

Meccano Suggestions Section

By "Spanner"

(436) Electric Motor (B. Ware, Caterham)

In "Suggestions Section" of the "M.M." for October 1937 appeared a novel type of electric motor built up from Elektron and Meccano parts. In Fig. 436 we illustrate another of these interesting models making use of Elektron parts. This motor is designed for operation from a 20-volt Transformer and embodies several ingenious features in its construction. It is assembled on a base consisting of a $5\frac{1}{2} \times 2\frac{1}{2}$ " Flanged Plate, to the end flanges of which are bolted two $2\frac{1}{2} \times 2\frac{1}{2}$ " Flat Plates.

The field coils of the motor are four Elektron Magnet Coils 1, the Cores of which are bolted in the slotted holes of a Face Plate 2, but are spaced from the Plate by two washers. The four Magnet Coils should be wired together before fitting them on the Cores, as this will be difficult if left until later. The wiring is carried out as follows. The inner terminal of one Coil is connected to the inner terminal of the next Coil. The outer terminal of the latter is connected to a similar terminal on the following Coil, the inner terminal of which is connected to the inner terminal of the third Coil. Finally the outer terminals of the third and fourth Coils are wired together, and long leads are taken from the remaining terminals on the first and last Coils.

The armature is similar to the field unit and also comprises four Magnet Coils 3 fixed to a Face Plate 4. These Coils are wired in exactly the same manner as those of the field unit.

The brushes 5 and 6 may now be fixed to the Face Plate 4. Each of them consist of a Pendulum Connection attached by an insulated 6 B.A. Bolt to an Angle Bracket,

which in turn is bolted to the Face Plate 4. The Brackets are fixed in the holes on each side of one of the Magnet Coils. The two wires from the Coils should be connected to the brushes. The latter are counter-balanced by bolts and washers fixed diametrically opposite on the Face Plate. The armature shaft is a $6\frac{1}{2}$ " Rod 9.

The next step is to build the frame that carries the armature and field Coils. Four $5\frac{1}{2}$ " Strips 7 are attached by Angle Brackets to the Face Plate 2, in the manner shown in Fig. 436. The four ends of the Strips are then bent together to form a cone and bolted to a Bush Wheel 8. Two of the $5\frac{1}{2}$ " Strips 7 are fixed to the Bush Wheel 8 by 1" Screwed Rods.

The commutator is formed by a Bush Wheel 10 to which four $\frac{1}{2}$ " 6 B.A. Bolts 11 and 12 are fixed, Insulating Bushes and Washers being used to insulate the Bolts from the Bush Wheel. The two Bolts 11 are electrically connected by wire, as also are the two Bolts 12. The commutator 10 is fixed to Bush Wheel 8 by the 1" Screwed Rods previously mentioned.

The electrical circuit is wired as follows. One of the wires from the field coil is taken to an insulated Terminal on the Face Plate 2, and the other wire is connected to one of the Bolts 11 on the Bush Wheel 10. A wire is then connected to one of the Bolts 12 and is taken to a second insulated terminal on Face Plate 2. The brushes 5 and 6 should now be adjusted so that they make contact with the 6 B.A. Bolts of the commutator when the Magnet Cores of the armature are half way between the Magnet Cores of the field coil unit. The brushes should break contact when the two sets of Cores are nearly opposite each other.

(437) Aeroplane Control Gear

Meccano users who build model aeroplanes can increase the interest of their models considerably by fitting them with control mechanisms for operating the elevator, rudder and ailerons. Suitable gear for the purpose that can be fitted into

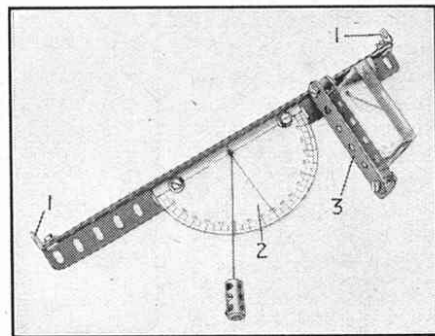


Fig. 438

almost any model aeroplane is shown in Fig. 437. The joystick 59 is a $1\frac{1}{2}$ " Rod held in the boss of a Swivel Bearing. The "spider" of the latter is secured to a 3" Rod 60, which is journaled horizontally in a $2\frac{1}{2} \times \frac{1}{2}$ " Double Angle Strip and carries a Coupling 62. A $\frac{1}{2}$ " loose Pulley 61 turns on a $\frac{3}{4}$ " Bolt secured to the Flat Plate by two nuts, and is retained in position by means of a Collar. The rudder bar 63 consists of a $2\frac{1}{2}$ " Strip pivoted at its centre to the Flat Plate.

The wire 57 is fastened at one end to a short lever secured at right angles to the under surface of the elevator; it is then attached to the joy-stick 59, led around the Pulley 61, and taken back to another short lever secured to the upper side of the elevator. When the stick is pushed forward the elevator drops and sends the nose of the aeroplane downward. When the stick is pulled back the elevator is raised and the nose of the aeroplane also rises. The wire 70 is secured at its centre to the Coupling 62 and its ends, after being led round guide pulleys, are fastened to short levers projecting at right angles from the upper surface of the ailerons.

The ailerons are connected by another wire attached to further levers projecting from their lower surfaces. The aileron on the right side is pulled down, thus causing the wing on that side to rise when the stick is moved to the left. Simultaneously the aileron on the left side is pulled up, assisting the downward motion of the left wing, and the machine banks. When the lever is pushed to the right, the reverse movements take place.

The ends of the rudder bar 63 are connected by wires 55 to levers projecting on opposite sides of the rudder, which can be moved right or left by pushing the rudder bar with either the right or left foot.

The complete unit can easily be bolted in the cockpit by passing bolts through Angle Brackets 64 and similar parts bolted to the rear of the Flat Plate.

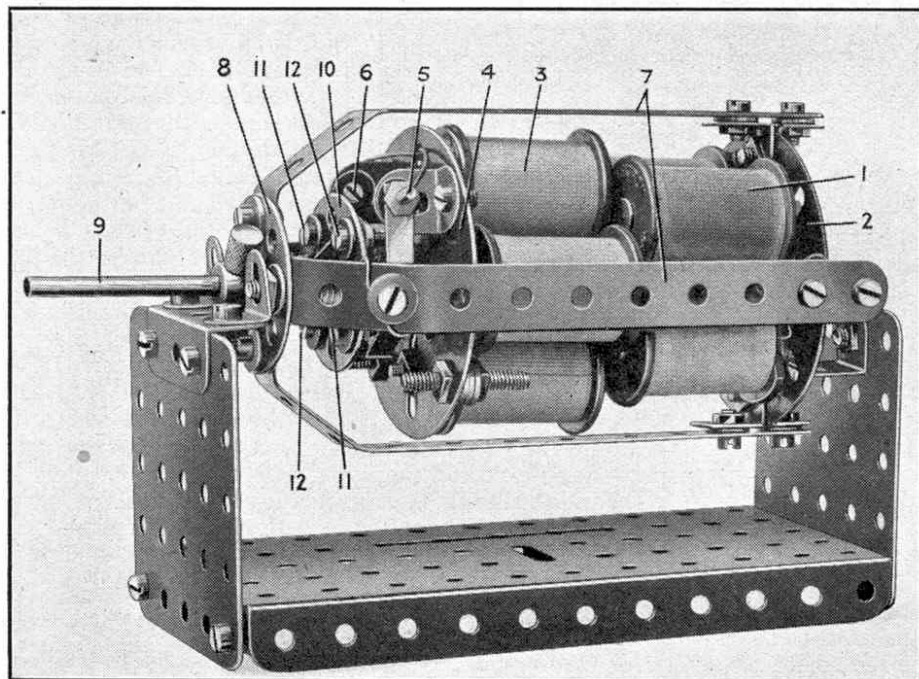


Fig. 436

(438) Clinometer

(P. K. Choksi, Karachi, India)

Details of many scientific instruments reproduced in Meccano parts have been published in the "M.M." from time to time, and another of these useful models is shown in Fig. 438. It is a clinometer, an instrument used for measuring angles when finding the heights of objects such as mountain tops or trees.

The instrument consists essentially of a $9\frac{1}{2}$ " Angle Girder, at the ends of which are fixed Angle Brackets 1 to form the sights. A Theodolite Protractor 2 (Part No. 135) is cut out and bolted to the Angle Girder as shown, and a hole is punched in it at the centre of the semi-circle. A length of Cord or thread passed through this hole carries a bob formed by a Coupling.

A small piece of mirror glass is clamped by $\frac{1}{8}$ " Bolts between a Strip 3 and a Flat Girder. The latter is attached by Hinges to a Flanged Bracket bolted to the Angle Girder.

The instrument is quite easy to use. For example, suppose it is desired to find the height of a tree. The tree is "sighted" by looking through the Angle Brackets 1 and the mirror is then swung into position so that it reflects the angle indicated by the plumb line on the Theodolite Protractor. The mirror enables this reading to be taken without removing the eye from the sights. The angle indicated is the angle of elevation of the top of the object. If two such angles are measured at points along a straight line passing through the base of the object, and at a known distance apart, the height of the object can be calculated or measured on a scale drawing.

(439) Servo Friction Clutch

(K. Wallace, Motherwell)

In Fig. 439 is illustrated a servo friction clutch that makes use of the turning power of the driving motor for its application. One of its special features is that it takes up the drive smoothly, and it can be used to advantage therefore in models such as cranes. The construction of the clutch is made clear in Fig. 439, which shows the mechanism as it would be fitted in a model crane.

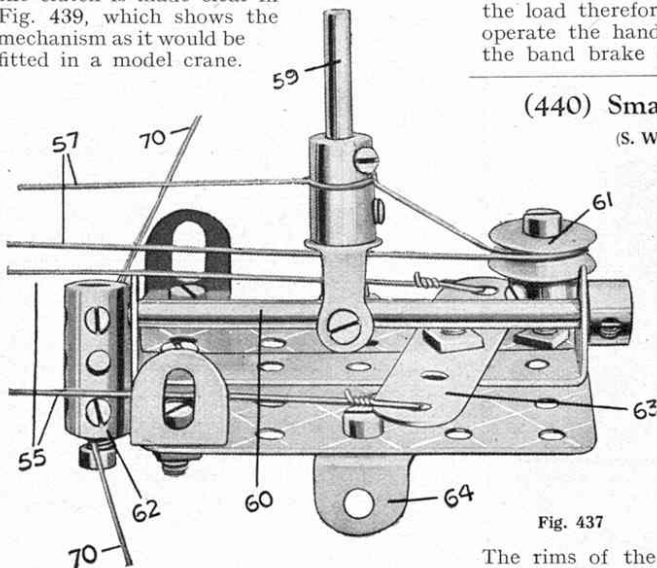


Fig. 437

The winding drum is a Rod 2 on which a 3" Pulley is free to rotate. This Pulley is driven from Rod 1, and carries a 1" Rod on which a Collar 4 and a 50-teeth Gear are fixed. The Collar is fitted with a bolt to which a length of Cord is tied. The latter passes around the rim of a $1\frac{1}{2}$ " Pulley 3

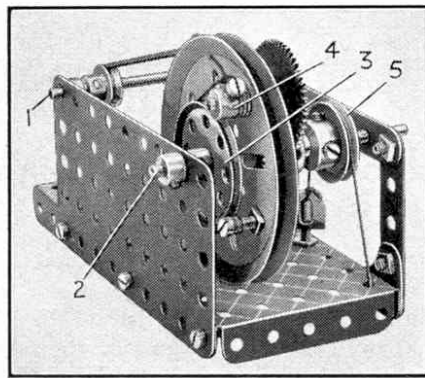


Fig. 439

fixed to Rod 2, and is tied to a $\frac{1}{2}$ " Bolt lock-nutted to the 3" Pulley.

The 50-teeth Gear meshes with a $\frac{3}{4}$ " Pinion, which is connected to a 1" Pulley 5 by a Socket Coupling. This assembly is free to rotate on Rod 2, but its rotation can be retarded by a band brake made by anchoring a length of Cord to the baseplate, passing it around the 1" Pulley, and tying it to an Angle Bracket. The Bracket can be moved up and down the shank of a $\frac{3}{4}$ " Bolt by means of a Threaded Boss. When the band brake on Pulley 5 is slack, the 3" Pulley and Pulley 5 rotate as one unit and no drive is transmitted to Rod 2. If the rotation of Pulley 5 is retarded, however, the 50-teeth Gear rotates around the $\frac{3}{4}$ " Pinion and tightens the band brake around the $1\frac{1}{2}$ " Pulley. As this is fixed to Rod 2, it transmits the rotation of the 3" Pulley to this Rod.

When incorporated in a model the band brake around Pulley 5 can be operated by a suitable hand or foot lever.

The outstanding feature of this clutch is that when fitted to a model crane it facilitates the lowering of loads under gravity. When the power unit is stopped the load remains still, but as soon as the friction brake is released on Pulley 5, the band brake on the $1\frac{1}{2}$ " Pulley 3 is released and the load commences to fall. To control the descent of the load therefore it is only necessary to operate the hand or foot lever actuating the band brake around Pulley 5.

(440) Small Pivot Bearing

(S. Williams, Cardiff)

It is often necessary to provide some form of pivot bearing in models, such as a roundabout, where a rotating structure is supported from the top of a central column. The bearing shown in Fig. 440 is ideal for use in models of this kind. It consists essentially of two $1\frac{1}{8}$ " Flanged Wheels, the lower one bolted to the vertical pillar and the upper one to the superstructure of the model.

The rims of the Flanged Wheels rotate on four $\frac{1}{8}$ " loose Pulleys, which are carried on the shanks of Pivot Bolts. The latter are screwed into the tapped holes of a "spider" taken from a Swivel Bearing and are held in place by lock-nuts. The drive to the superstructure can be taken from the Rod that passes through the boss of the lower Flanged Wheel.

(441) Simple Expanding Brake

(N. Ferry, Timperley)

Recently I received details of a new internal expanding brake for model motor cars made by N. Ferry, Timperley. The main features of the device are simplicity and neatness, and a description of it will be of interest to other model-builders.

The brake mechanism is built up on a Face Plate and the brake drum may be either a Boiler End or a Wheel Flange. The friction shoes are Obtuse Angle Brackets, each of which is bolted to the short arm of a $1" \times \frac{1}{2}"$ Angle Bracket pivoted by its slotted hole to a Face Plate. The pivot bolts pass through adjacent holes in the inner circle of holes in the Face Plate, and the Angle Brackets are connected together by a short length of Spring Cord, which keeps them in contact with the boss of the Face Plate.

The brake shoes are expanded by a 1" Corner Bracket, which is fixed on a lock-nutted bolt that is free to slide in the slotted hole of the Face Plate between the two shoes. When the complete assembly is fitted in a chassis, the bolt carrying the Corner Bracket is connected to the brake pedal by wire or Strips. When the pedal is pressed down the bolt is pulled along the slotted hole of the Face Plate, and as a result the Corner Bracket forces the shoes into contact with the brake drum.

It will be gathered from this description the device requires only a few parts for its construction and consequently will be of use to model-builders whose stock of parts is rather limited.

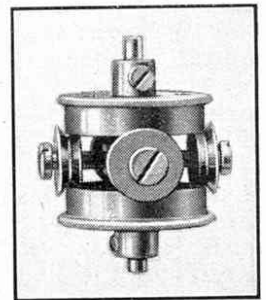


Fig. 440

Miscellaneous Suggestions

Under this heading "Spanner" replies to readers who submit interesting suggestions regarding new Meccano models or movements that he is unable to deal with more fully elsewhere. On occasion he offers comments and technical criticisms that, he trusts, will be accepted in the same spirit of mutual help in which they are advanced.

M213. It sometimes happens that a model-builder finds himself short of a $3\frac{1}{2}"$ Gear Wheel, and it is then necessary to bolt the Gear Ring (Part No. 180) to a Face Plate in order to fix the Ring to a Rod. This must be done accurately, however, as the boss of the Face Plate must be at the exact centre of the Gear Ring, otherwise the built-up gear wheel will not run truly and will cause trouble when meshed with a Pinion. A. Reeves, Woking, points out that a $2\frac{1}{2}"$ Gear Wheel can be pressed into the centre of a Gear Ring and makes a firm built-up $3\frac{1}{2}"$ gear that is not in the slightest degree eccentric. The fact that the $2\frac{1}{2}"$ Gear can be fitted into the Gear Ring demonstrates the accuracy with which Meccano Gears are cut and is a further example of the adaptability of Meccano parts.

M214. Several model-builders have suggested that the hooks fitted to the Meccano Pulley Blocks should be supplied as separate parts, with threaded shanks to allow them to be fitted to built-up pulley blocks. We should like to hear the opinions of other model-builders on this proposal.

