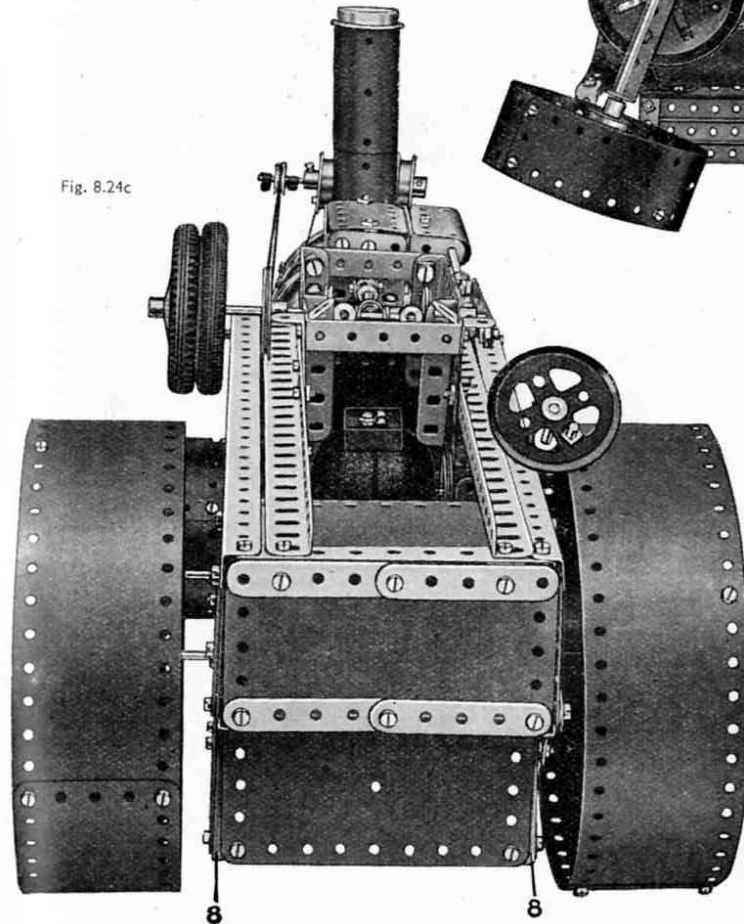
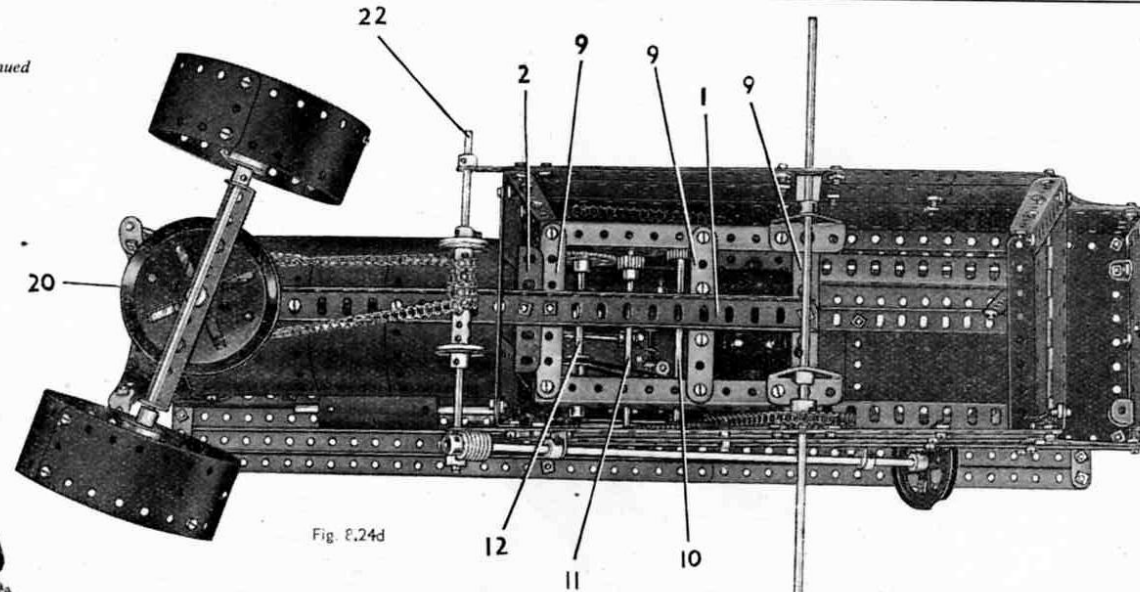


Fig. 8.24d



The sides are formed by 12 1/2" Strips fixed to 5 1/2" Strips bolted across the girders. The struts at the front of the roof consist of 6 1/2" Rods fixed in Cranks bolted to the roof. The lower ends of these Rods are supported in Obtuse Angle Brackets attached to the dynamo platform.

