

# Meccano Suggestions Section

By "Spanner"

## (420) Automatic Speed Controller for Electric Motors

(N. Ta'Bois, Woodford Green)

From time to time I have described in "Suggestions Section" ingenious ideas suitable for controlling the speed of Electric Motors.

In most of these devices use was made of a centrifugal governor, either connected by a lever to a variable resistance or fitted with a stop to limit the movement of the governor weights, as in a gramophone speed governor.

While devices such as these are satisfactory in most cases where the speed of a Motor has to be kept constant, there are certain instances when this type of mechanism is unsuitable. For example, in an electric clock the speed of the driving motor must be known, and one method of ensuring this is to subject it to the control of an auxiliary motor of the synchronous type, the exact speed of which can be readily calculated. A Meccano Electric Motor controlled by an easily assembled synchronous motor is shown in Figs. 420 and 420a. The mechanism was designed by N. C. Ta'Bois, Woodford Green, Essex, and the synchronous motor is suitable for working from a 6-volt Transformer. The Meccano Electric Motor can be of either the 6-volt or 20-volt type.

The principle of the mechanism is as follows. The Electric Motor and the synchronous motor are both coupled through reduction gearing to a differential gear, the cage of which is connected through further gearing to a contact that moves over an electrical resistance connected in series with the Electric Motor. When both driving Contrates of the differential are rotating at the same speed, the cage remains stationary; but it at once commences to rotate if the speed of the Electric Motor fluctuates. The contact then moves over the resistance and increases or decreases its value accordingly, so that the Motor gains or loses speed. This continues until the cage is stationary once more.

The maximum speed of the Electric Motor is considerably higher than that of the synchronous motor, and to obtain the highest efficiency it must be allowed to run as near to this speed as possible. It is necessary therefore to incorporate a greater ratio between the differential and Electric Motor than between the differential and synchronous motor.

The components of the mechanism are mounted on a base built as shown in the illustrations. The rotor of the synchronous motor is a Face Plate 1 and is provided with 8 poles, which on a frequency of 50 cycles give a speed of 750 r.p.m. The casing or stator consists of two  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ " Flat Plates 2 in which four Elektron Magnet Coils complete with Cores are mounted, one Coil being secured to the base and the remaining Coils in the positions shown. The Coils are wired together in series.

Bearings for the differential mechanism are provided by Flat Trunnions 4 and 5. A  $4\frac{1}{2}$ " Rod 7 is journaled at one end in a Strip 6, and at its other end in an Angle Bracket as shown. Pinion 8 meshes with a 57-teeth Gear on a 3" Rod 9, that carries also a Socket Coupling 10 fitted with a  $\frac{3}{4}$ " Pinion and a Double Arm Crank, the

entire assembly being free to rotate on the Rod. Rod 11 is gripped in a Coupling by two Pivot Bolts, each of which carries a  $\frac{3}{4}$ " Pinion on its shank. A  $\frac{3}{4}$ " Contrate 12 meshes with these Pinions as shown.

The 5" Rod 13, which is free to slide in its bearings over a length of about  $\frac{1}{4}$ ", is fitted with a  $\frac{1}{2}$ " Pinion and a 50-teeth Gear that meshes with the  $\frac{3}{4}$ " Pinion on Rod 9. A 3" Pulley with Rubber Tyre is attached to the base by a 1" x 1" Angle Bracket, and two lengths of Spring Cord are mounted on it as shown, care being taken to stretch the Cord slightly in order to prevent the turns of the wire touching each other.

A Pendulum Connection 17 makes contact with both pieces of Spring Cord of the resistance controller.

The ratio of the gearing between the Electric Motor and the differential permits the armature to rotate at four times the speed of the synchronous motor, that is at 3,000 r.p.m.

In order to operate the mechanism the  $\frac{1}{2}$ " Pinion on Rod 13 is thrown out of mesh with the  $\frac{3}{4}$ " Contrate by lever 16, and the rotor of the synchronous motor is spun in an anti-clockwise direction.

When the synchronous motor commences to operate, the Meccano Electric Motor is switched "on." If the two  $\frac{3}{4}$ " Contrates in the differential rotate in the same direction the Motor switch lever must be reversed.

