New Meccano Model

Electric Derrick Crane

IN modern engineering a great variety of types of cranes are employed. There are, for example, the huge block-setting cranes used in harbour construction; railway breakdown cranes for handling derailed or damaged locomotives; hammerhead and hydraulic cranes for dockside operations; gantry cranes for engineering shops; and many other special types too numerous to mention. Perhaps the best known type however, is the derrick, and it is a Scotch-type derrick crane that forms the subject of the new Meccano model described this month.

The Meccano model is built to a scale of $\frac{3}{4}$" to 1 ft., the jib measuring 6 ft. in length. The arrangement of the mechanism in the model closely resembles that adopted in the prototype, and the three movements of hoisting, luffing and slewing are controlled from a gear-box of simple design. The model is capable of level luffing, and a safety interlocking device controls the pawl and ratchet gear on the luffing barrel. The motive power is supplied by a 6-volt Motor, the speed of which may be adjusted by means of a resistance controller, built-up from standard Meccano parts and inserted in one of the battery leads to the Motor.

The construction of the Meccano model should be commenced by building the jib. By a careful study of the general view (Fig. 1) the main details of this portion of the model should be fairly clear. Each of the main longitudinal members of the jib consists of three $24\frac{1}{2}$" Angle Girders, bolted together and overlapped two holes. The top and bottom members of the centre portion are joined together by $2\frac{1}{2}$" Strips, while each end section of the jib tapers down towards its extremity. The complete sides are connected together by $2\frac{1}{2}$" Strips at points one third from either end, the bottom end tapering down to a $7\frac{1}{2}$" Flat Girder while the top is bridged by a $1\frac{1}{2}$" Strip.

SPECIAL INSTRUCTION LEAFLET

Full instructions for building the Meccano Electric Derrick Crane, together with a large number of sectional illustrations in half-tone that make every detail clear, are contained in the Special Instruction Leaflet No. 36. This Leaflet may be obtained from any Meccano dealer price 2d., or direct from Meccano Ltd., Binns Road, Old Swan, Liverpool, price 2d. post free.

As will be seen from the illustration, the jib is very adequately braced by Strips on all four sides. The length and bracing of these Strips is the same throughout the centre section of the jib, each one consisting of two $2\frac{1}{2}$" Strips overlapped one hole.

The jib head pulley, over which runs the hoisting rope, is a $1\frac{1}{2}$" Pulley mounted on a short Rod that is journalled in the side members of the jib and to the ends of which Cranks are secured. To each of the Cranks two $12\frac{1}{2}$" Strips are bolted face to face, and to the ends of these Strips are secured a further pair of $12\frac{1}{2}$" Strips. The ends of the latter are fitted with Cranks, which serve to hold a $1\frac{1}{2}$" Rod that carries a 1" loose Pulley forming one of the luffing purchases, and also a $1\frac{1}{2}$" Strip.

Each of the horizontal members or "sleepers" 2 consists of an $18\frac{1}{2}$" and $12\frac{1}{2}$" Angle Girder overlapped three holes, to the flanges of which are secured one $9\frac{1}{2}$" and two $12\frac{1}{2}$" Girders, giving the member a "channel" section.

The front ends of the sleepers are attached to a $5\frac{1}{2}" \times 2\frac{1}{2}"$ Flanged Plate 1 in such a manner that they are at right angles to each other. The geared portion of a Meccano Ball Bearing (part No. 168) forms one part of the slewing race, and it is secured by bolts to the top flanges of the sleepers 2, additional support being afforded by means of 1" Screwed Rods, which pass through the Plate and race, and are secured in place by nuts. A Bush Wheel bolted to the upper side of the race carries a 2" Rod that forms the central pivot about which the model slews.