Meccano Suggestions Section

By "Spanner"

(442) Remote Controller for a Reversing Electric Motor

(A. Imlay, Skene)

The pleasure obtained from operating an electrically-driven model such as a crane can be increased considerably by fitting the model with this interesting form of remote control, in which all the necessary movements are electrically-operated. The various control switches are mounted on a central switchboard, so that the operator can sit at a distance from his model and put it through its paces in a most realistic manner. The controller is illustrated in Fig. 442. It is suitable for a Meccano Motor of the reversing type, and is based on a suggestion by A. Imlay, Skene.

It is built up of two Elektron Magnet Coils supported on a platform consisting of two $4\frac{1}{2}$ " Strips, which are clamped to the Trunnions 1 by Flat Brackets. The Trunnions are bolted to the side plates of the Motor, and are strengthened with 1" Corner Brackets. The bolts holding the clamping Brackets hold also $1\frac{1}{2}$ " Flat Girders, which are spaced from the Strips by two washers. The Magnet Coils 2 and 3 fit on these Flat Girders and are clamped in place by Double Bent Strips and $\frac{3}{4}$ " Bolts. Before Magnet Coil 3 is clamped down the Cores should be fitted in position. They are joined by a Coupling 4 and must slide freely in the bores of the Coils 2 and 3.

A 2" Slotted Strip is bolted to the reversing lever of the Motor, but is spaced from it by the thickness of a washer. A bolt passes through the slot in the Strip into the centre tapped bore of the Coupling 4. A $\frac{3}{8}$ " Bolt 5 screwed through from the opposite side locks the bolt in position. The head of the $\frac{3}{8}$ " Bolt acts as a stop to prevent the Cores being drawn too far into the Coils. Its travel is limited by two $\frac{3}{4}$ " Bolts lock-nutted to the rear $4\frac{1}{2}$ " Strip.

In order to ensure free movement of the reversing switch the nut and collar on the switch pivot are removed, a Meccano washer is slipped on its shank, and then the nut and collar are replaced. The bores of the Coils may be oiled slightly.

The switch by which remote control is

terminal of Coil 2 and the corresponding Bolt on the other side is wired to Coil 3. The central Bolt 8 is "dead." The wiring is completed by connecting together the remaining terminals of the Magnet Coils and the Motor.

A 2" Rod is locked in the boss of the Bush Wheel, and on it is a Double Arm Crank, held by a Collar. A Spring Buffer mounted on the end of the Double Arm Crank makes contact with the heads of the 6 B.A. Bolts.

In connecting the unit to the Transformer used to supply current for its operation one lead is taken to the Bush Wheel, and the other is fastened to the right-hand terminal of the Motor. When starting the Motor, the switch handle is moved to Bolt 6. In its passage it makes contact momentarily with Bolt 7, which is wired up to Coil 2. The latter therefore is energised for a period just long enough to draw over the reversing lever. The Motor is reversed in a similar manner by moving the contact to the other Bolt.

(443) Maltese Cross Mechanism

The article describing the cinematograph built by Mr. Bihn, Paris, which appeared in the "M.M." for June, aroused great interest among model-builders and I have received many enquiries regarding alternative intermittent motion mechanisms for models intended for projecting standard size films. This month therefore I am illustrating in Fig. 443 a small Maltese Cross mechanism that can be used for this purpose. The driving member consists of a Bush Wheel, which is mounted on a suitable shaft and is fitted in seven of its holes with Threaded Bosses, six of these being held in place by their Bolts. The remaining Threaded Boss is held in place by a 1" Threaded Rod 1 and a nut. The driving member, which rotates the film feed sprocket, consists of two built-up sections mounted on one Rod. The inner section is made up of a "spider" from a Swivel Bearing, which carries four Threaded Pins that lock the "spider" securely to the Rod. The other section is built up from a Coupling 2 carrying two $1\frac{1}{2}$ " Rods. The two portions of the member are fitted at right-angles to each other by securing them in the outer two transverse holes of the Coupling.

The operation of the mechanism is as follows. As the driving member rotates, the Threaded Rod 1 strikes one of the Threaded Pins on the driven member, and simultaneously the gap in the circle of Threaded Bosses allows a $1\frac{1}{2}$ " Rod to pass through.

(444) Overload Release for Electric Motor (P. Rogers, Sheffield)

Every electric circuit should be equipped with a safety device of some kind to protect

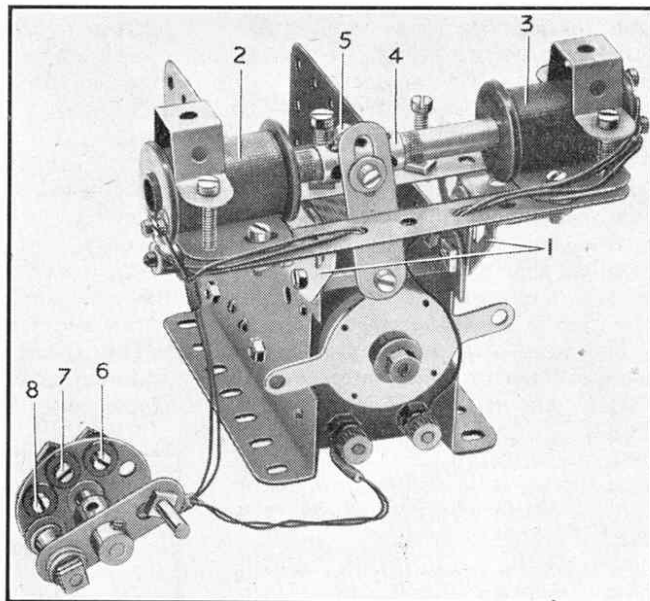


Fig. 442

the apparatus it supplies from damage that might arise from the passing of a heavier current than that for which the circuit is designed. This applies particularly in the case of electric motors, and where these are used it is customary to ensure protection by means of a device known as a cut-out or overload release, of which the Hornby Circuit Breaker is an example.

Model-builders who are interested in protecting their 6-volt Meccano Motors can make a suitable device quite easily by winding two layers of Meccano 26 gauge S.C.C. Wire on a Meccano Bobbin (Part No. 181), and then clamping the Bobbin to a suitable base. A short Rod should be arranged to slide in the bore of the Bobbin, and one end of this should be connected pivotally to a switch arm consisting of a 2" Strip. The hole in the Strip next to the point where the Rod is pivoted to it carries a Spring Buffer, which forms an electrical contact. The other end of the Strip is pivotally attached to a pillar fixed to the base in such a manner that the Rod is free to move in and out of the Bobbin. A 6 B.A. Bolt is now fixed in one of the holes of the base in such a position that its head makes contact with the head of the Spring Buffer.

One end of the Bobbin winding is attached to a second Terminal insulated from the base, and the other end is connected to the base plate. The device is connected in series with the Motor and Transformer. When the current rises above a certain value the Rod forming the plunger of the solenoid is sucked into its interior, thus moving the switch arm and breaking the circuit.

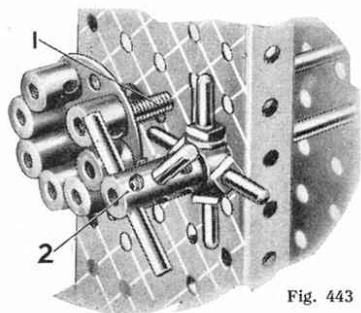


Fig. 443

effected is a particularly interesting unit. It consists essentially of a Bush Wheel fitted with five insulated 6 B.A. Bolts. Wiring connects the two outer Bolts, one of which is shown at 6, to one terminal of the Motor. Bolt 7 is connected to one

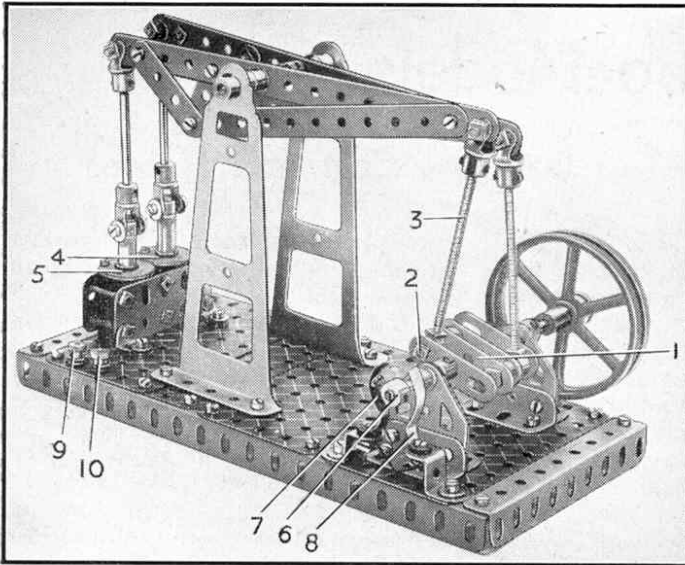


Fig. 445

(445) Electric Beam Engine

(N. Craig, Glasgow)

Solenoid engines possess a fascination for young Meccano model-builders, who find them both instructive and practical. These novel power units can be built in a variety of forms, and in Fig. 445 is illustrated a model beam engine operated on this system. When connected to a Meccano T6, T6A or T6M Transformer it will work efficiently at a good speed.

The model is built up on a base consisting of 9 1/2" Angle Girders joined by 4 1/2" Angle Girders and four 4 1/2" x 2 1/2" Flat Plates. The twin beams are supported by two Large Shafting Standards bolted in the positions shown. Each beam is made from a 7 1/2" Strip, one 5 1/2", one 2" and one 1 1/2" Strip, all of which are bolted together in the manner shown. The beams are pivoted on a 3" Rod and are spaced apart by a Coupling. Bearings for the crankshaft are made by bolting two Flat Trunnions between two 1 1/2" Angle Girders, which are then bolted to the base.

The crankshaft can now be assembled. The centre webs 1 are Cranks, and the outer webs are Double Arm Cranks. In order to ensure correct alignment a Rod is pushed through their centre holes while they are being assembled. The crank-pins are 1" Screwed Rods, shown at 2 in our illustration. Each is first passed through two Cranks 1 and is fixed in place by nuts, and a Collar is then pushed on it and the Screwed Rod is secured to one of the Double Arm Cranks by lock-nuts. A 1 1/2" Rod is fixed in the boss of one of the Double Arm Cranks, while the other carries a 2 1/2" Rod. Washers prevent the crankshaft from moving endways when mounted in its bearings.

The connecting rods 3 are 3" Screwed Rods, screwed into the Collars on the crank-pins and held in place by lock-nuts. They are gripped at their upper ends in the bosses of End Bearings, which are pivotally attached to the beams by lock-nutted bolts. At this point it is as well to look over the various joints to make sure that they run freely.

The twin "cylinders" of the engine are Elektron Magnet Coils 4 and 5, and they are clamped between two 2 1/2" Flat Girders by means of six 1" Screwed Rods. The lower Screwed Rods each hold an Angle Bracket by which the unit is bolted to the base, and each Angle Bracket is spaced from the base

by two washers. The "pistons" are Magnet Cores, each of which is fitted with a Collar as shown. Small Fork Pieces are pivoted to the Collars by bolts, and connecting rods formed by 2" Rods link the cores to the beams.

A commutator consisting of a Collar 6 fitted with a bolt is now fitted to the crankshaft. As the crankshaft rotates the bolt makes contact with two brushes made from Pendulum Connections, which are held by insulated 6 B.A. Bolts on Reversed Angle Brackets.

The electrical connections are as follows Brush 7 is connected to one terminal of Coil 5, and brush 8 is connected to a terminal of Coil 4. The remaining terminals of the Magnet Coils are connected by a short wire, and a lead is taken from them to Terminal 9, which is insulated from the base. Terminal 10 is in electrical contact with the base.

A Meccano Flywheel is fitted to the crankshaft, and the brushes are adjusted by bending them so that the bolt in Collar 6 makes and breaks contact at the beginning and end of each downward stroke of the Magnet Cores. The latter should be given a coat of thin oil to allow them to move easily in and out of the Coils. In order to secure good running the Cores should be arranged so that they project as far as possible into the bores of the Coils when they are at the bottom of their stroke.

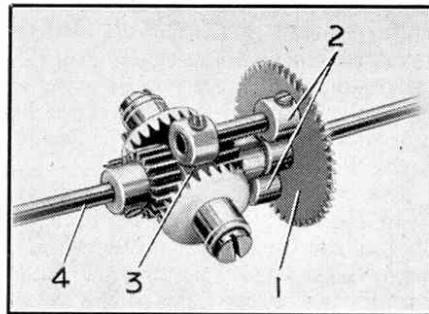


Fig. 446

(446) The Smallest Meccano Differential?

The differential gear illustrated in Fig. 446 has raised a controversy in the Editorial offices as to whether it is the smallest differential that can be built in Meccano. It is certainly one of the neatest, and we shall be interested to learn what readers think of it.

The unit illustrated is the work of D. Perkins, Hull. It is constructed by fixing two Collars 2 to a 50-teeth Gear 1. A 7/32" Grub Screw is screwed through the tapped hole of each Collar into the tapped hole of the 50-teeth Gear, an operation for which a screwdriver with a thin shaft is necessary, and two more Collars are fixed in a similar manner to a "spider" 3. Two 1" Rods

connect the sets of Collars and are held in place by Grub Screws. A Rod is pushed through the boss of the 50-teeth Gear and is fitted at its inner end with a 1/2" Pinion. The Rod projects only 1/4 in. into the bore of the Pinion.

The 3/4" Contrate Wheels are now fitted. They rotate on Pivot Bolts, which are screwed into the remaining tapped holes of the "spider" and are held in place by lock-nuts. The sides of the nuts should be parallel to the end of the "spider," so that the corners do not catch in the teeth of the Pinions.

The Rod 4 also is fitted with a 1/2" Pinion and passes through the "spider" into the bore of the first 1/2" Pinion.

Another differential gear, the outstanding feature of which is simplicity, is illustrated in Fig. 446a. It was submitted by W. McSimon, Liverpool, and is intended for use with a Sprocket Chain drive.

The gearing is contained in a framework that consists essentially of two 1 1/2" x 1/2" Double Angle Strips 3, which are bolted at one end to a 2" Sprocket Wheel 4, and at the other end to two 1 1/2" Discs. Rod 2 is passed through the boss of the 2" Sprocket Wheel and is locked in the boss of a 3/4" Pinion. Rod 2 projects only halfway through the boss of this Pinion. Rod 1 passes through the 1 1/2" Discs and carries a Collar, a washer and a 3/4" Pinion, the Collar being placed between the two 3/4" Pinions. Rod 1 projects into the bore of the first-mentioned 3/4" Pinion. Two 3/4" Contrate Wheels held in the frame by Pivot Bolts mesh with the 3/4" Pinions.

Cash Prizes for New Ideas

Cash prizes are awarded for all ideas published in "Suggestions Section," and readers are invited to send particulars of any ingenious mechanism they have designed that has not already been dealt with in these pages, and of new uses they find for Meccano parts. Contributions should be original and should be illustrated if necessary with photographs or sketches. A

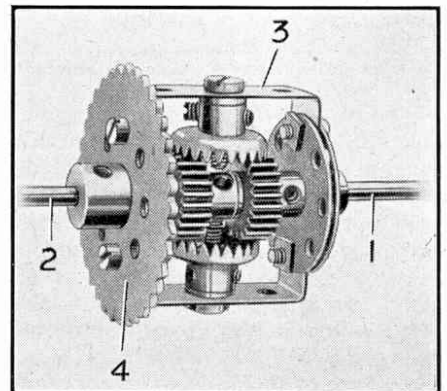


Fig. 446a

mechanism need not be a complete model, but perhaps part of a large model in which it serves some definite function. Novel uses for Meccano for purposes other than model-building also will be considered for publication.

Model-builders who are keen on devising new mechanisms should consider which of their recent efforts are suitable for publication, and send details of the devices. Here is a good opportunity to earn extra pocket money and at the same time to be of real help to other readers.

Ideas should be submitted to "Spanner," "Meccano Magazine," Binns Road, Liverpool 13, and may be sent at any time.

