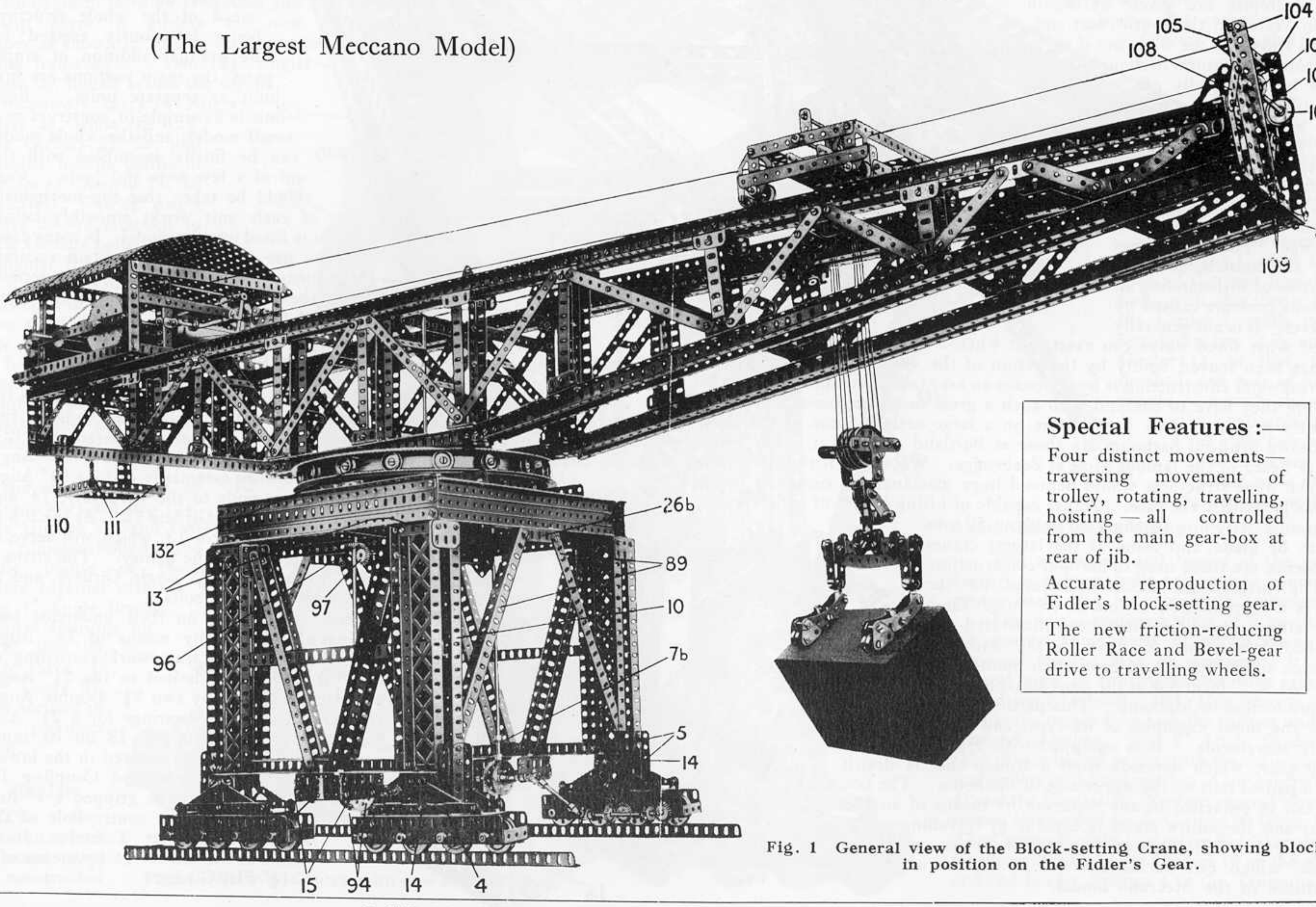
Giant Block-setting Crane

(The Largest Meccano Model)



Special Features :—

Four distinct movements—traversing movement of trolley, rotating, travelling, hoisting — all controlled from the main gear-box at rear of jib.

Accurate reproduction of Fidler's block-setting gear.

The new friction-reducing Roller Race and Bevel-gear drive to travelling wheels.

Fig. 1 General view of the Block-setting Crane, showing block in position on the Fidler's Gear.

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On every coast line, no matter which one you take, you will always find a few natural harbours. This rule applies equally to the coasts of the British Isles. Good examples are given by Southampton Water on the south coast and Milford Haven on the west, but if we relied solely on natural harbours we should be very badly off. In olden times these natural harbours were sufficient for our small fleets, but as times changed more harbours became necessary. So artificial means had to be brought into use where nature would not oblige. The breakwaters which are constructed must be capable of withstanding an enormous pressure caused by the waves. It is not generally realised what force waves can exert, but when a breakwater weighing 3,300 tons has been moved bodily by the action of the waves we can understand that breakwater construction is by no means an easy task to complete efficiently. Knowing they have to contend with such a great force, engineers have consequently to design their breakwaters on a large scale. Some of the most well-known artificial harbours are those at Portland and Dover, while every boy has heard of the famous Mole at Zeebrugge. We would naturally expect that such huge structures would demand huge machinery to construct them, and this is actually the case. Cranes capable of lifting blocks of concrete and granite weighing anything up to about 50 tons have to be made, and some of the largest cranes in existence are those used in harbour construction.

The magnificent model illustrated on the cover is a reproduction of one of the huge Titan block-setting cranes that have been illustrated and described from time to time in the Meccano Magazine and which, as we have often pointed out in the "M.M.," form one of the most suitable subjects for reproduction in Meccano. This particular crane is one of the finest examples of its type, and has several distinct movements. It is equipped with Fidler's block-setting gear, which depends from a trolley that is drawn along a pair of rails on the upper side of the boom. The boom itself can be swivelled in any direction by means of an Electric Motor, and the entire crane is capable of travelling under its own power on four separately-propelled bogies—every action, in fact, which can be carried out by the actual crane, is reproduced in the Meccano model.

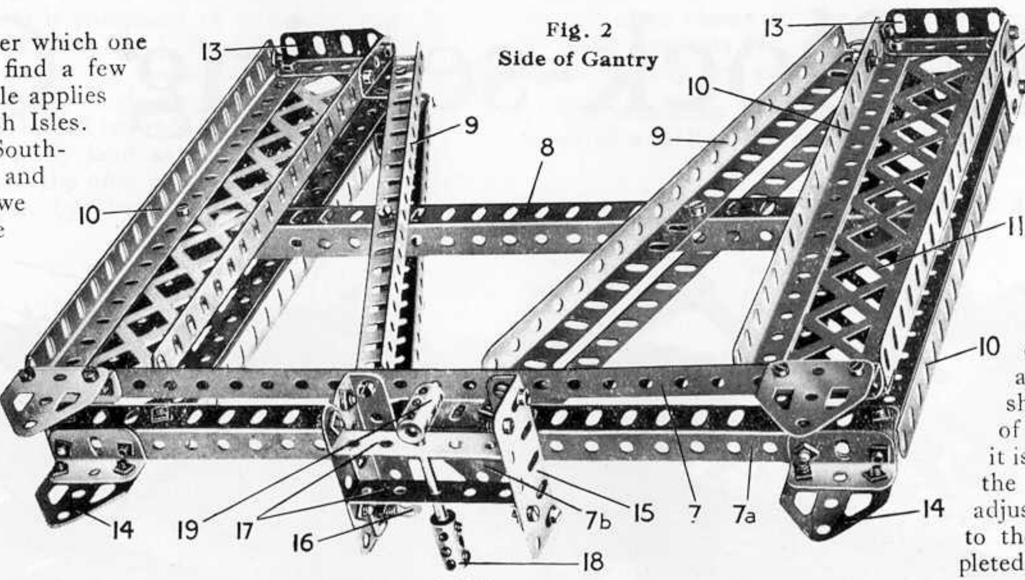

Fig. 2
Side of Gantry

Building the Model

This leaflet describes the construction of the model by the unit system, i.e., instead of the whole structure being laboriously erected by the gradual addition of single parts the main portions are first built as separate units. Each unit is as simple to construct as a small model, and the whole model can be finally assembled with the aid of a few nuts and bolts. Care should be taken that the mechanism of each unit works smoothly before it is fitted into the model. In many cases the use of Washers to obtain accurate adjustments will contribute materially to the successful operation of the completed model.

Constructing the Sides of the Gantry

Fig. 2 shows one complete side of the gantry before incorporation in the model. The two upright pillars are connected at their lower ends by two 12½″ Angle Girders 7, 7A, and higher up by the cross-piece 8 (another 12½″ Angle Girder), and are further supported by the struts 9 (four 9½″ Angle Girders). Each of the pillars consists essentially of four 9½″ Angle Girders 10 bolted at their lower ends to the Girders 7, 7A, and joined by Braced Girders 11 and Flat Girders 12. At the top of each pillar are the 2″ Angle Girders 13, which will serve to connect the pillars to the top of the gantry. The struts 9 are joined to the Girders 10 by 1½″ Angle Girders, and to the Girders 7, 7A by nuts and bolts.