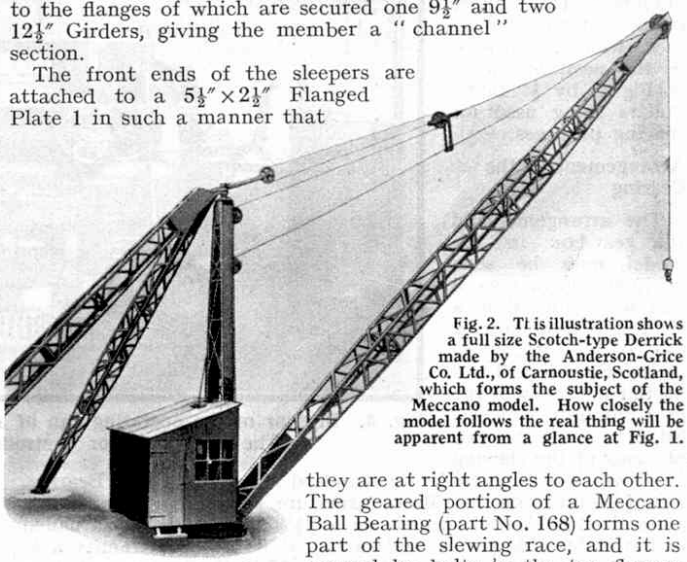

Fig. 2. This illustration shows a full size Scotch-type Derrick made by the Anderson-Grice Co. Ltd., of Carnoustie, Scotland, which forms the subject of the Meccano model. How closely the model follows the real thing will be apparent from a glance at Fig. 1.

The rear ends of the sleepers are mounted on $5\frac{1}{2}" \times 2\frac{1}{2}"$ Flanged Plates, to which they are attached by means of $5\frac{1}{2}$" Angle Girders. The Flanged Plates are spaced apart by the member 4, which consists of four $12\frac{1}{2}$" Angle Girders.

Each of the rear tie members 5 is 42 inches in length and is composed of six $12\frac{1}{2}$" and two $9\frac{1}{2}$" Angle Girders. The upper extremities of both members are fitted with 3" Strips that project three holes beyond the ends of the Girders and the ends of these Strips are bent downward slightly. The end holes will eventually be passed over a $1\frac{1}{2}$" Rod mounted on the top of the mast 6.

The Vertical Mast and Gear-Box

Each side of the vertical mast 6 is composed of two $18\frac{1}{2}$" and two $12\frac{1}{2}$" Angle Girders with their flanges bolted to the edges of $12\frac{1}{2}$", $9\frac{1}{2}$", and $7\frac{1}{2}$" Flat Girders to form a channel-section girder of great strength. The top ends are bridged by means of two $1\frac{1}{2}$" Angle Girders, and a third $1\frac{1}{2}$" Angle Girder is bolted across the rear face of the mast in the second hole from the top. This latter Girder, together with the one above it, will form a bearing for the pin that serves as a means of pivotally attaching the tie

Fig. 1. General view of the Meccano model Derrick Crane.

members to the mast head.

The front of the mast, the lower portion of which may be seen in Fig. 3, is braced by 5½" Strips. This view shows also how the mast is secured to the platform or swivelling base on which is built the gear-box. The foot of the mast is actually attached to a 9½" Angle Girder 7 that forms the front edge of the platform, the floor of which consists of three 5½" × 3½" Flat Plates. Trunnions are bolted to the foot of the mast to accommodate the jib pivot pin. The gear-box sides are 4½" × 2½" Flat Plates, and they are attached both to the mast and to 5½" Angle Girders that are bolted to the base, while to the underside of the latter is mounted the upper portion of the slewing race, which is secured in the position shown in Fig. 3 by ½" Bolts, Collars being used for spacing purposes.

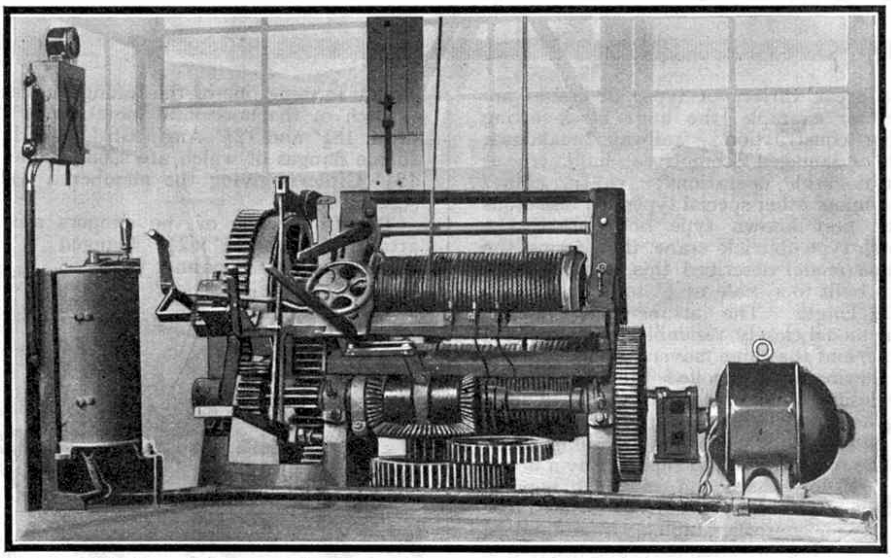

Fig. 4. Interior of the operating cab of an actual Derrick showing gears and motor. The electric motor controller can be seen on the right.

