Meccano Hammerhead Crane

A powerful model of one of the massive cranes used in shipyards and harbours

Fig. 2. A Giant Hammerhead Crane at work.

Fig. 1. General view of the Model Hammerhead Crane.

SPECIAL FEATURES

The movements of the model comprise the rotation of the boom, the traversing of the crane trolley or traveller, and hoisting, and all are operated by the Electric Motor mounted on the shorter arm of the boom. The boom is supported by a built-up roller bearing and all the movements are controlled by levers conveniently situated on the gear box.

THIS model is an elaborate and very interesting example of the latest Meccano construction. The particular type of crane from which it has been designed is known as the "hammerhead"—a title easily explained from a glance at the general shape of the structure—and the realistic appearance of the model is well shown by comparison with the illustration on the preceding page of an actual hammerhead crane.

Hammerhead cranes are used in shipbuilding yards and other places where it is required to move heavy loads over a large radius ; they have been specially adapted, also, to the construction of harbours, breakwaters, etc., and in this work they have proved their value in swinging into position the huge blocks of concrete, weighing tens of tons, which form so stout a defence against the might of the sea.

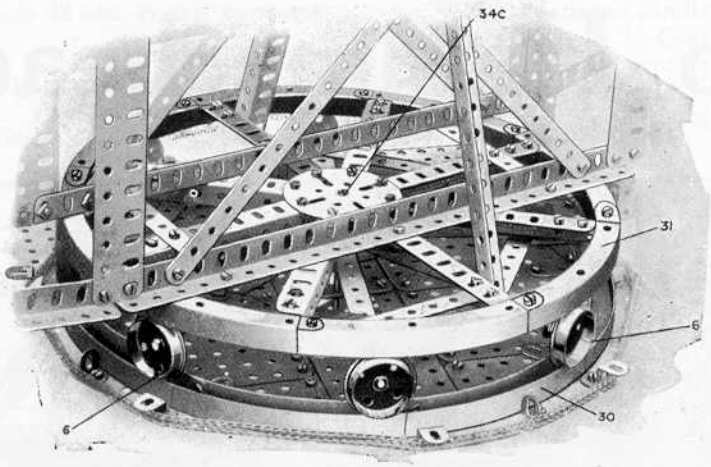

Fig. 3. The Roller Bearings, completely assembled. Note how the main Boom is secured.

Building the Meccano Model

In building the model the main tower or pedestal should be constructed first. As in the actual crane this part is of very massive construction, for it must be capable of withstanding exceptional stresses and strains. Each vertical corner member 1 (Fig. 1) is composed of three 24½″ Angle Girders, connected at the top and bottom by 12½″ Angle Girders 2. The framework is held perfectly rigid by means of a series of ties and struts consisting of 12½″ Strips 3 and Flat Girders 4.

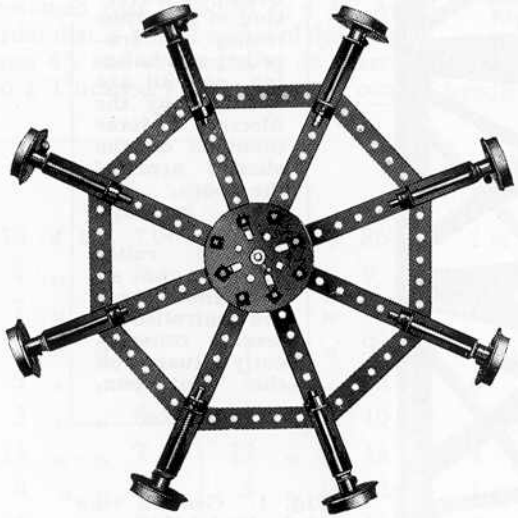

Fig. 4. The Spider Frame

The upper platform that carries the rotating boom is composed of a number of Flat Plates bolted to the 12½″ Angle Girders that are secured transversely in the tower. This platform is shown in Fig. 5 and it will be noted that a space is left at its centre to accommodate the Axle Rod 34c (Fig. 3) of the wheel race. When the construction of the tower has been completed, attention may be given to the roller bearings on which swivels the rotating arm or boom of the crane.

Arrangement of the Roller Bearings

Where a heavy mass is to be rotated about an axis, it is necessary to devise some method of relieving the tremendous strain that would be imposed upon that axis. The usual procedure is to distribute the weight of the mass over wheels or rollers arranged at a distance from and rotating round the central pivot. This arrangement is employed in the Hammerhead Crane to take the weight of the boom, and so allow it to rotate freely on its axis.

