MECCANO PONTOON CRANE

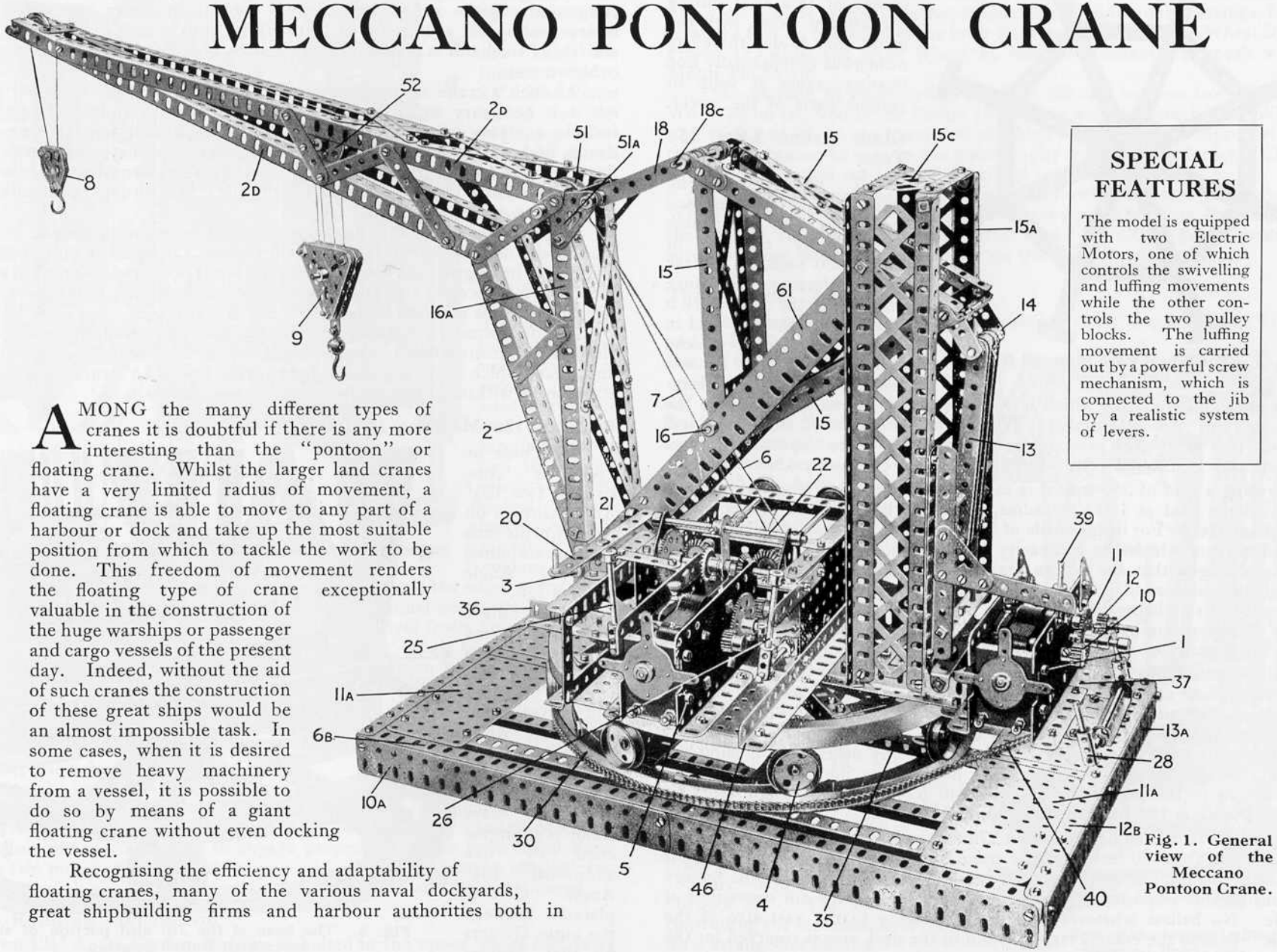

Fig. 1. General view of the Meccano Pontoon Crane.

SPECIAL FEATURES

The model is equipped with two Electric Motors, one of which controls the swivelling and luffing movements while the other controls the two pulley blocks. The luffing movement is carried out by a powerful screw mechanism, which is connected to the jib by a realistic system of levers.

