Meccano Transporter Bridge

Suspension type : complete with Automatic Reversing Mechanism for controlling the movement of the Carriage

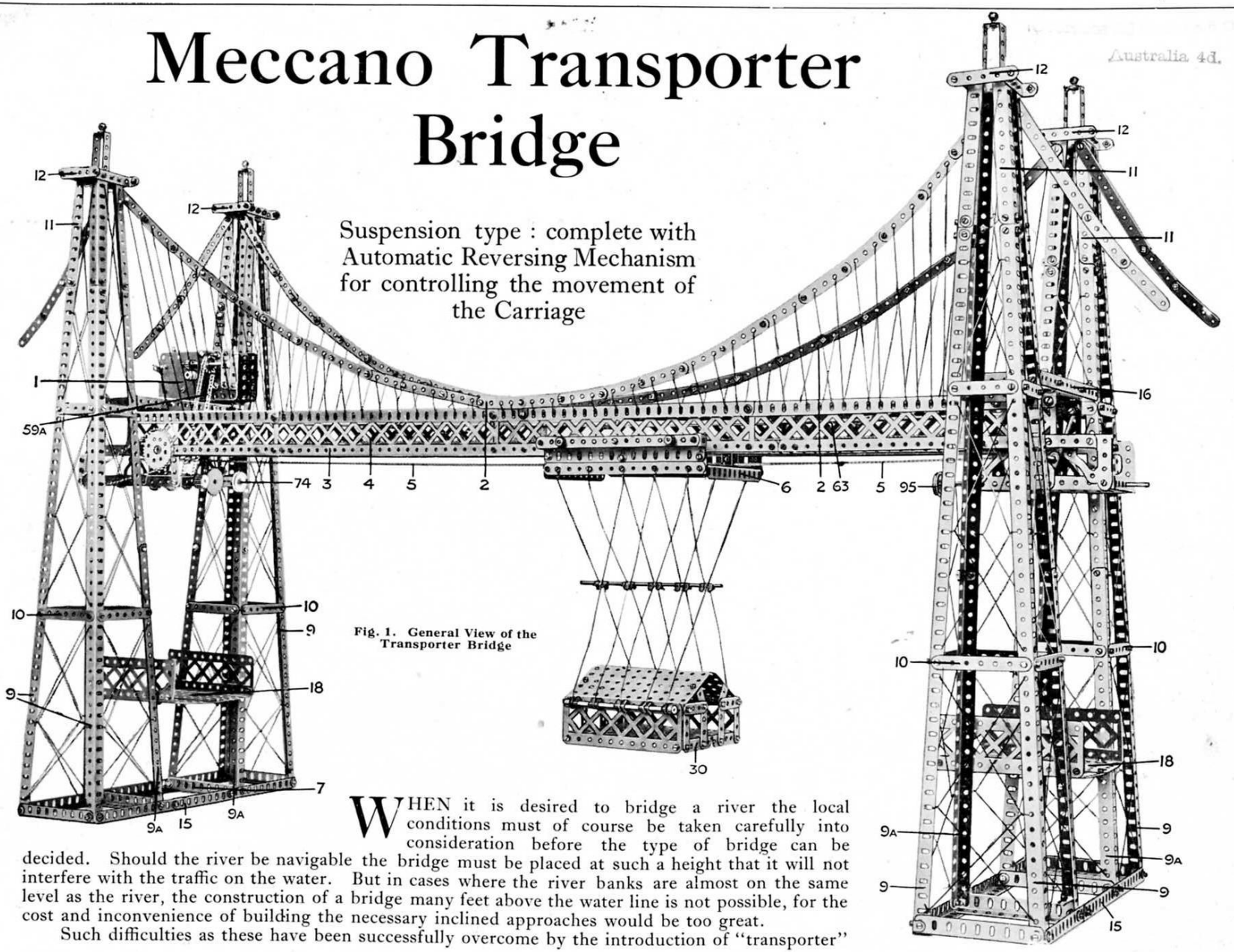

Fig. 1. General View of the Transporter Bridge

WHEN it is desired to bridge a river the local conditions must of course be taken carefully into consideration before the type of bridge can be decided. Should the river be navigable the bridge must be placed at such a height that it will not interfere with the traffic on the water. But in cases where the river banks are almost on the same level as the river, the construction of a bridge many feet above the water line is not possible, for the cost and inconvenience of building the necessary inclined approaches would be too great.

