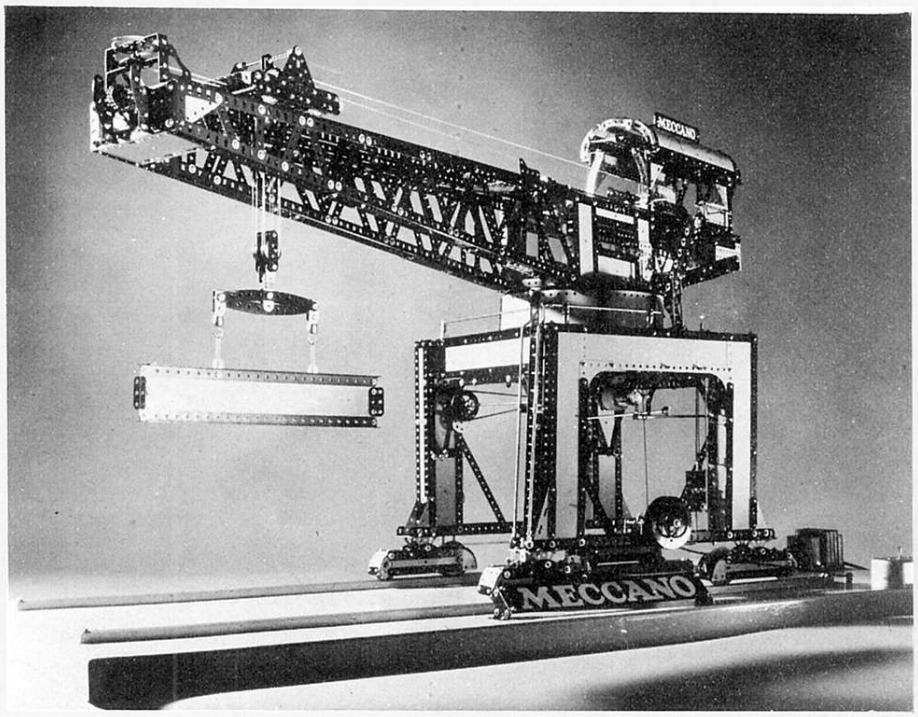


Included in the instructions literature for the No. 10 Set is a leaflet describing a Blocksetting Crane – perhaps the most famous of all advanced Meccano subjects. The model is reasonably large and fairly advanced, but unfortunately it is not the ultimate No. 10 model of its type. For instance, it uses far from all the parts in the Set and thus it falls short of the full modelling potential of the biggest Meccano Set on the market. In contrast, the Electric Dockyard Crane, illustrated in full colour on our cover and featured constructionally here, is a No. 10 Set masterpiece! Newly designed and built by Mr. Bert Love, it uses nearly everything in the Set and offers strength, substance, rugged form and, of course, fully operational working features. Though technically not a Block-Setter in that it is fitted with hook-lifting equipment instead of block-setting gear, it is the same breed of Giant Hammerhead Crane and is instantly recognisable as such.

Electric Dockyard Crane

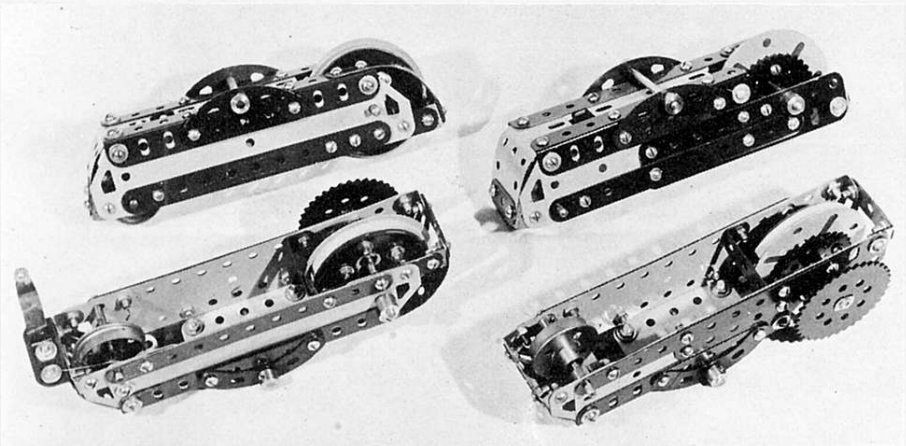
A No.10 Set model built & described by B.N. LOVE

Because of the size and complexity of this outstanding, advanced model we are unable to provide the full building instructions in this one feature. They would take up most of the magazine! We are therefore splitting the instructions into two instalments with PART 1, here, dealing with the travelling bogies and tower. PART 2 in our next issue will conclude with the jib, hoisting gear and wiring, etc. We are indebted to Mr. Bert Love, the builder, both for the accompanying illustrations and the comprehensive building instructions.

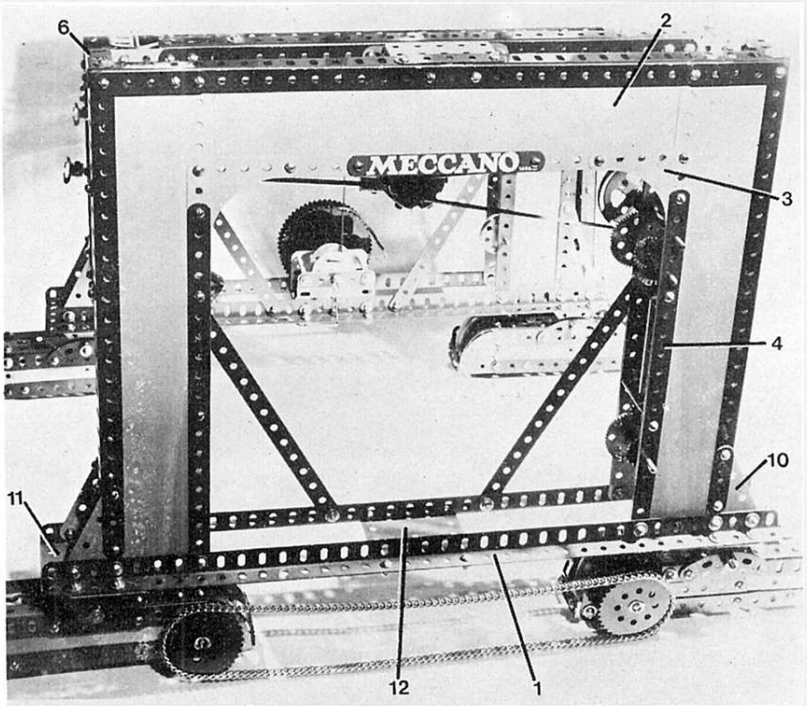
BOGIE CONSTRUCTION

All four bogies are of slightly different construction and their general arrangement may be seen from the overall view of the Dockyard Crane in Fig. 1. Two of the bogies are directly chain driven through gearing from a Powerdrive Motor inside the Tower and a third bogie picks up its drive by external Sprocket Chain on the far side of the model. Fig. 2 shows the construction for a powered and non-powered bogie, one of each being required at both sides of the Tower but a "mirror-image" or reversal of each construction is needed to complete the set. It should be noted that the non-powered Flanged Wheels in each bogie are free to slide on their Axle Rods and are thus self-aligning in the sunken rails required for dockyard working where vehicular traffic requires access under the portals of the crane. The two Bell Cranks in the No. 10 Set secure the trailing Axle Rod in two of the bogies while Collars and the two ½" Pulleys with Boss do the same job in the other pair. It is left to the ingenuity of the builder to place his limited number of Collars (24 of them) in the most appropriate parts of the model and to bear in mind that any spare gears or, indeed, any spare wheel with boss can double-up as a Collar if applied sensibly.

Fig. 1, above, shows a general view of the completed Crane which is built entirely from the contents of a standard No. 10 Set. Fig 2, below, gives a close-up view of the four travelling bogies, each pair of which is a "mirror image" of the other pair.