The construction of the main pivot and roller bearing, or wheel race, is shown in Figs. 3, 4 and 5. Fig. 3 shows the bearings completely assembled. Fig. 5 is a plan view of the lower wheel race, and Fig. 4 illustrates the spider or wheel frame. The lower or stationary race 30 (Fig. 3) is constructed from eight Channel Segments and forms a track upon which the spider frame revolves. From Fig. 5 it will be noted that the Channel Segments are bolted to the base by means of 1″×½″ Angle Brackets 58. Care should be taken to see that the Segments meet correctly to enable the wheels to run smoothly.

Eight Flanged Wheels (Fig. 4) are mounted on 2½″ Rods that are journalled in 1½″×½″ Double Angle Strips. The latter are bolted to a frame, or "spider," composed of eight 4½″ Strips placed radially round a Face Plate and bolted thereto. The frame thus formed is braced securely by means of eight 3½″ Strips placed as shown.

The revolving upper race (31, Fig. 3) is secured to the base of the boom and rests upon the wheels 6, and a shaft 34c journalled in the bearing 61 (Fig. 5) forms a common

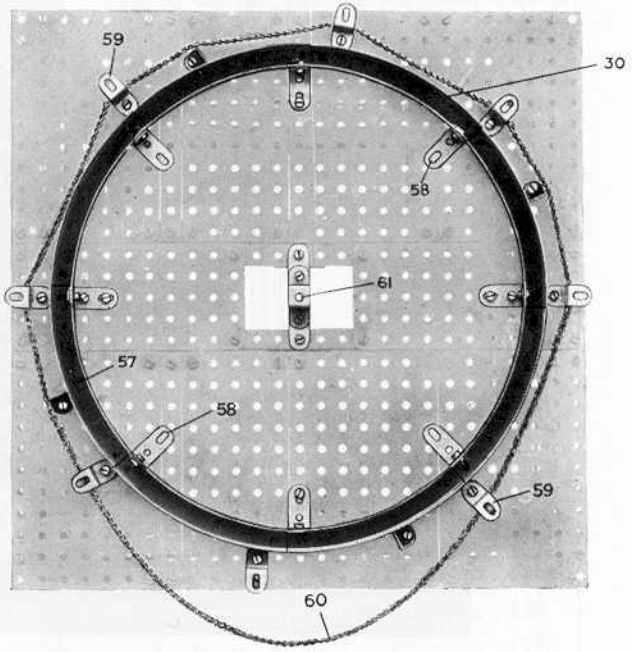

Fig. 5. Plan view, showing construction of the upper Platform and the lower fixed Roller Race.

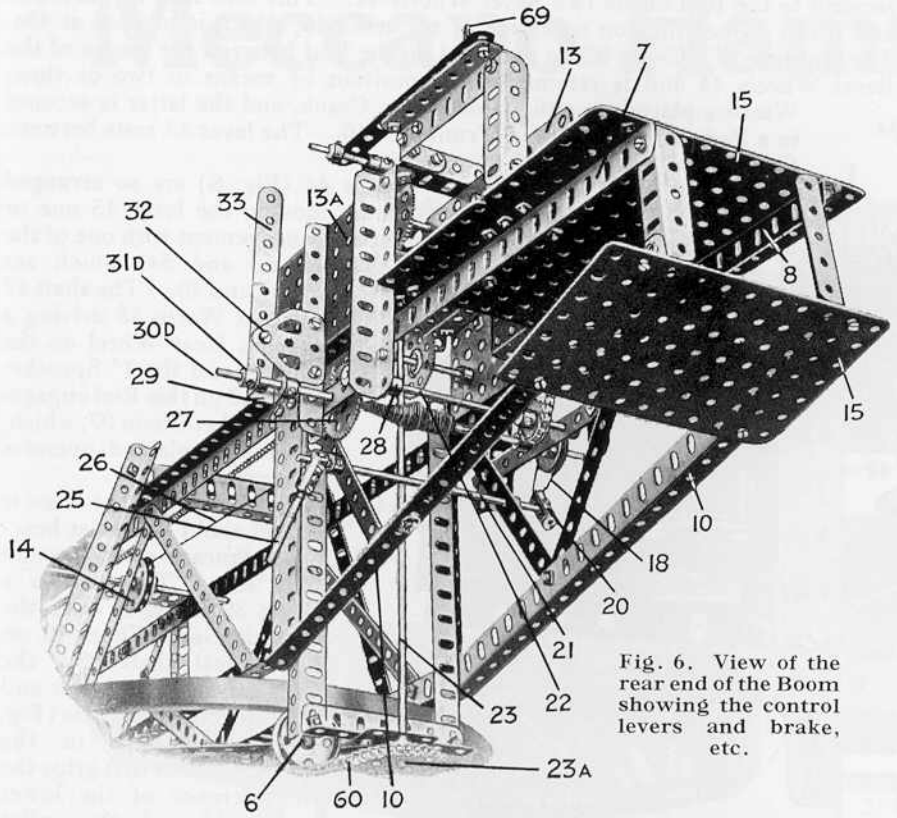

Fig. 6. View of the rear end of the Boom showing the control levers and brake, etc.