The Girders 7, 7A carry on their underside four Flat Trunnions 14 affixed by means of 1½″ Angle Girders, and also a small framework consisting of two 2½″ Flat Girders 15 bolted to the 2½″ Angle Girders 16 and joined by two 2½″ Double Angle Strips 17, which form bearings for a 2½″ Axle Rod carrying the Coupling 18 on its inner end. This Rod is also secured in the lowest transverse hole of a second Coupling 19, in the end of which is gripped a 1″ Rod passing through the centre hole of the Girder 7. A Flat Trunnion 7B is fixed to the Girder 7A by means of a 1½″ Flat Girder

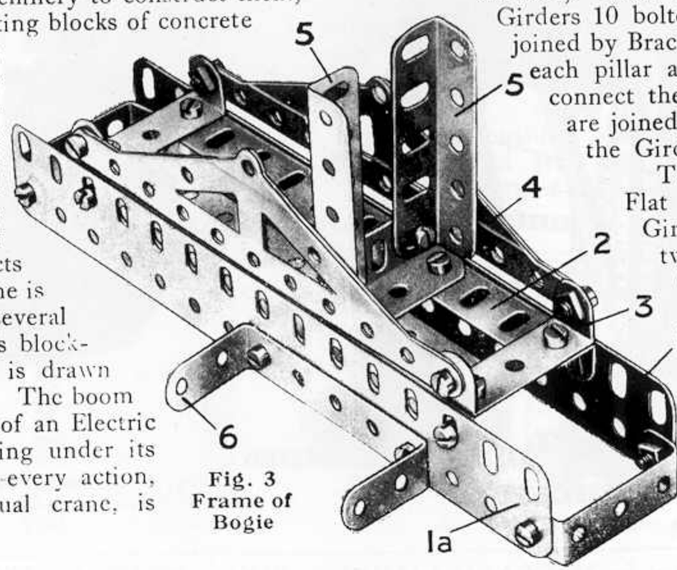

Fig. 3
Frame of Bogie

Top of Gantry (Figs. 4 and 5)

Begin this part of the crane by building four composite girders, each consisting of two 12½″ Flat Girders with the round holes of one overlapping the elongated holes of the other throughout their length, four 12½″ Angle Girders being bolted to the two edges to form an H-section joist. The four built-up joists or girders are now bolted together as shown in Fig. 5, making a rectangular framework. Two 12½″ Angle Girders 20, bolted across the top of this framework, carry 1½″ Angle Girders 21, while the 12½″ Angle Girders 22, 23, join the inside middle points of the pairs of Girders 24, 25 respectively. Two 2½″ Angle Girders 26 are attached to similar Girders bolted to the rectangular framework, and two identical Girders 26A are fastened in the same way to the Girder 22. A 2½″ Angle Girder 26B may be seen bolted to the underside of the Girder in the foreground of Fig. 5, and a corresponding part should be fitted to the back of the frame.

Across the bottom of the framework are two 12½″ Angle Girders 27, and two Flat Trunnions bolted to the middle points of these Girders, together with the 1″ by 1″ Angle Bracket 28, form bearings for the 8″ Rod 29, to which three ⅞″ Bevel Gears 97, 98 are secured in the positions shown.

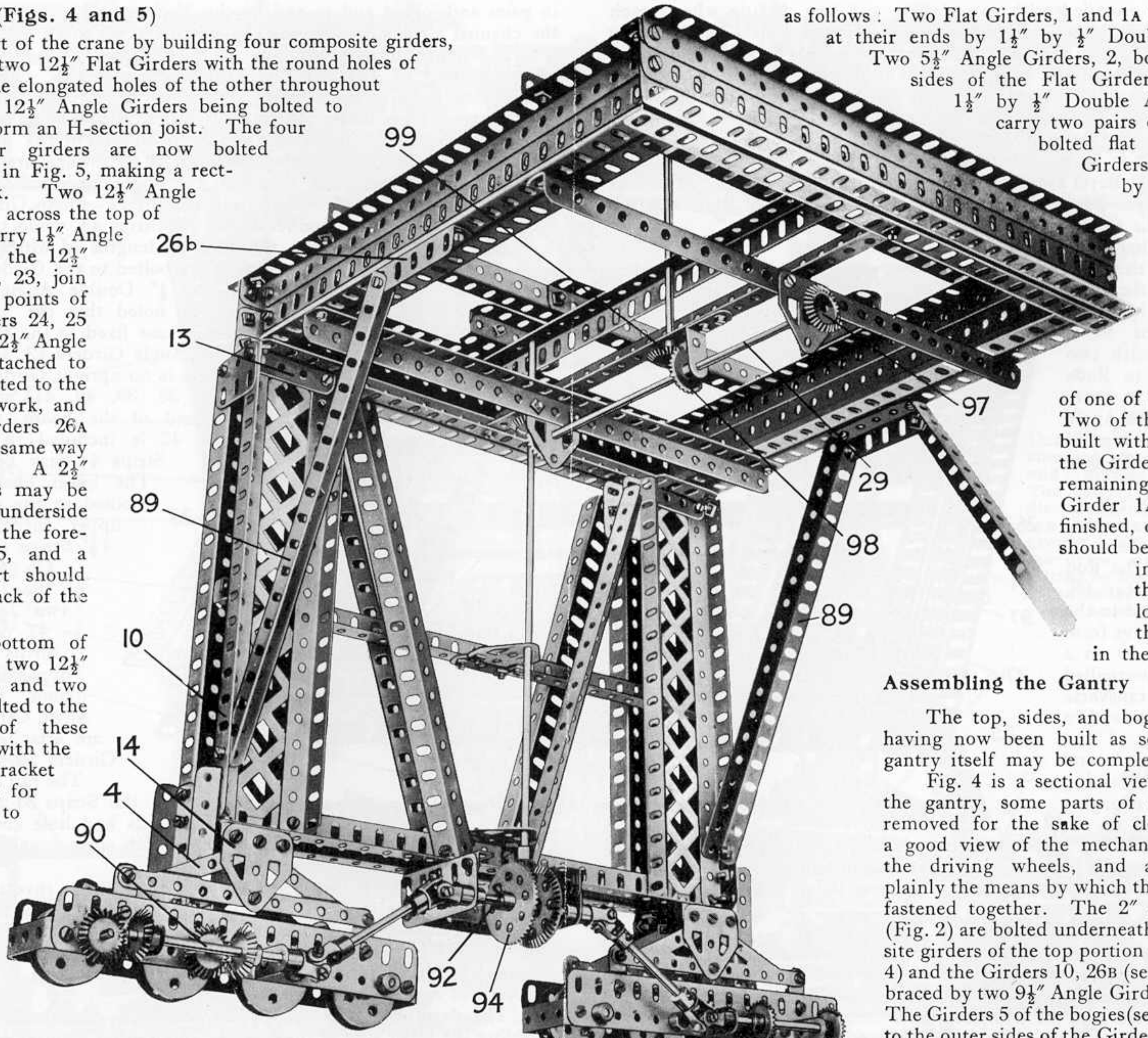

Fig. 4. View of Gantry with one side removed.

The Bogies

The four bogies on which the crane runs are constructed as follows: Two Flat Girders, 1 and 1A (Fig. 3) are joined at their ends by 1½″ by ½″ Double Angle Strips. Two 5½″ Angle Girders, 2, bolted to the inner sides of the Flat Girders, are joined by 1½″ by ½″ Double Angle Strips that carry two pairs of Girder Frames bolted flat together. The Girders 2 are also joined by a 1½″ Angle Girder supporting two upright 2½″ Angle Girders 5. A 2½″ by 1″ Double Angle Strip 6 is bolted to the outer side of one of the Girders 1, 1A. Two of the four bogies are built with this Strip 6 on the Girder 1, while in the remaining two it is on the Girder 1A, so that, when finished, one pair of bogies should be exactly the same in appearance as the other pair would look if viewed with the aid of a mirror in the reverse position.

Assembling the Gantry

The top, sides, and bogies of the gantry having now been built as separate units, the gantry itself may be completely assembled.

Fig. 4 is a sectional view of a portion of the gantry, some parts of which have been removed for the sake of clearness. It gives a good view of the mechanism that operates the driving wheels, and also shows quite plainly the means by which the various units are fastened together. The 2″ Angle Girders 13 (Fig. 2) are bolted underneath the main composite girders of the top portion of the gantry (Fig. 4) and the Girders 10, 26B (see general view) are braced by two 9½″ Angle Girders 89 (Figs. 1, 4). The Girders 5 of the bogies (see Fig. 3) are bolted to the outer sides of the Girders 10 on the gantry and the Girder Frames 4 to the Trunnions 14.

Each bogie is provided with two trailing and two driving wheels each made by butting together a Bush Wheel and a Flanged Wheel and securing them to the axle, which in the case of the trailing wheels is a 2″ Rod and in the case of the driving wheels a 2½″ Rod. The driving wheels are operated by ⅞″ Bevel Gears meshing with similar gears on the 3½″ Axle Rods 90, which are journalled in the Double Angle Strips 6 (see Fig. 3). A Washer is placed on each driving axle to keep the ⅞″ Bevel Gears in correct engagement.

Each of the Rods 90 is connected by a 2″ Rod 91 and two Universal Couplings 93 to a 1½″ Bevel Gear 94, secured to a 1½″ Axle Rod 92. The four Rods 92, to which the Bevels 94 are secured, are separate 1½″ Rods entering opposite sides of the Couplings 18: their other ends are journalled in the Flat Girders 15, and they are held in position by fixed Collars. The four Bevel Gears 94 engage with two ½″ Bevels secured to Rods that are journalled in bearings consisting of the Angle Girders 22, 23 (see Fig. 5) and the Trunnions 7B (see Fig. 2). These Rods carry at their upper ends two ⅞″ Bevel Gears 96 meshing with the ⅞″ Bevel Gears 97 (see Figs. 5, 6) on the Rod 29. The Bevel Gear 98, which is also secured to the Rod 29, takes the drive from the ⅞″ Bevel Gear 99 on a Rod 100 that is journalled in one of the top transverse Girders of the boom and in the centre bosses of the roller-bearing unit, and carries at its upper end a ⅞″ Bevel Gear 101 engaging with a similar wheel on the Rod 102, which is driven from an Electric Motor via the mechanism of the gear-box, and causes the four bogies to travel simultaneously along the rails. Hence the model is actually propelled by eight of its sixteen wheels.

