MECCANO Trench Digger

(MODEL No. 10.17)

SPECIAL FEATURES

This model is based on an actual machine designed for digging narrow trenches suitable for laying drainage pipes, cables, etc. The trench is excavated by a continuous moving chain of sharp-edged digger buckets, and the depth of the trench can be adjusted as required.

The model can be steered as it travels and is powered by a Meccano E15R type Electric Motor.

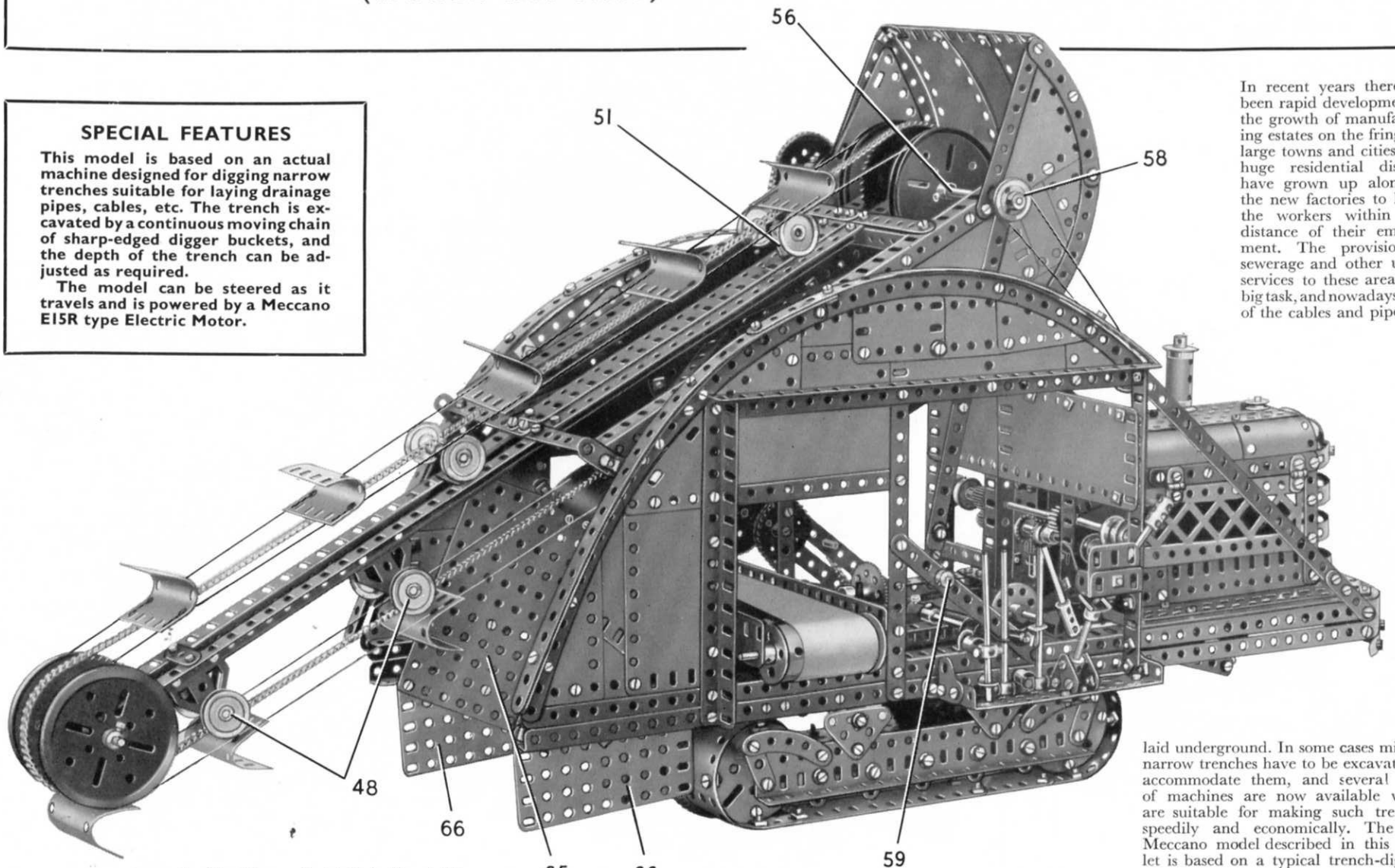


FIG. 1 *The Meccano Bucket Chain Trench Digger. Its construction is fully described in this Leaflet*

In recent years there has been rapid development in the growth of manufacturing estates on the fringes of large towns and cities, and huge residential districts have grown up alongside the new factories to house the workers within easy distance of their employment. The provision of sewerage and other utility services to these areas is a big task, and nowadays most of the cables and pipes are laid underground. In some cases miles of narrow trenches have to be excavated to accommodate them, and several types of machines are now available which are suitable for making such trenches speedily and economically. The fine Meccano model described in this Leaflet is based on a typical trench-digging

machine. It is fitted with an endless chain of buckets that bite into the ground as the machine moves slowly forward on its creeper tracks. The spoil falls on to a conveyor and is distributed alongside the trench as the machine moves along. The depth of the trench can be varied by adjusting the angle of the boom that carries the bucket chain.

Details of the Chassis (Figs. 2, 6 and 7)

Each side-member of the chassis consists of two 24½″ Angle Girders arranged to form a channel section girder by bolting to them two 7½″ Angle Girders (1) and (2) and a 7½″ Strip (3) (Fig. 7). The top ends of the Girders (1) and (2) and the Strip (3) are connected by bolting to them a 12½″ Angle Girder (4). The side-members are connected by two built-up strips (5) and (6) (Fig. 2), each made from two 5½″ Strips overlapped seven holes. Two similar built-up strips (7) and (8) are fixed in position, and a further built-up strip (9) (Fig. 3) is bolted across the chassis. The strip (9) is made from two 4½″ Strips overlapped three holes. Two 18½″ Angle Girders (10) are bolted to the strips (5) and (6) as shown.

