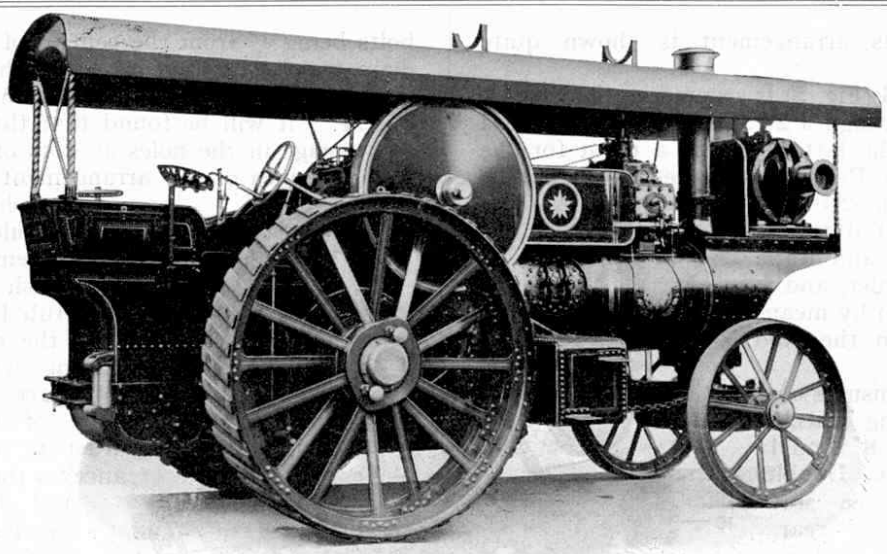


Fig. 8. This splendid engine is the prototype of the Meccano model. It was built by Ransomes, Sims & Jefferies Ltd. (Ipswich), to whom we are indebted for the photograph

together with the centre Plate overlapping the rear end Plate by three holes and the front end Plate by four holes. The sides of the canopy are extended by 7½" Strips 41a joined to the Plates 41 by Flat Brackets, and the portion that surrounds the chimney is formed by 2" Flat Girders 20c secured to the front Plate 41 and to a 3½" Flat Girder, the latter being joined to the 7½" Strips 41a by Flat Brackets.

The 3½" Rods 20 forming the supports for the canopy are secured in Couplings 20a, which in turn are secured by bolts to the Plates 41. The lower ends of the Rods are secured in Collars 80a carried on the Boiler and bunker frame Plates. These are clearly shown in Fig. 4.

To complete the realistic appearance of the model steps 36 (Fig. 5) consisting of 1½" Angle Girders should be bolted to the Plates of the main frame. Two Double Brackets to which are bolted two 1" Triangular Plates form the coupling 33 by means of which the trailer draw-bar may be attached to the traction engine.

General Remarks

When the model has been completed a Meccano 4-volt 8-amp. Accumulator may be placed in the space provided in the rear portion of the model as shown in the general view of the model (see Fig. 1 in the October "*M.M.*," also Fig. 6 below), the terminals being connected by two insulated wires to the terminals of the Electric Motor.

In order to prevent the various gear wheels, etc., slipping on the shafts when the model is hauling heavy loads, it is wise to tighten two set-screws on each Gear Wheel (assuming, of course, that the wheels are fitted with the new-style bosses, the tapped holes of which pass completely through the bosses, diametrically). If this is done there will be no trouble with loose Wheels.

To set the model in operation it is necessary first to engage the slow or bottom gear by moving the lever 72 over to the extreme left. Before switching on the Electric Motor see that the brake is "off," i.e., with cord slack. Now switch on the Motor by pulling or pushing the handle 71 (Fig. 4) according to the direction (either forward or reverse) in which it is desired to travel. When only a light load is being hauled or the engine is running "light" the fast or top gear may be employed, but for the heavier loads the bottom gear should always be used. When it is desired to run the engine without the tractor moving (such as when driving the dynamo) the lever 72 should be placed in the central position. In this position both the Gear Wheel 56 and the Pinion 44 are disengaged from their respective gears and no power is transmitted to the driving wheels.

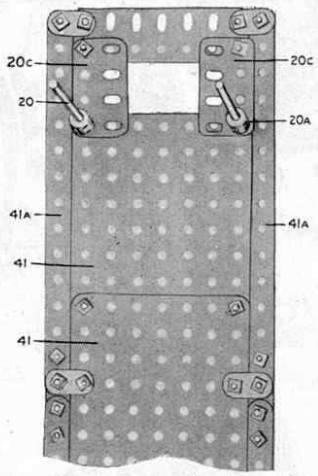


Fig. 7. Underneath view of a Section of the Canopy

Great Loads Hauled by the Model

One of the outstanding features of this model is its great load-pulling capacity. The illustration incorporated in the heading of this article is a reproduction from an actual photograph showing the tractor at work hauling a load many times its own size and weight. In this particular case the "driver" weighs 100 lbs.!