Large flanged wheels are built up by bolting Face Plates to Wheel Flanges, but for the Sprocket-driven pair, the boss of the Face Plate is pushed through the Wheel Flange and the 1½" Sprocket Wheels employed are positioned at the same time, but stood away from the Face Plate by double Nuts to give clearance for the Chain drive. On the plain bogie, (and the far side bogie picking up its drive by external Sprocket Chain) the built-up flanged wheels protrude between a pair of Formed Slotted Strips, but for the Sprockets mounted internally only one Formed Slotted Strip is used on each bogie, again to give clearance for the Sprocket Chain. Construction of the bogies is clear from Fig. 2, each one being topped by 5½" or 4½" Angle Girders, reinforced externally on the lower edges by overlaid 5½" Strips and braced internally by a 1½" x ½" Double Angle Strip in the position shown. Ten Flat Trunnions, four 2½" Semi-Circular Plates and two 4½"



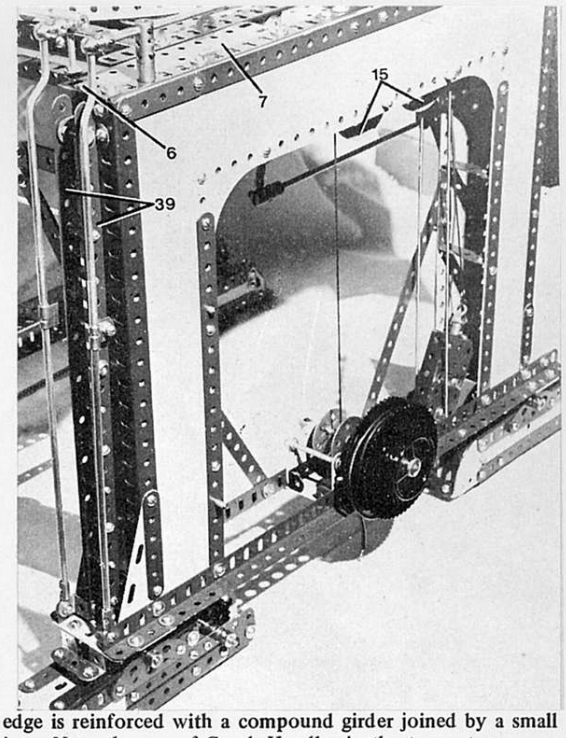


Fig. 3, above left, shows a general view of the outer face of a portal frame. The top edge is reinforced with a compound girder joined by a small Flanged Plate, as shown. Fig. 4, above right, is another view showing portal construction. Note the use of Crank Handles in the tower top access ladder rails to achieve neat contour appearance.

Flat Girders provide reinforced journals for the driven and trailing axles in the bogies. As the bogies are free to float and thus accommodate slight fluctuations in rail level, they are provided with journals beneath the feet of each Tower portal. A pair of 2½" Curved Stepped Strips are mounted on the bogie Girders, placed centrally and stood off with one Washer to allow for the distance between the Trunnions bolted onto the base of the portal legs. Any convenient size of Axle Rods (3½" in the illustrations) are used to pivot the bogies to the portal and the sheer weight of the model holds them in place without using Collars. Smaller Axle Rods and Collars may be added as extras if preferred.

BUILDING THE TOWER

There are four sections to the Tower, namely the two portals or side frames, the platform and the turntable. Construction is started by building identical portals and reference should be made to Figs. 1 and 3. Each portal is 12½" high and 15½" long at the top edges. Pairs of 18½" Angle Girders 1 brace the bottom and overlap the portal legs by 1½" at each end. Outer faces of the portal frames are made from five 12½" x 2½" Strip Plates, vertical pairs overlapping and sandwiching a horizontal Plate 2 by two holes at each end, thus providing the 15½" dimension of the top edge. The inside corners resulting are overlaid externally with Corner Gussets 3 for reinforcing the corners and providing a neat curvature in the design. Vertically below the Gussets, 9½" Strips 4 continue the overlay for additional support, while outer edges of the portal frames are all reinforced by Girders. A compound girder is made from two 7½" Girders joined by a 2½" x 1½" Flanged Plate, leaving a ½" gap at the join, and this girder runs inside the top edge of the horizontal Strip Plate 2. Outside, a 12½" Strip is overlaid and lengthened by 2½" Strips at each end to make up the 15½" span. The bottom edge of the horizontal Strip Plate is reinforced internally by a 12½" Strip and is held in place by the Bolts which attach the Corner Gussets at that level. Leading vertical edges of the portal legs are reinforced by 12½" Angle Girders.

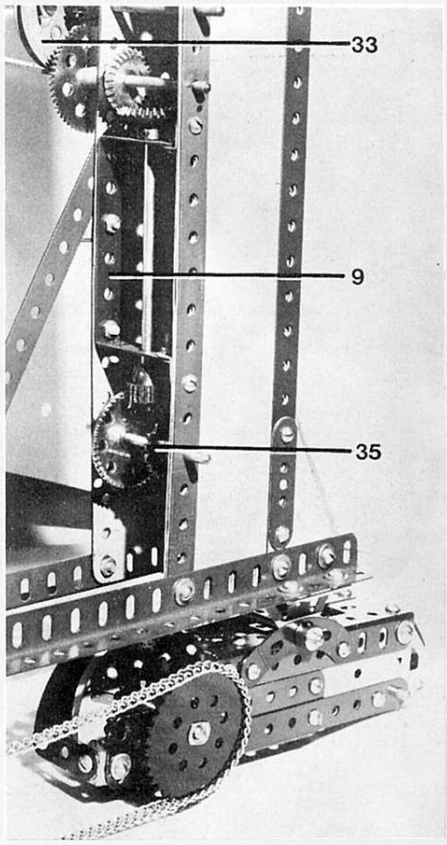
The inner faces of the portal frames are somewhat different in construction. This time, the horizontal Strip Plates at the top are doubled up to sandwich 4½" x 2½" Flat Plates (22), allowing 1½" of Plate to extend at each end. The holes provide attachment points for the main platform across the top of the Tower. The inner faces of all four portal legs are clad with double thicknesses of 5½" x 2½" Flexible Plates 5, reinforced at their leading edges with 12½" Angle Girders and by vertical 12½" Strips as overlays. The Flexible Plates overlap by one hole. When the internal and external faces of the portal frames are completed, each side may be completed by joining the faces with 1½" Flat Girders at the bottom of each portal leg and by 1½" Girders 6 at the top. This can be seen in Figs. 1 and 4. One 5½" x 1½" Flexible Plate 7 is bolted into the top of the legs as extra bracing on each leg (any extra plate shown, as in Fig. 1, should be ignored). Just inside each portal leg, at the height of the lapover of the 5½" Flexible Plates, a 2½" Angle Girder is bolted on horizontally by its round holes to form ledges as anchoring points for a double layer of 5½" Curved Strips 8 which form bracing struts from the legs to the platform.

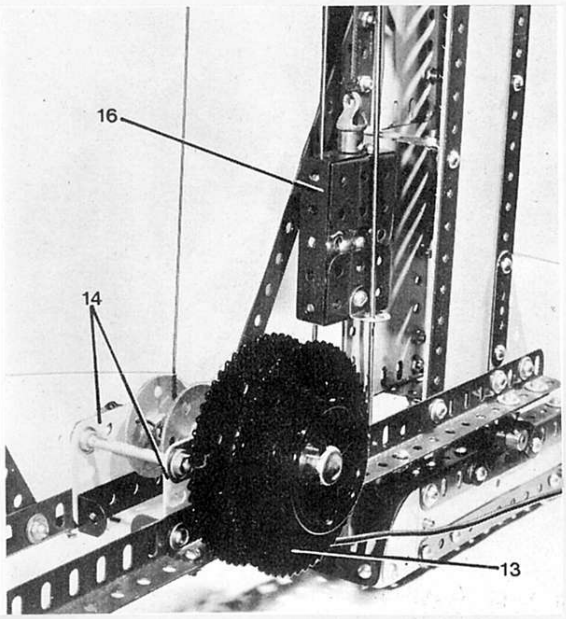
Internal bracing of the portal legs is achieved by using four Double Angle Strips with 1½" lugs. The location of the 3" x 1½" D.A.S. 9 is shown in Fig. 5, and can be seen to carry the vertical drive shaft for the bogie through its central holes. Angle Brackets fix the free end of the lugs to the portal legs as shown. The legs which have no transmission shaft inside are reinforced in a similar manner using a pair of 2½" x 1½" D.A. Strips. Some additional support to the portal feet is provided by a pair of 2½" x 1½" Triangular Flexible Plates 10 on three of the legs and one pair of 3½" x 1½" T.F. Plates on the fourth leg carrying the ladder. The shorter Plates carry vertical overlays of 2" Strips and the longer pair are covered by 3" Strips. This gives a neat line of continuity up the corner Angle Girders of the portal.

At this stage the pairs of 18½" Angle Girders can be bolted, slotted flanges upwards, to the bottom of the portal legs as shown in Fig. 1, being secured in place with Washers under the boltheads. It will be noted as construction progresses that various illustrations show more standard Washers than are available in the No. 10 Set, but most of them, are for 'show' and are not essential to the construction. At each end of 18½" Girders 1, pads made from double thicknesses of 2½" x 2½" Flexible Plates 11 are bolted on below and fixed in place by Trunnions in the positions shown. It is necessary to have the elongated holes of the Plates available because of the slightly expanded width of the portal legs. A similar double thickness pad 12 is bolted under the centre point of the 18½" Girders. Four 9½" Strips complete the portal frames as diagonal struts bolted from the vertical flanges of Angle Girdles 1 to the vertical overlaid 12½" Strips on the inner faces of the frames.

Continued →

Fig. 5, open side of portal leg showing Double Angle Strip bracing acting as journals for travelling gear drive. Note small Sprocket Wheel on lowest shaft.