The Pendulum Connection 17 is next moved over the Spring Cord until the  $1\frac{1}{2}$ " Rod in the cage of the differential remains stationary, and the  $\frac{1}{2}$ " Pinion is then slid into mesh with the  $\frac{3}{4}$ " Contrate. Any fluctuations in the speed of the Electric Motor will now be transmitted through the differential cage to the Pendulum Connection 17, which will simultaneously move over the Spring Cord and automatically increase or decrease the resistance in the electric circuit to the Meccano Motor. The model to be driven can be connected to any of the geared shafts in the Motor side plates.

## (421) Lubricating Bearings in Meccano Models

When operating Meccano models over long periods, it is always advisable to keep the bearings of the various shafts well oiled in order to avoid wear on the shafts and bearings, and also to reduce friction to a minimum. Normally the model-builder goes over the model with an oil can occasionally, but when a model is required to operate without any attention, some system of automatic lubrication is necessary if it is to remain trouble free.

The best method is to use the Meccano Grease Cup (Part No. 174). This makes use of semi-solid lubricant

such as vaseline or graphite grease, which is fed to the bearing by screw pressure.

An alternative automatic lubrication system is the syphon wick lubricator. In this arrangement a cup filled with oil is arranged near the bearing to be lubricated. A short length of wick such as that used in petrol cigarette lighters is threaded through Spring Cord and one end is dipped in the oil, the other end being fitted in the tapped hole of the boss forming the reinforced bearing for the shaft.

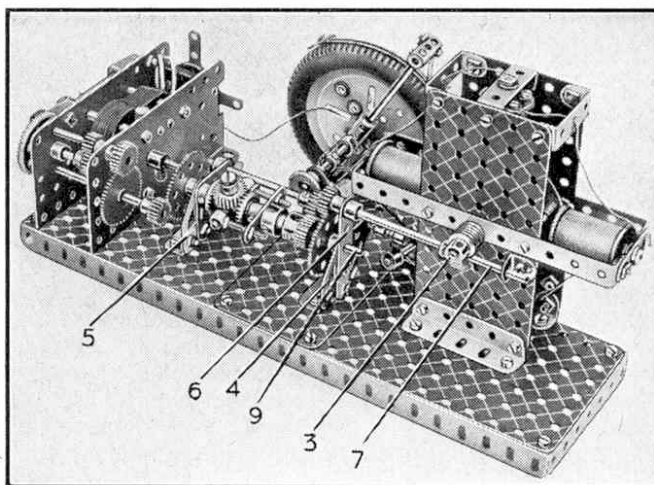


Fig. 420

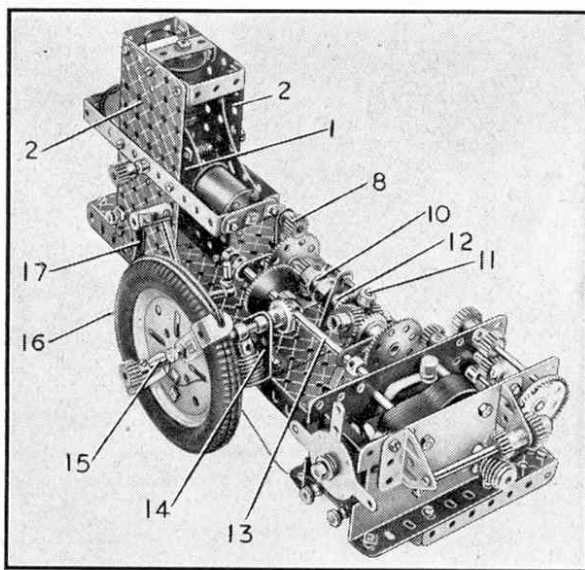


Fig. 420a

**(422) Penny-in-the-Slot****Mechanism** (H. Norton, Sheffield)

In exhibitions of working models, such as those held periodically by Meccano Clubs, it is advantageous to arrange the models so that they can be set in operation by visitors. A simple switch will of course serve the purpose, but where a Meccano Club is concerned a "penny-in-the-slot" mechanism is more desirable. With a device of this kind a model is set in motion when a penny is inserted in the slot provided, and is automatically switched off after a definite period of operation. Such a mechanism is shown in Fig. 422, and as will be noted, simplicity is the keynote of its design.

