Level-Luffing Automatic Grabbing Crane

An L Outfit Model

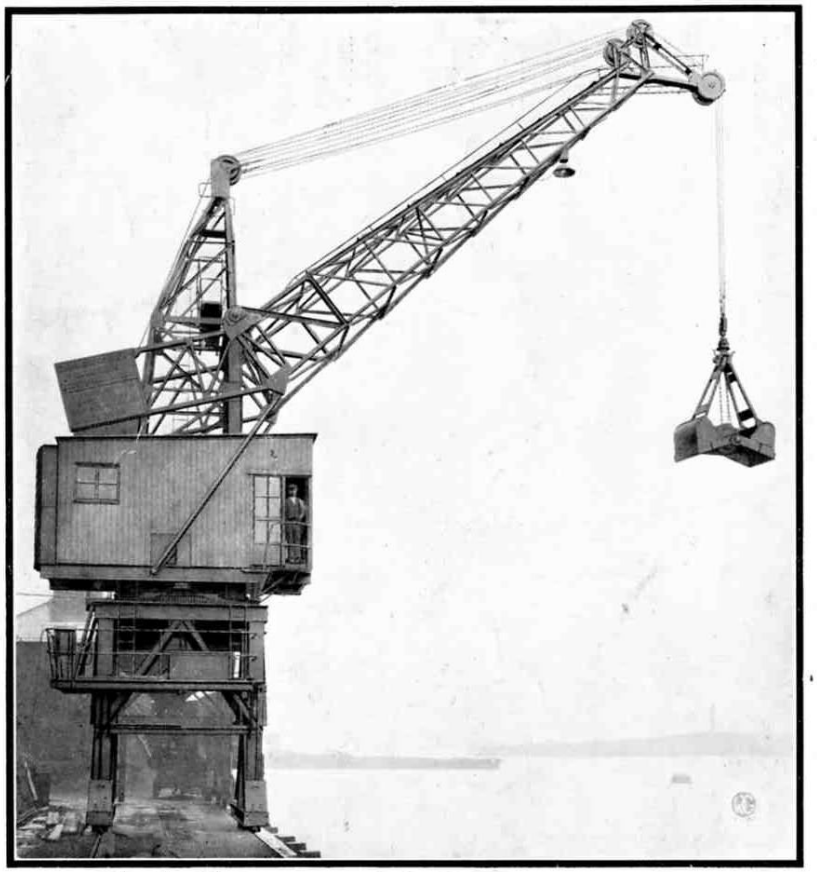

Fig. 1. The prototype of the Meccano model

SPECIAL FEATURES

Outstanding features of the crane include the Toplis level-luffing gear, the crank-operated balanced jib, and the single suspension grab, which is raised, lowered, opened or closed by operating the hoisting barrel.

The four movements of hoisting, slewing, travelling and luffing are all driven at will from a 6-volt Motor through an efficient gear-box. The Motor obtains its current supply from a 6-volt 20 amp. accumulator carried in the swivelling superstructure, and its speed is regulated by means of a neat built-up 6-notch controller. An automatic servo brake is provided for the hoisting barrel.

IN the ordinary type of crane a considerable amount of power is necessary to raise the jib on account of its weight and the effect of the load. How the load affects the operation may be easily demonstrated by means of a Meccano crane. If the jib is luffed in and out with the hoisting barrel "braked," the load will be found to rise and fall also, so that power has to be expended in this direction as well as in lifting the dead-weight of the jib. In practice this means an increase in running costs, especially in the case of cranes engaged in the handling of ships' cargoes, etc., where it is necessary to luff the jib almost continuously.

In order to eliminate some of this waste of power, many cranes are fitted with balanced jibs and level-luffing gears. The balanced jib gets over the difficulty of the dead-weight of the jib, and the level-luffing gear counteracts the effect of the load by making the crane hook maintain always the same height above the ground whilst the jib is being luffed. Hence the luffing motor only has to overcome friction, so that the motor can be of much lower power than is necessary with the ordinary non-compensated crane. Also it will be readily appreciated that the driver can handle a load with a much clearer conception of its path when it follows a horizontal course instead of a constantly varying one.

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One of the simplest and most efficient balanced-jib level-luffing systems and one, therefore, that goes a long way to reducing running and maintenance costs, is the "Toplis" gear, which is the type reproduced in the Meccano model. In order to make matters quite clear to the reader we show in Fig. 11 a line drawing of the layout of the "Toplis" gear. The hoisting rope passes up from the hoist barrel to a pulley in the superstructure head B. From here it passes round one of the pulleys at the jib head A, back round the remaining pulley at B, and lastly over the second pulley at A, and so down to the load.

Now point B is at such a distance above the jib pivot that when the jib head A rises through, say, 3″, the distance AB decreases by 1″. Owing to the fact, however, that there are three falls of the hoisting rope passing between A and B, the shortening of the distance AB by 1″ means that the end of the rope to which the hook is attached is paid out 3″. Hence the load remains level throughout the entire luffing range.

Another common feature of most cranes is that the jib is luffed by a rope or ropes that are wound upon a barrel; but in the case of the prototype of the Meccano model, the jib is luffed by means of a system of cranks and links, and this method of operation is reproduced accurately in the model. It holds several important advantages over the usual system. For example, limit switches and their attendant gear are rendered unnecessary, since it is obvious that with the crank-operated jib it is impossible to over-luff. Another advantage of equal importance is that the motion of the jib reaches a maximum speed round the middle of the luffing range where it can safely be used, and falls off rapidly to zero at either end. Luffing ropes have the great disadvantage that they require overhauling periodically, and there is always the possibility of breakage. With the crank-operated system these defects are eliminated.