The Power Unit and Main Drive (Figs. 2, 3, 6 and 8)

An E15R Electric Motor is bolted by its flanges to the Girders (10) (see Fig. 6) and a $\frac{7}{16}$″ Pinion on its armature shaft drives a 60-tooth Gear (see Fig. 2) on a 3″ Rod mounted in the Motor side-plates. This Rod carries a ¾″ Pinion (11) (Fig. 6) that drives a 50-tooth Gear on a 2½″ Rod. A Worm (12) (Fig. 2) fixed on this Rod engages a ½″ Pinion on an 11½″ Rod (13). The bearings for Rod (13) are provided by a Double Arm Crank (14) and a 1½″ Strip, each of which is attached to the Girders (10) by two Angle Brackets. The 1½″ Strip is positioned immediately behind a ½″ Pinion (15) (Fig. 8) fixed on the Rod, which carries also a ¾″ diameter ½″ face Pinion (16) and a ⅞″ Bevel Gear (17).

A Universal Coupling is fixed to the end of Rod (13) (Fig. 2) and is fitted also with a 4½″ Rod that is supported in an Obtuse Angle Bracket bolted to the strip (8). The 4½″ Rod carries a ½″ Bevel Gear and is free to turn in a Coupling (18). This Coupling is loosely mounted on the driving axle, between a Collar and a 1½″ Bevel Gear that meshes with the ½″ Bevel Gear. The driving axle is a 5″ Rod supported in two Corner Gussets, which are fixed to 1½″ Angle Girders bolted to the strips (6) and (9).

The Motor switch is operated by a lever (71) (Figs. 3 and 6) formed by a 2″ Rod in a Coupling. The Coupling is fixed on a 3½″ Rod mounted in Double Brackets bolted to the chassis, and the Rod carries a Bush Wheel to which a built-up strip is *lock-nutted*. This strip consists of two 5½″ Strips placed face to face and extended by a 3½″ Strip that overlaps the 5½″ Strips by three holes, and it is *lock-nutted* also to a Bush Wheel on a 2½″ Rod. The Rod is held by Collars in Flat Trunnions bolted to the Girders (10), and a 2½″ Strip (72) (Fig. 2) is fixed across the Bush Wheel. Another 2½″ Strip is *lock-nutted* to the Strip (72) and is pivoted at its upper end on a ⅜″ Bolt screwed into a Handrail Support that is *lock-nutted* to an arm of the Motor switch.

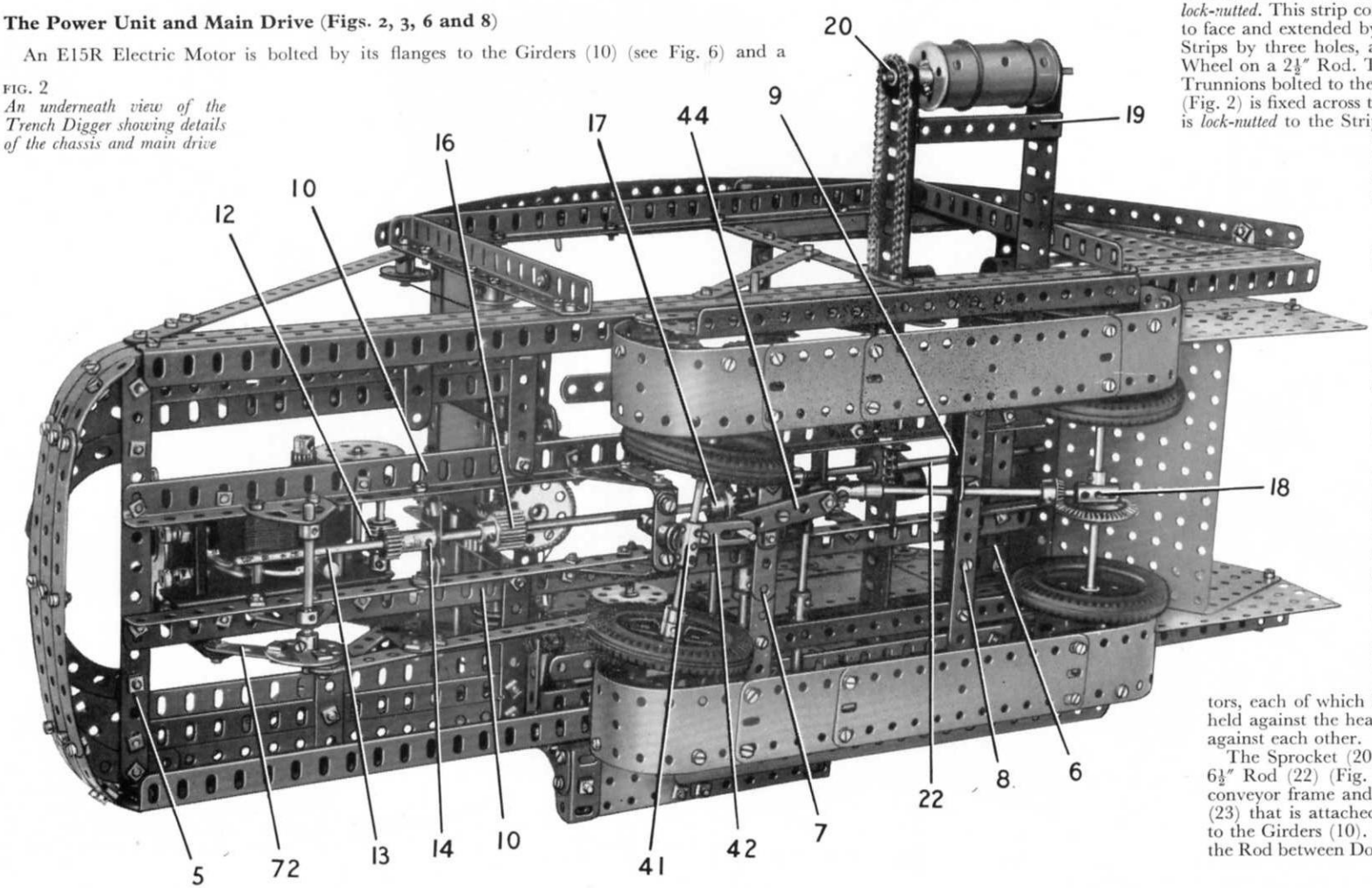


FIG. 2
An underneath view of the Trench Digger showing details of the chassis and main drive

Assembly of the Conveyor (Figs. 2, 3, 7 and 8)

The conveyor frame consists of two 12½″ Flat Girders, one of which is attached to the Girders (1) (Fig. 7) by 1″×½″ Angle Brackets while the other is similarly attached to the Strips (3). A 3½″×½″ Double Angle Strip (19) (Fig. 2) is bolted between the Flat Girders at one end.