AMONG the many different types of cranes it is doubtful if there is any more interesting than the "pontoon" or floating crane. Whilst the larger land cranes have a very limited radius of movement, a floating crane is able to move to any part of a harbour or dock and take up the most suitable position from which to tackle the work to be done. This freedom of movement renders the floating type of crane exceptionally valuable in the construction of the huge warships or passenger and cargo vessels of the present day. Indeed, without the aid of such cranes the construction of these great ships would be an almost impossible task. In some cases, when it is desired to remove heavy machinery from a vessel, it is possible to do so by means of a giant floating crane without even docking the vessel.

Recognising the efficiency and adaptability of floating cranes, many of the various naval dockyards, great shipbuilding firms and harbour authorities both in

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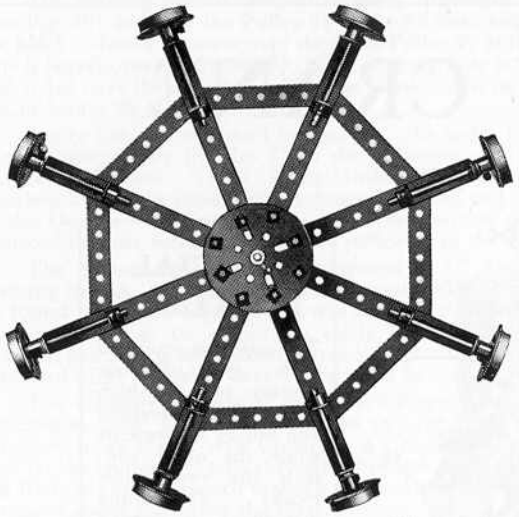

Fig. 2. The Wheel Race removed from the Roller Bearing

this country and abroad, have placed orders for giant cranes of this class during the last few years, with the result that to-day there are numerous exceptionally fine floating cranes at work in various parts of the world.

Giant Crane Lifts 350 Tons

A monster floating crane that has been designed and built for a Japanese shipyard is capable of lifting 350 tons. The task of transferring this huge crane from the site where it was built to the shipyard in Japan necessitated special arrangements. It was erected sectionally in England by the builders, after which it was towed by tugs to Japan, where the various sections were assembled. The following details of this crane will give some idea of its great size and power, while the more important features described may be taken as typical of all the larger pontoon cranes.

Carrying a load of 350 tons it is capable of revolving through a complete circle with the load at 100 feet radius, and it can lift this load vertically to a height of 140 feet! For lifting loads of 200 tons or more, two main blocks are provided, each of which has a capacity of 175 tons, the operating machinery being so arranged that the blocks may be used either coupled together or independently, as desired. At the end of the jib a further purchase is provided, the capacity of this being 50 tons. The distance between the main purchase and the auxiliary purchase is 40 feet. This latter or secondary block has a vertical lift capacity of 200 feet.

Carried on a trolley that travels along the underside of the jib is another auxiliary purchase of 50 tons capacity, and this is capable of moving the load through a distance of about 75 feet, measured horizontally. This last purchase is an extremely useful feature in that it enables the crane to deal with comparatively small loads at high speed and without any necessity for using the derricking motion of the jib. When the jib is at its minimum radius, the overall height to the top of the crane is 240 feet. The maximum working radius of the jib is 121 feet, and the minimum 50 feet.

The crane is carried on a pontoon 270 feet in length and 92 feet in width. The draught is about 10 feet when the crane is unloaded, so it will be seen that it is possible to use the crane in comparatively shallow water. This feature is of considerable importance when it is necessary to carry out operations at low tide. No ballast whatever is necessary, owing to the vast size of the pontoon. Behind the crane a large portion of the deck area is reserved for the carrying of a deck load.

The Propelling Machinery

Placed amidships, the propelling machinery consists of twin-screw compound engines which are supplied with steam from two single-ended boilers working at a pressure of 150 lbs. per square inch. The hull is built entirely of steel and is divided transversely by bulk heads, forming water-tight compartments.

As such a crane as this is sometimes required to make long journeys by sea it is necessary to carry various articles of deck equipment, and these include a steam windlass, steam capstans, steam and hand steering gear, davits, lifeboats, and all the accessories necessary for a sea-going vessel. This floating crane (which might almost be termed a ship) is navigated from a steel bridge extending the whole width of the deck and situated immediately in front of the crane base.