Meccano Suggestions Section

By "Spanner"

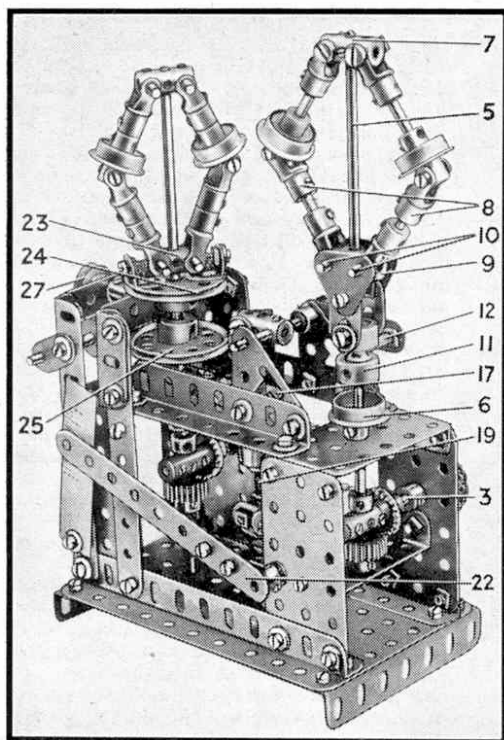


Fig. 447

(447) Knowle's Supplementary Governor

The mechanism shown in Fig. 447 is a reproduction in Meccano of Knowle's Supplementary Governor, a device that regulates the speed of a steam engine when the steam pressure falls below a certain value or there is a correspondingly unwanted increase. It really consists of two separate governors, known as the primary and supplementary governors, which operate in conjunction with each other. The two governors are driven by a Crank 1, Fig. 447a. Shafts 2 and 3 are connected by Sprocket Chain, and shaft 3 carries a $\frac{3}{4}$ " Contrate that drives a $\frac{3}{4}$ " Pinion on the vertical 8" Rod 5. This Rod is journaled at its lower end in a $2\frac{1}{2}$ " x $\frac{1}{2}$ " Double Angle Strip and also in a $2\frac{1}{2}$ " x $1\frac{1}{2}$ " Flanged Plate, a $\frac{3}{4}$ " Flanged Wheel 6 is fitted to the Rod and immediately above this is secured the primary governor proper.

Two Small Fork Pieces are pivotally secured to a Coupling 7 by means of Pivot Bolts, and in the bosses of the Fork Pieces are gripped $1\frac{1}{2}$ " Rods. Each Rod carries a $\frac{1}{2}$ " fast Pulley and a $\frac{3}{4}$ " Flanged Wheel to form a weight. In the tapped holes of the Flanged Wheel two special set-screws removed from Swivel Bearings, are fixed, and these form pivots for a Small Fork Piece 8. The latter is attached to a second Fork Piece by means of a 1" Rod, the fork of the second Fork Piece being fitted over the Coupling 9, where it is held in place by a Rod 10.

The two Rods 10 support two 1" Triangular Plates, to the lower corners of which Flat Brackets are bolted. The Flat Brackets are also attached as shown to a Socket Coupling 11, which is free to slide up and down the Rod 5.

The groove in the Socket

Coupling 11 accommodates one end of the Threaded Pin 12, which is locked in the end hole of a 2" Strip bolted to a Crank. The Crank is secured on a 2" Rod 13 that carries a Coupling 14, as shown in Fig. 447a. The end plain hole of this Coupling is fitted with a Pivot Bolt, on each end of which is supported a Flat Bracket. The two Flat Brackets are bolted rigidly to a Small Fork Piece 15, in the boss of which a 1" Rod is free to turn. This Rod is held in place by a Collar 16 and a 1" fast Pulley 17, a Washer being used for spacing purposes between the Pulley and Small Fork Piece.

The boss of the Pulley 17, which projects downwards, is gripped in one end of a Socket Coupling 18. The other end of this latter part is fitted with a Threaded Boss, into which is screwed the Threaded Rod 19. The unoccupied end

of the Threaded Rod is fixed by means of a nut in one of the threaded holes of a Collar, which is secured by a Pivot Bolt to a 2" Strip 20. A Crank, to which this Strip is fixed transmits the vertical movement of the Socket Coupling 18 to the Rod 21, on the end of which is secured the pointer 22. This pointer is fitted in place of the throttle lever of the actual mechanism, in order to indicate the amount of correction made by the supplementary governor.

The second or supplementary governor, which is shown on the left in Fig. 447, is driven in a similar manner to the primary governor, and its construction is almost identical. The Coupling 23 is attached by two $\frac{3}{4}$ " Bolts and Angle Brackets to a $1\frac{1}{2}$ " Pulley 24. A Socket Coupling connects this Pulley to a similar part 25.

A Coupling 26, Fig. 447a, carries a Dinky Toys Motor Tyre, and as the governor rises and falls the Tyre is rotated by one or the

other of the Pulleys 24 and 25. This turning movement is transmitted to the 1" fast Pulley 17 by a length of light cord or cotton, which passes around the fast Pulley 27 and the loose Pulleys 28. The operation of a governor of this kind is as follows. If the load on the engine to which it is fitted suddenly falls, or the steam pressure rises beyond normal, the supplementary governor rotates the Pulley 17 in an anti-clockwise direction. This movement unscrews the Threaded Rod 19 from its Threaded Boss and partially closes the throttle, thus cutting down the steam supply and adjusting the speed of the engine to its normal value. Control is then taken up again by the primary governor. If the load on the engine is increased or

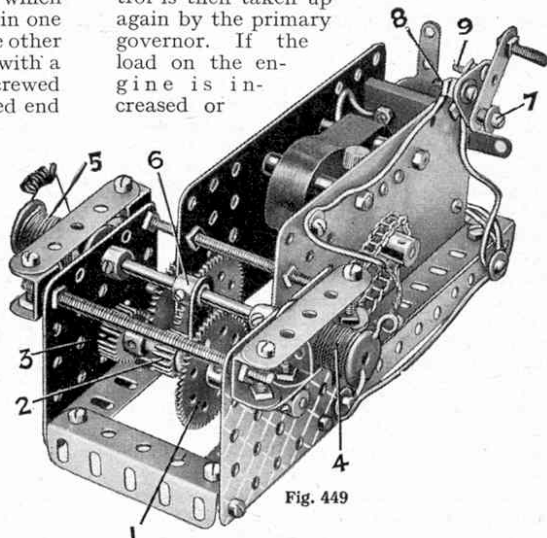


Fig. 448

the steam pressure falls, the reverse action takes place.

(448) Axle Springing

(W. Henry, Toronto, Canada)

The attention paid by car designers to suspension systems has aroused the interest of the Meccano enthusiast, for he too is concerned with the inclusion of a complete true-to-type suspension system in his model vehicle.

Fig. 448, on the opposite page, shows a suspension of the swinging axle type that is suitable for heavy model carts or motor cars. The axles are mounted on a beam consisting of two $3\frac{1}{2}$ " Strips spaced apart by Double Brackets, and fitted in the middle with two Flat Trunnions. The axles, $2\frac{1}{2}$ " Strips spaced by Double Brackets, are pivotally mounted on a 1" Rod that passes through the Flat Trunnions and are connected to the beam by $1\frac{1}{2}$ " Rods 1, on which are fitted Compression Springs. An Aeroplane Collar is fixed on each end of the Rods. The bolts holding the Double Brackets carry two washers under their heads, so that the Collars have free movement.

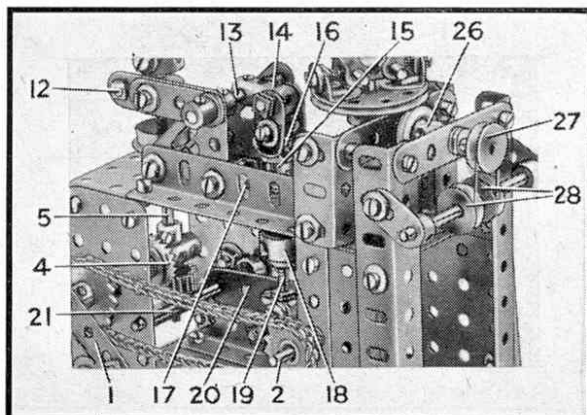


Fig. 447a

(449) Remote Control for Gear-Box

(L. F. Atkinson, Croydon)

The remote controller for an Electric Motor described in "Suggestions Section" for July 1939 aroused much interest and Fig. 449 shows another device for this purpose. The mechanism is intended for operating a two-speed gear-box from a distance, and in a model with several movements it will be necessary to fit a controller for each movement.

The two-speed gear-box shown in the illustration is mounted between $2\frac{1}{2}" \times 2\frac{1}{2}"$ Flat Plates and the Motor side plates. The drive from the armature shaft of the Motor is conveyed through Sprocket gearing to a $1\frac{1}{2}"$ Rod journaled between one of the Motor side plates and a $2\frac{1}{2}" \times 2\frac{1}{2}"$ Flat Plate. The Rod carries a $\frac{1}{2}"$ Pinion that is constantly in mesh with the Gear 1 on a sliding $3\frac{1}{2}"$ Rod, which carries also a $\frac{1}{2}"$ Pinion 2 and a $\frac{1}{4}"$ Pinion 3. A Collar at each end limits its longitudinal movement. The final driven shaft consists of a further $1\frac{1}{2}"$ Rod journaled coaxially with the first in the opposite Motor side plate and Flat Plate. The two Rods must be in proper alignment.

The selector consists of a Crank 6 the web of which fits between the Gear 1 and Pinion 2. It is spaced from the Gear by Washers. The boss of the Crank is fixed on a sliding Rod, the ends of which project beyond the Plates and are inserted in the solenoids 4 and 5. These are made from Meccano Bobbins wound with 23 SWG. copper wire and are clamped in position by $2\frac{1}{2}"$ Strips secured at each end to Double Brackets. The lower Strips carry Angle Brackets centering the solenoids.

The gear control switch is shown near the Motor reversing switch for convenience, but can be taken to any position. A $1"$ Triangular Plate is held on a $\frac{3}{4}"$ Bolt 7 by two nuts, and two further nuts hold it in position on the Motor. Two 6 B.A. Bolts 8 and 9 are insulated from the Triangular Plates and form studs for the contact arm, made from a $1\frac{1}{2}"$ Strip, which is mounted on the Bolt 7, and held against the heads of the 6 B.A. Bolts by a Compression Spring. The Bolt 8 is connected to one end of the wire of the solenoid 4, the other end of which is connected to one of the Motor terminals. The same Motor terminal is connected to the solenoid 5, which is wired to the Bolt 9.

One of the wires from the Transformer is connected to the remaining Motor terminal and the other is "earthed" by fixing it to the frame of the mechanism. With the lever as shown the solenoid 5 is in series with the Motor and causes the Crank 6 to bring the Pinion 2 into mesh with the 57-teeth Gear, at the same time throwing the Pinion 3 out of engagement with its respective Gear. The solenoid 4 is energised when the control lever is moved to the left to make contact with the Bolt 8 and this causes the Pinion 3 to engage with its Gear Wheel. The mechanism works only when the Motor is in operation.

(450) Bicycle Brake

(L. Dean, Northampton)

The model shown in Fig. 450 demonstrates the action of a simple form of bicycle brake, and if suitably strengthened could be put to practical use in model-building. It is easy to build and consists essentially of the two levers 1, which carry the brake blocks. These levers are built up of $4\frac{1}{2}"$ Strips, duplicated for strength and lengthened with $2\frac{1}{2}"$ Curved Strips, and they are pivoted by means of Pivot Bolts to a back-plate consisting of a $3\frac{1}{2}" \times 2\frac{1}{2}"$ Flanged Plate and two Semi-Circular Plates. The back plate forms a support for the mechanism.

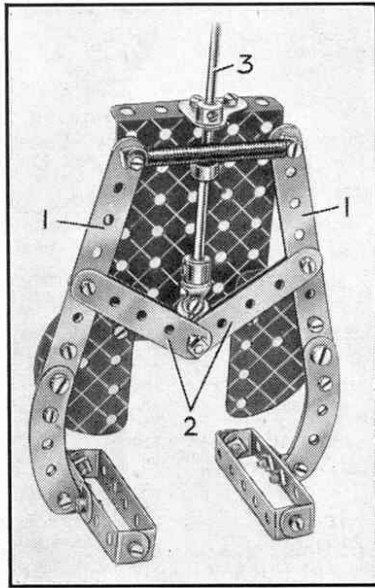


Fig. 450

The brake blocks, which are represented by $2\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strips, are held apart by a Spring, but are forced into contact with the wheel rim by the two short levers 2, made from $2\frac{1}{2}"$ Strips. The Rod 3 represents Bowden wire used in an actual brake of this kind, and when it is pulled up the resistance of the spring is overcome and the brakes applied. Bowden cable could be used instead of the Rod 3, or a substitute could easily be made by threading wire Spring Cord.

(451) A Simple Centrifugal Governor

(J. Rolfe, Ruabon)

A centrifugal governor is often very useful to limit the speed of the driving motor of a model to a certain value, especially in such models as roundabouts and big wheels. Model-builders therefore will be interested in details of a simple governor of this type used in small Clockwork Motors recently sent by J. Rolfe, Ruabon. In this the weight consists of a Rod Socket fitted with Washers fastened on the end of a $1\frac{1}{2}"$ Rod. The Rod passes through a Coupling and carries at its other end a Compression Spring and Collar. The Coupling is fixed on a Rod driven by the driving motor, and a Boiler End is fixed to a framework so that the $1\frac{1}{2}"$ Rod is housed inside it. In action the weighted end of the Rod swings outward by centrifugal force when the speed is too high and friction with the rim of the Boiler End then reduces the speed of the Motor.

An alternative scheme for controlling the speed of a Clockwork Motor is to use a fan brake. The fan consists of a Flexible Plate of suitable size fixed at its centre to an End Bearing. The latter is fastened on a Rod journaled in the Motor side plates and driven through a step-up gearing of 3:1. The air resistance to the fan is sufficient to keep the speed within the required limits.

Miscellaneous Suggestions

Under this heading "Spanner" replies to readers who submit interesting suggestions regarding new Meccano models or movements that he is unable to deal with more fully elsewhere. On occasion he offers comments and technical criticisms that, he trusts, will be accepted in the same spirit of mutual help in which they are advanced.

M.215. The Meccano Worm is intended primarily for use in gear trains to give a slow-speed drive, and its thread is cut to the pitch best suited for this purpose. Consequently it is not very suitable for operating steering mechanisms, as it requires a large number of turns to operate the wheels through a complete lock. A Worm with a greater pitch than the present one therefore is suggested by P. Johnson, Exeter, and others, but I think the constructional difficulty can be overcome by arranging for the Worm to turn a $\frac{1}{2}"$ Pinion on a short Rod that carries also a Crank fitted with a $1\frac{1}{2}"$ Strip to form the drop arm. The latter is connected in the usual way to the steering arm.

M.216. R. Jones, Cardiff, points out that Float Tie-Rods, Aeroplane Constructor Part No. P57, make excellent tie-rods for bracing small Meccano structures such as bridges. The idea is a good one and no doubt other model-builders would like to try it out in practice.

M.217. Pivot Bolts fitted with cardboard discs at each end and wound with 26-SWG. S.C.C. copper wire make excellent miniature solenoids for operating relays and similar small electro-magnetic mechanisms. The scheme is suggested by N. Adams, Buxton.

M.218. When building small models to scale it is sometimes found that the Meccano Rods are too large in diameter to form neat handrails. Neat handrails can be made from Spring Cord, through the centre of which is passed a length of stiff wire such as the Elektron Connection Wire (Part No. 1566). Rails made in this way can be supported on $\frac{3}{4}"$ Bolts and may be bent to any desired shape. The idea is suggested by J. Phillips, Birmingham.

M.219. A compact and simple form of friction gearing used by H. Roberts, Warrington, consists of a $1"$ Pulley fitted with a $1"$ Rubber Ring arranged to engage with the inside rim of a Wheel Flange. A ratio of approximately 1.6:1 is obtained.

M.220. Meccano Rods can be used in conjunction with Elektron Magnet Coils if the diameter of the Rods is increased by

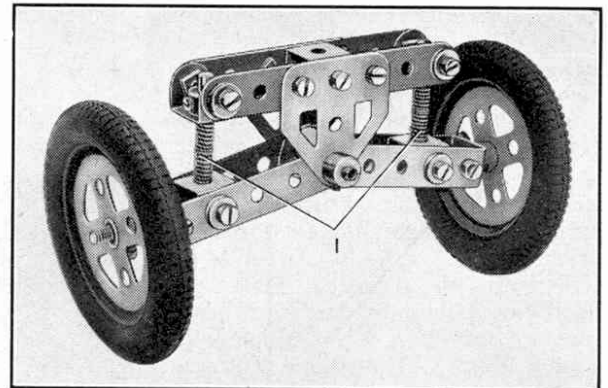


Fig. 448

fitting them with Aeroplane Collars (Part No. P52), which are a sliding fit in the bores of the Magnet Coils. Model-builders who use Magnet Coils in conjunction with Meccano parts will find this scheme very useful.

