

Meccano Steam Shovel

A model of unlimited interest and application that performs all the operations of an actual steam shovel or mechanical navy

Built with Meccano Outfit L

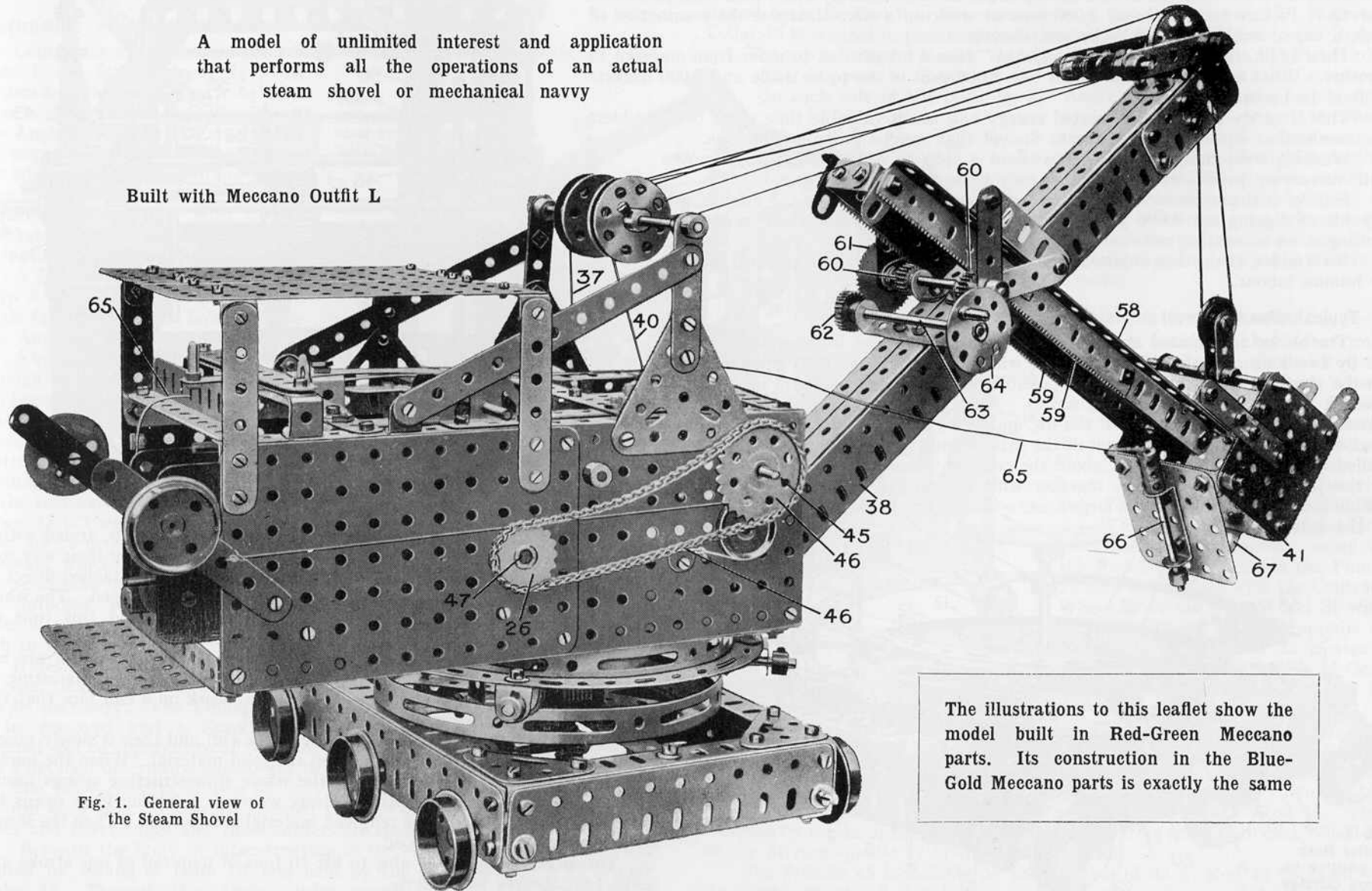


Fig. 1. General view of the Steam Shovel

The illustrations to this leaflet show the model built in Red-Green Meccano parts. Its construction in the Blue-Gold Meccano parts is exactly the same

MANY labour-saving devices are available to present-day engineers, and among these there is probably none more useful than the steam shovel, or mechanical navy as it is sometimes called.