A floating crane of this type is well suited for reproduction in Meccano. The model described in this leaflet will be found to embody all the principal features of its huge prototype, and while it is not of course practical to actually construct in Meccano a pontoon that could be floated on water, nevertheless the model forms an accurate replica of the actual crane.

Besides forming a pleasing toy of unlimited application, the model affords also valuable instruction in the principles of mechanics and the various ways and means which have to be employed in order to build a structure of sufficient strength to withstand tremendous stresses and strains.

Building the Meccano Model

The base or "pontoon" consists of two 18½" Angle Girders 6b (Fig 1.), to the ends of which are bolted two 12½" Angle Girders 12b.

To the longer sides of the frame thus formed, two 9½" Flat Girders 10a are secured and overlapped one hole, while 12½" Flat Girders 13a are bolted to the shorter sides.

The base frame is strengthened by five additional 18½" Angle Girders placed between the outer Girders 6b that, besides

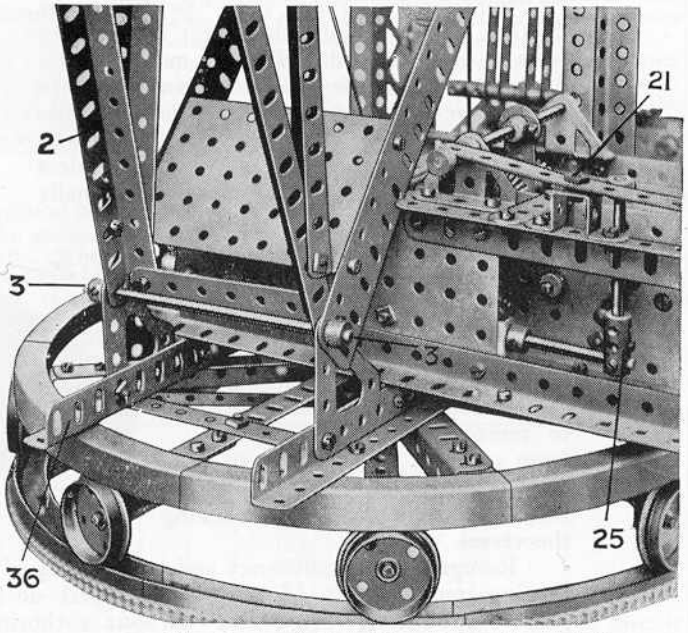

Fig. 3. The base of the Jib and portion of the assembled Roller Bearing

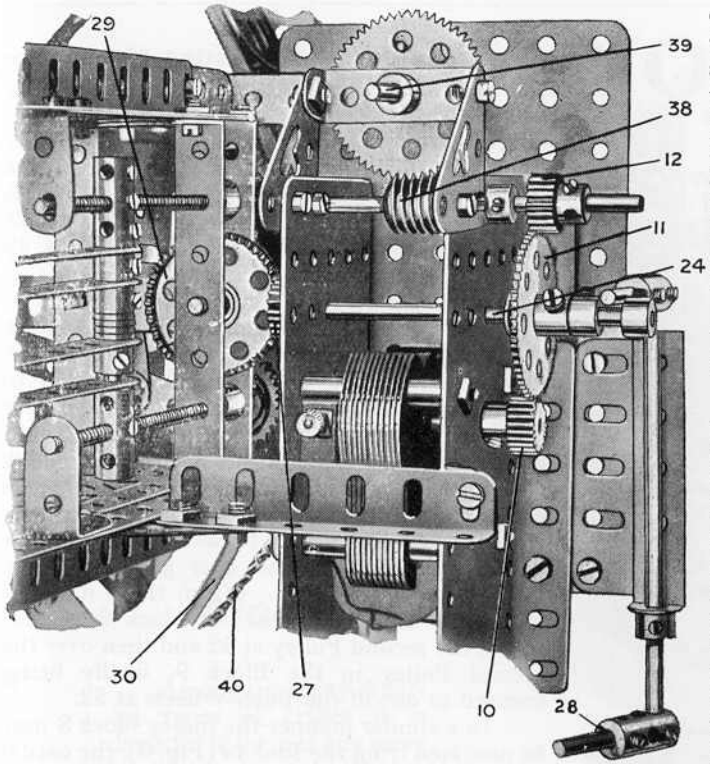

Fig. 4. Plan view, showing Electric Motor and Gearing controlling Swivelling and Luffing Motions.

offering extra strength, also serve to support the deck plates 11a that are formed by $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plates bolted to the $18\frac{1}{2}''$ Angle Girders, as shown in Fig. 1.