Meccano Suggestions Section

By "Spanner"

(452) A Unique Drive

(Gian Singh, Innisar, India)

An ingenious scheme for connecting shafts that are placed out of line is shown in Fig. 452. This is suitable for use in almost every case where lack of space prevents Universal Couplings or Flexible Coupling Units from being employed.

The driving shaft 1 is approximately $\frac{1}{2}$ in. out of line with the Rod 2, and each Rod carries at its end a Face Plate. Four Flat Brackets are pivotally attached to the Plates by means of $\frac{3}{8}$ " Bolts, each of which carries two nuts for holding the Brackets in place. Washers are used for spacing purposes, and when in position the Bolts should be sufficiently loose to allow the Flat Brackets to move freely.

As the Rod 1 rotates, the movement of

base of the model in the position shown, and are inclined at a slight angle to the horizontal. The end of the winding of one Bobbin is connected to the commencement of the winding of the other, and the two remaining free ends are secured to terminals, one of which is insulated from the frame by Insulating Bushes and Washers.

The fountain pen is clamped rigidly between two Bush Wheels on a Rod journaled in two vertical Strips. The Rod carries a Coupling in which is secured a short Rod 2 that forms the armature for the electro-magnets. The latter projects over, and a short distance above, the pole faces of the electro-magnets. A short piece of Spring Cord, attached to the Coupling and to the frame, serves to maintain the pen normally raised clear of the tape, but on passing current through the electro-magnets it is brought into contact with the moving tape.

The ribbon of paper is wound off the drum 3 by being pulled through a pair of rollers at the other end of the device. The top roller 5 consists of a pair of 1" fast Pulleys shod with 1" Rubber Tyres and secured to a Rod that is driven by the Electric Motor. The second roller consists of a $\frac{1}{2}$ " Pinion, and it is immediately below the first, so that it makes light contact with the tyres.

The tape passes over a smooth piece of cardboard, at the point where the nib of the pen makes contact with it, and it also runs under two Rods that form guides. One of the Rods is journaled in the bottom holes of the vertical Strips carrying the pen Rod, and

the other is mounted in Flat Brackets that are attached to the Motor end of the base. Care should be taken to see that when the Rod 2 is attracted by the magnets, the pen rests only lightly on the tape. Also the ink must flow freely from the pen when the recorder is in operation.

It will be found a great advantage to incorporate a Resistance Controller in the Motor circuit, so that the speed of the tape may be varied to suit the speed at which the message is transmitted, for this is liable to

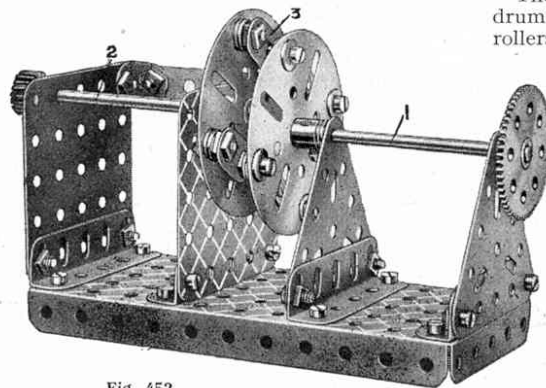


Fig. 452

the one Face Plate is imparted to the other by means of the Flat Brackets.

(453) A Meccano Morse Code Recorder (G. Hopper, Wallasey)

The novel apparatus shown in Fig. 453 will help readers interested in telegraphy to improve their knowledge of the Morse Code and give them good practice in tapping out correctly spaced signals.

The apparatus consists essentially of a pen actuated by an electro-magnet in such a manner that it may be made to press lightly on a travelling strip of paper when the magnet is energised. As the ribbon is in continual motion the pen makes long or short marks on the paper, according to the time that the key controlling the energising current of the magnet is held down. The aid of a friend may be sought to read the messages as they come through on the tape, and it is advisable that the partners be in separate rooms so that the temptation to communicate verbally is removed.

Two Meccano Bobbins wound to capacity with 26 D.C.C. copper wire, are mounted on 2" Screwed Rods, which are secured to two $1\frac{1}{2}$ " Strips placed face to face. The Strips are attached by a $\frac{1}{2}$ " \times $\frac{1}{2}$ " Angle Bracket to the

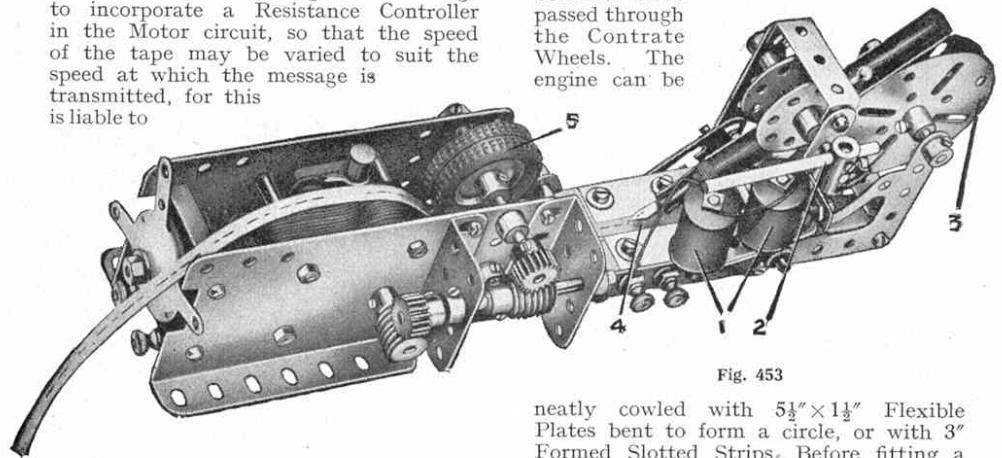


Fig. 453

considerable variation when beginners get busy! The instrument is also useful for recording Morse signals heard on the wireless.

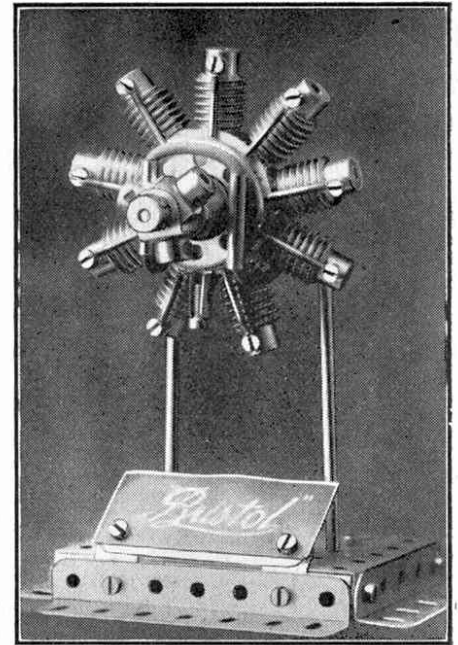


Fig. 454

(454) Bristol "Mercury" Aeroplane Engine (A. Spring, Cainscross)

In reply to the large number of enquiries I have received I illustrate in Fig. 454 a dummy model of an aeroplane engine that can be fitted in Meccano aeroplanes. In the illustration the engine is shown mounted on a demonstration stand just as the real engine would be if it were on exhibition, and it is complete with a variable pitch propeller hub. The engine was designed by A. Spring, Cainscross, and was awarded a prize in a recent competition.

The crank-case of the model is made from two $1\frac{1}{2}$ " Contrate Wheels, between which are clamped nine Worms, disposed radially in the manner shown. The Worms are fitted with bolts and lengths of Spring Cord to represent the rocker arm casings and push rod casings respectively. The reduction gear housing is a Chimney Adaptor, and three Large Fork Pieces form the variable pitch propeller hub. The complete engine can be mounted in a model aeroplane by Screwed Rods passed through the Contrate Wheels. The engine can be

neatly cowed with $5\frac{1}{2}$ " \times $1\frac{1}{2}$ " Flexible Plates bent to form a circle, or with 3" Formed Slotted Strips. Before fitting a cowl, the engine should first be mounted on a back-plate formed by a Face Plate or Pulley.

(455) Pre-selector Self-changing Epicyclic Gear-Box (R. Cooper, Ringmer)

Pre-selector gear-boxes are very attractive to keen Meccano enthusiasts. Perhaps the best known of these is the Wilson self-change gear-box installed in Armstrong Siddeley cars, and a Meccano version of this, which will appeal strongly to ad-

engagement by a Compression Spring.

The Flanged Brackets 7 serve to carry the clutch operating gear. This consists of a Coupling fitted with a $\frac{3}{4}$ " Bolt. The latter engages with the neck of the Socket Coupling, and the Coupling is mounted in the Bracket 7 by passing 1" Rods into its longitudinal bore. A second coupling 8, Fig. 455a, fixed to one of the 1" Rods carries a $1\frac{1}{2}$ " Rod 9 fitted at the end with a Collar.

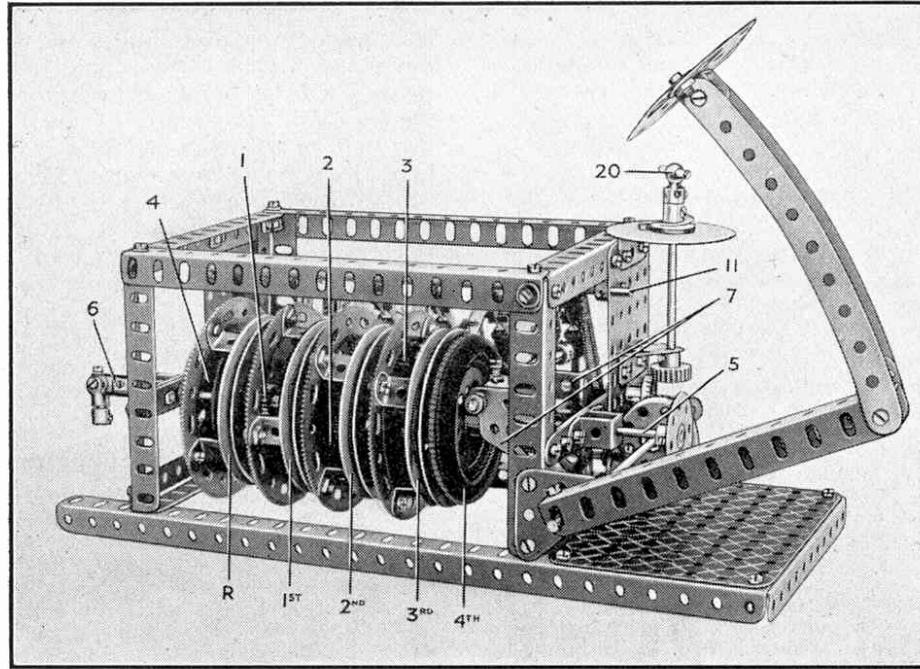


Fig. 455

vanced model-builders, is shown in Figs. 455 and 455a. The model provides four forward speeds and reverse, and these are obtained by means of a series of epicyclic gear trains consisting of a Gear Ring attached to a 3" Pulley by four Reversed Angle Brackets. The reverse gear Pulley R (Fig. 455) is fitted with two planetary $\frac{1}{2}$ " Pinions 1, which revolve freely on lock-nutted $\frac{3}{4}$ " Bolts. The Pinions mesh with the 1st-speed Gear Ring as shown. The 1st-speed Pulley carries two 1" Gears 2 also rotating on $\frac{3}{4}$ " Bolts, and these in turn mesh with the 2nd-speed Gear Ring. Finally the 2nd-speed Pulley is fitted with $\frac{1}{2}$ " Pinions 3.

Inside the reverse speed Gear Ring is a casing 4 made from two Face Plates connected by $\frac{3}{4}$ " Bolts. Between them are carried five $\frac{1}{2}$ " Pinions meshing with each other, four of the Pinions being mounted on 1" Rods and spaced from one Face Plate by washers. The fifth Pinion, which is the central one, is fixed on the 8" Rod 5, which passes through the boss of the 3" Pulley and one of the Face Plates, and projects halfway into the bore of the Pinion. Rod 6 is fixed in the boss of the remaining Face Plate and projects into the unoccupied half of the Pinion boss.

A 57-teeth Gear is next fixed on Rod 5 but spaced from Pulley R by three washers. It is followed by the 1st-speed Pulley, which is free on the Rod. Next a $\frac{1}{2}$ " Pinion is fixed in place and the 2nd-speed Pulley added, then a 57-teeth Gear and the 3rd-speed Pulley, washers being used for spacing purposes. Finally the boss of a 2" Pulley fitted with a Rubber Tyre is gripped in a Socket Coupling and the complete unit is passed on to the Rod. This forms a clutch that provides fourth gear. It is held out of

The next step is to assemble the operating mechanism. First the 8" Rods 10 and 11 are inserted and Rod 10 (Fig. 455a) carries five simple Bell Cranks each free to swivel between two Collars. To each Bell Crank is pivoted an End Bearing 12 fitted with a $1\frac{1}{2}$ " Rod and a Rod and Strip

Connector. A short length of Spring Cord 13 keeps the Rods in contact with their respective cams. The four 3" Pulleys are fitted with cord band brakes, which are anchored to Rod 14 and to the ends of the Bell Cranks. These are brought into operation by the movement of the Bell Cranks, the brakes being "off" when the Bell Cranks are in contact with Rod 11.

The last Bell Crank controlling 4th gear is fitted with a roller 15 consisting of four $\frac{3}{4}$ " Discs free to turn on a lock nutted Bolt. This roller depresses Rod 9, which in turn slides the clutch into engagement. Rod 16 is fitted with five Collars, each of which carries a $1" \times \frac{1}{2}"$ Angle Bracket secured to the Collars by a bolt and nut. The ends of the Angle Brackets are bent up in the manner shown. A Collar fitted with a bolt is fixed at each end of the Rod, the bolt passing through the loop of a Spring. The ends of the Springs are anchored to Rod 11. Rod 16 is journaled at one end in a Double Arm Crank and at the other end is a $\frac{1}{2}"$ Pinion. This meshes with the $1\frac{1}{2}"$ Contrate on the shaft carrying the foot pedal.

The selector mechanism consists of a Rod 18 fitted with five cams, each of which is a Collar with a flat filed on it as shown. These are passed on to the Rod, which is fitted with a $\frac{3}{4}"$ Contrate at one end. The Contrate meshes with a $\frac{1}{2}"$ Pinion on Rod 19, which passes through the centre of the cardboard disc bolted to a $1\frac{1}{4}"$ Disc and Trunnion. The Rod is fitted with a Pawl and a knob 20. The disc is marked around its circumference at 60° intervals, the marks being allotted the symbols R (reverse), N (neutral), 1st, 2nd, 3rd and 4th respectively. The pointer is set at reverse and the reverse gear cam is fixed with its flat face in contact with its Rod and Strip Connector. The pointer is then moved from R to 1st, the corresponding cam being similarly dealt with, as are the others in their turn.

Normally the cams hold the Rod and Strip Connectors clear of the $1" \times \frac{1}{2}"$ Angle Brackets, but on selecting a gear, the appropriate arm is allowed to move forward. On depressing and releasing the pedal a Bracket raises this arm and contracts the band brake.

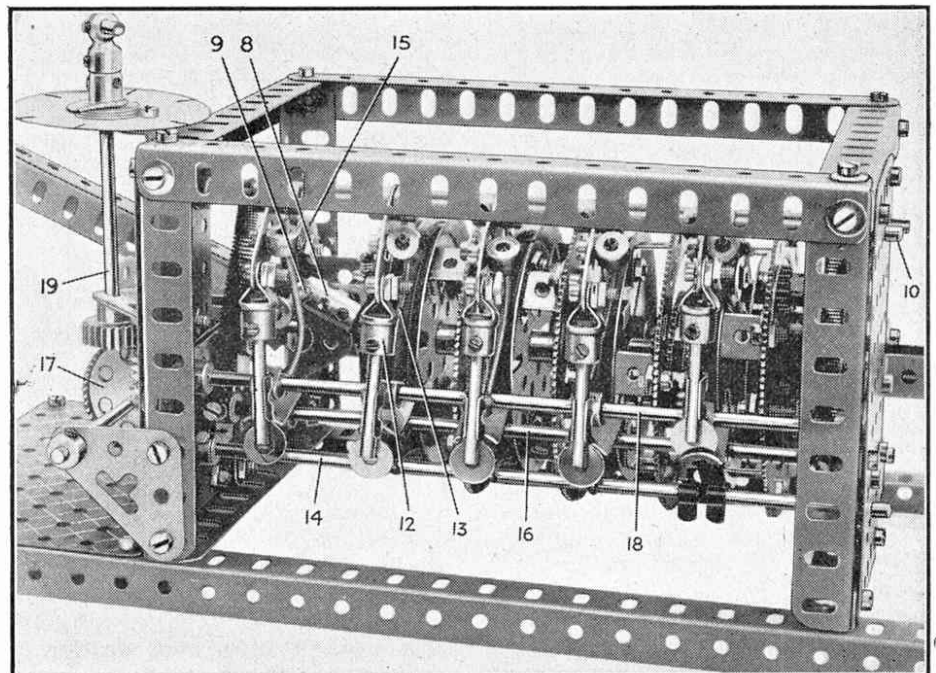


Fig. 455a

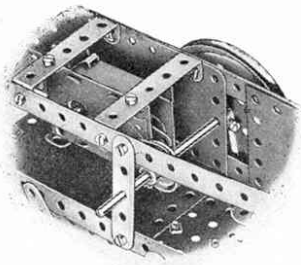


Fig. 1. The Mechanism of the model paddle steamer described in this article.