Arrangement of the Gearing

The arrangement of the gear-box in the model may be seen fairly clearly in Figs. 3 and 6. Fig. 6 is a semi-plan view showing the 6-volt Motor in place, while Fig. 3 is a partial side view of the gear-box unit, which is lifted to show the two portions of the slewing race, which is composed of a standard Meccano 4" Ball Bearing.

A ¾" Pinion on the Motor armature spindle engages with a 50-teeth Gear Wheel secured on a 2½" Rod which is journalled in the Motor side plates, and carries at its other extremity a ½" Pinion. The latter is in mesh with a 57-teeth Gear mounted on a Rod vertically above the first. On the same Rod is a ½" Pinion engaging with a 57-teeth Gear on a 3" Rod that is journalled in the gear-box side plates. This Rod has, on the end seen in Fig. 3, a ¾" Pinion in constant mesh with a 50-teeth Gear 9, that is secured on what may be termed the mainshaft of the gear-box.

A ¾" Pinion 10 (Fig. 6) on the mainshaft may be engaged with either the Gear 12 on the hoisting barrel or with the Gear 13 on the slewing shaft, by sliding the mainshaft in its bearings. The sliding movement is effected by means of the lever 11, which is attached pivotally to a 2½" Angle Girder that is bolted to the vertical girders 6 and carries a ⅜" Bolt, the shank of which locates between two Collars that are secured on the mainshaft a short distance apart. The lever works in a quadrant composed of two 2½" Strips that are spaced apart by Washers and secured by ½" Bolts a short distance below a transverse 2½" × ½" Double Angle Strip. The latter is seen clearly in the illustration.

The slewing shaft has, in addition to the Gear Wheel 13, a Worm meshing with a Pinion 14 mounted on a short vertical Rod. The latter is journalled in a reinforced bearing, consisting of three 1½" Strips laid on top of each other and bolted across two parallel Z-section girders 21; each of these girders is composed of two 2½" Angle Girders secured together so that their other flanges point in opposite directions. A Bush Wheel is also bolted to that portion of the Plate below the bearing so that the Rod passes through its boss. A ¾" Sprocket Wheel 19 (Fig. 3) is secured on the lower end of the Rod.

The luffing winch barrel is a 3½" Rod that is journalled freely in the side plates and on which are mounted, in the order named, from left to right, a Ratchet Wheel, one Washer, a Collar, the 50-teeth Gear 15, a Coupling, a Collar, three Washers and a ½" fast Pulley.

A Pawl 18 engages with the teeth of the Ratchet Wheel and so prevents the unwinding of the luffing barrel. The Pawl pivots on a ¾" Bolt that is secured to a Corner Bracket, bolted to the end of the gear-box plate.

The luffing barrel is driven from the hoisting barrel through the medium of a sliding layshaft 16, which is operated by the lever 17. The latter is attached pivotally to a 1" × ½" Angle Bracket on the left-hand gear-box side-plate, and is connected to the Rod that it actuates, in a similar manner to the lever 11. In its neutral position, that is when the layshaft Pinion is out of engagement with the Gear 12, the lever is over the top of the Pawl 18, thus preventing the latter from being raised and letting the jib fall. On the other hand, when the lever is moved over to the left to effect engagement of the layshaft pinion with the Gear 12, the Pawl is free to be lifted out of engagement with the Ratchet teeth by means of a Flat Bracket secured to its boss. This, of course, is similar to the safety interlocking device employed in the actual crane.

The hoisting barrel is fitted with an effective semi-automatic brake 22 (Fig. 3). Although this type of brake allows the load to be hoisted perfectly freely, the load cannot be lowered until the end of the brake lever is raised. It should be noted that these results can only be attained when the points of attachment of the brake cord are on opposite sides, and at different distances, from the fulcrum of the brake lever. The fulcrum is a 1" × 1" Angle Bracket which is bolted to the floor, and the brake lever is attached pivotally to the Bracket by a lock-nutted bolt (Standard Mechanism No. 263).

