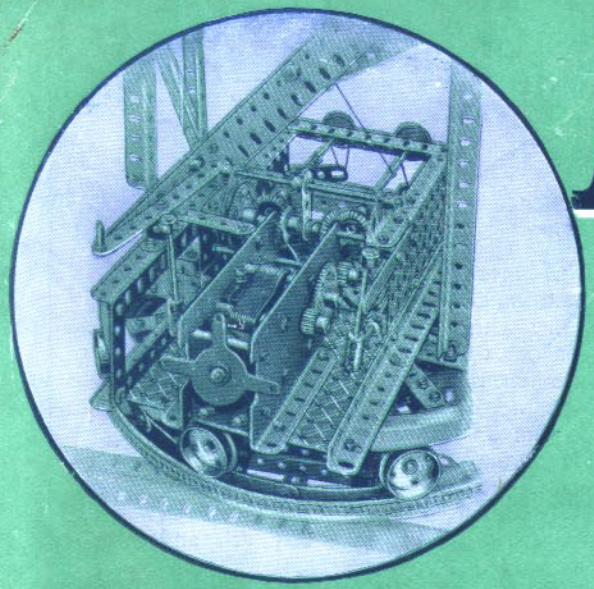
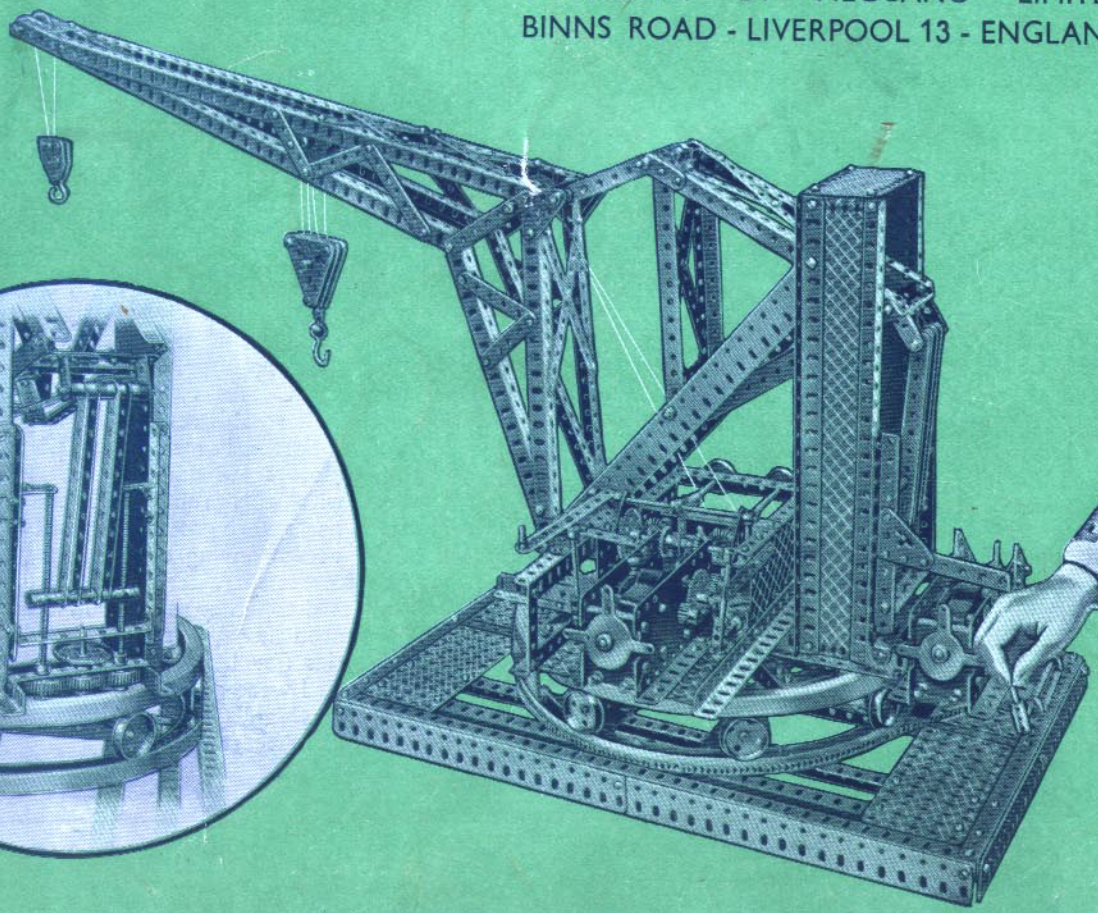
MECCANO

PARTS AND HOW TO USE THEM





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HOW MECCANO PARTS ARE CLASSIFIED

THE primary object of this book is to outline the principal functions of the standard parts that together constitute the Meccano system. It would be impossible to enumerate every function of every part, but we believe that by pointing out the special purposes for which the various parts have been designed, together with a few of the other uses that have been suggested from time to time by Meccano boys themselves, we shall help Meccano enthusiasts to build more interesting models, and also to construct them on scientific and practical lines.

Before any attempt could be made to describe the uses of the individual parts it was necessary to divide them into groups and to classify them in a systematic manner. For the purpose of this book we have grouped the parts first of all into two main sections, which we have termed respectively the "Structural Section" and the "Mechanical Section." Secondly, we have divided these Sections into a number of classes, each of which is dealt with separately.

The Structural Section includes all those parts that are used principally for the construction of frames, beams, bases, supports, etc. as opposed to parts intended essentially for assembly in mechanical movements, gear-boxes, driving mechanisms, etc., which are grouped under the various classes in the Mechanical Section. The grouping of the parts in the different classes will be made clear by reference to the table printed in the panel on this page.

This classification and grouping should not be taken too literally, for it is impossible to state definitely all the functions and varied applications of any one Meccano part, nor can we say that certain parts are used only for frames, beams, girders, etc., and others only for gear-boxes, driving mechanisms, and other mechanical movements. The Meccano Strips, for example, are used principally in the construction of frames ; that is, as structural parts. They may however be used also as levers, connecting rods, and for other similar purposes ; and when thus employed they would more correctly be considered not as structural but as mechanical parts. From this it will be seen that the arranging of Meccano parts in definite groups is a difficult matter. Nevertheless we think that the method adopted will enable anyone who is not already familiar with the various components of the system to see at a glance all the parts that are most likely to be suitable for obtaining any desired movement or structure.

The parts included in Class A, Strips, may be said to form the backbone of the Meccano system, for some of them are to be found playing an important part in practically every Meccano model.

Class B deals with Girders and similar parts, which are used principally for the heavier constructional work, to give strength and rigidity to various structures. Class C comprises the smaller parts that are intended to form connecting links between the larger structural parts in Classes A and B. In Class D are included all the parts intended for "filling in" the framework of models, and for building floors, gear-box frames, etc.

Class E deals with certain parts that are indispensable for all kinds of model-building, namely, Nuts and Bolts and tools. It also includes the Meccano Instruction Manuals, Super Model Leaflets, and other publications.

The contents of Classes F, G, and H are clearly indicated by their descriptive titles, and therefore need no explanation.

After the appropriate parts had been allocated to Classes F, G, and H, it was found that there still remained a large number of unclassified mechanical parts, not counting Motors and similar units. In order to deal with this remainder, the special electrical parts were grouped together into a class by themselves—Class L in the accompanying table. Then, of the parts still left, some were found to possess characteristics quite different from the rest, and these were collected together as Special Accessories, Class J. By Special Accessories we mean those parts that are designed for specific purposes, such as Shuttles (for Looms), Signal Arms, etc. Finally, all the accessories still unclassified were placed under Class K.

The Electric Motors, Transformers, and Clockwork Motors are grouped under Class M, Power Units and Accessories.

STRUCTURAL SECTION

Class A—Strips.
,, B—Girders.
,, C—Brackets, Trunnions, etc.
,, D—Plates, Boilers, etc.
,, E—Nuts, Bolts and Tools.

MECHANICAL SECTION

Class F—Rods, Cranks, and Couplings.
,, G—Wheels, Pulleys, Bearings, etc.
,, H—Gears and Toothed Parts.
,, J—Special Accessories (designed for specific purposes).
,, K—Miscellaneous Mechanical Parts.
,, L—Electrical Parts.
,, M—Power Units and Accessories.

Class A. STRIPS

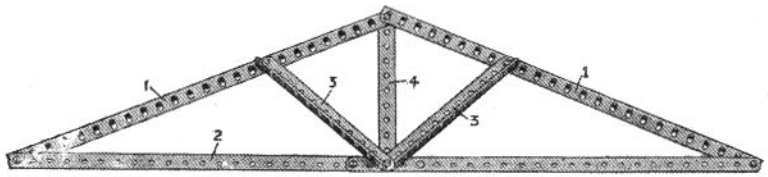


Fig. 1

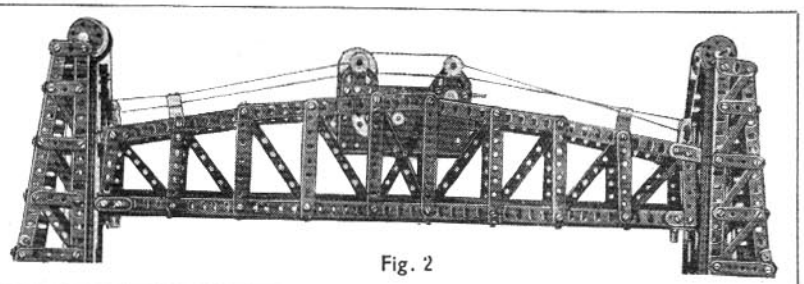


Fig. 2

PERFORATED STRIPS.

No. 1, 12½″ long. No. 1b, 7½″ long. No. 2a, 4½″ long. No. 4, 3″ long. No. 6, 2″ long.
No. 1a, 9½″ long. No. 2, 5½″ long. No. 3, 3½″ long. No. 5, 2½″ long. No. 6a, 1½″ long.

There are two main uses for these parts—for bracing and for "filling-in." For the first use, a few strips, provided they are arranged correctly, will convert a normally weak framework into a rigid structure. This point is illustrated in Fig. 3. Here a vertical column, composed of four Angle Girders and eight short Strips, is made absolutely rigid by the use of twelve 5½″ Strips arranged in the form of simple bracing.

An example of Strips forming compound bracing is shown in Fig. 2. The model is a small reproduction of a large vertical lift bridge the prototype of which spans the world-famous Welland Ship Canal. It will be noticed that the compression members of the main columns carrying the two slides for the lifting section of the model are represented by 12½″ Angle Girders, while the corresponding tension members, which are weaker, consist only of 12½″ Strips. The diagonal bracing, which is a distinctive feature of the original bridge, is reproduced in the model by means of Strips of various lengths.

Fig. 1 is a model of a simple roof truss. The sides 1, which have to withstand a compressive force, are constructed from Angle Girders ; the side 2, which is merely in tension, consists of two 12½″ Strips overlapped and bolted together. The triangle so formed would be quite rigid for ordinary purposes, but struts and ties are usually added at 3 and 4 respectively in order to obtain still greater rigidity.

An excellent example of the use of Strips for filling-in is illustrated in Fig. 4. This example is the lower part of a Meccano model outboard engine, and represents the steering fin fitted to actual engines of this type. The outline of the fin is formed from Curved Strips and the space so enclosed is filled in with Strips of various lengths. As will be seen, the result is extremely neat, and gives some idea of the possibilities of this type of building in other models.

Fig. 4 shows also how a streamlined body can be constructed without distorting too many parts. This construction is shown attached to the upper face of the horizontal Boiler, and it consists of a number of vertical Strips bolted to two ellipses, each of which is constructed from two slightly bent 3½″ Strips. These Strips are secured together at their ends by means of ½″ × ½″ Angle Brackets.

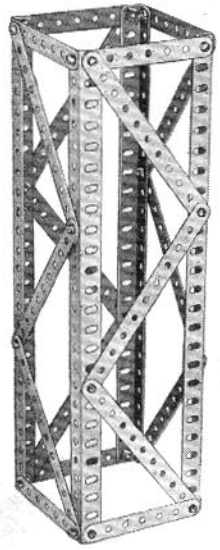


Fig. 3

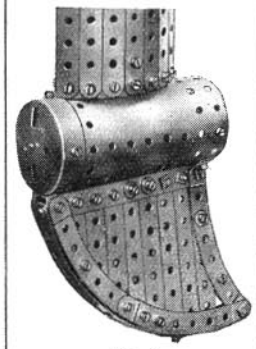


Fig. 4

DOUBLE ANGLE STRIPS.

No. 46, 2½″ × 1″. No. 48, 1½″ × ½″. No. 48c, 4½″ × ½″.
No. 47, 2½″ × 1½″. No. 48a, 2½″ × ½″. No. 48d, 5½″ × ½″.
No. 47a, 3″ × 1½″. No. 48b, 3½″ × ½″.

Except that their ends are bent at right-angles, these parts are exactly similar to the Strips already described. They are used in a great many ways and they are specially useful where it is necessary to join two halves of a bridge or motor-car chassis together. They can be used also in the construction of a square column or other similar unit.

Fig. 5

SLOTTED STRIPS.

No. 55, 5½″ long. No. 55a, 2″ long.

No. 55 is provided with three ordinary holes and two slots, each 1⅛″ long ; while No. 55a has two ordinary holes and a slot ⅝″ long. These slots can be used as guides for sliding mechanisms. They are invaluable also in obtaining small adjustments, between parts, that would be impossible with the standard holes spaced ½″ apart.

CURVED STRIPS.

No. 89, 5½″ long, 10″ radius, 12 to circle. No. 90, 2½″, 2⅜″ radius, 8 to circle.
No. 89a, 3″ cranked, 1⅜″ radius, 4 to circle. No. 90a, 2½″, cranked, 1⅜″ radius, 4 to circle
No. 89b, 4″ cranked, 4½″ radius, 8 to circle.

The uses for these parts are many and varied, and it will only be possible to give here a general idea of their adaptability. Their most elementary and obvious use is, of course, that of building circular figures for flywheels, roller bearings, etc. For this form of construction great care must be taken in order that a true circle may result. These circles of Curved Strips, when used in pairs and spaced apart by Washers, form excellent pulley wheels, and can be used in such models as cranes, pit-head gears, etc.

It is also possible to build correctly grooved pulleys in this way. This is accomplished by making the radius of the circle smaller than that for which the Curved Strips were designed, this causing the inner edges of the Strips to turn inward. In this manner a V shaped groove can be formed by connecting two of these circles together by means of Angle Brackets. If this construction is carried out with two Strips only, the resulting unit forms an excellent mud-guard for Meccano motor cars. Bell mouths for cowls and funnels also are possible by this means.

For constructional purposes these Curved Strips are invaluable, and those used in Fig. 4 as already mentioned, form a good example of their uses in this direction. Here 4″ cranked Curved Strips are used to form the framework of the steering fin of the outboard engine.

Fig. 5 is an example of the use of 2½″ large radius Curved Strips. The illustration shows these parts reproducing the rear upswept end of a Meccano motor chassis. The new Meccano Motor Chassis described in Leaflet No. 1a affords other examples of Curved Strips used to reproduce the upswept ends found in an actual chassis.

These parts are also extremely useful for decorative purposes as shown in the Mantel Clock, Model L17, and also in the Single and Double Flyboats, described in Super Model Leaflet No. 33.

CIRCULAR STRIP.

No. 145. 7½″ diam. overall.

Can be used in circular structures, such as a flywheel, or in a built-up roller bearing as a means of supporting the rollers (see Standard Mechanism No. 139).

Class B. GIRDERS

Meccano Girders play an important part in Meccano engineering. They give great rigidity to any structure in which they are incorporated and serve admirably as bearings for shafting. A few Girders placed together with proper care and braced by one or two Strips or Rods will form a structure capable of supporting a man's weight without the slightest disruption.

The secret of the strength of the Meccano Angle Girders lies in the right-angle formation of their flanges, which enables them to withstand bending stresses in any direction. This will be more clear from the following considerations. If a wooden beam is mounted so that its ends only are supported, and a heavy load is placed on it, it will bend. The material in the upper part of the beam is then compressed or squeezed together, and that in the lower part is in tension or stretched out. The force bringing this about exerts its greatest effects along the outer edges of the beam, and there is a central line, dividing the part where the wood is compressed from that where it is in tension, along which there is no change. This line is called the central axis, and the greater the depth of material above and below it to resist the action of the force tending to produce bending, the stronger will be the beam. Thus it is clear that the strength of a beam is determined by its depth, rather than by its width.

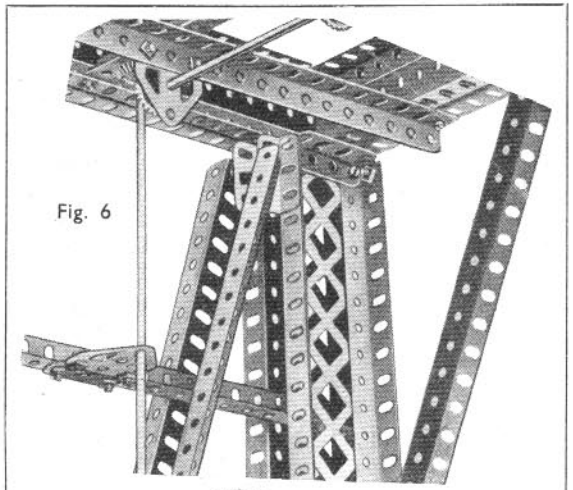


Fig. 6

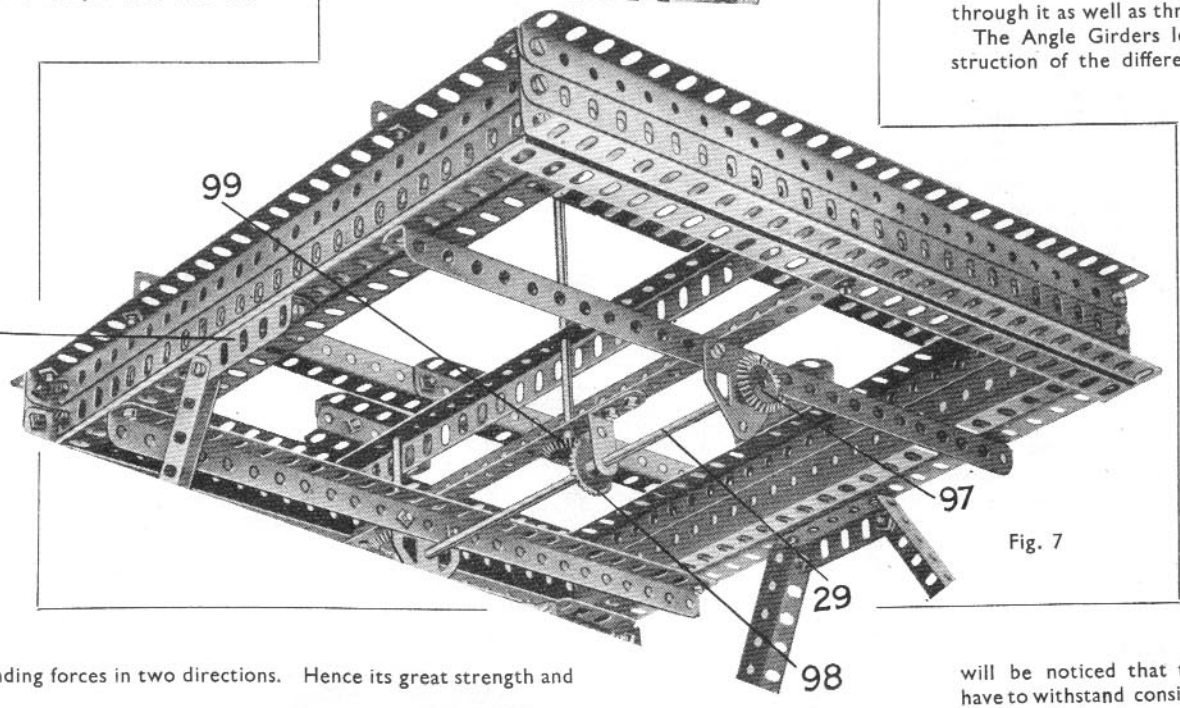


Fig. 7

If a Meccano Strip is laid flat across two supports and a small load is placed on it, it will bend readily, for the parts in compression and tension are small, and therefore offer little resistance to the bending force. If the Strip is placed on edge, however, it will not bend anything like so readily, because there is more material in the correct position to withstand the action of this force. A single Angle Girder is equivalent to two ordinary Strips secured rigidly at right-angles along their flanges, and thus offers great resistance to bending forces in two directions. Hence its great strength and its value in model-building.

When a Meccano boy runs short of Girders he usually improvises by placing two long Strips together lengthwise and bolting them at right-angles by Angle Brackets. It is also a very good plan, when angle girders having a very solid appearance are required, to use two Flat Girders secured together at right angles by 1″×1″ Angle Brackets. To make this construction rigid, an Angle Bracket should be used every two or three inches.

ANGLE GIRDERS

No. 7, 24½″ long	No. 8b, 7½″ long	No. 9c, 3″ long
No. 7a, 18½″ long	No. 9, 5½″ long	No. 9d, 2½″ long
No. 8, 12½″ long	No. 9a, 4½″ long	No. 9e, 2″ long
No. 8a, 9½″ long	No. 9b, 3½″ long	No. 9f, 1½″ long

Angle Girders differ only in their lengths. Each is perforated with round holes in one flange and elongated holes in the other. The object of the elongated holes is to provide the "play" that often is necessary when bolting a Girder to other parts. The value of this "play" is illustrated in Figs. 9 and 10, which represent sections of two Angle Girders that are bolted together to form channel-section girders, Fig. 9 showing the right method of securing the Girders, and Fig. 10 the wrong method. In the former the narrow flange of one Girder is bolted to the broad flange of the other, with the result that the centres of the holes in the remaining flanges are exactly opposite—a feature that is important when it is desired to journal a Rod through the flanges of a channel girder of this type. Whenever a Rod is to be journalled through the wide flange of an Angle Girder, a short Strip should be bolted to the flange so that the Rod can pass through it as well as through the elongated hole.

The Angle Girders lend themselves readily to the construction of the different types of Girders used in actual practice. Fig. 16 shows a built-up I-section Girder, consisting of four Angle Girders bolted to a Flat Girder. Fig. 15 shows a built-up Channel Girder consisting of two Angle Girders connected together by Flat Girders or by Flat Brackets. Figs. 11, 12, and 13 illustrate further examples of built-up Girders that are capable of withstanding tremendous bending or compressive stresses.

Figs. 6 and 7 show complicated girder construction, the subjects being sections of the Giant Block Setting Crane (Instruction Leaflet No. 4). Fig. 6 shows a portion of the travelling gantry, viewed from underneath, and it shows in detail one of the four columns that support the gantry. It will be noticed that the upper horizontal girders, which have to withstand considerable bending stresses, are of the "I" type, similar to that shown in Fig. 16 but larger. The supporting columns are in reality large rectangular girders. It is also interesting to note the use that has been made of Braced Girders. Two of these have been built into the corner so that the bracing in these parts assists the Angle Girders in resisting side stresses. They are secured together to form two sides of a rectangle and are strengthened by Angle Girders.

Class B. Girders (Contd.)

BRACED GIRDERS

No. 97, 3½″ long	No. 99a, 9½″ long
No. 97a, 3″ long	No. 99b, 7½″ long
No. 98, 2½″ long	No. 100, 5½″ long
No. 99, 12½″ long	No. 100a, 4½″ long

These are not only useful in building large structures, but are also ornamental. They consist, in effect, of two parallel strips placed so that the opposite holes are 1½″ between centres, and connected together by a series of diagonal ties and struts. In order to strengthen the Braced Girders and also to improve their appearance when built into a model are finished off at the ends by the addition of a narrow strip of metal at right angles to the sides. This of course is a great improvement, as each Braced Girder now forms a complete unit in itself. When connecting two Braced Girders together by overlapping, they should, wherever possible, be overlapped an odd number of holes, so that the diagonals coincide. If they overlap an even number of holes the diagonals of one Girder appear between those of the other, and the result is not so neat or realistic. The uses of Braced Girders will be obvious and a detailed description of them is not necessary.

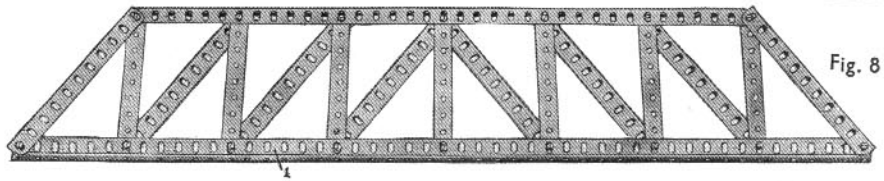


Fig. 8

FLAT GIRDERS

No. 103, 5½″ long	No. 103c, 4½″ long	No. 103g, 2″ long
No. 103a, 9½″ long	No. 103d, 3½″ long	No. 103h, 1½″ long
No. 103b, 12½″ long	No. 103e, 3″ long	No. 103k, 7½″ long
	No. 103f, 2½″ long	

Used principally in connection with Angle Girders in building up large girders. Several of their uses in this connection have already been mentioned (see Figs. 11, 15 and 16). Good use of Flat Girders is made in various parts of the Meccano Dragline (Special Instruction Leaflet No. 27). For example, each of the four-wheeled bogies on which this model runs consists primarily of two 3½″ Flat Girders connected together by Double Brackets in such a way that their round holes can be employed as bearings for the wheel axles and rods of the gearing, etc.

An interesting demonstration of the value of the elongated holes in the Meccano Girders will also be found in this model. The compensating beam, which is pivoted at a central point to the travelling base and is mounted across the rear pair of bogies, consists of an I-shaped girder similar to that shown in Fig. 16. As the strain on this girder is at a maximum at its centre and diminishes towards the ends, in practice it is made deeper at the centre than at the ends, and this shape has been reproduced very closely in the Meccano model, owing to the fact that the play allowed by the elongated holes makes it possible to place the lower flanges of the I-girder on a slant.

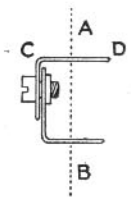


Fig. 9

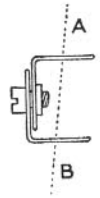


Fig. 10

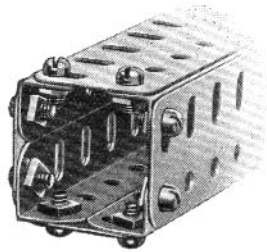


Fig. 11

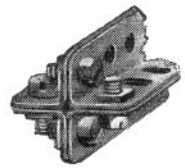


Fig. 12

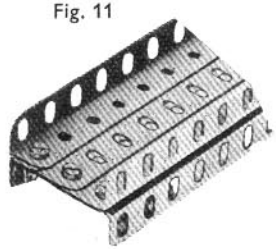


Fig. 13

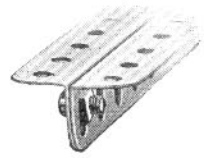


Fig. 14

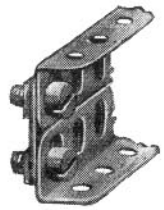


Fig. 15

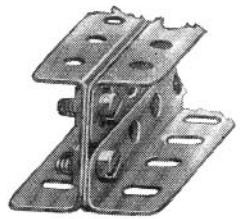


Fig. 16

When the elongated holes of these parts are used for carrying the securing bolts, Washers should be placed under the bolt heads. If this is not done, and the bolt is screwed up very tight, the head of the bolt is liable to force the metal of the girder outward and thus become loose.