THE simple models described in these articles are always realistic and attractive in construction, and most of them are made more fascinating by the inclusion of motors to give them life and movement. This month's models are excellent examples of this. Two of them are specially designed for owners of No. 2 Outfit, while the others are more ambitious efforts, which require however only the parts that are included in Nos. 3 and 4 Outfits respectively. All four are working models driven by Meccano Motors. For three of them the *Magic Motor* is used with excellent effect, while the fourth is fitted with the Enclosed Electric Motor, which may be of either the 6v. or 20v. type.

The simplest of the four models is the horse and dray shown in Fig. 2. This can be assembled from the contents of an Outfit No. 2 with the addition of a few extra parts. The dray is first constructed. It is based on a $5\frac{1}{2}" \times 2\frac{1}{2}"$ Flanged Plate, to the flanges of which two $5\frac{1}{2}" \times 1\frac{1}{2}"$ and two $2\frac{1}{2}" \times 1\frac{1}{2}"$ Flexible Plates are bolted, the bolts in the longer flanges holding also two $5\frac{1}{2}"$ Strips. The Flat Trunnions that form bearings for the rear axle are bolted direct to the flanges, while Trunnions are attached to the front by Angle Brackets.

Two $2\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strips are then fixed to the bottom of the dray and a $2\frac{1}{2}" \times 2\frac{1}{2}"$ Flexible Plate is bolted between them. The ends of the Double Angle Strips are joined by a $2\frac{1}{2}"$ Strip, which is fixed in place by $\frac{3}{8}"$ Bolts and lock-nuts as shown. This structure forms the driver's seat. The wheels are 1" Pulleys fixed on the ends of $3\frac{1}{2}"$ Rods, which pass through the ends of the Trunnions and Flat Trunnions.

The *Magic Motor* can now be fixed to the underside of the Flanged Plate, and the small pulley is arranged to drive the $\frac{1}{2}"$ fast Pulley on the rear axle through a short Driving Band. At the front of the dray is the shaft to which the horses are harnessed. This consists of two

$5\frac{1}{2}"$ Strips, which are attached to the Flanged Plate by a Double Bracket.

The two horses are constructed in the same manner and the description of one will suffice. The body is a U-Section Curved Plate, to the corners of which are bolted four $2\frac{1}{2}"$ Strips. The bolts that hold the $2\frac{1}{2}"$ Curved Strips forming the neck carry also Angle Brackets that join the sides of the body. Flat Brackets form the head and ears. A 2" Rod pushed through the $2\frac{1}{2}"$ Strips and Curved Plates forming both horses couples them to the shaft.

To allow the horses to travel smoothly over the ground a further 2" Rod is pushed through holes in their hind legs and is held in place by Spring Clips. The Rod carries at its centre a $\frac{1}{2}"$ loose Pulley. A finishing touch is given by the addition of the reins.

Parts required to build the horse and dray: 2 of No. 2; 9 of No. 5; 4 of No. 10; 2 of No. 11; 8 of No. 12; 2 of No. 16; 2 of No. 17; 4 of No. 22; 6 of No. 35; 37 of No. 37a; 29 of No. 37b; 1 of No. 40; 2 of No. 48a; 1 of No. 52; 4 of No. 90a; 4 of No. 111c; 2 of No. 126; 2 of No. 126a; 1 of No. 191; 2 of No. 199; 1 *Magic Motor*.

The model shown in Fig. 3 is a particularly fine one to build, and its operation when completed will give its builders great fun. It is a small electric hoist built from the parts in Outfit No. 3 and incorporates an Enclosed Electric Motor.

Construction is commenced by bolting two $2\frac{1}{2}"$ and two $5\frac{1}{2}"$ Strips to the feet of the Motor, the ends of the $5\frac{1}{2}"$ Strips being joined by a $2\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strip 2. Trunnions are then bolted to the $5\frac{1}{2}"$ Strips, and are connected by a further $2\frac{1}{2}"$ Strip bolted in the position indicated by bolt 1. A $5\frac{1}{2}"$ Strip is next fitted midway between the first two $5\frac{1}{2}"$ Strips, the bolt at the end holding also a Double Bracket 2. These three $5\frac{1}{2}"$ Strips are horizontally placed, and $5\frac{1}{2}"$ Strips are now bolted to the sides of the framework to form supports for the rest of the mechanism. Each bolt also holds a $2\frac{1}{2}"$

Strip placed vertically. Bolt 4 and a bolt in a similar position on the opposite side of the model secure a Double Angle Strip and a $5\frac{1}{2}"$ Strip bent to form a semi-circle. The other $2\frac{1}{2}"$ Strips form a support for a circle composed of four Formed Slotted Strips, and two Semi-Circular Plates 3.

Rod 5 is 4" long and forms the hoisting drum. It is journalled as shown and carries at its inner end a 1" Pulley.

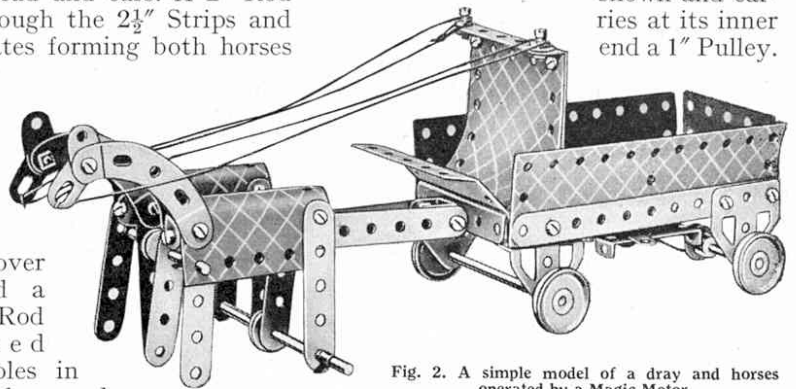


Fig. 2. A simple model of a dray and horses operated by a *Magic Motor*.

This is driven direct from the armature shaft of the Motor by a small Driving Band. Two Road Wheels are fixed on the Rod 5 and between them is a Cord Anchoring Spring, to which the hoisting Cord is tied. The hoisting Cord is wound a number of times around Rod 5 and

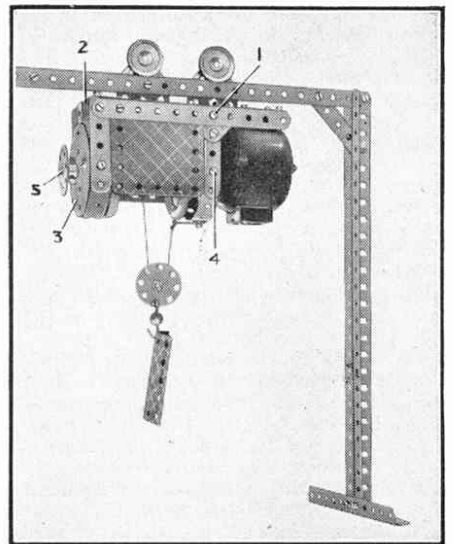


Fig. 3. This fine electric hoist is driven by the Enclosed Electric Motor. The model is built from the parts in No. 3 Outfit.

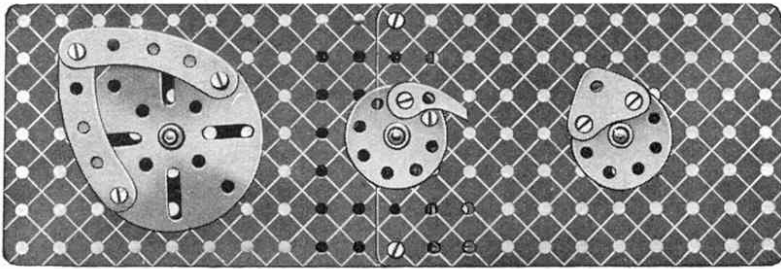


Fig. 459

(459) Useful Meccano Cams ("Spanner")

Cams are used for a large number of purposes in Meccano model building, almost any design being possible with the aid of remarkably few parts. Tappet rods for use with the cams may consist of Rods or Strips, and for more accurate work a small roller may be carried at one end of a Rod or Strip. A small Flanged Wheel or Pulley makes a suitable roller.

The cam shown on the left in Fig. 459 gives a rapid rise and fall of the tappet rod. It is made by securing two $2\frac{1}{2}$ " large radius Curved Strips on a Face Plate as shown. A smaller cam of this type can be built up from a Bush Wheel, or other similar part and a 1" Corner Bracket, as shown on the right in the illustration.

Where a comparatively slow rise but quick drop is necessary, the cam shown in the centre in Fig. 459 will be found useful. The Bush Wheel forming the cam disc is fitted with a Pawl without boss. A nut and bolt form the necessary connection, a second nut and bolt being used as a stop in order to prevent the Pawl from being pressed level with the edge of the Bush Wheel.

Another very useful and easily built cam can be assembled from two $1\frac{1}{2}$ " Pulleys or Bush Wheels connected by three Double Brackets, which are bolted edge to edge between them. If Pulleys are used a Washer should be placed on the shank of each bolt between the Pulleys and the Double Brackets to prevent the rims of the Pulleys from damage. A cam of this type is suitable for use in cases where a very rapid action is not essential.

(460) Rear Wheel Springs for Model Lorries

(R. N. Strawbridge, Te Awamutu, New Zealand)

The large number of suggestions I receive for mechanisms and refinements for model motor car chassis is striking evidence of the popularity of this kind of model-building. Methods of springing attract

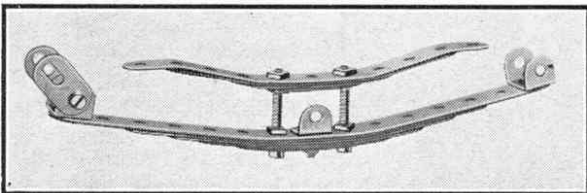


Fig. 460

many model-builders, and various types of this essential feature of a car have been described in the "M.M." from time to time.

Yet another suggestion comes from R. N. Strawbridge, a New Zealander. His device is shown in Fig. 460. It is suitable for springing the rear wheels of a heavy lorry and is of the semi-elliptic type. There are two springs, a main spring and an

auxiliary spring, the two being arranged as shown in the illustration. The main spring consists

of a $5\frac{1}{2}$ ", $4\frac{1}{2}$ ", $3\frac{1}{2}$ ", $2\frac{1}{2}$ " and $1\frac{1}{2}$ " Strip. The auxiliary spring, which consists of a $5\frac{1}{2}$ ", $4\frac{1}{2}$ ", $2\frac{1}{2}$ " and $1\frac{1}{2}$ " Strip, is separated from the main one by $1\frac{1}{2}$ " Bolts and is held in place on the Bolts by means of nuts as shown. The main spring carries at each end a Double Bracket, and to one of them is bolted two Flat Brackets to form the shackle. The space between the two springs should be sufficient to allow room for the bearings and the rear axle. On the sides of the motor chassis, above each end of the auxiliary spring, $\frac{1}{2}$ " Bolts pointing outward are fitted. When a heavy load is put on the lorry the main spring bends upward and forces the auxiliary spring against the Bolts, thus causing the latter to take up part of the load.

Spring arrangements of this kind would make an interesting variation to the usual methods adopted by model-builders, and no doubt many readers will experiment with the idea in future models.

(461) Reversing Gear for Right-Angle Drive ("Spanner")

In Fig. 461 is shown an interesting drive reversing arrangement that is designed for incorporation in models where it is required to transmit a drive at right angles, with provision for reversing the direction of rotation of the driven shaft.

The essential feature of the arrangement shown in Fig. 461 is that it is not necessary to slide either the driving or the driven shafts in their bearings. Reversing is effected by means of an intermediary sliding shaft 1, which carries two $\frac{3}{4}$ " Pinions 2 and a $\frac{1}{2}$ " x $\frac{1}{2}$ " Pinion 3. The $\frac{1}{2}$ " x $\frac{1}{2}$ " Pinion is in constant engagement with a $\frac{1}{2}$ " Pinion on the driving shaft 4, which rotates always in the same direction. On sliding shaft 1, by moving the lever 5, either of the $\frac{3}{4}$ " Pinions can be brought into engagement with the $1\frac{1}{2}$ " Contrate Wheel 6 on the driven shaft 7. The direction in which the shaft 7 rotates is dependent on which Pinion is in mesh with the Contrate Wheel.

The mechanism is housed in a $2\frac{1}{2}$ " x $1\frac{1}{2}$ " Double Angle Strip and the control lever is supported in a left-hand Corner Bracket fixed to a $1\frac{1}{2}$ " Strip. The latter is bolted to one arm of the Double Angle Strip. The control rod carries an End Bearing, the arms of which are opened out slightly so as to engage between two Collars fixed to one end of the sliding shaft.

The device was used by a reader of the "M.M." recently in the construction of a coil winding machine.

(462) A Neat Electric Contact Button (H. C. Tudor, Blackburn)

A remarkably neat Meccano switch of the push button type that can be used for electric bells, buzzers and flash-lights, and also in innumerable Meccano models, may be built up in the following manner.

The device consists essentially of a Flanged Wheel and a Pivot Bolt that is pushed through the boss of the Wheel. The Wheel in turn is fixed to a Plate, Strip, or other suitable Meccano part. A small spring obtained by cutting two or three turns from the Compression Spring, Part No. 120b, is placed between the head of the Pivot Bolt and the boss of the wheel. The contact piece comprises a 6 B.A. Bolt secured with its head immediately beneath the shank of the Pivot Bolt.

One connecting wire is secured to the bolt holding the Flanged Wheel in place and the other to the insulated contact bolt.

(463) How to Use Helical Gears

Several model-builders have written to me recently regarding the proper use of the Helical Gears, Parts Nos. 211a and 211b. Owing to the design and angle of the teeth of these gears they can only be used together. They are of course intended primarily for producing a right-angle reversible drive, the ratio of which can be

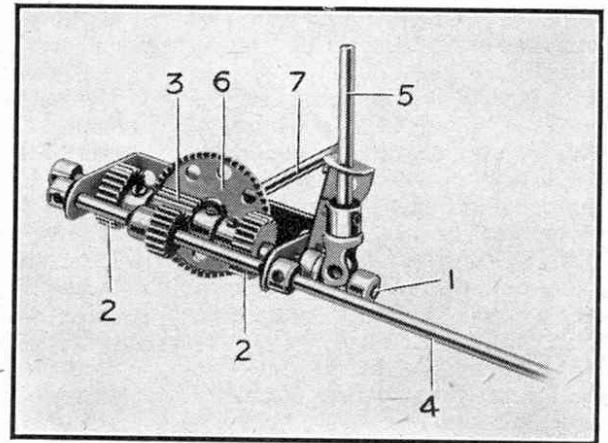


Fig. 461

either 1 : 1 or 3 : 1. When fitting these gears it is very important that they should be exactly in correct position, otherwise they will tend to bind. When they are meshed correctly, however, they transmit a very efficient smooth and silent drive, and are of great use in car differentials, steering gears and similar mechanisms.

When Helical Gears are to be used in a gear-box the frame must be strongly built because of the side-thrust generated when two gears of this type are in motion. This side-thrust can be put to practical use in a neat clutch mechanism. In this a large Helical Gear, Part No. 211b, is free to move on a horizontal shaft, but is held in contact with a friction face by means of a light Compression Spring. When a small Helical Gear meshed with the large Gear rotates in one direction the larger Gear is pressed into contact with the friction face, but when the small Gear is rotated in the opposite direction the large Gear is disengaged and slightly compresses the spring, already mentioned. Thus the final driven shaft can be turned when the large Helical Gear rotates in one direction but remains stationary when the direction of the Gear is reversed.

