Meccano Stone-Sawing Machine

Built with Outfit K

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the same, except that Strip Plates should be used wherever Braced Girders are shown, as the latter parts have been withdrawn from the Meccano Outfits. If preferred, however, Braced Girders may be purchased separately.
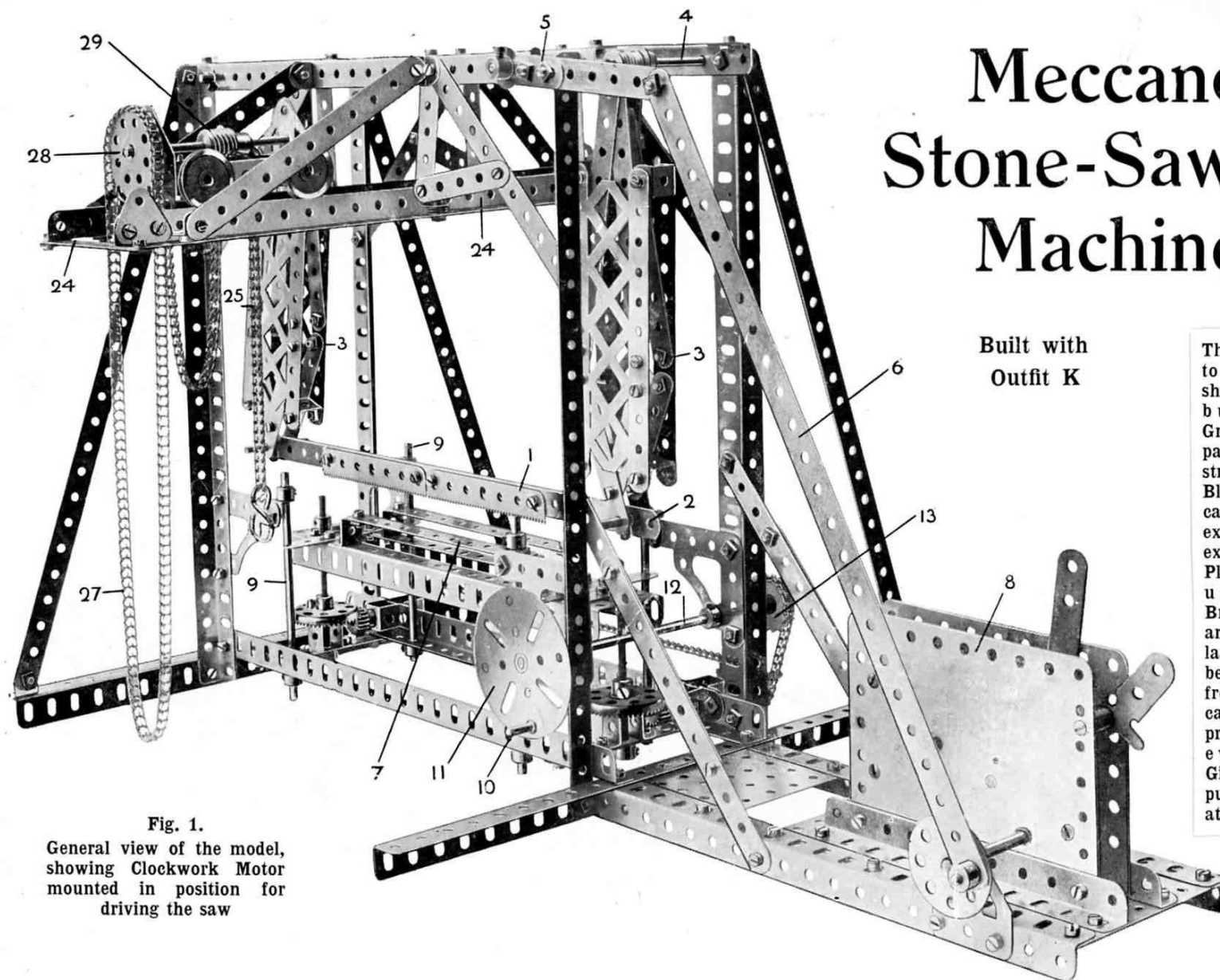
Fig. 1.
General view of the model, showing Clockwork Motor mounted in position for driving the saw

ANY Meccano boy who resides near a large stone quarry will be familiar with the wonderful machines that are capable of cutting into large or small blocks the very stone of which large portions of the country are formed. He will be aware of the slow but sure work which these machines perform, gradually cutting their way stroke by stroke through the hardest stone or rock. But all Meccano boys are not so fortunate to be able to study this type of machine at work, and doubtless when they have seen large modern buildings in course of construction they have wondered how the blocks of stone—weighing sometimes a ton or more each—were cut into such exact shapes and sizes.