The truth of this statement will be realised when it is learned that a large steam navy can move as much material in one day as could be excavated by 2,000 men with picks and shovels! Picture for a moment 2,000 men at work on a site. Imagine the commotion of such a crowd wielding 2,000 picks and shovels.

Then again, think of all the stoppages to "take a breath" or to move from one spot to another. What a dinner hour it would be—2,000 cans of tea to be made and 2,000 baskets of food to be opened!

This is surely a picture of wasted energy and much valuable time when one considers the mechanical equivalent, the Steam Shovel that weighs perhaps 100 tons.

Working from morning to night without a stop to rest or cogitate, it moves with unvarying precision, and requires only three men to look after it.

Fed on coal and water, and working at about four strokes to the minute, it is capable of digging out 6,000 yards of material in a working day, and in addition loading it on to waiting railway wagons.

No wonder, then, that engineers and contractors prefer the mechanical method to human labour.

A Typical Steam Shovel

The bucket is mounted at the end of a beam that in turn is connected with the jib by two long racks meshing with gear wheels driven by steam engines mounted on the shovel frame. This makes it possible to rack the bucket arm in or out as desired, thus varying the working radius. As in the case of a crane, a wire rope passes over a pulley at the top of the jib, and on to a winding drum, with the result that as soon as the gear is thrown in the drum winds in the rope and the bucket is pulled upward, describing an arc about the point at which the bucket arm is pivoted to the jib. These movements, together with the raising or lowering of the jib, enable the bucket to excavate a large area 18 without having to alter the position of the entire machine.

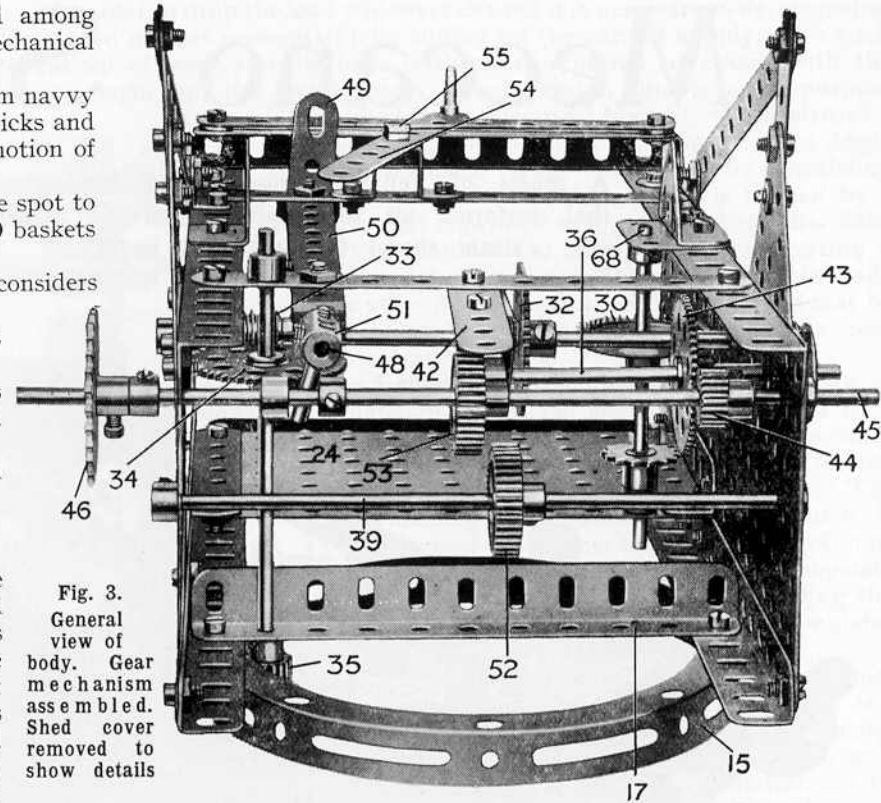


Fig. 3.
General view of body. Gear mechanism assembled. Shed cover removed to show details

The leading edge of the bucket is fitted with a cutting lip, armed with a number of teeth. These are made of the hardest steel, and dig their way into the material to be removed. In most machines, the jib is attached direct to the main frame, in which the gears, engines and boiler are housed. The whole revolving superstructure is mounted on an undercarriage and this runs on rails, the travelling motion being taken from the main engines.