axis for the spider frame and revolving race, both of which rotate at different speeds. The bearing 61 consists of a Double Bent Strip bolted to a $2\frac{1}{2}$" Strip that, in turn, is secured to the upper platform of the vertical tower. The shaft 34c should be secured in the Face Plate forming the hub of the upper race, but the spider frame should be allowed to swivel freely upon it.

A vertical driving Rod 23 (Fig. 6) situated on the rotating structure carries a $1\frac{1}{2}$" Sprocket Wheel 23a placed within and engaging the Sprocket Chain loop 60 (Fig. 5). The latter is arranged round the series of Reversed Angle Brackets 59. On rotation of the Sprocket Wheel 23a the chain grips the Brackets 59 and becomes immovable, whereupon the Sprocket commences to travel round the chain, carrying the pivoted superstructure with it.

For the interest of those readers who possess the new Meccano Geared Roller Bearings (Part No. 167), it may be mentioned here that this part can be used in place of the arrangement described. If it is decided to use the new part several slight alterations in the general layout will be required. The necessary adjustments are very simple and do not need a detailed description, for they will become at once apparent when the Roller Bearings are incorporated in the model.

Constructing the Boom and Traveller

Each side 7 and 8 (Fig. 1) of the main boom is composed of two $24\frac{1}{2}$" Angle Girders bolted together. The lower portions of the boom consist of $24\frac{1}{2}$" Girders 9 and $12\frac{1}{2}$" Girders 10 braced by a series of ties and struts 5 and 11. A Pulley Wheel 14 is carried on a $4\frac{1}{2}$" Rod journalled in the Girders 7 and 8 and forms a guide Pulley for the hoisting cord.

The constructional details of the traveller are shown clearly in Fig. 7. The axle frame 62 is constructed from two $3\frac{1}{2}$" Flat Girders connected by two $2\frac{1}{2}" \times 1"$ and one $2\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strips 68. The traversing movement is imparted by means of a Sprocket Chain 37, the ends of which are connected to the Double Angle Strips 68.

As will be seen from Fig. 1, the Chain 37 passes over a 1" Sprocket Wheel 38 carried on a Rod that is journalled in two $2\frac{1}{2}$" Angle Girders secured to the $4\frac{1}{2}" \times 2\frac{1}{2}"$ Flat Plate which spans the front end of the boom. At the rear end of the boom the Chain passes round a Sprocket Wheel 49 (Fig. 8) which is driven by the Electric Motor 13. It will thus be seen that when the Motor is set in operation, and providing that the gear control lever is placed correctly, the Sprocket Chain tends to either draw or pull the traveller along.

A feature of the traveller is the two-sheaved pulley 64 (Fig. 7) with specially deep grooves. This is built up by placing two 1" loose Pulleys 63 between two Bush Wheels.

Operation of Control Mechanism

The three movements of the model—hoisting, traversing of the crane trolley, and slewing—are driven and controlled from the Electric Motor and gear box secured upon the upper side of the boom. The Motor (13, Fig. 6) is bolted to the $5\frac{1}{2}" \times 3\frac{1}{2}"$ Flat Plates 15 carried on the main Girders 7 and 8 of the boom, while the sides of the gear box 13a are bolted directly to the inside flanges of the Girders.