An example of the use of these parts in building up irregular bodies is shown in the new Meccano Motor Chassis, described in Super Model Leaflet No. 1A. In this model the petrol tank is built up entirely from Flat Girders held together by Angle Girders and Angle Brackets, and full use of the slots is made in obtaining the triangular shape of the tank.

No. 113, GIRDER FRAME

This may be likened to a large trunnion. It consists of a strip perforated with 11 holes, at the centre of which, and at right-angles to it, is a piece 1¼″ long supported by two diagonals. It is particularly useful for bolting to the sides of Meccano wagons, etc., to form bearings for the axles, and it can be used to form journal bearings in many other types of model. It also has a certain ornamental value, as is shown by the Meccano model Flyboats (Special Instruction Leaflet No. 33). In both the Single and Double Flyboats, Girder Frames are used as finishing pieces for the vertical A-frames that support the large revolving wheels.

The part is specially useful in model workshops where overhead shafting is employed for driving the various machines. Angle Girders secured in the roof of the workshop form the means of fixing in place the Girder Frames, the bottom holes of which may be used as bearings for the shafting carrying the belt pulleys. Where a heavy drive is to be transmitted, the bearings may be reinforced by securing two or more Girder Frames together.

No. 143, CIRCULAR GIRDER, 5½″ diam.

Two or more of these parts can be used as the "ribs" of a Meccano built-up boiler, a series of Strips being bolted round their circumference. Incidentally, Hub Discs, part No. 118, could be employed equally well for this purpose, but these parts are included under Class G : Wheels, Pulleys, etc. Another important function of the Circular Girder is illustrated in the Steam Shovel (Special Instruction Leaflet No. 19) where it is used as the upper guide rail of a built-up roller bearing unit (see also Standard Mechanism No. 139). The part is invaluable in building models of large cement-mixing machines, wagon tipplers, and similar models where circular structures are necessary.

Class C. BRACKETS & TRUNNIONS, Etc.

In actual engineering, constructional work is carried out not only by a number of girders and similar members but also by large numbers of brackets of different shapes. At every point at which one member is secured to another, or where a shaft is supported by a framework, special brackets and trunnions are used, and these form vital strengthening factors of the complete structure.

The Meccano range of parts includes a great variety of Brackets, and these have been found to provide for almost every contingency that can arise in the construction of a model.

FLAT BRACKET. No. 10., ½″ wide, ⅞″ long.

This part is produced with one round hole and one elongated hole, the latter enabling various adjustments to be carried out that are not possible with short Strips and other similar parts. It is extremely useful when slight adjustment for length is required, on a Strip or Girder and also when a circle of small radius has to be obtained. Circles made in this manner and fitted with Angle Brackets are used in the construction of cylinders and ships' funnels. The oval shape of a ship's funnel can be readily obtained by this means.

Excellent endless belting and heavy gauge chain can be constructed by using Threaded Rods in conjunction with Flat Brackets. Two of these parts also form an excellent substitute for a 1″ Triangular Plate or Small Corner Bracket. This latter use is illustrated in Fig. 24. In this example two Flat Brackets are used to form a small triangular plate, and each slotted hole of the two Brackets carries a Strip. The slotted holes are used here in order to allow longitudinal adjustment for the Strips.

In Fig. 21 two Flat Brackets are shown representing one of the anchoring shackles of a motor chassis spring. A Double Bracket is bolted to the outer extremity of the spring, and each upturned lug of this carries a pivotally mounted Flat Bracket. These in turn are attached by locknutted bolts to the frame of the model.

The tail of a Meccano animal is shown formed from a Flat Bracket in Fig. 20 a nut and bolt being used to hold it.

DOUBLE BRACKET No. 11.

The most general use to which this part is put is that of a short Double Angle Strip. It is shown used in this manner in Fig. 21. There are also many occasions, especially in smaller Outfits, when it can be used as a substitute for an Eye Piece, and Fig. 23 illustrates its use in this manner. Here the Double Bracket is pivotally attached at its centre hole to a Bush Wheel, and carries between its two turned-up ends a Strip of any suitable length. This Strip slides to and fro on the bolt head, forming the connection between the Bracket and the Bush Wheel ; and it is prevented from excessive vertical movement by a short Rod held in place by means of Spring Clips.

Fig. 17

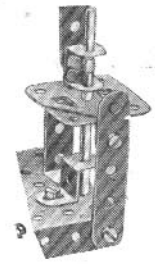


Fig. 18

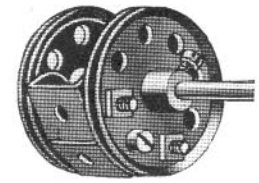


Fig. 19

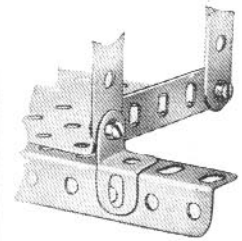


Fig. 20

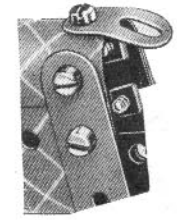


Fig. 21

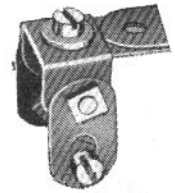


Fig. 22

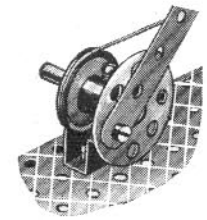


Fig. 23

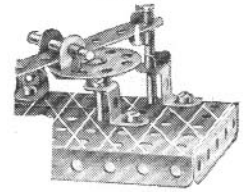


Fig. 24

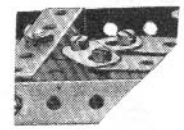
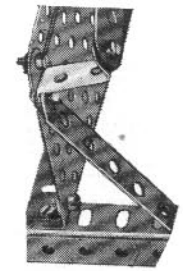


Fig. 25



This part is often used as a connection between a Strip and a Rod. The manner of accomplishing this is shown in Fig. 17, where the Bracket forms the necessary connection between the connecting rod and piston rod of a small model beam engine. The Double Bracket is pivotally attached at its centre hole to the Strip forming the connecting rod, and in its two outer holes is carried a short Rod, that is prevented from sliding in the Double Bracket by means of two Spring Clips.

A special use often found for Double Brackets is seen in Fig. 18. In this illustration three Double Brackets are shown bolted in position between two 1½″ Pulley Wheels and in this way forming a useful cam. This example has been used on Meccano Looms with great success for a number of years. Suitable tappet arms for use with this are shown in Standard Mechanisms 90 and also Instruction Leaflet No. 16a.

ANGLE BRACKETS.

No. 12, ½″×½″ No. 12a, 1″×1″. No. 12b, 1″×½″.

These parts, especially the small size, are without doubt the most useful of all Meccano Brackets, as they form an indispensable link between Strips and Girders of all sizes, particularly in small models. They are often used when securing Strips together in order to form special girders and channels, and for building up special brackets that are not included in the standard parts.

In Fig. 32 a number of ½″×½″ Angle Brackets are shown forming the necessary securing lugs by means of which two Large Corner Brackets are attached to the front of a model locomotive. They are illustrated again in use in Fig. 41, where they are shown supporting Double Arm Cranks above the bearings of a crankshaft.

Where a stronger connection than that formed by a ½″×½″ Angle Bracket is required, a 1″×1″ Angle Bracket can be used. These parts are similar to those already described, except that they are twice as large and are not fitted with slotted holes. As bearings, where small power is to be transmitted, they will serve quite well in place of stronger and more costly parts. An example of this use is shown in Fig. 26.

The 1″×½″ Angle Brackets are very useful where slight adjustment is required in a model, as they are fitted with a slotted hole at the outer end of their long arms. This point, as is shown in Fig. 102, is often extremely useful, and the part can be made still more adaptable by utilising a Flat Bracket. This Bracket must be bolted by its elongated hole to the inner hole of the Angle Bracket. Thus a Rod journalled in the slotted hole of the Angle Bracket can be varied as desired, within limits, in a horizontal direction.

OBTUSE ANGLE BRACKETS. No. 12c, ½″×½″.

These parts have been introduced into the Meccano system in order to reduce the amount of bending of Flat Brackets and ½″×½″ Angle Brackets to a minimum. They will be found extremely useful in building up boilers and cylinders of

Class C. Brackets & Trunnions, Etc. (Contd.)

Obtuse Angle Brackets (Continued)

the type shown in Model K28, Watt's Beam Engine. This model is fully described in the F-L Instruction Manual.

In Fig. 39 of this Manual four of these parts are shown supporting a Hinged Plate, representing the roof of a crane. They are also used for securing Strips and Girders together at an angle of about 45 degrees when building roof trusses.

REVERSED ANGLE BRACKETS. **No. 124, 1". No. 125, ½".**

The dimensions refer to the centre portions of the parts only, and in each case the ends are turned at right angles to form a flange that is about ½" long and perforated with a round or elongated hole. Fig. 25 shows the 1" Reversed Angle Bracket used as a support for one end of the dashboard in a Meccano motor chassis. Both types of Reversed Angle Brackets form excellent reinforced bearings for Axle Rods, and typical examples of the use of the ½" size for this purpose will be found in Figs. 17 and 23. Many photographs in this Manual illustrate the adaptability of this part.

CORNER ANGLE BRACKETS. **No.154a, Right. No.154b, Left.**

These are similar to part No. 12 but have an additional flange. Fig. 19 shows a Corner Angle Bracket used as a guide for a lift cage. The Bracket is secured by one of its flanges to the top of the cage, thus leaving the other two flanges free to slide against the vertical Angle Girder which forms one of the guides for the lift. Three other girders are fitted similarly.

CRANKED BENT STRIP. **No. 44.**

SINGLE BENT STRIP. **No. 102.**

These two parts are similar in appearance except that No. 102 has two holes in each side instead of one, and one side of No. 44 is cranked so as to allow more space between the ends. The principal function of both parts is to form a simple and compact bearing for short Axle Rods, see Fig. 22. They are also used in the construction of innumerable small mechanisms, such as pulley blocks, castors, guides, etc., or as "claws" for gear-shifting levers in model cranes, etc.

DOUBLE BENT STRIP. **No. 45.**

Designed to form reinforced "footstep" or extended bearings for Axle Rods, etc., see Fig. 29. Invaluable where space is restricted; when bolted to a Strip or Plate ample journal bearings are provided for a short Axle Rod, the Rod passing through the Strip and Double Arm Crank if necessary, and through the centre hole of the Double Bent Strip.

ARCHITRAVE. **No. 108.**

Intended for strengthening corners of frames, as shown in Fig. 27. Also extremely useful as an ornamental piece. The top of the Eiffel Tower, model No. L.15 in the F-L Instruction Manual, consists principally of four Architraves.

Fig. 26

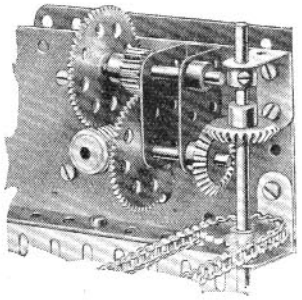


Fig. 27

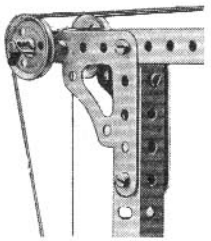


Fig. 28

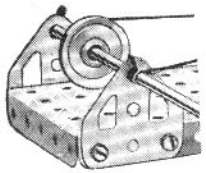


Fig. 29

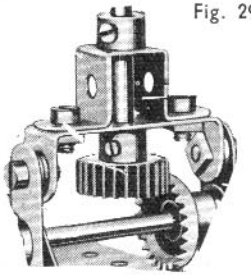


Fig. 30

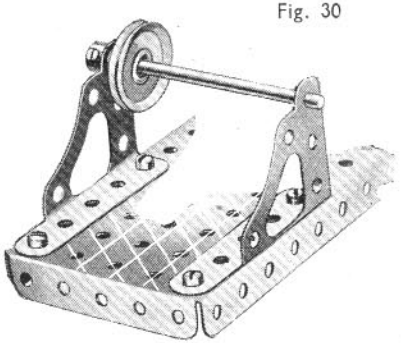
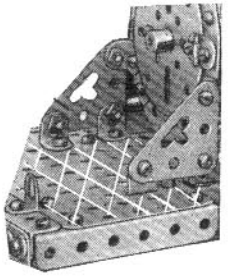


Fig. 31

Fig. 32



FLANGED BRACKETS. **No. 139, Right. No. 139a, Left**

The Right- and Left-hand Flanged Brackets resemble the Architraves except that in each of the former one side is bent over to form a flange.

Fig. 30 shows these parts used as bearings for a horizontal shaft. They are also extremely useful for strengthening various structures where space is not restricted.

TRUNNION. **No. 126.** **FLAT TRUNNION.** **No.126a.**

In addition to their obvious use as bearings for axles of trucks, etc., these parts lend themselves to many other different adaptations. In Fig. 15 two Flat Trunnions are shown bolted together in such a way that they form a small plate 1½" square. In Fig. 28 two ordinary Trunnions, which differ from the Flat Trunnions only by the fact that one end is bent over to form a flange, are bolted to a rigid base of a small swivelling structure for supporting a handle.

CORNER BRACKET. **No. 133, 1½". No. 133a, 1"**

This part, like the Architrave, is designed primarily for use as a corner strengthening piece, but owing to its smaller size can be used in many places where the Architrave would prove unsuitable. Fig. 32 indicates other uses for the Corner Bracket. The illustration is of the front footplating of the Meccano Tank Locomotive, and it will be noticed that two Corner Brackets are used as strengthening pieces between the footplating and the front buffer beam. Four other Corner Brackets are assembled to represent the steam pipes leading from the cylinders to the smoke box.

CHANNEL BEARING. **No. 160. 1½" × 1" × ½"**

Used principally to form bearings for Rods. Each side of the channel measures 1½" × 1" and is perforated with six holes, while the connecting piece is ½" wide and is pierced with three holes. The part is small but rigid and therefore very valuable where space is limited. In Fig. 26 it is seen attached to the side of an Electric Motor, where it provides bearings for two Rods carrying a part of the Motor reduction gearing. To build up similar bearings from other Meccano accessories would require a good deal of time and a number of small parts and the result would not be nearly so neat or rigid.

GIRDER BRACKET. **No. 161. 2" × 1" × ½"**

Intended for forming bearings for shafting. A valuable feature of the part is the fact that the four holes in the flange are elongated, thus enabling certain adjustments to be made that would be impossible with the ordinary round holes,

Class D. PLATES AND BOILERS, Etc.

PERFORATED FLANGED PLATES. **No. 52, 5½″×2½″** **No. 53, 3½″×2½″**

No. 52 has flanges on all four sides, while No. 53 is flanged on only two sides. No. 52 is used to a large extent as a base for small models, and in the construction of work-tables, platforms and sides of gear-boxes, etc.

The large Flanged Plate is shown in use in Fig. 40. Here it forms the base of a simple model step-ladder constructed with a small Outfit, and it gives a good idea of how the part can be used, in a similar manner, in many other models where a strong rigid platform is required on which to build a tall structure. The Plate is also shown in use in Figs. 75 and 82.

The smaller Flanged Plate, Part No. 53, can be used where a small base or side frame is required in a model where strength is not of primary importance. This part has two flanges only, but if three or four are required they can be built up from 3½″ Angle Girders. Two fairly common methods of employing this part are shown in Figs. 87 and 117. These illustrate its use as a base, but it may also be built into any model as the side frame of a gear-box.

PERFORATED FLANGED SECTOR PLATES.

No. 5a, 4″ long. **No. 54a, 4½″ long.**

These parts measure 2½″ across at their widest end and taper down to 1½″ at their other end, the sides being provided with flanges punched with slightly elongated holes. Fig. 37 shows two small Sector Plates used to form the top of the base of an elevated jib crane.

When a Sector Plate is bolted by one of its flanges to a Girder or other part, its other flange and the rows of holes punched in its face lie at an angle to the part, and this fact proves advantageous in numerous cases. In Fig. 35 for example, a Sector Plate is shown secured to the base of a rotating crane. Another is bolted to the opposite side of the base, so that Axle Rods journalled in Angle Brackets bolted to the Sector Plates are disposed radially to a fixed point near the rear of the model. These Rods carry the travelling wheels. Hence the model is capable of rotating completely about the fixed point.

For many purposes the 4″ Flanged Sector Plate is too short in comparison to its length, and for this reason the 4½″ Sector Plate has been introduced into the Meccano system. This part, No. 54a, is especially useful for models where a fairly long tapered part is required, examples of this being illustrated in Figs. 33, 34 and 43.

In Figs. 33 and 34 this part is used to represent the top of the bonnet of a car, and as will be seen, the effect is far more realistic than if Part No. 54 had been used.

In Fig. 43 two large Sector Plates have been used in order to reproduce the taper at the front of a model high-winged monoplane. Here the wide ends of the Plates have been bolted to the fuselage of the plane, and the narrow ends are connected together by a 1½″ Strip and a 1½″×½″ Double Angle Strip. The Double Angle Strip is fitted with a Double Bent Strip, and these two parts form a bearing for the Rod carrying the propeller. The top of this section of the fuselage is tapered as shown, and the space enclosed by the Sector Plates is filled in by means of Strips. If desired these Strips can be replaced by a third Sector Plate.

When bolted edge to edge these Plates will be found to form an excellent rim for a heavy flywheel with a diameter of 9¾ ins.

FLAT PLATES.

No. 52a, 5½″×3½″ **No. 70, 5½″×2½″**
No. 53a, 4½″×2½″ **No. 72, 2½″×2½″**

When it is necessary to build up a large platform it is often desirable to have this as free as possible from flanges and other obstructions. In these circumstances Flat Plates are used. These parts are made of comparatively heavy gauge metal, and it is therefore possible to construct quite a large platform without the use of a great number of girders and other forms of bracing. Examples of this type of construction are shown in Super Model Leaflets Nos. 32 and 34.

In Leaflet No. 32, Flat Plates have been used to form the base of a large twin cylinder mill-engine fitted with a boiler. In Leaflet No. 34 several 5½″×3½″ Flat Plates have been built up to form the wings of a large three-engined passenger biplane, and it is in this example that the extra thickness of the Flat Plates is utilised to advantage. Only two long Angle Girders, joined together to form a "U" section girder, are used to prevent each of the wings from warping, the remainder of the required strength being given by the Flat Plates.

Fig. 33

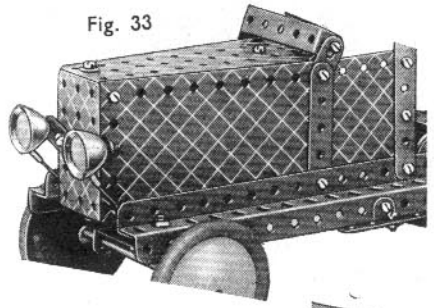


Fig. 34

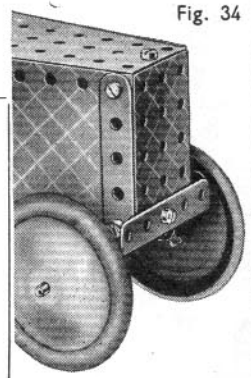


Fig. 35

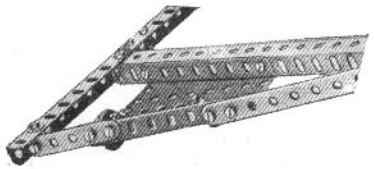


Fig. 36

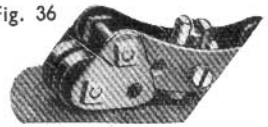


Fig. 37

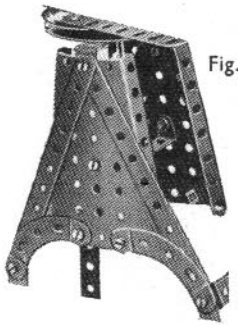


Fig. 38

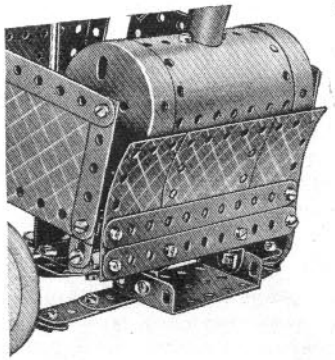


Fig. 39

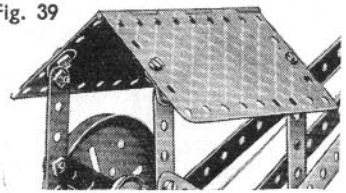


Fig. 40

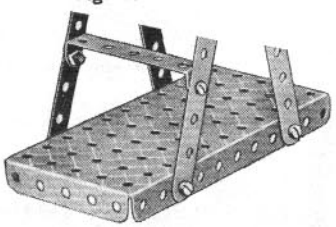
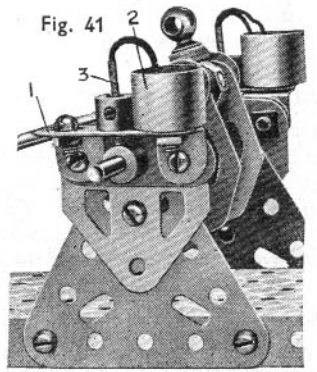


Fig. 41



Class D. Plates and Boilers (Contd.)

In Fig. 49 two $5\frac{1}{2}'' \times 2\frac{1}{2}''$ and two $4\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plates are used to form the upper portion of an automatic discharging hopper ; and in Fig. 50 Flat Plates of various sizes have been joined together to form the sides of the cab of a large model crane. In this instance the door of the cab has been reproduced by means of a $5\frac{1}{2}'' \times 3\frac{1}{2}''$ Flat Plate mounted on Hinges.

It should be noted that the two ends of the $4\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plates have elongated holes. These are extremely useful when constructing an awkward model, as they allow for a considerable amount of adjustment.

STRIP PLATES.

No. 193, $2\frac{1}{2}'' \times 2\frac{1}{2}''$. **No. 194,** $3\frac{1}{2}'' \times 2\frac{1}{2}''$. **No. 195,** $5\frac{1}{2}'' \times 2\frac{1}{2}''$.
No. 196, $9\frac{1}{2}'' \times 2\frac{1}{2}''$. **No. 197,** $12\frac{1}{2}'' \times 2\frac{1}{2}''$

For filling in and for reproducing curved portions of a structure these parts will be found extremely useful. They are made of considerably thinner metal than Flat Plates and are only perforated round their edges. They are shown in use in Figs. 33, 38 and 43, those used in Fig. 38 being bent slightly. In Fig. 43 they are shown used to advantage for the wing of an aeroplane, and it is under these conditions that the absence of the holes in the parts is utilised to best advantage.

FLEXIBLE PLATES.

No. 188, $2\frac{1}{2}'' \times 1\frac{1}{2}''$ **No. 189,** $5\frac{1}{2}'' \times 1\frac{1}{2}''$. **No. 190,** $2\frac{1}{2}'' \times 2\frac{1}{2}''$.
No. 191, $4\frac{1}{2}'' \times 2\frac{1}{2}''$. **No. 192,** $5\frac{1}{2}'' \times 2\frac{1}{2}''$

These Plates are made of special fibre that enables them to be bent and twisted without fear of damage. Numerous instances for their use are to be found in Meccano model-building, a simple example being shown in Fig. 47. They can be used also in place of the Strip Plates shown at the foot of the model in Fig. 38.

HINGED FLAT PLATE.

No. 198, $4\frac{1}{2}'' \times 2\frac{1}{2}''$

This part has been introduced to enable roofs and other similar structures to be constructed without the necessity of bending and mutilating parts. It is shown used in its most elementary manner in Fig. 39 where it forms the roof of a small swivelling crane.

TRIANGULAR PLATES.

No. 76, $2\frac{1}{2}''$. **No. 77,** $1''$.

These are intended principally for use as supports for journal bearings, as shown in Figs. 36, 44 and 45, but they have numerous other important uses. In Fig. 49, four $2\frac{1}{2}''$ Triangular Plates form the sides of a hopper and in Fig. 46 two are used in the construction of a pulley block.

The $1''$ Triangular Plate enables $\frac{1}{4}''$ distances to be obtained, which is not always easy with the ordinary parts perforated at intervals of $\frac{1}{2}''$. Fig. 45 shows two of these parts attached to the rear of the Meccano Traction Engine, to receive the end of the drawbar attached to a trailer. The rear of the Traction Engine is $3''$ wide ; hence it would not be advisable to attach the drawbar pin direct to one of the holes in the rear plate, as it would be out of centre. By attaching two $1''$ Triangular Plates as shown and securing the pin to their protruding ends, the drawbar of the trailer is connected centrally.

SLEEVE PIECE.

No. 163.

The Sleeve Piece is intended primarily for use in the construction of cylinders and chimneys. To form a complete cylinder, two $\frac{3}{4}''$ Flanged Wheels should be pushed over its ends. The Sleeve Piece can be secured in position by bolts inserted in the holes punched round its centre.

When used as a chimney the Sleeve Piece can be secured to a model by means of a $\frac{3}{4}''$ Flanged Wheel clamped over one end or by a Chimney Adaptor. In building up longer chimneys, two Sleeve Pieces can be connected together by pushing them over opposite ends of a Chimney Adaptor, but a more rigid and efficient method is that adopted in the chimney shown in Fig. 42.

This consists of three Sleeve Pieces placed end to end with the centre Sleeve Piece overlapping each of the other two by $\frac{3}{8}''$. A $3\frac{1}{2}''$ Rod passed lengthwise through the centre of the three Sleeve Pieces carries at one end a $\frac{3}{4}''$ Flanged Wheel that forms the top of the chimney. The top and bottom Sleeve Pieces are held in place by means of bolts passed through them and inserted in the holes of several Collars carried on the $3\frac{1}{2}''$ Rod.

Fig. 41 shows the Chimney Adaptor used as the oil receptacle in a syphon lubricator for journal bearings.

CHIMNEY ADAPTOR.

No. 164.

CIRCULAR PLATE.

No. 146. 6″ diam. overall.

Can be employed as a large flywheel or turntable, etc., or as a circular fixed base for machinery, or in the construction of driving wheels for giant Meccano locomotives. Fig. 51 shows one of the six driving wheels of the Baltic Tank Engine. It consists of a Circular Plate having a Hub Disc bolted to it to form the flange.

The Circular Plate has a large perforation at its centre through which the boss of a wheel can be slipped. The Plate is secured to an Axle Rod by first bolting it to a Bush Wheel or similar part then fixing it to the Rod by its Set Screw.

BOILER, No. 162 COMPLETE WITH ENDS.

BOILER ENDS. **No. 162a.** **BOILER.** **No. 162b.**

The Boiler can be incorporated in Meccano locomotives, stationary engines and other models of a similar type. It measures $4\frac{3}{4}'' \times 2''$, and is fitted at each end with a movable cap or Boiler End. With one Boiler End removed it can be incorporated in a model as a boiler, Fig. 42, or with both ends closed it will serve as a horizontal boiler as shown in Fig. 38. When constructing boilers or cylinders of large diameter, two or more Boilers may be opened out.