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

The front axle consists of a 5" and a 3 1/2" Rod joined by a Rod Connector. It is free to turn in a 4 1/2" x 1/2" Double Angle Strip bolted to a 3" Pulley 20. The 3" Pulley is passed over the lower end of a 5" Rod and held in place by a Collar. The 5" Rod is mounted in a Double Bracket bolted to the Flat Trunnions 21, and is passed through one of the holes in the boiler. It is held in position by a 3/4" Flanged Wheel inside the boiler. A Coupling is fixed on this Rod in the centre of the boiler, and it supports a 2" Rod. A Road Wheel fitted over the 2" Rod is held in position by a 3/4" Flanged Wheel.

Steering is controlled by a 2" Pulley fitted with a Threaded Pin. This is fixed on an 11 1/2" Rod mounted in two Angle Brackets bolted to the side of the model. The end of this Rod carries a Worm, which meshes with a 1/2" Pinion on a 6 1/2" Rod 22. The Rod is supported in the end holes of 2" Strips bolted to the Strips 7, and is fitted with a drum consisting of two Couplings and a Collar. A 1" Pulley is fixed at each end of the drum. A length of Sprocket Chain is wound four times around the drum and is fastened at each end to an Angle Bracket bolted to the 3" Pulley 20.

The rim of each of the front wheels is a 2 1/2" x 1 1/2" and two 5 1/2" x 1 1/2" Flexible Plates joined together to form a circle. The hub is a Bush Wheel, and the spokes are 3 1/2" Strips and 3 1/2" Compound strips made by overlapping two 2 1/2" Strips three holes. The spokes are attached to the rim by Angle Brackets.

The roof is supported by six struts. The rear pair consist of a 4 1/2" x 1/2" Double Angle Strip and a 4 1/2" Strip bolted to the Angle Girders 14. The centre struts are each formed by two 2 1/2" Strips joined together and bolted to the Angle Girders 14. The struts on each side are connected by a compound girder made from two 12 1/2" Angle Girders overlapped eight holes. The centre of the roof is filled in by three 5 1/2" x 2 1/2" and two 2 1/2" x 2 1/2" Flexible Plates bolted to the girders.

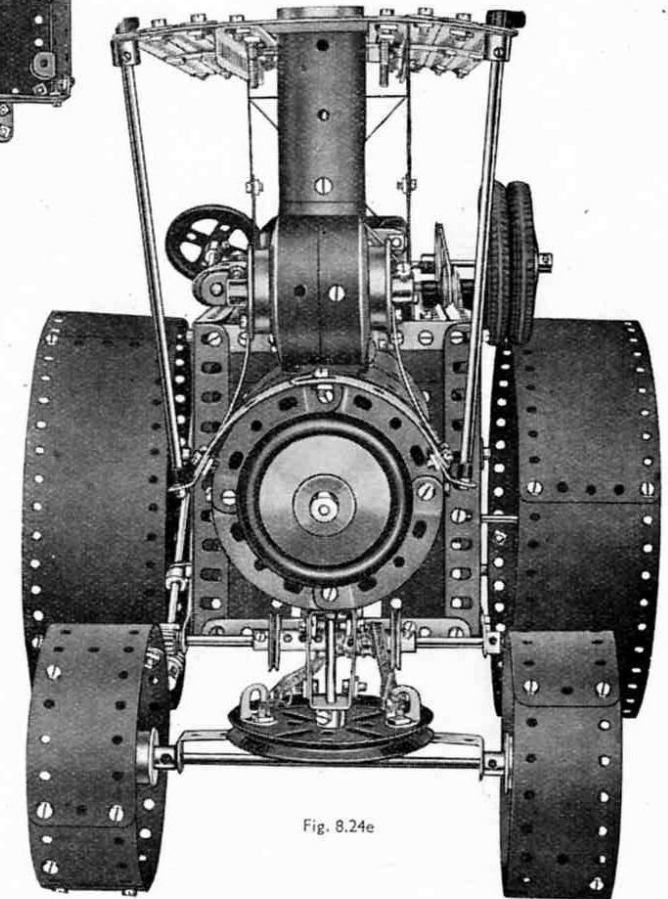


Fig. 8.24e

8.25 DERRICK CRANE

A No. 1 Clockwork Motor operates the hoisting, lowering and luffing movements of the crane. Slewing is manually controlled by the Steering Wheel seen in the main illustration. The cab pivots about a Rod 1 held in a 3" Pulley bolted to the Flanged Plates forming the base, and about a 3" Rod held in a Face Plate 2. The Curved Strips 3 are attached to a 1½" Flanged Wheel by Angle Brackets.

