In Search of New Models

Excavators and Trenching Machines

AMONG the most useful machines that the modern engineer has at his disposal are the many varieties of excavators and trench digging machines. These "machines for digging holes," as they may be called, are made in a variety of types and sizes, and provide the Meccano model-builder with splendid subjects. In addition to the pleasure obtained in building the model, there is the thrill of setting it in motion and of seeing it carry out all the movements of its powerful prototype.

Many different kinds of excavators and trench digging machines have been illustrated and described from time to time in the "*M.M.*" so that readers should have no difficulty in finding suitable illustrations on which to base their models. One of the best known types of excavators is the mechanical shovel. Most model-builders will have seen one of these machines in action, levelling hilly ground or digging large pits for the foundations of buildings. It has a large bucket shovel mounted on the end of a stout steel arm or dipper stick, that in turn is connected with a jib by two long racks meshing with gear wheels driven by a steam engine, or an electric motor. The bucket arm can be racked in or out as desired, thus varying the working radius. A wire rope fastened to the bucket passes over a pulley at the top of the jib, and then is attached to a winding drum. The result of this arrangement is that as soon as the gear clutch is engaged, the drum winds in the rope and the bucket is pulled upward. As the superstructure has a swivelling movement, a considerable area can be excavated without the necessity of altering the position of the base of the machine.

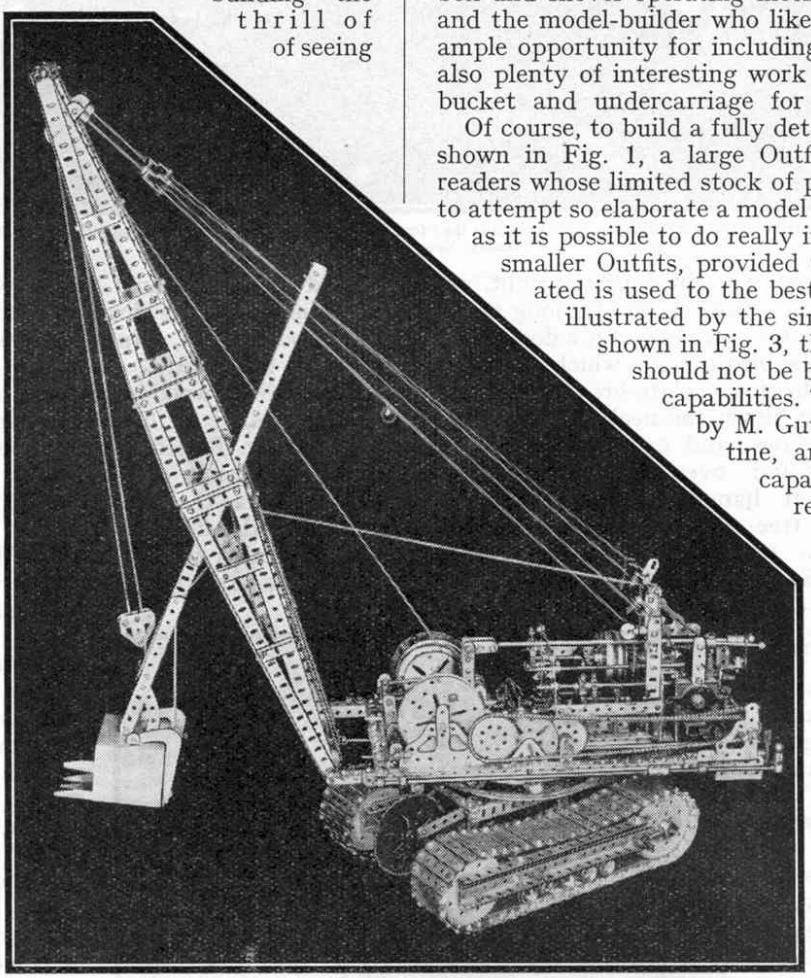

Fig. 1. This model of an electric shovel is the work of J. Willems, Antwerp, Belgium. It is operated by an Electric Motor, which drives 10 separate movements through a well-designed gear-box.

The leading edge of the digger bucket is fitted with a cutting lip armed with a number of teeth that dig their way into the material to be removed. In most machines, the jib is attached to a swivelling framework, in which the gears and power unit 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 or motor.