Suggestions Section

By "Spanner"

(464) A Meccano Harmonograph

(A. N. Waters, Liverpool)

Fig. 464 on this page and Fig. 464a on the opposite page show a Meccano harmonograph, an interesting model designed to record harmonic motions, that is reciprocating movements like those of a piston or pendulum, in a permanent visible form. The records obtained by means of the model can be made to form a variety of designs, similar to those produced by the

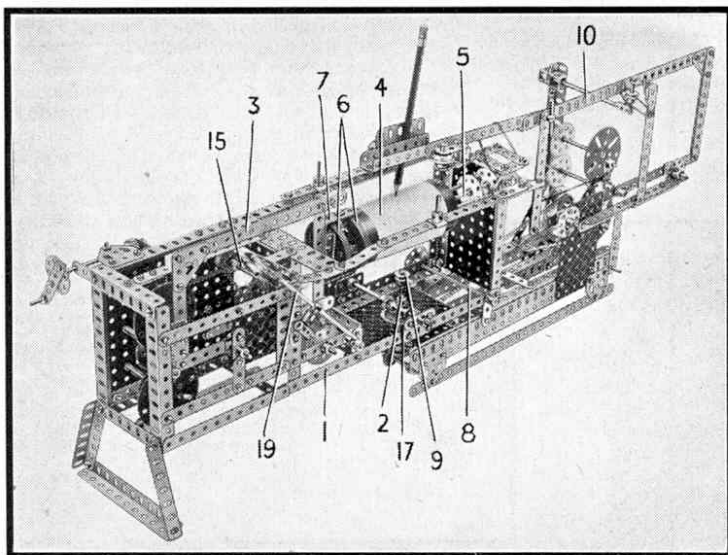


Fig. 464

well-known Meccanograph. The harmonograph also has a scientific application, for its records can be used in studying vibrations of all kinds. The chief purpose of this model indeed is to demonstrate the scientific uses of the harmonograph.

The model was designed as the result of a desire to produce an instrument capable of giving accurate results, and in Mr. Waters' model the motions are produced and combined, and the result recorded, simply by turning a handle. The machine is primarily devised for combining two harmonic motions occurring in the same straight line or at right angles to each other, but it also can be made to give the resultant of two motions at any intermediate angle.

As the handle of the model is turned a drum 4 is made to rotate slowly, and at the same time to move to and fro in simple harmonic motion. An arm 10 carrying a pencil also moves backwards and forwards in simple harmonic motion. The pencil presses lightly on a strip of paper wrapped around the drum, and the resultant of the two motions is drawn on the paper in the form of a graph.

To combine motions occurring at right-angles the drum is not used but a table carrying a piece of paper is made to slide to and fro in simple harmonic motion. The pencil arm and its accompanying mechanism is swung out through a right angle, as shown in Fig. 464a, and the pencil then records the resultant of the two motions.

(465) Compact Spur Differential

(J. A. Blacklin, Liverpool)

The differential gear shown in Fig. 465 is noteworthy on account of its compact design and the ingenious method of construction. The side frames consist of 1" Triangular Plates, lock-nutted on Screwed Rods 1 passed through diametrically opposite holes in a 1½" Bevel Gear or, if this is not available, in a 1½" Contrate Wheel. A Rod 2 of suitable length is passed through the boss of the Gear and a 1" Triangular Plate fitted over the Rod and the far Screwed Rod. This is followed by a 1½" Strip 3, which fits over both Screwed Rods 1 and Rod 2, and a second Triangular Plate is fitted to the nearer Screwed Rod to the first one. The Strip and Triangular Plates are fixed in position by lock-nuts. A ½" Pinion is fitted on Rod 2, which passes halfway through the bore of the Pinion.

Two nuts are then put on each of the Screwed Rods, followed by a Washer and a ½" Pinion, a second Washer and a nut. Rod 4 is then fitted with a ½" Pinion and sufficient length is left to allow the Rod to fit into the remaining part of the boss of the Pinion on Rod 2. The remaining side of the frame is now added. It is identical with the first side and is held in place by means of lock-nuts. The 1½" Rods 5 and 6 are next fitted. Rod 5 carries a ½" Pinion and two Aeroplane Collars, and Rod 6 carries four Washers, a ½" Pinion and an Aeroplane Collar. Both Pinions are fixed on their respective Rods, but the Pinions on the Screwed Rods are free to rotate.

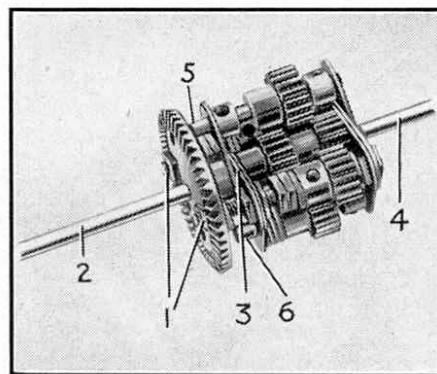


Fig. 465

The Pinion on Rod 6 meshes with the Pinion on Rod 2 and also with the one on the nearest Screwed Rod 1. This last mentioned Pinion meshes with the Pinion on Rod 4. Similarly the Pinion on Rod 5 meshes with the Pinion on Rod 2 and with that on the rear Screwed Rod 1, which also meshes with the Pinion on Rod 4.

(466) Four Wheel Steering Mechanism

(R. S. Drinkwater, Hornsey, London)

For correct steering the front wheels of a motor vehicle must turn about the same centre or pivot, whether there are two or four wheels. This condition is met by the ingenious four wheel steering device illustrated in Fig. 466, which is an application of the Ackermann principle.

Each side member of the chassis of this model is built up from two 12½" Angle Girders, which are lengthened by 4½" Angle Girders and bolted to form a U-section girder. The axles for each of the four wheels consist of 2" Rods locked into Rod Couplings that are pivoted to the Springs by 1" Screwed Rods. Swivel Bearings locked to the ends of 2½" Rods link the movements of opposite axles, and are connected to the Couplings holding the axles by means of 1" Rods.

The turning movements of the front and rear axles are kept in step by a 4" Axle Rod, which is joined by Swivel Bearings to 2" Rods attached by Couplings to the 1" Rods held in the Axle Couplings. The 4" Rods must be joined at corresponding positions to the front and rear axle. The steering wheel drive is transmitted to the 4" Rod, which governs the movement of the wheels by connecting the Swivel Bearing to the screwed coupling 3 on the wheel drive.

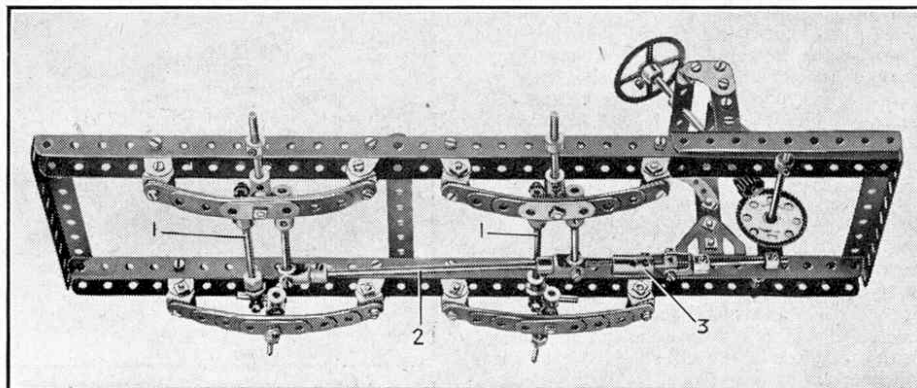


Fig. 466

(467) Screw-Operated Shoe Brake

The most powerful type of brake used in engineering is the screw-operated shoe brake, the shoes being of the external contracting type. Brakes of this kind are fitted on many winding engines used in coal and other mines, and in very large cranes. They are efficient and effective. They have the disadvantage of being somewhat slow in operation, but are comparatively simple in form, as the model shown in Fig. 467 suggests.

The brake drum 4 of the model is built up of two $1\frac{1}{2}$ " Flanged Wheels, which can be replaced by Wheel Flanges if great pressure is required. The brake shoes are $3\frac{1}{2}$ " Strips 2 and 3, which are pivotally attached to the framework at the base of the model by means of a Double Bracket and $1\frac{1}{2}$ " Rod. The inner end of the Rod is carried in one hole of a $2\frac{1}{2}$ " \times $1\frac{1}{2}$ " Double Angle Strip while the outer end rests in a similar positioned hole of a $2\frac{1}{2}$ " \times $1\frac{1}{2}$ " Double Angle Strip. The Strip 2 is fitted with a Threaded Crank 5 that moves laterally on a $3\frac{1}{2}$ " Threaded Rod 6. The end hole of Strip 3 passes over the Threaded Rod 6 and that end of the Strip bears against a Threaded Boss 7.

One end of the Threaded Rod 6 is journaled in the end hole of a short Strip; the other end is fitted with a $1\frac{1}{2}$ " Pulley 1 and a Threaded Pin to form a handle. Turning the latter clockwise causes the shoes to press on the drum, and the brake is released by turning in the opposite direction.

Apart from its power this form of brake has the great advantage that it can be applied to hold a load in a raised position, and this makes it of special value in certain types of crane.

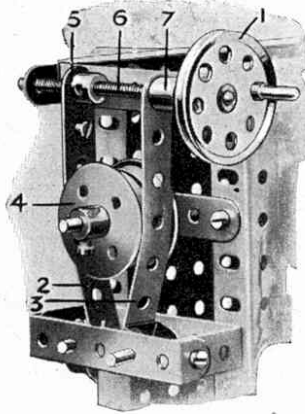


Fig. 467

(468) A Planetary Gear-Box

Here is an excellent model of a planetary gear-box that will appeal particularly to the more advanced model-builder. Planetary gearing is interesting in itself and gear-boxes of this type lend themselves to experimental work on pre-selector mechanisms.

The model is illustrated in Fig. 468. The $6\frac{1}{2}$ " Axle Rod 1 takes up the drive from the power unit, and is journaled in the centre of a $5\frac{1}{2}$ " Angle Girder and a $5\frac{1}{2}$ " \times $1\frac{1}{2}$ " Double Angle Strip forming part of the framework for the gear-box. The driven $5\frac{1}{2}$ " Rod 2 is journaled in a similar manner at the other end of the frame. The cage for the planet gears is built up from two Face Plates, which should be lined up carefully so that the holes through the bosses are in perfect alignment, and it is free to slide on the Rods 1 and 2.

The Rod 2 carries at its inner extremity a $1\frac{1}{2}$ " Gear Wheel 4, in the centre hole of which the end of the Rod 1 is inserted to prevent wobble. The Rod 1 carries a fixed $\frac{3}{4}$ " Pinion 3. The sun wheels 6 and 7, consisting of a 57-teeth and a 50-teeth Gear Wheel, are held together by a Socket Coupling placed over their bosses, and the Rod 1 is free to

rotate in their centres. The Gears are prevented from rotating by a $2\frac{1}{2}$ " \times $\frac{1}{2}$ " Double Angle Strip attached to the 57-teeth Gear by $\frac{1}{2}$ " Bolts, on the shank of each of which is a Collar for spacing purposes.

The general construction of the gear-box should now be clear from Fig. 468, but fuller details will be sent to any reader who is interested. Its operation is simple. The $1\frac{1}{2}$ " Rod at the end of the gear lever should be adjusted so that normally it fits into one of the holes in the Curved Strip but by a slight upward movement of the lever can be disengaged to allow the lever to be moved in another position.

In the illustration reverse gear is in engagement. In this position the Pinion 3 on the driving shaft engages with the Gear 10, thus causing the $\frac{1}{2}$ " planet Pinion on the Rod 8 to travel round the sun wheel 6. This movement causes the cage to revolve, and for reverse gear the cage

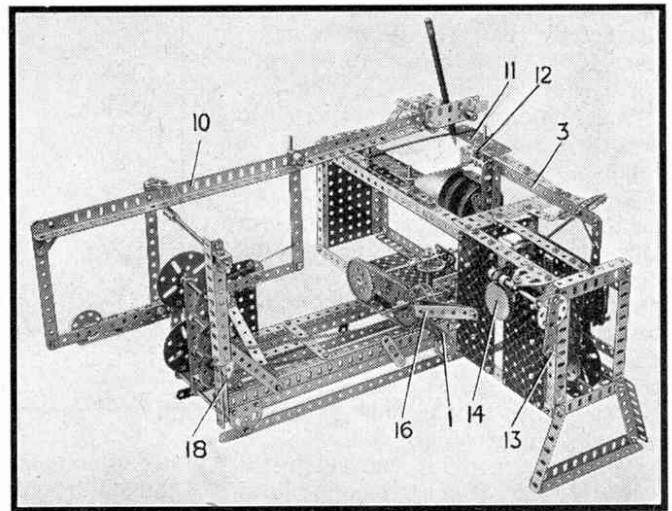


Fig. 468a

is locked "solid" with the driven shaft by means of a fixed $\frac{1}{2}$ " Pinion that engages the $1\frac{1}{2}$ " Gear 4.

First Gear is engaged on moving the lever to the next position on the left after which comes a neutral position, followed by second, third and top gear positions.

(469) Automatic Brake for Trailers

(S. Spire, Peterborough)

S. Spire has devised a very simple automatic brake mechanism for trailers. A Single Bent Strip is attached rigidly to the leading vehicle, and a Coupling is pivoted on it by means of a short Rod. A $2\frac{1}{2}$ " Rod is fitted in the Coupling.

A 3" Strip is attached to the trailer by a Simple Bell Crank and a $2\frac{1}{2}$ " Angle Girder, and one end of it is fitted with a $1\frac{1}{2}$ " \times $\frac{1}{2}$ " Double Angle Strip. The $2\frac{1}{2}$ " Rod passes through the holes in the flanges of the $1\frac{1}{2}$ " \times $\frac{1}{2}$ " Double Angle Strip, and carries at its end a Collar.

Behind the $1\frac{1}{2}$ " \times $\frac{1}{2}$ " Double Angle Strip are two $1\frac{1}{2}$ " Strips pivoted vertically at their centres on a Double Bracket under the 3" Strip. Cables connect the lower ends of the $1\frac{1}{2}$ " Strips to the brake mechanism. When the brakes are applied the Double Angle Strip slides forward and the upper ends of the $1\frac{1}{2}$ " Strips are pushed back. The lower ends go forward and apply the trailer brakes.

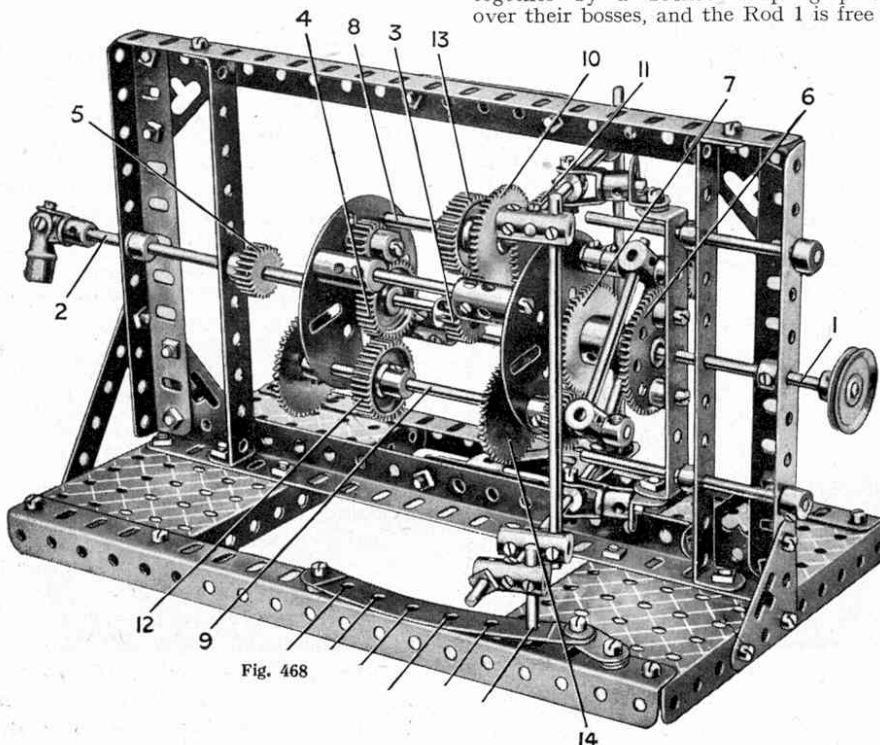


Fig. 468

Suggestions Section

By "Spanner"

(470) Triplicated Crankshaft

("Spanner")

This "suggestion" is a reproduction of a special formation of cranks designed primarily for use in connection with certain types of oil engines. In these engines each cylinder contains two pistons that work in opposite directions to each other, although both are actuated simultaneously. One piston moves downward as the other moves upward, the movement of each piston being reversed for every cycle of operation. The pistons are coupled up to the crankshaft by means of three connecting rods, the two outside connecting rods working in unison as they are attached to the upper piston. A threefold crankshaft mechanism

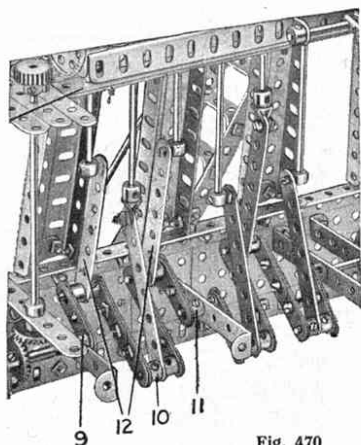


Fig. 470

of this kind may be built up on a small scale, and incorporated in model marine or car engines or other similar movements.