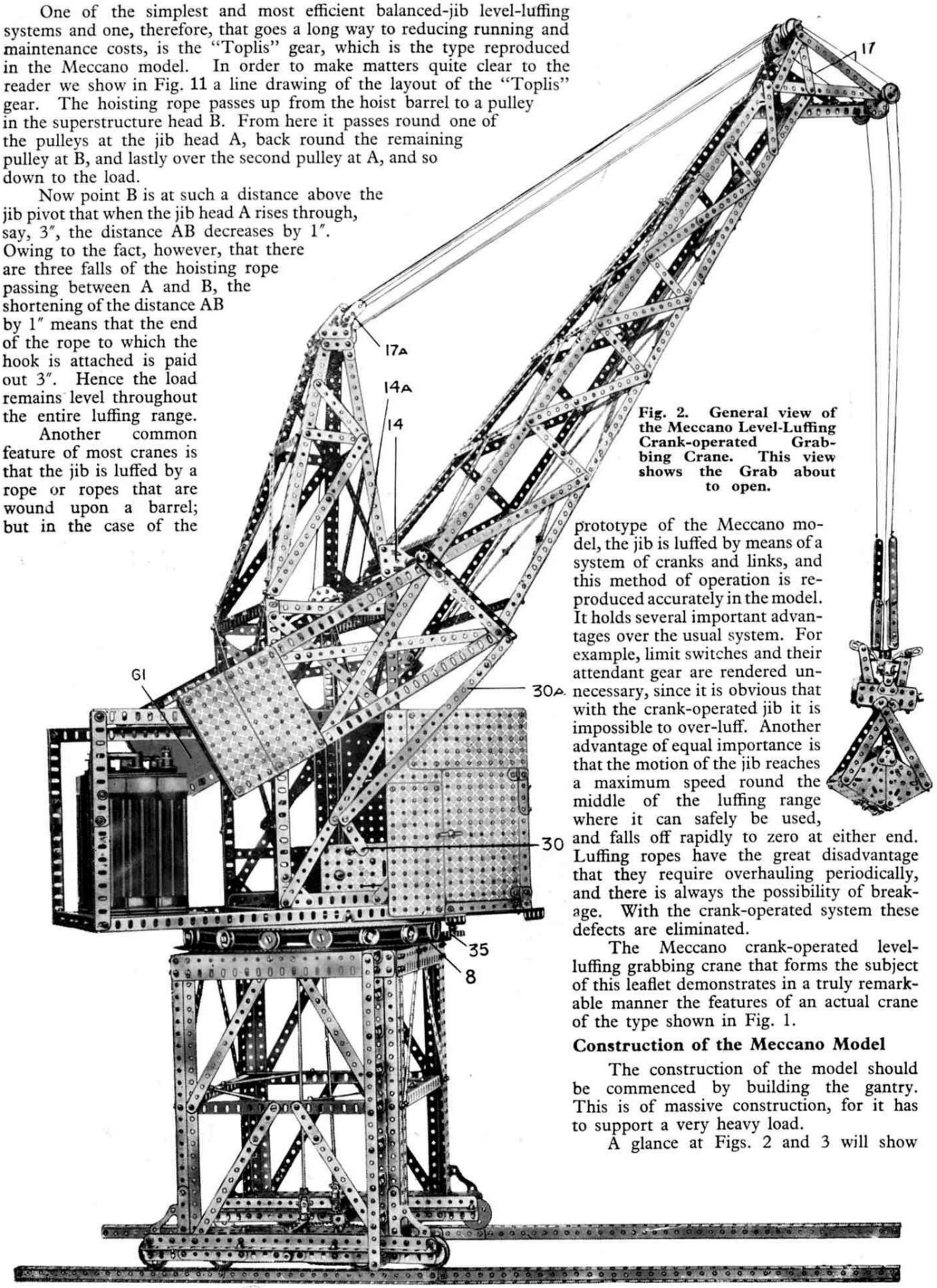

Fig. 2. General view of the Meccano Level-Luffing Crank-operated Grabbing Crane. This view shows the Grab about to open.

The Meccano crank-operated level-luffing grabbing crane that forms the subject of this leaflet demonstrates in a truly remarkable manner the features of an actual crane of the type shown in Fig. 1.

Construction of the Meccano Model

The construction of the model should be commenced by building the gantry. This is of massive construction, for it has to support a very heavy load.

A glance at Figs. 2 and 3 will show

that the four main supporting girders 1 are each composed of a 12½" Angle Girder and two 12½" Strips, bolted together so as to give an "L" Section to the girder, which is one of the shapes best calculated to resist effectively the crushing or compressive stresses to which these members are subjected. The bottoms of the girders are attached near the ends of the girders 2, in which the road wheel axles are journalled. Each girder 2 consists of two 12½" Angle Girders bolted together to resemble in section the letter "T"—a form that easily resists the stresses set up in this part of the structure. Architraves are employed to strengthen the connections between the girders 1 and 2.

It will be realised that the top cross girders or "beams," to which the lower portion of the Geared Roller Race 8 is bolted, are subjected to severe downward-acting bending stresses due to the weight of the crane proper. Consequently, each beam consists of a 9½" Angle Girder to the downward flange of which is secured a Flat Girder of similar length. This construction, by strengthening the flanges, reduces the tendency of the lower edges of the Girders to tear asunder.

Having reached this stage of the construction, it will be found that the gantry is still far from rigid in spite of the strength of its main members. In fact, if the base be held firmly, it is possible to push the top horizontally in nearly every direction. This defect is due to a lack of strength at the corners, and in order to obtain the required rigidity it is necessary to add to the structure diagonal corner "ties." The various ties in the model take the form of Strips. As in the actual crane, the forces at work are always pulling on the ends of the ties in the model, and each tie is pulling against its neighbour, or an opposing external force, so that it may be said that a continual tug-of-war is taking place, in which neither side gains the advantage, unless a bolt pulls out or a tie breaks!