The hoisting gear is operated as follows: the Motor, by means of a $\frac{1}{2}$" Pinion 15a (Fig. 8) on its armature spindle, drives a 57-teeth Gear Wheel secured to an axle carrying a 1"

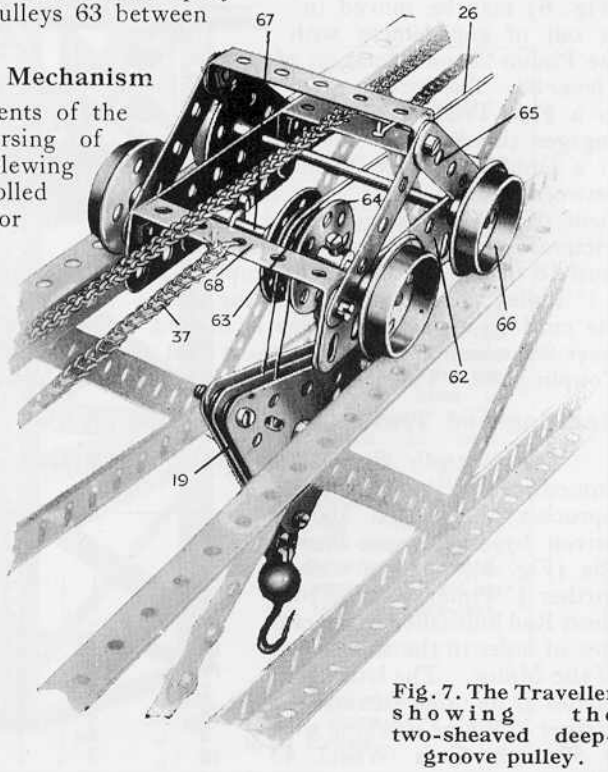

Fig. 7. The Traveller showing the two-sheaved deep-groove pulley.

Sprocket Wheel 16a. The 57-teeth Gear cannot be seen in the photograph as it is hidden by the casing of the Motor. The Sprocket Wheel 16a is connected by a short length of Sprocket Chain to a similar wheel mounted on a Rod 22 (Fig. 6) and a ½″ Pinion 28 secured to the latter Rod drives a 57-teeth Gear Wheel 27 on the winding shaft 30d.

The hoisting cord 26 passes from the winding shaft 30d over a guide Pulley 14 and over a sheave 63 in the traveller (Fig. 7); from thence it is led round one of the sheaves of the two-sheaved pulley block 19, back round the other sheave 63, then over the second sheave in the pulley block 19, and is finally secured in a hole in the Bush Wheels 64. The Bush Wheels are secured to the Rod 67 and do not revolve with the sheaves 63.

The Gear Wheel 27 (Fig. 6) may be moved in or out of engagement with the Pinion 28 on operation of a lever 33. The latter is pivoted to a Flat Trunnion at 32 and engages the Rod 30d by means of a Double Bracket 29 mounted between Collars 31d. The movement of the load is controlled by a friction brake consisting of a length of cord 18 tied to the end of a Coupling 20 and engaging a 1″ Pulley secured to the winding shaft. The grip of the cord 18 about the Pulley is relaxed on lifting the lever 25, which consists of a short Rod attached to the shaft 21 carrying the Coupling 20. The arrangement of the brake is shown clearly in Fig. 6.