From the description given it will be seen that steam shovels are not unlike cranes with large scoops attached, and while they are interesting to inspect when at rest, it is only when they are at work on a cliff face that the reality of their power can be fully appreciated.

The bucket is thrust against the side of the cliff and then is slowly raised, its sharp teeth tearing and ripping open the solid material. When the bucket is full the operator pulls a lever and the whole superstructure swings round, until the bucket is over a waiting railway wagon. A further lever opens the bottom of the bucket and the removed material is deposited. Then the shovel swings back for a further load.

The largest shovels are able to lift 10 tons of material at one stroke and make four strokes per minute.

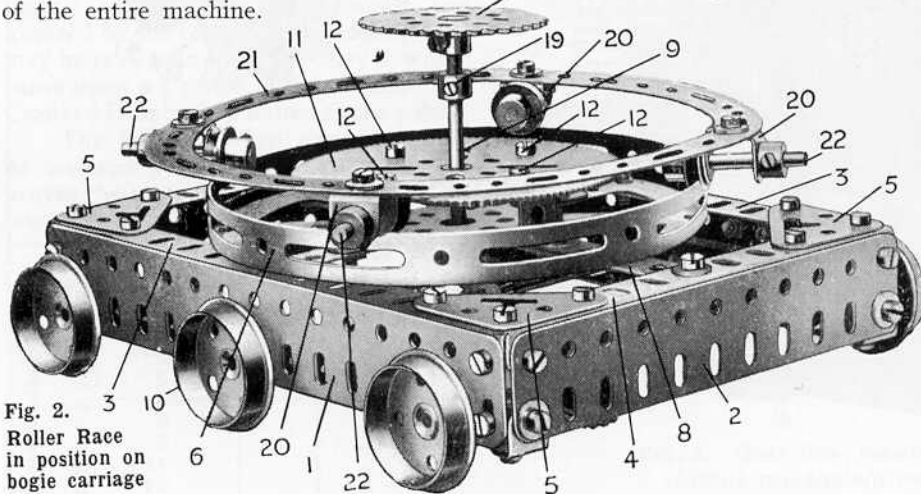


Fig. 2.
Roller Race in position on bogie carriage

The whole movement occupies only a few minutes, but it is a fascinating display of great strength coupled with almost human intelligence.

The Meccano Steam Shovel has been designed after careful study of a typical Shovel in practical use, and every feature that figures in its prototype figures also in the Meccano model. Each part of the model is described in detail and will offer no difficulty in construction.

Construction of the Model

Commence construction with the base frame as shown in Fig. 2. The sides 1 are formed from $7\frac{1}{2}$ " Flat Girders and these are joined to $5\frac{1}{2}$ " Flat Girders 2 to form a box-like frame. The Angle Girders 3 and 4 are $7\frac{1}{2}$ " and $5\frac{1}{2}$ " respectively and are joined to the top edges of the Flat Girders 1 and 2 as shown. The top corners of the framework are braced with Corner Brackets 5 and the bottom corners with Angle Brackets.

A Hub Disc 6 is bolted to a $7\frac{1}{2}$ " Strip 8 which is secured across the Angle Girders and also bolted to the side Angle Girders 3.

A vertical $4\frac{1}{2}$ " Rod 9 is then passed through the centre hole of the Strip 8 and beneath is secured a Bevel Wheel. This Wheel engages another Bevel Wheel on the Axle which carries the central travelling wheels 10. This axle is connected by Sprockets and chain to the rear axle. The large $3\frac{1}{2}$ " Gear Wheel 11 is then secured to the Hub Disc by four $\frac{1}{2}$ " Reversed Angle Brackets, which are held by bolts 12. The remainder of the base frame and the Sprocket Wheel 18 should be added at a later stage and will be dealt with in due course.

If desired the new Meccano Ball Race may be used in place of the built-up roller race, and if it is decided to use the Ball Race unit several alterations will be necessary. The Pinion 35 (Fig. 3) together with its Rod will have to be removed and a Sprocket drive arranged. The slight alterations required will be apparent to all Meccano boys who prefer to use the Ball Race, and a detailed description should not be necessary.