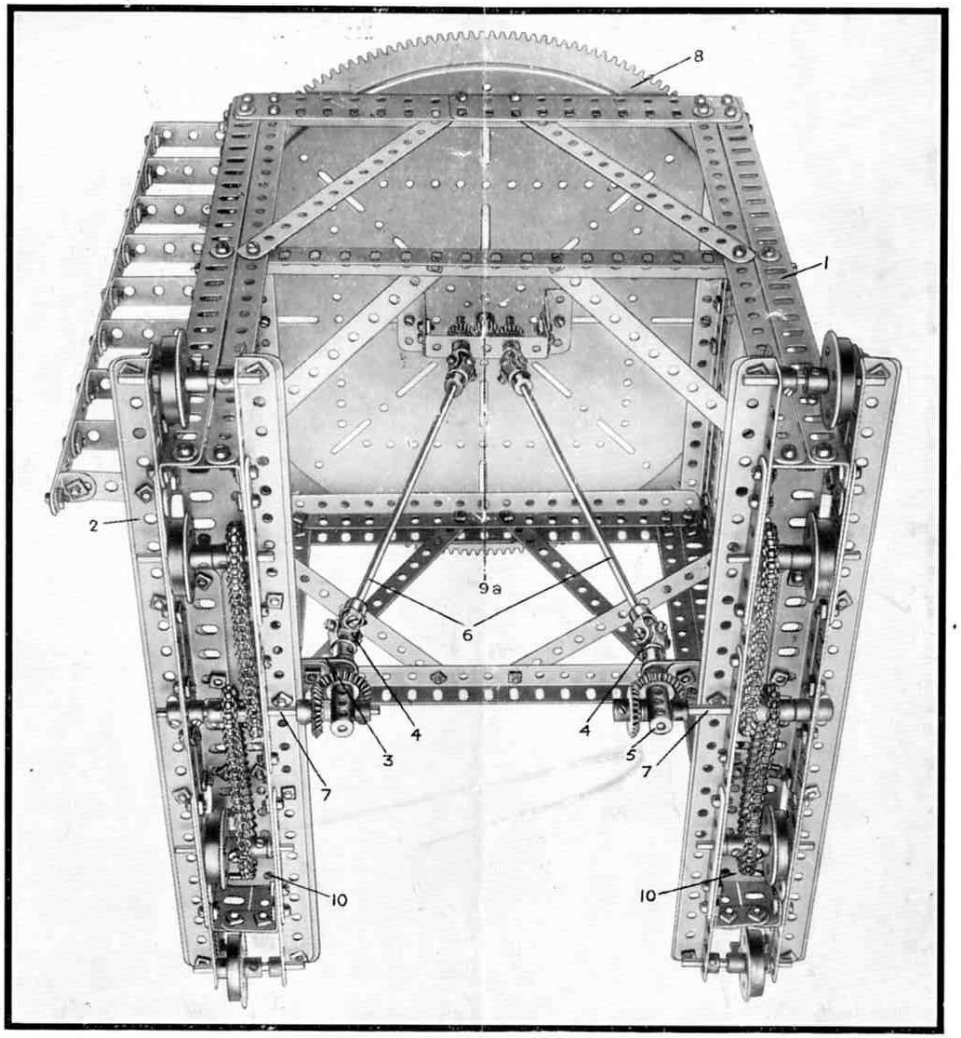

Fig. 3. View of Gantry from underneath, showing method of driving the wheels.

The idler travelling wheels are secured to Rods that are journalled in the slots of the girders 2 so that they are free to rise and fall therein, but the driving wheel axles are journalled in Strips that are bolted over the slots of the girders. In this manner the whole weight of the model is thrown on to the driving wheels, so ensuring proper adhesion of the wheels on the rails.

The arrangement of the drive to the travelling wheels is identical on each side of the gantry, and the construction is as follows. A Rod 7 carries on its end a ⅞" Bevel, which is in mesh with a similar Gear on a 1" Rod that is journalled in 2½" Strips 3 and in a Coupling 5 on the Rod 7. The Coupling is, of course, quite free on the Rod, and the 2½" Strips 3 (which are trebled for strength) are bolted across a 9½" Flat Girder 10. The latter is attached to 4½" Angle Girders that are secured to the top flanges of the girders 2.

The other end of the 1" Rod is fitted with a Universal Coupling 4, and this is connected by an 8" Rod 6 to a further Universal Coupling. The latter, in turn, is secured to a Rod that is journalled in a 2½"×1" Double Angle Strip and in the Geared Roller Race and carries a ½" Pinion. The Pinion is in constant mesh with a second Pinion 9a, which is secured to a Rod 9 (Fig. 4) that passes completely through both the upper and lower Roller Races. It will be seen that by rotating the Rod 9, the Rods 7 are both driven at the same speed via the train of three ½" Pinions, the universally-jointed Rods 6, and the ⅞" Bevels. The drive is transmitted finally to the wheels by Sprocket Chain, which passes over ¾" and 1" Sprocket Wheels secured on the Rods 7 and the wheel axles. Before laying the gantry aside and continuing with the construction of the model, it is important to see that the transmission works as freely as possible Bearings and gears should be oiled lightly, and small

adjustments made if necessary with this end in view.

The Swivelling Superstructure

As will be seen from Fig. 4, the swivelling superstructure is built upon the upper portion of the slewing race 8. The two side members are 18½″ Angle Girders 11 and they are joined by 9½″ Angle Girders 12 at the points shown, and also at the rear by a similar Girder. The Girders 12 are secured firmly to the Race by means of 5½″ Angle Girders. The vertical 12½″ Girders 13 comprising side members of the tower are attached to 5½″ Angle Girders on the side Girders 11, and the points of attachment are strengthened by means of Corner Brackets.

The pulleys 15 and 16 and the 1½″ Strips 17a are mounted loosely on a Rod that is journalled in Corner Brackets at the top of the tower, to which they are attached by 2½″ Strips and Flat Brackets. The pulleys 15 are 1″ fast Pulleys, which are spaced from the centre pair (1″ loose Pulleys) by Collars and Washers, and guards, to keep the hoisting cord in the grooves of the pulleys 16, are formed from 2½″ Strips. Suitable bracing is added to the tower as indicated in the illustration.

The construction of the gear cabin should be fairly clear from the general view, with the exception of the roof, which is composed of three 5½″×2½″ Flanged Plates and one 5½″×2½″ Flat Plate. The rear portion of the cabin is left uncovered in order to show the internal construction more clearly, but if desired 9½″×2½″ and 12½″×2½″ Strip Plates can be used for filling-in purposes. At certain points these Plates should be made easily detachable.