The main conveyor rollers are formed by 1⅛″ Flanged Wheels pressed into Cylinders, and each is fixed on a 4″ Rod mounted in the Flat Girders. The Rod that supports the driving roller carries a ¾″ Sprocket (20) (Fig. 7), and two 2½″ Driving Bands are stretched round this roller. The belt can be made from a length of cloth or strong paper joined together at its ends. The supporting rollers (21) (Fig. 3) are Chimney Adaptors, each of which is free to turn on a ½″ Bolt and is held against the head of the Bolt by two nuts screwed against each other.

The Sprocket (20) is driven by a 1″ Sprocket on a 6½″ Rod (22) (Fig. 3). This Rod is supported in the conveyor frame and in a 1½″×½″ Double Angle Strip (23) that is attached to 1″×½″ Angle Brackets bolted to the Girders (10). A Compression Spring is fitted on the Rod between Double Angle Strip (23) and a Collar

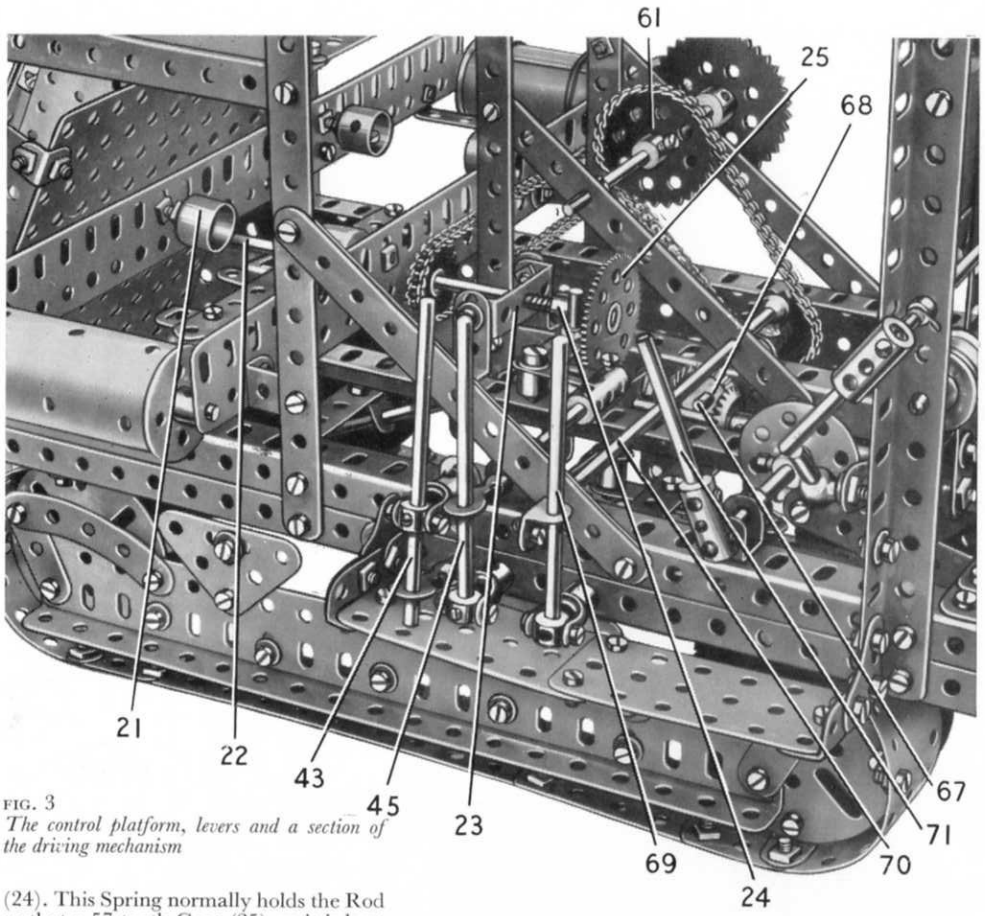


FIG. 3
The control platform, levers and a section of the driving mechanism

(24). This Spring normally holds the Rod so that a 57-tooth Gear (25) on it is kept clear of the Pinion (15) (Fig. 8). The Gear and Pinion can, however, be brought into mesh by sliding the Rod, to engage the drive to the conveyor. The movement of Rod (22) is restricted by a Collar placed inside the conveyor frame, and is controlled by a lever (45) (Fig. 3). This lever is a 3½" Rod fixed in a Swivel Bearing attached to the chassis by a Pivot Bolt. The lever carries as shown a Rod and Strip Connector fixed on a 3½" Rod that slides in a Double Bracket bolted to the chassis. A Strip Coupling on the 3½" Rod is connected by a ⅜" Bolt to one arm of a Bell Crank, and this is mounted freely on a Pivot Bolt fixed in one of the Girders (10). The other arm of the Bell Crank carries a Threaded Pin that engages between the Collar (24) and the Gear (25).

Supporting Frame for the Bucket Boom (Figs. 1, 5, 7 and 8)

The outer edge of the frame on each side consists of a 3" Strip (26) and four 5½" Curved Strips. The rear Curved Strip is connected by a 9½" Strip and a 2" Strip to the rear end of the chassis. Two 12½" Strips (27) on each side are spaced apart by a nut on each of two ⅜" Bolts (28), and these Bolts attach the Strips to Angle Brackets bolted to the frame. Another 12½" Strip overlaps the rear ends of the Strips (27) by five holes, and this Strip also is connected to the frame by an Angle Bracket.