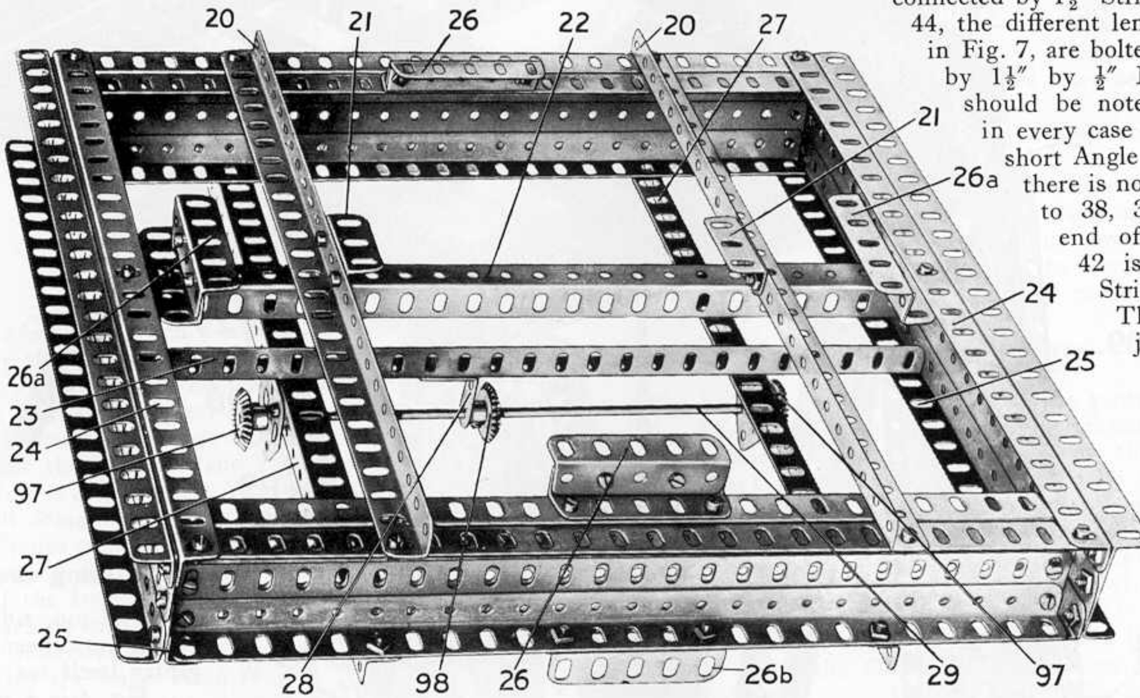

Fig. 5. Top of Gantry, showing short Girders (26, 26a) on which roller race is mounted

Structural Details of the Boom.

Fig. 7 is a view of one side of the boom: the other side, being exactly similar, has been removed for the sake of clearness. Each side should be built separately in accordance with the instructions given below, and the whole then assembled into the complete unit.

Along the upper edge extend a pair of U-section channel girders 30 and 30A, each composed of four 24½″ and two 12½″ Angle Girders bolted together in pairs and joined end to end by the 3″ Strips 32. Six 1½″ Strips 31 hold the channel girders 30, 30A side by side about ½″ apart.

The girders forming the lower edge are similarly constructed, the forward end consisting of 12½″ channel girders 33 and 18½″ channel girders 34. The slotted holes of the Girders allow them to be bolted at an angle to the 12½″ centre girders 35 by means of 2″ Strips 36. The Channel Girders 37 are attached in the same manner and are composed of 18½″ Angle Girders.

The upright Angle Girders 38, 39, 40, 41, which are respectively 5½″, 4½″, 3½″ and 2½″ long, are bolted to the upper girders 30, 30A, and to the lower girders 35, 34, 33 and 37 by means of 1½″ Angle Girders 42, and are connected by 1½″ Strips 43, while the oblique struts 44, the different lengths of which are clearly seen in Fig. 7, are bolted to the Girders 42 and joined by 1½″ by ½″ Double Angle Strips 45. It should be noted that the Strips 44 are not in every case fixed to the same point on the short Angle Girders 42, and that, although there is no upright Girder (corresponding to 38, 39, 40, 41) near the extreme end of the boom, the short Girder 42 is included in order that the Strips 44 may be attached to it. The lower channel girders are joined in the same way as the upper girders 30, 30A by 1½″ Strips at the points 46.

On the forward end of the boom are bolted two 7½″ Angle Girders 47 connected by 2½″ Strips 48, while the opposite end of the boom bears two 3½″ Angle Girders 49, to which are attached the 7½″ Angle Girders 50.

The rail 51 is bolted under the Strips 31 to the girder 30, its end hole coinciding with the third hole of the girder, and is provided with stops consisting of a Flanged Bracket and a 1″ Triangular Plate.

The end of a 5½″ Angle Girder 52 is bolted in an inverted position to the inside upper edge of the Girder 30: two similar girders are attached to the upper edge of the Girder 30, and carry respectively a 1½″ and a 3½″ Flat Girder. Another 1½″ Flat Girder 54A is bolted lengthwise by its slotted holes to the Channel Girder 30. A 5½″ Angle Girder 53A is bolted as shown to one of the vertical Angle Girders 38.

The parts 47, 48, 50, 52, 53, 54, 53A, 54A, should not be duplicated in building the other side of the boom. In all other respects the second portion is constructed in exactly the same manner as the first, but in an inverse

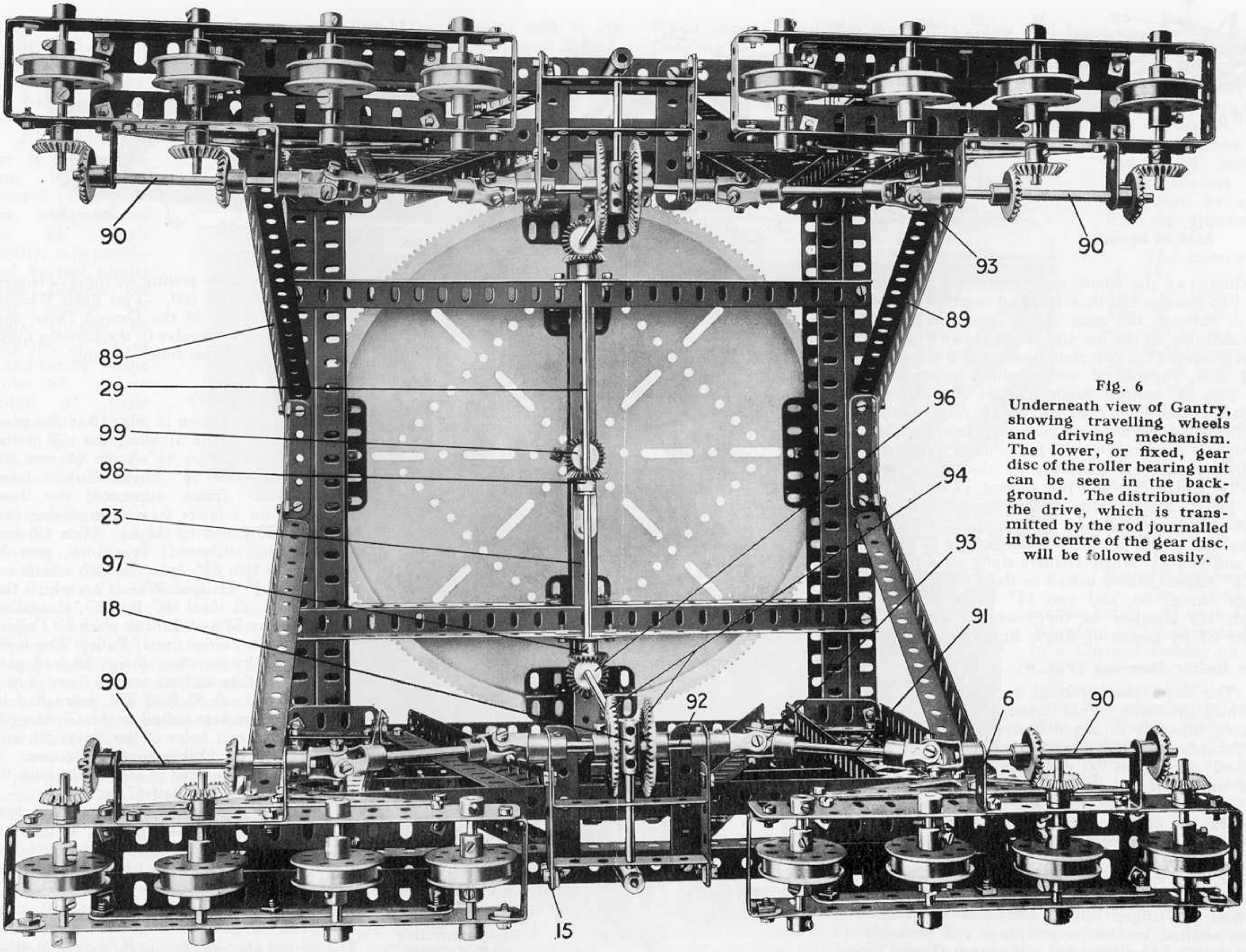

Fig. 6

Underneath view of Gantry, showing travelling wheels and driving mechanism. The lower, or fixed, gear disc of the roller bearing unit can be seen in the background. The distribution of the drive, which is transmitted by the rod journalled in the centre of the gear disc, will be followed easily.