Such difficulties as these have been successfully overcome by the introduction of "transporter"

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bridges. These consist essentially of a girder, suspended at such a height that it clears the tallest masts, and fitted with rails carrying a trolley from which a car is suspended by steel cables. The car is moved across the river by steam or electric power. The level of the car platform being the same as that of the approaches, traffic passes direct from the shore into the car, and vehicles and pedestrians are carried bodily across the river. A fine example of this type of bridge crosses the River Mersey between Runcorn and Widnes. It has been in successful and continuous operation for the last quarter of a century.

The Meccano model follows the general design of this bridge very closely and embodies most of its principal features. An automatic reversing device is incorporated by means of which the car is caused to travel from one end to the other of the bridge, pause for a few seconds, and then reverse, entirely without attention.

Construction of the Towers

The base of each tower is formed by bolting together two pairs of 9½″ Angle Girders 15 (Fig. 2) overlapped nine holes. These are connected crosswise by four 4½″ Angle Girders 7. The outer vertical members of each tower are constructed with 24½″ Angle Girders 9 butt-jointed to 5½″ Angle Girders 11. Each inner vertical member is built up from two 12½″ Angle Girders 9a bolted together and extended by 5½″ Angle Girders 11. The 3½″ Strips 10 and 2½″ Strips 14 connect the four girders of each tower, while the top is braced by 2½″ Strips 12 bolted to 2½″ Double Angle Strips 12a.

The pinnacles of the towers are formed by two 2½″ Double Angle Strips 13 bolted to 1½″ Double Angle Strips that, in turn, are bolted to the inside faces of the Double Angle Strips 12a. Handrail Supports secured to the top of the Double Angle Strips 13 complete the structure.

The landing stages 18 are each composed of a 5½″×2½″ and a 5½″×3½″ Flat Plate overlapped one hole and bolted together. Two 5½″ Angle Girders 19 bolted to these Plates carry two 5½″ Braced Girders 17. Each stage is attached to the vertical Angle Girders 9a of its respective towers by Angle Brackets. Two 7½″ Angle Girders 16 may next be secured to 2½″ Angle Girders bolted to the inner sides of the towers.

When each tower unit has been assembled completely Meccano Cord may be laced through holes in the Girders as shown. This will give the towers a very realistic appearance, especially if care is taken to draw the cord quite tight.