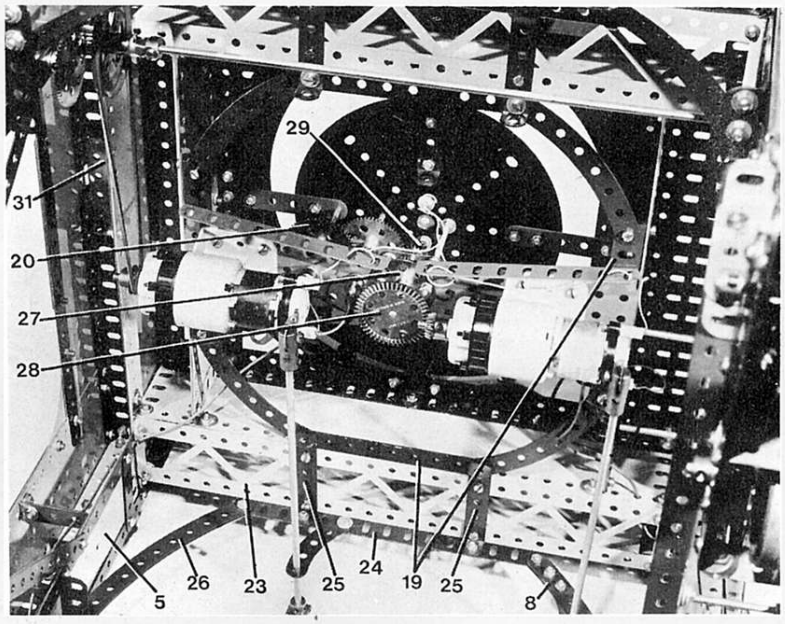


Fig. 6, above left, shows the cable drum mounting of the No. 10 Set Electric Dockyard Crane. Reinforced Plastic Plates give insulated feed for the flexible cable and note the counterweight giving automatic reel-in. Fig. 7, above right, is a view from beneath the tower platform showing the mounting for travelling and slewing motors. Note transverse reinforcing provided by 12½" Braced Girders.

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ELECTRICAL FEED TO TOWER

Construction of the automatic reel-in, reel-out power feed is quite straightforward. A 4" Axle Rod is capped with a Steering Wheel followed by the face of a 3" Sprocket 13, boss inwards. Two 1" Motor Tyres are passed over the boss and are jammed in place, roughly centred, by a second 3" Sprocket secured tightly with one Grub Screw. The boss of this Sprocket also points inwards towards the model. Very flexible multi-stranded plastic covered wire is required and that used in the model is known as 'Radiospares Flexible Instrument Lead Wire'. A 2 amp carrying-capacity is adequate, but the cable must be very flexible. Two metres of wire are adequate. A standard Bolt fitted with a Nut and then a Washer is screwed into the second hole of the boss on the inner Sprocket. Two cm. of cable is bared of insulation and passed through an inner hole of the Sprocket face, round the Bolt and trapped in place by the Nut and Washer. Most of the insulated flexible cable is then wrapped round the drum between the Sprocket faces.

It is obvious that the Axle Rod is now 'live' but will be carrying only 12 volts for the Power Drive Motors. *(N.B. Under NO circumstances must this method of electrical feed ever be used at mains voltage!)* It is now necessary to ensure that this 'live' Rod runs in insulated journals and these are supplied by a pair of 2½" Strips reinforcing the top edges of a pair of 2½" x 1½" PLASTIC Plates 14. These Plates are bolted directly to the vertical flanges of 18½" Angle Girders 1, at their centre, and two 2" Screwed Rods make a rigid cross connection to the top of the plates, as shown in fig. 6. The electrical drum shaft is now passed through the middle holes of the 2½" Strips and a pair of 6-hole Bush Wheels, boss to boss, are slipped on between the Strips to make a small winding drum for the counterweight. A Collar and Washer secures the drum shaft and the Washer is arranged to rub against a Fishplate or freely-turning solder tag to which the ordinary insulated wiring is carried up the tower to the motors. Two 2" Pulleys 15 revolve freely on Axle Rods set into the portal frame as shown, being arranged to receive a vertical rise of cord from the winding drum and a vertical fall of cord to the counterweight 16, which consists of a pair of Channel Bearings joined by a 2½" x ½" Double Angle Strip and a 2½" x 1" D.A.S. This allows the latter to be swung out of the way while the container thus formed is filled with Meccano Steel Balls. A 2½" x 1½" Plastic Plate, Transparent or coloured is inserted as a 'U' shape to prevent balls from spilling through the gap between the Channel Bearings. One pair of ½" Angle Brackets are bolted to the centre holes of the lower Channel Bearing, slotted lugs outwards, and these act as guides running on a single loop of Spring Cord secured by Hooks inside the portal frame at the top and passing through the slotted ends of a pair of Fishplates bolted to the bottom 18½" Girders 1, and set to make the Spring Cord run vertically and parallel.

General arrangement of the reel and counterweight is shown in Fig. 6. Sealing the counterweight is done by swinging the 2½" x 1" D.A.S. back into place and tightening up the lower Bolt and then the upper one, which is a ½" Bolt (or Threaded Pin) carrying an End Bearing to which the Meccano Cord is attached. This completes the insulated supply line for the crane and the remainder of the wiring may be carried out in any low voltage, single strand insulated wire generally available.

All motors in this model have one terminal wired directly to the nearest point of the model's framework as a 'common' earth return and no trouble should be experienced if the model is made in parts using the zinc finish. With the latest finish on Meccano Strips and Girders, it may be necessary to run a separate return wire down to a pick-up point on the rails as there can be sufficient insulation from the new enamels to prevent circuit continuity through the model's framework.

MAIN PLATFORM

As this will support the full weight of the boom and its loads, a sturdy platform of deep web box-girder construction is used to give a firm base for the roller bearing. Figs. 7 and 8 should be studied carefully when constructing this part of the model. Assembly is started by laying the slotted flange of a 9½" Angle Girder over one edge of a 9½" x 2½" Strip Plate 17 and a 9½" Strip on the other edge of the Plate, separating and overlaying them with 2½" Strips at each end. Angle Brackets are fitted internally (the Strips and Angle Girder will show to the outside of the model) by their round holes at each end of the 9½" Strip. This operation is repeated to make an identical pair. The top edge of a 12½" x 2½" Strip Plate is now sandwiched between the slotted flange of a 12½" Girder 18 and a 12½" Strip. The same thing is repeated and then the 9½" assemblies are bolted to the 12½" assemblies by means of the round holes in the Girder flanges to form a 9½" square, the four Angle Brackets being bolted to the bottom edges of the longer Strip Plates. Internal reinforcing is carried out on the bottom edges of all four Strip Plates by 4½" Angle Girders 19 located as shown in Fig. 7 and each pair is braced at their outer ends by 4½" Curved Strips to make rigid corners. The top inside edge of each portal frame is fitted with a 12½" Angle Girder, slotted holes downwards, overlaid inside the frame with a 12½" Strip. Secured by ½" Angle Brackets to this Strip, at the top centres of each portal frame, are small Flanged Plates 20, the securing Bolts passing through the Girder on the other side at the same time. The top edges of the portals are thus reinforced and may now be bolted on, by the round holes in the Girders, to the centre section of the main platform just described. The bottom corners of the two 12½" Strip Plates across the main platform are now fitted with pairs of ½" Angle Brackets, each pair back-to-back by the round holes, and four of these Brackets are then bolted by their slotted lugs to the portal frames horizontal internal Strip Plates. At this stage, the Tower assembly should already be taking on a rugged appearance.

Additional bracing for the Tower is supplied by front and rear deep web girders as seen in Fig. 1. This time, a 12½" Strip Plate 21 is fitted externally at the top with a 12½" Girder, by the round holes and then a 12½" Strip overlays the bottom row of holes as shown. At each end, vertical 2½" Girders are bolted on by their round holes *behind* the ends of the Strip Plates and then overlaid for appearance by 2½" Strips at the front. This allows the forward-running slotted flange of the short Girders to tuck in neatly and to be bolted to the perforations of the 4½" Flat Plates 22 extending at either end of the insides of the portal frames. Fig. 7, showing the view of the Tower from below, illustrates additional support for the front and rear deep girders by horizontal 12½" Braced Girders 23. The lower edges of Strip Plates 21 are fitted with 7½" Flat Girders 24, placed centrally as shown in Fig. 1, and these are used to secure four 2½" x ½" Double Angle Strips 25, which are also bolted at their inside ends to two of the 4½" Angle Girders providing internal bracing. The Braced Girders are bolted, in turn, to the D.A. Strips and further reinforced by ½" Angle Brackets, four of which are already in place at the bottom corners of the central 9½" square assembly. A careful check should be made to ensure that the portal frames are vertical and parallel at this stage. Pairs of 5½" Curved Strips 26 are now fitted with 1" x ½" Angle Brackets, lugs forward, and are fixed to the four horizontal 2½" Girders mounted inside

the portal legs. The upper ends of the Curved Strips sandwich the frontal 7½" Flat Girders 24 at each end and then, after checking once again that the portals are equally spaced all the way across the Tower, the Curved Strips and the 1" x ½" Angle Brackets are bolted securely in place. All nuts and bolts round the Tower assembly should now be checked.