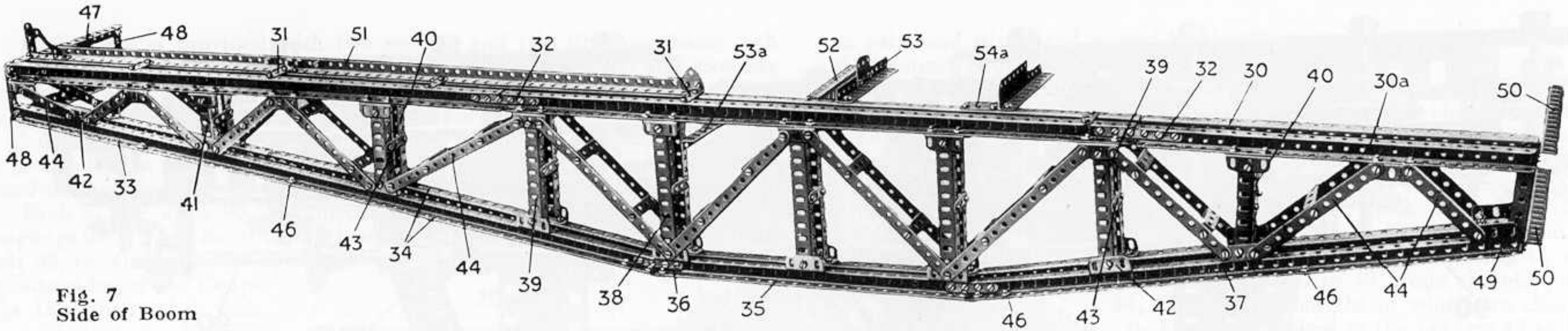

Fig. 7
Side of Boom

direction, i.e., the whole unit is reversed to correspond with the first half. The two sections can then be fitted together and secured with nuts and bolts passed through the ends of the transverse members 47, 50, 52, 53, etc. Provided that all the ties and struts shown in the illustrations are reproduced the complete boom will form an extremely rigid unit, capable of withstanding tremendous strain.

Two $5\frac{1}{2}''$ vertical Angle Girders 104, bolted to the Girders 47 (see Figs. 7, 8), carry a $4\frac{1}{2}''$ Angle Girder 105, and form journal bearings for a $4\frac{1}{2}''$ Axle Rod 106, to which are secured two 1″ fast Pulley Wheels 107. Further rigidity is imparted to the structure by two $2\frac{1}{2}''$ Strips 108 and the crossed $\frac{1}{2}''$ Strips 109.

The "cradle" 110, which is designed to accommodate a balance weight for counteracting the weight of the boom, consists of two $3\frac{1}{2}''$ and two $4\frac{1}{2}''$ Angle Girders slung on a pair of $2\frac{1}{2}''$ Angle Girders bolted to the Lower $7\frac{1}{2}''$ Angle Girder 50, and two $1\frac{1}{2}''$ Strips 111, which are attached to the lower channel girder 37 by means of Angle Brackets.

The Roller Bearing (Fig. 9).

The large roller bearing, by means of which the boom of the crane is able to turn smoothly in any direction, may be purchased, together with the small toothed wheel, as a complete unit. The upper Geared Disc, which forms the movable race, is bolted to the Girders 35 of the boom, while the lower Disc is secured to the Girders 26 on the top of the gantry. The Ring Frame 132 is spanned by a $9\frac{1}{2}''$ Strip, through the central hole of which passes the Rod 100. Sixteen $\frac{3}{4}''$ Flanged Wheels journalled on Pivot Bolts secured around its periphery run smoothly on a shoulder near the edge of the lower Geared Disc, and the upper Disc, by means of a similar shoulder resting on the $\frac{3}{4}''$ Flanged Wheels, revolves easily but steadily about the Rod 100. Two Bush Wheels, with set-screws removed, are bolted to the centres of the Geared Discs, and the Rod 100 is free to revolve in their bosses quite independently of the roller bearing.

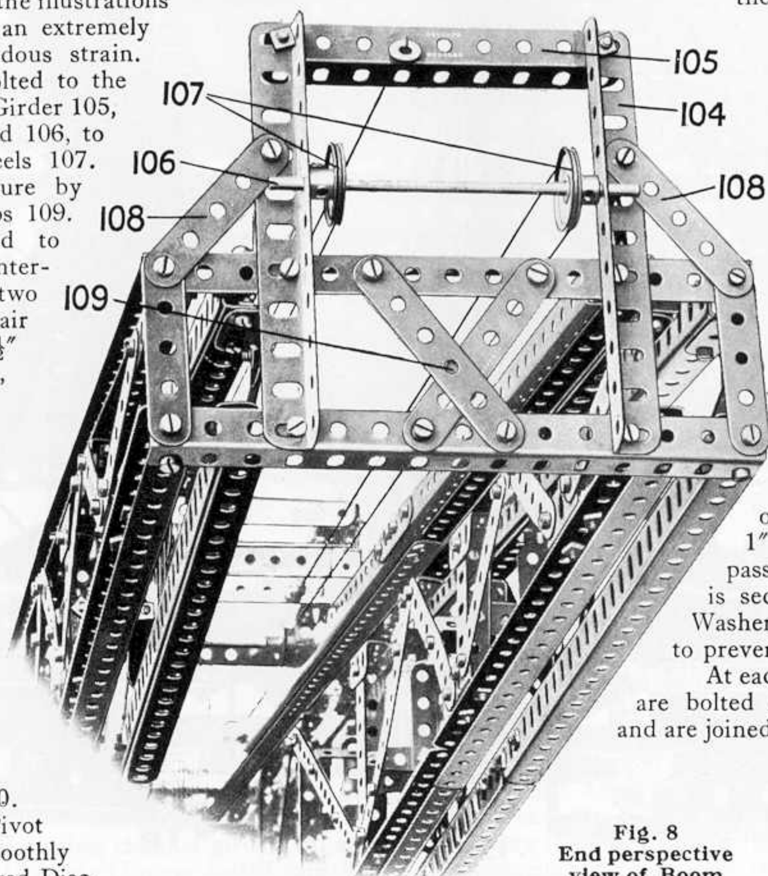

Fig. 8
End perspective view of Boom

The Crane Trolley

The trolley shown in Fig. 10 is designed to travel on the rails 51 along the top of the boom (Fig. 7). Two $4\frac{1}{2}''$ Angle Girders 55, together with two $5\frac{1}{2}''$ Angle Girders, form a rectangular frame supported by four Trunnions on a lower frame comprising two $5\frac{1}{2}''$ Strips 60 joined by the $5\frac{1}{2}''$ Angle Girders 56. Four inverted Trunnions provide bearings for two $6\frac{1}{2}''$ Axle Rods to which are secured the $\frac{3}{4}''$ Flanged Wheels on which the trolley runs. A third $6\frac{1}{2}''$ Rod 57, journalled in the Girders 55 and held in place by Collars and set screws, carries five 1″ Pulley Wheels 58 spaced apart by six short Strips 59, and prevented by Collars and set screws from sliding on the Rod 57. A 5″ Rod 57A, journalled in 1″ by $\frac{1}{2}''$ Angle Brackets bolted to the Girders 55, passes through the end holes of the Strips 59, and is secured in place by Collars and set screws. A Washer is placed under the head of each of the bolts 61 to prevent it from touching the Rod 57.

At each end of the trolley, two 1″ by 1″ Angle Brackets are bolted to the underside of the inverted Trunnions, and are joined by a $5\frac{1}{2}''$ Strip 62. Handrail Supports attached to the Strips 62 enable the trolley to be drawn along by cords.

The Gear Box

The roof of the gear-box is formed by bolting six 5½″ by 3½″ Flat Plates together in threes (Fig. 11), and joining them by a middle portion consisting of two 5½″ by 2½″ Flat Plates overlapped three holes. The cover thus formed is then attached to the framework by means of Meccano Hinges 103, which readily conform to the angle of the roof. The framework itself consists of four 9½″ Angle Girders bolted together as shown (Fig. 11).

Fig. 12 shows a view of the gear-box, from which the roof and the greater part of the mechanism have been removed. The square base, composed of four 9½″ Angle Girders, is strengthened by two similar Angle Girders 64. Four vertical 4½″ Angle Girders 65 carry the 7½″ Strips 66 and the 9½″ Angle Girder 67. Two vertical 3″ Angle Girders bolted to the Girder 67, together with two 2½″ Angle Girders 69 (which are braced by Corner Brackets), form supports for a 7½″ Angle Girder 70 and two 7½″ Strips 71. A 4½″ Flat Girder 72, carrying two 1½″ Flat Girders 73, is bolted to a vertical 2½″ Strip 74 and the upright Girders 69, 65. These Strips and Girders, etc., form the necessary bearings for the shafts of the gear box. Care should be taken to see that they are placed exactly in their correct positions and secured very rigidly.