The main section of each crank consists of two separate webs, each of which is constructed from two $2\frac{1}{2}$ " Strips bolted together and two Cranks. The Cranks are bolted to opposite sides of the Strips at each end. At the point 10 the two webs are joined rigidly by a 1" Rod, a $3\frac{1}{2}$ " Strip being carried on the Rod between the two Cranks. This Strip is coupled to an End Bearing on the bottom end of the lower piston rod by a $\frac{3}{8}$ " Bolt, which is held in place by lock-nuts.

Each of the small webs 9 and 11 is built from two Cranks and two $1\frac{1}{2}$ " Strips, the entire assembly being secured together by a single nut and bolt. These webs are attached to the unoccupied ends of the larger cranks by means of 1" Rods carrying $3\frac{1}{2}$ " Strips 12 in a similar manner to that already described. They are also pivotally attached to the lower ends of $11\frac{1}{2}$ " Rods by bolts carried in the threaded transverse holes of Collars. The upper ends of the $11\frac{1}{2}$ " Rods are joined by short Strips, the centres of which are connected by a Coupling to the upper piston rod.

(471) Developing Tank Agitator

(R. Glenfield, Jedburgh)

Now that brighter days are returning amateur photographers will be getting busy again, and those who carry out the developing and printing processes them-

selves will find the apparatus shown in Fig. 471 a useful addition to their darkroom equipment. It is essential when processing films, plates or papers, to keep developing or fixing solutions in constant movement, so as to prevent the formation of air bubbles and the risk of patchy negatives. In Fig. 471 is illustrated an easily built agitator for the cylindrical type of processing tank designed to accommodate the film in spiral grooves.

The frame of the apparatus consists essentially of two $12\frac{1}{2}$ " Angle Girders connected by three $5\frac{1}{2}$ " Angle Girders. At one end of the frame a $5\frac{1}{2}$ " Angle Girder carries a $2\frac{1}{2}$ " x 1" Double Angle Strip, the ends of which are connected by a $2\frac{1}{2}$ " Strip. A second rectangular frame 1 is now made from $5\frac{1}{2}$ " Angle Girders braced with $5\frac{1}{2}$ " Strips. The Strips are fitted with Threaded Pins, which serve to hold the developing tank in position. The frame 1 is hinged at one end to the $2\frac{1}{2}$ " Strip 2, bolted across a Double Arm Crank. The latter is pushed on a vertical $2\frac{1}{2}$ " Rod 5, but is spaced from the Double Angle Strip by a $\frac{1}{2}$ " loose Pulley.

The agitator is operated by an E06 or E020 Electric Motor, which is supported between the two Flanged Plates by $3\frac{1}{2}$ " x $\frac{1}{2}$ " Double Angle Strips. A Worm on the armature shaft of the Motor drives a 50-teeth Gear on the $4\frac{1}{2}$ " Rod 5, which is fitted with a Universal Coupling. In the other end of the Coupling is a 1" Rod, and on this is a Triple-Throw Eccentric 6, the arm of which is fixed to the frame 1 by a lock-nutted bolt. When the Motor is set in motion, the Eccentric imparts a peculiar circular movement to the frame, and this effectively circulates the solution round the film.

Some modern developing tanks have a knob at the top so that agitation can be carried out by hand. This knob allows the film spool to be rotated, and as the spool has a special cam at the bottom it also rises up and down. A tank of this kind can be agitated mechanically if it is clamped in a frame built up from Meccano parts, so that

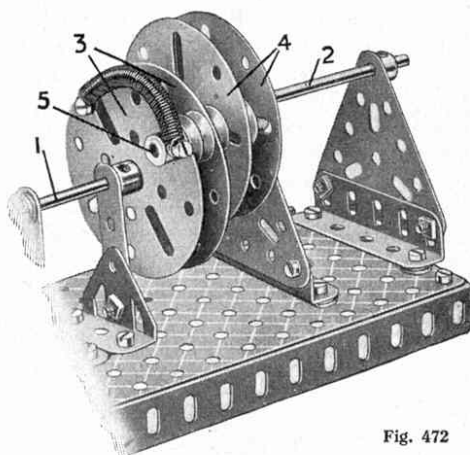


Fig. 472

the knob can be rotated by means of a Driving Band passed around the Pulley of a Motor. In this case a Clockwork Motor can be used for the driving unit, and if it is fitted with a fan air brake it will operate the agitator for periods up to 15 minutes on one winding. The fan of course should be driven through step-up gearing.

(472) Quick Return Motion

(N. C. Speech, Birmingham)

In some machines, for example, planing and slotting machines, quick return mechanisms are incorporated for the purpose of speeding up operations by increasing the speed of the return or idle stroke of the cutting tool. They can be used also for intermittent feed movements in which a Pawl is used for rotating a Ratchet Wheel. In this case the arm carrying the Pawl would be speeded up on the return stroke so that the interval between successive movements of the Ratchet would be decreased.

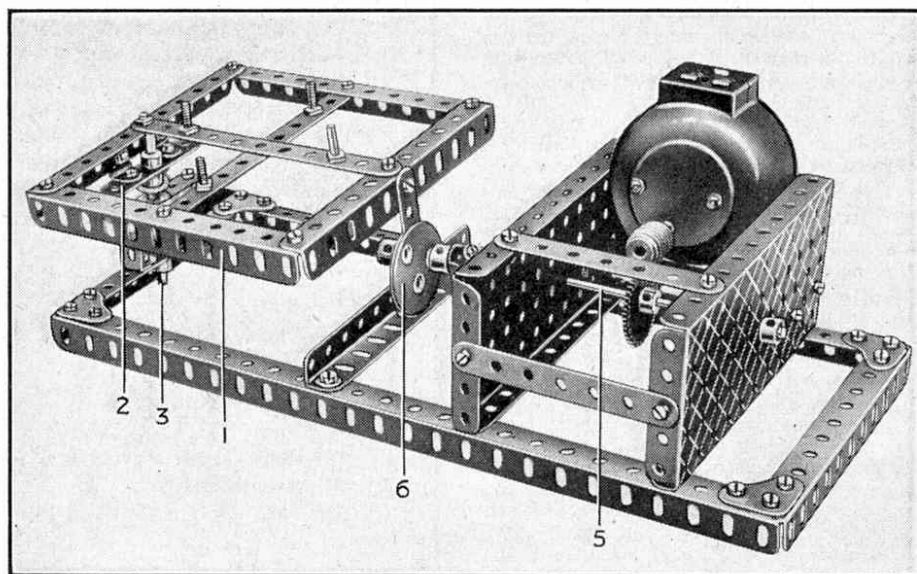


Fig. 471

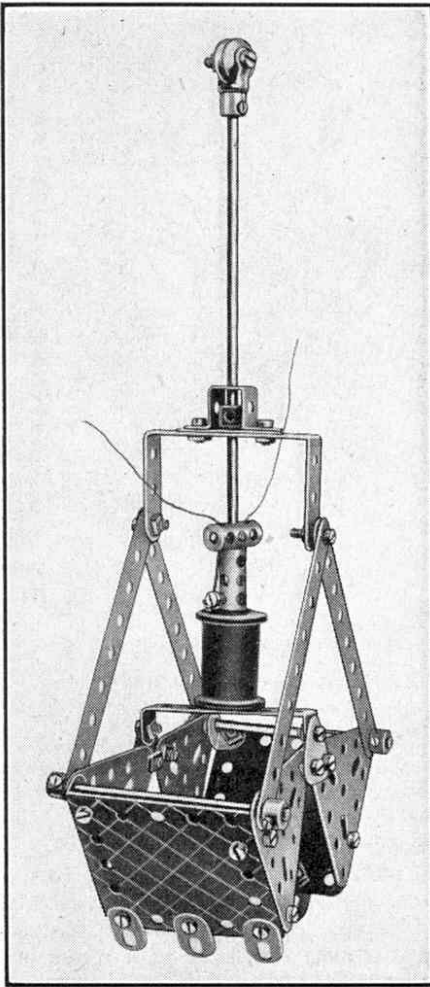


Fig. 474

Many different types of quick return motions have appeared in "Suggestions Section" from time to time, and a further interesting example is shown in Fig. 472. This movement is of special interest, as it is a distinct departure from the usual lever or gear-operated quick return movement. Its action is controlled by a spring, and therefore is quick and positive.

Construction of the mechanism is carried out in the following manner. The driving shaft 2 is journaled in two $2\frac{1}{2}$ " Triangular Plates secured in the slotted holes of $2\frac{1}{2}$ " Angle Girders, which are spaced from the base plate by two Washers on each securing bolt. The bearings for the driven Rod 1 are formed by 2" Strips held in Trunnions. The two sets of bearings should be so arranged that the centres of the Rods are exactly $\frac{1}{2}$ " apart, and it is essential that the Rods should be parallel to each other.

Two Face Plates 3 are secured on the Rod 1 and spaced apart about $\frac{3}{8}$ ", with the slots in each Plate directly opposite. The Face Plates 4 are mounted in a similar manner on the Rod 2, and a $1\frac{1}{2}$ " Rod 5 is passed through slots in each pair of Plates. The Rod carries five $\frac{1}{2}$ " loose Pulleys arranged as shown, and a Collar on each end of this Rod holds it in position. The Face Plates should be spaced so that the Pulleys slide freely. A Spring that controls the movement of the gear is fitted to one end of the Rod, and the other end of the Spring is secured by a $\frac{3}{8}$ " Bolt to one of the Face Plates 3.

The drive from the Rod 1 passes through the Face Plates to the Rod 2 by means of

the Rod 5. This Rod slides up and down in the slots, so that in its lowest position it is at the lower ends of the slots in the Face Plates 3, and at the upper ends of the slots in the Face Plates 4. Thus the Rod 2 rotates faster than the Rod 1, but as the Plates continue to rotate the difference in speed of the two Rods is gradually reduced, while in the second half revolution Rod 1 rotates more quickly than Rod 2.

(473) Synchronous Motor

(G. Woolfenden, Liverpool)

Figs. 473 and 473a show a synchronous motor built up from Meccano parts. The model is exceptionally robust, and is designed to work from a Meccano 6-volt Transformer connected to 50 cycle A.C. mains.

Construction is commenced by winding eight Meccano Bobbins to capacity with No. 23 gauge enamel covered wire. These are then wired together in series, and the free ends of the first and eighth coils are taken to Terminals on the 1" Triangular Plate shown in Fig. 473. Each coil is held in a built-up yoke, each half of which is constructed from two Angle Brackets and a Flat Bracket held on a $\frac{1}{2}$ " Bolt as shown. Washers are placed on each side of the Flat Bracket to space it centrally between the Angle Brackets.

The units are then connected together by means of 1" Screwed Rods passed through the Angle Brackets of each unit and a Rod Socket as shown, and held in place by means of a nut on each end. The Coils are then slipped in the yokes and the nuts on the Screwed Rods are tightened up. Insulation in the form of sheet fibre or a wrapping of brown paper should be placed around the Bobbins to prevent the possibility of short circuiting.

The units are then linked together by means of the Flat Brackets, as shown. Finally, an Angle Bracket and a $1\frac{1}{2}$ " Strip are slipped on the threaded shank of each Rod Socket, and the other end of the Strip is bolted to a Face Plate by $\frac{1}{2}$ " Bolts, a Washer and a Collar being placed on the underside.

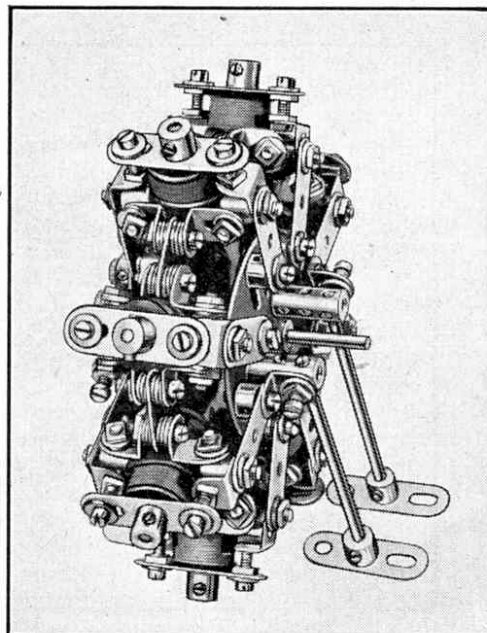


Fig. 473a

The rotor consists of a 3" Sprocket Wheel mounted on a $3\frac{1}{2}$ " Axle Rod, which rotates in the bores of the two Face Plates. Care must be exercised in aligning the bosses of the Face Plates, and the various nuts and bolts should not be tightened up until the Rod runs quite freely.

The Angle Brackets attached to the $1\frac{1}{2}$ " Strips are connected by $\frac{1}{2}$ " Bolts to Double Arm Cranks, through which $1\frac{1}{2}$ " Axle Rods are pushed. These Rods form the cores of the magnets, and their inner ends should be as near as possible to the teeth of the Sprocket Wheel.

If the Bobbins are wound as described the motor is suitable for working from any of the 6-volt Meccano Transformers. To start it the rotor spindle should be spun at approximately 100 r.p.m., which is its normal working speed.

(474) Electro-Magnetic Grab

(P. Hands, Hillingdon)

An electro-magnetic grab fitted to a Meccano crane will greatly increase the fun and pleasure obtained from operating it. A

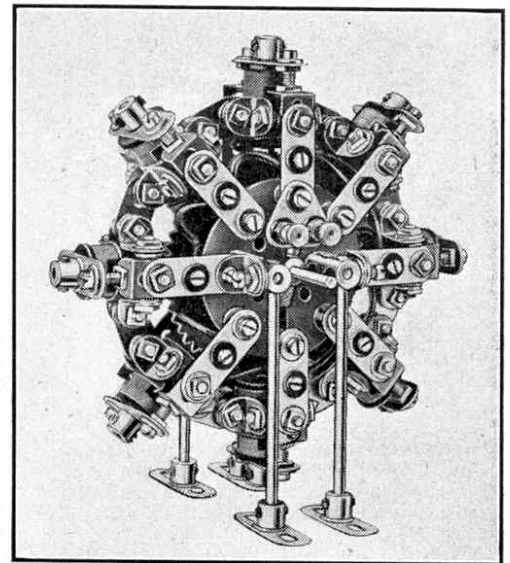


Fig. 473

simple method of constructing such a grab is shown in Fig. 474. The principal feature of this device is that only one cord is used for hoisting and lowering and opening and closing the jaws.

Four $4\frac{1}{2}$ " Strips are pivoted on 3" Rods pushed through holes in the $2\frac{1}{2}$ " Triangular Plates, and are held in place by Collars as shown. The upper ends of the Strips are pivotally connected by lock-nutted bolts to a $2\frac{1}{2}$ " x $1\frac{1}{2}$ " Double Angle Strip. To the centre of this Double Angle Strip is bolted a Double Arm Crank and a Double Bent Strip as shown. A 6" Rod, which at its lower end carries a Coupling, is passed through the centre holes in the Double Bent Strip, Double Arm Crank and Double Angle Strip. The Coupling on this Rod is connected to an Elektron Electro-Magnet, which has a tightly-fitting Core, and is held in place by the grub screws in the lower end of the Coupling. The 6" Rod must not touch the Core of the Magnet. Above the first Coupling is a second similar part placed at right angles to the first Coupling. At the upper end of the 6" Rod is a Small Fork Piece, between the arms of which is mounted a $\frac{1}{2}$ " loose Pulley around which passes the hoisting and grab opening cord.