The Roller Bearings

The roller bearings 30 are shown in Fig. 1. The lower race, formed of Channel Segments, is secured to the base or pontoon and an upper race is bolted to two $12\frac{1}{2}''$ Angle Girders 36 attached to the body of the model. The spider frame (Fig. 2) carries a series of Flanged Wheels which run on the edges of the upper and lower races. Each race consists of sixteen Channel Segments.

Both the spider frame and the upper race swivel freely round a vertical Rod which is journalled in a hole of the centre $18\frac{1}{2}''$ Angle Girder 35 (Fig. 1) in the base of the crane. This Rod is held in position by means of Collars placed on the Rod against each side of the Girder 35. The spider frame (Fig. 2) is built up of eight $4\frac{1}{2}''$ Strips attached to a centre Face Plate. To the $4\frac{1}{2}''$ Strips $1\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips are bolted, the holes in the turned-up ends acting as journals for the wheel axles, which are secured by Collars in their respective bearings.

It may be mentioned that the new Meccano Geared Roller Bearings may be used in place of the built-up bearings if desired, in which case it would be necessary to make a slight alteration in the position of the Electric Motor, so as to allow the special Pinion to engage properly with the lower fixed Race. One or two minor alterations in the general layout would also be entailed, but they are of such simple character that no difficulty would be experienced.

Crane Rotating Mechanism

Two $12\frac{1}{2}''$ Angle Girders 36 (Fig. 3) bolted to the upper wheel race carry a $5\frac{1}{2}'' \times 3\frac{1}{2}''$ Flat Plate 37 (Fig. 1) that is secured in the last holes at one end of the Girders 36. This Plate 37 carries the Electric Motor 1, which drives the Rod 24 (Fig. 4) by means of the $\frac{1}{2}''$ Pinion 10 and the 57-teeth Gear Wheel 11. The Rod 24 carries a further Pinion 27 and slides in its bearings, being so arranged that on operation of the lever 28 it engages a Contrate Wheel 29 or the Pinion 12, while the Gear Wheel 11 remains constantly in mesh with the Motor Pinion 10.

The method of constructing the lever 28 can be seen from Fig. 4. A Worm 38 on the Rod of the Pinion 12 engages with a 57-teeth Gear Wheel on a vertical Rod 39, on the lower end of which is mounted a 1" Sprocket Wheel (this wheel cannot be seen in the photograph) engaging the Sprocket Chain 40 which passes round the lower fixed wheel race 30.

Thus by throwing the Gear 11 into mesh with the Pinion 12 the Sprocket Wheel on the Rod 39 is rotated, and since the Sprocket Chain 40 tends to grip the base 30, the Sprocket Wheel travels round the Chain 40, so rotating the superstructure bodily about its pivot on the roller bearings.

The Jib and Luffing Mechanism

The vertical member of the jib consists of two $9\frac{1}{2}''$ Angle Girders 2 (Fig. 1) and two $9\frac{1}{2}''$ Angle Girders 16a bolted together at their lower ends and braced at the sides by $2\frac{1}{2}''$ and 3" Strips and at the rear by $5\frac{1}{2}''$ Strips placed crosswise.

The vertical member of the jib is attached to the Flat Girders 61 by the 5" Axle Rod 3, about which the entire jib pivots. The Rod is carried in two Architraves bolted to the Angle Girders 36. The horizontal arm of the jib is built up from $18\frac{1}{2}''$ Angle Girders 2d braced by Strips of various lengths as shown.

The positions of the Rods carrying the purchase Pulleys 51 and 52 will be made quite clear by a glance at Fig. 1, which also indicates the method of attaching the jib members to the $3\frac{1}{2}''$ Strips forming the links 18.