TRAVELLING AND SLEWING MECHANISM

A simple, but strong, motor platform is made from a pair of Flanged Sector Plates fixed to the 4½" Angle Girders and joined by an 8-hole Bush Wheel 27, boss downwards in the centre. The Bush Wheel is secured by a 3" Screwed Rod through one hole and a 1⅛" Bolt through its opposite hole. Lock-nutted both to the Screwed Rod and to the end of the long Bolt is a 1½" Strip and its centre hole forms a second journal, with the boss of the Bush Wheel, for a 2½" Rod on which a 1½" Bevel Gear 28 picks up the slewing drive from a first Power Drive Motor. One Collar is used to space the large Bevel from the Bush Wheel and a 19-t Pinion 29 is secured to the top end of the 2½" Rod.

Attached to the top of the main platform is a 6" diameter Circular Plate 30 located by two 3½" Strips and two 3½" x ½" Double Angle Strips, as seen in Fig. 8. No weight is placed on the Circular Plate which simply carries a 6-hole Wheel Disc at its centre to centralise the pivot rod from the boom's roller race. Journalled in this Plate, and in the Sector Plate below, are the second and third shafts for the slewing drive being 3½" or 4" Rods. Mounted on the second shaft is a 57-t Gear, meshing with 19-t Pinion 29, and a 15-t Pinion which meshes with a 60-t Gear 31 on the third shaft. At the top of the third shaft, spaced by four Washers above the surface of the Circular Plate, is the final drive 19-t Pinion 32 which will engage a 3½" Gear Wheel attached to the crane boom. All of this gearing needs careful setting up for free running without slop and should then be lightly lubricated. This arrangement of shafts and the general selection of gears in the No. 10 Set permits changes of gear ratios to suit individual tastes for 'scale' slewing speed. The Power Drive Motor should be set in its highest ratio (60 : 1).

Mounting for the travelling motor is also shown in Fig. 7 where the leading edge of the base plate is set one hole in from the broad end of the Sector Plate. A 2½" Axle Rod is journalled through the rear edge of the portal leg carrying the ladder, nine holes below the top of the portal frame, and is fitted with a 2" Pulley 33 and a Swivel Bearing. Between the 2" Pulley and the portal leg, a 19-t Pinion is fitted to the Rod, boss inwards. After looping a 10" Heavy Driving Band over the Pulley, an 11½" Axle Rod is also fitted with a 19-t Pinion 34 and then locked in the swivel of the Swivel Bearing. Once the second 19-t Pinion is locked in place as shown in Fig. 1, no Collars are required to hold this compound shaft in place and the Swivel Bearing gives all the flexibility required.

Again, the motor is set to the highest ratio and connected up via a ½" Pully (supplied with the Motor) by the Driving Band to the 2" Pulley. Just below the 19-t Pinions, 57-t Gears are mounted on 2½" Rods also passing through the portal legs and they carry 7/8" Bevel Gears just inside the legs which also position these shafts without the use of Collars. Fig. 5 shows how the drive is carried on via a second Bevel and Contrate Gears to a ¾" Sprocket Wheel 35 which provides the final drive to the bogies. All of the travelling bogies now may be fitted and Sprocket Chain connected up for a test run. It is important that the Chain is slightly slack, rather than tight, otherwise the large driving flanged wheels will actually be lifted off the track, thus losing traction. On the far side of the crane, each bogie is fitted outboard with a 2" Sprocket on the driving shaft and connected up by a length of Sprocket Chain running from one bogie to the next. The fourth bogie remains unpowered.

TURNTABLE AND ROLLER BEARING

Eight 4½" x 2½" Flexible Plates 36 with centre holes are required for the roller bearing drum which is simple to construct, but which must be assembled with care. Each Plate is attached by a ½" or ⅜" Bolt through every second hole on the outside rim of a Large Flanged Ring, but the Plates must be spaced internally from the Ring by two Washers and one Spring Clip. The centre holes in each Plate are used for the initial attachments, but Nuts are left fingertight. The ends of each Plate are now overlapped in turn, overlaid with vertical 2½" Strips and bolted to the Large Flanged Ring with the same stand-off spacing just mentioned. The assembly should be stood on a flat table top to check that all plates are aligned at their bottom edges and are standing vertical to the Flanged Ring. All Nuts are tightened in turn and then Bolts and Nuts are added to the bottom end of each 2½" Strip, but not to the upper end. These should be left clear to avoid fouling the internal rollers.

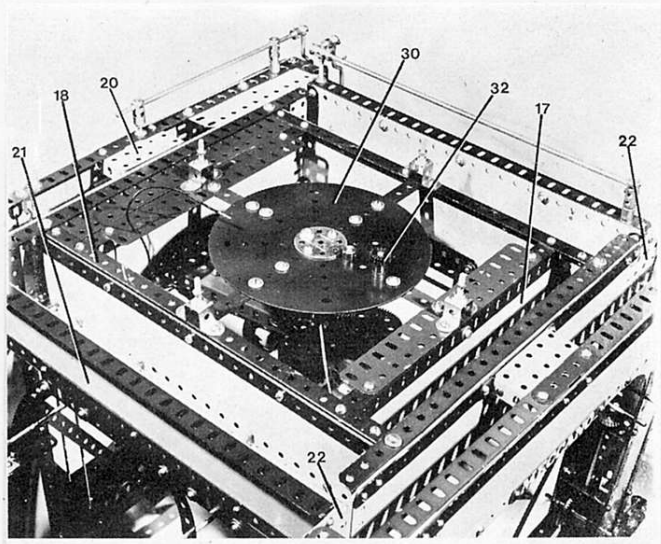
Fig. 9 shows the drum in position on the Tower and it is attached to ½" Bolts set in Double Bent Strips which can be seen centrally located on the sides of the 9½" square at the top of the Tower in Fig. 8. A roller race is made from a 7½" Circular Strip fitted with four Couplings 37, attached by pairs of ½" Bolts and four Collars mounted by standard Bolts, Washers and lock-nuts. The Couplings carry 2" Rods and the Collars are fitted with 1½" Rods. Spring Clips hold eight ¾" Flanged Wheels on a fixed radius so that their rims just run inside the upturned flange of the Large Flanged Ring. When a second Flanged Ring, fixed to the boom above, is located over the rollers, they become self-centring, allowing electrical contact to be passed up the crane through the centre of the roller bearing to the machinery house. It will be noticed in Fig. 9 that a 2½" x 1½" Plastic or Transparent Plate 38 is bolted to the Flanged Ring and has a ¾" Washer attached. This acts as an insulated electrical wiper to pass current up to an insulated ring in the upper half of the roller bearing and this will be dealt with in PART 2 of this feature to be published in the October MM. When fixing the roller bearing drum to the Double Bent Strips, lock-nuts must be placed on the bolt shanks to ensure level plane attachment without distorting the Large Flanged Ring.

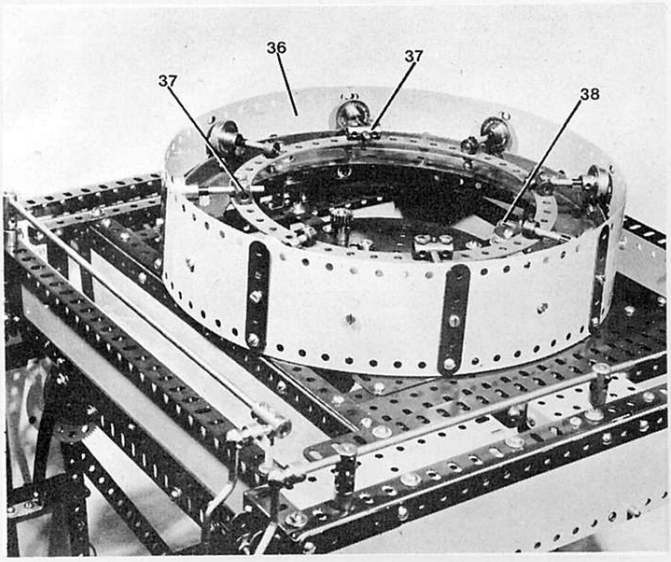
TOWER LADDERWORK

A pair of 12½" Strips 39 are joined at their centre holes by a 1" Screwed Rod, four lock-nuts and Washers (optional). In alternate holes of each Strip ¾" Bolts are fixed with one lock-nut to form rungs and ½" Reversed Angle Brackets are bolted to the foot of the ladder, attaching these to the front holes of the horizontal 18½" Angle Girders 1 as shown in Fig. 4. At the same points, Rod and Strip Connectors are attached to hold a pair of 8" Axle Rods acting as the first section of handrails. These Rods pass through Right-angled Rod and Strip Connectors and these are attached by a pair of ¾" Bolts with lock-nuts to the ladder, ten holes down from the top. The top pair of holes in the ladder are left open and the second holes are fitted with Angle Brackets with which the ladder is secured to the vertical 12½" Angle Girders of the Tower portals, one hole down from the top. A pair of 3½" Crank Handles continue the handrails, terminating in Handrail Couplings at the top of the ladder. From here, handrails may be extended to suit any residual Axle Rods or spare Couplings.