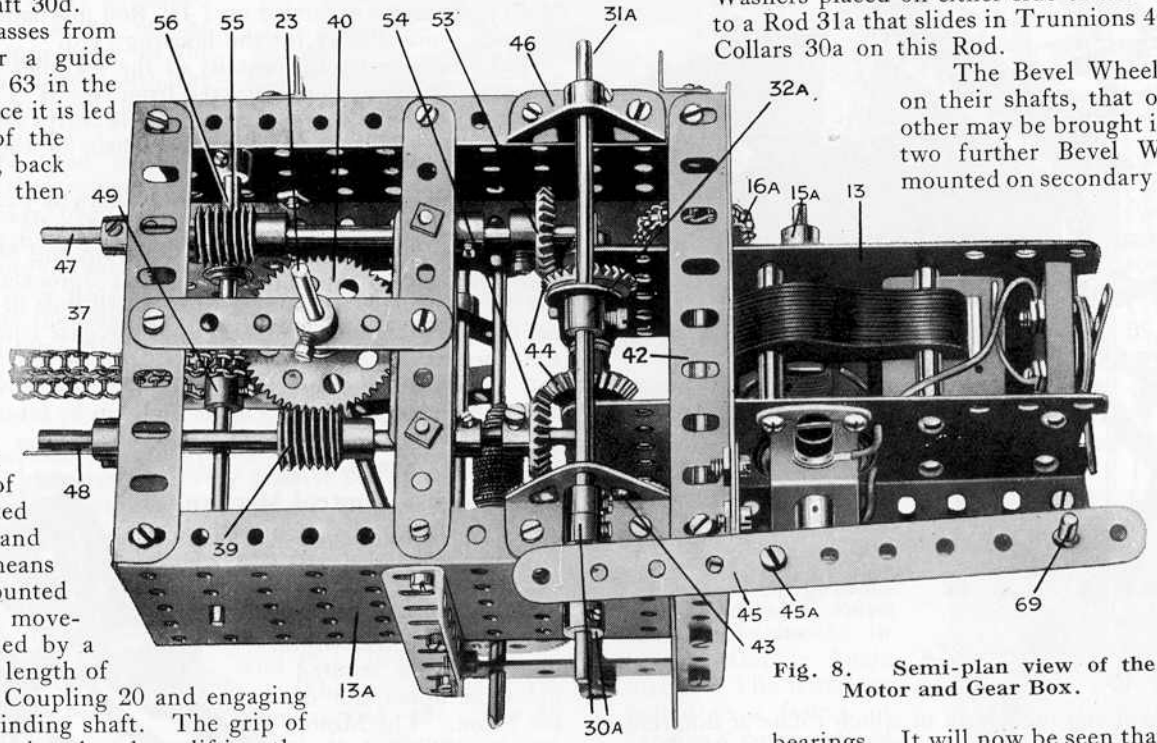

Fig. 8. Semi-plan view of the Motor and Gear Box.

Rotating and Traversing Movements

The 57-teeth Gear Wheel which, as already mentioned, is mounted immediately behind the Sprocket Wheel 16a and is driven by the Motor Pinion 15a (Fig. 8), engages with a further ½″ Pinion secured to a short Rod journalled in the end row of holes in the side casing of the Motor. The latter Rod carries at its other extremity a further ½″ Pinion meshing with a 57-teeth Gear Wheel 43 secured to the Rod of the two Bevel Wheels 44. This Rod may be moved to and fro in its bearings on operation of the lever 45, which is pivoted at 45a. The end hole of a Crank 32a is threaded on the Rod between the bosses of the Bevel Wheels 44 and is retained in its position by means of two or three Washers placed on either side of the Crank, and the latter is secured to a Rod 31a that slides in Trunnions 46. The lever 45 rests between Collars 30a on this Rod.

The Bevel Wheels 44 (Fig. 8) are so arranged on their shafts, that on moving the lever 45 one or other may be brought into engagement with one of the two further Bevel Wheels 53 and 54, which are mounted on secondary shafts 47 and 48. The shaft 47 carries a Worm 55 driving a 57-teeth Gear Wheel on the Rod 56, and the 1″ Sprocket Wheel 49 on this Rod engages the Sprocket Chain 37, which, as already explained, operates the traveller.

The boom of the crane is rotated about the roller bearings by means of the second shaft 48. This carries a Worm 39 engaging with the 57-teeth Gear Wheel 40 on the vertical shaft 23; the latter carries at its lower end the Sprocket Wheel 23a (Fig. 6) which rotates in the Sprocket Chain that grips the circumference of the lower fixed guide of the roller bearings. It will now be seen that a slight movement of the lever 69 enables the Motor to operate either the traveller or the rotating boom.

Several Standard Mechanisms are used in the Hammerhead Crane. They are as follows:—S.M. 32 (Two-sheave Pulley Block), S.M. 39 (Guide Pulley), S.M. 69 (Drive-changing Gear), S.M. 101 (Roller Bearings), S.M. 155 (Overhead Trolley), and S.M. 169 (Traversing Gear), etc.

Parts required to build the Hammerhead Crane

24	of No.	1	20	of No.	8	4	of No.	12	3	of No.	16b	4	of No.	30	1	of No.	48a	4	of No.	70	2	of No.	103d
4	,,	1b	4	,,	8b	2	,,	12a	1	,,	17	2	,,	32	2	,,	52	3	,,	76	1	,,	103h
13	,,	2	5	,,	9	16	,,	12b	1	,,	18a	447	,,	37	8	,,	52a	80″	,,	94	2	,,	109
10	,,	2a	15	,,	9a	1	,,	13	12	,,	20	5	,,	37a	2	,,	53a	1	,,	95a	3	,,	111
14	,,	3	2	,,	9b	1	,,	13a	1	,,	22	44	,,	38	1	,,	57b	3	,,	96a	16	,,	119
7	,,	4	7	,,	9d	2	,,	14	5	,,	22a	1	,,	40	32	,,	59	4	,,	103	8	,,	125
8	,,	5	2	,,	9f	5	,,	15	4	,,	24	1	,,	45	1	,,	62	12	,,	103b	2	,,	126
5	,,	6a	1	,,	10	3	,,	16	4	,,	26	2	,,	46	3	,,	63	1	,,	103c	1	,,	126a
18	,,	7	1	,,	11	8	,,	16a	5	,,	27a	8	,,	48				1 Electric Motor.					