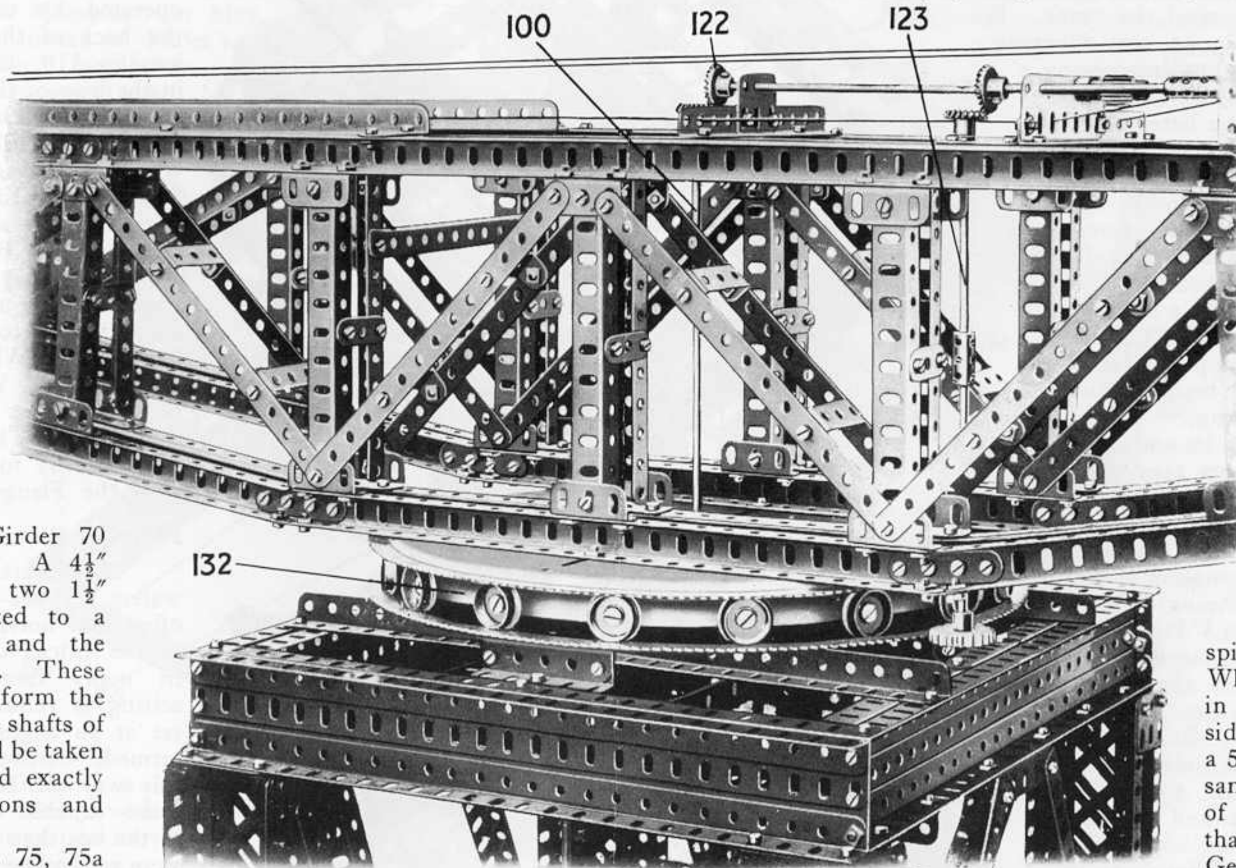

Fig. 9 Central portion of model, showing roller bearings supporting the boom

Two 3½″ Axle Rods 75, 75a are journalled in a pair of Flanged Brackets and 7½″ Strips 71, and meet inside the Worm Wheel 77 which is secured to the Rod 75. Two 1″ Gear Wheels are secured to the Rods 75, 75A and a second Worm Wheel is mounted on the Rod 75A. The Worms are spaced on their respective Rods by means of Collars and set screws. The 5″ Rod 79, bearing a ½″ Pinion Wheel and a 50-teeth Gear Wheel that meshes with the Worm Wheel 77, is journalled in bearings consisting of a 1½″ Angle Girder and a 3½″ Angle Girder 82: an 8″ Rod, parallel with the Rod 79, carries a second 50-teeth Gear Wheel engaging with the Worm 77A: this Rod bears on its outer end a Coupling 83. Washers are placed between the Girder 82 and the Girders 64 in order to bring the 50-teeth Gear Wheels into mesh with the Worms 77, 77A.

A 5½″ Strip 86 is attached by means of a Meccano Hinge to the Girder 67, one end of the Strip being left free inside the gear-box. The manner of attaching the remaining parts of this unit, viz., a 1½″ Flat Girder 84, two 1″ by 1″ and one ½″ by ½″ Angle Bracket 85, 85A, a 1″ Triangular Plate 87, and the 3½″ and 2″ Angle Girders 88, 88A, may be seen from the illustration (Fig. 12.)

The framework of the gear-box, built as shown in Fig. 12, should be attached to the rear end of the boom by means of nuts and bolts, and the remainder of its mechanism may then be added. The Electric Motor, which is of the high-voltage type, is bolted to the Angle Girders 64, 88, 88A (Figs. 12, 13). A Worm Wheel secured to the armature spindle turns a 57-teeth Gear Wheel on a 2″ Rod journalled in a Channel Bearing on the side of the motor frame, and a 50-teeth Gear Wheel on the same Rod engages the teeth of a ¾″ Pinion Wheel 113 that meshes with a 57-teeth Gear Wheel on the Rod 114 (Fig. 13). This Rod, which is thus in constant rotation, may be caused to transmit the power from the Electric Motor to the Rods 75, 75A (which as already stated, meet inside the Worm Wheel 77) by operating the Threaded Pin 115. By this means a 1″ Gear Wheel on the Rod 117 can be made to engage simultaneously the 1″ Gear Wheel 116 and the 1″ Gear Wheel on the Rod 75. The drive is then led through the gears shown in Fig. 12 to the ½″ Pinion Wheel on the outer end of the Rod 79. A ½″ Pinion on the Rod 118 can be brought into gear with this ½″ Pinion by pulling the handle 119, which thus causes the double width face ½" Pinion Wheel 120 to turn a similar Pinion on the Rod 121. Reference to Fig. 9 will show that this Rod actuates the traversing mechanism of the crane by means of the Bevel Gears 122 and the gears already described in the section dealing with the gantry.

The handle 115, which causes the crane to travel on its wheels as described when turned in a clockwise direction, is also used to swivel the crane. For this purpose it is turned in an anti-clockwise direction (i.e., to the left) thus interposing a 1" Gear Wheel between similar Gear Wheels on the Rods 114, 75A. The latter Rod, which is thus caused to revolve, rotates the Coupling 83 by means of the Worm and 50-teeth Gear Wheel shown in Fig. 12, and a Rod secured in the Coupling turns a vertical Rod 123 by means of two ⅞" Bevel Gears. The small toothed wheel of the roller bearing unit, which is secured to the lower end of the Rod 123, rolls around the teeth of the upper Geared Disc and swivels the boom bodily about the centre of the roller bearing.

The Rod 114 carries on its ends two 1" Sprocket Wheels which are connected to a 1" Sprocket Wheel and a 3" Sprocket Wheel secured respectively to the Rods 124, 125. The Rods 124, 125 are thus constantly revolving, and operation of the handle 131 interposes ½" Pinion Wheels secured to a 6½" Rod between ½" Pinions on the Rods 124, 125 and 57-teeth Gear Wheels on the spindles of the Wood Rollers 126, 127, causing the latter to rotate. (Only one of the Rollers, of course, can be operated at a time.) The Roller 127 carries two cords, which are each given a few turns round its circumference. One end of each cord is led under one of the ½" Loose Pulley Wheels 128, and is tied to a Handrail support on the end of the trolley (see Fig. 10). The other ends of the cords are stretched to the forward end of the boom, passed round the 1" Pulley Wheels 107 (see Figs. 1, 8) and tied to the remaining Handrail Supports on the trolley.

The Wood Roller 126 carries only one cord, which passes in turn round the five 1" loose Pulley Wheels of the trolley and the four similar wheels that form the sheaves of the pulley block from which the block-setting gear is suspended. The end of the cord is then carried to the front end of the boom and is tied to a Washer on the opposite side of the Girder 105.

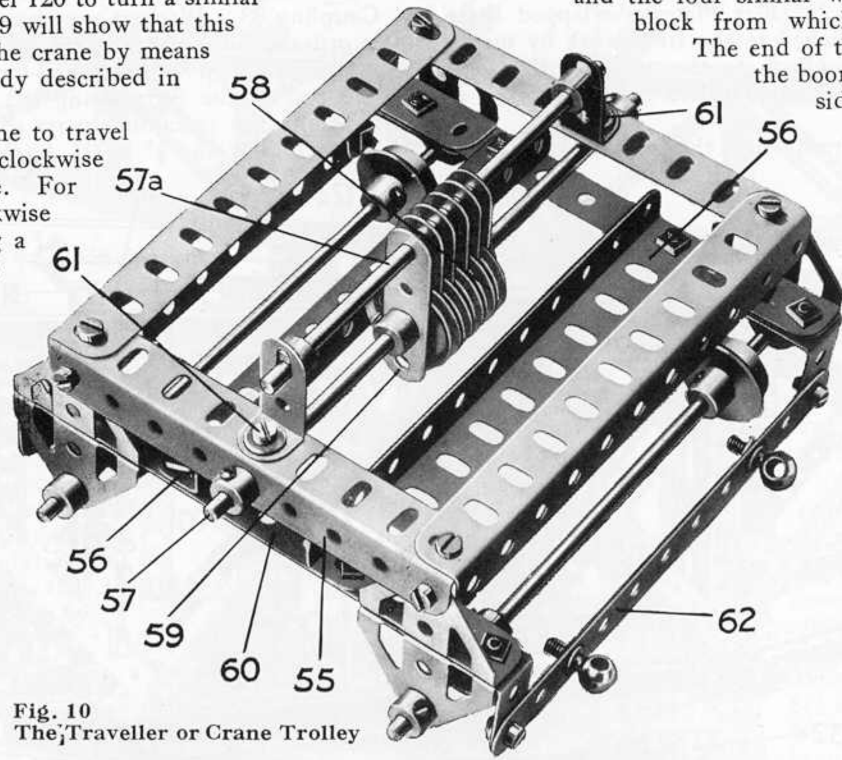

Fig. 10
The Traveller or Crane Trolley

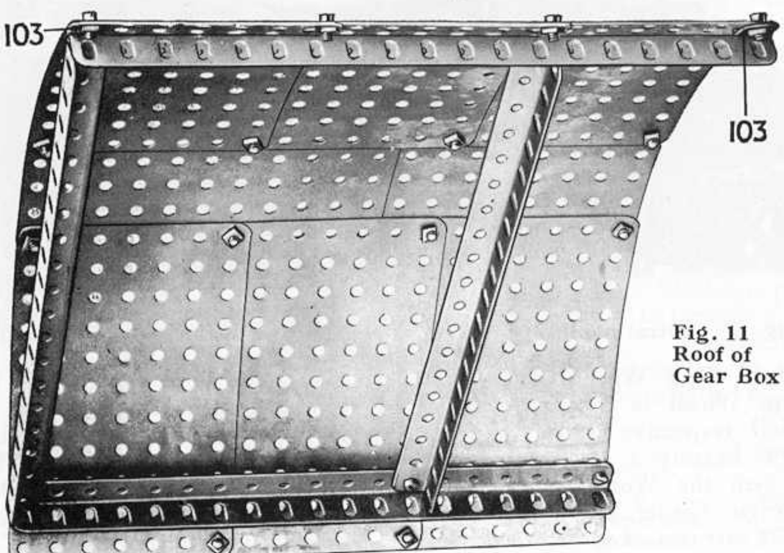

Fig. 11
Roof of Gear Box

The block-setting gear is prevented from falling-back by means of a brake operated by the handwheel shown in the back of the gear box between the handles 119, 131. A 2½" Rod secured in the boss of the Bush Wheel is gripped in the smooth bore of a Threaded Coupling, into the threaded bore of which is screwed a 1" Screwed Rod. An End Bearing on the opposite end of the Screwed Rod actuates a Crank that is secured to a 6½" Rod by means of a ⅜" bolt, so that when the hand wheel is turned to the right, the ⅜" Bolt causes the Strip 86 to press on the flanges of two Flanged Wheels secured to the same Rod as the Wood Roller 126, thus preventing the cord on the Roller from unwinding. The Strip 86 should be bent slightly to ensure effective contact with the Flanged Wheels.