The Motor and gear-box form a complete unit held in position by Fishplates bolted to the Motor side-plates and the Strips 4. The drive is taken from a 2" Sprocket on the Motor driving shaft to a 2" Sprocket on the 2" Rod 5 (Fig. 8.25a). This Rod is journaled in a Channel Bearing bolted to the Motor, and carries a Bush Wheel. The Bush Wheel is connected by two Pivot Bolts to a second Bush Wheel fixed on a 4" Rod journaled in the Flanged Plates 6 and 7 so that it is free to slide. A ½" Pinion on this Rod transmits the drive to either one of the gears 8 and 9 secured to 4½" Rods. The gear selector mechanism consists of a 1" Rod engaging two Collars on the sliding Rod. The 1" Rod is held in a Coupling fastened on a 4" Rod. A similar Coupling at the opposite end of this Rod holds a 3½" Rod, and the control lever is attached to this by a Swivel Bearing.

The Rod 10 (Fig. 8.25b) controls the luffing of the jib and is fitted with

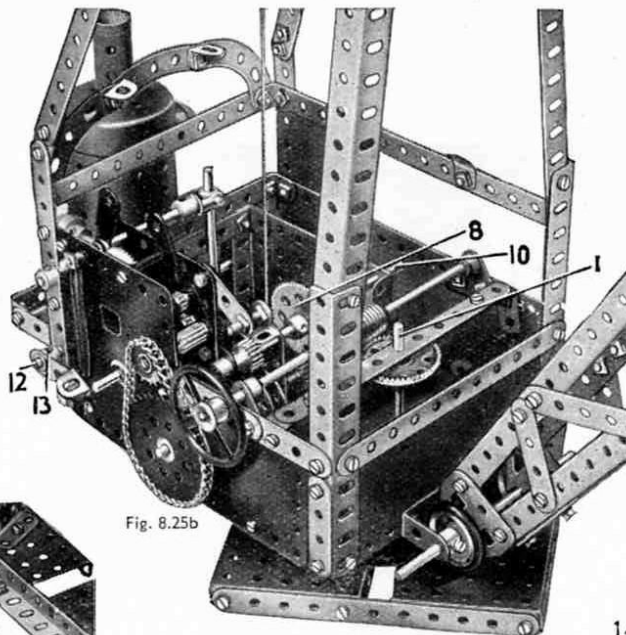


Fig. 8.25b

a Cord Anchoring Spring. A simple ratchet brake shown in Fig. 8.25a prevents the jib from over-running. The Gear 9 operates the raising and lowering of the load through a drum made by two 2" Flanged Wheels and a Sleeve Piece. A brake is formed by a 1" Pulley 11 secured to the same Rod as Gear 9. A length of Cord passes around this Pulley, and is secured to a Crank on the 6½" Rod 12. The brake is operated by a second Crank 13. Slewing is controlled by a Worm meshing with a 1½" Contrate on the Rod 1.

The cab base consists of a 5½" x 1½" and three 5½" x 2½" Flexible Plates fixed by Angle Brackets to the sides. Rod 1 passes through the joint between two of these Plates, and this joint is strengthened by a 5½" Strip.