Of course, in hauling a load of this description it will be necessary to add ballast to the engine for, unless firmly held down, it has a tendency for using its back axle as a base for pivoting operations! The engine affords a curious sight when the nose rises in the air as the flying crankshaft and gears force the driving pinion round the stationary axle! The additional weight required can be obtained by filling the Boiler with pieces of lead or a large number of Meccano Strips.

To obtain the best results care must be paid to every detail of the construction and the gear shafts must run quite freely. A little oil applied to the Gear Wheels and Rods will greatly assist the smooth working of the model.

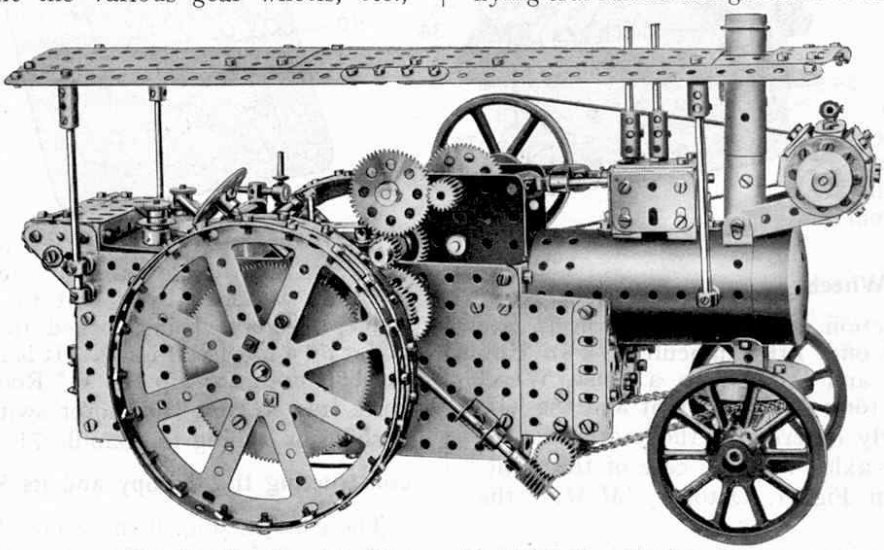


Fig. 6. The Complete Meccano Model Traction Engine

For list of parts required to build this model see October "M.M.," p. 851.

Scientific Apparatus in Meccano

Microscope Accessories made by Dr. Ernest Bade

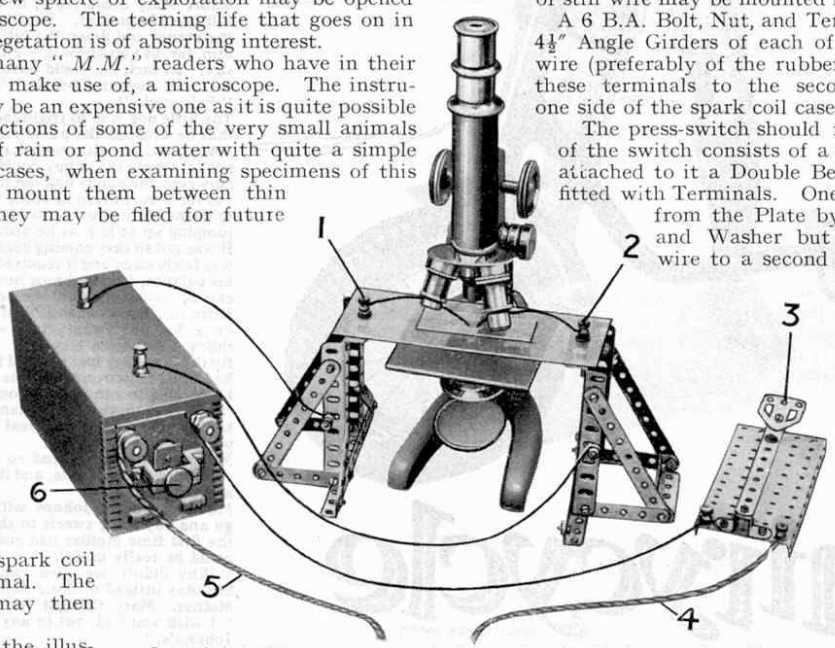
I.—AN ELECTROCUTING DEVICE FOR MICROSCOPIC ANIMALS

THE wonderful adaptability of the Meccano system is well-known to most "*M.M.*" readers, but it may come as a surprise to some people to learn that Meccano can be utilised in constructing delicate apparatus for use in connection with the study of microscopy. Meccano is used by Dr. Ernest Bade in the construction of all kinds of instruments and experimental apparatus that he uses in his scientific studies. We have received particulars of a number of these instruments, and details of one are given in full below. We propose to include descriptions of others in the Magazine from time to time.

Nature study is a subject that appeals to most of us, and without doubt it forms one of the most interesting and instructive spare-time occupations. While a great deal of pleasure may be obtained by studying the animals, birds or insects that are visible to the naked eye, an entirely new sphere of exploration may be opened up by means of a microscope. The teeming life that goes on in the air or in water and vegetation is of absorbing interest.