Fidler's Block-setting Gear

The concrete blocks of which breakwaters and sea-walls are constructed are often laid horizontally in the same way as the bricks of an ordinary wall, but in many cases a more complicated setting is required, and the blocks are set at an angle—or, as it is technically termed, "on the inclined bond." In this way the breakwater is made much more capable of resisting the assaults of the sea than it would be if the blocks were set in the more usual position with their faces vertical.

The problem of slinging the blocks for setting on the inclined bond, however, presents some difficulty, a fact which will be more readily appreciated by anyone who has constructed a model of a crane and attempted to set a small block of wood or stone in the manner described. The problem is difficult even with a model, but in actual practice it is considerably more complicated, for the blocks must be lowered to within an inch or less of their correct position, and the movements controlled to a nicety even though they may be carried out amid heavy seas and stormy weather.

The difficulty is solved by the ingenious tilting mechanism known as Fidler's patent block-setting gear. Photographs of this gear, together with a detailed account of its action, appeared in an article on Giant Block-setting Cranes in the "Meccano Magazine" for May, 1925. The Meccano model of Fidler's Gear differs from the actual mechanism in detail only, and carries out its functions in exactly the same manner as its prototype.

Two pairs of 5½" Curved Strips 1, bearing twelve Flat Brackets 2 and spaced apart by the thickness of two Washers, represent the massive notched beam of the Fidler's Gear (Fig. 16). This beam hangs from a swivelling joint, the whole being suspended from a special four-sheaved pulley block. The swivel bar consists of a 2" Rod 12 bearing at its lower end a small Fork Piece (part No. 116A) on which the beam is pivoted, and is itself supported in the Pulley Block by means of a Collar. The rotating movement of the beam on the central swivel is controlled by a Worm Wheel 15, which meshes with a ½" Pinion 16 secured to the vertical swivel bar.

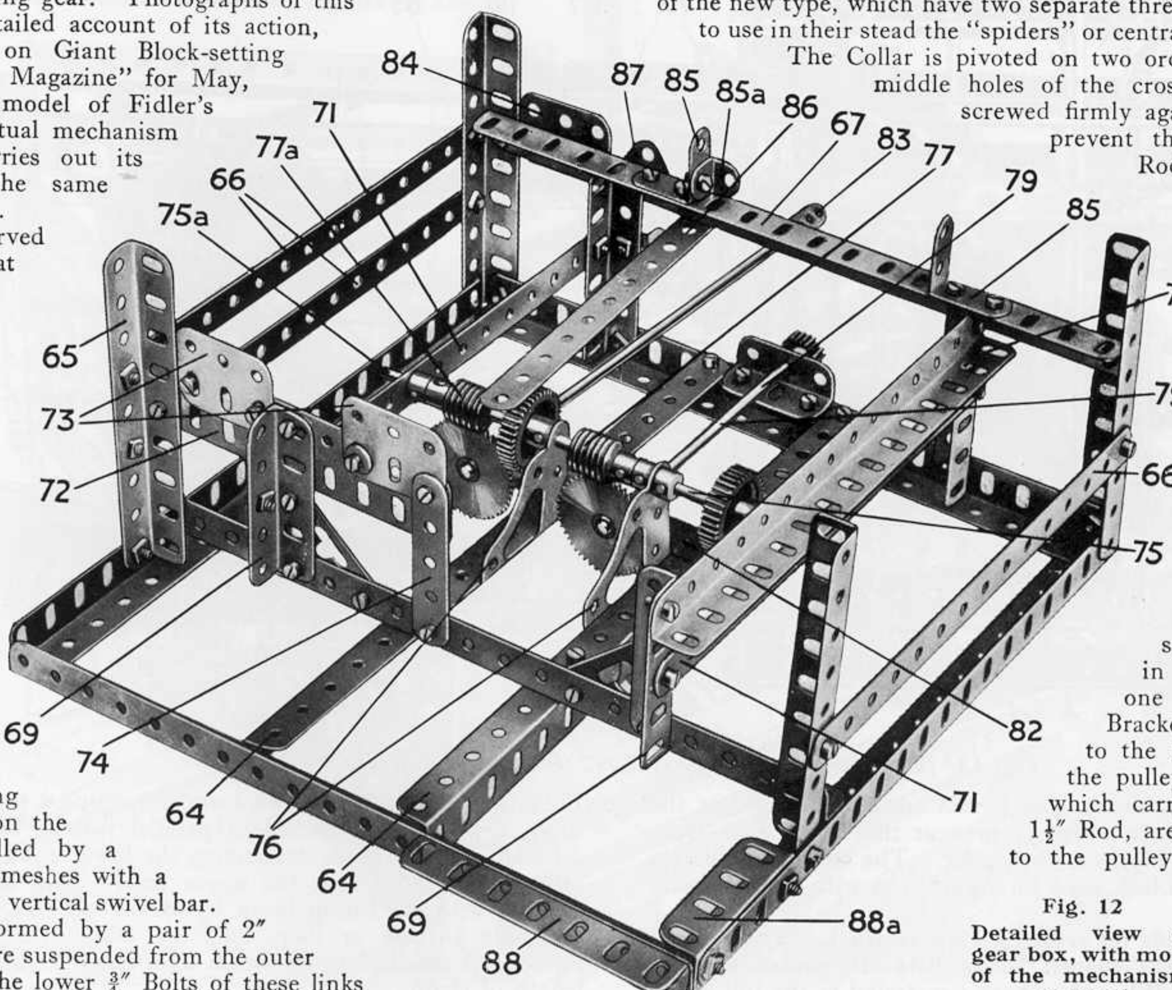

Fig. 12

Detailed view of gear box, with most of the mechanism removed

Two links 3, each formed by a pair of 2" Strips and two ¾" Bolts, are suspended from the outer notches of the beam. The lower ¾" Bolts of these links pass through the smooth bores of Handrail Supports 4 that are screwed into the longitudinal bores of two Threaded Bosses, where they are secured in position by nuts screwed tightly against the tops of the Bosses. Two ¾" Bolts, passed through the transverse holes of these Threaded Bosses, and held in place by lock-nuts (Standard Mechanism No. 263), support the crossheads 5. Each crosshead consists of two 2½" large radius Curved Strips to which two 1" Triangular Plates 6 are rigidly secured by means of a ¾" Bolt and nuts. A roller consisting of two ½" loose Pulley Wheels 7 is mounted on a ¾" Bolt secured between each pair of Triangular Plates.

From the middle point of each crosshead hangs a Lewis Bar. This bar is made by securing a Coupling across the end of a 5" Rod 8, the upper end of the Rod being attached to a Collar. Those who do not possess Collars of the new type, which have two separate threaded bores, will find it necessary to use in their stead the "spiders" or central collars of Universal Couplings. The Collar is pivoted on two ordinary bolts passed through the middle holes of the crosshead 5 and secured by nuts screwed firmly against the sides of the Collar to prevent the bolts from binding on the Rods 8. The upper end of each Lewis bar is fitted with a portion of a Dog Clutch, and the corresponding part of one Clutch should be attached to a Rod 9 to form a key with which the Lewis bars may be turned. The key is provided with a handle consisting of two Threaded Pins screwed into a Collar 10. The same arrangement is used to turn the Worm Wheel 15 that controls the swivelling movement of the beam.

The Fork Piece 11 from which the beam is suspended is secured to a 2" Rod 12 journalled in two Double Brackets bolted one within the other to Angle Brackets, which in turn are secured to the 1" by ½" Angle Brackets 13 in the pulley block. Two 1½" Strips 14, which carry the Worm Wheel 15 on a 1½" Rod, are secured by means of ⅜" Bolts to the pulley block, from which they are spaced away by two Washers mounted on the shanks of the bolts.

It will be observed that the pulley block is constructed from two pairs of simple Bell Cranks bolted to the 1" by ½" Angle Brackets 13, their outer arms being spaced apart by means of the 2" Threaded Rods 18. The sheaves consist of four 1½" Pulley Wheels, one of which should be secured to the 2" Axle Rod 19 in order to retain the latter in position.

The concrete blocks which are to be set by Fidler's Gear are specially made with two perpendicular holes running completely through them. The holes are of sufficient width across one of their sections to take the T-shaped with the hole in the block, and the crane again hoisting, the Lewis bars are withdrawn, leaving the block set at the correct angle.

A disadvantage of Fidler's method of using Lewis bars lies in the fact that the releasing mechanism requires the attention of divers for underwater block-setting, or workmen for blocks above the waterline. When the blocks are required to be set in an upright position, and not on the inclined bond, the hoisting arrangement may be made very much more simple, and self-releasing mechanisms are then employed.