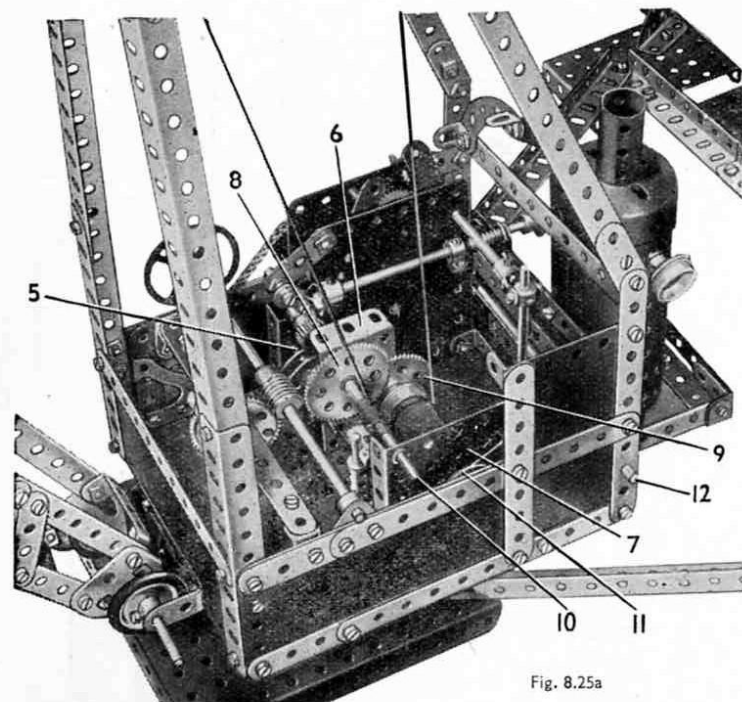
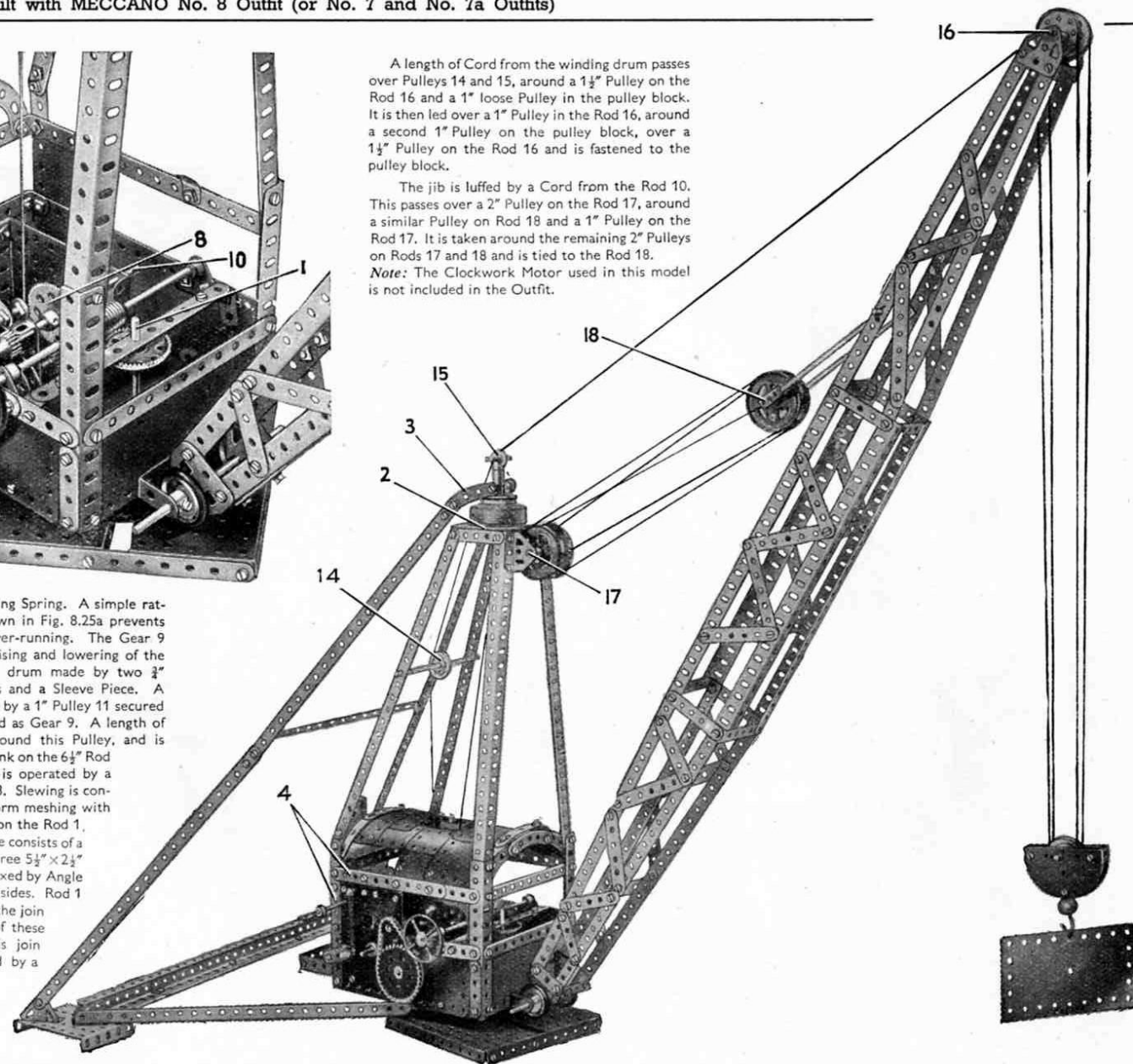


Fig. 8.25a

A length of Cord from the winding drum passes over Pulleys 14 and 15, around a 1½" Pulley on the Rod 16 and a 1" loose Pulley in the pulley block. It is then led over a 1" Pulley in the Rod 16, around a second 1" Pulley on the pulley block, over a 1½" Pulley on the Rod 16 and is fastened to the pulley block.

The jib is luffed by a Cord from the Rod 10. This passes over a 2" Pulley on the Rod 17, around a similar Pulley on Rod 18 and a 1" Pulley on the Rod 17. It is taken around the remaining 2" Pulleys on Rods 17 and 18 and is tied to the Rod 18.