The Construction of the Jib

The main constructional features of the jib may be seen fairly clearly by a careful study of Fig. 2. The two lower longitudinal side members each consist of one 24½″ and one 12½″ Angle Girder overlapped eight holes, whilst each of the upper longitudinal members is composed of one 24½″ and one 9½″ Angle Girder overlapped 2 holes. The bottom end of the jib is extended at an angle to the main portion by 12½″ Angle Girders, the ends of which are connected together by 4½″×2½″ Flat Plates.

The upper extremity of the jib is extended by 7½″ Angle Girders that are bolted to the end holes of the side members, and a 7½″ Strip is placed over the slotted holes of each Girder in order to give a neat appearance. Bracing should now be added to the sides as shown, care being taken to ensure that the various Strips are disposed exactly as indicated in the illustration.

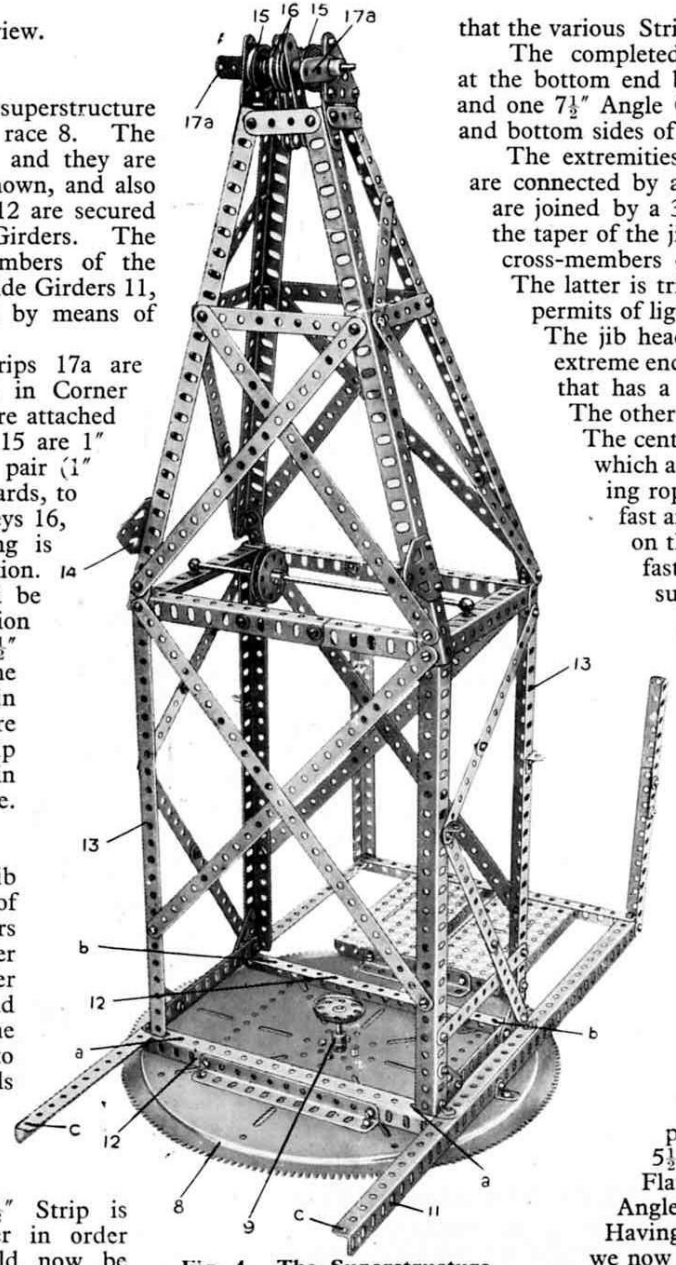

Fig. 4. The Superstructure and upper Slewing Race

The completed sides are now joined together. This is effected at the bottom end by girders, each of which is 10 inches long (one 5½″ and one 7½″ Angle Girder overlapped six holes) and is bolted to the top and bottom sides of the jib, 2″ in front of the jib pivot pin 14a.

The extremities of the two upper longitudinal members of the jib are connected by a 3½″ Angle Girder and those of the lower members are joined by a 3″ Angle Girder. Having in this manner determined the taper of the jib, it is a simple matter to bolt into place intermediate cross-members of the correct length and then to add the bracing. The latter is triangulated, which makes the jib very strong, and yet permits of light construction.

The jib head has two distinct sets of pulleys. One set is at the extreme end of the jib and consists of a 1½″ Pulley secured to a Rod that has a 1″ fast Pulley mounted loosely on each extremity. The other set comprises three pairs of Pulleys on a common rod. The centre pair comprises two 1″ loose Pulleys, on each side of which are placed Flat Trunnions to act as guards for the hoisting rope, and each of the two remaining sets consists of a 1″ fast and a 1″ loose Pulley. The respective groups are spaced on the Rod by Collars and Washers, and the bosses of the fast Pulleys serve to keep the Pulleys away from the supporting frame, so that all may run freely.

Construction of the Gear-Box

The gear-box (Fig. 5) enables the four movements of hoisting, slewing, travelling and luffing to be driven from the 6-volt Meccano Electric Motor merely by the operation of two levers. A point worthy of note is the fact that it forms a self-contained unit that is readily fitted into the model.

The 5½″ Angle Girders 18, 18a, are butt-jointed together so that their vertical flanges point in opposite directions, the left-hand pair being bolted to a 5½″×2½″ Flanged Plate, whilst the right-hand pair are connected together by means of a 2″ Strip. The Girders 18a also are secured at right-angles to, and two holes from each end of a 9½″ Angle Girder that will eventually be secured to the ends of the Girders 11 (see Fig. 4). Cross girders, each 7½″ long, are bolted across the Girders 18, 18a to carry the centre plate 19 and the right-hand plate of the gear-box, and a 5½″ Angle Girder 20. The centre plate 19 is a 5½″×2½″ Flat Plate and it is secured to the cross girders by a 5½″ Angle Girder.

Having now completed the constructional part of the gear-box, we now turn our attention to the gearing. The mainshaft 21, which is driven by the Motor, has secured to it a 1″ Gear in mesh

with a similar Gear on the Motor, and also a ½" diameter ½" wide Pinion. On each side of the mainshaft are two sliding layshafts 22 and 23, each of which carries a ¾" Pinion and a 57-teeth Gear, the latter being in constant mesh with the ½" wide Pinion on the mainshaft.