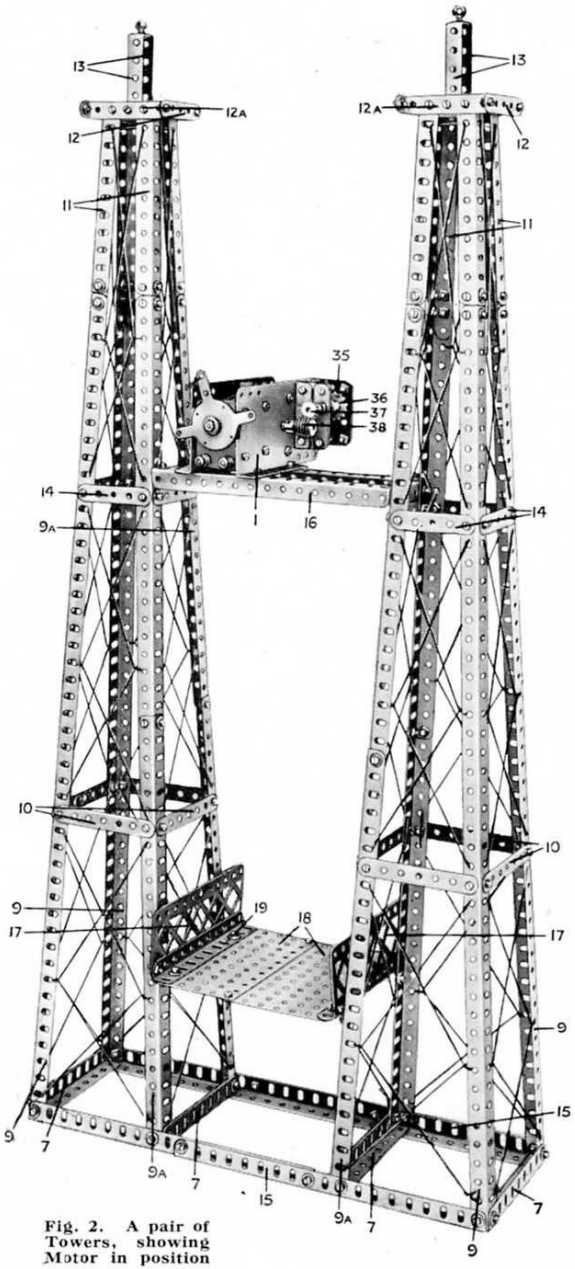

Fig. 2. A pair of Towers, showing Motor in position

The Main Span

Each of the upper Girders of the main span or gantry (Fig. 1) is formed by bolting three 12½″ and one 9½″ Angle Girders end to end. Each of the lower Girders 3, on which the carriage 30 (Fig. 1) travels, consists of one 24½″, one 12½″, and one 9½″ Angle Girders bolted to Braced Girders 4. The wheels of the carriage travel on the out-turned flanges of the Angle Girders 3.

The two similar sides of the main span should now be joined together at each end of the bridge by bolting two 3½″ Angle Girders across the upper Girders. In addition to these 3½″ Angle Girders, a 3½″ × 2½″ Flanged Plate is secured by the same bolts across each end (as shown at 98, in Fig. 4) and one is also secured across the centre of the main span, in order to hold the girders rigid.

To secure the main span to the towers proceed as follows. At the Motor end bolt the 3½″ Angle Girders to the transverse Angle Girders 16 (Fig. 2) of the towers. The non-Motor end is secured by bolting the Flanged Plate 98 (Fig. 4) to the Angle Girders 16 of its respective towers.

The suspension "cables" 2 (Fig. 1) are each constructed from twenty-four 2½″ Strips bolted end to end. Both chains are attached to the centre of the main span by Flat Brackets, and Meccano cord threaded as shown through the holes of the 2½″ Strips and the top Angle Girders of the main span represents the suspension bars of the actual bridge.

Although the model will be quite rigid without the use of "back-stays" or anchorages for the suspension cables, these would of course be absolutely essential in a real bridge and as most Meccano boys will desire to make the model as correct as possible they should complete it by extending the ends of the cables down to the ground. If the model is mounted on a baseboard and the suspension cables are brought down and secured at each end to suitable anchorages, a very graceful and realistic model will be obtained.

The Operating Mechanism

The driving power is obtained from a Meccano Electric Motor, which may be of either the 4-volt or the high voltage type. If the former is used the necessary current may be taken from a 4-volt Meccano Accumulator, while in the latter case the current supply may be taken from the house lighting circuit. Whichever type motor is used, however, it should be mounted on the platform 16 of one of the end towers as shown in Fig. 2.