A mechanical shovel of this kind possesses many features that make it a good subject for a model. There are, for example, many different ways in which the gear-box and shovel operating mechanism can be arranged, and the model-builder who likes experimenting is given ample opportunity for including original ideas. There is also plenty of interesting work in designing an efficient bucket and undercarriage for the machine.

Of course, to build a fully detailed model, such as that shown in Fig. 1, a large Outfit will be required, but readers whose limited stock of parts will not allow them to attempt so elaborate a model need not be discouraged, as it is possible to do really interesting work with the smaller Outfits, provided that each part incorporated is used to the best advantage. This fact is illustrated by the simple but realistic model shown in Fig. 3, the construction of which should not be beyond even a beginner's capabilities. This model was designed by M. Gutierrez, Martinez, Argentine, and although small it is capable of working in a realistic manner. A miniature boiler is made with a Sleeve Piece fitted with a Chimney Adaptor, and the engine cylinder is formed with a Coupling. The superstructure of the model can be swivelled and the dipper stick is operated by turning separate Rods.

For driving a small model of this type there is no more suitable power unit than a *Magic* Motor, and with one of these and a few gears it is quite easy to arrange a simple yet practical mechanism that will carry out all the essential movements.

A mechanical shovel that can be used also as a rock breaking machine has been introduced in America. This machine is similar in action to that already described, but the bucket can be replaced by heavy hammer-shaped weights. The dipper stick is pivoted at its upper end instead of its centre, in such a manner that it can be raised and then dropped quickly, so that the weights hit the rock to be broken with great force.

In a model machine of this type the hammer can be represented by two Boiler Ends fastened together by a Screwed Rod and Nuts to form a drum. If desired, the drum could be loaded with bits of stone or rock to

give it additional weight so that it will fall quickly.

An excavator that differs considerably from the mechanical shovel, yet possesses equal interest to the model-builder, is the dragline. The name "dragline" is derived from the fact that the digging bucket is suspended from the end of a very long jib and is dragged along the ground towards the machine by a flexible rope, instead of being attached to a dipper stick as in the case of the mechanical shovel. While mechanical shovels excavate above the level of the ground on which they stand and advance into the excavation as the work proceeds, a dragline excavates below the level on which it stands, and travels backwards when it has excavated all the material within reach. Some draglines are mounted on creeper tracks so as to make them suitable for working on soft or marshy ground. For a small model the tracks can be represented by Sprocket Chain, but when they are required for a large model the best plan is to construct segmented tracks from Strips bolted to endless lengths of Chain.

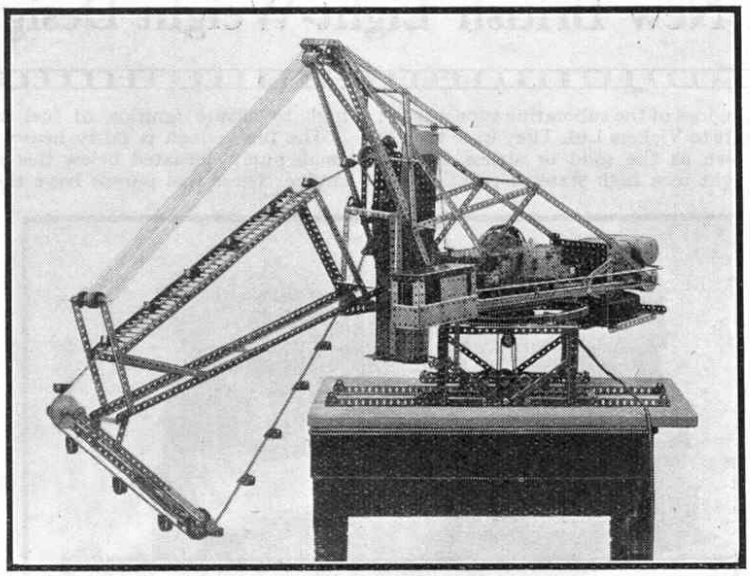

Fig. 2. A good example of a multi-bucket excavator built in Meccano. It was constructed by R. Campbell, London, S.W.16.