The body consists of two $5\frac{1}{2}$ " \times $3\frac{1}{2}$ " Flat Plates overlapped three holes to form each side. These are secured to $9\frac{1}{2}$ " Girders 13 (Fig. 4) along the upper and lower edges and these Girders are connected across by $5\frac{1}{2}$ " Girders 14. Beneath the body or superstructure of the model a Circular Girder 15 is secured by means of bolts 16, and held by the same bolts is a $5\frac{1}{2}$ " Angle Girder 17. Through this Angle Girder passes the $4\frac{1}{2}$ " Rod 9 carrying a

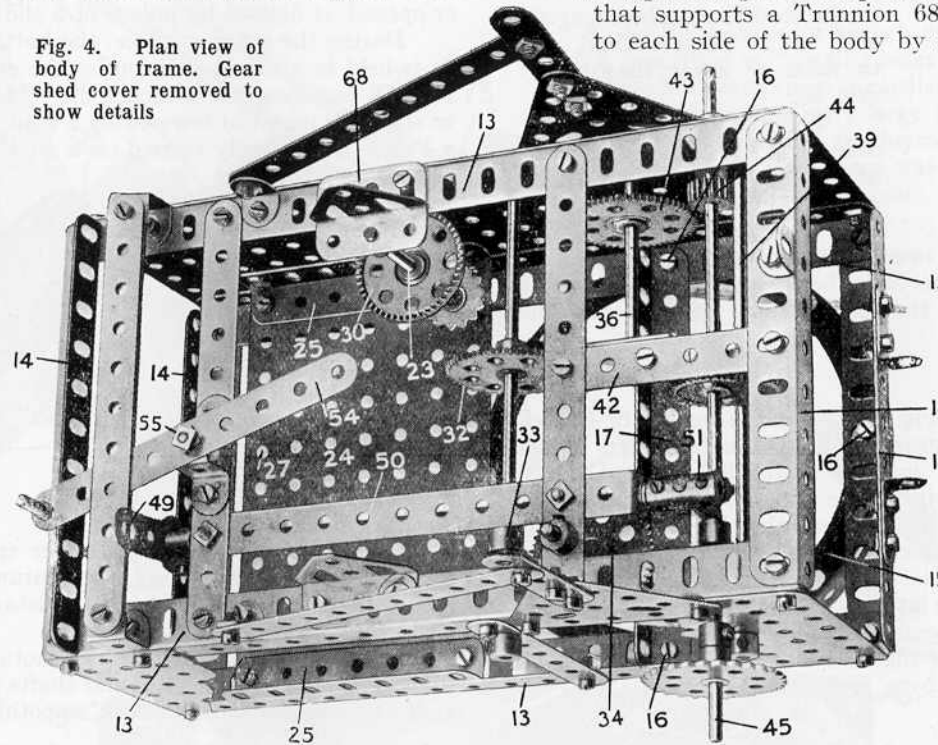
2" Sprocket Wheel 18 (Fig. 2). A Collar 19 engages above the Angle Girders 17 (Figs. 3 and 4).

Next build up the Roller Race (Fig. 2), which is formed of four Double Brackets 20 bolted to a Circular Strip 21.

The $1\frac{1}{2}$ " Rods 22 carry $\frac{1}{2}$ " fast Pulleys and are journalled in the Brackets 20. The whole is then placed on the top edge of the Hub Disc and the body is passed over the Rod 9 in the centre hole of the Angle Girder 17. After the Collar 19 is secured in position, the Sprocket Wheel 18 is bolted to the Rod 9.

The top bearing for the $3\frac{1}{2}$ " Rod 23 (Fig. 4) is formed by a $1\frac{1}{2}$ " Flat Girder that supports a Trunnion 68. A $5\frac{1}{2}$ " \times $3\frac{1}{2}$ " Flat Plate 24 is secured to each side of the body by $3\frac{1}{2}$ " Angle Girders 25 in the second hole up. This provides a bed to which the Electric Motor (Fig. 5) is secured. On the lower part of Rod 23 is secured a $\frac{3}{4}$ " Sprocket Wheel from which a chain drives the Sprocket Wheel 18 (Fig. 2) which in turn operates the Bevels beneath the base frame thus transmitting the drive to the travelling wheels.