The mechanism is carried on a base formed by joining a  $5\frac{1}{2}" \times 2\frac{1}{2}"$  Flanged Plate to a  $5\frac{1}{2}"$  Angle Girder by the Electric Motor and a  $3"$  Flat Girder. The lever 1 is formed by a  $3"$  and a  $2\frac{1}{2}"$  Strip overlapping three holes, a Double Bracket being clamped between the two Strips. One of the Bolts joining the Strips is an Elektron Contact Screw 4, the purpose of which will be explained later. The Double Bracket is pivotally mounted on a  $1"$  Rod held in a Collar by Spring Clips. The Collar is supported by a  $\frac{1}{2}"$  Bolt fastened to the base, and side play in the Double Bracket is prevented by Washers. At one end of the lever 1 is a Bush Wheel 2, on which the pennies fall. The rear end of the lever 1 is kept in contact with a stop by a length of Spring Cord 3, which is clamped at one end between two vertical  $2"$  Strips.

The weight of a coin dropped down the chute depresses the Bush Wheel against the action of the Spring Cord and brings the Contact Screw 4 into contact with a second similar part fixed to the base. The second Screw is insulated from the base, but is connected by a length of wire to one terminal of the Electric Motor. One of the leads from the Transformer is connected to the remaining terminal, while the other lead is connected to the Motor frame. When the two Screws make contact, the electric circuit is completed and the Motor comes into operation and drives the model to which it is coupled.

In order to remove the coin from the Bush Wheel, and thus to stop the model, the Screwed Rod 5 is arranged to move across the face of the Bush Wheel. The Screwed Rod is lock-nutted in the tapped hole of a Collar fixed on a  $2\frac{1}{2}"$  Rod. The latter part carries a 57-teeth Gear and is journaled in the boss of a Crank bolted to a  $3\frac{1}{2}"$  Strip, which can be seen in Fig. 422. The 57-teeth Gear is driven from the Motor, a Worm on the armature shaft of which drives a 57-teeth Gear on a  $3"$  Rod journaled in two  $1" \times 1"$  Angle Brackets. A  $\frac{3}{4}"$  Contrate Wheel on this Rod drives a  $\frac{3}{4}"$  Pinion on Rod 7, and a  $\frac{1}{2}"$  Pulley on Rod 7 drives through a Driving Band a similar part of a Rod carrying Worm 6, which finally turns the 57-teeth Gear. The ratio of the gearing is such that the Motor is switched off one minute after a coin has been placed in the slot. The height of the Screwed Rod 5 is so adjusted that it continues to press

on the Bush Wheel until it has moved clear of its face.

The chute in which the coin is placed consists of four  $3\frac{1}{2}"$  Angle Girders, pairs of which are fitted together in the manner shown so that a penny can easily be placed between them. The pairs of Angle Girders are connected by  $1\frac{1}{2}" \times \frac{1}{2}"$  Double Angle Strips, a washer being used on the inside of

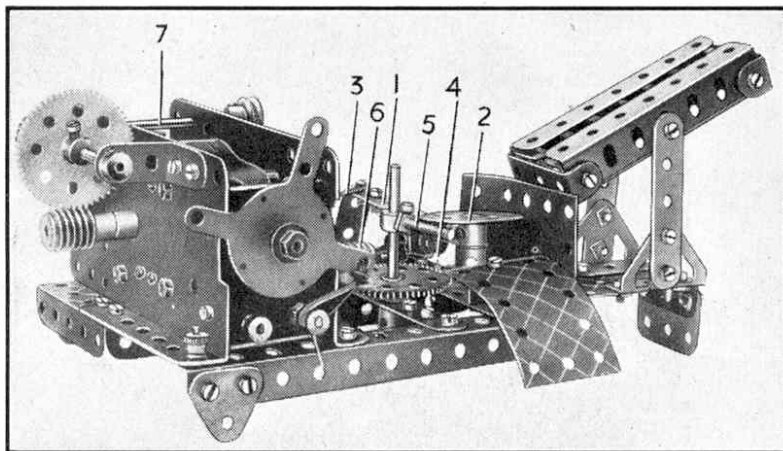


Fig. 422

each lug for spacing purposes. The angle of the chute is so adjusted that the coin does not slide down too rapidly. The Flexible Plates are then fitted to guide the coins into a suitable receptacle.

When mounted in a model, the mechanism should be covered with Plates, and the drive should be taken to the model from the shaft carrying the 57-teeth Gear and Contrate Wheel. If desired a celluloid window can be fitted in the mechanism casing so that the operation of the device can be seen.

The device is shown with a reversing Electric Motor, but if desired either an

to which the moving jaw of the vice is fixed, and each pair of Angle Girders is spaced apart by the flanges of two Angle Girders placed one on top of the other. A  $3\frac{1}{2}"$  Angle Girder is attached to each guide by a  $3"$  Flat Girder, and each supports a pair of  $2\frac{1}{2}" \times 2\frac{1}{2}"$  Flat Plates. The vertical  $3"$  Angle Girders 3 carry the fixed jaw of the vice.