The layshaft 22 is moved in its bearings by the Crank 36, which is secured on an 8" Rod that carries the lever 41. The layshaft 23 is actuated in a similar manner by the lever 39 through the medium of the Crank 38. Both Cranks carry bolts, the shanks of which locate between Collars spaced a short distance apart on the Rods.

By sliding the layshaft 23 to the right the ¾" Pinion is brought into engagement with a 50-teeth Gear 26. This Gear is secured to a Rod carrying a ¾" Contrate that is in mesh with a ¾" Pinion on a Rod 41. The latter is journalled in a Flat Trunnion that is bolted to the front top edge of the gear-box and also in one of the 5½"×3½" Flat Plates forming the front of the cabin. It has secured to it a ½" Bevel, and this meshes with a 1½" Bevel on a short vertical Rod on the lower extremity of which is fixed the Pinion 35 that meshes with the teeth of the fixed slewing Race 8 (see Fig. 2). When the Pinion 35 rotates, it runs round the circumference of the Race and thus causes the model to slew.

A reinforced bearing is provided for the Rod carrying the Bevel and the Pinion 35 by bolting a 7½" Girder across the Girders 18a beneath the floor plates. The Rod also passes through the end hole of a Strip that is bolted to the upper member of the slewing race.

On moving the layshaft 23 to the left the ¾" Pinion is brought into mesh with a 50-teeth Gear 27 on the hoisting barrel shaft. The hoisting barrel 31 consists of a Sleeve Piece, one end of which is passed over a ½" fast Pulley secured against the face of the 50-teeth Gear, and it is held firmly in place by means of a ¾" Flanged Wheel that is pushed on to its other end.

The hoisting barrel is fitted with an automatic servo brake that allows the load to be hoisted with perfect freedom, but applies the brake when the barrel tends to unwind. An unequal-armed crank, composed of a 2" Strip bolted to a Double Arm Crank, is fitted on the end of a Rod that is journalled in the gear-box sideplate and in the 5½" Angle Girder 20. The Rod may be operated by the lever 33 that is secured to it by a Coupling; by raising the lever the brake is released. A short length of cord is passed round the brake drum 32 and its ends tied to the shanks of bolts on the extremities of the crank. The automatic servo effect is accounted for by the fact that the points of attachment of the brake band to the crank are at different distances from the fulcrum.

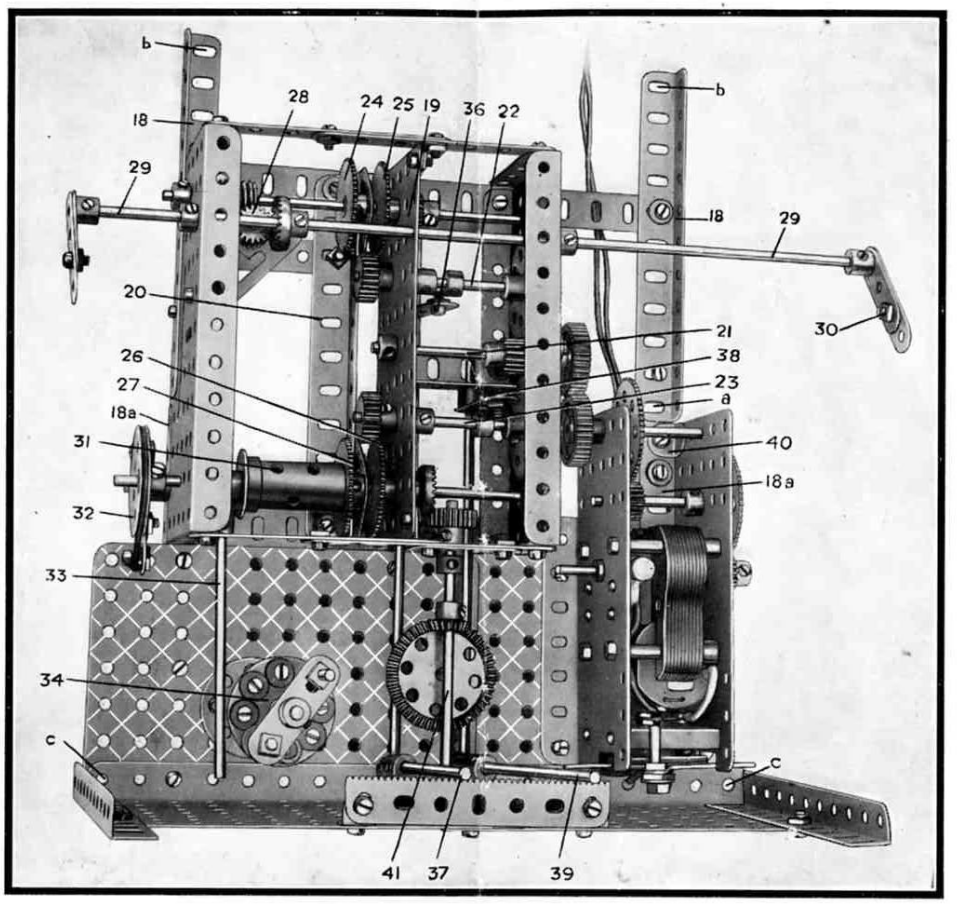

Fig. 5. Plan view of Gear-Box. Its simplicity of design is clearly apparent

A 50-teeth Gear 25 is secured to a Rod that also carries a ½" Pinion. The latter will mesh eventually (when the gear-box is mounted in place) with a 1½" Contrate on the upper end of the Rod 9 (see Fig. 4). In this manner the drive will be transmitted from the gear-box to the wheels.

The last movement to be considered is that of luffing the jib. The luffing cranks 30 are secured on the extremities of an 11½" Rod 29, which has fixed to it a ¾" Contrate that meshes with a ½" Pinion 28 on a short vertical Rod. The latter has a further ½" Pinion that meshes with a Worm on the Rod carrying the 50-teeth Gear 24. The Rod with the Pinion 28 is journalled at its bottom end in a Strip, and at its upper end in a Corner Bracket that is attached to the Flanged Plate by a 1½" Angle Girder. One of the bolts that serve to secure the 1½" Angle Girder to the Plate is also passed through a 2½" Angle Girder, which is bolted vertically to the Plate for strengthening purposes.