Fig. 4. Plan view of body of frame. Gear shed cover removed to show details



Assembling the Mechanism

Now build up the Motor unit, (Fig. 5) but leave off the Rod 25 and Sprocket 26. (The Gear Wheels and Rod are clearly seen in Fig. 5.) The Motor is then secured to the Plate 24, the correct position being found when the fourth hole from the back of the Motor registers with hole 27 in the $5\frac{1}{2}$ " \times $3\frac{1}{2}$ " plate (Fig. 4).

When the Electric Motor has been secured in position, owing to the Rod 28 being slidable the Pinion 29 may be engaged with the Contrate Wheel 30 or the Gear Wheel 31 with the Gear Wheel 32. The spindle of this latter Gear Wheel 32 carries a

Worm 33 (Fig. 3), which engages a Gear Wheel 34. On the spindle of Gear Wheel 34 is a $\frac{1}{2}$ " Pinion, which engages and drives the $3\frac{1}{2}$ " Gear Wheel 11 (Fig. 2), thus rotating the shovel.

On the $3\frac{1}{2}$ " Rod 36 is wound the cord 37 by means of which the raising and lowering of the jib 38 is carried out, and on the 6" Rod 39 is wound the cord 40 which operates—i.e., raises and lowers—the shovel 41. The Rod 36 is journalled in a Trunnion bolted underneath the Strip 42 and carries a $1\frac{1}{2}$ " Gear Wheel 43 which is engaged by a Pinion 44 on an 8" Rod 45. This is driven by means of the $1\frac{1}{2}$ " Sprocket Wheel 46 from the 1" Sprocket Wheel 26 on the driving spindle 47 of the Electric Motor.

The Spindle 45 is slidable by the rotation of an 8" Rod 48 operated by the Crank 49, the Rod being journalled in the ends of a $5\frac{1}{2}$ " \times $2\frac{1}{2}$ " Double

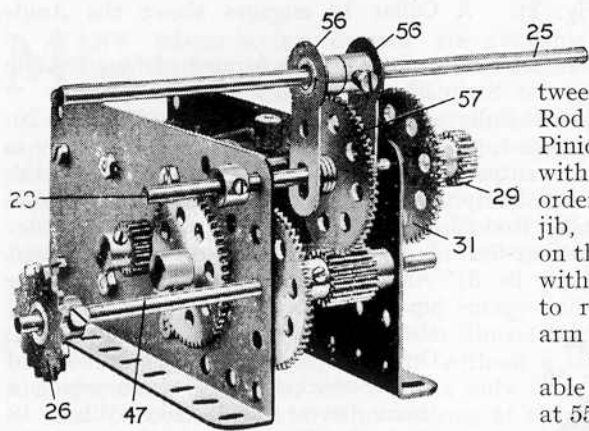


Fig. 5. Electric Motor Unit

of a 1½" Gear Wheel 57 (Fig. 5), Washers being placed between the Cranks to take up the slack. When the gear trains have been assembled the only remaining portions to be constructed are the shovel proper and the movable arm on which it operates.

The Construction of the Shovel Arm

The shovel arm, which is shown in Fig. 1, carries the bucket or shovel proper and is a kind of sliding frame consisting of 9½" Angle Girders 58 to which are bolted Racks 59. The inner surfaces of the 9½" Angle Girders are fitted or lined as it were with 9½" Strips. The latter are bolted at either end to the Girders but are spaced away by Washers, thereby allowing space between the Strips and the Girders 58 to accommodate the heads of the bolts securing the Rack Strips 59. The jib has an uninterrupted sliding surface throughout the length of the boom. The latter is held in position so that the Rack Strips engage the Pinions 60, by means of two 2½" Angle Girders bolted to 2½" Strips that pivot about the ends of the Rod carrying the Pinions.

A 50-teeth Gear Wheel 61 is driven by a ¾" Pinion 62 on a 3½" Rod 63 which is operated by the hand wheel 64.

Angle Strip 50, a Coupling 51 carrying a 1" Rod which engages between two Collars on the Rod 45. In this way the Pinion 44 may be meshed with the Gear Wheel 43 in order to raise or lower the jib, or a 1" Gear Wheel 52 on the Rod 39 may be engaged with a 1" Gear Wheel 53 to raise or lower the shovel arm 58.