A built-up strip (29) (Fig. 8) is attached to the Strips (3), and a 5½" Strip is connected to the strip (29) by an Angle Bracket and bolted at its lower end to one of the Girders (10). The 5½" Strip is connected to the Girder (10) by another 5½" Strip (30). The strip (29) is made from two 4½" Strips overlapped three holes.

Two 5½" Angle Girders (31) are connected to the Girders (10) by Corner Angle Brackets, and each is joined to one of the Girders (2) by a 3" Strip. The Girders (31) are connected by two 5½" × 2½" Flexible Plates overlapped seven holes and edged by two 7½" Strips. These are attached to the Girders (2) by Angle Brackets. A 2½" × ½" Double Angle Strip (32), with a Double Arm Crank bolted to it, is fixed between the lower ends of the Angle Girders (31) (Fig. 6).

Drive to the Boom Winding Drums (Figs. 1, 5, 6, 7 and 8)

A 1½" Contrate that meshes with the Pinion (16) (Fig 6) is fixed on a 1½" Rod free in the Double Angle Strip (32) and in the boss of the Double Arm Crank. A ½" Pinion (33) is fixed on the upper end of the Rod. A cross shaft (34) is formed by a 5" Rod mounted in the Girders (31), and this carries two ¾" Contrates arranged one on either side of the Pinion (33), with a Compression Spring between each Contrate and one of the Girders (31).

The movement of Rod (34) is controlled by a Bell Crank mounted on a Pivot Bolt (35) (Fig. 6). One arm of the Bell Crank is extended by a 1" Rod held in a Handrail Support, and a Threaded Pin is fixed in the other arm. The Threaded Pin engages a ½" loose Pulley (36) with a ¾" Washer and a Collar on either side of it. A ½" Pinion on Rod (34) drives a ½" diameter, ½" face Pinion (37) on an 8" Rod (38). This Rod carries two pairs of ¾" Flanged Wheels and a Ratchet Wheel (39). A Pawl on a 4½" Rod (40) engages