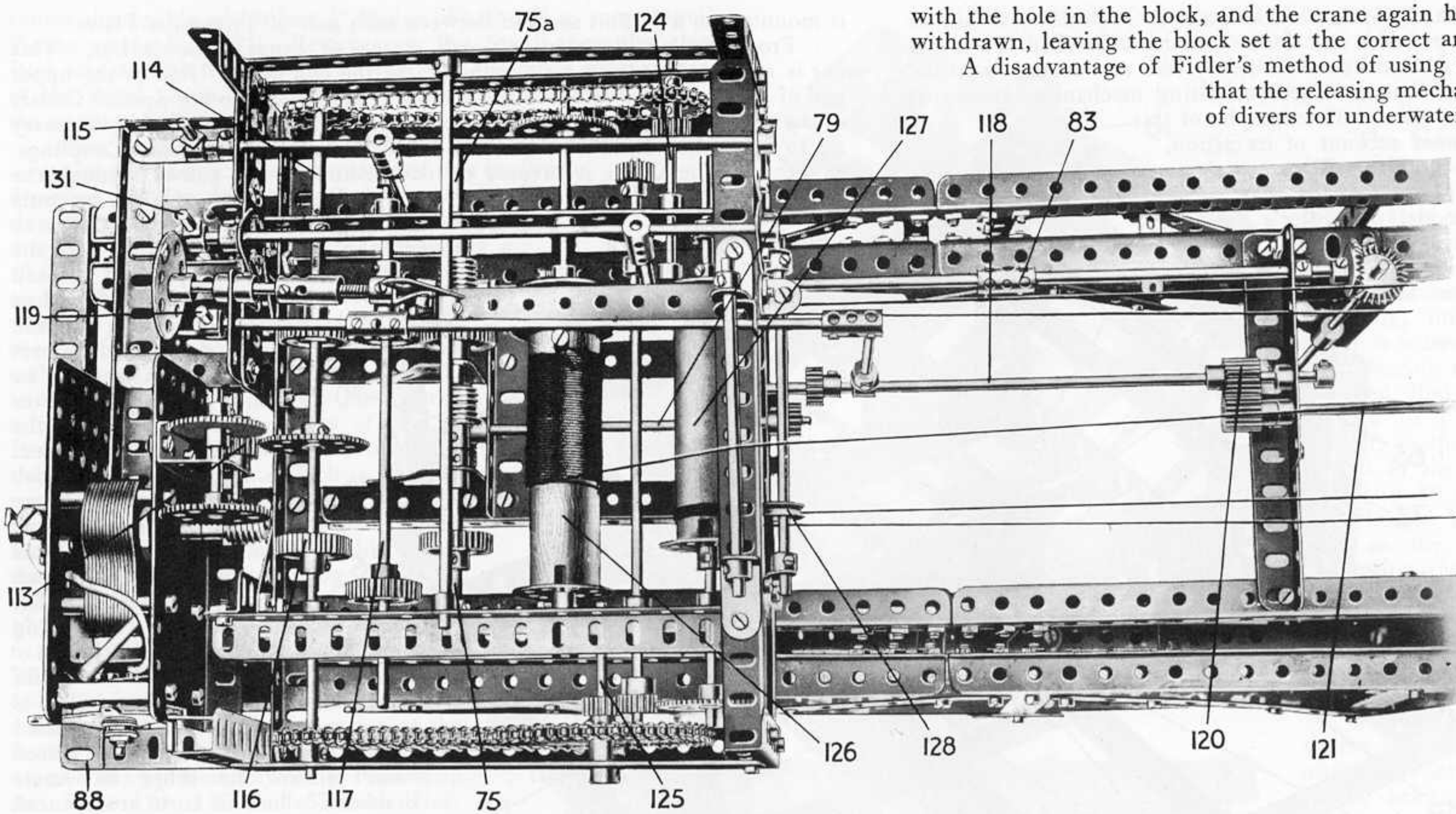

Fig. 13. Bird's-eye view of Gear Box, Motor, and adjacent mechanism.

pieces at the ends of the Lewis Bars. The blocks are also recessed at the lower ends of the vertical holes in order to prevent the Lewis Bars from fouling the breakwater while the blocks are being set. The holes and recesses are reproduced in the wooden block used in conjunction with the Meccano model.

The block is brought alongside the crane on a special truck. The Fidler's Gear is then lowered, and the T-shaped Lewis Bars are guided through the vertical holes in the block. When they have penetrated to the full depth of the holes, the bars are given a quarter turn, which throws their T-shaped ends out of register with the holes and prevents them from being withdrawn. Meanwhile the rollers on the crossheads take a bearing on the top of the block and roll across, altering the relative positions of the points of suspension and the Lewis Bars. The block is then lifted at the exact angle at which it is to be set in position. The crane swivels round until the block is directly above its place in the breakwater, and lowers it as necessary. When the block rests in position, the T-shaped rods are again turned until they are in register

Other Block-setting Gears.

One of the most popular self-releasing devices embodying the Lewis bar principle necessitates a tapered hole in the concrete block. The hole is drilled so that it is narrower at the top of the block than at the bottom. Each of the two lifting bars corresponding to those illustrated in the Fidler's gear consists of two members coupled together by short connecting links, so that they resemble a parallel ruler. The connecting links are of different lengths, those connecting the lower ends of the two members being longer than those near the upper ends. One member—the outer one—is connected to the lifting beam by means of a simple shackle or loop, and the other member is attached to the beam by a short length of chain.

To raise the block the shackle of the outer member is passed over the lifting beam and the hoisting mechanism set in motion. As the outer member rises, the connecting links force the two members apart so that they become jammed in the tapered hole in the concrete block. The release is effected as follows: when the block is deposited on

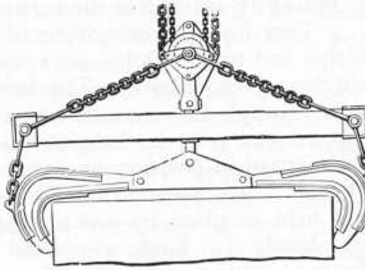

Fig. 14. Friction Grip for setting Concrete Blocks.

the ground, the shackle falls by its own weight away from the lifting beam. The hoisting mechanism is then set in motion, but this time the chain-coupled member only is raised, and owing to the peculiar arrangement of the connecting links it is automatically drawn close to the outer member so that both members may be withdrawn easily from the block.

In order that the mechanism may be perfectly self-acting, it has been found necessary to add a lever and weight to ensure the falling away of the loop or shackle from the lifting beam as soon as the tension is relaxed, which happens when the block rests upon the ground.

Meccano boys may wish to try other forms of block hoisting gear. There are a large number of different types of grips or mechanical jaws for handling blocks that depend for their operation entirely on friction, and any one of these could easily be reproduced in Meccano. The general principle upon which friction grips are designed is that the direction of pressure between the grip jaws and the block shall make an angle with the normal to the surfaces in contact, which angle is less than the angle of friction.

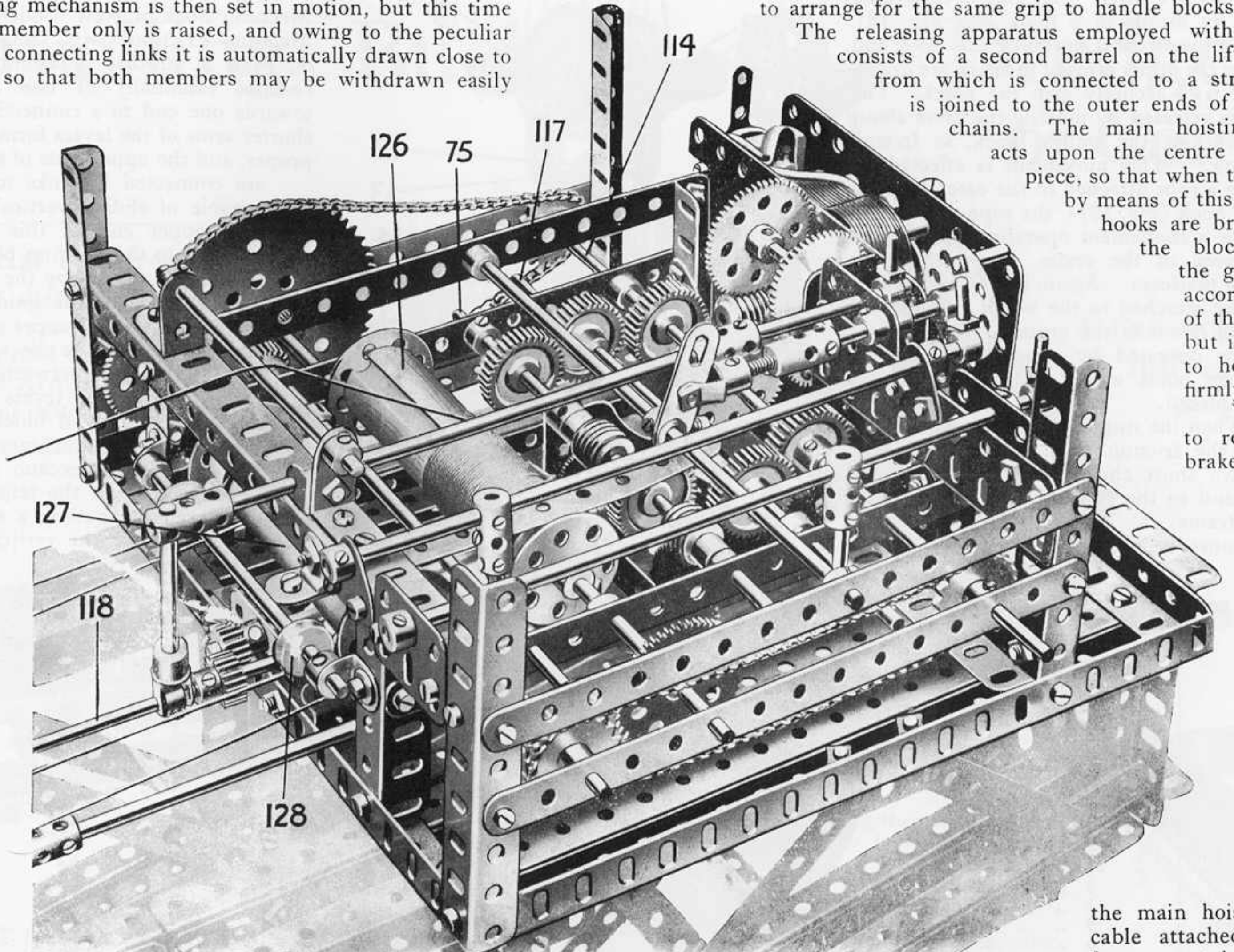

Fig. 15. General view of Gear Box with all mechanical details in position.