The Electric Equipment of the Model.

There are only two items that claim our attention under this heading, the Motor and its gearing, and the built-up controller, which enables six different speeds to be obtained from the Motor.

The Motor is secured to the floor plates in the position indicated in Fig. 5, by nuts and bolts and by a ½″ × ½″ Angle Bracket 40. A gear train, providing a reduction ratio of 9 : 1 and consisting of two ½″ Pinions and two 57-teeth Gears, is employed to transmit the drive from the armature spindle to the Rod carrying the 1″ Gear.

The controller is shown at 34 and is conveniently placed in relation to the other controls; it is of exceptional interest as it is built up entirely from standard Meccano parts. Space precludes anything but a brief description of the device, but readers who require fuller information on the point should refer to detail No. 110 in the Standard Mechanisms Manual.

The resistance is formed from a short length of Spring Cord, drawn out so that no two adjacent turns touch, and attached to the shanks of 6 B.A. Bolts that are insulated from the Bush Wheel on which they are mounted by Insulating Bushes and Washers. A seventh insulated stud is provided; it is not connected in any way, since it forms the "off" position of the controller. The switch arm is a Double Arm Crank, on one end of which is mounted a Spring Buffer that makes contact with the studs. The Bush Wheel is mounted on a Rod, the upper extremity of which forms a pivot for the Double Arm Crank, its lower end being secured in the boss of a Bush Wheel that is bolted to the floor.

A length of insulated wire is taken from one Motor terminal to one end of the resistance, and the other terminal of the Motor is connected to one terminal of the accumulator. The remaining terminal of the latter is "earthed," that is, connected to the frame of the model. If coloured parts are used, it may be found necessary to remove the enamel from beneath the bolt holding the earth wire to the frame and also beneath the bolts securing the controller to the floor plates.

Final Assembly of the Model

We now come to the most interesting stage of the construction, that of fitting together the various units to form the complete model. The gear-box unit should be first fixed into position on the Girders 11 and 12 and between the Girders 13. This is accomplished by arranging the holes a, b, c (Fig. 5) of the gear-box to coincide with similar indexed holes on the Girders 11 and 12 (Fig. 4). Bolts should then be inserted in these holes.

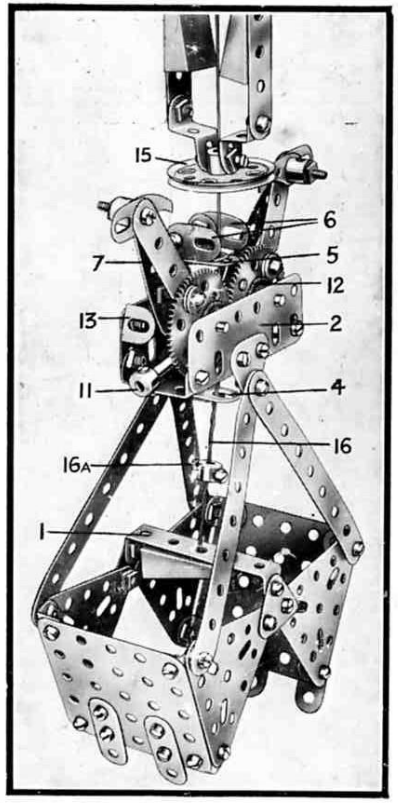

Fig. 6. The Single Suspension Grab

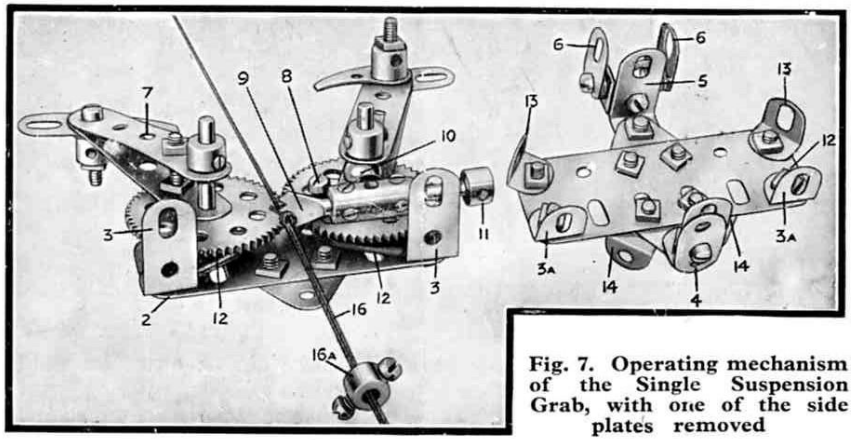

Fig. 7. Operating mechanism of the Single Suspension Grab, with one of the side plates removed

It will be necessary to remove the Rod 29 temporarily before sliding the gear-box into place.

The superstructure is now lowered on to the ¾″ Flanged Wheels of the Ring Frame. The Rod 9 passes freely through both Races, of course, and has secured to its upper end the 1½″ Contrate that meshes with the ½″ Pinion on the shaft carrying the Gear 25. The upper Race should bed down quite evenly on the ¾″ Flanged Wheels and the complete superstructure should turn at a touch. The Pinion 35 must also be arranged to mesh with the teeth of the lower Race.

The jib is mounted pivotally on the front of the tower by passing the 11½″ Rod 14a through the Flat Trunnions 14 and through the bosses of Cranks that are secured to the sides of the jib. It is now necessary to add weights at 61 in the shape of pieces of scrap lead melted into blocks of the required shape, or large quantities of Meccano parts, until the jib is accurately balanced. The connecting rods 30a may then be attached pivotally by lock-nutted bolts to the luffing cranks 30.

The hoisting cord is attached to the hoisting barrel 31, and is led over one of the pulleys 16 at the superstructure head, passing through a guide pulley on its way. The guide pulley consists of a 1″ loose Pulley running between two Bush Wheels mounted on an 8″ Rod that is secured by Handrail Supports to the tower. From Pulley 16, the cord passes over one of the centre pair of pulleys at the jib head, back over the remaining Pulley 16 and thence to the other centre Pulley on the jib head, after which it runs over the 1½″ Pulley at the extremity of the jib and so down to the load hook or grab, to which it is secured.