TO BE CONCLUDED IN OUR NEXT ISSUE

Fig. 8, below left, is a top view of the tower platform showing the final slew drive pinion and construction of central section. Note the Double Bent Strips with Bolts to support and to secure the turntable drum. In Fig. 9, below right, the turntable drum and roller race are shown in position. Note the absence of Bolts in the upper rim to give roller clearance inside the drum. A large Washer on a pair of small Plastic Plates is bolted to the Flanged Ring to act as an insulated contact wiper arm for the revolving crane boom.





Electric Dockyard Crane

Part 2

A No.10 Set model built & described by B.N. LOVE

In the first part of this feature, published in the July MM, we gave building instructions for the bogies and travelling tower of this highly impressive No. 10 Set model. Now we conclude the building instructions by covering the boom, the upper part of the turntable, the machinery house, the travelling crab and the hoist system.

MAIN BOOM CENTRE PORTION

Figs. 10, 11 and 13 show the simple box structure and upper turntable ring forming the centre portion of the boom and of these, the turntable ring should be constructed first. A 'flexible joint' arrangement is used here by attaching a large Flanged Ring to a sandwich of two 6" Circular Plates via four 3½" x 2½" Flexible Plates 40 as shown in Fig. 10. This allows the inevitable flexing of the boom under load without distorting the centralising of the gear drive to the turntable. 2½" Curved Strips 41 are overlaid on the slotted holes of the Flexible Plates for additional anchoring where they are attached to the Flanged Ring. Four Double Arm Cranks 42 are bolted to the Circular Plates, as shown, and they carry 2½" or 3" Rods to form a 'cage' axle adding considerable rigidity to the central drive and ensuring that the 3½" Gear Wheel 43 cannot slip. All four rods are locked into their Double Arm Cranks, but only two of them are fixed to the 3½" Gear Wheel by means of Rod Sockets, the other two Rods simply protruding through the Gear by a few millimetres. When securing the inner Bolts, an 8-hole Bush Wheel is inserted through the Circular Plates' centre holes and fitted with a 4" Rod which is also locked into the boss of the 3½" Gear Wheel, allowing about one inch of Rod beyond the boss. This extension will locate the upper turntable ring in the 8-hole Wheel Disc which is already mounted in the centre of the lower portion of the turntable.

At this stage, the electrical pick-up is fitted for power to the hoisting motor. Fig. 11 shows a second 5½" Circular Girder 44 suspended and insulated by a pair of 5½" x 1½" Plastic or Transparent Plates, 1½" below the first Circular Girder. A feed wire is bolted to the insulated Circular Girder and passed up eventually to one terminal of the Powerdrive Motor in the machinery house. Modern Meccano is well enamelled so the second terminal of the motor is fitted with an 'earth' (chassis) return lead fastened by a Bolt and lock-nut into a Collar at the top end of the Axle Rod passing through the 3½" Gear Wheel. This ensures a good return path for the power supply to the crane tower.

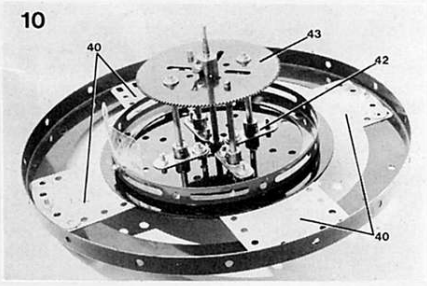
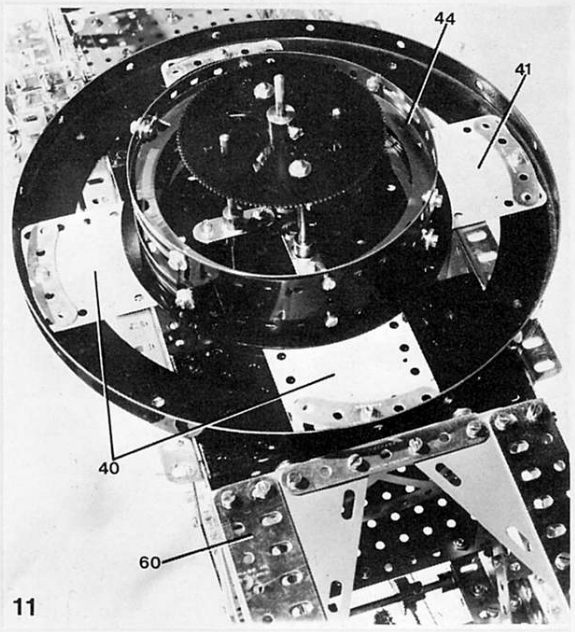


Fig. 13 shows the central portion of the boom which is of box construction, the base being a pair of 5½" x 2½" Flanged Plates, upside down and secured at the extreme ends of the 9½" Angle Girders 45 shown externally. Standing vertically at the four corners of this 5½" x 9½" base are 5½" Angle Girders 46 sandwiched between the 9½" Girders and the Flanged Plates. Four vertical 5½" x 2½" Flexible Plates reinforce the uprights, overlaid by 5½" Strips and spaced by another pair of similar Strips horizontally to form the windows of the central section. Transparent Plates and 2½" Narrow Strips complete the windows and the construction is clear from Fig. 13.

At this stage, the first of the long girder sections is fitted by placing 18½" Angle Girders

Fig. 10, above, and Fig. 11, below left, show the upper ring of the turntable, Fig. 11 showing it fixed in place to the underside of the boom. Note the 'flexible joint' provided by Flexible Plates 40 which allows flexing of the boom without distorting the centralising of the gear drive to the turntable. Fig. 12, below right, a close-up view of the forward boom showing the crab trolley in position. Note the liberal cross-bracing of the boom.



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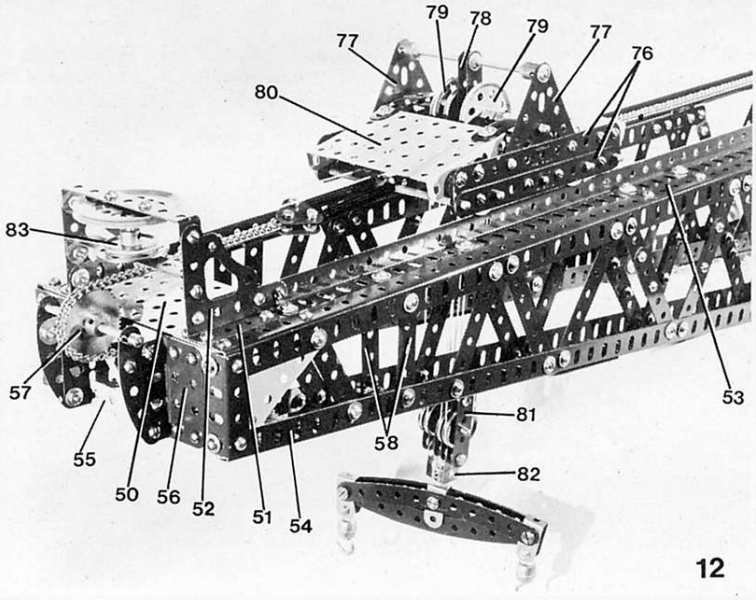

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47 on the top of the centre box, allowing seven holes clear overhang to the rear which gives eleven holes clear overhang to the front. One 5½" x 2½" Flanged Plate is placed across the top of the structure in its centre and bolted to the Angle Girders and then the first of the upper deck plating is attached by fitting 5½" x 3½" Flat Plates at either side of the Flanged Plate. Anchoring plates for the front end of the boom are provided by 1" Corner Brackets 48 while 2½" Strips are bolted on at the back for the rear section and these can be seen in the various illustrations. One 5½" Braced Girder 49 is used at the front of the centre box section to give lateral support between the 5½" vertical Girders. The completed section can now be bolted to the upper turntable ring and this is done at two points only, through the centre holes of the leading edges of both inverted Flanged Plates which coincide with the holes on opposite sides of the large Flanged Ring (see Fig. 11).

A trial run should be carried out to ensure that the centre section of the boom is running properly on the turntable. Adjustment of the Spring Clips on the roller race will be required to ensure that the small Flanged Wheels run just clear inside the flange of the lower Flanged Ring. Meshing of the final turntable drive Pinion from the tower to the 3½" Gear Wheel is best adjusted by setting the 19–t Pinion up or down on Washers to obtain centre line engagement. A check should be made to ensure that the small Flanged Wheels do not scrape against the inside of the turntable drum and that they are all properly located inside the flanges of the turntable rings. Rotation from the Powerdrive Motor below should be almost effortless at this stage. Light lubrication of the rollers and a smear of graphite grease will assist smooth running on the ring flanges.