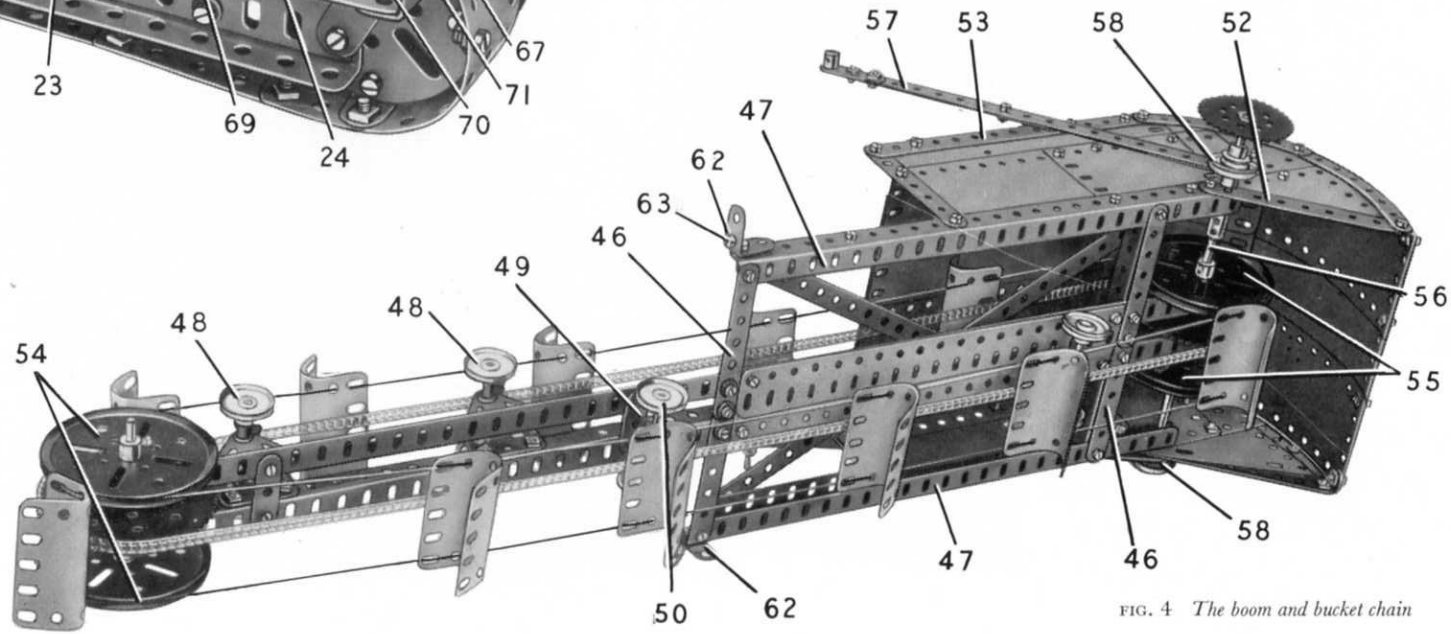


FIG. 4 *The boom and bucket chain*

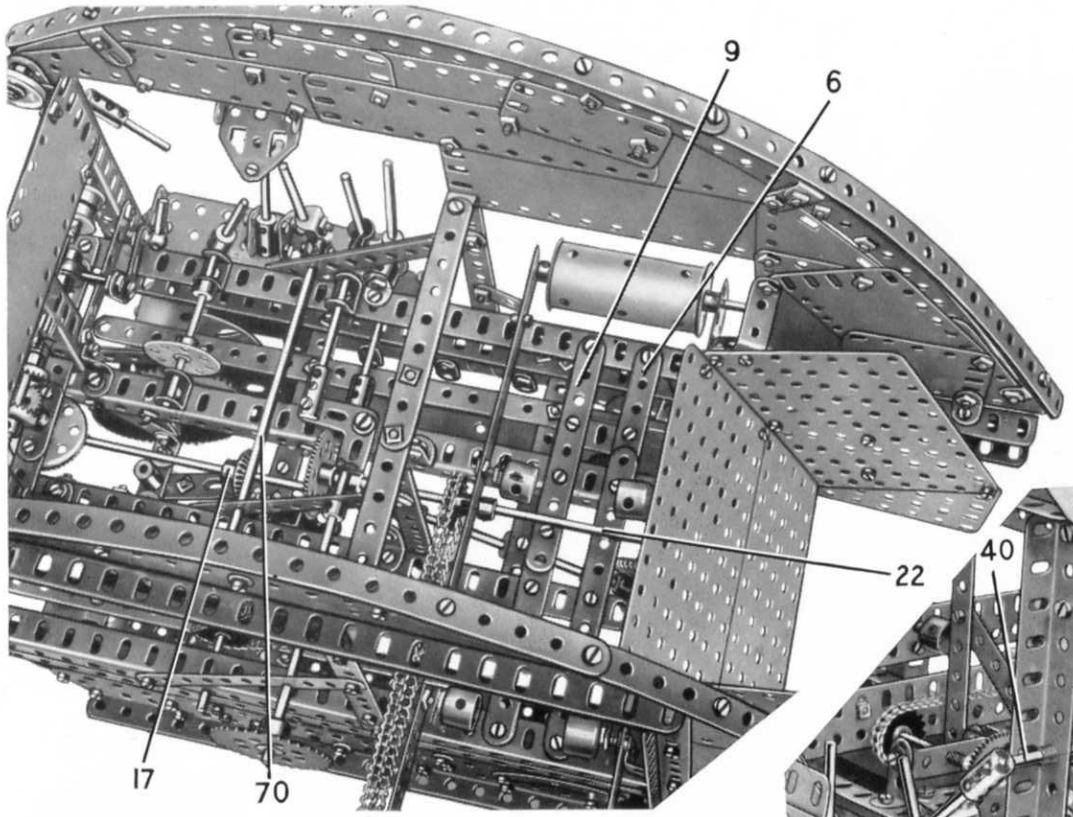


FIG. 5 *Plan view of the Trench Digger with the boom and bucket chain removed*

the Ratchet and can be released by operating a handle formed by a 1½" Rod held in a Coupling.

Arrangement of the Steering Mechanism (Figs. 1, 2 and 3)

Each steerable wheel is free to turn between two Collars on a 2" Rod, which is gripped in a Coupling (41). This Coupling is fixed on a 1½" Rod passed through a Double Arm Crank that is attached by Angle Brackets to two 1½" Strips bolted to the Girders (10). Each 1½" Strip is braced by a 2" Strip that also is bolted to the Girder (10). A Crank, fitted with a 2" Slotted Strip (42), is fixed on the 1½" Rod, which is held in place by a Collar.

The steering lever is a 3½" Rod (43), fixed in the 'spider' of a Swivel Bearing. The Swivel Bearing is fixed on a Pivot Bolt attached to an Angle Bracket bolted to the chassis. A Rod and Strip Connector is passed over the lower end of the lever and is fitted to one end of a made-up rod formed by two 2" Rods joined by a Coupling. The other end of the made-up rod also carries a Rod and Strip Connector, which is pivoted on a ⅜" Bolt fixed in a Rod Socket. The Rod Socket is bolted to a 2½" Strip (44), and this Strip pivots on a ⅜" Bolt fixed in a Double Arm Crank bolted to the strip (7). A Threaded Pin in Strip (44) engages the slotted hole of the Slotted Strip (42).

Details of the Tracks and Track Guards (Figs. 1, 2 and 7)

Each of the dummy tracks consists of three 5½" × 1½" Flexible Plates and a 2½" × 1½" Flexible Plate. A Face Plate is attached to each end by Angle Brackets and the track is then bolted underneath the chassis frame.

The track guards are each formed by a 9½" Angle Girder and a 9½" Flat Girder. Two 1½" Corner Brackets attached to the Flat Girder are connected to the chassis by Angle Brackets.

Construction of the Boom and the Bucket Chain (Figs. 1, 4 and 7)

The boom that supports the bucket chain consists of two 24½" Angle Girders connected by a 1½" Strip, two 9½" Flat Girders and two built-up strips (46) (Fig. 4), each made from two 3½" Strips. The upper one of the strips (46) is strengthened by a 3" Angle Girder on each side. A 12½" Angle Girder (47) on each side is bolted to the ends of the strips (46), and this structure is braced by two crossed 12½" Strips. The lower ends of the 12½" Strips are bolted to 4½" Angle Girders fixed to the Girders (47), and the upper ends are attached to Angle Brackets also bolted to the Girders (47).

Two pairs of Flat Trunnions are bolted to the 24½" Angle Girders as shown, and in each pair a 2" Rod is held by Spring Clips and is fitted with 1" Pulleys (48). A Threaded Coupling (49) is fixed on a bolt passed through a 1½" Strip, and in this a 2" Rod is freely mounted and is held in position by the separated halves of a Dog Clutch. This Rod carries two 1" Pulleys (50). A