A form of grip embodying this principle that was actually employed in connection with the Madras Harbour works is illustrated in Fig. 14. It consists simply of two hooks spanning the block, the hooks being hinged to a central connecting piece. By using connecting pieces of different lengths, or by varying the distance between the pivots of the hooks, it is easy to arrange for the same grip to handle blocks of various sizes.

The releasing apparatus employed with this type of grip consists of a second barrel on the lifting gear, the chain from which is connected to a stretcher-frame. This is joined to the outer ends of the hooks by short chains. The main hoisting cable or chain acts upon the centre of the connecting piece, so that when the load is suspended by means of this cable, the grappling hooks are brought to bear upon the block. The power of the grip varies of course according to the weight of the block being lifted, but it is always sufficient to hold the block quite firmly and safely.

When it is required to release the block, a brake is applied to the second barrel while the main hoisting cable is lowered. As the latter is paid out the stress is diverted to the chains connected to the stretcher-frame, and this allows the hooks to open. By reversing the crane mechanism the grip may then be raised clear of the block. When the block is being raised or lowered the main hoisting cable and the cable attached to the stretcher-frame must be hauled in or paid out at exactly the same speed and the strain must bear entirely on the pulley block and not on the short chains connected to the stretcher-frame. This method of operation is similar to that employed in controlling the grab in the Meccano Ship Coaler.

Another effective block-setting grab, or grip, illustrated in Fig. 17, was specially designed for placing in position the apron blocks at the Harbour works at Mormugao. In this model the jaws of the grip are in the shape of bell cranks, the upper arms of which are connected together by short links and a massive ring. This ring is connected to the pulley block by means of a hook (see Fig. 18). When a block is lifted the stress is borne by this hook and the ring, and therefore the upper arms of the clips are drawn together so that the jaws securely grip the block. The block is released by moving the hook about its pivot on the pulley block, so freeing the ring. This movement is effected by pulling a rope attached to the extended arm of the hook (Fig. 18): the rope may be led back to a convenient operating position on the boom of the crane, or even on the driving platform. Again, it may be led over a pulley attached to the boom and allowed to hang down to the ground, where it may be operated by a man standing near the point where the blocks are being placed.

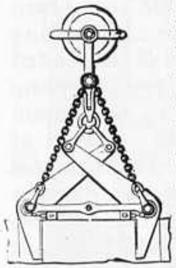

Fig. 17. Another type of Friction Grip

When the ring is released from the hook, the friction grip mechanism is supported by the two short chains shown attached to the pulley block and to the ends of the distance-piece or stretcher-frame. The length of the distance-piece must be adjusted according to the size of the block that it is desired to handle.

Meccano boys who are able to refer to the 1928 Meccano Book of New Models will find a simple type of Meccano Friction Grip Tongs illustrated and described on page 21 of that publication. This particular model consists essentially of two levers pivoted towards one end to a connecting bar. The shorter arms of the levers form the grip tongs proper, and the upper ends of the longer arms are connected by links to a bar that is capable of sliding vertically in a guide. The upper end of this sliding bar is attached to the hoisting block, and when the strain is taken by the hoisting cable, the bar rises in the guide and thereby forces outward the upper ends of the grip levers. This has the effect of gripping the block very tightly between the lower ends of the levers. The levers are adjusted to take various sizes of blocks by changing the points of attachment to the connecting bar.

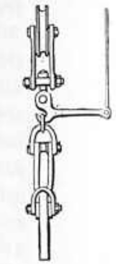

Fig. 18. Detail of Grip shown in Fig. 17.

In the Meccano model the blocks may be released when the tension of the hoisting cord is relaxed, by pulling a short length of cord, which draws down the vertical sliding bar.

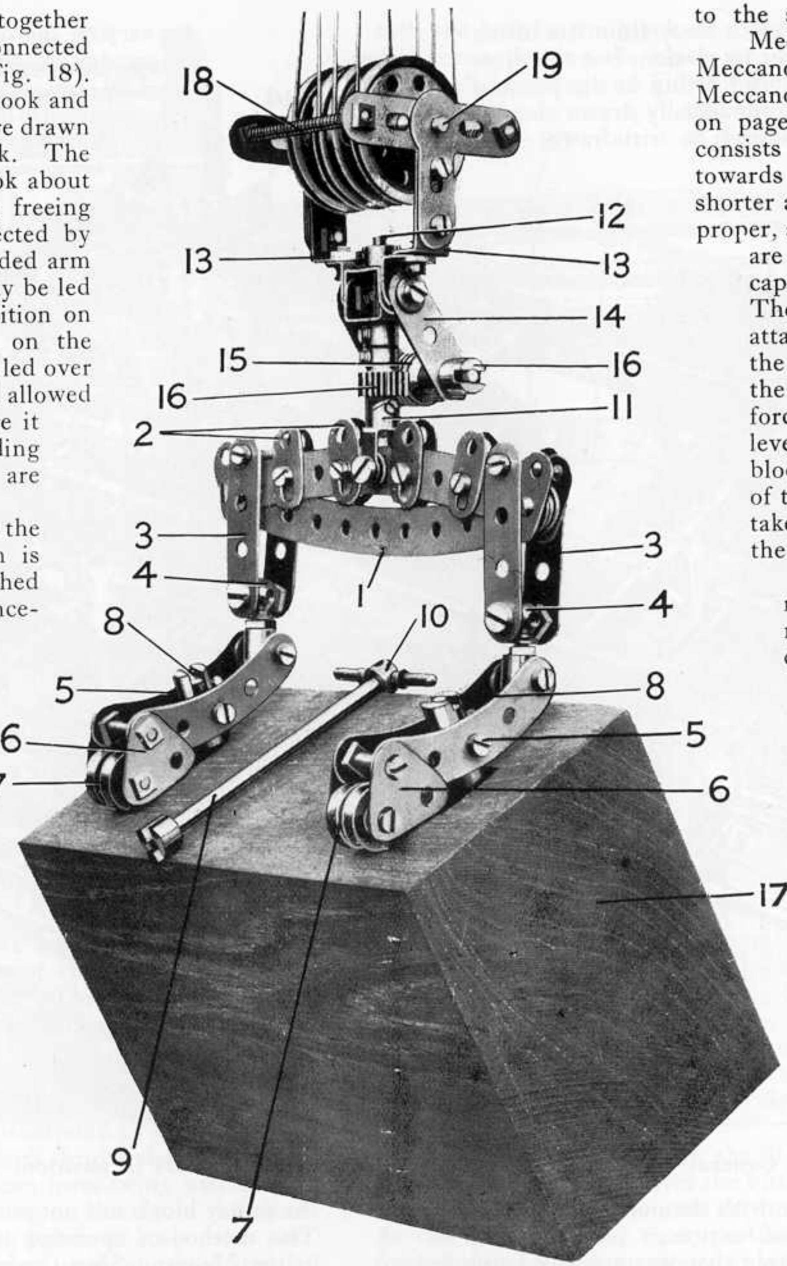

Fig. 16. The Fidler's Block-setting Gear, designed to set the blocks at an angle

Parts required for Building the Giant Block-setting Crane

2 of No.	1	2 of No.	12b	6 of No.	31	8 ft. of No.	103a
1 ,, ,,	1a	4 ,, ,,	13	4 ,, ,,	32	6 ,, ,,	103b
2 ,, ,,	1b	10 ,, ,,	13a	683 ,, ,,	37	1 ,, ,,	103c
15 ,, ,,	2	2 ,, ,,	14	30 ,, ,,	37a	1 ,, ,,	103d
5 ,, ,,	2a	6 ,, ,,	15	43 ,, ,,	38	4 ,, ,,	103f
8 ,, ,,	3	4 ,, ,,	15a	1 ,, ,,	45	9 ,, ,,	103h
20 ,, ,,	4	5 ,, ,,	16	4 ,, ,,	46	8 ,, ,,	103k
5 ,, ,,	5	4 ,, ,,	16a	57 ,, ,,	48	2 ,, ,,	106
17 ,, ,,	6	16 ,, ,,	17	4 ,, ,,	48a	6 ,, ,,	111
28 ,, ,,	6a	7 ,, ,,	18a	6 ,, ,,	52a	7 ,, ,,	111c
16 ,, ,,	7	2 ,, ,,	18b	90 ,, ,,	59	8 ,, ,,	113
18 ,, ,,	7a	18 ,, ,,	20	1 ,, ,,	62	5 ,, ,,	114
52 ,, ,,	8	20 ,, ,,	20b	12 ,, ,,	63	6 ,, ,,	115
44 ,, ,,	8a	4 ,, ,,	21	1 ,, ,,	63c	8 ,, ,,	126
4 ,, ,,	8b	2 ,, ,,	22	2 ,, ,,	64	12 ,, ,,	126a
32 ,, ,,	9	9 ,, ,,	22a	2 ,, ,,	70	4 ,, ,,	127
16 ,, ,,	9a	6 ,, ,,	23	2 ,, ,,	76	3 ,, ,,	133
13 ,, ,,	9b	22 ,, ,,	24	8 ,, ,,	77	6 ,, ,,	136
2 ,, ,,	9c	1 ,, ,,	25	2 ,, ,,	81	2 ,, ,,	139
29 ,, ,,	9d	7 ,, ,,	26	1 ,, ,,	82	2 ,, ,,	139a
9 ,, ,,	9e	2 ,, ,,	26a	4 ,, ,,	90	8 ,, ,,	140
104 ,, ,,	9f	3 ,, ,,	27	4 ,, ,,	89	3 ,, ,,	144
16 ,, ,,	10	4 ,, ,,	27a	2 ft. of No.	94	19 ,, ,,	147b
2 ,, ,,	11	26 ,, ,,	30	1 ,, ,,	95b	1 ,, ,,	160
3 ,, ,,	12	2 ,, ,,	30a	3 ,, ,,	96	1 ,, ,,	165
7 ,, ,,	12a	4 ,, ,,	30c	8 ,, ,,	99a	1 ,, ,,	166

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