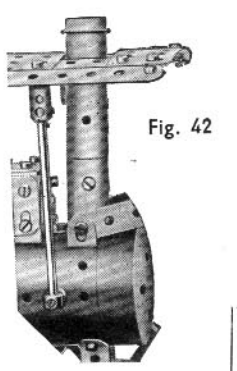


Fig. 42

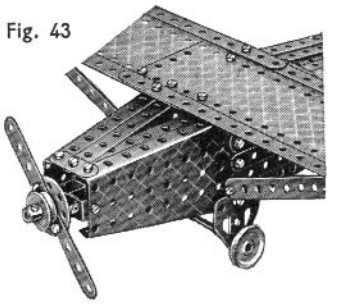


Fig. 43

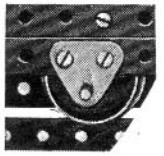


Fig. 44

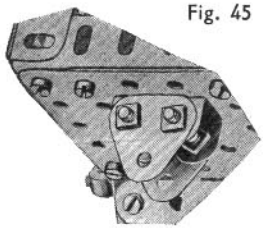


Fig. 45

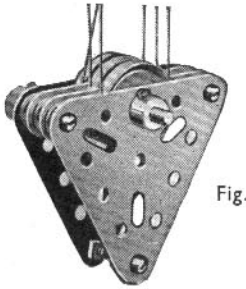


Fig. 46

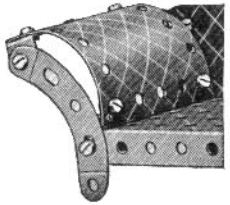


Fig. 47

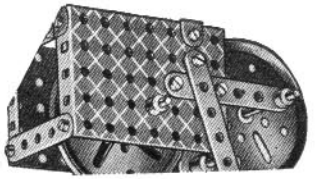


Fig. 48

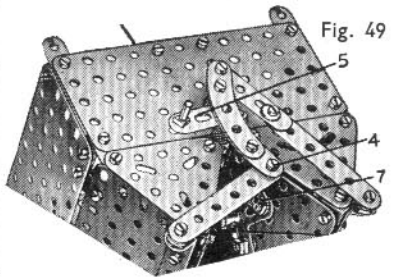


Fig. 49

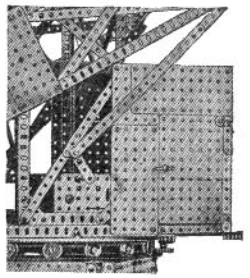


Fig. 50

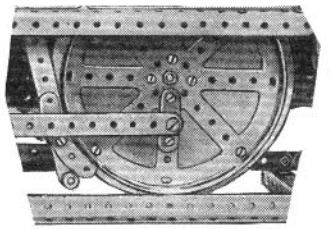


Fig. 51

Class E. NUTS, BOLTS & TOOLS

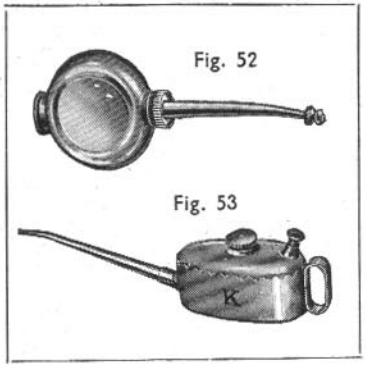


Fig. 52

Fig. 53

NUTS AND BOLTS. No. 37, 7/32".

The best method of securing nuts and bolts is with the head of the bolt on the outside of the model, for the Screwdriver forms a speedier method of tightening the nuts and bolts than the Spanner. Also, a model having all the bolt heads on the outer side will have a much neater appearance than one in which the nuts and shanks are all exposed. For ordinary model-building, sufficient rigidity can be obtained by using the Screwdriver only, merely steadying the nut with the fingers, but wherever great strain is expected, both Spanner and Screwdriver should be used simultaneously, the nut being held firmly by the Spanner in one hand while the bolt is turned by the Screwdriver in the other hand, or vice versa. A very important use of the nut and bolt is found in the making of pivotal parts. Typical pivots so formed are described under Standard Mechanism Nos. 1 and 1A. (See "Standard Mechanisms Manual," described at the end of this Section). In S.M.1 the bolt passes through the first Strip and is securely held to a second Strip by means of two nuts, which are screwed tight against opposite sides of this Strip. Sufficient space is left between the nut and the bolt head to allow free movement of the first Strip.

S.M.1A is a similar arrangement, except that both Strips are allowed freedom of movement about the bolt instead of one Strip only. Both Strips are first placed on the bolt and the nuts are then placed together on its shank. The nuts are turned in opposite directions until they securely grip each other in position on the bolt. S.M.1 is to be preferred wherever it is required to move only one Strip about the bolt, for this method affords a minimum amount of "play" or slackness in the joint.

Another kind of pivot formed from a bolt and nut is included in Fig. 65. Bolt 1 in this illustration passes through the end hole of a Crank 6 and enters the threaded bore of a Collar 2, without touching the Rod 3. It is secured rigidly in this position by locking a nut 4 against the Collar. Sufficient freedom is allowed for the Crank 6 to turn easily about the bolt, and the Collar 2, which is free on the shaft 3, is held in position by two further Collars. By means of this pivotal connection, easy longitudinal movement of the Rod 3 is obtained on operation of the Crank 6.

BOLTS. No. 111, ¾". No. 111a, ½". No. 111c, ⅜".

There are four different sizes of Meccano bolts, ¾", ½", ⅜", and 7/32" (No. 37b), but the pitch of the thread is the same in every case, 32 threads to the inch. The 7/32" Bolt, part No. 37b, and nut, part No. 37a, can be obtained separately or complete as part No. 37. It is this size of bolt that is supplied in considerable quantities, complete with nuts, in all the Meccano Outfits. The other three kinds of bolts are for use in special cases where an extra long shank is required.

SET SCREWS. No. 69, GRUB SCREWS. No. 69a, 5/32". GRUB SCREWS. No. 69b, 7/32".

No. 69 are of similar shape to the bolts but are only 3/16" in length, and are designed primarily for securing the various Meccano wheels to the Axle Rods. The Grub Screws have no head at all. They are employed for securing the smaller Meccano parts, such as Collars, Couplings, etc., to Rods. It will sometimes be found that the Set Screw of a Meccano Pulley or Gear Wheel fouls some other part of the model, in which case it can be replaced by a Grub Screw, which will fit almost flush with the boss.

PIVOT BOLT WITH TWO NUTS. No. 147b.

The Pivot Bolt is of a different design from the ordinary bolts. The greater portion of its shank is smooth and the part is particularly suitable for use as a small pivot or fixed pin about which a small pulley or lever can rotate. It is secured in position by clamping the two nuts on its shank to a Meccano Strip or other part, as in S.M.1.

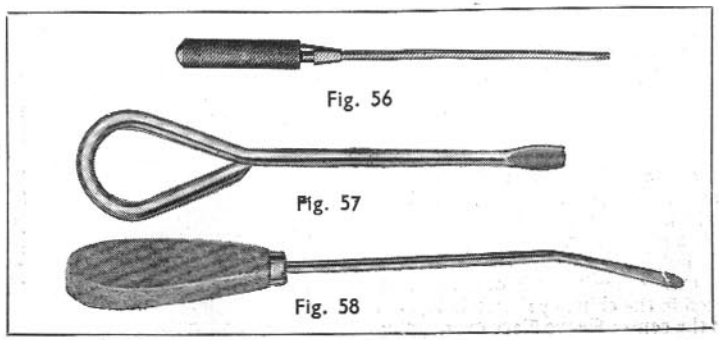


Fig. 56

Fig. 57

Fig. 58

WOODSCREWS. No. 68, ½".

Woodscrews are also included in the Meccano system. These are for the benefit of boys who wish to secure their models to wooden bases. They are supplied in ½" lengths only. Any model that does not travel will be improved in appearance and operation if it is screwed down to a wooden base.

SPANNER. No. 34. SCREWDRIVER. No. 36.

Parts Nos. 34 and 36, Figs. 54 and 57, are the tools that are found in every Meccano Outfit and are the only essential ones.

BOX SPANNER. No. 34b.

The Box Spanner, Fig. 55, has a channel at each end into which the nut is slipped. With the aid of this tool a nut can be placed in positions impossible to reach with the fingers.

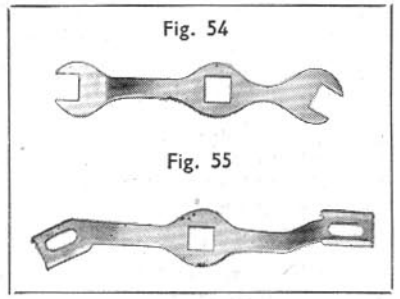


Fig. 54

Fig. 55

EXTRA LONG SCREWDRIVER. No. 36a. SPECIAL SCREWDRIVER. No. 36b.

Part No. 36a is of similar pattern to part No. 36, but the blade is 5" long instead of 3½", and instead of the end being flattened slightly it is of the same diameter as the shaft. This enables the blade to be passed completely through the standard Meccano holes.

The Special Screwdriver, Fig. 56, is all-metal and measures 8" in length. The blade of this tool is of such a diameter that it can be passed through standard Meccano holes.

REED HOOK. No. 105.

This is designed to facilitate the threading of the warp threads through the healds and reed of the Meccano Loom. The design of the hook portion of the tool is shewn in Fig. 58.

OIL CANS. No. 1 (ordinary type). No. 2 ("K" type).

The "K" type is reproduced in Fig. 53. The oil may be ejected drop by drop by depressing the valve. The No. 2 Oil Can, Fig. 52, measures 5" in overall length. A specially prepared lubricating oil is included in the Meccano system and can be obtained in small bottles. This oil is particularly suitable for lubricating Meccano Clockwork and Electric Motors.

MECCANO INSTRUCTION MANUALS.

Complete Outfit Manuals. A, A-B, A-C, A-D, A-E, F-L.
Accessory Outfit Manuals. Aa, Ba, Ca, Da.

The greatest thrill of Meccano model-building is to be derived from building according to one's own ideas, but before a Meccano boy attempts to do this he should make a point of building all the models shown in the Meccano Instruction Manual that are within the range of his Outfit.

The Manuals are being continually revised, not only to illustrate uses of new parts that are regularly introduced into the Meccano system, but also to give prominence to new ideas and new models suggested by Meccano boys.

SPECIAL SUPER MODEL INSTRUCTION LEAFLETS.

Some of the models included in the Manuals require so many illustrations in order to show each detail clearly that they would occupy several pages. Such models therefore are dealt with in special instruction leaflets, which are beautifully printed and profusely illustrated from actual photographs. These leaflets are included in the Outfits with which the respective models can be built, and they can also be obtained separately.

STANDARD MECHANISMS MANUAL.

The Meccano Standard Mechanisms Manual is designed for the use of the more advanced model-builder. It contains details of a large number of Meccano movements that are to a large extent standardised, in that they may be applied to more than one model with very little alteration.

The various devices dealt with in the Manual have been divided into a number of different sections, under such headings as Levers, Intermittent Rotary Motions, Governing Appliances, Applied Screw Mechanisms, Electrically Operated Movements, etc., so that, used in conjunction with the ordinary Instruction Manuals, the Standard Mechanisms Manual will form a very useful and instructive book.

Class F. RODS, CRANKS AND COUPLINGS

AXLE RODS.

No. 13, 11½″ long. No. 15a, 4½″ long. No. 17, 2″ long.
No. 13a, 8″ long. No. 16, 3½″ long. No. 18a, 1½″ long.
No. 14, 6½″ long. No. 16a, 2½″ long. No. 18b, 1″ long.
No. 15, 5″ long. No. 16b, 3″ long.

The Rods are made to a diameter of .160 inches. If very long lengths are required, two Axle Rods can be joined end to end by means of a Coupling. In addition to their obvious uses as shafting or spindles for rotating machinery, the Rods are often employed as levers, guides for sliding mechanisms such as the work-table of a lathe or planing machine, tie rods or struts in structural work, etc.

In assembling rotating machinery the bearings should receive careful attention. When very heavy strains are to be met it is a good plan, instead of journalling the Rod in a hole in a single Plate or Strip, to reinforce the bearing by bolting a Wheel or Crank to the Plate so that the Rod can turn freely in the boss. If the Wheel is bolted so that the Set Screw hole is uppermost, an excellent oil receptacle will be provided. This can be fitted if desired with a Grease Cup, described elsewhere in the Manual.

For all ordinary purposes the Set Screws provided with the various Meccano Wheels and Cranks should be sufficient to hold the parts rigidly in position on the Axle Rods. In the latest Meccano parts, however, the Set Screw hole has been extended right through the boss so that two Set Screws can be inserted if desired, one on each side.

Fig. 59

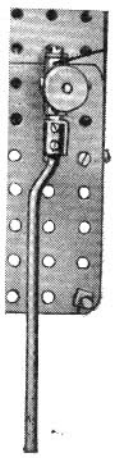


Fig. 60

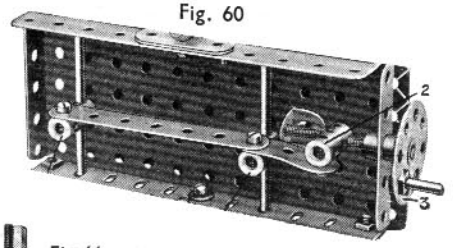


Fig.61

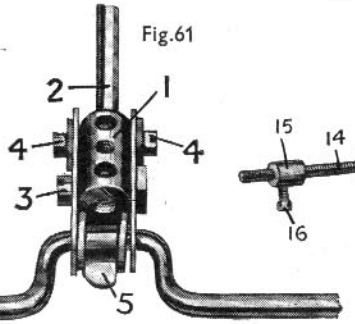


Fig. 62

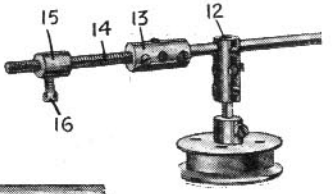


illustration the Crank Handle is journalled in a Crank and is prevented from moving vertically by two Collars, one of which is placed on each side of the Crank. The bottom end of the Crank Handle engages between two 1½″ Pulleys, and by turning the steering wheel, a 1½″ Pulley, the movement is transmitted, via the cranked portion of the steering column to the track rod. This part forms the connection between the two front road wheels which are mounted as shown on two stub-axles.

CRANKSHAFT.

No. 134. 1″ stroke.

Can be used to convert rotary motion to reciprocating motion, or vice versa. It gives a stroke or total rectilinear movement of 1″. An ordinary Meccano Strip is intended to be used as the connecting Rod. Itshould be slipped into place in the centre of the crank portion and held in position by two Spring Clips. A more elaborate connecting rod can be built-up as shown in Fig. 61. It consists of an Axle Rod 2, the big-end bearing being formed from two 1½″ Strips mounted on the crank and bolted to a Coupling 1. The Strips are held in place by a ½″ Bolt 3 passing completely through the end of the Coupling, and by a pair of Set Screws 4, which serve also to grip the connecting rod in the Coupling. The position of the connecting rod in the centre of the crank is maintained by a Spring Clip 5 mounted between two Washers.

CRANK HANDLES. No.19, 5″ long. No. 19s, 3½″ long.

In the simpler models, or in instances where electric, clockwork or steam power is not available, Crank Handles are used for operating the various movements. Good examples of the uses in this direction of these parts are to be found in the great number of cranes illustrated in the Instruction Manuals. In addition to these uses, however, they can be adapted to a great many others, a few of which are shown in Figs. 59, 63 and 64.

Fig. 63

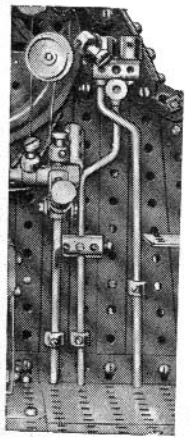
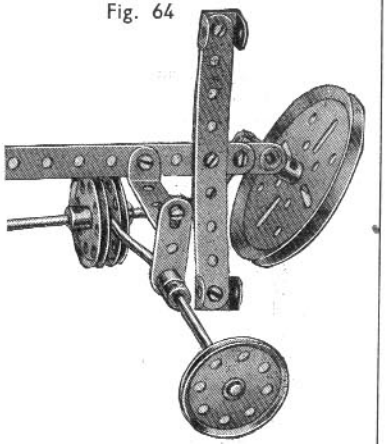


Fig. 64



In Figs. 59 and 63 both sizes of Crank Handles are shown in use representing steam pipes in the cabs of Meccano locomotives. The first is taken from the cab of the Baltic Tank Locomotive, fully described in special Instruction Leaflet No. 15. In Fig. 63 a portion of the cab is shown of a fine model of the L.N.E.R. locomotive "No. 10000." This has been described in the "Meccano Magazine" and is a remarkably fine example of Meccano construction.

A large Crank Handle is shown used as the steering column of a car in Fig. 64. In this

SCREWED RODS.

No. 78, 11½″ long. No. 79a, 6″ long. No. 80a, 3½″ long. No. 81, 2″ long.
No. 79, 8″ long. No. 80, 5″ long. No. 80b, 4½″ long. No. 82, 1″ long.

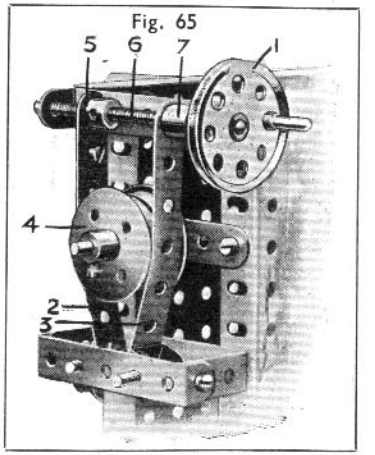
The Screwed Rods are cut throughout their lengths with the Meccano standard thread, 32 threads to the inch. Their principal function is the conversion of rotary motion to longitudinal motion, as in screw elevating machinery, etc. Also, in cases where a long bolt is required, one of the shorter Screwed Rods can be used with advantage.

Several Meccano parts are specially designed for use in connection with the Screwed Rods, such as the Threaded Boss, Threaded Crank and Threaded Coupling. If one of these parts is secured to a portion of a model and a Screwed Rod threaded through it, then the latter can be caused to move longitudinally as it rotates, or this movement can be prevented and instead that portion of the model carrying the threaded part caused to move up and down the Rod.

If it is required to fix a Threaded Boss or Threaded Coupling on a Screwed Rod, a nut should be placed on the Rod and screwed tightly against the part. It should never be secured by a Set Screw, as this will damage the thread of the Rod. Any other Meccano Wheel, Pinion, etc., can be attached rigidly to a Screwed Rod by gripping it tightly between two nuts threaded on the Rod.

When it is required to journal a Screwed Rod so that it can rotate like an ordinary Axle Rod, it should be connected by Threaded Couplings to Rods so that the latter can be journalled in the bearings instead of the Threaded Rod. If this is not possible,the Rod should be journalled in the boss of a Crank or Wheel, etc., in order that the bearing surfaces shall be as large as possible.

Fig. 65



Class F. Rods, Cranks and Couplings (Contd.)

It should be remembered that the Screwed Rod proves invaluable as a means of increasing the available power, although at a considerable loss of speed. It can be used wherever it is necessary to cope with specially heavy loads. Fig. 65 shows a Screwed Rod employed to expand or contract the bands of a brake.

A special use for a Threaded Rod is shown in Fig. 62. Here one end of the beam of a model weighing machine has been extended in order to accommodate a 2" Threaded Rod 14. This is secured to the Rod forming the end of the scale beam by means of a Threaded Coupling 13. The main balance weight of the scales is roughly adjusted by sliding the Coupling 12 along its Rod, but finer adjustment is made by means of the Threaded Boss 15 and Bolt 16. This Threaded Boss is made to move a short distance along the Threaded Rod 14 by turning it slightly.

In Fig. 60 a 2" Threaded Rod is fitted with a Coupling 2 which is caused to move horizontally by turning the hand wheel, secured to the Threaded Rod, in either direction. This movement is transmitted to a series of Cranks that are arranged to lift the platform of a small hand truck.

CRANK. No. 62. **DOUBLE ARM CRANK.** No. 62b.

THREADED CRANK. No. 62a **SIMPLE BELL CRANK.** No. 127

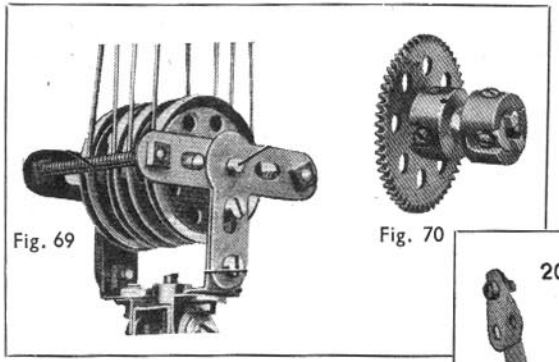
BOSS BELL CRANK. No. 128.

No. 62 is in reality a short Strip fitted with a boss so that it can be attached easily to an Axle Rod. In addition to its obvious uses as a crank, it can be employed to secure an Axle Rod to any other Meccano part, or to form handles. For this latter purpose Threaded Pins can be used in conjunction with the Cranks.

The Threaded Crank is similar to the ordinary Crank except that the longitudinal bore of the boss is tapped, or threaded. The functions of this part have already been indicated in connection with the Screwed Rods.

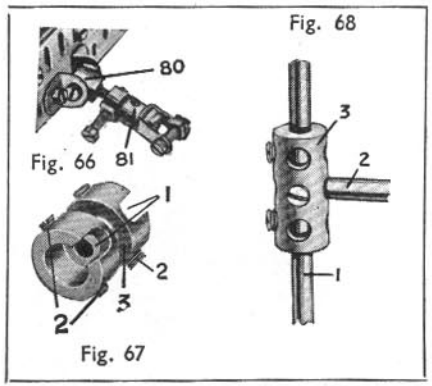
The Double Arm Crank has similar functions to part No. 62, but when a crank stroke of only 1" is required it proves far more adaptable. It is ideal for securing Rods to Strips or Plates, as will be seen from Standard Mechanism No. 110. This illustration shows a Meccano electric controller, and it will be seen that another Double Arm Crank is used as the controller handle. This Crank is free to turn about the fixed vertical Rod, being held in position by a Collar placed on the extreme upper end of the Rod; and one arm is used to carry the spring contact while the other is fitted with the Threaded Pin that forms the operating handle.

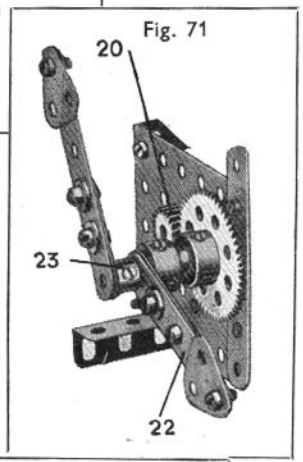
The only difference between parts Nos. 127 and 128 is that the Simple Bell Crank has no boss.



Four Simple Bell Cranks are shown used in Fig. 69, where they form an excellent pulley block frame for a large crane. Each side of the pulley block consists of two Bell Cranks connected together by means of two 2" Threaded Rods. A Rod is journalled at each end in the centre hole of each pair of Bell Cranks, and on this Rod are carried the Wheels forming the lower section of the pulley system.

The Meccano Bell Crank is a lever of the first order and is employed as a means of changing the direction of a force through a right angle. For example, supposing the Bell Crank is mounted on a horizontal Rod, a downward pull on one arm may be converted to a transverse pull or push on the other. Another important use of the Bell Crank is found in strengthening the corners of a rectangular framework of Strips, where it forms a very neat connecting piece in place of Corner Brackets.





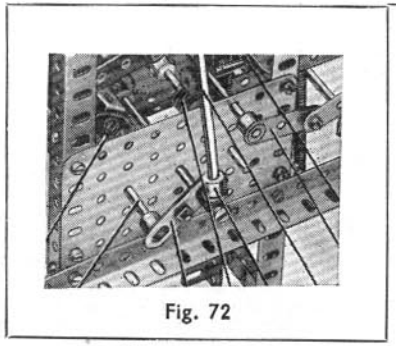


Fig. 72

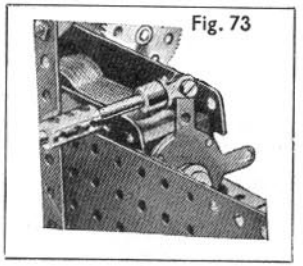


Fig. 73

COUPLING. No. 63. **STRIP COUPLING.** No. 63b.

OCTAGONAL COUPLING. No. 63a.

THREADED COUPLING. No. 63c

TRAIN COUPLING. No. 121 **UNIVERSAL COUPLING** No. 140.

SOCKET COUPLING. No. 171

Part No. 63 is intended primarily for connecting Meccano Rods at various angles to each other. Typical uses of the part are shown in Figs. 68 and 73. The use of the Coupling in Fig. 6 has already been described.

The Strip Coupling is intended for coupling a Strip to a Rod. An excellent example of the use of this part is shown in Model K 2. The Threaded Coupling has the longitudinal bore tapped for half its distance, so that a Screwed Rod can be inserted in one end and an ordinary Rod in the other. It is shown in use in Fig. 62. The Octagonal Coupling has a number of flat surfaces, the object of which is to receive Strips when it is required to bolt them to the side of the Coupling. The part will also form a kind of ratchet when it is desired to turn a Rod step by step, a spring strip being caused to press upon the flats.

The Train Coupling provides means of connection between Meccano models of railway subjects and Hornby rolling stock. The Universal Coupling is intended to couple two shafts together end to end, so that they may rotate when arranged at an angle to each other.

The Socket Coupling is designed to couple two wheels or gears together rigidly so that they can turn as a unit on a shaft, or alternatively remain stationary while the shaft carrying them turns in the Coupling. Fig. 70 shows a Socket Coupling used to connect a section of a Dog Clutch to a 57-teeth Gear Wheel. The slots 1 of the Coupling, Fig. 67, enable wheel bosses to be inserted without removing the Set Screws, while the Grub Screws 2 secure the bosses in position. The groove 3 facilitates the sliding movement of the Coupling.

An excellent method of employing the Socket Coupling is found in the hour hand mechanism of a clock. The method of accomplishing this is shown in Fig. 71 where a $\frac{1}{2}$" Pinion 20 drives the hour hand 22 through the medium of a 57-teeth Gear and Socket Coupling. The Socket Coupling is free to rotate on a Rod carrying the minute hand 23.

SWIVEL BEARING. No. 165.

Intended for coupling Rods together when they are used as levers, etc. One of these parts is shown in use in S.M. 132. In this example the fork portion is mounted in a horizontal position on a Rod that is free to turn in its bearings. The spider of the part carries the Rod to be universally mounted. This Rod is free to turn in the spider and is prevented from moving vertically by means of two Collars placed one each side of the spider.

END BEARING. No. 166.

The End Bearing has functions similar to those of the Strip Coupling. It can be used as a crosshead between the piston rod and connecting rod of a small reciprocating engine.

In Fig. 73 an End Bearing is shown forming a connection between the reversing lever of an Electric Motor and the end of a control rod. The connection is made by passing a $\frac{3}{8}$" Bolt through the End Bearing and Motor lever and locking two nuts, as in S.M.1a, on the outer end of the Bolt.

Class G. WHEELS, PULLEYS, BEARINGS, Etc.

WHEELS. **No. 19a, 3″ diam.**

No. 19a has a smooth circumference and is provided with 10 spokes. It is intended for use as a travelling wheel in vehicles of all descriptions.

These Wheels are specially suited to guns and gun carriages. They are shown used to advantage in Instruction Leaflet No. 37. In this model good use is made of the smooth rim of the Wheels, brakes being applied to the periphery as in actual units of this type. These brakes are described in Standard Mechanism No. 145.

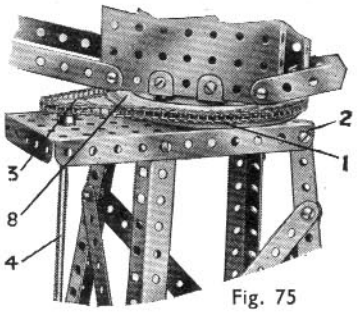


Fig. 75

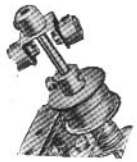


Fig. 77

FLANGED WHEELS.