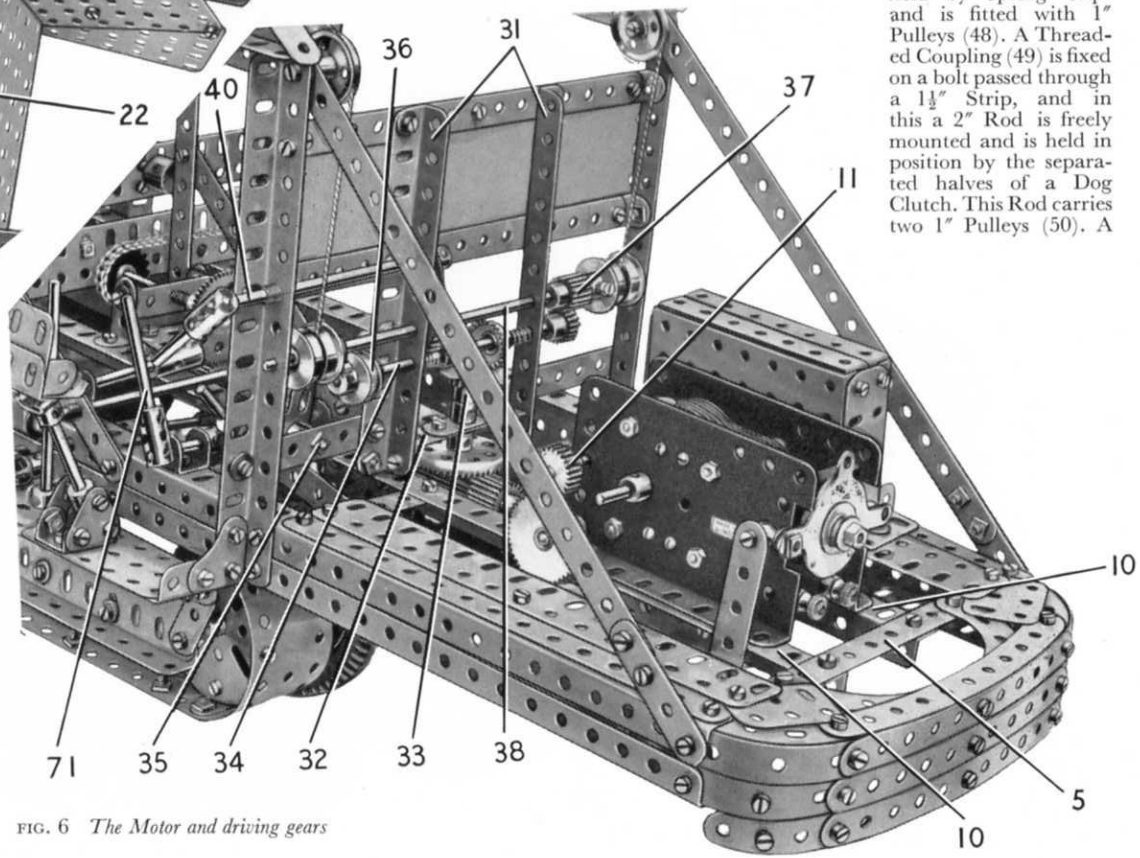


FIG. 6 *The Motor and driving gears*

Coupling (51) is fixed on a Threaded Pin bolted to the 9½″ Flat Girders, and this also carries a 2″ Rod fitted with two 1″ Pulleys. The Rod is held in place by Collars.

The framework of each side of the hopper at the top of the boom consists of a 4½″ Strip (52), a 3½″ Strip and a built-up strip (53) made from a 5½″ and a 4½″ Strip. The rounded base of the hopper is formed by three 9½″×2½″ Strip Plates and three 5½″×2½″ Flexible Plates, attached to the sides by Angle Brackets.

At the lower end of the boom two 3″ Pulleys (54) and a 3″ Sprocket are fixed on a 3½″ Rod. At the upper end two 3″ Pulleys (55) and a 3″ Sprocket are fixed on an axle (56) made from a 6½″ and a 2½″ Rod joined by a Coupling. The bucket chain consists of 12 U-section Curved Plates threaded on two endless belts of Cord, each of which is passed round the Pulleys (54) and (55) and is supported by the 1″ Pulleys of the boom.

The boom is supported by two built-up strips (57), each made from a 9½″ Strip and two 5½″ Strips bolted together face to face to form a 9½″ strip of double thickness. The top ends of these strips are passed over the ends of the axle (56), but are spaced from the hopper by a Collar on each side. Two 1″ loose Pulleys (58) are mounted on the axle. One of them is held in place by a Collar and the other is retained on the axle by a ½″ fixed Pulley. The lower ends of the strips (57) are fitted with Cranks, one of which is fixed on a 1″ Rod (59) that is held in the frame by a Collar. The other Crank is freely mounted on a 5″ Rod (60), which is supported in the Strip (30) and in the Strip that braces one of the Strips (3). Rod (60) carries a 1½″ Sprocket (61), and a 2″ Sprocket that is connected by Chain to a similar Sprocket at one end of the axle (56).

A 1″×1″ Angle Bracket (62) is *lock-nutted* to the Girder (47) on each side, and in the Angle Bracket is fixed a bolt (63) fitted with two Washers. The outer lugs of the Angle Brackets slide freely between the Strips (27) on each side.

A 1″ loose Pulley (64) on each side is freely mounted on a ⅜″ Bolt screwed into a Threaded Boss. The Threaded Bosses are screwed tightly on to bolts passed through the top ends of the Girders (2) (Fig. 7). A length of Cord on each side is fastened to the Rod (38) between the ¾″ Flanged Wheels, is passed over the Pulley (64) and then round the Pulley (58). The Cord is then tied to the Threaded Boss.

A 5½″×3½″ Flat Plate (65) on each side, to which a 4½″×2½″ Flat Plate (66) is bolted at an angle as shown (Fig. 1), is connected to the main chassis girder by a 1″×1″ Angle Bracket and to the Girder (1) by a 1″ Reversed Angle Bracket. Two 5½″×3½″ Flat Plates, overlapped two holes lengthways, are attached to the rear edges of the Flat Plates (65) by means of Angle Brackets.