The Rod 25 (Fig. 5) is slidable by a 4½" Strip 54 pivoted at 55 (Fig. 3), the end of which engages between two Cranks 56.

These engage on each side

The bottom of the shovel is released by a cord 65 connected to a sliding Rod 66, the end of which enters the aperture of a Flat Bracket 67.

The Shovel (Fig. 6)

If desired the Meccano Digger Bucket can be used on this model in place of the built-up shovel shown. The shovel illustrated is a Standard Meccano Mechanism and is bolted to the arm 58 (Fig. 1) which pivots from a point in the jib of the excavator.

The bottom Plate 2a of the bucket is hinged to the Rod 3a and is closed or opened as desired by means of a sliding Rod 66 operated by a cord 65.

During the cutting stroke, the bottom Plate 2a is held in a closed position by the end of the Rod 66 engaging the Bracket 67. The bucket or shovel is raised or lowered by a cord engaging a Pulley 8a pivotally carried on a Rod 9a. The radius of the cut is regulated by altering the length of the arm 58 which is controlled by the Rack and Pinion mechanism in the jib. The sides of the shovel are formed from 2½" x 2½" Flat Plates as is also the shovel bottom 2a.

The sliding Rod 66 is carried loosely in a Double Angle Strip as illustrated and carries on its upper end a Coupling. A glance at the various illustrations will make any further details quite clear.

Before setting the model in motion apply a little oil to all gears and shafts so that the mechanism will work smoothly.

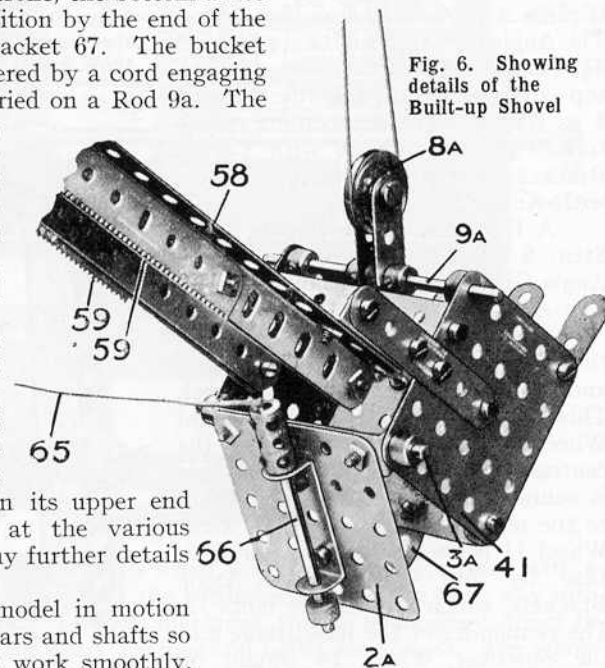


Fig. 6. Showing details of the Built-up Shovel

Parts Required

2 of No. 1a	7 of No. 9	1 of No. 15a	5 of No. 24	220 of No. 37	2 of No. 63	2 of No. 103b	1 of No. 143
1 " 1b	2 " 9b	7 " 16	1 " 25	24 " 38	2 " 70	2 " 103f	1 " 145
7 " 2	4 " 9d	4 " 16a	9 " 26	1 " 40	4 " 72	1 " 103h	1 " 147b
1 " 2a	4 " 9f	1 " 18a	1 " 27	1 " 45	2 " 76	2 " 103k	
4 " 3	7 " 10	5 " 18b	7 " 27a	1 " 48	2 " 77	4 " 110	
5 " 4	6 " 11	8 " 20	1 " 27b	3 " 48a	36" " 94	4 " 111	
5 " 5	11 " 12	1 " 21	1 " 28	1 " 48d	1 " 95	2 " 115	E6 Electric Motor
7 " 6	4 " 12b	2 " 22	2 " 30	5 " 52a	1 " 95a	1 " 118	
4 " 8	2 " 13a	4 " 22a	2 " 31	1 " 53a	3 " 96	4 " 125	
6 " 8a	8 " 14	2 " 23	1 " 32	36 " 59	1 " 96a	3 " 126	
4 " 8b	2 " 15	4 " 23a	5 " 35	3 " 62	2 " 103	4 " 133	