Doubtless, there are many "*M.M.*" readers who have in their possession, or are able to make use of, a microscope. The instrument need not necessarily be an expensive one as it is quite possible to study the form and actions of some of the very small animals present in, say, a drop of rain or pond water with quite a simple instrument. In many cases, when examining specimens of this kind, it is required to mount them between thin slips of glass, so that they may be filed for future reference. It is here that a difficulty occurs, for it is practically impossible to kill such tiny animals in the ordinary manner without totally destroying their original shape.

With the apparatus about to be described, however, it is possible to execute a minute animal instantaneously by pressing a switch, so causing a high-voltage current generated by a spark coil to pass through the animal. The electrocuted specimen may then be studied at leisure.



General view of the apparatus, showing the spark-coil and microscope in position

It will be seen from the illustration that, in addition to the microscope and Meccano parts, a spark-coil is required to complete the apparatus, and the rather high cost of one of these coils might at first deter readers from carrying out the experiments. There is no necessity to purchase a brand new coil, however, for a second-hand article, which can be bought at many electrical stores, will be found quite satisfactory. The coil shown in the illustration is of an old "army" type used in field transmitters during the war, and many dealers in government surplus materials are willing to sell these coils for quite a small sum.

Again, a spark coil, somewhat similar to that illustrated, was at one time fitted to the Ford car, and it should be quite a simple matter to obtain one of these from a garage or electrical shop, for a few shillings.

Commencing to Build the Instrument

The standards holding the glass plate should first be constructed. Each consists of two 4½" Angle Girders spaced apart at their upper ends by 2½" Angle Girders and at the bottom by 5½" Angle Girders. The upright Girders are further strengthened by 4½" and 2½" Strips bolted in the positions shown and spaced by a 2½" Angle Girder held to the Strips by means of Angle Brackets.

When these standards have been completed a strip of clear glass, approximately 6"×2", should be obtained, and two holes bored in it to receive the Terminals shown. The drilling of the holes can be carried out with the aid of a three cornered drill, but those who do not wish to undertake this operation (which calls for considerable care if the glass is to be drilled properly, and not cracked) may avoid the necessity of passing bolts through the glass by using clips to hold the glass in place. The clips may consist of Flat Brackets bolted to the 2½" Angle Girders on which the glass plate rests, and the Terminals should be connected to them. Two clips should be used at each end of the plate.

The two standards should next be screwed down to a base of hardwood or some other insulating substance and the glass plate placed on top of the supports and fastened in position.

In the illustration each end of the plate is shown secured by means of a 6 B.A. Bolt pushed through the centre slot in the 2½" Angle Girder and also through the drilled hole in the plate. A 6 B.A. Nut and Terminal is screwed on each Bolt so that short lengths of stiff wire may be mounted in the positions indicated.

A 6 B.A. Bolt, Nut, and Terminal is attached to one of the 4½" Angle Girders of each of the standards, and lengths of wire (preferably of the rubber covered type) are taken from these terminals to the secondary terminals mounted on one side of the spark coil case.

The press-switch should next be constructed. The base of the switch consists of a 5½"×2½" Flanged Plate having attached to it a Double Bent Strip and two 6 B.A. Bolts fitted with Terminals. One of these Terminals is insulated from the Plate by means of an Insulating Bush and Washer but is connected by a length of wire to a second insulated 6 B.A. Bolt fastened to the centre of the Plate. The other Terminal is in electrical contact with the Plate. The switch arm consists of a 5½" Strip rigidly secured to the Double Bent Strip and fitted with a 6 B.A. Bolt and a Flat Trunnion 3. Upon depressing the latter the 6 B.A. Bolts are brought together and thus current can flow between the two Terminals of the switch.

A length of wire 4 should be taken from one Terminal of the switch to one pole of a 6- or 4-volt accumulator. The wire 5 is attached to the second terminal of the accumulator and its other end is fastened between the binding nuts of one of the primary terminals mounted on the spark coil box. Finally, a length of wire connects the other primary terminal and the second terminal of the switch.

All is now ready for carrying out the experiment. The two short wires should be arranged so that their ends are about ⅛" apart. Upon depressing the Flat Trunnion of the switch a spark should pass between the ends of the short wires. If a spark cannot be obtained the ends of the wires should be brought nearer together and the interrupter screw 6 on the end of the coil box should be adjusted. Having obtained the spark the drop of water, known to contain the minute animal that is to be examined, is next placed on the glass slip. The latter should then be placed on the glass plate so that the drop can be viewed through the eyepiece of the microscope in the usual manner, care being taken to see that the ends of the two wires dip into the fluid.

When the animal is seen to be in a suitable position between the ends of the wires the switch should be closed by depressing the Flat Trunnion and a charge of electricity will pass between the ends of the wires, thus electrocuting the animal. The dead animal may then be mounted between glass slips in the usual manner.

Other interesting experiments may be carried out by substituting specimens of plant and animal tissue in place of microscopic animals, and noting the varying effect that the electric discharge has upon them.