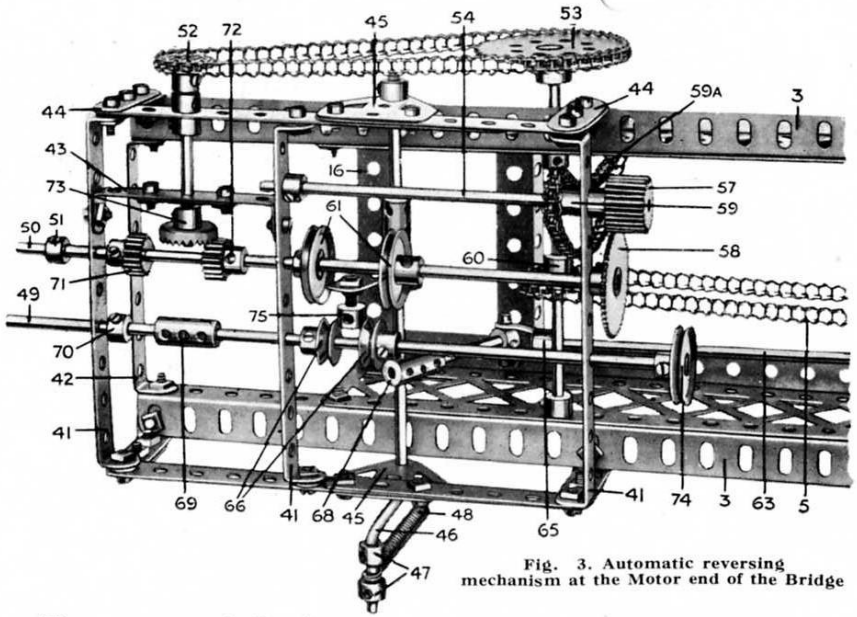

Fig. 3. Automatic reversing mechanism at the Motor end of the Bridge

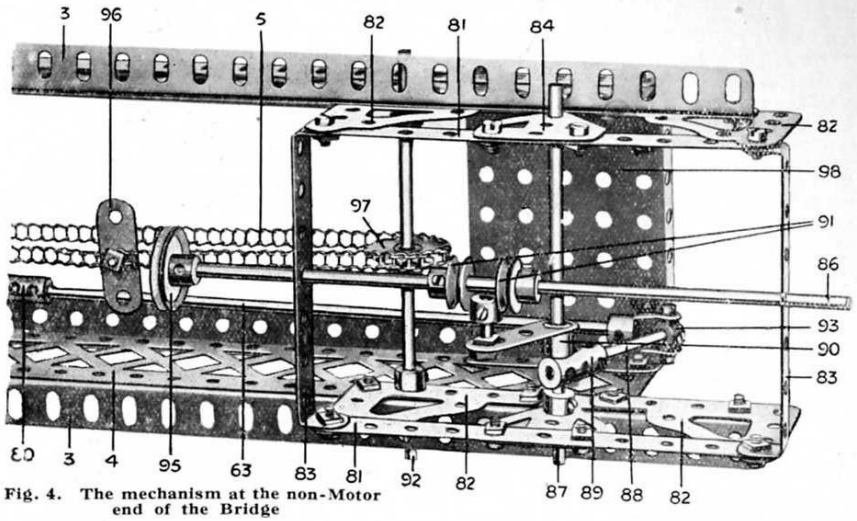

Fig. 4. The mechanism at the non-Motor end of the Bridge

The armature spindle of the Electric Motor carries a Worm 38 engaging the Pinion 37, which is mounted on a Rod that is journalled in 2″ Flat Girders 35 bolted to the Motor casing by means of 2″ Angle Girders. Additional support is given to the Rod by 2″ Strips bolted to the Flat Girders. The Rod of the Pinion 37 also carries a ¾″ Sprocket Wheel 36, which is connected by a Sprocket Chain 59a (Fig. 3) with a ¾″ Sprocket Wheel 59 carried on a Rod 54 incorporated in the mechanism at the driving end of the main span. This mechanism is shown in detail in Fig. 3. The framework supporting it consists of 4½″×½″ Double Angle Strips 41 connected at their ends to 5½″ and 3½″ Strips overlapped three holes and bolted together. The framework is supported from the Angle Girders 3 of the main span by short Strips and 1″×½″ Angle Brackets bolted to the Girders.

The Rod 54 carries a Double Width Pinion 57 that engages with a 50-teeth Gear 58 carried on the end of the Rod 50, on the other end of which are two ½″ Pinions 71 and 72. The Rod 50 is slidable in its bearings, the sliding movement being controlled by a Crank secured to the shaft of the 5½″ Crank Handle 46 and carrying a Threaded Pin to which is secured a Collar 75. The arm of the Crank engages between two 1″ Pulleys carried on the Rod 50 as shown, while the Collar 75 engages between two ½″ Pulleys 66 carried on a Rod 49 that is slidable in its bearings.

On the inner end of the Rod 49 is a 1″ Pulley 74. By pushing or pulling this Pulley the Rod 49 and the Crank are moved and the latter transmits movement to the Rod 50, thus bringing one or other of the Pinions 71 and 72 into engagement with the Contrate Wheel 73. It will be seen from Fig. 3 that by this means the direction of rotation of the Contrate Wheel 73 may be reversed according to which of the Pinions 71 and 72 is in engagement.

A Spring 48 attached to the Crank Handle tends to bring the latter over sharply so soon as it has been moved past its "critical" position by the Crank carrying the Collar 75. Hence one or other of the Pinions 71 and 72 is always held properly in mesh with the Contrate Wheel, and there is little possibility of its working out of engagement before the proper period has expired.