FORWARD BOOM;

Double bracing of channel section girders is employed throughout the forward section of the boom and these must be assembled by judicious use of the Angle Girders and Strips left in the No. 10 Set. Two side frames are made up of identical, but reversed (mirror image reversal), construction. Fig. 12 should be carefully studied as this gives most of the required visual information. A start is made by bolting a 24½" Angle Girder by its round holes to the 5½" x 2½" Flat Plate 50 which forms the small platform on the top of the leading edge of the boom. This is the upper and outer girder. The inner and upper girder is another 24½" Angle Girder, but this time it has only one hole lapped on to the 5½" Flat Plate, the space in front of this Girder being taken up by a 2" Girder 51 bolted on to the Flat Plate by its round holes. A joint between these two Girders is made by the five-hole edge of a Corner Gusset 52 and this is clearly seen in Fig. 12. Note the arrangement of the slotted flanges of all Girders throughout the construction of the boom.

Twenty-six holes back from the boom front, the upper 24½" Girders are joined by a reinforcing plate which is a 2½" Flat Girder 53. The inner Bolts for this Flat Girder also hold a 12½" Girder, slotted flange downwards, under the upper 24½" Girder. Location of the 12½" Girder is fifteen holes back from the front of the boom. A second channel section for the lower edge of the boom is another pair of 24½" Girders, but this time they are staggered by five holes instead of four. The outer lower 24½" Girder 54 is bolted to a second 5½" x 2½" Flat Plate running across the boom head at the lower level and the other 24½" Girder has its leading vertical slotted hole joined to the rear edge of the Flat Plate by a Right-hand Corner Bracket and this can be seen in Fig. 12. Twenty holes back from the boom head, a 2½" Flat Girder makes an overlay joint under the lower pair of 24½" Girders.

All of the double bracing struts for the boom are set at an angle as shown, starting with 2½" Strips five holes in for the top girders, angled to seven holes in for the lower girders. Across the boom head, a 5½" Braced Girder 55 forms a bracing panel four holes deep and this is reinforced by 2" Girders vertically at the corners and fronted by Girder Brackets 56

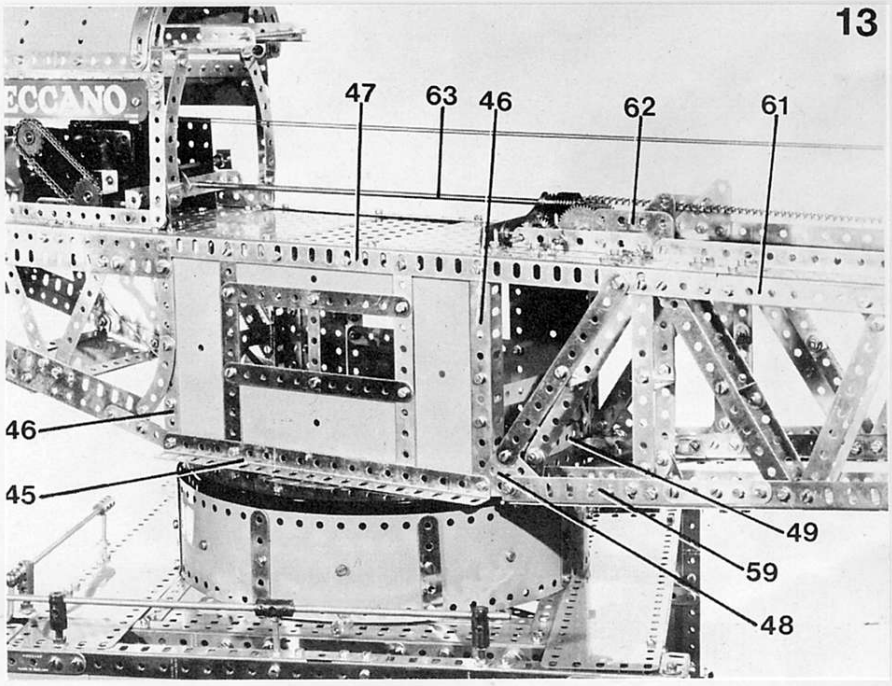
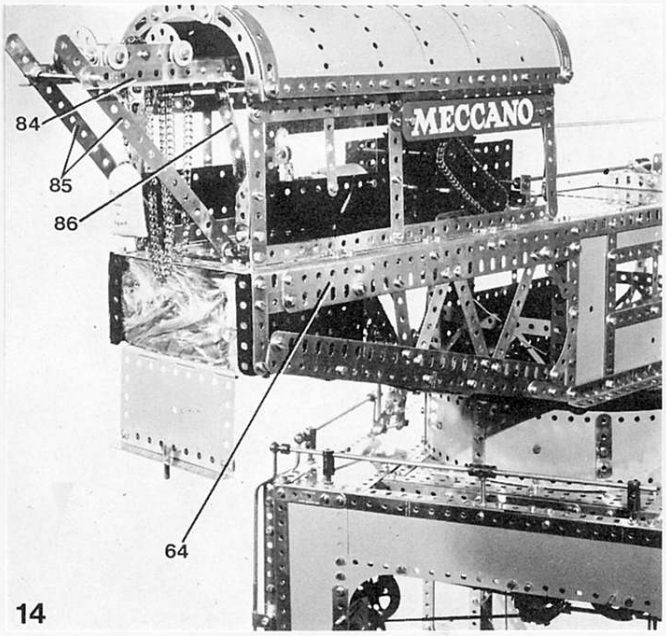
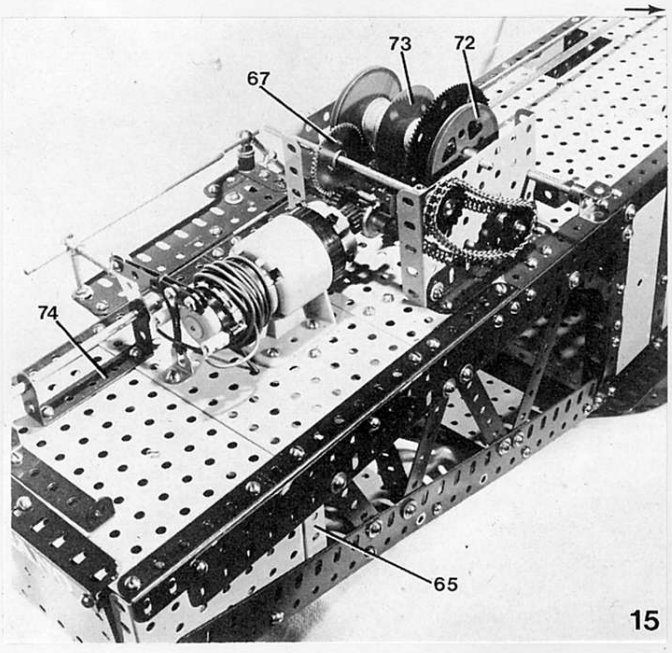


Fig. 13, a close-up view of the central portion of the boom secured to the upper turntable ring. Note that the boom is fixed to the ring at two points only, as described in the text. Construction of the control cabin representation is also fairly clear from this illustration.

Fig. 14, below left, shows the rear boom section which also includes the machinery house and service gantry. Note the counterweight compartment beneath the machinery house, the author filling this with sand held in a strong quality plastic bag. Fig. 15, below right, shows the rear boom section viewed from above, with the machinery housing removed to show the hoist and trolley winch and driving motor. Also, note the solid deck plating





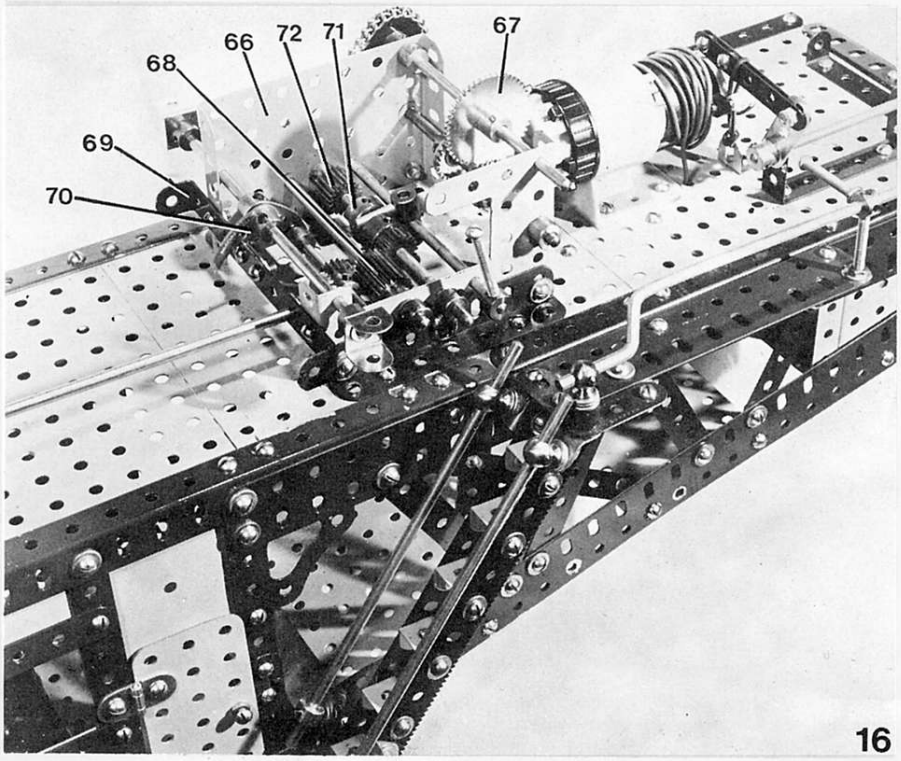


Fig. 16, another close-up view of the hoist and trolley winch, this time with the winding drums and one side plate removed to show the gearing and control linkages. Again, attention should be drawn to the very solid construction of the deck, thanks to the liberal use of Flat Plates.