The Single Suspension Grab

Although the model may be used as an ordinary crane by fastening a Loaded Hook to the end of the hoisting cord, its interest is vastly increased by the addition of a grab.

The grab employed on the model is known as the single suspension type, and is opened and closed merely by manipulation of the hauling rope, instead of depending for its operation, as is quite usual, upon two distinct falls of rope wound on separate barrels. An excellent example of a grab of the latter type is afforded by the Meccano High Speed Ship Coaler (see Instruction Leaflet No. 2).

Fig. 6 is a general view of the single

suspension grab, whilst Fig. 7 shows the grab head partly dismantled. From the latter view it will be seen that the mechanism of the grab is ingenious, yet, at the same time, remarkably simple. The construction of the jaws themselves should not present any particular difficulty since they are fairly apparent from the illustration. The apices of the Triangular Plates forming the sides of the jaws are attached pivotally by lock-nutted bolts (see Standard Mechanisms No. 1) to 1" Triangular Plates that are locked rigidly to each end of a 2½"×½" Double Angle Strip 1, and four connecting links (4½" Strips) are attached pivotally to the outer ends of the jaws by lock-nutted bolts. The Double Angle Strip 1 is weighted by the addition of a number of 2" Strips or a 50-gramme weight, to make the jaws open.

The side plates 2 (Fig. 7) carrying the operating mechanism are 3" Flat Girders, which are connected together by 1"×½" and ½"×½" Angle Brackets 3, 3a. On the side plate shown detached are fixed two 1" Triangular Plates that carry 1"×½" Angle Brackets 4 and 5, and to the Bracket 5 is secured a Double Bracket, with two Flat Brackets 6 bolted to it. Two Washers are placed between each Flat Bracket and the Double Bracket for spacing purposes.

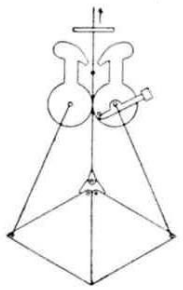

Fig. 8

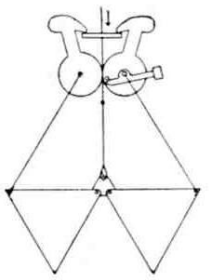

Fig. 9

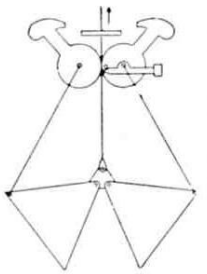

Fig. 10

Diagrams illustrating operation of Single Suspension Grab

The hooks 7 are composed of 2½" Strips bent to the shape shown in the illustrations and attached by means of ½" Bolts to 57-teeth Gears. The ends of the Strips are each fitted with a Pawl and a Flat Bracket. The catch 9 is composed of a Centre Fork held in the end bore of a Coupling, which also carries a Handrail Support 10 and a balance weight 11 consisting of a 1" Rod to the end of which is secured a Collar. The Gears are arranged to mesh with each other so that the Hooks 7 lie at the same angle to the perpendicular, and the Rods on which they are secured should be perfectly free to turn in the side plates 2.

The Handrail Support 10 of the catch is mounted freely on the spindle of the right-hand Gear, and a ⅜" Bolt 8 is secured by double nuts to the Gear in the third hole from that in which the 2½" Strips are secured. Each hook is kept in the normal position by a piece of Spring Cord 12, one end of which is attached to the side plate and the other to a set-screw inserted in the boss of the 57-teeth Gear. Each piece of Spring Cord should be partially carried round the boss of the 57-teeth Gear before it is attached, so that its effort to come back to its normal state, and not its actual tension, is utilised to return the hooks. If it were used in the normal way, the tension would be too great for the purpose in view.

The connecting links between the grab proper and the grab head are attached by lock-nutted bolts to the 1" Triangular Plates, and the hoisting cord 16 is secured to the cross member 1. The cord is then threaded through the round holes in the lower guide 4, and a large knot made in it in such a position that when the jaws are open the knot rests on top of the guide. The cord is then passed through the upper guide 5 and through the 1½" Pulley 15, which is termed the "suspender ring." This consists essentially of a 1½" Pulley that is hung by two cords 17 from the jib head. These cords are each passed over the Pulleys 15 on the tower (Fig. 4) and over the outside pairs on the jib in exactly the same manner as that followed with regard to the hoisting cord, but the ends of the cords are attached to 1½" Strips 17a at the top of the tower, and are not let down to a winch. A winch may be added if it is desired to effect discharge at different levels, otherwise it is only necessary to adjust the suspender to the most convenient height and then secure the ends of the cords to the Strips 17a. The object of the pulley system is to maintain the suspender in one horizontal position through all luffing angles in accordance with the Toplis principle.

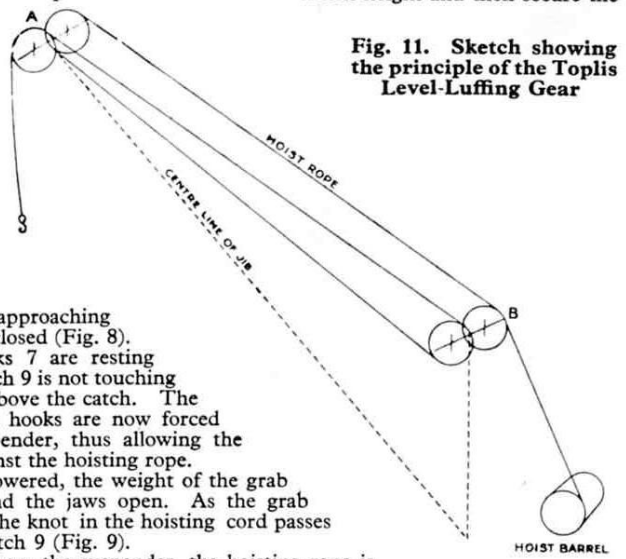

Fig. 11. Sketch showing the principle of the Toplis Level-Luffing Gear

The diagrammatic illustrations (Figs. 8-10) should help to make clear the operation of the grab. The grab should be assumed to be approaching the suspender with jaws closed (Fig. 8). In this position the hooks 7 are resting against the stops 6, the catch 9 is not touching the cord, and the knot is above the catch. The Pawls on the ends of the hooks are now forced over the rim of the suspender, thus allowing the catch to rise and bear against the hoisting rope.