Four $12\frac{1}{2}''$ Angle Girders 15a form the box-like column between the sides of which works the triangular frame 15. The lower ends of the Angle Girders 15a are bolted to the Angle Girders 36. The mechanism controlling the movements of the jib is arranged as follows :—

The $1\frac{1}{2}''$ Contrate Wheel 29

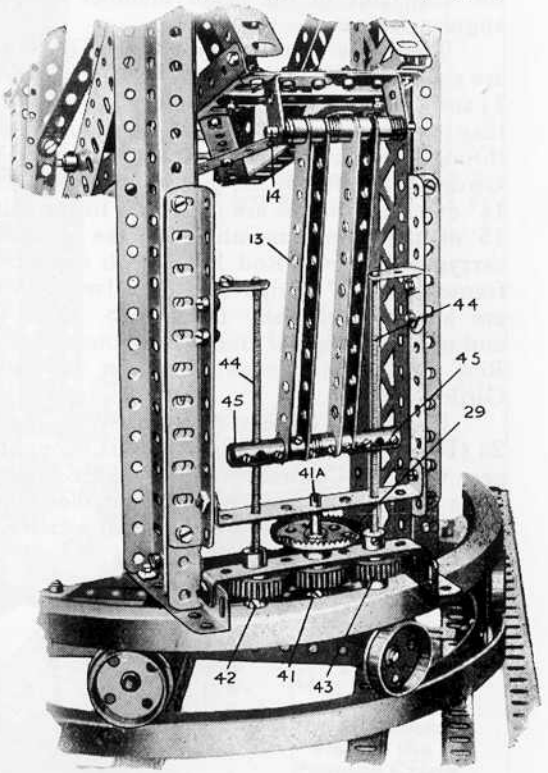

Fig. 5. View of the screw Luffing Gear, showing links, etc.

(Fig. 4) which may be engaged by the Pinion 27, is mounted on a short Rod journalled in 3½″ × ½″ Double Angle Strips bolted to 5½″ Angle Girders which, in turn, are bolted to the Girders 15a, as shown in Figs. 1 and 5. This Rod carries also a 1″ Gear Wheel 41 (Fig. 5). The latter meshes with two other 1″ Gears (42 and 43) mounted on the Threaded Rods 44, which carry two Couplings 45 connected by a 3″ Rod.

Four 5½″ Strips 13 are connected pivotally to the Rod of the Couplings 45 and to the Rod 14 carried on the triangular framework 15 (see also general view of model). The Strips 13 are spaced by Collars carried on the pivot Rod 14 and on the Rod of the Couplings 45. The Rod 14 is journalled in two 1″ × 1″ Angle Brackets secured to the underside of the lower member of the triangular frame.

The three members of the triangular frame are each built up with 7½″ Angle Girders 15 (Fig. 1) and braced by 5½″ Strips placed crosswise, and they are joined to each other by bolts passing through the end holes of each of the side Angle Girders 15. It will be noted from Fig. 1 that 1½″ extension Strips are joined on to the Girders 15 of the upper member for the purpose of carrying the pivot Rod 18c, which connects the frame to the 3″ Strips 18. The latter, in turn, are attached pivotally to the jib. The lower end of the triangular frame is pivoted at 16 on a Rod located in one of the holes in the Flat Girders 61.

It will now be seen that on moving the lever 28 (Fig. 4) so that the Pinion 27 is brought into gear with the Contrate Wheel 29, the Threaded Rods 44 (Fig. 5) are rotated and the Threaded Couplings 45 move up or down according to the direction of rotation of the Motor, so causing the jib to be elevated or lowered.