No. 20, 1½″ diam. **No. 20b, ¾″ diam.**

Intended primarily for use in all kinds of models that are required to run upon rails. They have other important uses, however, chief of which is their employment as belt pulleys. An excellent belt pulley can be formed by mounting two Flanged Wheels together as shown in Fig. 77. An important adaptation of the ¾″ Flanged Wheel for forming the ends of a realistic cylinder is described in connection with the Sleeve Piece. This use has already been dealt with in Class D. Incidentally, another novel use for the part is shown in Fig. 42, the chimney of the Meccano Traction Engine illustrated therein being topped by a ¾″ Flanged Wheel, the boss of which is inserted in the upper Sleeve Piece.

The large Flanged Wheels, which are 1⅛″ in diameter, are shown in use in Fig. 79, where they form the front bogie wheels of a model locomotive. In this example the Set Screws have been removed from the bosses of the Wheels, thus allowing them to rotate freely on their respective Rods. These Rods are free to move vertically in the slots of the Flat Girders forming the sides of the bogie, and a spring is employed as shown in order to give the necessary shock-absorbing effect to the Wheels.

These large Flanged Wheels are employed also in Instruction Leaflet No. 15, where a pair is used in order to represent the chimney of a scale model tank locomotive.

BUSH WHEEL. **No. 24, 1¾″ diam.**

The functions of the Bush Wheel are too numerous to mention in detail, but the chief are its use as a boss to which other Meccano parts, such as Hub Discs, etc., can be bolted, and as an end plate for a cylinder, etc.

In Fig. 76 two Bush Wheels are shown forming the flexible connection between a model turbine unit and propeller shaft thrust block. One of the parts is fitted with four nuts and bolts as shown, and the shanks of the bolts engage with corresponding holes in the second Bush Wheel.

A further use for the part is shown in Fig. 80. Here it forms a support for the two arms of a centrifugal governor, both of which are represented by Cranks held in place by means of lock-nutted Pivot Bolts.

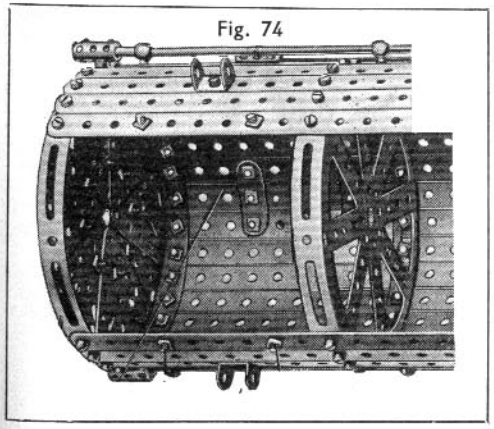


Fig. 74

FACE PLATE. WHEEL FLANGE.

No. 109, 2½″ diam. **No. 137, 2½″ diam.**

The Face Plate and Wheel Flange used in conjunction are very useful for building up large flanged wheels. Fig. 82 shows a section of a large Meccano locomotive, the bogie wheels of which each consist of a Wheel Flange bolted to a Face Plate.

The Wheel Flange, in addition, has many widely different adaptations. Fig. 80 shows it used as part of a centrifugal governor. In this mechanism the governor weights 5, which are attached to short arms 3 carried on a Bush Wheel 1, fly outward when the latter rotates and press against the inside of the Wheel Flange so preventing the Bush Wheel exceeding a certain speed limit. In the Meccano Motor Chassis, Wheel Flanges form the brake drums for the internal expanding brakes on the four road wheels.

The Face Plate also fulfils other functions. An obvious use is in a lathe, where it serves as a face plate and thereby justifies its name. In Fig. 86 two Face Plates are shown employed as a hub for a large built-up flywheel.

In Fig. 78, a Face Plate is illustrated forming the centre of the top of a roundabout. The Face Plate is locked on to the vertical driven shaft by its Set Screw, and four Angle Girders are attached as shown. These are braced by means of four 5½″ Strips and at their ends are carried the flyboats of the model.

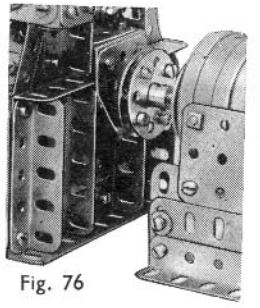


Fig. 76

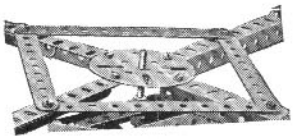


Fig. 78

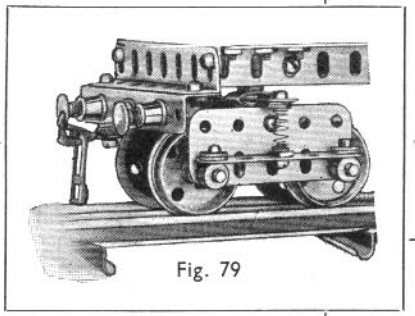


Fig. 79

HUB DISC.

No. 118, 5½″ diam.

When bolted to a Circular Plate, this part is well suited to form a very large flanged wheel. In Fig. 51 it is shown in this connection where it forms one of the main driving wheels of a Meccano locomotive.

In addition to this important adaptation, the Hub Disc is admirably suited to form a flywheel or large travelling wheel. Fig. 84 shows one of the rear travelling wheels of the Meccano Traction Engine, and as will be seen it consists of two Hub Discs bolted together so that a wheel of specially wide tread is obtained. Nuts and bolts are inserted round the circumference of the Hub Discs to obtain a better grip on the road. When it is desired to secure a Hub Disc to an Axle Rod it will be necessary first to bolt the Disc to a Bush Wheel or 1½″ Pulley, etc., so that the Set Screw of the latter may be utilised to grip the Rod. In Fig. 74 a Hub Disc forms the end plate of a Boiler, while another serves as an internal supporting rib.

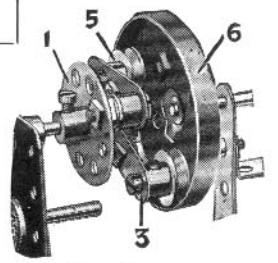


Fig. 80

The appearance of the Hub Disc, forming the front plate of the boiler, may be made more solid and realistic if it is filled in. This is carried out by bolting a 2½″ Triangular Plate over each of the gaps in the Hub Disc. A single bolt is used for securing each Triangular Plate in place and this passes through one of the three slotted holes in the part. By fitting the Plates in this manner their outer edges can be brought into close contact with the inner face of the Hub Disc's rim.

Class G. Wheels, Pulleys, Bearings, Etc. (Contd.)

FLYWHEEL.

No. 132, 2¾″ diam. Weight 5oz.

Made of lead alloy, with brass boss. Can be employed wherever it is required to smooth over unequal stresses in rotating machinery. The hub and the circumference of the wheel itself are provided with grooves to receive belt drives.

This groove is shown utilised in Fig. 88. In this example it forms a ratchet wheel in a silent intermittent rotary motion, the drive being transmitted from a Triple Throw Eccentric to the Flywheel by means of a built-up segment engaging the groove of the Flywheel. As it is oscillated, the curved portion of the segment grips the serrations inside the groove of the Flywheel for every up stroke. On the down strokes the segment is trailing and therefore transmits no motion.

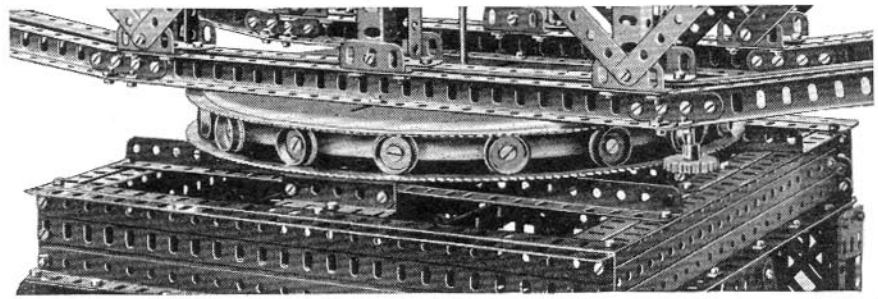


Fig. 81

PULLEY WHEELS.

No. 19c, 6″ diam., with centre boss and set screw.
No. 19b, 3″ diam., with centre boss and set screw.
No. 20a, 2″ diam., with centre boss and set screw.
No. 21, 1½″ diam., with centre boss and set screw.
No. 22, 1″ diam., with centre boss and set screw.
No. 23a, ½″ diam., with centre boss and grub screw.
No. 22a, 1″ diam., without centre boss and grub screw.
No. 23, ½″ diam., without centre boss and grub screw.

A pulley is a wheel with a grooved rim, round which a rope can be passed, and is capable of rotation about an axis through its centre. For use it is mounted in a frame to form what is called a block ; and model pulley blocks can readily be built up with Meccano Pulleys. A single pulley wheel is used in certain mechanisms, but usually two or more, called sheaves, are combined in a single block, and systems of pulleys formed by the use of these blocks are machines or contrivances by means of which a load can be moved, or a resistance overcome, by the application of a relatively small force.

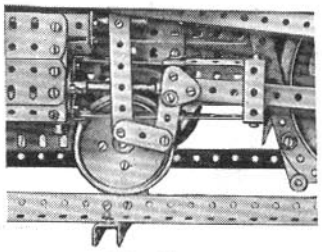


Fig. 82

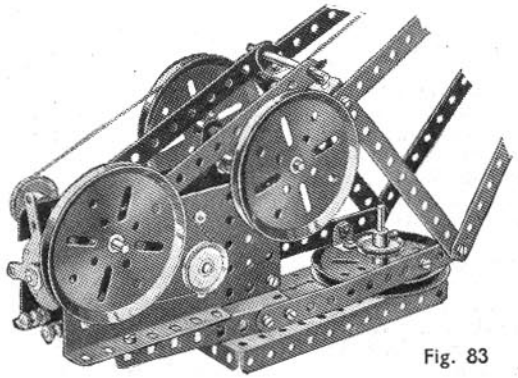


Fig. 83

Considerable loads can be lifted with comparative ease by using a system of pulleys with a Meccano Motor, or even a Crank Handle. The mechanical advantage arises from the fact that the effort and the load are applied at the ends of ropes that pass round the pulleys, and allow greater movement to the effort than to the load. The greater the number of pulleys employed, the greater will be the mechanical advantage, but it is important to remember that such increased advantage can only be obtained at the expense of the speed at which work is done.

Supposing a model crane is capable of lifting a load of 1 lb. attached directly to the crane hook, then if the hoisting cord, instead of being attached to the hook, is led round the sheave of a pulley block and taken back and fastened to the jib of the crane, a load of 2 lb. could be raised with only a very slight increase in the power. this slight increase being necessary to overcome friction created in the pulley block, and in the bending of the cord. The load of 2 lb. could only be raised at half the speed of the former load, however.

Similarly, if an extra sheave is incorporated in the suspended pulley block, and the hoisting cord, after passing round the first sheave, is led back and round another pulley at the jib head, then round the second sheave in the pulley block, and finally fastened to the jib head, then the crane hook will move at a quarter of its original speed and the crane will be capable of raising a load of 4 lb. (or slightly less, allowing for friction).

Besides their use as sheaves for pulley systems, the Meccano Pulleys can be used as the running wheels of travelling models of all descriptions, and most important function of all, they make possible the construction of belt gearing. Fig. 83 shows a belt system constructed with their aid, by which the speed of an Electric Motor is reduced so that a crane can be operated from it. It will be seen that a 1″ Pulley secured to the armature shaft drives a 3″ Pulley secured to a secondary shaft, while another 1″ Pulley on the latter drives a second 3″ Pulley on the winding shaft. Since the diameter of the driven pulley is roughly three times the diameter of the driving pulley, a speed reduction of approximately 3:1 will be obtained in each case, thus resulting in a total reduction between the armature and winding shaft of 9:1.

PULLEY BLOCKS.

Single Sheave, No. 151. **Two Sheaves, No. 152.** **Three Sheaves. No. 153.**

Complete with lifting hook and a lug to which the hoisting cord may be attached.

CONE PULLEY. No. 123.

A single Cone Pulley corresponds to three ordinary Pulleys of ¾″, 1″, and 1¼″ diameters formed into a unit. Cone Pulleys are intended for use in pairs, so that a drive can be transmitted from one Cone Pulley to the other by a belt passing round, say, the ¾″ diam. groove of one and round the 1¼″ groove of the other. Then if it is desired to vary the relative speeds of the shafts, the belt can

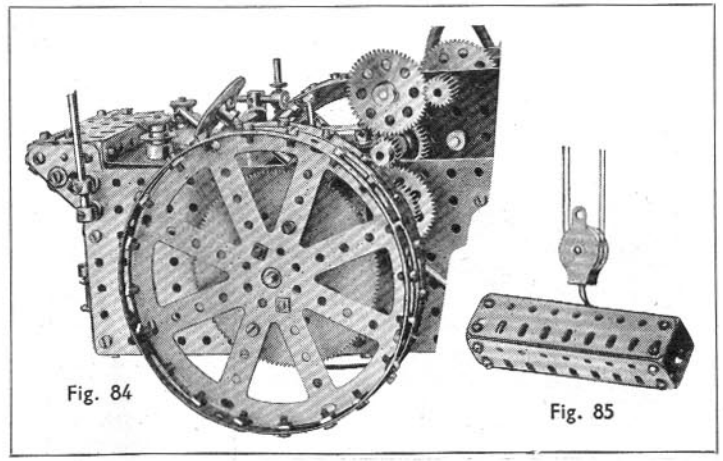


Fig. 84 Fig. 85

Class G. Wheels, Pulleys, Bearings, Etc. (Contd.)

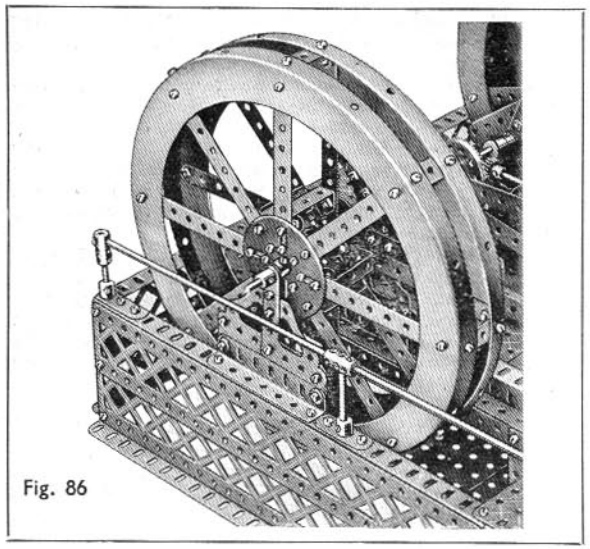


Fig. 86

be removed and placed over the 1″ groove in each Pulley; or alternatively, round the 1¼″ groove of the first Pulley and the ¾″ of the second. The respective ratios so obtained are roughly 5:3; 1:1; 3:5.

GEARED ROLLER BEARING.

No. 167, complete, 12″ diam.
Components:
GEARED ROLLER RACE, No. 167a, 192-teeth.
RING FRAME, No. 167b.
PINION, No. 167c, 16-teeth.

The complete Meccano Geared Roller Bearing consists of the following units: two Geared Roller Races, one Ring Frame, sixteen ¾″ Flanged Wheels, sixteen Pivot Bolts each with two nuts, one 9½″ Strip, two Bush Wheels, one 1½″ Rod, ten Nuts and Bolts, and one special Pinion. The complete bearing measures 12″ in overall diameter and is intended for use in building large swivelling structures, such as rotating bridges, etc.

The Roller Bearing is assembled as follows. One of the Roller Races is secured to the fixed portion of the model and the 1½″ Rod is fastened in the Bush Wheel bolted to its centre. The Ring Frame is then placed over the Race so that the flanges of the wheels run on its raised rim. The second Roller Race is then placed over the Ring Frame so that its raised rim rests on the flanges of the wheels. The 1½″ Rod passes through the centre hole of the 9½″ Strip that is bolted across the Ring Frame, and through the Bush Wheel in the centre of the upper Roller Race.

Fig. 81 shows a typical adaptation of the standard Roller Bearings. In this case the superstructure is caused to turn round on the Flanged Wheels on operation of a certain lever incorporated in the control mechanism. The drive from the Motor controlling the rotational movement is directed to a vertical Rod, on the the lower end of which is mounted the special 16-teeth Pinion. The latter engages with the teeth of the lower Roller Race; hence on rotation of the vertical Rod the Pinion travels round the Roller Race, carrying the superstructure with it.

Alternatively, if the driving mechanism is in the fixed base of the model, the Pinion should be secured to a Rod journalled in a vertical position in the base and caused to engage with the upper Roller Race.

BALL BEARING.

No. 168, complete, 4″ diam.
Components:
BALL RACE, No. 168a, Flanged.
BALL RACE, No. 168b, Toothed.
BALL CASING, No. 168c, complete with Balls.

The complete Ball Bearing consists of three sections, namely, one Flanged Ball Race, one Toothed Ball Race, and one Ball Casing complete with Balls. Fig. 75 shows the application of the Ball Bearing to a small crane. The Flanged Ball Race 1 is secured to the Flanged Plate 2, and the Geared Ball Race 8 is fastened to the swivelling structure. The Ball Casing is placed between these two parts so that the Flanged Ball Race rests upon the Balls. A short Rod, passed through the centre of the Ball Races 1 and 8 and maintained in its position by Collars, holds the unit together. The superstructure is rotated by means of a Sprocket Chain passed round the teeth of the Toothed Ball Race 8 and engaging a 1″ Sprocket Wheel 3, which is secured to a driven Rod 4.

In Fig. 87 a Ball Bearing unit is shown forming the pivot of a large derrick-type crane. In this example the drive is similar to that shown in Fig. 75, with the exception that the ¾″ Sprocket 19 is carried by the rotating portion of the crane. This necessitates the Toothed Ball Race 3 being secured to the base 1 while the Flanged Ball Race is bolted to the superstructure 7.

It will be noticed that the Flanged Ball Race is spaced away from the underside of the rotating superstructure by means of four Collars, one of which is placed on each of the four securing ½″ Bolts. This construction allows the ¾″ Sprocket Wheel 19 to be accommodated on its Rod without catching on the main spreader girders 2, of the crane.

In this model the Geared Ball Race overhangs the base girders 2 for more than half of its width and this necessitates strengthening the part. A Face Plate is used for this purpose, and is attached to the underside of the Ball Race by eight nuts and bolts.

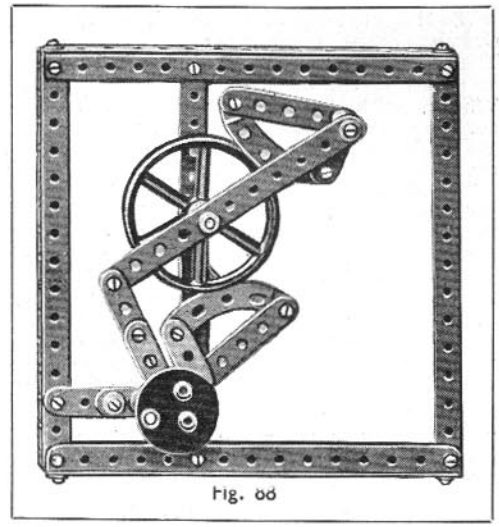


Fig. 88

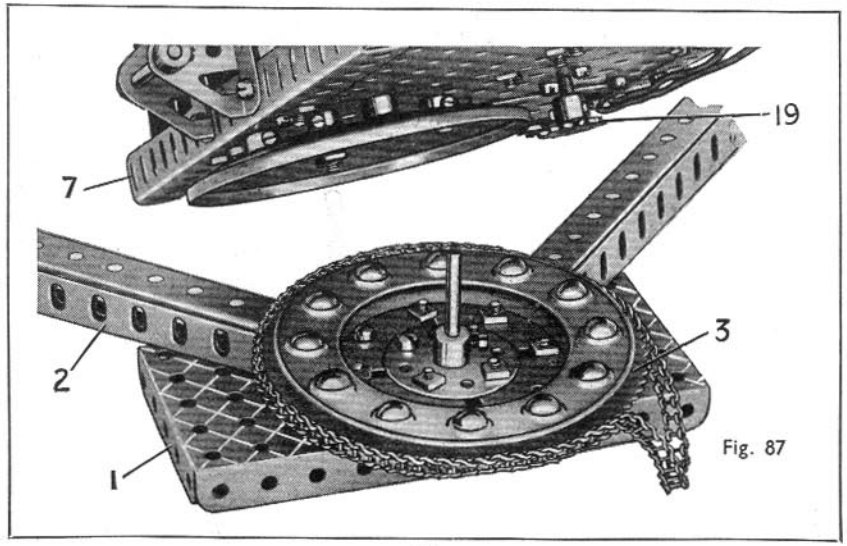


Fig. 87

RING FRAME.

The designed uses for this part have already been described in the section allocated to the Geared Roller Bearing, but since the withdrawal of Channel Segments this component has been found more and more useful in the construction of flywheels, special roller races, etc. Owing to its greater strength and more solid appearance it has entirely replaced Channel Segments and it has the added advantage of being very simple to incorporate in a model.

In Fig. 86 two of these Ring Frames forming a flywheel are shown built into a large Meccano model horizontal engine. The Ring Frames are secured together by means of eight 1½″ Strips and the complete rim so formed is attached to a hub, composed of two Face Plates, by sixteen 4½″ Strips. The Strips overlap the Face Plates two holes at their inner ends, but at their other extremities the end holes only are used. The Face Plates are coupled together, as shown in the illustration, by means of eight 1½″ × ½″ Double Angle Strips.

Class H. GEARS & TOOTHED PARTS

The Meccano range of gear wheels is very comprehensive and enables almost any speed ratio to be obtained. The gears are manufactured from solid brass, with the exception of the 3½" Gear Wheel and the Sprocket Wheels, which are of specially fine steel. The teeth are cut one at a time, not stamped out, and the precision of the finished parts is such that they are regularly used in the construction of all kinds of scientific apparatus.

The Pinions and Gear Wheels enable ordinary gear trains to be assembled, while the Bevel Gears and Contrate Wheels are for transmitting the drive through right angles. The Sprocket Wheels are designed for use in connection with chain drive transmission.

The published diameters of the various Meccano Pinions and Gear Wheels do not represent the overall measurements of the Gears, for they are measured from the "pitch line." This is an imaginary line that runs through approximately the centre of the teeth ; it indicates the points on the teeth where the actual thrust is imparted from one gear to the other.

PINION WHEELS.

No. 25, ¾" diam., ¼" wide.
No. 25a, ¾" diam., ½" wide.
No. 25b, ¾" diam., ¾" wide.
No. 26, ½" diam., ¼" wide.
No. 26a, ½" diam., ½" wide.
No. 26b, ½" diam., ¾" wide.

GEAR WHEELS.

No. 27, 50-teeth, 1 5/16" diam.
No. 27a, 57-teeth, 1½" diam.
No. 27b, 133-teeth, 3½" diam.
No. 27c, 95-teeth, 2½" diam.

In Fig. 97c a ¾" Pinion is engaged with a 50-teeth Gear Wheel. Let us assume that the Rod on which the Pinion is fixed is rotated at a speed of 60 revolutions per minute. The ¾" Pinion has 25 teeth, and for every complete revolution that it makes it will cause the 50-teeth Gear Wheel to turn a distance occupied by 25 of its teeth, which is exactly one half of its circumference. Thus the 50-teeth Gear will turn only 30 revolutions per minute. The difference in speed obtained in this combination of Pinion and Gear is therefore as 2 to 1, and is written "ratio 2:1."

A ½" Pinion having 19 teeth is shown in Fig. 97e in mesh with a 57-teeth Gear Wheel. As the latter has three times as many teeth as the Pinion and its pitch line diameter is three times as great, three revolutions of the Pinion are required for every complete revolution of the Gear Wheel The ratio of this combination is therefore 3 : 1.

In addition to these two gear ratios several others are often used. By using any two gears of a similar diameter together, 1 : 1 ratios result, these arrangements being reproduced with Meccano parts by using pairs of either ½" Pinions, 1" Gears or 57-teeth Gears. In Fig. 97d two 1" Gears are shown used together, the distance between gear centres in this arrangement being 1". If ½" Pinion are used, the distance is ½", and similarly with 57-teeth Gears the distance is 1½".

High ratios in a single stage of gearing can be obtained by employing either a 3½" or 2½" Gear in conjunction with a ½" Pinion. If the larger Gear is used a 7 : 1 ratio results, this being the biggest step-up or reduction in the system that can be built up from two gears only. By meshing a 2½" Gear with a ½" Pinion a 5 : 1 ratio is obtained.

Two new Meccano gears are shown in Fig. 97j. These are known as ½" and 1½" Helical Gears, Parts Nos. 211a and 211b respectively. It is possible by using these parts to obtain a reversible right-angle drive giving a ratio of 3 : 1. They can only be used together, and are arranged similarly to a worm and worm wheel transmission unit, the latter arrangement, however, as described in this section, giving only a high ratio non-reversible drive.

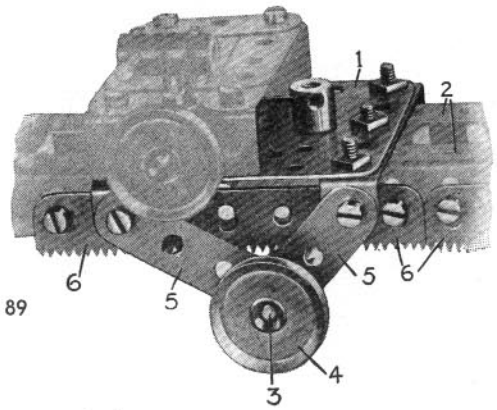


Fig. 89

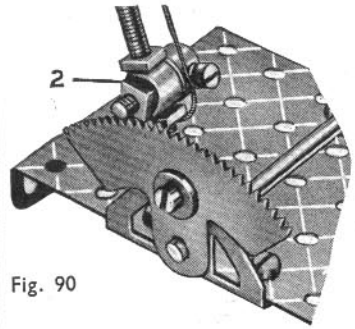


Fig. 90

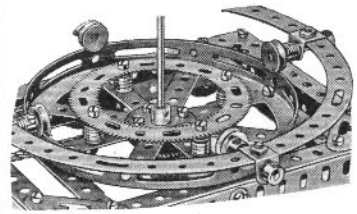


Fig. 91

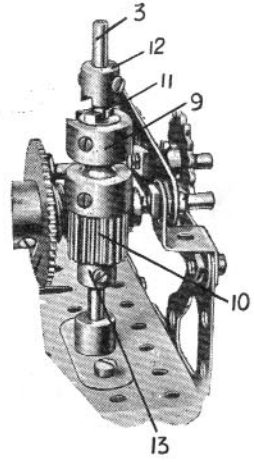


Fig. 92

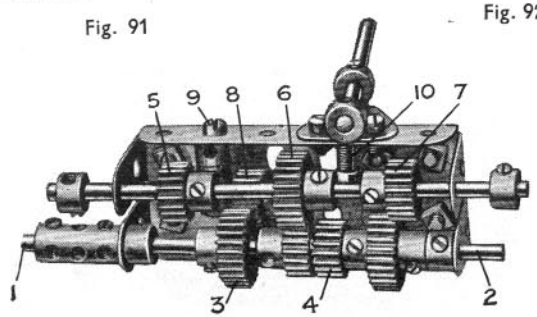


Fig. 93

In Fig. 99 two ½" Pinions are shown in mesh with two vertically arranged 3½" Rack Strips. This arrangement is used on a Meccano model planing machine for raising and lowering the tool.