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



CONTENTS OF MECCANO OUTFITS

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
—	—	—	—	—	—	—	—	—	—	1	Perforated Strips, 12"	10	2	12	—	12	2	14	—	14	10	24
—	—	—	—	—	—	—	—	—	—	1a	"	14	—	14	—	—	3	21	—	2	6	6
4	—	4	—	—	—	—	—	—	—	2	"	2	—	—	—	4	6	6	3	24	12	36
—	—	—	—	—	—	—	—	—	—	3a	"	2	—	—	—	—	6	6	6	6	8	8
—	—	—	—	—	—	—	—	—	—	4	"	2	—	—	—	—	6	6	6	6	12	18
—	—	—	—	—	—	—	—	—	—	5	"	2	—	—	—	—	6	6	6	6	12	12
2	2	4	2	6	3	9	—	—	—	6a	"	2	—	—	—	—	6	6	6	6	36	72
—	—	—	—	—	—	—	—	—	—	7	"	2	—	—	—	—	6	6	6	6	8	10
—	—	—	—	—	—	—	—	—	—	7a	Angle Girders, 24"	4	—	—	—	—	2	—	—	2	6	10
—	—	—	—	—	—	—	—	—	—	8	"	4	—	—	—	—	2	—	—	2	6	8
—	—	—	—	—	—	—	—	—	—	8a	"	—	—	—	—	—	2	—	—	2	6	8
—	—	—	—	—	—	—	—	—	—	8b	"	—	—	—	—	—	2	—	—	2	6	16
—	—	—	—	—	—	—	—	—	—	9	"	—	—	—	—	—	2	—	—	2	6	6
—	—	—	—	—	—	—	—	—	—	9a	"	—	—	—	—	—	2	—	—	2	6	6
—	—	—	—	—	—	—	—	—	—	9b	"	—	—	—	—	—	2	—	—	2	6	6
—	—	—	—	—	—	—	—	—	—	9c	"	—	—	—	—	—	2	—	—	2	6	6
—	—	—	—	—	—	—	—	—	—	9d	"	—	—	—	—	—	2	—	—	2	6	6
—	—	—	—	—	—	—	—	—	—	9e	"	—	—	—	—	—	2	—	—	2	6	6
—	—	—	—	—	—	—	—	—	—	10	"	—	—	—	—	—	2	—	—	2	6	6
4	4	4	—	—	—	—	—	—	—	11	Fishplates	8	—	—	—	—	8	—	—	2	6	6
—	—	—	—	—	—	—	—	—	—	12	Double Brackets	4	—	—	—	—	8	—	—	2	6	6
4	4	8	—	—	—	—	—	—	—	13	Angle Brackets	4	—	—	—	—	8	—	—	2	6	6
—	—	—	—	—	—	—	—	—	—	14	"	—	—	—	—	—	8	—	—	2	6	6
—	—	—	—	—	—	—	—	—	—	15	"	—	—	—	—	—	8	—	—	2	6	6
—	—	—	—	—	—	—	—	—	—	16	"	—	—	—	—	—	8	—	—	2	6	6
—	—	—	—	—	—	—	—	—	—	17	"	—	—	—	—	—	8	—	—	2	6	6
—	—	—	—	—	—	—	—	—	—	18	"	—	—	—	—	—	8	—	—	2	6	6

[illegible]

Full instructions for building a fine range of models are included with each Outfit.

THE MECCANO SYSTEM

The foregoing list contains all the Meccano parts that are included in Outfits. It shows which parts are required to build up any Outfit into the one next larger. Thus it is helpful to boys who wish to add a few parts from time to time instead of buying an Accessory Outfit. It also enables a boy to check the contents of his Outfit at intervals, so that he can note and replace any missing parts.

There are in addition many Meccano parts that are not included in Outfits. These parts will be found in the illustrated list in the following pages, which includes every part in the Meccano System.



WHAT THE GUILD MEANS

The Meccano Guild is an organization for boys, started at the request of boys, and as far as possible conducted by boys. In joining the Guild, a Meccano boy becomes a member of a great brotherhood of world-wide extent. Wherever he happens to be, even in strange countries, he will know that he has met a friend whenever he sees the little triangular badge of membership. The Meccano Guild is bringing together Meccano boys all over the world, and helping them to get the best out of life. At its head — guiding and controlling and taking a personal interest in this great movement — is the President, Mr Roland G. Hornby, son of the inventor of Meccano.

HOW TO JOIN THE MECCANO GUILD

Any owner of a Meccano Outfit, no matter what its size, may become a member. All he has to do is to fill in the official application form on the back of this leaflet, have his signature witnessed, and send the form to Headquarters with a postal order (not stamps) for the necessary amount in payment for the official badge, which he will wear in his buttonhole.

The price of the badge for boys living in the British Isles is 1/-. For those living overseas it is 1/6 (30 cents in Canada).

Applicants living in Canada, Australia, New Zealand or South Africa should write to the Meccano agents in their countries. Their addresses are as follows:

CANADA: Meccano Ltd, 675 King Street West, Toronto.