Now if the latter is lowered, the weight of the grab is borne by the hooks and the jaws open. As the grab opens to its fullest extent the knot in the hoisting cord passes to the underside of the catch 9 (Fig. 9).

To release the grab from the suspender, the hoisting rope is hauled in a little, thus causing the knot to bear against the underside of the catch. The latter bears, in turn, against the ⅜" Bolt 8 and the arms of the hooks fall back on the stops 13. The grab is now freed from the suspender and it can be lowered in the open position (Fig. 10). On reaching the material to be removed, the hoisting rope is allowed to fall quite slack so as to give the weight of the Collar 16a a chance to pull the knot free from the catch, and so permit of the closing of the jaws when hoisting is commenced.

The two ½"×½" Angle Brackets 14, by bearing against the connecting arms of the grab, serve to maintain the grab head in a horizontal position in relation to the jaws under all conditions of service.

We are indebted to Stothert and Pitt Ltd., the makers of the prototype of the model, for the illustration on page 1 of this leaflet, and for valuable technical assistance in connection with the building of the model.

Parts required to Build the Meccano Level-Luffing Crane:

13	of No.	1	26	of No.	8	24	of No.	12	4	of No.	18b	6	of No.	27a	1	of No.	46	1	of No.	65	1	of No.	110	4	of No.	136
12	„	1a	14	„	8a	4	„	12a	8	„	20	1	„	28	8	„	48	7	„	70	4	„	111	2	„	140
13	„	1b	7	„	8b	2	„	12b	1	„	20b	2	„	29	1	„	48a	2	„	72	4	„	111a	2	„	147a
40	„	2	24	„	9	2	„	13	3	„	21	4	„	30	6	„	52	4	„	76	4	„	111c	1	„	163
12	„	2a	10	„	9a	4	„	13a	6	„	22	1	„	30a	8	„	52a	5	„	77	2	„	114	2	„	165
22	„	3	2	„	9b	1	„	14	7	„	22a	1	„	30c	1	„	53	18	„	94	2	„	115	1	„	167
24	„	4	1	„	9c	2	„	15a	1	„	23a	2	„	31	4	„	53a	4	„	96	2	„	116a	7	„	182
42	„	5	2	„	9d	10	„	16	4	„	24	1	„	32	6	„	58	4	„	96a	2	„	120a	7	„	182a
24	„	6	1	„	9e	2	„	16a	3	„	25	594	„	37	48	„	59	6	„	103	4	„	125	1	„	1563
13	„	6a	2	„	9f	5	„	16b	7	„	26	6	„	37a	6	„	62	4	„	103a	2	„	126	7	„	1575
4	„	7	9	„	10	6	„	17	1	„	26a	130	„	38	2	„	62b	2	„	103e	8	„	126a	13	„	1583
4	„	7a	1	„	11	6	„	18a	4	„	27	3	„	40	6	„	63	4	„	108	7	„	133	1 Electric Motor		

No. 13 Leaflet

MECCANO SUPER MODELS

Our expert designers have produced for us 23 super models that reach the highest pinnacle ever attained in Meccano construction. Each model in this series is a masterpiece and there is not a boy who will not be eager to build them all.

These models are so important that we have engaged expert engineers to describe them and a special leaflet with beautiful half-tone illustrations has been written for each of them. A selection of the leaflets is illustrated on this page.

A brief description of each model in the series is given below and the number and price of the special Instruction Leaflet are indicated. Copies of the leaflets may be obtained from any Meccano dealer or direct from us, post free, at the prices stated.

No. 6 Leaflet

No. 1a Motor Chassis. This model runs perfectly under its own power. It has Ackermann Steering, Differential, Gear-Box and Clutch, etc.

No 2 Ship Coaler. All the movements of a real ship coaler are reproduced in this model.

No. 5 Travelling Bucket Dredger In this model trucks and wagons can run underneath the shute 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 4½lb. with remarkable accuracy.

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. 11a 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. 18 Revolving Crane. This model is fitted with screw-operated luffing gear.

No 19 Steam Shovel. This model embodies travelling and rotating mechanisms and jib hoisting and lowering gear.

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 as long as the motor is driven, pausing for a few seconds at each end of its travel.

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

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. 28 Pontoon Crane. The movements of this model include the operation of the three 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, and also is fitted with laminated springs, brakes, out-riggers, etc.

No. 31 Warehouse with Elevators. The two cages are driven automatically and work alternately, pausing at top and bottom positions.

No. 35 Level-Luffing Crane. The model is provided with level-luffing gear, and an important feature is a grab that can be opened and closed automatically.

No. 25 Leaflet

INSTRUCTION LEAFLET PRICES

Leaflets Nos. 5 6 7 9 10 11a 12 14a 18 19 20 21 22 24 25 28 29—United Kingdom 2d., Overseas 3d., Canada 5 cents

Leaflets Nos. 1a 2 13 30 31 35—United Kingdom 3d., Overseas 4d., Canada 8 cents.

No. 19 Leaflet

THE

"MECCANO MAGAZINE"

The "Meccano Magazine" is the Meccano boy's newspaper. It is published monthly, and each issue contains details of splendid new Meccano models and new ideas for operating Hornby model railways. Interesting model-building and other competitions are announced each month, and details of all new Meccano products appear in its pages. It is the official organ of the Meccano Guild and the Hornby Railway Company, which have thousands of boy members in all parts of the world.

The "Meccano Magazine" appeals to every boy, for it deals with Engineering in all its branches—Railways, Aviation, Ships, Motor Cars, Hydro-Electric Schemes, Bridges, Cranes, etc. Specially attractive articles are devoted to Model Railways and Model Speed Boats, and Home Experiments in Electricity and Chemistry. Other sections deal with Books of interest to boys, Stamps, New Inventions, etc.

The Magazine may be ordered from any Meccano dealer or newsagent, price 6d (Can. 10c)

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