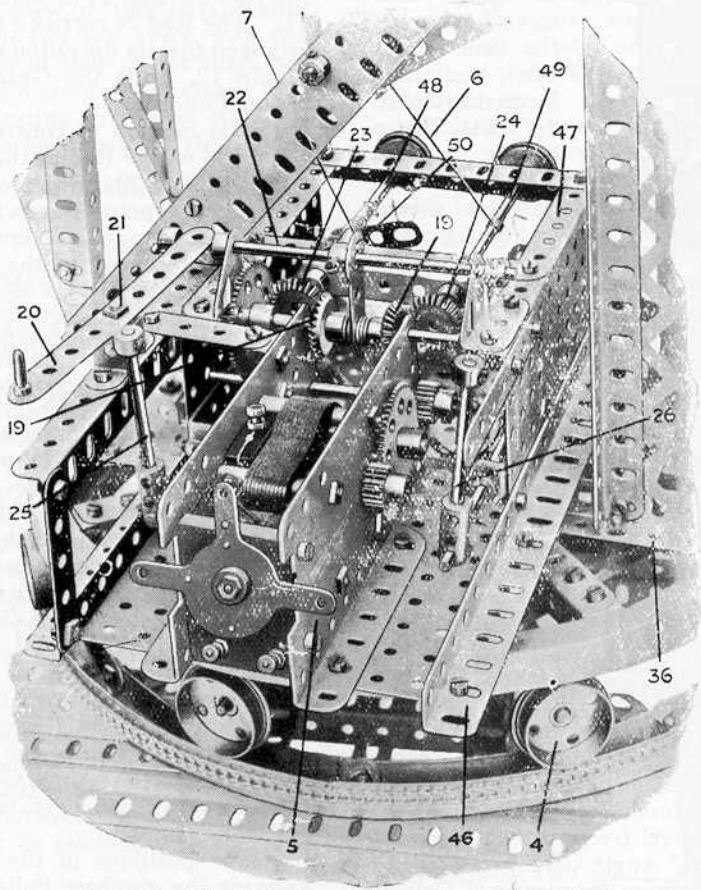

Fig. 6. The hoisting Motor, showing control and brake Levers.

Arrangement of the Hoisting Mechanism

The other Electric Motor 5 is mounted in a framework 46 (Figs. 1 and 6) formed by 9½″ Angle Girders bolted to Flanged Plates 47 (Fig. 6) which, in turn, are bolted to the transverse 12½″ Angle Girders 36 (Fig. 1). This Motor drives through ⅞″ Bevels 19, 23, and 24 (Fig. 6) either one or other of the Rods 48 and 49.

The change-over is effected by means of the lever 20 (Fig. 6) pivoted at 21, which slides a 6½″ Rod 22. The latter, in turn, slides the shaft carrying the two Bevel Wheels 19, to which it is connected by a Crank 50. Hence if the lever 20 throws one of the Bevels 19 into gear with the Bevel 23 on the Rod 48, the pulley block 9 (Fig. 1) is raised or lowered by means of the cord 7 (Figs. 1 and 6), which passes over one of the 1″ Pulleys set between the two Bush Wheels 51 (Fig. 1) and over another Pulley similarly situated at 52. From there it is led to one of the Pulleys in the block 9, thence round the second Pulley at 52 and then over the second Pulley in the Block 9, finally being secured to one of the Bush Wheels at 52.

In a similar manner the pulley block 8 may be operated from the Rod 49 (Fig. 6), the cord 6 from which is led over the second Pulley at 51 (Fig. 1) to the Pulley in the end of the jib 2; from there it passes over a ½″ Pulley in the block 8 and is secured to the jib.

The shafts 48 and 49 (Fig. 6) carry at their extreme ends two 1″ Pulleys, the grooves of which are gripped by cords that are tied to Cranks secured to two 8″ Rods arranged on either side of the Motor 5. These 8″ Rods carry Couplings and shorter Rods 25 and 26 which act as brake levers in controlling the loads on the pulley blocks 8 and 9.

List of Parts required to build the Pontoon Crane

12	of No.	2	8	of No.	8a	2	of No.	13a	2	of No.	22	1	of No.	32	2	of No.	48d	6	of No.	63	4	of No.	103a
11	,,	2a	6	,,	8b	2	,,	15	7	,,	22a	135	,,	37	2	,,	52	4	,,	70	4	,,	103b
12	,,	3	2	,,	9	5	,,	15a	1	,,	23	58	,,	38	2	,,	52a	3	,,	76	1	,,	103f
15	,,	4	10	,,	9a	6	,,	16	5	,,	24	1	,,	40	1	,,	53	2	,,	80	3	,,	111
4	,,	5	1	,,	9b	13	,,	16a	4	,,	26	1	,,	45	1	,,	57	1	,,	94	16	,,	119
1	,,	6	1	,,	9d	1	,,	17	5	,,	27a	1	,,	48	1	,,	57b	1	,,	96	2	,,	126
3	,,	6a	4	,,	12a	3	,,	18a	4	,,	30	1	,,	48a	62	,,	59	1	,,	97	2	,,	126a
11	,,	7a	16	,,	12b	8	,,	20	3	,,	31	4	,,	48b	3	,,	62	2	,,	99	5	,,	133
8	,,	8																					

2 Meccano Electric Motors