AUSTRALIA: E. G. Page & Co. (Sales) Pty. Ltd (P.O. Box 1832), Danks Building, 324 Pitt Street, Sydney, N.S.W.

NEW ZEALAND: Models Ltd (P.O. Box 129), 53 Fort Street, Auckland, C.I.

SOUTH AFRICA: Arthur E. Harris (P.O. Box 1199), 142 Market Street, Johannesburg.

Their Badges and certificates are then forwarded without delay, while their application forms are sent to Headquarters at Liverpool.

Applicants living in any other country overseas should forward their forms, preferably with a British postal order or a money order (not stamps) for 1/6, direct to the Secretary, the Meccano Guild, Binns Road, Liverpool, 13.

Guild members are eligible for the Correspondence Club, by which they are placed in touch with other members in various parts of the world. Full particulars and enrolment forms can be obtained from the Secretary.

The Secretary will send also, on request, full details of the Guild Recruiting Campaign, and of the Medallion awarded to members who are successful in obtaining recruits, together with particulars of the Meccano clubs founded and established by enthusiastic Meccano boys. A special booklet, 'How to run a Meccano Club' will be sent post free to any member on receipt of 2d. in stamps.

APPLICATION FOR MEMBERSHIP OF THE

MECCANO GUILD

Headquarters: BINNS ROAD, LIVERPOOL 13

BADGE OF
MEMBERSHIP

I possess a Meccano Outfit, and I hereby make application for membership of the Meccano Guild.

I approve of the objects of the Guild, and I promise on my honour

- (1) To conform to the rules and regulations of the Meccano Guild.
- (2) To promote its objects by my own example: to be helpful to others; to be clean in thought and habit; to be determined to learn and make progress.
- (3) To wear the Meccano Guild Badge on all possible occasions.
- (4) To recognize and acknowledge all other Members wearing the Guild Badge, and to render them help in case of need.

I enclose 1/- for the Guild Badge (Great Britain).

I enclose 1/6 for the Guild Badge (Overseas).

I enclose 30c. for the Guild Badge (Canada).

} Strike out line not applicable
(See other side).

Name of Applicant.....
(BLOCK CAPITALS PLEASE)

Address.....
.....
.....

Date..... Age.....