Those wonderful builders, the Romans, must have felt the need of some mechanical means of stone cutting when they were erecting their beautiful palaces and temples. Although their tools were of the crudest type, the work of these early stonemasons was in many respects equal, if not superior, to the work of our modern craftsmen, and it has stood the test of centuries. Some of their pillars and walls are standing to-day, the joints in the stonework fitting as perfectly now as when they were built, two thousand or more years ago. Nevertheless, their achievements, although admirable from the artistic point of view, were attained only at the expense of much human suffering.

Practically all the work had to be done by manual labour. Huge blocks had to be hacked out of the solid rock of the quarries, then perhaps dragged for many miles to the place where the building was in progress. On arrival there they were chipped into shape and the surfaces rubbed with pieces of harder stone until they were smooth and flat. They then had to be hauled up into position for setting. As the available knowledge of the mechanical powers was very small, it can be realised how hard and fatiguing the work was. Most of the builders were prisoners of

war who were turned into slavery and forced to these heavy and heart-breaking tasks under the lash of an ever-vigilant slave driver.

Owing to the crude methods employed in those days, buildings of any size or importance took very many years to construct. When one sees huge buildings now being erected in the course of a few months, the enormous change brought about by modern mechanical methods can be realised. One of the principal aids to the stonemason to-day is the machinery with which the stone blocks are cut and shaped.

Many different types of machines have been designed for stone cutting. The Meccano model that forms the subject of this leaflet represents a type that is in general use, however. It follows closely the principles of construction and operation that are to be found in the actual machine.

Driven by the Clockwork Motor shown in Fig. 1, or a Meccano Electric Motor, the model will afford many interesting points to enthusiastic Meccano boys. In the case of its prototype, the work of cutting and sawing stone into blocks of any size is a matter that can be performed accurately and comparatively quickly, when one remembers the hardness of the material through which the saw has to cut. By substituting a hack-saw blade for the Rack Strips that represent the saw, the model may be put to practical use.