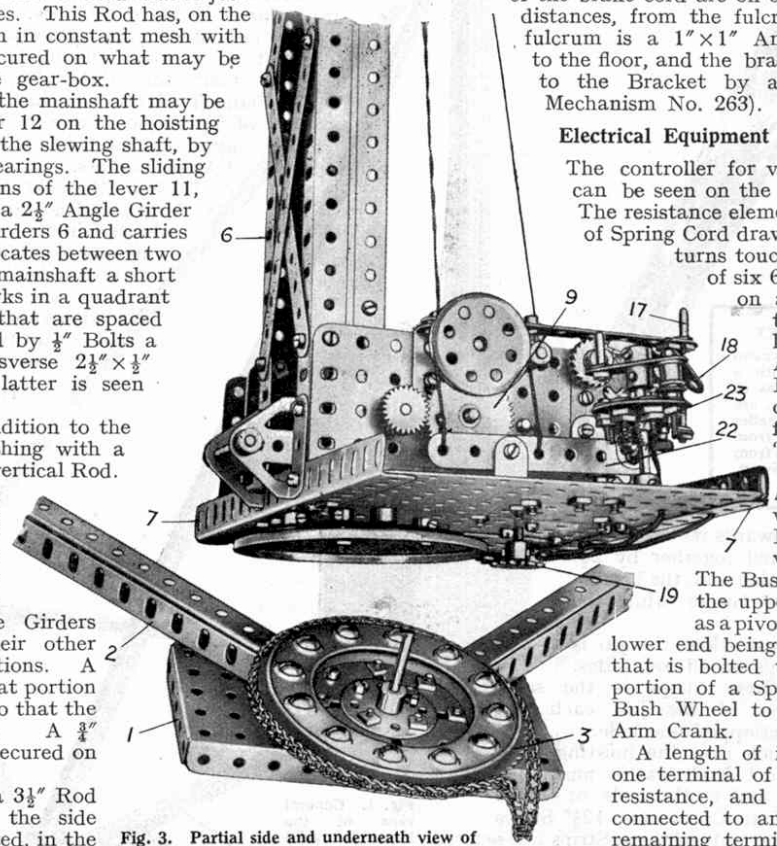

Fig. 3. Partial side and underneath view of Swivelling Platform and Gear-Box showing details of the Slewing Race, etc.

Electrical Equipment of the Model

The controller for varying the speed of the Motor can be seen on the left of the gear-box in Fig. 6. The resistance element is formed by a short length of Spring Cord drawn out so that no two adjacent turns touch, and attached to the shanks of six 6 B.A. Bolts that are mounted on a Bush Wheel and insulated therefrom by means of Insulating Bushes and Washers. A seventh insulated 6 B.A. Bolt is provided. This is not connected in any way, however, for it is intended to form an "off stud."

The switch arm is a Double Arm Crank on one end of which is mounted a Spring Buffer, which makes contact with the heads of the bolts. The Bush Wheel is mounted on a Rod, the upper extremity of which serves as a pivot for the Double Arm Crank, its lower end being held in the boss of a Crank that is bolted to the platform. The sleeve portion of a Spring Buffer is secured to the Bush Wheel to form a stop for the Double Arm Crank.

A length of insulated wire is taken from one terminal of the Motor to one end of the resistance, and the other Motor terminal is connected to an insulated terminal 20. The remaining terminal 20 is in metallic contact with the Girder on which it is mounted, and is consequently in electrical connection with

the switch arm of the controller. Hence it only remains to connect the Accumulator or Transformer to the Terminals 20 by suitable lengths of flex or insulated wire. The driver's cabin is illustrated upside down in Fig. 5. It will be seen that its construction is simple and no Meccano boy should find difficulty in building this portion of the model.

Final Erection of the Model

When the various units of the model have been completed, it only remains to fit them together in their respective positions — a simple task, as will be seen.

The first step is to secure the cabin (Fig. 5) to the swivelling base, and then to place this portion of the model over the central pivot (see Fig. 3), care being taken to see that the Ball Casing (part No. 168c) is included in the assembly.