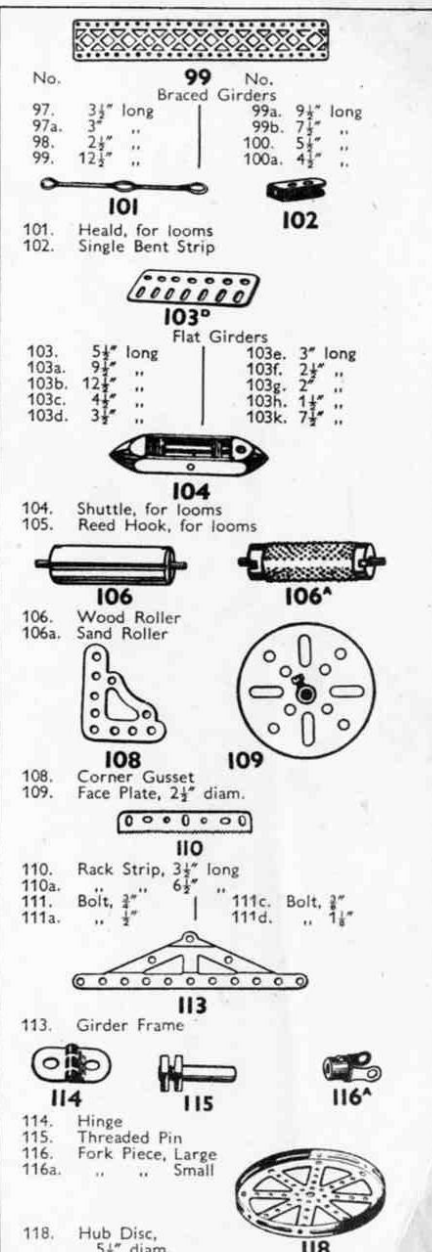
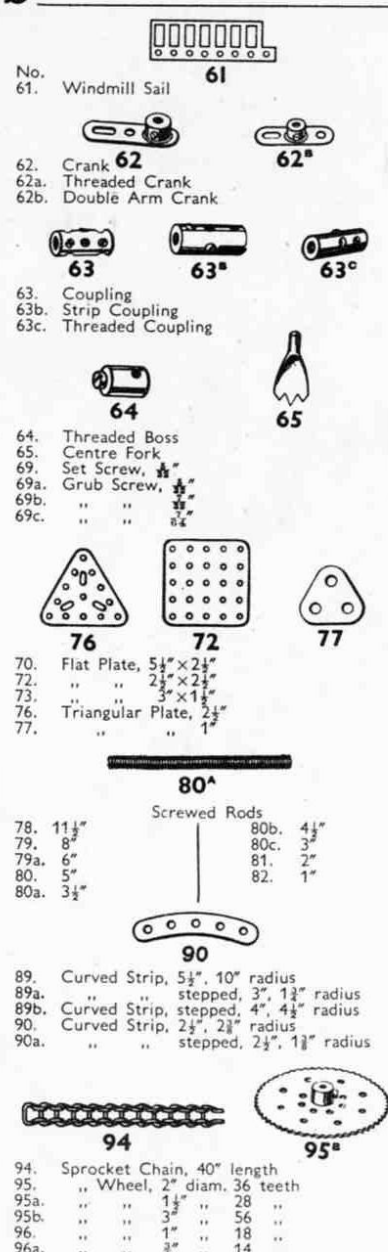
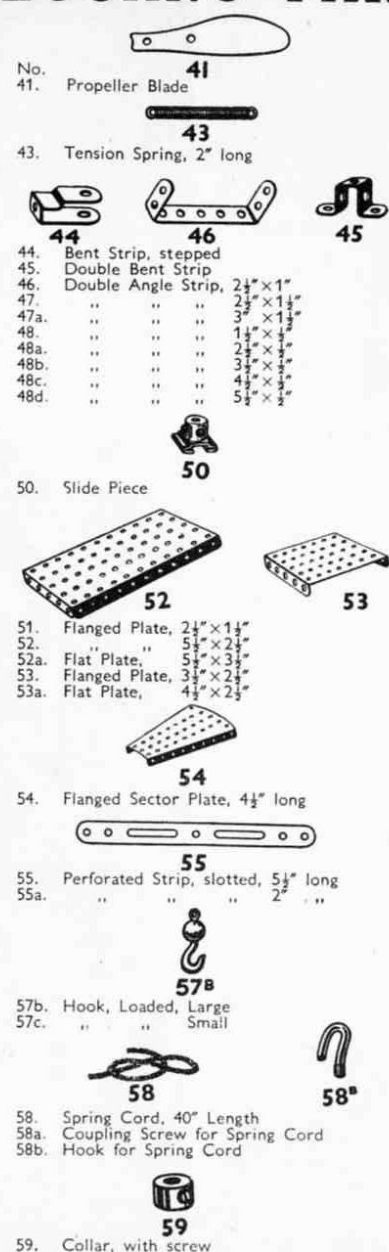
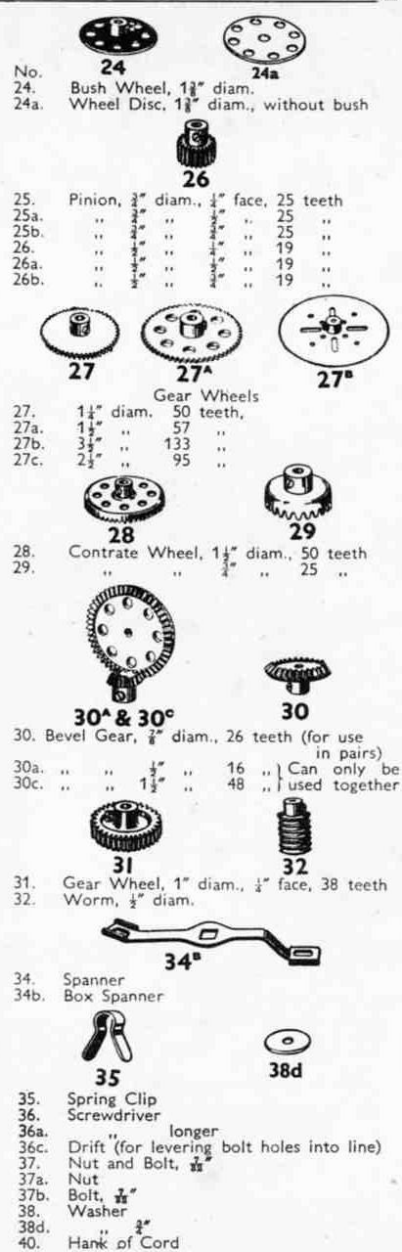
Witness

Address

The witness should be the Parent, Guardian, Employer, Schoolmaster or Church Minister, and should state which when signing.

THE THREE GREAT OBJECTS OF THE GUILD

- To make every boy's life brighter and happier.
- To foster clean-mindedness, truthfulness, ambition and initiative in boys.
- To encourage boys in their hobbies, and especially in the development of their knowledge of mechanical and engineering principles.