A variety of gear ratios can be obtained by connecting two Sprocket Wheels of varying diameter with a length of Sprocket Chain, and these are described in the chapter dealing with Sprocket Wheels.

The ½" and ¾" diam. Pinions are each made in three widths, ¼", ½" and ¾". The ¼" width Pinion is for ordinary gearing, while the wider Pinions are specially designed for use in cases where the shaft on which a Pinion is secured is required to move longitudinally without disengaging the Pinion from its Gear Wheel. This movement is frequently required in Meccano gear-boxes.

PINIONS IN GEAR-BOX DESIGN.

The ½" and ¾" Pinions are seldom used together, as their centres are not a standard distance apart, and for this reason it is generally found necessary to build up a complicated framework in order to accommodate them. It is, however, occasionally possible to use them together to good effect, as shown in Fig. 93. This illustration shows a number of ½" and ¾" Pinions, used together, in a very compact three-speed and reverse gear-box, the overall measurements of this unit being 3"×1"×1". It is probably the smallest gear-box of its type that can be built with standard Meccano parts.

The end of the Rod 1 is inserted in the bore of the ½" Pinion 4 that is carried on a separate Rod 2 from which the final drive is taken. The latter Rod carries also a ¾" Pinion and Collar. The sliding lay-shaft is a 4½" Rod on which are a ½" Pinion 5, a ¾" Pinion 6, and a ½" Pinion 7. A ½" Pinion 8 is carried on a ¾" Bolt screwed into the transverse bore of a Threaded Boss and locked by means of a Grub Screw screwed into the opposite end of the bore. The Threaded Boss is rigidly attached to the gear-box frame by a ½" Bolt 9, but is spaced by a Collar and two Washers.

The movement of the sliding shaft is controlled by a ⅜" Bolt 10, the head of which fits between the bosses of the Pinions 6 and 7. The Bolt is fixed in a Collar on the end of a 3" Rod forming the gear change lever, and pivoted to a 1" Triangular Plate by a further Collar secured in place on the Rod by its Grub Screw, and carrying also a bolt whose shank passes through one hole in the Triangular Plate.

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

Class H. Gears and Toothed Parts (Contd.)

A further example of the adaptability of the ½" width Pinion will be found in Fig. 92. In this case a ½" diam. ½" width Pinion 10 is connected by a Socket Coupling 9 to the male portion of a Dog Clutch 11. The unit so formed is free on the vertical Rod 3, but on operation of a lever that carries a bolt that engages with the groove of the Socket Coupling, it can be raised so that the lower clutch section is engaged with the upper section 12 secured to the Rod 3. When out of engagement the sliding unit rests on the Collar 13. The Pinion 10 is in constant engagement with a Worm on the driving shaft ; hence the Rod 3 can be thrown in or out of engagement when desired merely by moving the control lever up or down. The ½" width Pinion is necessary because if an ordinary ¼" width Pinion were used it would come out of engagement with the Worm as soon as the lever was raised.

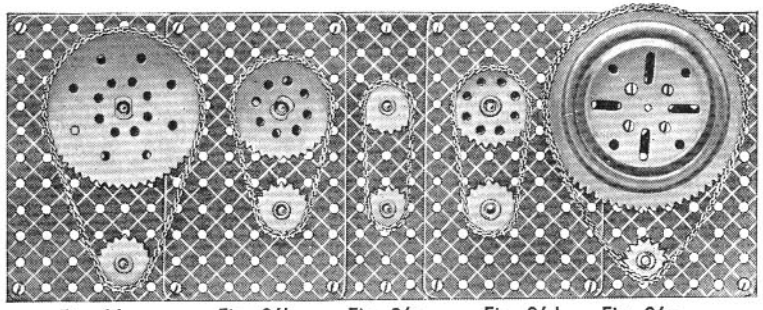


Fig. 94a Fig. 94b Fig. 94c Fig. 94d Fig. 94e

GEAR RING. **No. 180. 3½" external diam. ; 2½" internal diam.**

This part resembles a Circular Strip of 2½" inside diameter and 3½" outside diameter, with 95 teeth cut in the inner edge and 133 teeth round the outer rim. The part is provided with 16 perforations, as will be seen in the illustration in the panel on this page, and the arrangement of these holes is such that allowance is made for adjusting and centring the part by means of slots.

The applications of this part will at once be apparent to advanced model-builders, but a few notes on its various uses will be useful to those less experienced. The chief uses will be found in the construction of epicyclic gear-boxes, and an entirely new field for experiment is opened up in this direction. A 57-teeth Gear forming the "sun wheel" can be arranged to mesh with ½" Pinions serving as "planet wheels," and engaging the inside set of teeth of the Gear Ring. The Pinions can be mounted on ¾" Bolts each fixed by two nuts to a 3½" Strip or 4" Circular Plate, which is free on the Rod carrying the 57-teeth Gear. If a Strip is used for this purpose, a Double Arm Crank should be bolted over the centre hole. A Socket Coupling fitted to the Boss of the Double Arm Crank or Face Plate may be provided with a Gear or Pinion for driving purposes.

The Gear Ring can be mounted on a 4" Circular Plate fitted on an independent Rod, in which case there are three rotating units, namely, the Gear Ring, the "sun wheel," and the frame carrying the "planet pinions," any one of which can be stopped while the other two are connected to driving and driven shafts. A wide variation of speed can be obtained by driving through the 57-teeth Gear and the Face Plate carrying the Pinions, and also driving the Gear Ring by means of the external set of teeth. The speed of the driven shaft will then be varied according to the variation in the speed of the Gear Ring. The part can be utilised also where a small circular strip is required.

In Fig. 91 the Gear Ring is shown used, in place of a 3½" Gear, in the base of a travelling crane. A ½" Pinion situated on the lower end of a vertical Rod, driven from the gear-box, engages with the inside or outside teeth of the Gear Ring.

CONTRATE WHEELS.

No. 28, 1½" diam., 50-teeth. **No. 29, ¾" diam., 25-teeth.**

BEVEL GEARS.

No. 30, ⅞" diam., 26-teeth. **No. 30c, 1½" diam., 48-teeth.**
No. 30a, ½" diam., 16-teeth.

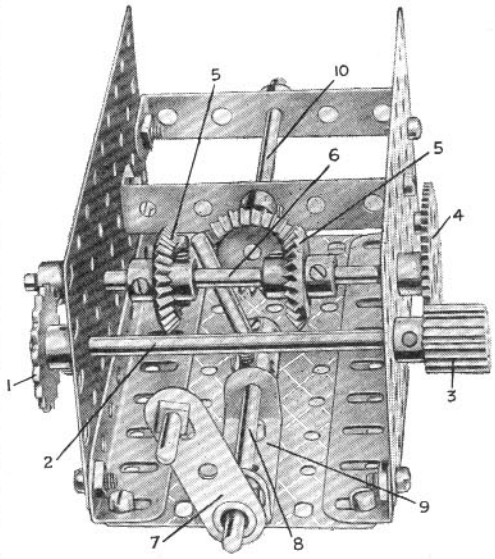


Fig. 95

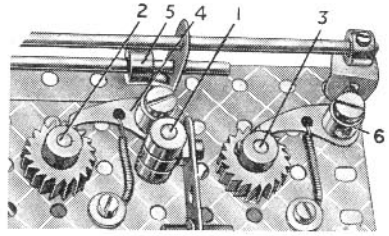


Fig. 96

The primary function of the Contrate Wheels, see Fig. 97a, is similar to that of the Bevel Gears, namely, the transmission of driving power at right angles. In certain cases, however, they lend themselves to adaptations that are not possible with the Bevel Gears. For example, two Contrates of similar size mounted face to face on a common axis so that their teeth interlock will form an efficient clutch unit, and one can be thrown in or out of gear with the other.

When it is required to transmit a powerful drive at right angles it is preferable to use Bevel Gears rather than Contrate Wheels, as in the former the teeth make contact over a greater area than in the Contrate Wheels. However, Meccano boys who possess Contrate Wheels but no Bevels will find that they can employ the former in almost every case in place of Bevel Gears, with fairly good results.

It should be noted that the total space occupied by the 1½" and ½" Bevel Gears, when used together, is greater than that occupied by the 1½" Contrate and ½" Pinion. For this reason, in many models, the Contrates are used in preference to Bevels. The Meccano Motor Chassis, described in Super Model Leaflet No. 1a, illustrates this point admirably, the differential being made considerably smaller than would otherwise have been possible.

BEVEL GEARING DESIGN

In order to reduce friction to a minimum and to obtain a smooth even drive, bevel gearing is always designed so that the surfaces of the teeth of two bevels that mesh with each other lie in planes which, if extended, would all meet in a common point, and this point would coincide with the imaginary point of intersection of the axis of the shafts carrying the bevels. The Meccano Bevels are made with the teeth at such an angle that two ⅞" Bevels can be meshed together, or a ½" Bevel can be engaged with a 1½" Bevel. Two 1½" Bevels should not be meshed together, nor should a ⅞" Bevel be engaged with a 1½" Bevel, for although such gearing would work, the teeth would not be properly in line.

Fig. 102 should give a good idea of some of the more important adaptations of the Meccano Bevel Gears. It represents the differential gear incorporated in a Meccano motor chassis. The ½" and 1½" Bevel Gears are used to transmit the drive from the propeller shaft to the rear wheels, and the series of ⅞" Bevels 5, 6, and 7 are arranged so that power can be applied to both road wheels under varying working conditions. Normally the Bevels 5, in rotating about the rear axle, carry the Bevels 6 and 7 bodily with them, but should one of the road wheels slow down or stop, as happens when the car turns a corner, one of the Bevels 6 or 7 slows down and the Bevels 5 tend to travel round its teeth, thus causing the opposite Bevel to turn at a greater speed.

In Fig. 95 three ⅞" Bevels are employed to form a simple and compact reversing gear. The driving power is applied to the shaft 2 and is directed via the ¼" diam. ½" width Pinion 3 to the Gear Wheel 4, which is secured to the Rod 6 carrying two Bevel Gears 5. The reverse is effected by a hand lever connected to a rocking arm that causes the Rod 6 to move longitudinally in its bearings by striking one of the Collars secured against the faces of the Bevels 5. The direction of rotation of the driven Rod 10 is changed by bringing one or other of the Bevels 5 into engagement with the third Bevel, which is rigidly fastened to the Rod 10.

Class H. Gears and Toothed Parts (Contd.)

Another useful adaptation of both Bevel and Contrate Gears is found in the assembly of reduction gearing between two shafts mounted in direct line with each other. A specimen gearing of this type, in which Contrates are employed, is shown in S.M. 57. The handle 1 is secured to a 2" Axle Rod journalled in the bearings 2. This Rod is free to rotate in the boss of a 1½" Contrate Wheel 3, but is secured in one end of the Coupling 4. A further Rod 5, which runs freely in the other end of the Coupling 4, carries the 1½" Contrate Wheel 7 fixed in the position shown.

A 1½" Rod 8 gripped in the central transverse hole of the Coupling 4 carries a ¾" Pinion 9, which is free to rotate about the Rod but is retained in position by a Collar 10. The Pinion is engaged by the teeth of both Contrate Wheels 3 and 7. The Double Bent Strip forming the bearing 2 for the driving Rod is bolted to the Plate by two ½" Bolts, the shanks of which enter holes in the Contrate Wheel 3 and so prevent the latter from rotating.

It will be found that the secondary shaft 5 rotates twice as fast as the driving Rod carrying the handle 1. Alternatively, by using the Rod 5 as the driving shaft, a 1 : 2 reduction gear will be obtained, for the 2" Rod will revolve once only to every two revolutions of the Rod 5. By repeating the device two or three times in a straight line, a very compact transmission gear can be obtained.

Fig. 97h

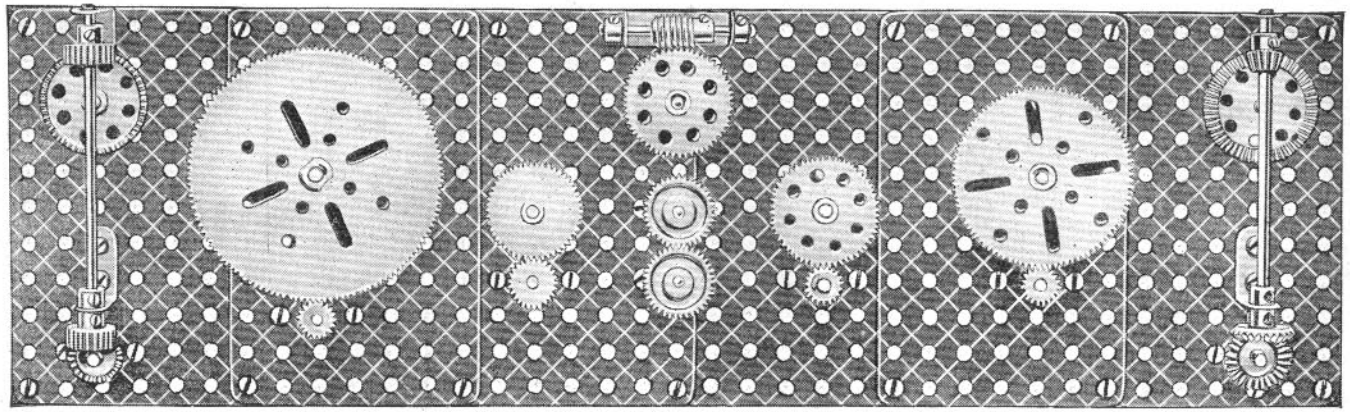


Fig. 97a Fig. 97b Fig. 97c Fig. 97d Fig. 97e Fig. 97f Fig. 97g

An idea of the value of the Meccano Worm in speed reduction mechanisms will be obtained when it is remembered that a ratio of 3249:1 can be obtained merely by duplicating the gearing shown in Fig. 97h, the second Worm being secured to the shaft of the Gear Wheel that is driven by the first Worm.

SPROCKET WHEELS.

No. 95b, 56-teeth, 3" diam.; No. 95, 36-teeth, 2" diam.; No. 95a, 28-teeth, 1½" diam.; No. 96, 18-teeth, 1" diam.; No. 96a, 14-teeth, ¾" diam.

The Meccano Sprocket Wheels and Chain provide an invaluable method for transmitting motion between two shafts where the distance is too great to enable gears to be used conveniently, and where a belt drive would not be sufficiently positive. There are five sizes of Sprocket Wheels, and the following are a few of the many different speed ratios that may be obtained with their aid. Certain of the figures shown are approximate only ; the exact ratios can be ascertained by dividing the number of teeth on the smaller wheel into the number of teeth on the larger wheel.

Ratio 4 : 1—¾" and 3" diam. Sprocket Wheels. Ratio 3 : 1—1" and 3" diam. Sprocket Wheels. Ratio 2 : 1—¾" and 1½" diam. Sprocket Wheels. Ratio 1⅓ : 1—1½" and 2" diam. Sprocket Wheels.

Ratios of 1 : 1 can be obtained by using any two Sprocket Wheels of similar diameter.

The great advantage of Sprocket gearing is that power can be transmitted through almost any distance with little loss through friction. Conveyors and caterpillar track, etc., also can be built up with its aid. The method of separating and connecting lengths of Sprocket Chain is dealt with more fully in Class P, in which this part is included.

Meccano boys sometimes use their Sprocket Wheels like ordinary gear wheels, placing them so that their teeth engage. This practice is permissible in the construction of simple models where only a light driving power is transmitted through the gearing, but it should be avoided in more important models, as the teeth are not designed to engage one with the other as in ordinary spur gearing.

The Geared Ball Race, part No. 168b, which forms part of the Meccano Ball Bearing, is provided with standard sprocket teeth, and can therefore be used in chain driving mechanisms. It measures 4" in diameter and has 73 teeth. For further particulars of this part see Class N.

WORM. No. 32.

The Meccano Worm has a pitch of 12 threads to the inch, to enable it to mesh properly with the various Meccano Gears. It is useful for speed reducing purposes, although it should be remembered that it absorbs a good deal of power, owing to friction created by the thrust that is produced through the tendency of the Worm to move longitudinally instead of turning the Gear Wheel. A Worm drive should always be kept thoroughly lubricated.

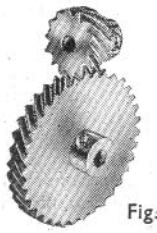


Fig. 97j

Owing to the fineness of the pitch the Meccano Worm is irreversible, that is, it cannot be rotated from a Gear Wheel but can only be used to impart motion to the Gear Wheel. This irreversibility of the Worm sometimes proves a great advantage. For example, if a Worm drive is applied to the winding drum of a hoisting gear, the load will remain suspended after the power is withdrawn, and there is no danger of the load over-running.

Each revolution of a Worm results in the Gear Wheel with which it meshes moving through a distance equal to one of its teeth. Hence the number of revolutions that must be made by a Worm in order to complete one revolution of the Gear Wheel or Pinion that it drives can be ascertained by counting the teeth on the driven wheel.

RACK STRIPS.

No. 110, 3½". No. 110a, 6½".

The Rack Strips, parts Nos. 110 and 110a, are designed for converting rotary motion to rectilinear motion, or vice versa. They are invaluable for obtaining the traversing movement of lathe saddles or other parts of machine tools. In model No. K.8 in the F-L Instruction Manual two 3½" Rack Strips are used to impart up and down motion to a Meccano jack, while in model No. L.36, Steam Shovel, Rack Strips are employed to

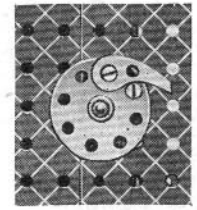


Fig. 98

move the shovel arm toward or away from the jib. The 6½″ Rack Strip is a later addition to the Meccano system, and it has found a very large number of uses.

Two Rack Strips 6, shown in Fig. 89, are bolted to the bed 2 of a Meccano lathe, and they are in constant mesh with a ½″ Pinion. This Pinion is locked on a horizontal shaft 3 carried in bearings 5 bolted to the tool holder of the lathe. The 1″ fast Pulley 4 is secured on the same Rod as the ½″ Pinion already mentioned. Thus by turning the Pulley in either direction it is possible to make the tool holder travel to and fro along the bed of the lathe.

Another use for the Rack Strip is illustrated in Fig. 99. In this example two Strips are secured by means of ½″ × ½″ Angle Brackets to the vertical Plates supporting the tool. The teeth of the Rack Strips are in engagement with ½″ Pinions 34 carried on a horizontal Rod 33, rotated by a ⅞″ Bevel 32. This Bevel is in mesh with a second similar part 31 that is driven from a hand wheel situated in the base of the model.

RACK SEGMENT. No. 129.

This part is intended principally for use where it is required to rotate a mechanism through part of a revolution, Fig. 101. It should be bolted to a Face Plate or other part that is capable of turning about a centre, and a 1″ Gear Wheel should be engaged with its teeth. The Segment has 28 teeth and a radius of 1½″, so if four Segments are placed together to form a circle, this will measure 3″ in diameter and will have 112 teeth. Great care should be taken when joining the segments together, because unless the adjoining teeth are spaced correctly they will fail to mesh properly with the Gear Wheel.

One of these parts is illustrated in Fig. 90 where it is used as a ratchet for a hand brake lever. The Rack Segment is secured to the model by means of a Trunnion, one end of a Rod being journalled in the bottom hole of this latter part. The other end of this Rod is carried in a suitable bearing bolted to the model.

The pawl 2 is represented by the nut section of a Threaded Pin, one of the corners of this section of the part being held in contact with the Rack Segment by means of a short length of Spring Cord. The pawl is held in the off position by means of a small lever situated at the upper end of the brake lever. This ratchet lever will be found useful for incorporating in a model chassis for coupling up the brakes. The connecting wires from the brakes are secured to a Coupling locked rigidly on the shaft carrying the brake lever.

DOG CLUTCH. No. 144.

Consists of one male and one female section. The object of this part is to enable two shafts to be engaged with each other or disengaged whenever desired. The shafts must be mounted end to end and one must be slidable in its bearings so that the clutch sections can be thrown in or out of engagement on operation of a suitable lever.

Alternatively, the Dog Clutch can be used, in conjunction with a Socket Coupling, to enable a Gear Wheel or Pinion, etc., to be mounted on a shaft so that it can either be carried round bodily with the shaft or allowed to remain stationary while the shaft carrying it turns in its boss. A typical example of the Dog Clutch used in this way has already been described in Fig. 92.

Fig. 108 shows the Dog Clutch employed in the construction of a reversing mechanism. In this mechanism either of the horizontal Rods can be used as a driving shaft. Each carries at its inner end one segment of a Dog Clutch 1, and one ¾″ Pinion 2, and 3. The left-hand horizontal Rod is slidable in its bearings and is controlled by a suitable hand lever.

In the first position of the hand lever the ¾″ Pinion 2 is caused to engage with a 1½″ Contrate Wheel, as in the illustration, while in its second position the Pinion is thrown out of engagement and the clutch members are combined. The Pinion 3 remains in constant engagement with the Contrate, and in the second position of the lever the Contrate merely revolves idly. Incidentally, this diagram indicates another important use for the 1½″ Contrate Wheel.

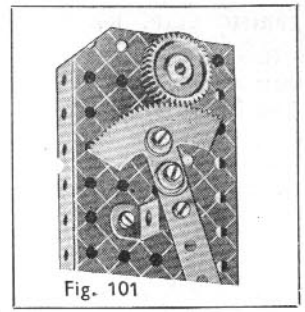


Fig. 101

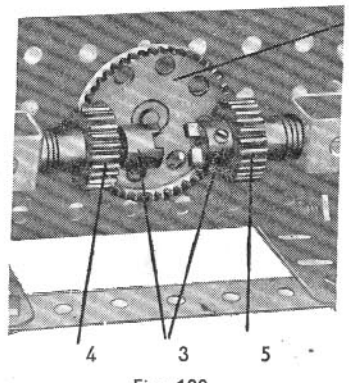


Fig. 100

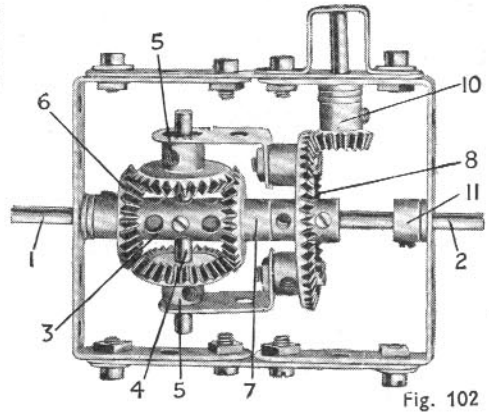


Fig. 102

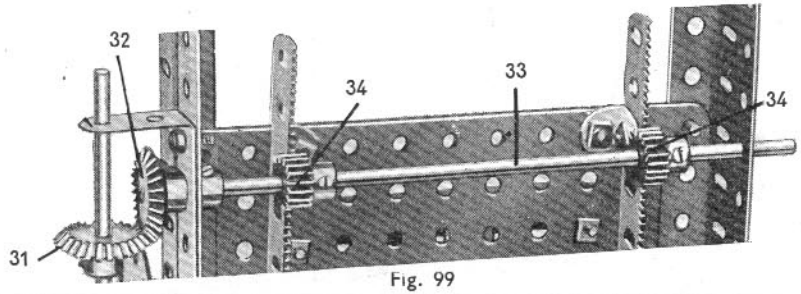


Fig. 99

PAWL. With Pivot Bolt and Nuts, No. 147.

PAWL. Without Pivot Bolt and Nuts, No. 147a

PAWL. Without Boss, No. 147c

RATCHET WHEEL. No. 148.

The Meccano Pawl and Ratchet Wheel may be said to be in partnership, for the one is seldom used without the other, except on those rare occasions when use can be found for the Pawl only, as in the safety device fitted to the Meccano Warehouse, Special Instruction Leaflet No. 31. Here it forms a small catch that engages with the lift guides in the event of accident to the hoisting mechanism. The Pawl may be used also in conjunction with any of the Meccano spur gears as a pawl and ratchet mechanism. Used in conjunction with each other, the Pawl and Ratchet provide a mechanism that allows the shaft on which the Ratchet Wheel is secured to rotate in one direction only.

A slight pressure should always be applied to the Pawl by means of a spring or weighted lever to ensure that it is always in proper engagement with the teeth of the Ratchet Wheel.

The Pawls can be obtained complete with a Pivot Bolt and two nuts. This Bolt forms an ideal pivot for the Pawl ; it should be clamped to a Meccano part by the two nuts so that the Pawl is allowed plenty of freedom.

A section of a model self-locking gear-box is shown in Fig. 96, the locking mechanism in this example being formed from two Pawls and Ratchet Wheels. The Pawls are held in constant engagement with the Ratchet Wheels by means of short lengths of Spring Cord, and they are thrown out of engagement automatically when either of the two gear levers is operated.

By this means the hoisting shafts 2 and 3 are prevented from unwinding when they are thrown out of engagement with the main driving shaft of the gear-box.

The most recent addition to this class of parts is the Pawl without Boss. The many uses for this part will be obvious, and many unusual applications will be found for it. In Fig. 98, one of these parts is shown bolted to a Bush Wheel, a useful cam being the result.

Class J. SPECIAL ACCESSORIES

SPRING CLIP. No. 35.

Part No. 35 is designed to hold Axle Rods in position in their bearings or to maintain loose parts in place on the Rods. It can only be used for light work, however, and in every case where considerable stresses are met with a Collar should be used.

In the mechanism shown in Fig. 121 it was required to mount the Rod 5 so that it could be moved longitudinally in its bearings, but not rotated. Consequently two Spring Clips were placed on it with their arms towards the Double Angle Strip in which the Rod is mounted, with the result that, should the Rod start to turn, they strike against the Strip and prevent further movement.

It is sometimes necessary, in the construction of model cranes, etc., to apply a slight constant pressure to a gear change lever in order to prevent it from slipping. This can be accomplished by making use of a Spring Clip as shown in Fig. 116c. The shaft carrying the gear-change lever, a Crank fitted with a $2\frac{1}{2}$" Strip, carries at one end a Spring Clip. The shaft is journalled in the top hole of a Flat Trunnion, the hole immediately below being occupied by a $\frac{1}{2}$"×$\frac{1}{2}$" Angle Bracket. This Bracket is secured in place by a nut and bolt, the elongated hole of the part being used for this purpose in order to enable adjustment to be carried out. The two lugs of the Clip are in contact with the Angle Bracket, and in this way the Rod is prevented from being turned by vibration in the model.

WASHER. No. 38.

The Washers are designed principally to decrease friction between moving parts. They are also used for spacing purposes. A single Washer frequently proves invaluable for obtaining correct spacing when building various Meccano structures. If two enamelled parts are connected pivotally by bolt and nut, Washers should be placed against the parts to prevent the bolt head and nut wearing away the enamel.

In Fig. 116a several Washers are shown used together on a Rod in order to make it greater in diameter. It is often found necessary when building a model to reproduce a cylinder or tube for which a Meccano Rod is too narrow. The method illustrated in Fig. 116a may then be employed with excellent results. In this example the Rod, fitted with Washers, represents the exhaust manifold fitted to the new Meccano Motor Chassis, fully described in Super Model Leaflet No. 1a.

MECCANO CORD, Coloured. No. 40.