The Crank Handle 46 is journalled in Flat Trunnions 45 and carries a Coupling 68 in which is secured a 2″ Rod carrying a Swivel Bearing 65. This is connected with Rod 63, which runs the length of the main span and connects up with the mechanism at the other end of the bridge, as will be explained later. It will be necessary to couple three 11½″ and one 8″ Rod together in order to obtain the required length.

The final drive to the car is taken from the ¾″ Sprocket 52 (Fig. 3) carried on the Rod of the Contrate Wheel 73. This Rod is journalled in a Double Angle Strip 43 and the Strip of the frame as shown. The Sprocket Wheel 52 drives a 2″ Sprocket 53 on a Rod that is journalled in the Angle Girders 3. This Rod also carries a 1″ Sprocket 60 round which passes an 80″ endless length of Sprocket Chain 5 (see also Fig. 1) that carries a 1½″ Strip 96 (Fig. 4) and runs the whole length of the main span to the other tower, where it passes round a 1″ Sprocket 97 (Fig. 4) secured to a Rod 92 journalled in the Angle Girders 3. The purpose of the Strip 96 will be explained later, together with an explanation of the operation of the mechanism. This completes the reversing and traversing gear so far as the Motor end of the bridge is concerned.

Mechanism at the Non-Motor End

This is shown in Fig. 4. The framework that supports the Rods of the mechanism is constructed from 3½″×½″ Double Angle Strips 83, to which are bolted 5½″ Strips 81. The rectangular frame thus formed is attached to the Girders 3 of the main span by Architraves 82.

A Rod 87 journalled in Flat Trunnions 84 carries a Crank 90, in the end of which is a Threaded Pin carrying a Collar that engages between two ½″

Pulleys 91. These are secured about ½" apart on the Rod 86, which also carries at its inner end a 1" Pulley 95. A Coupling 89 secured to the Rod 87 carries a 2" Rod 88, on the end of which is fastened the collar of a Swivel Bearing 93. It will now be seen that by pushing the Pulley 95 the Crank 90 will be actuated and in turn will operate the Rod 63 through the Coupling and Rod 88.

Details of the Travelling Carriage

The travelling carriage, or "transporter," is shown in Fig. 5. It will be seen that it is composed of two parts—that which carries the travelling wheels 22 and the suspended portion forming the carriage proper.

The rectangular framework carrying the wheels 22 (¾" Flanged Wheels) is built up from two 5½" Angle Girders 6 bolted to 7½" Flat Girders 20 that carry Flat Brackets to which are bolted 7½" Strips 21. The travelling wheels 22 are secured to 1½" Rods journalled in the Flat Girders 20 and in the Strips 23. Two Double Bent Strips 24 are bolted to the Angle Girders 6 ; the purpose of these will be explained later.

The carriage proper is suspended from the trolley by means of the Loom Healds 26 attached to the Rods 99 and 27, and spaced apart by Spring Clips. The carriage is composed of two 5½" × 2½" Flanged Plates 30 that form the base, and to which are secured 5½" Braced Girders 28. The Girders 28 carry Angle Brackets 31 in the holes of which are journalled the 5" Rods 27. The construction of the ends and roof of the carriage does not need detailed explanation as the illustration is sufficiently clear on these points.

After the carriage and trolley have been constructed the whole unit may be placed in position on the main span of the bridge. To do this it will be necessary to remove one side of the trolley in order to set the travelling wheels 22 to run on the flanges of the Girders 3 (Fig. 1). When the trolley is in position two Angle Brackets 25 (Fig. 5) may be placed as shown so that they bear against the under surfaces of the Angle Girders 3 and thus prevent the trolley being lifted from the rails.

The Sprocket Chain 5 (Figs. 1, 3 and 4) may now be passed round the Sprocket 97 (Fig. 4), thence through the Double Bent Strips 24 (Fig. 5) secured to the trolley, and round the Sprocket 60 (Fig. 3). The 1½" Strip 96 (Fig. 4) must be secured to the Chain 5 in a position between the Double Bent Strips 24 so that as the Chain moves along, the Strip 96 bears against one or other of the Double Bent Strips, with the result that the carriage is moved along also. It is important to note that the Chain itself is not actually secured in any way to the trolley.