The slides for the moving jaw are pairs of  $5\frac{1}{2}"$  Angle Girders 2, which are connected by a  $2\frac{1}{2}" \times 1\frac{1}{2}"$  Flanged Plate 5 supported by  $2"$  Angle Girders. A  $3\frac{1}{2}"$  Angle Girder bolted across the  $2"$  Angle Girders carries the  $3\frac{1}{2}" \times 2\frac{1}{2}"$  Flanged Plate that forms the moving jaw. This Plate is braced at each side of the jaw by three Architraves, which are bolted to Flanged Plate 5 and to a second similar Plate fixed to the  $3\frac{1}{2}" \times 2\frac{1}{2}"$  Flanged Plate.

The vice is operated by a Screwed Rod 6, which is screwed into a Threaded Crank bolted at the back of the fixed jaw. The Screwed Rod passes through a  $1\frac{1}{2}"$  Angle Girder fixed to Plate 5, end play being prevented by a Threaded Boss clamped in position by a nut, and the  $3"$  Pulley. The latter part is fixed to the Screwed Rod by its set screw and is additionally gripped by two nuts placed one on each side of its boss.

The vice can be secured to a work bench by passing screws through the Flanged Plate forming the base.

**(424) Wind Direction Indicator**

(P. Lees, London N.1)

P. Lees, London N.1, recently sent us details of an interesting wind direction indicator that he constructed from Meccano parts. In this a large vane is mounted on the end of a horizontal Rod fixed in a Coupling on the upper end of a vertical Rod. The latter Rod is supported by a framework of Angle Girders, and at its lower end is a  $\frac{3}{4}"$  Bevel Gear that meshes with a second similar part on a horizontal Rod. This Rod is fitted with a pointer that moves over a circular dial on which the main points of the compass are marked. The pointer is set so that it indicates north on the dial when the vane is pointing in that direction, and the true direction of the wind at any time can then be seen at a glance.

Another ingenious device, also made by Lees, is a wind speed indicator. This consists of a two-bladed fan mounted on the end of a Rod journaled in a suitable framework of Strips. The Rod is fitted with a lever arm that is connected by a Spring to the framework of the model. The shaft on which the fan is mounted has a Rack Segment fixed to it, this part being meshed with a  $\frac{1}{2}"$  Pinion. A further step-up gear of 2 : 1, consisting of a 50-teeth Gear and  $\frac{3}{4}"$  Pinion, is arranged in the framework of the mechanism, the final shaft being fitted with a pointer. This pointer moves over a dial graduated in miles per hour, and in order to graduate the scale correctly Lees took the device out in a motor car on a calm day and noted the position of the pointer at various road speeds. The device depends for its operation on the tendency of the airflow to turn the fan blades against the Spring.

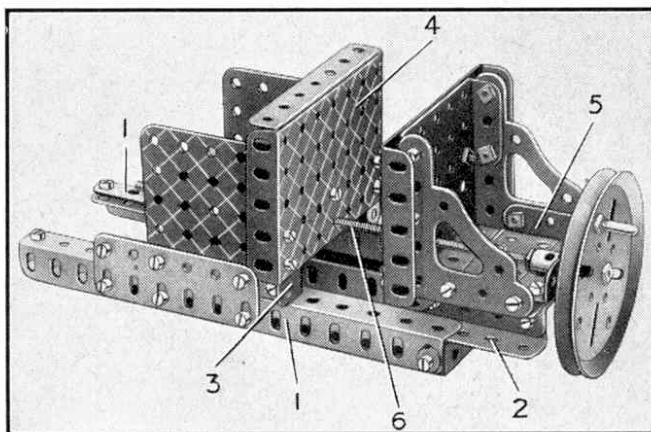


Fig. 423

E1 or an E120 type Motor can be used.

**(423) Meccano Vice**

(L. Williams, Northampton)

One of the most useful tools in a model-builder's workshop is a vice for holding objects while they are being filed or soldered. A strong Meccano vice of a handy size for average work is shown in Fig. 423, and was suggested by L. Williams, Northampton.

A base for the vice is provided by a  $5\frac{1}{2}" \times 2\frac{1}{2}"$  Flanged Plate, to each of the long flanges of which are secured two  $7\frac{1}{2}"$  Angle Girders. These form guides for slides