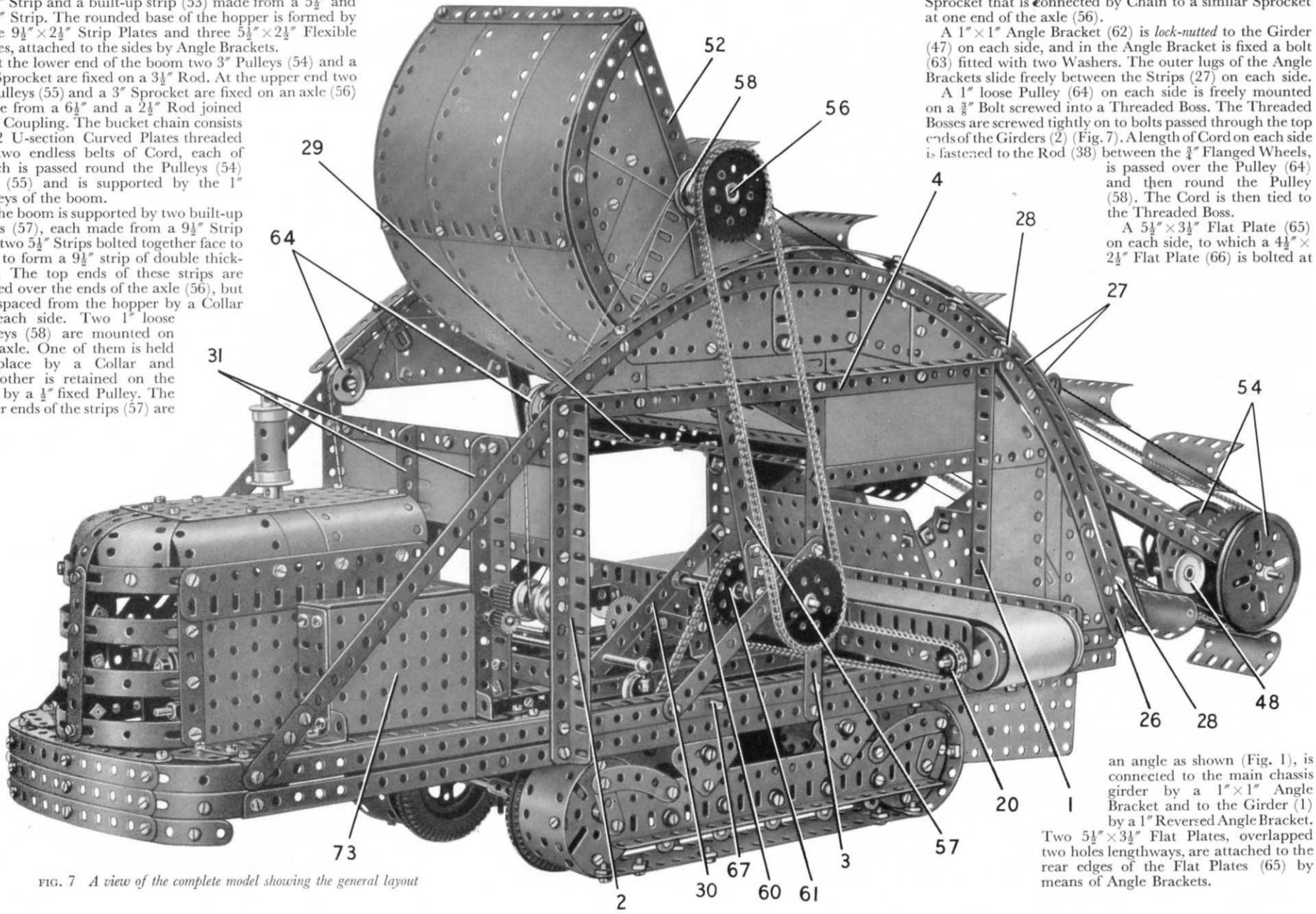


FIG. 7 *A view of the complete model showing the general layout*

Drive to the Bucket Chain (Figs. 3, 5, 7 and 8)

A 4″ Rod (67) (Fig. 3) is mounted in one of the Girders (10) and in one side of the chassis frame. The Rod carries a ⅞″ Bevel Gear (68), a 1″ Sprocket connected by Chain to the 1½″ Sprocket (61), and a ¾″ Flanged Wheel. A Compression Spring is fitted on Rod (67) between the Girder (10) and the Flanged Wheel, and this normally holds the Rod in such a position that Bevel Gear (68) is clear of Bevel Gear (17). The two Bevel Gears can be meshed by moving a lever (69). The lever is a 3½″ Rod held in a Swivel Bearing fixed on a Pivot Bolt bolted to the side of the chassis. An Angle Bracket passed over the lever is *lock-nutted* to a Rod and Strip Connector on a 6½″ Rod (70) and a Handrail Coupling engages the ¾″ Flanged Wheel on Rod (67).

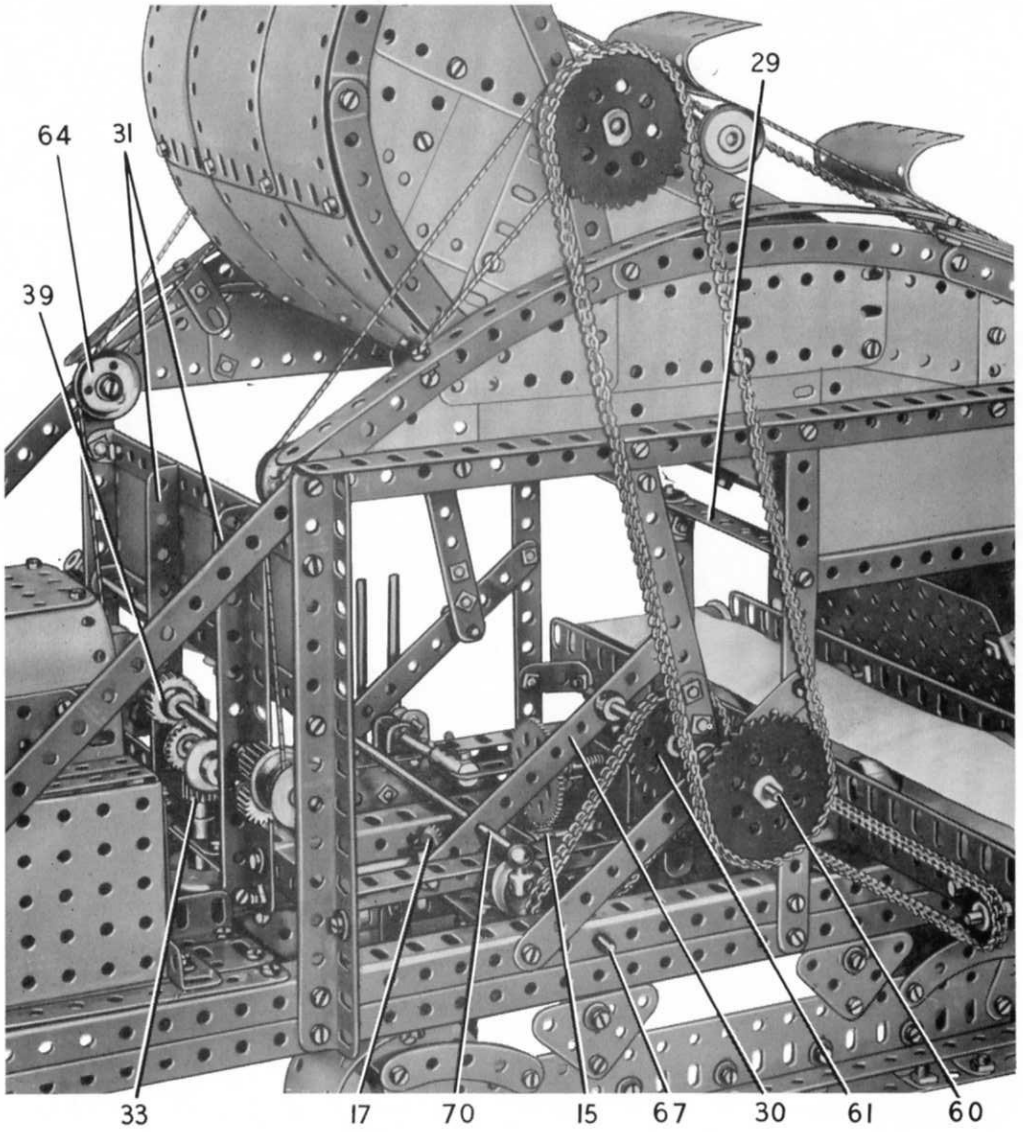
Assembly of the Driving Platform and the Engine Cover (Figs. 1, 3 and 7)