Fig. 2.
Framework of the Stone-Sawing Machine

The Meccano Model

Fig. 1 is an illustration of the complete model. The saw 1 is attached pivotally to the swinging frames 3. One of these frames is pivoted loosely on a Rod carried in the top of the frame, and the other is secured by a Crank
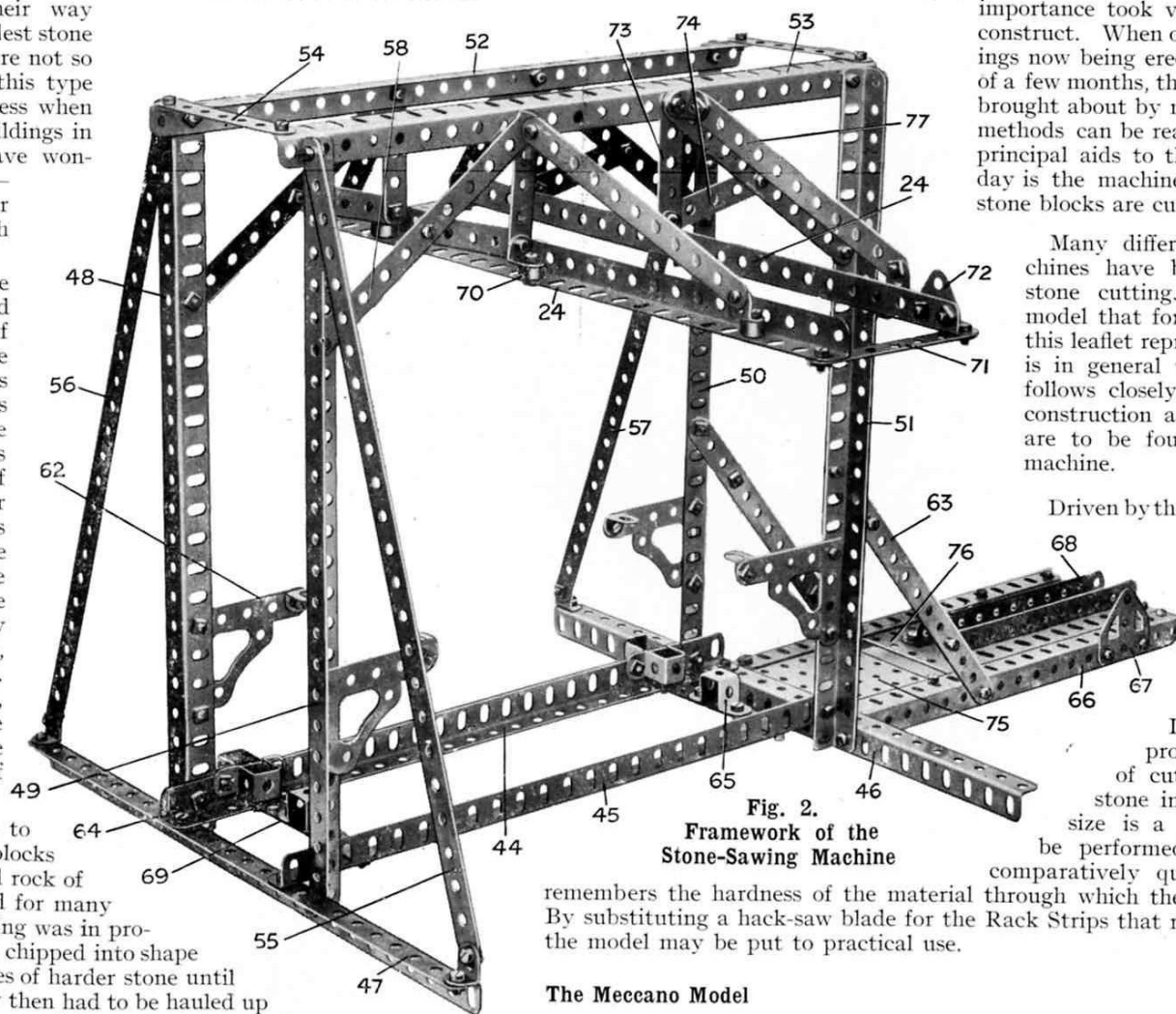
to the Rod 4. When the Clockwork Motor is set in motion the swinging frames are oscillated, thereby imparting a reciprocating or sawing motion to the saw 1.

The stone to be shaped is placed on the work table 7, and in order to allow for various depths of saw cuts this work table is constructed so as to permit raising and lowering on operation of the hand wheel 11.

The overhead trolley embodies a self-sustaining hoist, and is used for raising the stone blocks and placing them in position on the work table 7 for cutting. The trolley runs on the gantry rails 24.

Having obtained some idea of the working arrangements of the model construction may be commenced. The following notes deal with each part of the model in the order in which the building should proceed.

Building the Framework

The frame of the model is shown in Fig. 2. Its construction should be commenced by forming the base with the Angle Girders 44, 45, 46, and 47. All are $12\frac{1}{2}''$ long and should be bolted together as shown in the illustration. The outside edges of the Girders 44 and 45 should be $3\frac{1}{2}''$ apart.

To form the uprights carrying the gantry rails, $12\frac{1}{2}''$ Angle Girders are bolted at each inside corner of the base. These Girders are shown at 48, 49, 50 and 51. They are joined at the top by the $12\frac{1}{2}''$ Angle Girders 52 and 53, the ends of which are spanned by the $3\frac{1}{2}''$ Strips 54. The upright Girders braced by the $12\frac{1}{2}''$ Strips 55, 56 and 57. It will be noticed that no corresponding $12\frac{1}{2}''$ Strip is added as a support for the vertical Girder 51, as its presence would hinder the operation of the hand wheel 10.