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carrying 2½" Curved Strips, stood off by Fishplates at the upper ends to form journals for the head wheel of the crab-trolley chain-drive. Note that Cord Anchoring Springs locate the 3" Axle Rod at the boom head and that a 50–t Gear Wheel 57 plays the role of a sprocket wheel. One 4½" Angle Girder runs behind the upper edge of the Braced Girder and is fixed under the top 5½" Flat Plate to give a firm bracing.

The second pair of bracing struts for the boom are almost vertical and are made from 2½" Double Angle Strips 58. Due to the limited numbers of short Strips in the No. 10 Set, Double Angle Strips are pressed into service to brace the boom where possible. A general pattern for the remainder of the bracings is clear from Figs. 12 and 13, progressing through 3", 3½" and 4" Strips as available. Where obvious joints are shown in the bracings, combinations of lapped 2½" or 3½" Strips are used. Towards the back, the boom frame opens up to accept 5½" Strips and these are shown in Fig. 13, but these are not fitted until the boom frames are near completion when they are married to the 18½" Girders protruding from the centre box section of the boom. Because of the staggers in the 24½" Girders, rear extensions are required. Lower channels are extended rearwards by a 5½" Girder 59 outside and a 3" Girder inside. To ensure a straight and strong joint here, the underside of the channel is lapped by a 9½" Flat Girder 60, first portions of which can be seen in Fig. 10. The rounded hole flange of the topmost pair of 24½" Angle Girders form the running rails for the crab trolley and the inward ends are bolted on to the leading edge of a 5½" Flat Plate running across the boom just in front of the crab driving gear. Three holes overlap is required on to the Flat Plate and then, starting at the top of the vertical forward 5½" Girders of the central box section, first a 3½" and then a 3" Flat Girder are used as overlays on the top girders at the same time. The join of the outer top 24½" Girder to the 18½" Girder is overlayed at the side by a 5½" Strip 61.

A pair of 3½" Angle Girders form journals for the crab driving gear and are joined to the rear end of the crab rails by 2" Flat Girders 62, mounted vertically as shown in Fig.13, together with 1½" Corner Brackets which act as rear stops for the crab trolley. A slipping clutch mechanism is provided as follows: on the final drive shaft for the crab chain, a 57–t Gear Wheel takes the place of a sprocket and is pressed against a 1" fixed Pulley with Rubber or Plastic Ring, by a Compression Spring and Collar. No Grub Screw is put into the Gear Wheel which revolves only under the friction drive and will slip when overdriven at either end of the crab trolley run. A second gear wheel, this time a 50–t Gear, is also fixed to the shaft and is then driven by a 25–t Pinion and this can be seen in Fig. 13. A Journal for the longitudinal Worm drive shaft 63 is provided by a 2½" Curved Strip bolted to the vertical slotted flange of a 4½" Angle Girder across the boom as shown. The Worm at the end of the 11½" Rod engages with a 19–t Pinion on the reduction shaft.

REAR BOOM

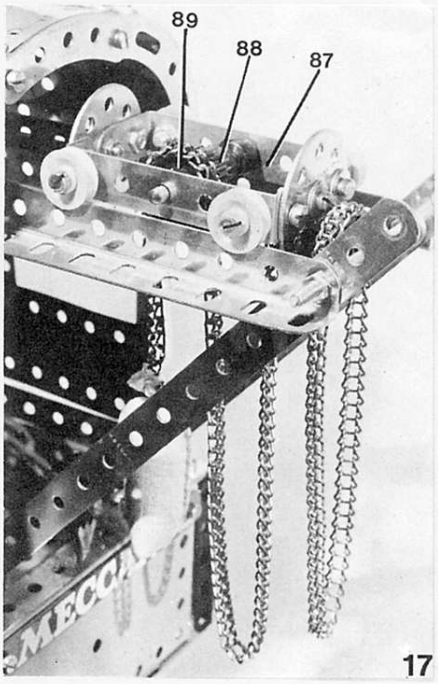
Fig. 14 illustrates the general construction of the rear boom in which the seven holes of the overhanging 18½" Angle Girder are extended by a 9½" Girder and reinforced as shown by an external 12½" Flat Girder 64, with slotted holes downwards to facilitate strut attachment. Upper deck plating can now be completed as shown in Fig. 15 and this requires one 5½" x 2½" Flat Plate followed by three 5½" x 3½" Flat Plates. A counterweight compartment is made from a 5½" x 2½" Flanged Plate 65, flanges forward and two 3½" x 2½" Flanged Plates to form the sides. A baseplate for the box is a 5½" x 3½" Flat Plate with its forward edge bolted to the lower flange of the Flanged Plate and secured by 1" x ½" Angle Brackets to the tail of the boom. A 4½" x 2½" Hinged Plate is bolted over the base of the box and capped with a 4½" Girder to form a closing lip when shutting the counterweight compartment. A good quality plastic bag with no perforations is filled with sand for stuffing into the box. Before doing so, the Meccano Ball Race, complete, should be bolted on centrally below the counterweight compartment for added ballast. If heavy loads are to be lifted, additional ballast in the form of lead weights should be substituted for the sand bag. Additional reinforcing for the lower 12½" Flat Girders on the rear boom is provided by internal 12½" Strips and a cross bracing below is provided by sandwiching 5½" x 2½" Flexible Plates and attaching them across the lower rear of the boom by Angle Brackets. Single strut bracing is added as shown, using appropriate Strips and Double Angle Strips as available.

HOIST AND CRAB TROLLEY GEAR

Figs. 15 and 16 show the hoist and trolley mechanism which is mounted in a pair of 3½" x 2½" Flanged Plates 66 supported by 3½" Angle Girders secured to the decking. One Plate has been removed to show the gearing clearly, as seen in Fig. 16. Location of the Plates and Powerdrive Motor is also clear from the illustrations and it will be seen that a 19–t Pinion on the motor shaft engages with a small Contrate Wheel to drive the first shaft of the gear box. From here, a 25–t Pinion drives the upper rear shaft via a 50–t Gear Wheel 67 and this shaft carries the drive by 1" Sprockets to a take-off shaft, three holes back from the front of the gearbox and two holes up. This shaft runs continuously when the motor is switched on. Drives to the crab or hoist are taken off by sliding Pinions from a ¾" face 19–t Pinion 68 mounted just inside the sideplate. A rear bearing for the 11½" Axle Rod 63 to the Worm drive is provided by a 4½" Double Angle Strip 69 mounted across the front of the gearbox two holes up and the Rod is fitted with a small Contrate Wheel at its inner end. A sliding shaft, operated by a second sliding shaft, moves a 19–t Pinion into engagement with either side of the small Contrate Wheel to effect reversing of the crab-trolley drive. Two Pawls with Boss 70 are fixed to the gear-shift shaft and the rear Pawl drops between a pair of Collars. In the fully 'off' position the 19–t Pinion for the crab is completely free of the long-face Pinion.

A take-off drive to the hoisting drum is provided also by a sliding shaft operated by yet another sliding shaft and this can be seen in the centre of the mechanism shown in Fig. 16. A Socket Coupling 71 is locked both to its shaft and to a 19–t Pinion and on the far end of the shaft a ½" face 19–t Pinion 72 passes on the drive to the winding drum and also

Fig. 17, a close-up view of the service hoist which, despite its comparatively simple construction, is nicely operational.



provides the 'stop' position when the shaft is disengaged. A simple, but effective, brake is provided by a Set Screw (*NOT* a standard Bolt!), in the Collar outside the gearbox on the take-off shaft mentioned so that when the hoist is disengaged by pushing the control lever inwards, the Set Screw locks against the external Collar on the adjacent shaft. It is important to fit that Collar with a 3mm Grub Screw to prevent 'knocking' every time the Collar rotates, which it will do all the time the motor is running. The control lever for the hoist is a long Bolt in a Collar on the end of a 4½" Rod with a Coupling in the centre of the Rod, fitted with two 1" Rods as a 'fork' for shifting the hoisting gear into mesh via the Socket Coupling.