Parts required to build the Transporter Bridge

4	of No.	1b	22	of No.	12	1	of No.	29	10	ft. of No.	94
8	,,	2	1	,,	12a	1	,,	32	1	of No.	95
18	,,	3	8	,,	12b	26	,,	35	2	,,	96
112	,,	5	3	,,	13	507	,,	37	3	,,	96a
14	,,	6	3	,,	13a	162	,,	38	6	,,	99
6	,,	6a	2	,,	14	8	,,	40	2	,,	99a
10	,,	7	4	,,	15	1	,,	43	6	,,	100
26	,,	8	2	,,	15a	2	,,	45	20	,,	101
10	,,	8a	3	,,	16a	4	,,	48	2	,,	103g
4	,,	8b	1	,,	16b	17	,,	48a	2	,,	103k
22	,,	9	2	,,	17	3	,,	48b	4	,,	108
8	,,	9a	4	,,	18a	3	,,	48c	2	,,	115
4	,,	9b	1	,,	19	2	,,	52	4	,,	126a
4	,,	9d	4	,,	20b	2	,,	52a	4	,,	136
2	,,	9e	4	,,	22	4	,,	53	2	,,	165
6	,,	10	4	,,	23a	28	,,	59	1	Electric Motor	
6	,,	11	1	,,	25a	2	,,	62			
			3	,,	26	7	,,	63			
			1	,,	27	4	,,	70			

Fig. 6. The Transporter Bridge over the River Mersey at Runcorn, Cheshire. The Meccano model closely follows the general design of this famous bridge.

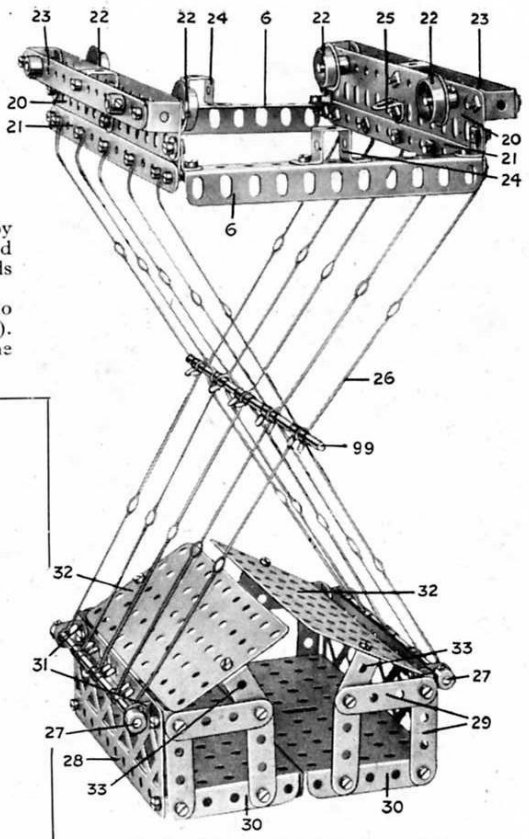

Fig. 5. The overhead Trolley, with suspended Carriage

Action of the Automatic Reversing Gear

When the carriage 30 (Fig. 1) moving to the left strikes the Pulley 74 (Figs. 1 and 3), of the reversing gear, the Crank 75 on the Crank Handle 46 is moved round until the Spring 48 on the Crank Handle pulls the latter hard over. In doing so, however, the end of the Crank presses against one of the Pulleys 61 on the Rod 50, thereby throwing the ½" Pinion 71 out of engagement with the Contrate 73 and bringing its fellow Pinion 72 into engagement with the Contrate, thus reversing the direction of rotation of the Sprocket Wheels 52 and 53 and hence the direction of motion of the carriage. When the carriage reaches the other end of the bridge it strikes the Pulley 95 (Figs. 1 and 4) thereby actuating the reversing mechanism through the medium of the Rod 63 (Figs. 1, 3 and 4). This time the Pinion 72 is thrown out of engagement with the Contrate and Pinion 71 is brought into gear, while the Rod 49 carrying the Pulley 74 is returned to its original position, ready to meet the carriage again when the latter once more reaches the left-hand end of the bridge.

It should be noted that when the direction of the Sprocket Chain is reversed, the 1½" Strip 96 (Fig. 4) must travel from one Double Bent Strip 24 (Fig. 5) to the other before setting the trolley in motion. Hence the carriage pauses realistically at each end of its travel before returning, thus giving the passengers plenty of time to embark or return to terra firma !