At the top of the frame the gantry rails 24 are supported by four $2\frac{1}{2}''$ Strips 73. These are bolted directly to the Girders 52 and 53, and attached to the rails 24 by means of Angle Brackets, which are spaced away from the rails by Collars 70. The object of this is to obtain the necessary headway for the trolley, which must be capable of travelling from end to end of the rails. The $5\frac{1}{2}''$ Strips 58, which make the upright frame quite rigid, are secured to the top Girders by the bolt passing through the Strips 73, and on the same bolts are placed Angle Brackets to secure the $5\frac{1}{2}''$ Strips 77. One end of each of the Strips 77 is secured near the outer ends of the gantry rails 24 by means of an Angle Bracket. Collars should also be placed beneath these Angle Brackets. The ends of the gantry rails 24 are spanned
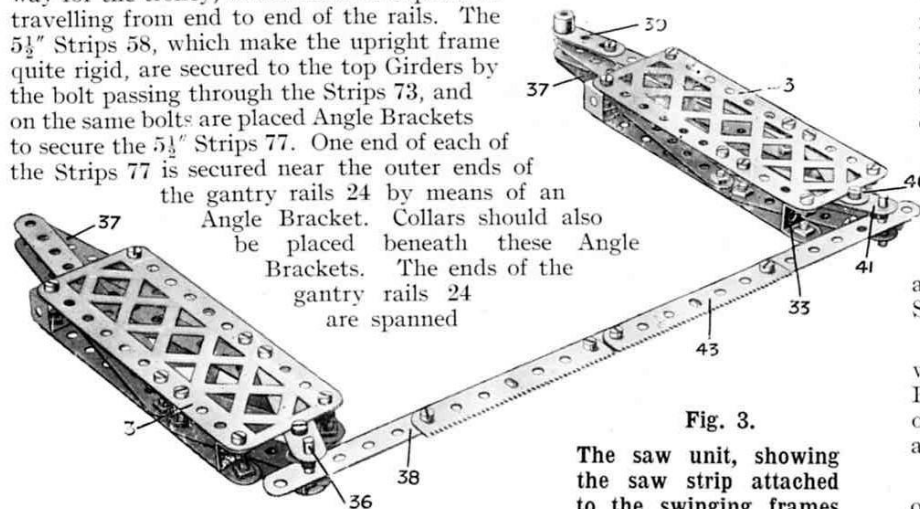

Fig. 3.

The saw unit, showing the saw strip attached to the swinging frames

by $3\frac{1}{2}''$ Strips 71. A 1" Triangular Plate 72 should be bolted at each end of the rails to act as a stop plate and so prevent the trolley from leaving the rails. An extension for the accommodation of the Motor is made in the base by securing the $9\frac{1}{2}''$ Angle Girders 66 at right angles to the base Girder 46. The Girders 66 are connected together by three $3\frac{1}{2}''$ by $2\frac{1}{2}''$ Flanged Plates. The Motor 8, Fig. 1, is secured in position on the platform thus formed by the two $5\frac{1}{2}''$ Angle Girders 68. A Flat Trunnion 67 bolted to one of the Girders 66 acts as an additional bearing for the Motor shaft.

To take the guides for the vertically-movable work table 7, four Architraves 62 are bolted to the vertical Angle Girders 48, 49, 50 and 51. All that now remains to complete the framework is to bolt the Double Bent Strips 64 and 65 in position to form bearings for the mechanism.

Construction of the Work Table

The work table, with its elevating mechanism, is shown in Fig. 5. The two $5\frac{1}{2}''$ Strips 7, which form the table proper on which the stone is placed for cutting, are mounted on the $9\frac{1}{2}''$ Angle Girders 7a by means of the $\frac{1}{2}''$ Reversed Angle Brackets 23a. A $3\frac{1}{2}''$ Strip is bolted across the Girders 7a near each end of the table, and the outer ends slide on vertical guide Rods 9.