The tie members 5 may now be put in place, their bottom ends being attached by 2" Rods to the rear anchorages (the Corner Brackets on the members 2) and their top ends meeting on a common pin that is journalled in the 1½" Angle Girders at the mast head. A length of Sprocket Chain is passed round the geared periphery of the lower portion of the slewing race 3, and round the ¾" Sprocket Wheel 19 (Fig. 3). The model should now be secured by ordinary wood screws to a suitable base, and the attachment of the jib to the model proceeded with. This is accomplished by passing a Rod completely through the Trunnions that are secured to the foot of the mast and through the end holes of the jib-foot. If the model is secured to a portable baseboard, it may be found necessary to add ballast at the rear, to prevent it from overbalancing when heavy loads are lifted.

The standing end of the luffing cord is tied to the 1½" Strip that is mounted by the side of the purchase pulley on the jib. The cord is then led over the pulley at the mast head and back round the pulley on the jib, from where it is passed over a 1½" guide pulley that is mounted on a short Rod journalled freely in the sides of the mast, and finally secured to the luffing barrel.

The hoisting cord is attached to its barrel and led over a guide pulley on the mast to the 1½" jib head pulley and then down to the hook. Matters must be so arranged that as the hoisting cord is wound on to the hoisting barrel, the luffing cord is simultaneously paid out, or vice versa.

Owing to the fact that the luffing barrel is of a larger diameter than the hoisting barrel, and to the effect of the luffing purchase system, the load maintains a practically constant height when the jib is luffed in or out. With a non-compensated crane the load moves a considerable distance vertically, and thus power has to be developed by the motor to overcome the effect of the load as well as that of the jib. In addition, the crane driver often has difficulty in judging the exact position of the load after he has altered the angle of the jib—a matter of extreme importance in many instances.

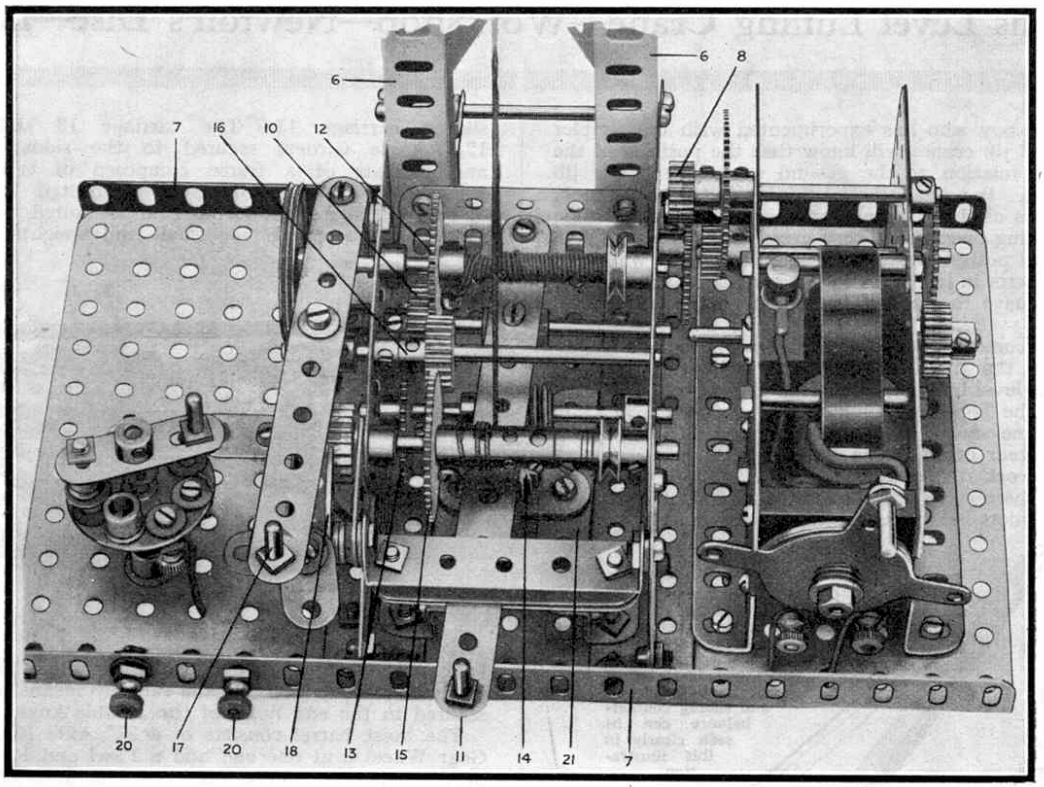

Fig. 6. Partial plan view of Gear-Box showing layout of Gears, Electric Motor, Controller, etc.