The driving platform consists of two 3″×1½″ Flat Plates bolted together and fitted at each end with a 1½″ Angle Girder that carries a 1″ Corner Bracket. One of the Girders is connected to the chassis by an Angle Bracket and the other is fixed to the Girder (2).

The driver's seat is formed by a 1½″ Flat Girder, a Flat Trunnion and a 1½″×½″ Double Angle Strip connected by a 1½″ Angle Girder. It is bolted to an Obtuse Angle Bracket that is inserted between the lugs of a Slide Piece, and is held in place by a 2″ Rod fixed in the Slide Piece. The 2″ Rod is gripped in a Coupling. The Coupling is fixed by nuts and bolts between two 1″ Triangular Plates connected by Double Brackets.

The side of the engine cover seen in Fig. 7 consists of a 5½″×2½″ Flat Plate and a 5½″ Flat Girder bolted at one end to a 3½″ Strip and at the other end to a 3½″ Flat Girder. The other side is formed by a 5½″ Strip, a 5½″ Flat Girder, a 3½″ Flat Girder, a 3½″ Strip and a 5½″ Braced Girder attached to the 5½″ Strip by two Hinges. A 5½″ Angle Girder extended by a 2½″ Angle Girder is bolted to the lower edge of each side of the engine cover, and these Girders are used to attach the structure to the chassis frame. At one side of the engine cover a box structure (73) is fitted (Fig. 7).

FIG. 8 *A close-up showing part of the drive to the bucket chain*



Parts Required to Build the Meccano Trench Digger

10	of No.	1	4	of No.	5	4	of No.	8b	5	of No.	11	3	of No.	14	
4	" "	1a	7	" "	6	4	" "	9	50	" "	12	3	" "	15	
5	" "	1b	10	" "	6a	2	" "	9a	4	" "	12a	3	" "	15a	
29	" "	2	6	" "	7	2	" "	9c	8	" "	12b	2	" "	15b	
8	" "	2a	2	" "	7a	2	" "	9d	3	" "	12c	5	" "	16	
10	" "	3	4	" "	8	7	" "	9f	1	" "	13	4	" "	16a	
7	" "	4	2	" "	8a	21	" "	10	1	" "	13a	3	" "	16b	

8	of No.	17	2	of No.	103			
2	" "	18a	4	" "	103a			
3	" "	18b	2	" "	103b			
4	" "	19b	2	" "	103d			
4	" "	20	2	" "	103f			
4	" "	20a	3	" "	103h			
7	" "	20b	4	" "	103k			
8	" "	22	2	" "	108			
4	" "	22a	4	" "	109			
2	" "	23	8	" "	111a			
1	" "	23a	19	" "	111c			
2	" "	24	2	" "	114			
1	" "	25	4	" "	115			
1	" "	25a	4	" "	120b			
4	" "	26	2	" "	124			
1	" "	26a	7	" "	126a			
1	" "	26c	2	" "	128			
1	" "	27	4	" "	133			
1	" "	27a	2	" "	133a			
1	" "	27d	2	" "	136			
1	" "	28	1	" "	136a			
2	" "	29	2	" "	140			
2	" "	30	4	" "	142a			
1	" "	30a	1	" "	144			
1	" "	30c	1	" "	147a			
1	" "	32	5	" "	147b			
4	" "	35	1	" "	148			
503	" "	37a	1	" "	154a			
463	" "	37b	1	" "	154b			
80	" "	38	1	" "	163			
2	" "	38d	4	" "	164			
1	" "	40	2	" "	165			
2	" "	48	1	" "	176			
1	" "	48a	1	" "	179			
4	" "	48b	2	" "	186			
1	" "	50	11	" "	188			
4	" "	52a	12	" "	189			
2	" "	53	5	" "	190			
2	" "	53a	4	" "	190a			
1	" "	55a	4	" "	191			
24	" "	59	7	" "	192			
3	" "	62	3	" "	196			
4	" "	62b	12	" "	199			
8	" "	63	5	" "	200			
1	" "	63b	4	" "	212			
1	" "	63c	12	" "	215			
2	" "	64	2	" "	216			
2	" "	70	6	" "	221			
2	" "	73	2	" "	222			
2	" "	77	2	" "	223			
9	" "	89	2	" "	224			
4	" "	89b	2	" "	225			
4	" "	90	2	" "	226			
4	" "	90a						
3	" "	94						
2	" "	95						
1	" "	95a						
2	" "	95b						
2	" "	96						
1	" "	96a						
1	" "	100						

1 E15R Electric Motor (not included in Outfit)