Two horizontal Rods 15 and 18 are journalled in the Double Bent Strips that are secured to the base Girder 44, see Fig. 2. These Rods carry on their inner ends $\frac{1}{2}''$ Pinions 19 engaging with $1\frac{1}{2}''$ Contrate Wheels 20. The Rods 15 and 18 are caused to rotate simultaneously and in the same direction by means of a Sprocket Chain engaging 1" Sprocket Wheels on the outer ends of the Rods.

The Contrate Wheels 20 are each secured to a $4\frac{1}{2}''$ Threaded Rod 21, which is journalled in the Double Bent Strips 65 in the base of the model, Fig. 2. The upper ends of the Threaded Rods 21 are inserted in the bosses of Threaded Cranks 22, which are bolted to the Strips 24a of the work table and also to $1\frac{1}{2}''$ Strips that, in turn, are bolted across the $9\frac{1}{2}''$ Angle Girders 7a.

The shaft 15 carrying the Sprocket Wheel 16 is caused to rotate on operation of the hand wheel 11, Fig. 1; by means of a short Sprocket Chain
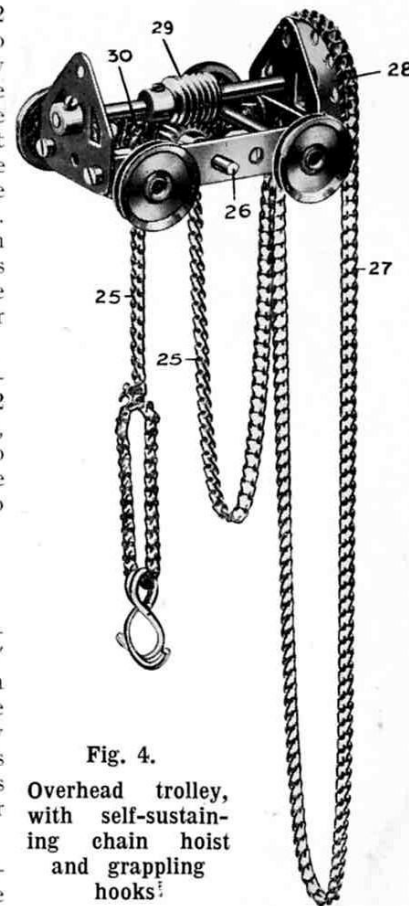

Fig. 4.

Overhead trolley, with self-sustaining chain hoist and grappling hooks.

engaging the Sprockets 13 and 14, see Figs. 1 and 5. Hence it will be seen that movement of the hand wheel results in a corresponding vertical movement of the table 7.

Swinging Frames

The swinging frames supporting the saw are shown plainly in Fig. 3. Each frame 3 consists of two 5½" by 2½" Strip Plates connected together by Double Brackets at each corner. The four 5½" Strips 37 are bolted as shown to the sides of the frame to form the swinging support. A 3" Strip 41 and 2½" Strip 40 are bolted to each side of the frames and secured together near their other ends. The protruding holes of the 3" Strips 41 form the bearings for the 1" Rods that carry the saw Strip 38.

Both frames 3 are identical with the exception of the Crank 39, which is used to secure one of the swinging frames to the Rod 4, Fig. 1.

Fig. 5.
The work table, showing elevating mechanism

This type of hand-operated overhead hoist is employed in many factories and workshops to facilitate the movement of heavy loads by hand power.

General Remarks

When completed, the model may be started, and a little oil applied to the various bearings and gears to ensure quiet and smooth running of the mechanism. It is a wise plan on completing any Meccano model to go over the whole mechanism carefully, to make sure that all shafts carrying Gears or Worms, etc., are in perfect alignment. If this is done, trouble may be avoided, and the machine will operate more easily and freely.

On the actual stone-sawing machine a flow of lubricant is used in order to counteract the heat generated by the saw blade.

The Overhead Trolley and Hoist

The trolley is constructed from two 2½" by ½" Double Angle Strips bolted together at each end by Flat Trunnions. The latter form the bearings for the Rod carrying the 1½" Sprocket Wheel 28 and the Worm 29. The Worm engages with a ½" Pinion secured to the 2" Rod 26, which also carries a ¾" Sprocket Wheel 30. One end of the load chain 25 is secured to the trolley framework and the other end is passed over the Sprocket Wheel 30 and attached to the grappling hooks. The Worm 29 is rotated by hauling upon the endless chain 27, which engages with the Sprocket Wheel 28, and the load may thus be raised.