The Meccano Cord is blue in colour and can be used for hoisting mechanisms, pulley and belt gear, or for bracing Meccano structures and many other similar purposes.

Fig. 103

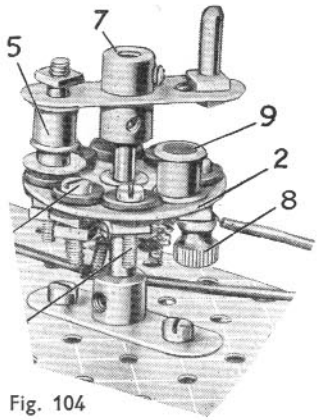


Fig. 104

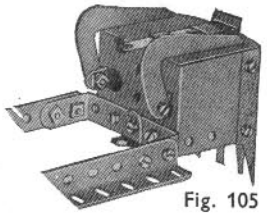


Fig. 105

Fig. 106

Fig. 107

For many purposes Aero Cord, Part No. 540, will be found a good substitute for standard Meccano Cord. This Cord is also blue in colour but is considerably thinner than Meccano Cord. For this reason the Aero Cord will be found very suitable for small models where cord is used to represent wire and narrow steel bracing.

SPRING. No. 43.

This tension spring measures 2" in length contracted and is fitted with a loop at each end to facilitate its connection to other Meccano parts. Its functions as a spring will be apparent to every Meccano boy. The Spring is frequently used in models of petrol and steam engines to represent a pipe.

An example of this form of construction is illustrated in Fig. 116a, where a Spring forms the connection between the exhaust manifold of a model car and the silencer.

COMPRESSION SPRING. No. 120b.

The Compression Spring normally measures $\frac{1}{2}$" in length, and is used to control movement and as a shock absorber, etc. In Fig. 119 a Compression Spring 3 is placed on a Crank Handle so that normally a Collar 2, having an ordinary bolt inserted in its Set Screw hole, is held against the bearing, and the Crank Handle is prevented from rotating by the stop 5. The Handle can only be turned by compressing the Spring; hence an efficient safety device is provided. The Compression Spring 4 in Fig. 123 is placed over the shanks of two opposite $\frac{3}{8}$" Bolts and acts as a shock absorber for both axles attached to the $2\frac{1}{2}$" Strip.

A Compression Spring does important service in the clutch of a Meccano motor chassis, described on page 23. If reference is made to this illustration it will be seen that the Spring holds the clutch member 3 in engagement with the member 1 until the operating pedal is pressed. In this case, however, the ordinary Compression Spring would be too large to go in the small space available; it is therefore cut in two and a portion only used. The cut part of the Spring should be filed smooth.

EYE PIECE, WITH BOSS. No. 50a.

The Eye Piece is particularly useful as a guide for sliding mechanisms, such as an engine crosshead. The slotted portion will fit over any Meccano Strip, which thus becomes a guide rail. Fig. 118 shows the crosshead of a Meccano horizontal steam engine, in which an Eye Piece acts as the "slipper" sliding on the "guide" formed from a $5\frac{1}{2}$" Strip.

HOOKS.

No. 57, ordinary. No. 57a, Scientific. No. 57b, Loaded, large. No. 57c, Loaded, small. No. 58b, Coupling Hook for Spring Cord.

The ordinary Meccano Hooks are of a suitable size for use as the load hooks in the majority of Meccano cranes. The Scientific Hooks are provided for the benefit of those boys who wish to carry out scientific experiments. The lower portion of the hook is straight and long so that three or four Meccano Weights, parts Nos. 66 and 67, can be added at one time.

The Loaded Hook is of much more massive construction than part No. 57 and is complete with a lead ball, the weight of which is intended to keep the hoisting cord of a crane taut round the circumference of the guide Pulley when no load is attached to the hook, and also to assist when lowering.

The Small Loaded Hook is for use in similar circumstances to the Large Loaded Hook, but is specially suitable for small model cranes built with Meccano Outfits A to D.

An illustration of a Large Loaded Hook is shown in Fig. 117, where the part is connected by means of a short Rod to two 2½" Triangular Plates forming the sides of a large pulley block. In Fig. 122 a Small Loaded Hook is shown. Here it is secured to the digging cord of a small model mechanical navvy. The bucket, formed by a Flat Trunnion, is connected to the Hook by a loop of cord.

In Fig. 127 two Hooks are shown attached to a loop of Sprocket Chain in such a manner that they automatically grip an object when any strain is placed on the hoisting cord of a crane fitted with this arrangement.

The Coupling Hook for Spring Cord is used for fixing the end of a length of Spring Cord to a model.

SPRING CORD.

No. 58, 40" length.

COUPLING SCREW.

No. 58a, for Spring Cord.

The Spring Cord has many varied uses. First is its function as a driving belt between two Pulleys. To make an endless driving belt, the necessary length of Spring Cord should be measured and cut off and the two ends then connected together by means of the special Coupling Screw, part No. 58a. The Screw should be inserted half-way into one end of the Spring Cord, and the other end then screwed on to it.

Where it is required to attach Spring Cord to a Meccano bolt or other part, its end should be heated in a lighted match so as to take the springiness out of the metal. It can then be twisted round the bolt as easily as a piece of thread.

Occasionally the Spring Cord is used as a kind of Bowden wire or cable to encase an operating wire or string. In Class D is illustrated a Meccano siphon lubricator, in which the " wicks " used to conduct the oil to the journal bearings are encased in short lengths of Spring Cord.

Yet another example of the adaptability of the Spring Cord is reproduced in Standard Mechanism No. 110. In this case the Spring Cord is used as resistance wire, and short lengths of it are connected between the studs on the switch. Portions of the Spring Cord may be used also as tension springs for light purposes. Small springs so formed are used frequently, for example, for holding Pawls in engagement with Ratchet Wheels as shown in Fig. 124. Again, in the internal-expanding brakes fitted to a Meccano motor chassis, see Fig. 114, short pieces of Spring Cord serve to return the brake shoes to the " off " position when the lever is released.

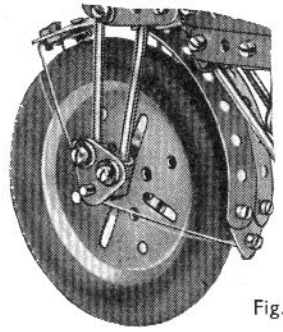


Fig. 108

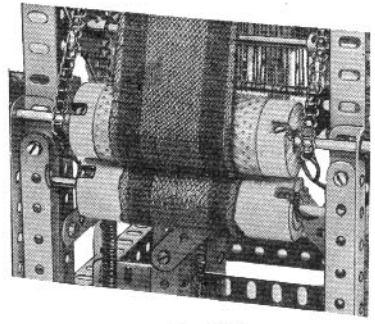


Fig. 109

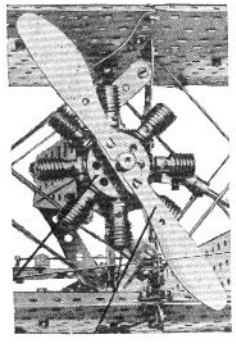


Fig. 110

COLLAR, WITH SET SCREW. No. 59.

The Collars with Set Screws, similarly to Spring Clips, are intended for holding shafts in place in their bearings, or for holding Strips, etc., loosely on Axle Rods. There are, however, many other novel uses for them. For instance, they form the brake shoes of the internal expanding brake shown in Fig. 114, while in Fig. 123 Collars secured to the 2½" Strip 3 form journal bearings for axles. The bolts holding the Collars are spaced by Washers so that they do not grip the axles. In Fig. 116B a series of Collars are employed to form a hinge, the Collars 1 and 2 being secured to the door 3, while two other Collars are secured to the jamb and to the Rod 4. The remaining three Collars are inserted for spacing purposes.

Collars in many instances are connected together by means of a 7/32" Grub Screw, one half of the Grub Screw being inserted in the tapped hole of one of the Collars. The second Collar is then passed on to the protruding portion of the Grub Screw and turned until it tightens against the first Collar. Fig. 116 shows one method of utilising this form of construction. Here the various Collars are so arranged that they form an excellent triple-throw crankshaft.

THREADED BOSS. No. 64.

The Threaded Boss is of the same diameter as the Collar, but measures ⅜" in length and is perforated longitudinally and transversely with threaded bores. Hence the part is particularly valuable in Meccano screw gearing. In Fig. 128 a Threaded Boss is shown mounted on a short Screwed Rod. It is prevented from rotating with the Rod ; consequently, when the hand wheel is turned, the Boss travels longitudinally, and in the example illustrated this movement is utilised to control a simple brake mechanism.

The Threaded Boss is useful also for connecting Strips and Girders to Screwed Rods for use in car jacks, etc.

CENTRE FORK. No. 65.

The Centre Fork can be used as a small pointer in certain Meccano indicating appliances, etc. Perhaps its most important function, however, is its use in intermittent motion, where it engages at intervals with the teeth of a Meccano Gear or Sprocket Wheel. It is shown used in this way in a Meccano distance indicator in Fig. 126. Here the Centre Fork is secured by a Coupling to a vertical rotating Rod, in such a way that once in each revolution of this Rod it engages with and partially turns a Sprocket secured to a second vertical Rod.

A somewhat novel use for the Centre Fork is illustrated in Fig. 125. Here it forms the " knife edge " in a Meccano knife-edge bearing. Fig. 125 is a section of the Meccano Harmonograph (see Special Instruction Leaflet No. 26), the Pinion 16 being secured to the

pendulum. This Pinion rests on the edge of the Centre Fork 17, the teeth of which lie between two of the teeth in the Pinion, and the Centre Fork is secured in the boss of a Crank 18 that is bolted to the fixed part of the model. The pendulum rocks about the extreme point of the Centre Fork.

SPROCKET CHAIN. No. 94.

The primary function of the Sprocket Chain is to provide a means of transmitting power between any two shafts where ordinary gearing would be impracticable and belt or cord drive insufficiently positive. It engages with the Meccano Sprocket Wheels, and the different speed ratios that are obtainable with their aid are described at length in Class O, Gears and Toothed Parts.

The Chain is supplied in lengths of 40in., and comprises 6 links to the inch. It can easily be separated and joined again when the requisite length has been measured off. To separate, the ends of one of the links are gently prised up with the blade of a screwdriver so that the adjacent link can be slipped out. After rejoining, the ends are bent back again carefully so that they do not grip the next link too tightly. The Chain should be passed round the wheels so that the turned-over ends of the links face outward or away from the wheel, as this will result in smoother running. The chain will also be less likely to jump the Sprocket Wheels.

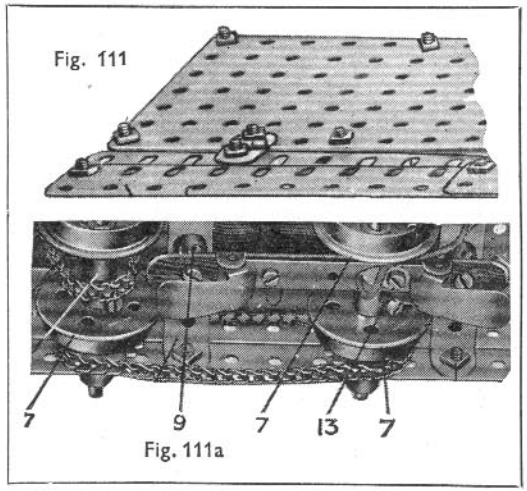


Fig. 111a

THREADED PIN. No. 115.

The smooth portion of the Threaded Pin terminates in a squared shoulder and short threaded shank. The shoulder permits of the Pin being secured rigidly with the aid of a spanner. The part is intended principally for use as a handle or as a fixed pivot for a $\frac{1}{2}$" or 1" loose Pulley. In Fig. 129 two Threaded Pins 11 and 14 are used as handles for operating sliding Axle Rods, the Pins being secured to the Rods with the aid of Collars. In Fig. 124 a Threaded Pin is seen inserted in the Set Screw hole of a Pawl, to serve as a handle by which the Pawl can be lifted clear of the Ratchet Wheel on the driven shaft.

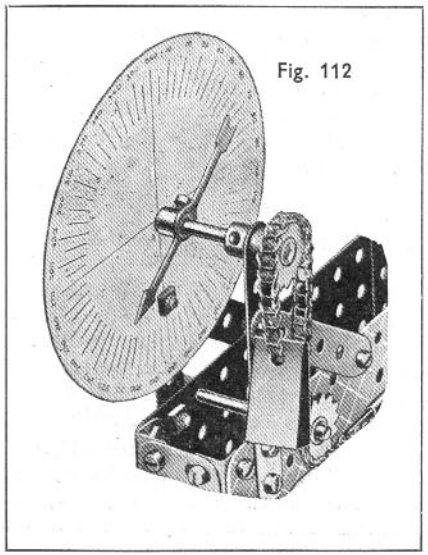


Fig. 112

FORK PIECES.

No. 116, large. No. 116a, small.

Fork Pieces are designed for pivotal connections between Rods and Strips or between two Rods meeting at right angles. In Fig. 115 a Large Fork Piece forms a connection between two Large Corner Brackets, while in Fig. 129 the same part is seen employed as a neat journal bearing for a short horizontal Rod. In Fig. 126a a Small Fork Piece is used as a bearing for a $\frac{1}{2}$" loose Pulley, which runs on a $\frac{1}{2}$" Bolt passed through its arms.

ECCENTRICS.

No. 130, Triple Throw. No. 170, Single Throw.

There are two kinds of Meccano Eccentrics, part No. 130 giving three different throws ($\frac{1}{4}$", $\frac{3}{8}$" and $\frac{1}{2}$") and No. 170 one throw only ($\frac{1}{4}$"). The term "throw" means the radius of eccentricity, so that the total rectilinear movements obtained for the three throws of No. 130 are $\frac{1}{2}$", $\frac{3}{4}$", and 1" respectively, while that of No. 170 is $\frac{1}{2}$". The great advantage of an eccentric is the fact that it permits reciprocating movements being obtained from a rotating shaft without breaking the line of the latter. On the other hand a disadvantage lies in the fact that, unlike the crank, it can only transform rotary movement to reciprocating, and cannot be used to produce rotary motion unless triplicated. In models, as in actual engineering, the most common use for the eccentric is found in the operation of valve mechanism for reciprocating engines. An Eccentric requires ample lubrication because of its large rubbing surfaces.

HANDRAIL SUPPORT. No. 136. HANDRAIL COUPLING. No. 136a.

The Handrail Support, in addition to the function indicated by its name, can be used as a journal bearing for rotating shafts. In Fig. 129 the part is seen employed as a bearing for the sliding Rod carrying the handle 11.

In addition, the Handrail Support can be used in innumerable cases where it is required to secure an Axle Rod to a Strip or other part. It is used also to a large extent as an ornamental top for a column.

The Handrail Coupling is similar to the Handrail Support, with the exception that the threaded shank of the latter part is removed and the length of the part increased. The extra length allows a hole to be drilled in the part at right-angles to that already drilled in the rounded top. The Handrail Coupling is therefore useful in any instance where a neat joint is required between two Rods meeting at an angle of 90 degrees, such as in handrails and transverse shafting supports built up from Rods.

FLEXIBLE COUPLING UNIT. No. 175.

This part forms a suitable substitute for a Universal Coupling, so long as the driven shaft is not at too great an angle to the driving shaft. It can be used also for representing a short curved handrail and tube.

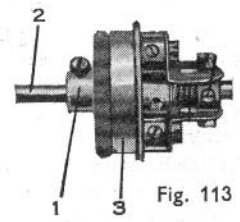


Fig. 113

ROD SOCKET. No. 179.

By means of this part, a Rod can be secured to a Strip or Plate in the simplest and neatest possible manner. At one end it is fitted with a threaded shank, while at the other end is drilled a hole suitable for accommodating a Rod or other part of similar diameter.

Class K. MISCELLANEOUS MECHANICAL PARTS

PROPELLER BLADE. No. 41.

The Propeller Blades have been improved in design and now conform closely to an actual aeroplane propeller, or airscrew.

Fig. 110 shows one of the three engines incorporated in the Meccano Biplane. This model is fully described in Super Model Leaflet No. 34. This airscrew is formed from two Propeller Blades, and the pair of blades is bolted to a Double Arm Crank, the boss of which serves to secure the complete airscrew to the engine shaft.

The hub end of each blade is rounded so that it partially encloses the boss of the Double Arm Crank ; hence one bolt is sufficient to hold the blade perfectly rigid. If a Double Arm Crank is not available the blades may be bolted to a Bush Wheel or similar part.

The broader parts of the blades are turned at an angle to the plane of rotation so that a considerable current of air is created by the airscrew when in motion. As a matter of fact the Propeller Blades have been employed successfully in a Meccano Electric Fan, although for such a purpose it is better to shape the fan itself from a sheet of tin so that the blades may be as broad as possible.

A very interesting small model making use of the Propeller Blades is the Helicopter Toy described under Model H16 in the F-L Instruction Manual.

WINDMILL SAIL. No. 61.

The Windmill Sail, like the Propeller Blade, has its hub end cut out so that it will fit round the boss of a wheel, or round the raised lip on the wheel on the reverse side to the boss. Among other adaptations of the Windmill Sail may be mentioned its use to represent cabin sides in model ships, complete with windows,and wings for small aeroplanes.

WEIGHTS. No. 66, 50-gramme. No. 67, 25-gramme.

Supplied specially for use in scientific experiments, where perfectly accurate weights are essential. They also find numerous other applications in ordinary model-building. Numerous examples of the uses of these weights are to be found in Meccano Looms, where they are hung at suitable intervals along brake levers, thus regulating the amount of retarding effort applied to a shaft. It is necessary in instances of this kind to be able to judge fairly accurately the amount of braking power that a brake is capable of exerting, and for this reason Meccano 25 and 50 gramme weights are extremely useful.

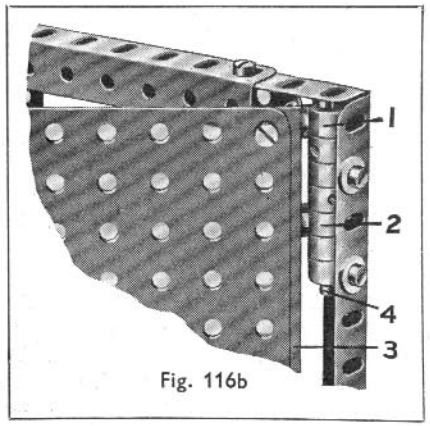


Fig. 116b

In Fig. 112 a 25 gramme Weight is used for returning a Pointer to "zero" or neutral, after deflection.

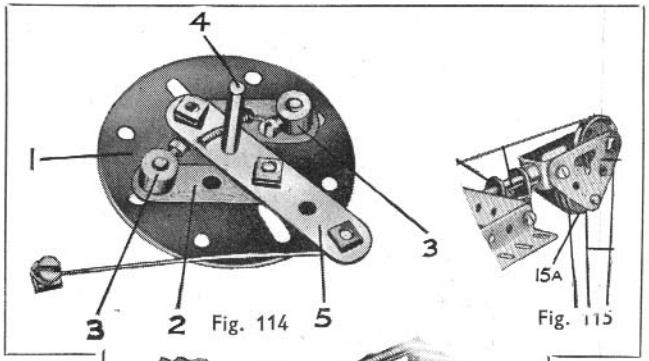
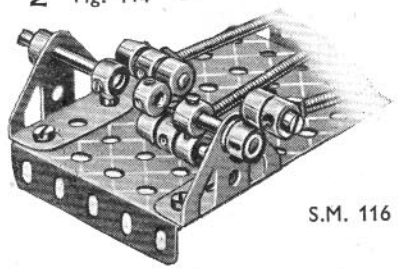
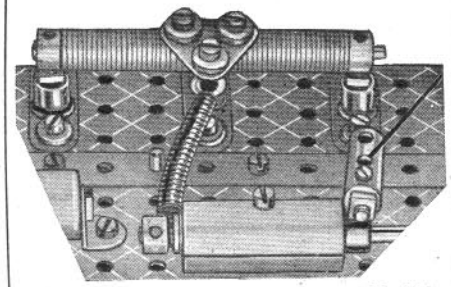
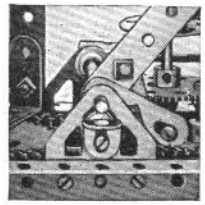


Fig. 114

Fig. 115


S.M. 116


S.M. 116a


S.M. 116c

HEALD FOR LOOM. No. 101.

In addition to the use for which it is specially designed, that is as a heald in the Meccano Loom (see Instruction Leaflet No. 16a),part No. 101 is often employed as a tie in bracing various Meccano structures. In the Meccano Biplane, described in Instruction Leaflet No. 34, Healds are used as the diagonal ties between each pair of upright wing supports. A portion of a pair of these supports with the Healds in position is shown in Fig. 110. Another important use for Healds is found in the Meccano Motor Chassis, where they are employed as the means of connection between the hand brake lever and the brake mechanism on the rear wheels.

It is sometimes found necessary, when building a small model, to reproduce a small bracing member or tie-rod, for which purpose ordinary Meccano Rods and Strips are too large and cumbersome. It is in these circumstances that Meccano Healds are found almost indispensable. An example of Healds used in this manner is shown in Fig. 108, where they form mudguard stays for a motorcycle. It is a simple matter to bend them into the shape shown in this illustration, and they may equally as easily be returned to their original form.

A further example of the use of part No. 101 occurs in the Model Racing Seaplane, which is described under model L.19 in the Manual of Instructions. In this model the Healds are employed as bracing wires for the wings and floats.

SHUTTLE. No. 104

Produced specially for use in the Meccano Loom. It is illustrated and its functions are fully explained in Instruction Leaflet No. 16a.

WOOD ROLLER. No. 106. SAND ROLLER. No. 106a.

In addition to their functions as the take-up rollers in the Meccano Loom, the Wood and Sand Rollers are frequently used as winding drums in cranes, etc. Both Rollers are provided at each end with a circular recess, to receive a Collar or wheel boss, and with a slot to receive the Set Screw inserted in the boss. Each is supplied complete with two Collars secured to a $4\frac{1}{2}$" Axle Rod. The Wood Roller also has a groove along one side, the object of which is to enable the woven material in the Loom to be secured by gripping it under a short Rod dropped into this slot. An ideal winding drum can be formed from the Wood Roller by adding a Bush Wheel at each end, the drum so formed having a large capacity. The Sand Roller differs from the Wood Roller in that it is encircled by a sheet of tin specially burred to grip the woven material in the Loom as it passes beneath it and is wound on to the Wood Roller, ready for use.

In Fig. 109 both these Rollers are shown fitted into the Meccano Loom. The Sand Roller is free to

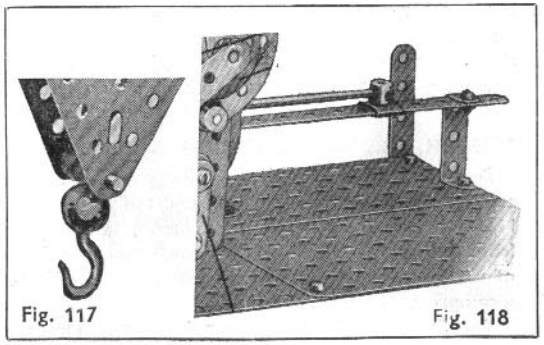


Fig. 117 Fig. 118

rotate in fixed bearings, and is slowly rotated through suitable gearing from the driving shaft of the Loom. The Wood Roller, however, is free to move vertically in two slides, situated at each side of the model, and is held in light contact with the Sand Roller by means of two Springs and two lengths of Sprocket Chain. This Chain is connected to the Rod carrying the Roller by means of two Hooks.

TABLE FOR DESIGNING MACHINE. No. 107.

Supplied specially for use with the Meccanograph, see Instruction Leaflet No. 13, wherein it is used to hold the paper while the design is being drawn by the writing arm. It is 6½" square, of smooth polished wood, and is supplied complete with a Bush Wheel screwed to its under side, by means of which it is secured to the vertical rotating spindle in the model. The part is also useful as a fixed base for small models.

HINGE. No. 114.

A Meccano Hinge is shown in Fig. 111 connecting one end of the aileron to the main wing in the Meccano Biplane. This part is invaluable for mounting doors and similar hinged parts in Meccano models. It is also frequently used in place of locknutted bolts, etc., in making pivotal connections between any two parts of a model.

STEEL BALLS. No. 117. ⅜" diam.

The Steel Balls are intended for use in building up ball bearings for swivelling structures. A typical built-up ball bearing unit is described in the Standard Mechanisms Manual, see detail No. 140, and on reference to this it will be found that 21 steel Balls are placed round the circumference of a Wheel Flange that is bolted to a 3" Pulley Wheel, while a further 3" Pulley, which is bolted to the swivelling superstructure, rests on the Balls. With this arrangement it is possible to rotate heavy structures easily and smoothly about a central pivot. The Steel Balls are used also in model building for ballast purposes and for driving "gravity wheels." In the latter case the Balls are arranged to drop one at a time on to the blades of a kind of waterwheel, and the weight of the Balls causes the wheel to rotate, just as the force of the impinging water operates the actual waterwheel.

BUFFER. No. 120. **SPRING BUFFER.** No. 120a.

Designed for use in models of railway vehicles. Both types are mounted on threaded shanks and fitted with standard nuts. No. 120 measures ½" in length, excluding the shank, and is cut from the solid, while No. 120a, which measures ⅝" in length minus shank, is provided with a separate sleeve that encloses a compression spring, and thus acts as a shock absorber.

The Spring Buffer can be employed also for other very

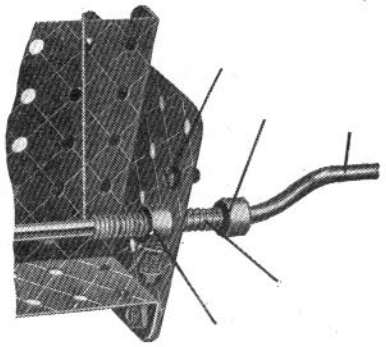


Fig. 119

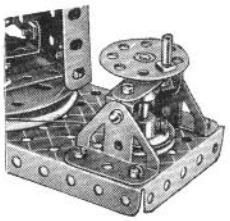


Fig. 120

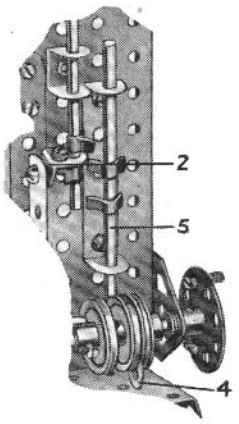


Fig. 121

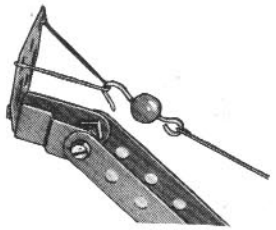


Fig. 122

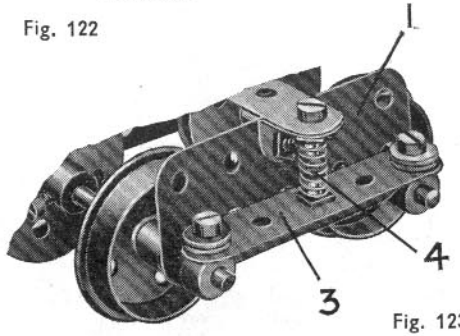


Fig. 123

different purposes. In Fig. 107 part No. 120a serves as a spring catch to hold a hand lever in position after the latter has been moved from one side to the other. The lever passes through the centre hole of a Coupling 19 and carries a second Coupling 20, which presses on the Spring Buffer 21 and is provided with two 7/32" Bolts inserted on opposite sides. These bolts act as stops to prevent the lever from moving too far in either direction.