Fig. 15 shows the twin hoisting drums in position which are made up as follows: first, a 2" Pulley 72 acts as a spacer, boss outwards, followed by a 2½" Gear Wheel, also boss outwards. Pressed to the face of the gear is a Conical Disc taking the closed end of a Chimney Adaptor against it. Inside the Chimney Adaptor is a Cord Anchoring Spring to which one end of a hank of Cord is attached after first passing the Cord through the side hole of the Chimney Adaptor. The process sounds fiddly, but is quite straightforward if done with a bit of patience and common sense and care is taken to ensure that the spring is rotated in the 'uncoiling' sense when locating it centrally inside the Chimney Adaptor. A back-to-back pair of Conical Discs 73 are now put on to the shaft to separate the twin drums and the second drum fitted, as described. Finally a second 2" Pulley traps the outer Conical Disc in place and all bosses are securely locked with Grub Screws. With the spacing described, the 2½" Gear Wheel will mesh correctly with the ½" face 19-Pinion below. A control switch rod for the Powerdrive motor is mounted in a 2½" x 1" Double Angle Strip 74 and led to the rear of the boom for reversing and stopping. Two 2½" Narrow Strips, spaced by Nuts, straddle the motor lever as shown in Fig. 15 and are held in place by a Driving Band through a ½" Angle Bracket bolted to the deck. Cranks, or long Bolts in Collars are used as shift levers on the Rod operating the motor switch.

CRAB TROLLEY

This is shown in Figs. 12 and 18 and the view from below should be studied first. The original trolley shown in Fig. 18 uses two Double Bent Strips 75 to support and space the lower pulley shaft. However, four Double Bents Strips are required to give the proper support for the turntable drum mounting on the crane tower, so one Crank is used to replace these parts and this will hold the shaft in place. Both Ratchet Wheels are retained to give correct spacing, with the internal Spring Clips, for location of the two 1" fixed Pulleys which are free to turn on the shaft and form part of the hoist system. It will also be noticed that four Cord Anchoring Springs are used on the front and rear draw bars of the trolley to locate the Axle Rods in place. These should be replaced with Spring Clips, one lug of which is trapped between the side Flat Girders of the trolley and the flange of the 3½" x 2½" Flanged Plates. Double Tension Springs are provided to take up slack in the Sprocket Chain drive and thus maintain tension throughout. All four 1" fixed Pulleys used as travelling wheels for the crab are free to turn independently, one being fixed by a Grub Screw on each 4½" Axle Rod while the second Pulley on each Rod is held in place by a Collar.

Upper construction of the crab is shown in Fig. 12, overlaying 5½" Strips 76 on the Flat Girders forming journals for the travelling wheel shafts. A pair of 2½" Triangular Plates 77 are joined across the top by a 3½" Screwed Rod running into Threaded Bosses and 2" Slotted Strips 78 are separated by a Spring Clip and lock-nutted in the centre of the Screwed Rod. These form internal spacers for a pair of 1" loose Pulleys which themselves are spaced by a Washer or two from 1½" Pulleys 79, boss outwards, these being located by Collars. The 'spring' effect of the Formed Slotted Strips securing the fore and aft 3½" x 2½" Flanged Plates 80 holds the pulley shaft in place. It is important that the side frames of the trolley are spaced from the flanges of the 3½" Flanged Plates by Spring Clips on ⅜" Bolts, eight of each being required and located in the positions shown. The slight upwards tilting of the Flanged Plates gives added rigidity to the trolley, apart from improving its appearance.

HOOK BEAM AND PULLEY BLOCK

Details of the block can be seen in Fig. 12 where six 2" Strips 81 form separators for the four 1" loose Pulleys running on a 1½" Axle Rod. This is trapped between the centre 2" Strips by a Spring Clip. Long Bolts are used with a series of lock-nuts at the top and bottom of the pulley block to set up critical spacing for free running of each Pulley. When fitting the lower 1⅛" Bolt, a 1" x ½" Double Bracket 82 has to be juggled into position and set to swing freely. A Pivot Bolt with Collar spacing passes through the Double Bracket into a Double Bent Strip and is secured by lock-nuts, allowing the hook beam to revolve freely. Reversed pairs of 5½" Curved Strips form the actual beam and the Pivot Bolts employed use internal Washer spacing to maintain the universal pivotting properties of the beam hooks which are attached by lock-nutted Bolts to the outer Double Bent Strips. All bolted elements of the hook beam must be set and spaced to swing freely.

HOIST SYSTEM

The double hoist system employed permits the winding drums to 'coil' at slight differences without tilting the pulley block and the first reeving of each separate cord from the twin drums is over the top 1½" Pulleys 79 of the crab, through the lower block, up round the top inner 1" loose Pulleys, down through the block again then up and over the lower pair of 1" fixed Pulleys (but loose running) in the lower portion of the crab. The twin tails of the cords then go up round the compensating Pulley 83 at the boom head where they are knotted together. Very little movement of the cord will ever be seen at this point, but the compensation for drum 'coiling' differences is quite automatic. Two 3½" Double Angle Strips form supports for the compensating Pulley, a 1" fixed Pulley free to revolve over a Wheel Disc on a 1" Rod fixed in a 2" Pulley bolted to the boom head brackets (Corner Gussets 52).

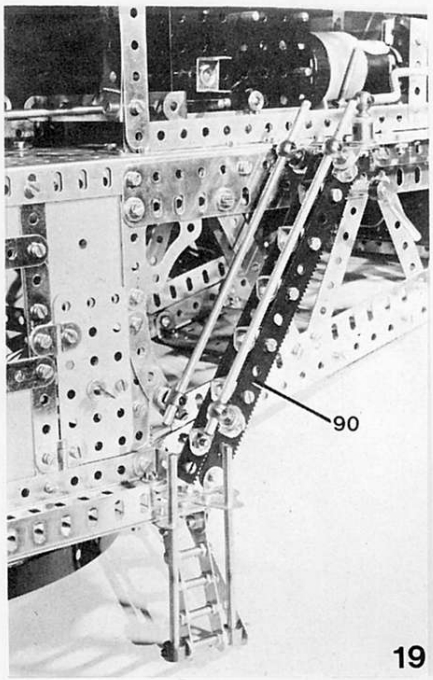


Fig. 19, the upper section of the access ladder-work. Note the unorthodox use of the Rack Strips 90 contained in the Set!

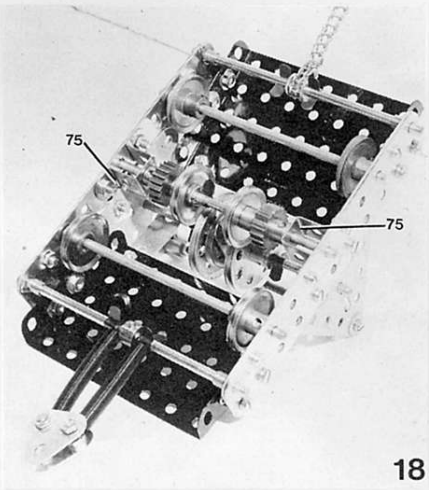


Fig. 18, an underside view of the gantry crab trolley. Note that one of the two Double Bent Strips 75 should be replaced with a Crank.

MACHINERY HOUSE & SERVICE GANTRY

Fig 14. shows most of the machinery house and service gantry which is of simple and open construction. The housing is 12½" long, using 12½" Strips with 5½" Double Angle Strips (preferred) so that Threaded Pins, either long or short, can be fitted to the bottom lugs of the Double Angle Strips and will thus allow the machinery house to be easily and quickly removed or located on the rear boom. It should be remembered that the structure forms part of the general balance or counterweighting of the whole boom. A gantry is formed from the last remaining pair of 18½" Angle Girders 84 in the No. 10 Set and these are supported by a pair of 9½" Strips 85 acting as rear struts, see Fig. 14. Curved Strips (4½") 86 and 1" x 1" Angle Brackets make vertical supports for the gantry rails and spacing for the rails is supplied by lock-nuts on a 3" Screwed Rod at the rear end and by a double thickness of 3" Curved Strips under the front end of the 18½" Girders. Roofing is made from twelve 5½" x 2½" Flexible Plates curved to the form of combined 3" and 2½" Curved Strips at either end, each side of the roof overhanging the machinery housing by the width of Double Brackets or ½" Reversed Angle Brackets. Four 12½" Strips are used on the roof, two along the top, 2½" apart, and two more along the lower edges each side.

There are enough parts left in the No. 10 Set to make a working service hoist as shown in Fig. 17. One 2½" x ½" Double Angle Strip and one 2½" x 1" Double Angle Strip 87 are bolted to a pair of 8-hole Wheel Discs and fitted with four ½" Plastic Pulleys, as shown, by ⅜" Bolts. A 3" Rod runs lengthwise through the bottom holes of the Wheel Discs and is rotated by Sprocket Chain in a 10" loop over a 1" Sprocket Wheel. This shaft carries a Worm which meshes with a 19-t Pinion 88 on a 2" Rod across the centre of the hoist. One end of an 18" length of Sprocket Chain is secured to an end Bolt of the hoist and then passed over a 1" Sprocket 89 also on the centre shaft and fitted with a Hook at the free end of the chain. Setting of the gantry rails should be to allow full run of the hoist right through the machinery house.

Final details are added by last stages of ladder work right up to the machinery house where even the 6½" Rack Strips 90 are pressed into service as ladder sides! (See Fig. 19). Six ½" Double Brackets form the final flight of steps and a Handrail Support set in a Threaded Crank at the top of the steps takes a Crank Handle for the last section of safety rail.