MECCANO PARTS

No. 120b. Compression Spring, $\frac{1}{4}$ " long



122. Miniature Loaded Sack



123. Cone Pulley, $1\frac{1}{2}$ ", 1" and $\frac{3}{4}$ " diam.
124. Reversed Angle Bracket, 1"
125. " " " "



126. Trunnion 126a. Flat Trunnion



127. Bell Crank
128. Bell Crank, with Boss



129. Toothed Segment, $1\frac{1}{2}$ " radius



130. Eccentric, Triple Throw, $\frac{1}{4}$ ", $\frac{3}{8}$ " and $\frac{1}{2}$ "
130a. Eccentric, Single Throw, $\frac{1}{4}$ "



131. Dredger Bucket
132. Flywheel, $2\frac{1}{2}$ " diam.



133. Corner Bracket, $1\frac{1}{2}$ "
133a. " " 1"

No. 134. Crank Shaft, 1" stroke



136. Handrail Support
136a. Handrail Coupling
137. Wheel Flange



138a. Ship's Funnel



139. Flanged Bracket (right)
139a. " " (left)



140. Universal Coupling

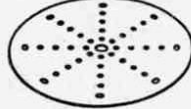
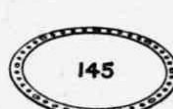


142. Rubber Ring (to fit 3" diam. rim)
142a. Motor Tyre (to fit 2" diam. rim)
142b. " " 3" "
142c. " " 1" "
142d. " " 1 $\frac{1}{2}$ " "



143. Circular Girder, $5\frac{1}{2}$ " diam.

No. 144. Dog Clutch



145. Circular Strip, $7\frac{1}{2}$ " diam. overall
146. " Plate 6" "
146a. " " 4" "



147. Pawl, with Pivot Bolt and Nuts
147a. Pawl
147b. Pivot Bolts with 2 Nuts
147c. Pawl without boss
148. Ratchet Wheel



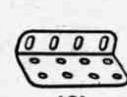
151. Pulley Block, Single Sheave
152. " " Two "
153. " " Three "



154a. Corner Angle Bracket, $\frac{1}{4}$ " (right-hand)
154b. Corner Angle Bracket, $\frac{1}{4}$ " (left-hand)
155. Rubber Ring (for 1" Pulleys)



157. Fan, 2" diam.



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 $\frac{1}{4}$ " diam.
164. Chimney Adaptor, $\frac{1}{2}$ " diam. x $\frac{1}{4}$ " high



165. Swivel Bearing
166. End " "
167b. Flanged Ring, $9\frac{1}{2}$ " diam.



168. Ball Thrust 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.
168d. Ball, $\frac{3}{4}$ " diam.



171. Socket Coupling



175. Flexible Coupling Unit



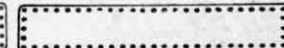
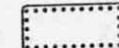
176. Anchoring Spring for Cord



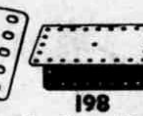
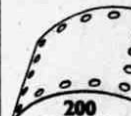
179. Rod Socket
180. Gear Ring, $3\frac{1}{2}$ " diam. (133 ext. teeth, 95 int.)



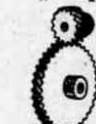
No. 185. Steering Wheel, 12" diam.
186. Driving Band, $2\frac{1}{2}$ " (Light)
186a. " " 10" "
186b. " " 10" "
186c. " " 10" (Heavy)
186d. " " 15" "
186e. " " 20" "
187. Road Wheel, $2\frac{1}{2}$ " diam.
187a. Conical Disc, $1\frac{1}{2}$ " diam.



192. Flexible Plates.
188. $2\frac{1}{2}$ " x $1\frac{1}{2}$ " 190a. $3\frac{1}{2}$ " x $2\frac{1}{2}$ "
189. $5\frac{1}{2}$ " x $1\frac{1}{2}$ " 191. $4\frac{1}{2}$ " x $2\frac{1}{2}$ "
190. $2\frac{1}{2}$ " x $2\frac{1}{2}$ " 192. $5\frac{1}{2}$ " x $2\frac{1}{2}$ "
Strip Plates.
196. $9\frac{1}{2}$ " x $2\frac{1}{2}$ " 197. $12\frac{1}{2}$ " x $2\frac{1}{2}$ "



198. Hinged Flat Plate, $4\frac{1}{2}$ " x $2\frac{1}{2}$ "
199. Curved Plate, U-Section
200. " " $2\frac{1}{2}$ " x $2\frac{1}{2}$ " x $\frac{1}{4}$ " radius
" " $2\frac{1}{2}$ " x $2\frac{1}{2}$ " x $1\frac{1}{4}$ " radius



211a. Helical Gear, $\frac{1}{4}$ " (Can only be used together)
211b. " " $\frac{1}{4}$ "



212. Rod and Strip Connector
213. Rod Connector



214. Semi-Circular Plate, $2\frac{1}{2}$ "
215. Formed Slotted Strip, 3"



216. Cylinder, $2\frac{1}{2}$ " long, $1\frac{1}{2}$ " diam.