One of the most interesting adaptations of the Spring Buffer is included in Standard Mechanism No. 110, Meccano Electric Controller. This mechanism is reproduced at Fig. 104, and it will be seen that the Spring Buffer 5 acts as a spring controlled contact, which ensures good contact being made with the studs of the resistance. The sleeve portion of another Spring Buffer is bolted at 9 to act as a stop.

MINIATURE LOADED SACK. No. 122.

This accessory adds a realistic touch to Meccano models of cranes, lorries, conveyors and other types of goods-handling machinery. It can be used also with advantage in connection with Hornby goods trains. It is filled with sawdust and provided with a small loop of wire by means of which the crane hook can be attached.

The use of a number of Miniature Sacks will also add considerably to the realism and pleasure of operating the lifts in the Meccano Electric Goods Warehouse, Special Instruction Leaflet No. 31.

DREDGER BUCKET. No. 131.

Intended for use in models of excavating machinery and conveyors. Is provided with a clip that can be pushed through one of the links in a length of Sprocket Chain, the ends of the clip then being bent back as shown in Fig. 106. Great care should be exercised in bending the clips to ensure that sufficient space is left between their ends to admit the teeth of the Sprocket Wheel round which the Chain passes. The Chain 7 on which the Buckets 15 are mounted should be kept taut or it will twist when the buckets are loaded.

CRANE GRAB. No. 150.

Useful in model cranes, for picking up and depositing loads. It consists of two jaws fitted with arms that are pivoted together and connected at their upper ends by short chains to a hook, which can be attached to the main crane hook. It is illustrated in Fig. 103.

DIGGER BUCKET. No. 169.

This part is shown in Fig. 105. Designed principally for use in Meccano steam shovels, or mechanical navvies. The mouth of the Bucket measures about 1⅞" × 2¼", while the depth, over cutting teeth, is 2½". The bottom of the Bucket

is mounted on hinged levers and normally is held in place by a sliding catch that engages with a slot in the front of the bucket. A cord can be attached to the catch, and on pulling this the floor falls open and so discharges the contents of the bucket. If a small quantity of gravel or grain is available a model excavator fitted with the Digger Bucket can be used to load Hornby Railway Wagons, etc.

THEODOLITE PROTRACTOR. No. 135.

The Protractor consists of a sheet of superfine ivory card on which are printed circular and semi-circular scales, marked out in degrees. These two scales are for use in the Meccano Theodolite, Model No. 6.17, the former for indicating the extent of rotation of the model in a horizontal plane and the latter for indicating the angle of the sighting arm. The scales are also useful in a number of other models. In Fig. 112 the circular scale is used as a measure of the extent of vertical rise or fall of a lift.

SHIP'S FUNNEL. No. 138. **RAKED SHIP'S FUNNEL. No. 138a-z.**

Part No. 138 is placed vertically on its base, while No. 138a is raked, that is, when secured to a model it lies at an angle to the vertical. Both are provided with two perforated lugs by means of which they can be bolted to any Meccano Strip or Plate. No. 138 is enamelled red and is designed for use in models of tramp steamers, etc. No 138a is obtainable in 26 different colour-combinations to represent the principal shipping companies. It is also provided with a miniature steampipe attached to the front of the funnel.

WIRE LINE. No. 141.

For suspending the 18 lb. weight required to drive the Meccano Grandfather Clock, Instruction Leaflet No. 14a. It can be used in any model where a very heavy load is to be raised, but is not suitable for small model cranes unless a pulley of large diameter is used, owing to stiffness.

MINIATURE TYRES.

No. 142b, to fit 3″ diam. Pulleys. No. 142d, to fit 1½″ diam. Pulleys.
No. 142a, to fit 2″ diam. Pulleys. No. 142c, to fit 1″ diam. Pulleys.

The 3″ and 2″ sizes of the tyres will be familiar to the majority of Meccano boys, but the 1½″ and 1″ are more recent additions to the system. These solid rubber tyres are perfect miniature reproductions of the real thing and are specially made for Meccano Limited. They are suitable for use in all models of motor vehicles, etc. The dimensions given represent their inside diameters and therefore the four tyres fit the 3″, 2″, 1½″ and 1″ Pulleys respectively.

RUBBER RINGS. No. 142. 3″. No. 155, ⅝″.

No. 142 is designed to fit round the groove of a 3″ Pulley Wheel and thus represent a pneumatic tyre in models of road vehicles. Also employed to provide the frictional surface in Meccano clutch mechanisms and frictional driving apparatus. The ⅝″ Rubber Ring is incorporated in the clutch of the Motor Chassis, Instruction Leaflet No. 1a. In Fig. 113 the Ring is

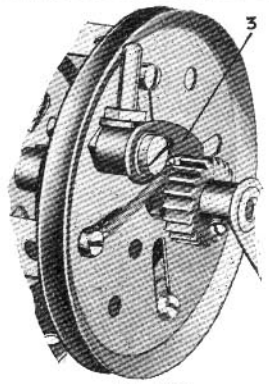


Fig. 124

Fig. 125

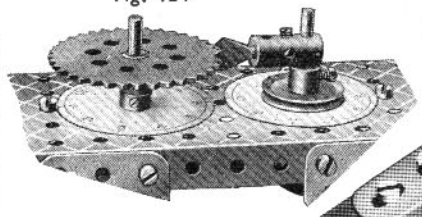


Fig. 126

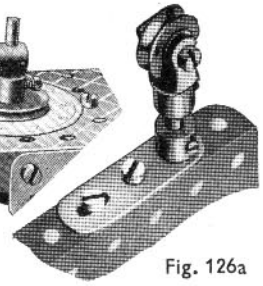


Fig. 126a


Fig. 127

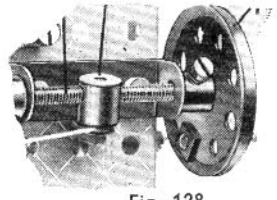


Fig. 128

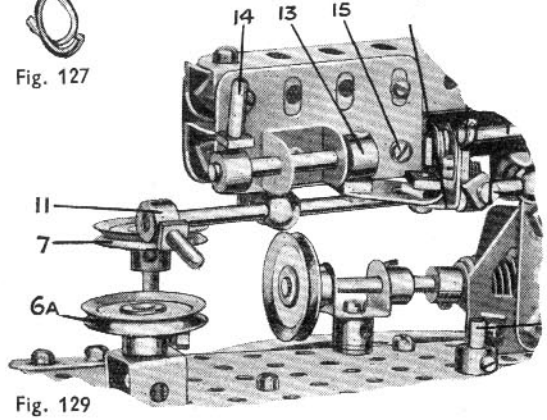


Fig. 129

placed round the groove of a 1″ Pulley 1, which is secured to the Rod 2 and forms one portion of a clutch. On operation of the clutch pedal the other clutch member 3, a 1⅝″ Flanged Wheel, can be moved to and fro and thus brought in or out of frictional contact with the Rubber Ring, which is driven continuously from the engine.

COLLECTING SHOE. No. 149.

Intended for use in models of electric locomotives, tramway cars, and other vehicles designed to run on the three-rail system. It consists of a fibre strip 4″ long on which are mounted the hinged metal contact pieces that press on the centre or "live" rail. The Shoe is shown in Fig. 111a secured to the underside of a model electric locomotive. An insulated wire is led from one of the Motor terminals through the locomotive undercarriage and is secured by the bolt 13, which also helps to secure the metal part of the Shoe to the fibre strip. The current is picked up from the centre rail by the Shoe and is directed to the Motor by the wire attached to the Bolt 13. It returns to the accumulator by way of the framework of the model, the running wheels 7, and the outer rails, which must be kept clean to ensure good contact.

POINTER. No. 156.

No. 156 measures 2½″ overall and is provided with a boss that is set slightly off centre so that if the part is mounted loosely on an axle the Pointer will tend always to remain in a vertical position, with the point uppermost. An example of its use is illustrated in Fig. 112.

FAN. No. 157.

The Meccano Fan can be used as a radiator cooling fan in model motor cars, etc. It also adds realism to model workshops when employed as a ventilating fan.

SIGNAL ARMS.

No. 158a, "Home" type. No. 158b, "Distant" type.

The difference between the two types of Signal Arms is the "fish-tail" on the "Distant" Signal. Each type measures 3″ in overall length. Transparent red and green "glasses" are attached and if a light is placed behind them a realistic effect is obtained.

A very fine model of a signal gantry can be built with the aid of these parts and ordinary Meccano Accessories.

PENDULUM CONNECTION. No. 172.

No. 172 is a short length of special springy brass strip and is primarily intended, as its name implies, to be used as a means of suspending the pendulum in the Meccano Grandfather Clock, see Instruction Leaflet No. 14a. It also forms an excellent "brush" contact in model electric motors and engines and also rotary flashing mechanisms.

RAIL ADAPTOR. No. 173.

This part is intended for use in models where it is necessary to attach a length of Meccano built-up track to Hornby Rails. It forms a neat joint, which cannot otherwise be obtained with ordinary parts, and adds to the smooth running of rolling stock especially over lift and swing bridges.

Class L. ELECTRICAL PARTS

Although Meccano parts are intended primarily for reproducing structures and mechanical movements, a great number of electrically operated mechanisms can be constructed. For the purpose of building these electrical models several low voltage insulating parts and other accessories necessary for this type of work are included in the range of Meccano parts. They consist essentially of small diameter nuts and bolts and insulating Bushes and Washers.

In addition to these, several special parts are also available, including silver tipped 6 B.A. screws for making contact points, and Bobbins wound with enamelled copper wire. These Bobbins form excellent electro-magnets for incorporating in a variety of models.

For lighting purposes electric lamps are provided, in five different voltages. They are attached to models by means of the Lamp Holders, as described later.

Two sizes of cotton-covered wire are available for forming connections between various terminals, etc. This wire will be found suitable also for forming solenoids and other types of electro-magnets. The two sizes supplied are 23 S.W.G. and 26 S.W.G.

It will be noticed that many of the electrical parts have numbers of 1500 and over. This indicates that these parts are supplied in Meccano "Elektron" Outfits in addition to Meccano constructional Outfits.

BOBBIN. No. 181.

Designed for use in the construction of small electro-magnets and solenoids. It is about 1" in length and its centre, which is of brass, is bored to fit round a Meccano Axle Rod. The two ends are of fibre and are $\frac{3}{4}$" in diameter. Fig. 130 shows two solenoids, formed from Meccano Bobbins, used to impart reciprocating motion to the "piston rods" 3 and 4 of a small horizontal engine. Each Bobbin is wound with several layers of No. 26 S.C.C. Wire and is covered with a strip of brown paper as extra protection. The Rods 3 and 4 are free to slide in the centre bores of the Bobbins, and matters are so arranged that current is supplied to the coils of wire alternately, thus imparting motion to the piston rods and thence to the crankshaft of the engine. Solenoids constructed in this way can be used for many purposes in Meccano model-building. For example, an electric railway signal can be brought to the "off" position by supplying current to a solenoid that operates the signal arm through a "plunger" and suitable lever mechanism, as shown in Fig. 131. In this example the current is kept on continually while the signal is in the down position.

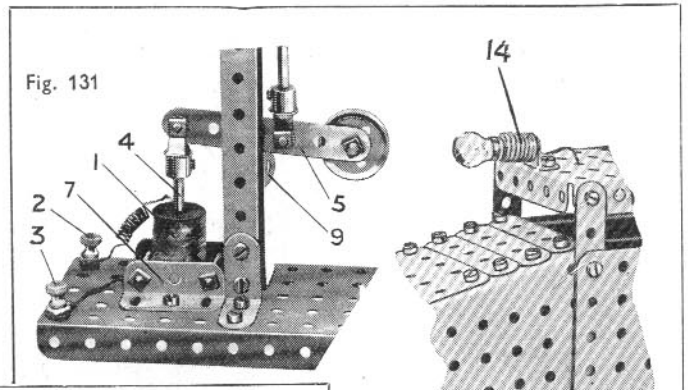


Fig. 131

Fig. 132

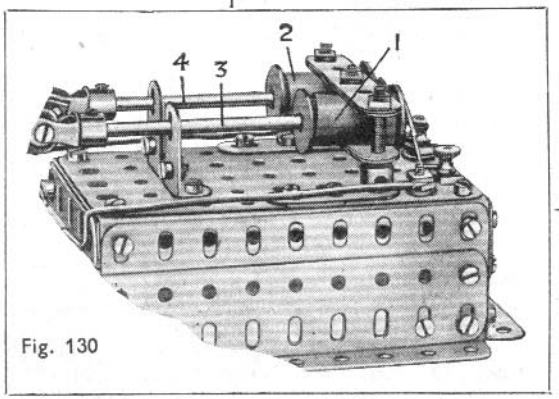


Fig. 130

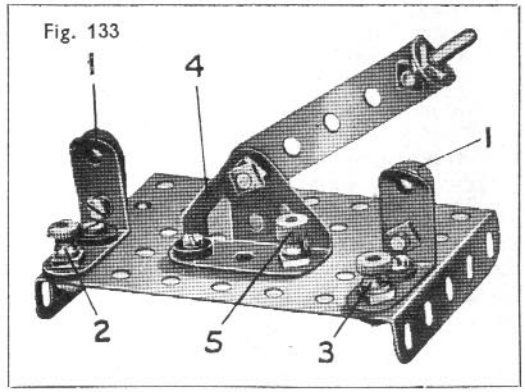


Fig. 133

Electro-magnets for operating bells, relays, and lifting magnets for cranes, consist of fully-wound Bobbins fitted with iron or steel cores. These cores may consist of either $1\frac{1}{2}$" Rods or 2" Threaded Rods, or if a very delicate relay is being constructed a bundle of soft iron wires should be used. These wires do not retain any magnetism after current has been switched off from the Bobbins. An electro-magnet is shown fitted to a buzzer in Fig. 134. If heavy-duty magnets are required, two Bobbins may be used, the cores of these being connected at one end by a yoke of $1\frac{1}{2}$" strips. About six Strips will be found sufficient, locknuts being used to hold them in position. For operating the magnets from a supply of 6 volts, both Bobbins must be wound with 26 S.C.C. wire. They are then connected in series, that is the inner wire of one is connected to the outer wire of the other, and care should be taken that the windings of the separate Bobbins are laid on in a similar direction. This complete electro-magnet consumes about 2.3 amps. and it should not be excited for more than 10 minutes at a time, as it is liable to become overheated. If necessary, a small resistance may be used in series with the magnets.

SILVER TIPPED CONTACT SCREW. No. 1569.

These screws are cut with a 6 B.A. thread and are $\frac{1}{2}$" in length overall. They are shown at 4 and 5 in Fig. 134 and should always be used where a rapid make-and-break is required, for they ensure perfect contact and do not burn away or "soot-up" under the heat of the sparks like ordinary screws. The gap between the contact points can be adjusted by turning one of the screws in the two nuts that hold it in position.

6 B.A. BOLTS, $\frac{1}{2}$in. No. 1575.
6 B.A. INSULATING BUSH. No. 182.
6 B.A. 1" SPECIAL BOLT. No. 1568
6 B.A. NUTS, Hexagonal. No. 1562.
6 B.A. NUTS, Square. No. 1583
6 B.A. INSULATING WASHER, Large. No. 1570
6 B.A. INSULATING WASHER, Small. No. 1561

The 6 B.A. Bolts and Nuts are supplied so that Meccano parts can be bolted together and yet insulated from each other by using these bolts in conjunction with the special Insulating Bushes and Washers. These latter parts are of fibre, and are similar except that the Insulating Bush has a small "shoulder" that fits inside a standard Meccano hole. Whenever it is necessary to insulate a bolt from a Meccano Strip, an Insulating Bush should be placed on one side of the Strip, with its shoulder inside a hole in the Strip, and an Insulating Washer on the other side; a 6 B.A. Bolt should then be passed through the two and secured by its nuts in the ordinary way. In this manner the bolt is prevented from making contact with the metal of the Strip. This simple means of insulation is very valuable in Meccano model-building.

Fig. 136 shows a 6 B.A. Bolt 5 used as the contact stud in a Meccano Morse tapping key. The bolt is insulated from the base plate, but the key 4 is in metallic contact with it. One wire is attached to the bolt 5 and another to the plate, so that the circuit is completed whenever the bolt 8 of the key touches bolt 5.

Class L. Electrical Parts (Contd.)

TERMINAL. No. 1563.

The Terminal consists of a milled brass knob bored and tapped to fit the 6 B.A. Bolts. Fig. 134 shows two Terminals mounted on the shanks of bolts at 6 and 8. It will be noted that an Insulating Washer is placed under the Terminal 6 ; an Insulating Bush is used on the other side of the plate, so that this Terminal is insulated from the model. Terminal 8 is in metallic contact with the model.

Fig. 133 shows a Meccano two-way switch. In this the switch arm is attached pivotally to a Trunnion that is insulated from the base plate in the manner described already, and the two contact pieces 1 carrying the Terminals 2 and 3 are also insulated. Hence, by engaging one or other of the latter with the switch arm the electric circuit can be led from Terminal 5 to Terminal 3, or alternatively from Terminal 5 to Terminal 2.

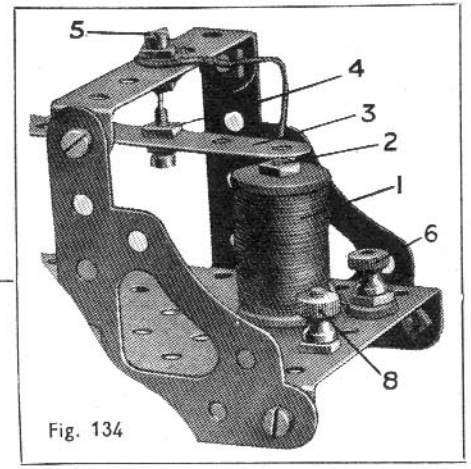


Fig. 134

LAMP HOLDER. No. 183.

METAL FILAMENT LAMPS.

2½ volt No. 184a 3½ volt No. 184b
6 volt No. 184c 10 volt No. 184d
20 volt No. 184e

The Lamp Holder is designed to form a screw socket for any of the Meccano Lamps. Its end is of fibre and it is secured to Meccano models as follows. A 6 B.A. Bolt is passed through the small perforation in its end, and then through a hole in a Meccano Strip, and an Insulating Bush is placed on the shank of the bolt so that its shoulder fits into the hole in the Strip. The bolt can then be secured by a nut or Terminal. When the latter is screwed up tight, the metal of the Lamp Holder will be in contact with the Strip, so that the electric current can be conducted to the lamp by attaching one wire to the 6 B.A. Bolt, the head of which presses against the contact in the end of the lamp itself, and another wire to the Meccano Strip.

Fig. 132 shows a Lamp and Holder mounted in the front of a model electric locomotive, the Holder 14 being bolted to an Angle Bracket. Current is led to the Lamp by an insulated wire slipped under the nut on the 6 B.A. Bolt by which the holder is secured, and returned to the source of supply through the Holder itself and through the frame of the model.

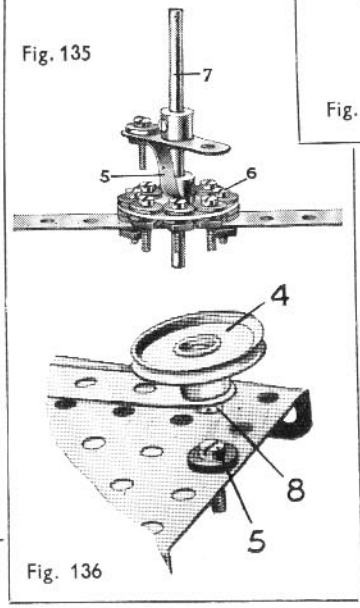


Fig. 135 Fig. 136

26 GAUGE, S.C.C. COPPER WIRE.
No. 1586.

23 GAUGE, S.C.C. COPPER WIRE.
No. 1587.

The 26 gauge Single Cotton Covered Copper Wire is usually employed in constructing electro-magnets, bobbins, etc., although it can be used for ordinary connecting purposes. The 23 gauge Copper Wire is intended for making all kinds of electrical connections in Meccano models.

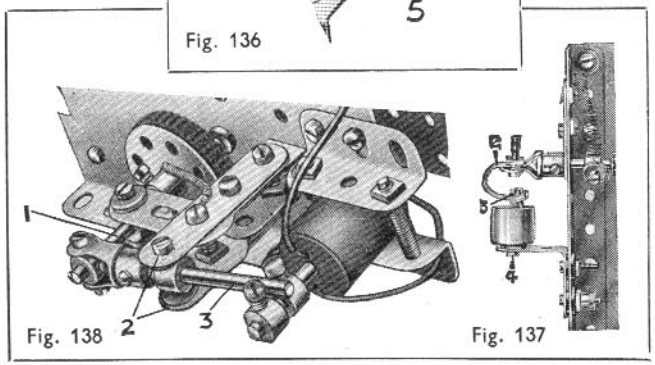


Fig. 138 Fig. 137

The current consumption of a Bobbin, Part No. 181, fully wound with 26 gauge wire, is .94 amps and a Bobbin wound with 23 gauge wire takes 1.5 amps. Both of these figures are for a two-volt supply which, if increased, causes a corresponding rise in current consumption.

It is scarcely necessary to give Meccano boys detailed instructions on the subject of wiring their models, but it may be well to mention one or two important points. All connections should be made as tight as possible—that is, when connecting a wire to some part of a model it should not be merely twisted round a Strip, but secured by a nut and bolt. Insulated wire should never be allowed to rub against metal or short circuits will quickly occur.

Another point to remember is the fact that wire exerts a certain resistance against the flow of the electric current, just as a water pipe resists the flow of water through it. In ordinary Meccano model-building the resistance likely to be exerted by the wiring is negligible, especially if the Meccano 23 gauge wire is used; but in exceptional cases where the current is directed over considerable distances, such as in Morse Telegraph instruments, electric signals and indicators, etc., a considerable loss of current will result if thin conductor wire is used, and the motor, bell or whatever it is required to energise, will fail to function properly. The resistance in the conductor can be decreased by making use of larger diameter wire or, if a larger wire is not obtainable, by connecting additional lengths of wire in parallel with the first.

PENDULUM CONNECTION. No. 172.

This part, although not included in the electrical equipment, has many uses when adapted for use with the electrical accessories. It consists of a piece of spring brass 1½″ in length and ¼″ in width, and it can be used as a brush or as a make-and-break contact.

Two of the uses for this part are shown in Figs. 135 and 137. The first of these illustrations show a rotary trailing contact originally designed for use in a model electric roulette wheel. The wheel is secured on the spindle 7 above the roulette table, and as it spins it causes a Double Arm Crank to rotate. The Double Arm Crank carries a Pendulum Connection 5 that is held in place by a 6 B.A. nut and bolt, and the lower end of this Connection trails across the eight insulated studs of the Bush Wheel 6.

Each stud is connected to an electric lamp and the contact 5 to one terminal of an accumulator. The other terminal of the accumulator is connected to the "earth" pole of all the lamps. It will now be seen that as the contact 5 rotates, the lamps coupled up to the eight insulated studs will light alternately. When the wheel stops one lamp only will remain alight.

In Fig. 137 a Pendulum Connection is shown incorporated in an electric make-and-break fitted with a spark arrester. This unit was fitted to a Meccano Electric Mantel Clock to prevent erosion of the Contact Screws 3 and 4. The Chimney Adaptor is filled with thin oil in which the contacts work. The Pendulum Connection is bent to the shape shown and mounted on one end of the pendulum tappet rod by means of an End Bearing and 6 B.A. bolt. An extra hole must be drilled in the Pendulum Connection for this purpose.

Class M. POWER UNITS AND ACCESSORIES

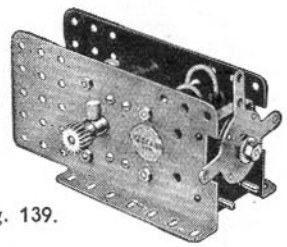


Fig. 139.

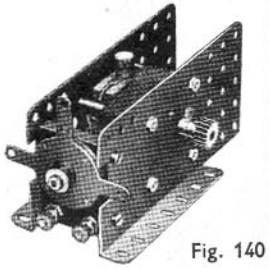


Fig. 140

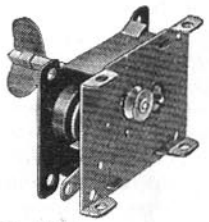


Fig. 139a

For setting his model in motion, the Meccano boy has a choice of "prime movers" employing the three principal sources of power used by the model engineer—steam, electricity and clockwork. Many boys find it difficult to decide which of these methods to adopt. Of course, the ideal plan is to make use of all three methods, so that when building, say, a model electric train an Electric Motor can be employed, while if it is desired to represent a small crane or similar machine, a clockwork motor can be used, and so on. Unfortunately few boys are in a position to collect the necessary equipment!

ELECTRIC MOTORS.

E1, 6-volt. E6, 6-volt.
E1/20, 20-volt. E20b, 20-volt.

The Meccano Electric Motors are each capable of driving practically every Meccano model, provided that the intermediate gearing is designed and constructed properly.

The range of Meccano Electric Motors now consists of four units each of which is designed for a special purpose. The popular E6, which has remained practically unchanged for many years, is now supplied with specially wide bearings and grease cups, enabling the Motor to run for long periods unattended. The E20b is similar in construction to the E6, but is wound for 20 volts instead of 6 volts, and E1, and E1/20 are smaller Motors than those already mentioned, and are non-reversing. They are wound for 6 volts and 20 volts respectively.

No matter what type of model is to be driven, the Electric Motor should always be allowed to rotate at maximum speed. This means that if it is required to operate a slow-moving model a gear that will provide a considerable reduction in speed must be employed. The simplest means of obtaining the necessary reduction is provided by the ordinary Meccano toothed gearing, see Standard Mechanisms Manual. If gears are not available, the drive from the Motor can be transmitted through belt mechanism, and the speed can be reduced at the same time by taking the drive from a small pulley to one of much larger diameter. Sprocket Wheel and Chain gearing can be used equally well in place of belts as described elsewhere in this book.

Whatever type of gearing is employed it is important to remember that, if the driven shaft moves more slowly than the driving shaft, a mechanical advantage is obtained and increased loads can be overcome, the apparent gain in power being roughly in proportion to the loss in speed. If the drive is led through 1 : 1 gearing, there is no gain in power to counteract the loss through friction. Such gearing should therefore be avoided as far as possible, and when it is necessary to transmit the power from one point to another, the gearing should always result in some reduction in speed in the driven shaft, unless it happens that speed is a more important consideration than power.

Another important means by which the Electric Motors can be used to overcome increased loads consists of pulley blocks. By incorporating a cord and pulley system in a model, a reduction in speed is obtained, the reduction increasing in proportion to the number of pulleys employed. For example, if a crane can lift a load of 10 lb. coupled direct to the hoisting cord, then by using a single-sheave pulley block, so that the load is raised in just twice the time formerly taken, the model should be capable of lifting 20 lb., not allowing for loss through friction. Similarly, if a two-sheave pulley block is used so that the crane hook is raised in four times the period occupied originally, then a load of nearly 40 lb. could be raised. Therefore the mechanical advantage is "2" and "4" respectively in these examples.