Owing to the arrangement of the Worm and Pinion, the load will remain suspended when raised. To lower the load the Chain 27 must be pulled in the opposite direction.

The trolley runs on four 1" Pulley Wheels, the grooves of which ride on the upturned flanges of the Girders 24, Figs. 1 and 2.
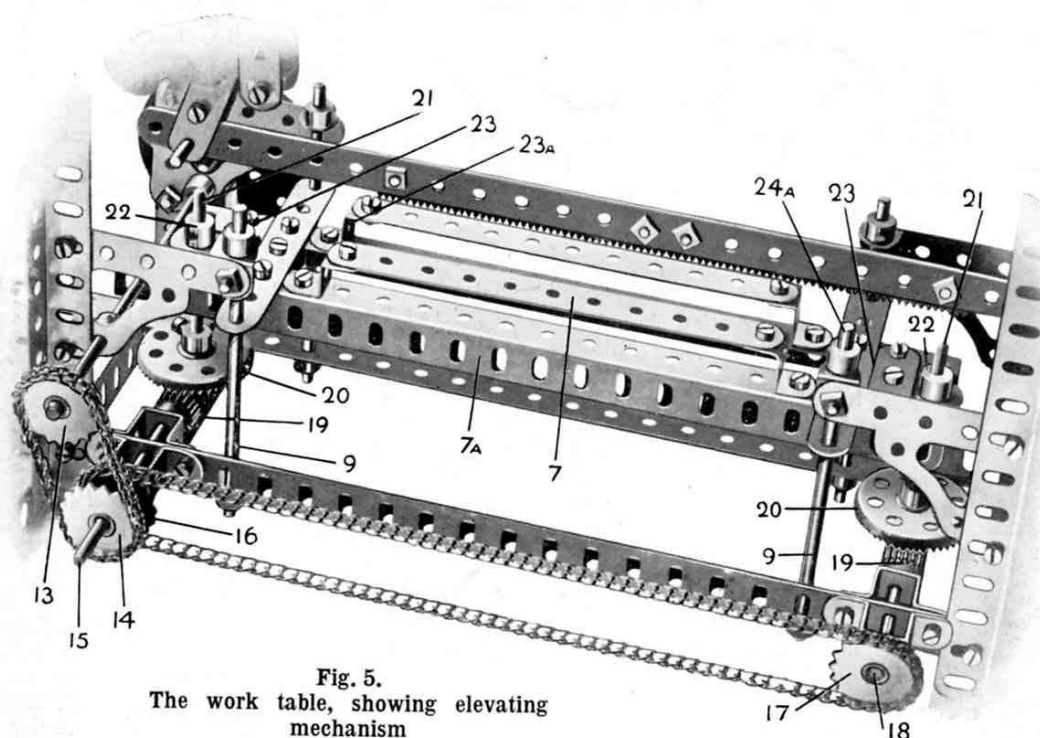
List of Parts Required to Build the Stone-Sawing Machine.

5 of No.	1	15 of No.	12	1 of No.	32	2 of No.	77
19 ,,	2	1 ,,	14	12 ,,	35	2 ,,	80a
1 ,,	2a	1 ,,	15	185 ,,	37	40in. ,,	94
11 ,,	3	5 ,,	15a	32 ,,	38	1 ,,	95a
4 ,,	4	3 ,,	16	6 ,,	45	1 ,,	96a
8 ,,	5	2 ,,	16a	1 ,,	47	4 ,,	108
2 ,,	6a	1 ,,	17	5 ,,	48a	1 ,,	109
12 ,,	8	2 ,,	18a	3 ,,	53	2 ,,	110
4 ,,	8a	4 ,,	22	2 ,,	57c	2 ,,	115
2 ,,	9	1 ,,	24	15 ,,	59	4 ,,	125
1 ,,	10	3 ,,	26	2 ,,	62	3 ,,	126a
8 ,,	11	2 ,,	28	2 ,,	62a	4 ,,	195

No. 2 Clockwork Motor