Another method of making creepers is shown in the model illustrated in Fig. 1. In these the segments or treads are represented by short Strips, which are bolted to belts of canvas. The canvas passes round driving wheels formed by 3" Sprockets, the drive being transmitted by the teeth of the Sprockets biting into the canvas. A tensioning device is fitted to take up any slackness in the belts.

A dragline must be strongly built. This applies particularly to such parts as the base and jib, which are subjected to heavy loads. In large models as much use as possible therefore should be made of Angle Girders. They can be bolted together to form T or channel section girders, and if skilfully arranged will give all the rigidness and strength required. There should be no difficulty in devising a roller bearing support for the swivelling superstructure, but it is advisable to see that there is no rocking movement, otherwise the model will not work smoothly and steadily. The arrangement of the mechanism for hauling the drag bucket backward and forward may be planned on similar lines to Suggestion No. 363, described on page 591 of the October 1936 "*M.M.*"

Another form of dragline used for working on marshes is a giant machine that "walks" with the aid of two great "feet," which are operated through a very powerful reduction drive. When the dragline reaches the site on which it is to work, the feet are raised and the dragline rests on its large circular base. This machine was illustrated and described on page 192 of the March 1937 "*M.M.*," and reproducing it in Meccano would prove an absorbing task, for there is ample opportunity for the enthusiast to display his model-building skill. The walking mechanism alone will supply a knotty problem to work out during the winter evenings!

Owners of large Outfits will find ample opportunity to test their model-building skill in modelling an excavator of the multi-bucket type, a fine model of which is shown in Fig. 2. These machines are used for constructing canals and widening and deepening rivers, and run on rails laid on the banks, the excavated material being discharged into trucks waiting alongside. The buckets travel along an arm that can be arranged at the angle necessary to produce the desired contour in the sides of the canal or river, and which can be raised or lowered as required as the work proceeds.

The Meccano Dredger Buckets can be used to good advantage in a machine of this kind, but where smaller buckets are required, they can be made with two Double Brackets bolted together to form a box. These can be attached to Sprocket Chain with short lengths of wire.

Other interesting excavating appliances that make excellent subjects for models are the various types of trench digging machines that are used for cutting trenches for pipe lines. Some of these machines are capable of digging trenches 6 ft. deep and 2 ft. wide at the rate of a mile a day. Usually they are in the form of a tractor fitted with creeper tracks, between which is a boom that supports an endless chain of buckets. The bucket chain is set in motion by the power unit, and as the buckets pass around the lower end of the boom they dig into the ground. Then they travel upwards with their load of spoil, and as they pass over the upper end of the boom the material is discharged on to a conveyor that deposits it at the side of the trench. Means are provided for raising and lowering the boom so that the depth of cut can be adjusted as required.

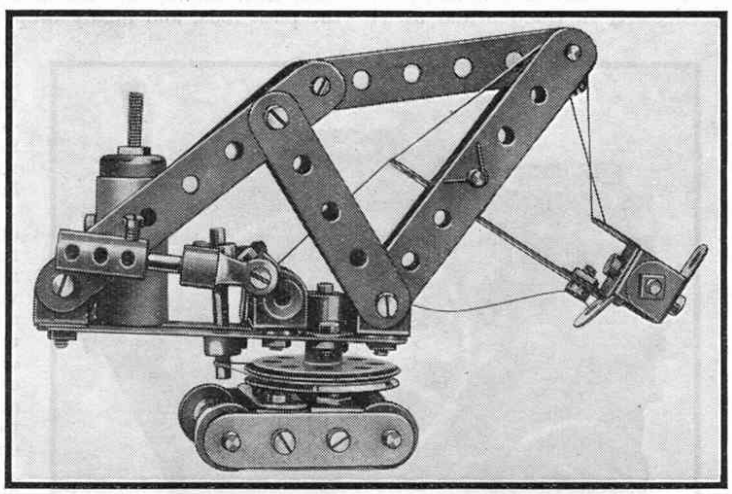

Fig. 3. This illustration of a simple model steam excavator shows the good work that can be done in this direction by owners of even small Outfits. The model was built by M. Gutierrez, Martinez.

The conveyor belt is driven at a higher speed than the buckets, and in a model can be made from a strip of canvas or corrugated cardboard. If sufficient parts are not available to make proper creeper tracks, it is a good plan to use straked wheels built up with Flexible Plates.