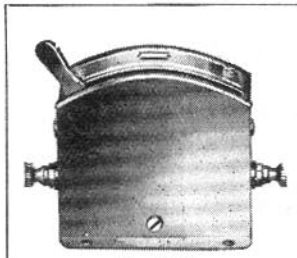


Fig. 141

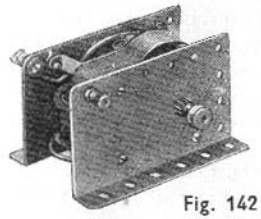


Fig. 142

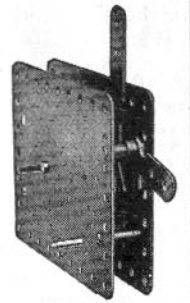


Fig. 142a

Of course, the same mechanical advantage could be obtained by using extra gearing and retaining the single hoisting cord, but the use of the pulley blocks is the better method, for it is more economical and it has the important advantage of distributing the load over several lengths of cord instead of one only, with the result that a lighter and more flexible cord can safely be used.

Meccano boys who have built the model Motor Chassis, Special Instruction Leaflet No. 1a, will readily appreciate the importance of gear ratios when fitting motors to Meccano models. The chassis has four forward speeds, and the great difference in the load that can be carried at the different speeds is obvious.

A striking illustration of the power of the Meccano Electric Motor is afforded by the Traction Engine, Special Instruction Leaflet No. 22. This model has two forward speeds. In the first a total ratio between the Motor armature and back axle of 283.5 : 1 is obtained, but the second provides the big ratio of 567 : 1, and with this gearing truly great loads can be hauled. The Traction Engine has been made to pull over a hard, smooth surface a load of no less than 140 lb., excluding its own weight and that of the ballast. This ballast which was necessary to obtain sufficient adhesion on the ground, consisted of lead blocks fitted inside the boiler. Fig. 148 shows the Traction Engine hauling its driver.

The side plates of the Electric Motor measure 5" × 2½" and are perforated with the Meccano standard holes. Hence the Motors may actually form parts of the models that they are required to drive, and they can be bolted in any position. In the Traction Engine the Motor is secured on end at the rear of the boiler, in the position occupied by the fire-box in the prototype, and the holes in its plates form bearings for the engine crankshaft and other parts. Fig. 143 shows an Electric Motor fitted with typical reduction gearing, giving a ratio of 171 : 1, the bearings for the various shafts being provided by a Channel Bearing and two 1" × 1" Angle Brackets bolted to one side of the Motor side plate.

For work that does not demand much power, one or two sets of belt reduction will be found to operate satisfactorily, a good example being shown in Fig. 83. In this model the Motor is

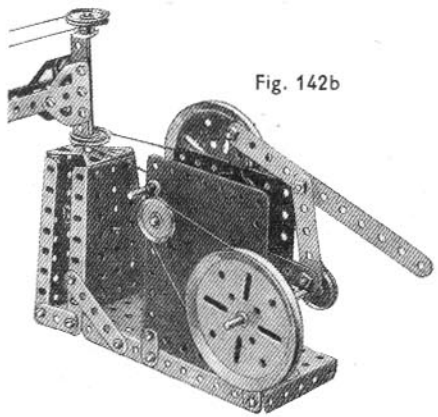


Fig. 142b

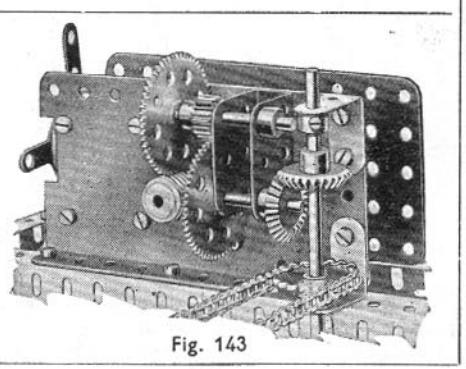


Fig. 143

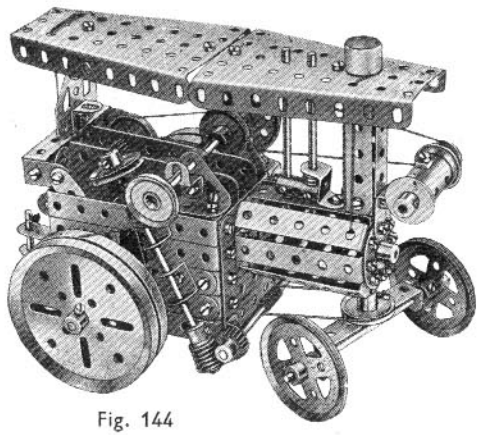


Fig. 144

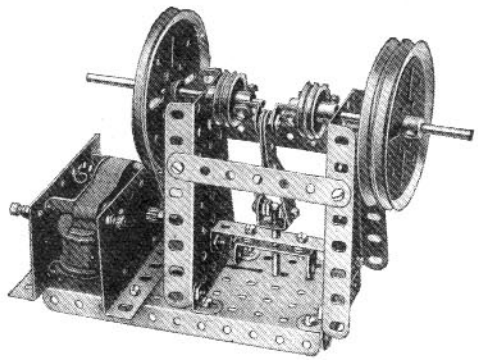


Fig. 145

required to lift only the crane hook, with a small load, and for this the belt transmission is entirely satisfactory.

Some of the standard electric motors are shown in Figs. 139, 140 and 142. These are E20B, E6 and E 1 respectively.

RESISTANCE CONTROLLERS. **6 volt and 20-volt.**

The two Meccano Resistance Controllers, one of which is shown in Fig. 141, are designed for use with Meccano 6-volt and 20-volt Electric Motors respectively. They each consist of a metal frame surrounding a porcelain tube on which is wound a length of resistance wire. A brass strip presses against this wire, and its position is altered by operating the insulated lever protruding from the top of the metal frame. Thus by moving the lever from side to side, more or less resistance is brought into use and the motor responds accordingly.

The controllers are used in series with a motor, that is, one wire from the accumulator or transformer to the motor is broken and the two terminals of the controller are joined to the resulting ends.

TRANSFORMERS. **Suitable for all standard voltages and frequencies.**

T6A, T6, and T6M for driving 6-volt motors.

T20A, T20, and T20M for driving 20-volt motors. TR6 Transformer Rectifier.

Fig. 147 shows the T6 Transformer fitted with a controller and one pair of plug sockets, and designed for running 6-volt Motors from the house supply, where this is alternating current. Other Meccano Transformers suitable for use with 6-volt Motors are the T6A, fitted with resistance controller and three pairs of plug sockets ; and T6M, without resistance controller, and fitted with one pair of terminals instead of plug sockets. It should be noted that these Transformers give an output of 9 volts. The reason for this is that motors designed to run on 6 volts direct current from an accumulator require an alternating current from a transformer of 9 volts, on account of the impedance of the windings to alternating current.

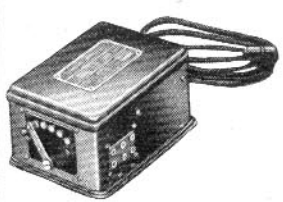


Fig. 146

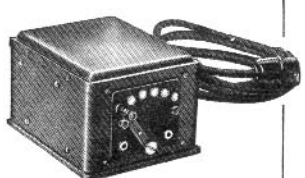


Fig. 147

For operating 20-volt Motors there are three Meccano Transformers—T20, with resistance controller and one pair of plug sockets ; T20A, with resistance controller and three pairs of plug sockets ; and T20M, without controller, and one pair of terminals.

These Transformers are available for all standard supply voltages from 100 to 250 inclusive, and for all standard frequencies. They are supplied complete with a length of flex and an adapter for connection to an ordinary lamp socket.

With regard to the rival merits of the two methods of running the electric Motor—by accumulator or transformer—the following points should be noted. In models that are required to travel along, such as motor cars, traction engines, etc., an accumulator can be incorporated in the model or carried on a trailer behind it, and the model then becomes a self-contained power unit. The accumulator, however, will require charging at intervals. A transformer can be incorporated in a model, but the radius of movement will always be limited by the length of the flex to the lamp socket. When using a transformer with normal loads on the Motor, the consumption of current will be something like one unit per 20 hours.

The selection of a transformer depends upon the type and amount of work that the model-builder has in mind. If it is required to operate, at constant speed, a single motor only, a T6M or T20M transformer will be all that is necessary. In many models, however, it is found advisable to vary the speed of the motor, as in cranes, electric trucks, etc., and under these circumstances a T6 or T20 unit will be required. These two transformers have a similar output to the T6M and T20M but are fitted with a 5 stud rheostat. The first stud on the left is the " off " point, as illustrated in Fig. 147, and the stud to the right of this is the full speed position for the control lever. The extreme right-hand stud is the slow speed point.

To start a motor, move the regulator handle to the stud at the extreme right without pausing on the intermediate studs. Then, by moving the handle towards the left, the speed is gradually increased, until maximum speed is reached when the handle is in contact with the stud next to the " off " stud.

For more advanced models a T6A or T20A transformer is to be recommended. Fig. 146 illustrates these units The T6A has an output of 9/3½ volts, 40 VA, and the T20A an output of 20/3½ volts, 35 VA. These Transformers have three pairs of sockets, one pair of which is controlled from the rheostat, fitted to the transformer. The two remaining pairs of sockets are full voltage and 3½ volts respectively, both of which are uncontrolled.

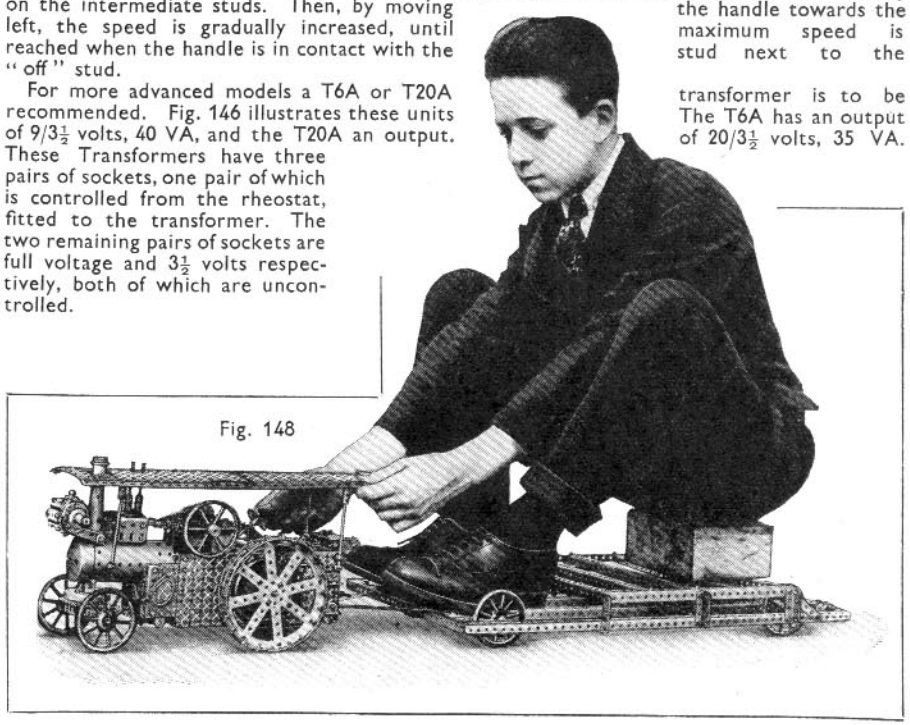


Fig. 148

Class M. Power Units and Accessories (Contd.)

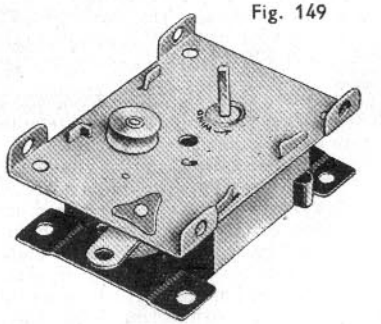


Fig. 149

CLOCKWORK MOTORS.

Clockwork Motors, suitable for incorporating in Meccano Models are now made in five different sizes. These are known as the *Magic* Motor, the No. 1, No. 1a, No. 2, and the "X" Motor.

The Meccano *Magic* Motor is well designed and strongly constructed, and is fitted with a powerful spring giving a long and steady run. It is non-reversing. Each *Magic* Motor is supplied with a separate $\frac{1}{2}$" Pulley Wheel and three pairs of driving bands of different lengths, so that it is a simple matter to fit the Motor in models of various types to set them in motion.

This splendid Motor is capable of driving all the Meccano A and B Outfit models, and many of the lighter models illustrated in the Manuals for the C, D and E Outfits.

Motor No. 1 is a small non-reversing motor built specially for lightness and compactness. Motors Nos. 1a and 2 are larger than No. 1 and are fitted with a reversing lever in addition to the usual brake lever. No. 2 is fitted with a specially strong spring, which gives the Motor great power and length of run.

The "X" Motor is designed primarily for use with "X" series Outfits.

The remarks already given regarding the gearing to be used in connection with the Meccano Electric Motors refer equally to the Clockwork Motors, but if considerable loads are to be overcome, one must expect to have to wind them frequently.

In Fig. 144 a Clockwork Motor No. 1 is shown incorporated in a model traction engine. The Motor is held inside the body of the model by means of four $\frac{1}{2}$" × $\frac{1}{2}$" Angle Brackets, and a 1" fast Pulley on its driving shaft is connected by a length of Meccano Cord or Spring Cord to a second 1" fast Pulley. This Pulley is secured on a $3\frac{1}{2}$" Rod representing the crankshaft of the engine and the free end of this is fitted with a further 1" fast Pulley. This is in turn coupled up to one of the twin driving wheels of the model by cord. A $1\frac{1}{2}$" Pulley on the crankshaft is connected by a length of cord to a small Pulley mounted on the armature of the dummy dynamo.

A further example of the adaptability of the Clockwork Motors is shown in Fig. 142b, where a No. 2 Motor is built into a small model drilling machine. The Motor in this example is secured to the base of the model by two Flat Brackets and two $\frac{1}{2}$" × $\frac{1}{2}$" Angle Brackets. A 1" fast Pulley on the driving shaft is connected by cord to a 3" Pulley that in turn drives a final 1" fast Pulley via a 3" and 1" Pulley reduction. The final Pulley is connected to a fourth 1" Pulley by means of a crossed belt.

Where only a light driving power is required, the period during which the Motor will run for each winding can be increased enormously by using a suitable governing device. One of the simplest of such devices consists of a fan wheel driven by the Motor, the resistance of the atmosphere against the blades of the fan being used to prevent a Motor from exceeding a certain speed, with the result that it will run for 10 minutes or more at a single winding. The fan wheel can easily be built up from Meccano parts. A light fan may be built up from Flexible Plates while a more robust unit can be made from Strip Plates. Other ways to regulate the speed of the Motor are to employ some form of governing device, for example, a friction brake that is applied by the action of weights flying outward under centrifugal force, or a clock escapement mechanism. The applications of the latter are limited, however, for on referring to the Standard Mechanisms Manual it will be seen that as one tooth only of the pallet wheel is released for each swing of the pendulum, the movement is rather jerky. This can be overcome to a certain extent by conveying the drive through a fairly long length of loose Sprocket Chain.

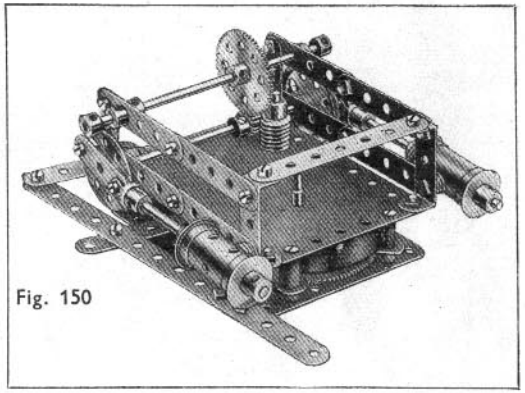


Fig. 150

The size and shape of the Clockwork Motors enable them to be incorporated in almost any model and it is often found convenient to arrange them as a section of the base of the structure, as illustrated in Fig. 150. In this example a motor is shown built into a model capstan, the resulting unit being extremely neat and realistic, also surprisingly powerful.

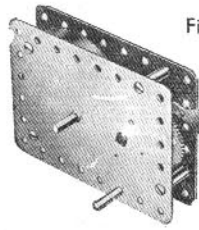


Fig. 151

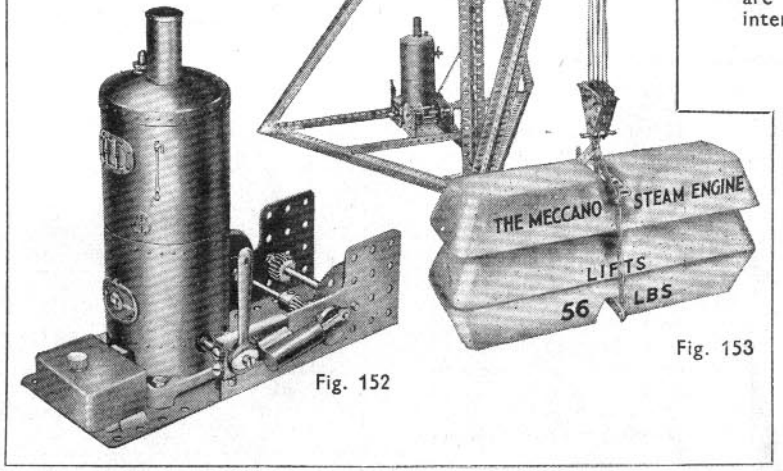


Fig. 153

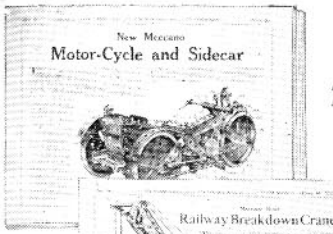
Fig. 152

STEAM ENGINE.

Fig. 152 shows the Steam Engine and Fig. 153 shows it applied to a Meccano stiff leg derrick. In this case the gearing, mounted between the side plates of the Engine, gives a ration of 58.5 :1, that is, the crankshaft of the Engine turns $58\frac{1}{2}$ times to each revolution of the winding shaft. This ratio is obtained as follows—Engine crankshaft to secondary shaft, 6.5 : 1, the Pinion and Gear Wheel giving this ratio are supplied with the Steam Engine ; secondary shaft to intermediate shaft, 3 : 1, $\frac{1}{2}$" Pinion driving on to a 57-teeth Gear Wheel ; intermediate shaft to winding shaft, 3 : 1, $\frac{1}{2}$" Pinion and 57-teeth Gear.

If we apply a load direct to the end of the hoisting cord, we shall find that the Engine can lift 9 lb. 13oz. If we decrease still further the speed at which the load is raised by adding pulley blocks, then the amount of the load that can be raised should increase proportionately for, as already stated, power is gained in proportion to the loss in speed. In Fig. 153 a three-sheave pulley block is used, and the hoisting cord is passed between this and the jib head six times, so that the load is raised six times as slowly as it would be if attached direct to the cord. Hence it should now be possible to lift a load of nearly 59 lb. The load illustrated actually weighs 56 lb., and this the engine will raise easily, the difference between 56 and 59 representing the amount of power lost through the increased friction existing in the various working parts of the gear train and pulley system.

MECCANO SUPER MODELS



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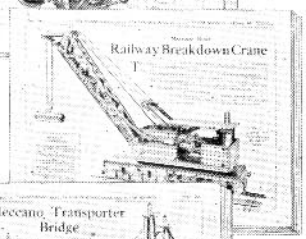

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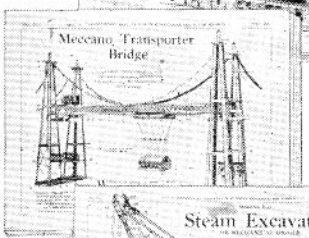

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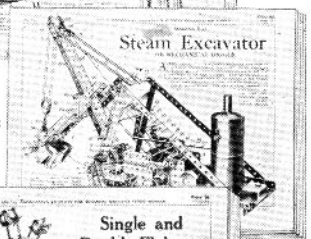

Leaflet No. 19a

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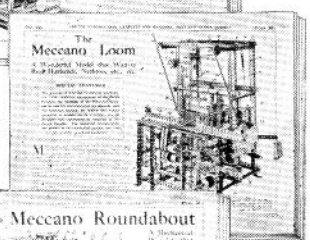


Leaflet No. 16a

Leaflet No. 8

INSTRUCTION LEAFLETS

The Meccano Super Models have been specially designed by our experts to demonstrate the immense possibilities of the Meccano System, and to show how machines and mechanisms of all kinds can be reproduced accurately and in working form by means of standard Meccano parts.

These 38 Models represent the highest pitch of Meccano construction, and each one is described in detail in a special Leaflet, fully illustrated from photographs. Every Meccano boy should make it his ambition to build some of these magnificent models.

A brief description of the nature of each model in the series is given below. Copies of the Leaflets can be obtained from any Meccano dealer, or post free direct from Meccano Ltd., Binns Road, Liverpool 13, at the prices shown at the foot of this page.

No. 1a MOTOR CHASSIS. This is an entirely new model, and is an accurate reproduction of a modern sports car. It embodies a four speed gear box and four wheel brakes.

No. 2 SHIP COALER. All the movements of a real ship-coaler are reproduced in this model.

No. 3 MOTOR-CYCLE AND SIDECAR. The sidecar is of stream-line design and is mounted on springs. The motor-cycle is complete with lamps, horn, exhaust pipes, etc.

No. 4 GIANT BLOCK-SETTING CRANE. This realistic model is fitted with an accurate reproduction of Fidler's block-setting gear.

No. 5 TRAVELLING BUCKET DREDGER. In this model trucks and wagons can run underneath the chute through which falls the material raised by the dredger buckets.

No. 6 STIFF-LEG DERRICK. This model has many interesting movements, including hoisting, luffing and swivelling, which are controlled by suitable levers.

No. 7 PLATFORM SCALES. This model will weigh articles up to 4½ lbs. with remarkable accuracy.

No. 8 ROUNDABOUT. This model is most attractive when in motion. As the roundabout rotates the cars spin round and the horses rise and fall.

No. 9 BAGATELLE TABLE. This is an interesting model that will give hours of fun to the players.

No. 10 LOG SAW. In this model the saw is driven rapidly to and fro while the work table travels beneath it.

No. 11 SINGLE-CYLINDER HORIZONTAL STEAM ENGINE. Fitted with balanced crankshaft, crosshead, and centrifugal governor.

No. 12 STONE SAWING MACHINE. The model is equipped with adjustable work table and overhead trolley with self-sustaining chain hoist.

No. 13 MECCANOGRAPH. This wonderful model will draw hundreds of beautiful designs.

No. 14a GRANDFATHER CLOCK. A practical example of Meccano model-building. The model keeps accurate time.

No. 15 BALTIC TANK LOCOMOTIVE. The driving wheels are operated by an Electric Motor. An accurate reproduction of Walschaerts' Valve Gear is fitted.

No. 16a LOOM. This is perhaps the greatest Meccano success. The model weaves beautiful material.

No. 17 PLANING MACHINE. Fitted with quick-return motion.

No. 18 REVOLVING CRANE. This model is fitted with screw-operated luffing gear.

No. 19 STEAM SHOVEL. This model embodies travelling, rotating, racking and digging movements, and lib hoisting and lowering gear.

No. 19a STEAM EXCAVATOR OR MECHANICAL DIGGER. A Meccano Steam Engine is incorporated in this model and provides the power for operating the four movements.

No. 20 MOBILE CRANE. This model has hoisting, luffing, travelling and slewing movements. It is fitted with an automatic brake.

No. 21 TRANSPORTER BRIDGE. The carriage automatically travels to and fro for as long as the motor is driven.

No. 22 TRACTION ENGINE. A remarkably realistic model that will pull a boy of average weight. Fitted with two speeds.

No. 23 VERTICAL LOG SAW. While the saws are in motion, the logs are fed slowly to them.

No. 24 TRAVELLING GANTRY CRANE. The movements of this model comprise the traversing of the entire gantry, hoisting and lowering, and the traversing of the crane trolley.

No. 25 HYDRAULIC CRANE. The hydraulic ram is represented realistically by a powerful screw mechanism.

No. 26 TWIN ELLIPTIC HARMONOGRAPH. Some beautiful designs may be produced with this model.

No. 27 DRAGLINE. This imposing model of a giant excavator is fitted with travelling, luffing, slewing, and dragging movements.

No. 28 PONTOON CRANE. The movements of this model include the operation of the two hoisting blocks, slewing of the entire crane and luffing.

No. 29 HAMMERHEAD CRANE. This is a very realistic and powerful model, comprising traversing, hoisting and slewing motions.

No. 30 BREAKDOWN CRANE. This model is equipped with travelling, slewing, luffing, and hoisting motions.

No. 31 WAREHOUSE WITH ELEVATORS. The two cages are driven automatically and work alternately.

No. 32 TWIN CYLINDER STEAM ENGINE & BOILER. This is a realistic working model of a complete steam plant.

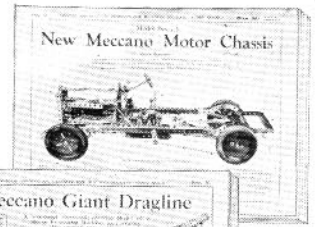
No. 33 SINGLE AND DOUBLE FLYBOATS. These two models represent popular pleasure-fair attractions.

No. 34 THREE-ENGINE BIPLANE. This is a realistic model of an "Argosy" machine, and is fitted with ailerons, elevators and rudders.

No. 35 LEVEL LUFFING CRANE. The model is provided with level luffing gear, and an important feature is a grab that may be opened and closed automatically.

No. 36 ELECTRIC DERRICK CRANE (Scotch Type). This imposing model is built to a scale of ¾in. to 1ft. The movements include hoisting and lowering, luffing and slewing.

No. 37 HOWITZER, LIMBER & TRACTOR. The gun fires ammunition (Washers) with considerable force and accuracy. The tractor is fitted with "creeper" track.



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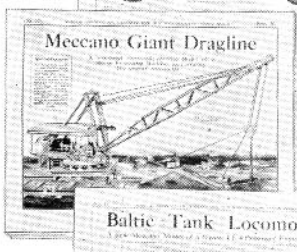

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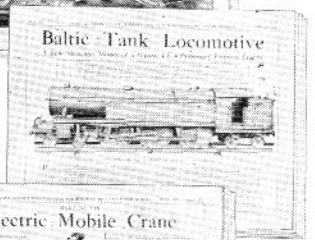

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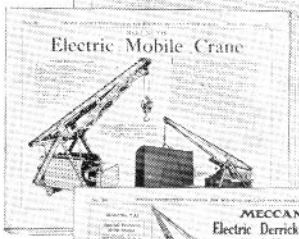

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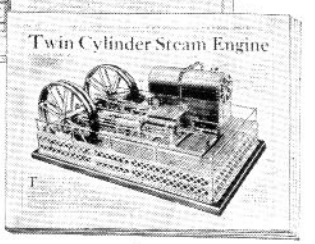

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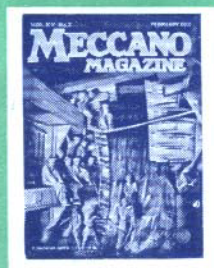

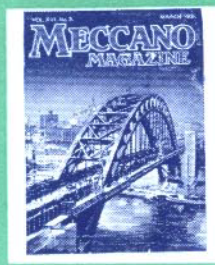

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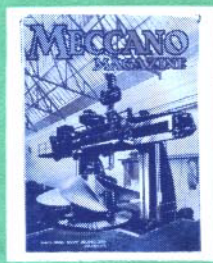

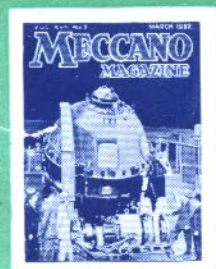

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