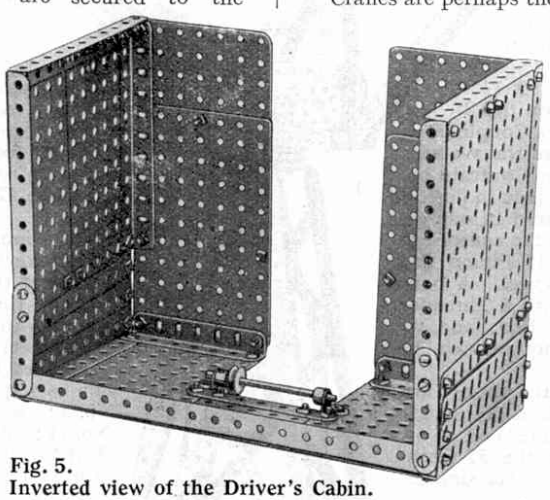

Fig. 5. Inverted view of the Driver's Cabin.

In order to build the Meccano Scotch type Derrick Crane, the following parts will be required :— 8 of No. 1 ; 5 of No. 2 ; 3 of No. 2a ; 20 of No. 3 ; 14 of No. 4 ; 110 of No. 5 ; 5 of No. 6 ; 11 of No. 6a ; 12 of No. 7 ; 6 of No. 7a ; 26 of No. 8 ; 9 of No. 8a ; 12 of No. 9 ; 2 of No. 9b ; 5 of No. 9d ; 3 of No. 9f ; 1 of No. 10 ; 2 of No. 11 ; 3 of No. 12 ; 1 of No. 12a ; 1 of No. 12b ; 4 of No. 16 ; 3 of No. 16a ; 5 of No. 16b ; 7 of No. 17 ; 1 of No. 18a ; 1 of No. 18b ; 4 of No. 21 ; 2 of No. 22 ; 1 of No. 23 ; 2 of No. 23a ; 3 of No. 24 ; 4 of No. 25 ; 3 of No. 26 ; 5 of No. 27 ; 2 of No. 27a ; 1 of No. 32 ; 320 of No. 37 ; 14 of No. 37a ; 48 of No. 38 ; 4 of No. 40 ; 1 of No. 48a ; 3 of No. 52 ; 8 of No. 52a ; 2 of No. 53a ; 1 of No. 57b ; 3" of No. 58 ; 37 of No. 59 ; 5 of No. 62 ; 1 of No. 62b ; 1 of No. 63 ; 5 of No. 70 ; 1 of No. 72 ; 3 of No. 82 ; 14" of No. 94 ; 1 of No. 96a ; 6 of No. 103 ; 2 of No. 103a ; 2 of No. 103b ; 2 of No. 103d ; 2 of No. 103k ; 1 of No. 111 ; 6 of No. 111a ; 4 of No. 115 ; 3 of No. 120a ; 2 of No. 126 ; 8 of No. 133 ; 1 of No. 147 ; 1 of No. 148 ; 1 of No. 168 ; 8 of No. 302 ; 8 of No. 303 ; 9 of No. 304 ; 15 of No. 305 ; 3 of No. 306 ; 1 Electric Motor.

The Advantages of Crane Models

Cranes are perhaps the most popular models among the majority of Meccano boys, and it is not difficult to account for their popularity, for every one is gripped by the fascination of handling a model that may be put through such interesting operations as a properly constructed crane.

The prototype of the Meccano model must be a very familiar sight to most of our readers, as its splendid outline may often be observed placed on the top of some building under construction. The appearance of the original has been well brought out in the model, as a glance at the general view and that of the prototype will show, and the weight-lifting capabilities of the Meccano derrick compare favourably with those of the actual crane, for it will lift 15 lb. with the utmost ease.

An interesting refinement that may easily be added to the crane is a "jib radius indicator." The load capacity of a crane varies according to the particular angle of the jib. A luffing crane is designed to lift a certain load at a certain position of the jib, and it is essential that these figures are maintained. To minimise the possibility of an error being made in practice, a radius indicator is fitted to the majority of luffing cranes. A glance at this indicator tells the operator the position of the jib and the maximum load that he can safely handle without increasing the angle. The construction of the Meccano jib radius indicator is fully described under detail No. 282 in the Standard Mechanisms Manual.