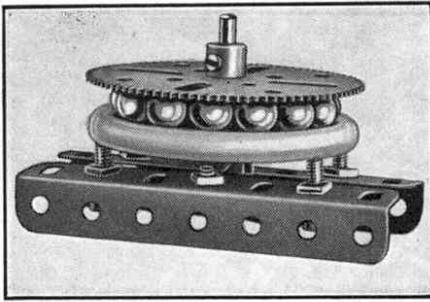


Fig. 475

(475) A Built-up Ball Race for Heavy Models

(J. A. Blacklin, Liverpool)

In building large working models that carry heavy revolving superstructures it is essential to mount the moving parts in stout bearings that run freely. This aspect of model-building becomes of even greater importance when only one Motor is available to drive several different movements, for in this case it is necessary to cut down friction to the lowest possible point. One of the best ways of doing this is to use ball-type bearings wherever possible. Several types that can easily be assembled from existing Meccano parts have been described in "Suggestions Section" from time to time, and here is another that will be found useful in many different kinds of models.

The bearing is shown in Fig. 475, and consists essentially of a Road Wheel (Part No. 187), which forms the lower race, 14 Steel Balls (Part No. 117), and a $2\frac{1}{2}$ " Gear Wheel (Part No. 27c). The design of the base on which the bearing is assembled depends on the model in which it is incorporated. In the example shown the bearing is built up on two $3\frac{1}{2}$ " Angle Girders, each of which carries an Angle Bracket at its centre. The Road Wheel is fixed between the free arms of the Angle Brackets by Bolts screwed into its boss. A Rod is pushed through the hub of the Road Wheel and is fitted with an Aeroplane Collar, which is pressed against the face of the boss. The Road Wheel is also supported by four $\frac{3}{8}$ " Bolts, which are pushed through the Angle Girders in the positions shown and make contact with the under surface of the Wheel. The Bolts are fixed in place by Nuts above and below the flanges of the Angle Girders. The Steel Balls are now placed in the rim of the Road Wheel and then a $2\frac{1}{2}$ " Gear forming the upper race is placed on the Rod in contact with them. The grub screw in the boss of the Gear is tightened up so that it grips the Rod.

A bearing of this type is particularly useful for supporting the booms of small hammerhead cranes, as it is possible to transmit driving motion to the boom by means of a Pinion meshing with the $2\frac{1}{2}$ " Gear.

We shall be glad to hear from readers who have experimented in the assembly of ball bearings and to learn of any novel ideas they have on this subject.

(476) A Useful Momentum Motor for Driving Small Models

(F. Schorreweegen, Lierre, Belgium)

Stationary Meccano models of a simple type such as drills and other machine tools can be driven by means of a momentum motor of the kind shown in Fig. 476. This consists of a heavy flywheel that can be

rotated at high speed by turning a crank handle. The model is provided with two clutches, one of which enables the flywheel shaft to be disconnected from the handle, while the other couples it to the shaft of the model to be driven.

Front and back of the casing consists of $3\frac{1}{2}$ " x $2\frac{1}{2}$ " Flanged Plates, and its sides of $3\frac{1}{2}$ " x $2\frac{1}{2}$ " Flexible Plates strengthened by $3\frac{1}{2}$ " and $2\frac{1}{2}$ " Strips. It is divided into two portions by another $3\frac{1}{2}$ " x $2\frac{1}{2}$ " Flanged Plate bolted 1" from one end. $3\frac{1}{2}$ " and $4\frac{1}{2}$ " Angle Girders bolted together to form Reversed Angle Girders are bolted along each side of the casing.

A $3\frac{1}{2}$ " Rod is journaled in the centre top holes of gear-box as shown, and it carries at its inner end a Washer and a Com-

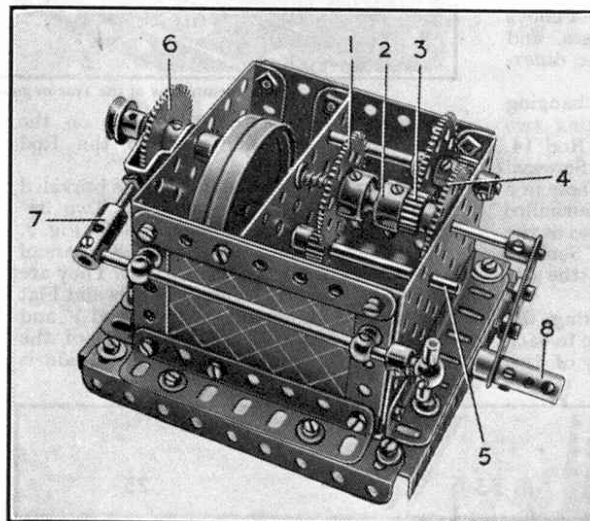


Fig. 476

pression Spring, a 57-teeth Gear 1, a Socket Coupling 2, a $\frac{1}{2}$ " Pinion 3 and a second 57-teeth Gear 4, arranged on the Rod in that order. The boss of the 57-teeth Gear 1 is gripped in one end of the Socket Coupling, and the other end of the Socket Coupling grips the boss of the $\frac{1}{2}$ " Pinion. The Socket Coupling and the gears, with the exception of the 57-teeth Gear 4, are free to revolve on the Rod. The outer end of the Rod is fitted with a built-up handle 8.

A $2\frac{1}{2}$ " Rod also is journaled in the sides of the casing as shown. It carries a $\frac{1}{2}$ " Pinion that engages 57-teeth Gear 4, and a 57-teeth Gear that meshes with $\frac{1}{2}$ " Pinion 3.

The 57-teeth Gear 1 meshes with a $\frac{1}{2}$ " Pinion on a $4\frac{1}{2}$ " Rod 5. This Rod also carries a Flywheel and, outside the box, a $\frac{3}{4}$ " Pinion. This Pinion meshes with a 50-teeth Gear 6 on a 2" Rod journaled in the side of the box and in a $2\frac{1}{2}$ " Strip bolted to a Flat Trunnion fixed to the base.

The 2" Rod carries a Cranked Bent Strip, between the arms of which is the 50-teeth Gear 6. This is spaced from the Cranked Bent Strip by two Washers. The Rod has a $\frac{1}{2}$ " fast Pulley on its outer end, and a Collar on its inner end. The Cranked Bent Strip is fixed by two Nuts to one end of a $1\frac{1}{2}$ " Screwed Rod, the other end of which is screwed into the bore of a Threaded

Suggestions Section

By "Spanner"

Coupling 7. The Threaded Coupling is fixed on one end of a 4" Rod journaled in two Handrail Supports attached to the side of the casing, and on the other end of the Rod is a Handrail Coupling that carries a 1" Rod in its tapped bore to form a handle.

(477) Air Brake Governor

When using a Meccano Clockwork Motor it is often found necessary to apply a slight retarding force in order to increase the duration of the Motor's run, and this can be accomplished efficiently by the mechanism shown in Fig. 477.

The driving shaft of the Motor carries a Sprocket Wheel, which drives the model, and a 57-teeth Gear 1 that engages with a $\frac{1}{2}$ " Pinion. The Pinion is mounted on a 2" Rod fitted with a fan wheel 5, the blades of which are composed of $2\frac{1}{2}$ " Flat Girders attached by means of Angle Brackets to a central Bush Wheel.

The Flat Girders forming each vane should be covered on one side with a piece of paper. By this means air leakage through the holes is prevented, and full use is thus made of the resistance area available.

A fan brake of this kind can be fitted to any Clockwork Motor, and is useful not only for extending the time of run on one winding of the spring, but for reducing the Motor speed in the absence of suitable gears. In this case it is advisable to provide means by which the speed of the drive can be varied at will. The easiest

method is to mount the vanes in such a manner that they can be turned on their axis so as to offer greater or lesser resistance to the air as required. The slowest speed of course will be obtained when the vanes are arranged in line with the shaft, and the highest speed when they lie at right angles to the shaft.

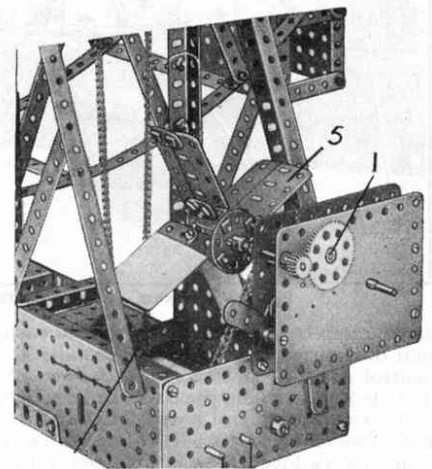


Fig. 477

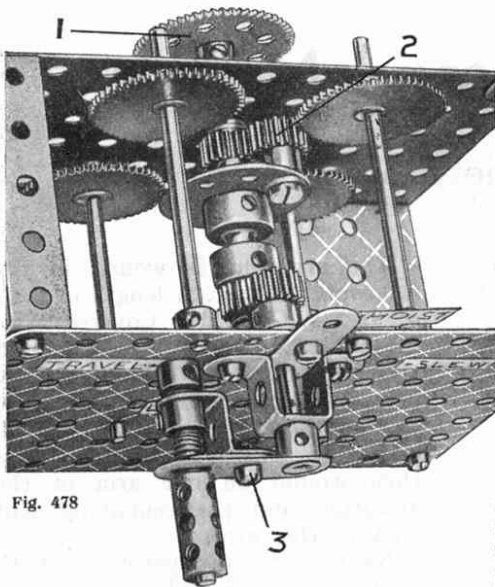


Fig. 478

(478) Novel Four-Movement Gear-Box

(G. Robinson, Leeds)

The usual method of obtaining two or more separate movements from one power unit, such as a Meccano Clockwork or Electric Motor, is to employ some form of gear-box so arranged that the desired movement may be connected up to the Motor by sliding certain gears into or out of mesh. The design of a gear-box for a crane, for example, in which there may be as many as four or even five separate motions to be driven from a single motor, is a task that requires much thought in order to produce a piece of mechanism that is both neat and capable of functioning in a reliable manner.

The alternative is to employ a separate motor for each motion, so as to avoid a complicated gear-box. This arrangement, although typical of the most up-to-date practice, is not likely to find favour with the majority of Meccano boys because of the number of motors required. What is wanted is a type of gear-box so designed that it may be put together easily, and will function efficiently, without any adjustment other than that met with in the ordinary course of model-building.

Fig. 478 shows a gear-box that fulfils these conditions in a remarkably ingenious manner. The device is arranged to supply four separate movements, one or more of which can be omitted if not required in the particular model in which the gear-box is incorporated.

The principle on which the gear-box is designed is as follows. A Pinion 2 is arranged so that on operation of the "selector" lever it may be moved bodily round another Pinion secured to the driving shaft, in the same way as the "planet" wheel travels round the "sun" wheel in epicyclic mechanism. The four separate shafts to be driven are arranged about the driving shaft, which carries the sun wheel, and they are fitted with 50-teeth Gears, each of which meshes with the planet wheel 2 when the latter is brought into position between it and the sun wheel. Thus the planet wheel forms a connecting link by means of which any one of the four driven shafts can be linked up as desired, with the driving shaft.

The sun wheel on the driving shaft is a $\frac{1}{2}$ " Pinion that is in constant mesh with a second $\frac{1}{2}$ " Pinion 2 forming the planet wheel.

Pinion 2 is fixed to a Pivot Bolt carried in a Bush Wheel, and the latter is free to rotate independently of the driving shaft on which it is mounted. On turning the Bush Wheel the Pinion 2 may be brought into mesh at will with the 50-teeth Gears on the driven shaft.

The Bush Wheel is connected by a Socket Coupling to a $\frac{1}{2}$ " Pinion that is loose on the driving shaft and is engaged with a similar Pinion secured on the end of a short Rod carrying at its outer extremity a Crank 3. The Rod is journaled in a reinforced bearing comprising a Double Bent Strip bolted to the $5\frac{1}{4}" \times 3\frac{1}{2}"$ Flat Plate that forms one side of the gear-box. The end of the Crank is provided with a spring loaded plunger that may be inserted, on rotation of the Crank, in certain holes in the Plate. These holes are marked in the illustration with the desired gear positions. The plunger is a short Rod free to slide in a Reversed Angle Bracket and a Flat Bracket bolted to the Crank, and a Compression Spring serves to keep the end of the plunger in the holes in the Plate. To change gear, it is only necessary to pull out the plunger and rotate the Crank until it is opposite the hole labelled with the movement required. The plunger is then released.

The drive from each of the Rods carrying the 50-teeth Gears may be conveyed by any suitable means to the particular movement it is intended to operate.

(479) Hypoid Drive for Model Motor Vehicles

(H. S. Everett, Wrotham)

Some modern motor cars are equipped with what is known as hypoid drive in the transmission to the wheel axles. In an ordinary bevel drive the crankshaft, gear-box and propeller shaft are in line with the centre of the crown wheel, and in many instances are level with or slightly

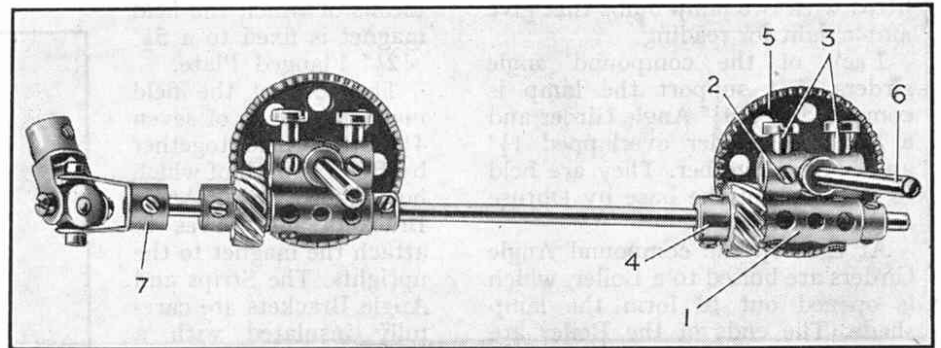


Fig. 479

nigher than the floor of the car. Metal covers known as shaft tunnels then have to be used to cover the revolving parts. In a hypoid drive, which is a form of bevel gear, the teeth engage considerably below the line passing through the centre of the crown wheel. With it the propeller shaft therefore can be carried lower down and the floor of the car can be quite flat.

Specially cut spiral bevels are used in actual hypoid gearing, but a good representation of a hypoid drive can be reproduced in Meccano by using the $\frac{1}{2}$ " Helical Gear (Part No. 211a) and the $1\frac{1}{2}"$ Contrate Wheel (Part No. 28). Fig. 479 shows an arrangement of this kind suitable for twin axle drive, which was suggested by H. S. Everett, Wrotham, Kent. It comprises

two similar units, one for each axle. These are carried on the propeller shaft, and each consists of a Coupling 1, free on the propeller shaft, to which a second Coupling 2 is fixed by means of two Pivot Bolts 3. A $\frac{1}{2}"$ Helical Gear 4 secured on the propeller shaft engages a $1\frac{1}{2}"$ Contrate 5 fixed on a Rod 6 carried freely in the centre transverse hole in Coupling 2. Rod 6 is prevented from moving endways in the Coupling by means of two Collars fixed on the Rod, one on each side of the Coupling. The Coupling 1 is retained on the propeller shaft by a Collar. A Universal Coupling 7 is provided for connection to the gear-box driving shaft.

A mechanism of this kind is very smooth and silent in operation and when incorporated in a model vehicle greatly increases its interest.

Miscellaneous Suggestions

Under this heading "Spanner" replies to readers who submit interesting suggestions regarding new Meccano models or movements that he is unable to deal with more fully elsewhere. On occasions he offers comments and technical criticisms that, he trusts, will be accepted in the same spirit of mutual help in which they are advanced.

(M.221.) In cranes in which multi-sheave Pulley Blocks are used it is essential that the hoisting cord should always remain taut, for if it is allowed to become slack it is likely to slip off the pulleys. When the pulley block reaches the ground the hoisting barrel should immediately cease paying out, but if the operator is unable to see the ground a short interval may elapse before he applies the brake.

An ingenious method of showing when the hook is relieved of its load, and at the same time keeping the cord taut if the drum pays out a little too rapidly, consists of an Axle Rod pivoted near the centre to the jib and carrying at its lower end a Worm or other suitable weight. An End Bearing at the upper extremity of the Rod carries a $\frac{1}{2}"$ loose Pulley. The hoisting cord passes over the Pulley and the weight

of the load hook should be sufficient to hold the lever in a position almost parallel to the jib. As soon as the hoisting cord is relieved of its weight when the Pulley block reaches the ground, the Worm at the end of the lever returns it to the vertical position, thus taking up the slack in the cord and giving the crane operator ample warning to apply the brake.

(M.222.) In the construction of gear mechanism the necessity occasionally arises for a small internally toothed gear, and as such a part is not yet included in the Meccano range readers will be interested in learning how a novel substitute can be devised. A $1\frac{1}{2}"$ Bevel Gear is used and a $\frac{1}{2}"$ Pinion is placed so that it meshes with the inner edges of the Bevel teeth.

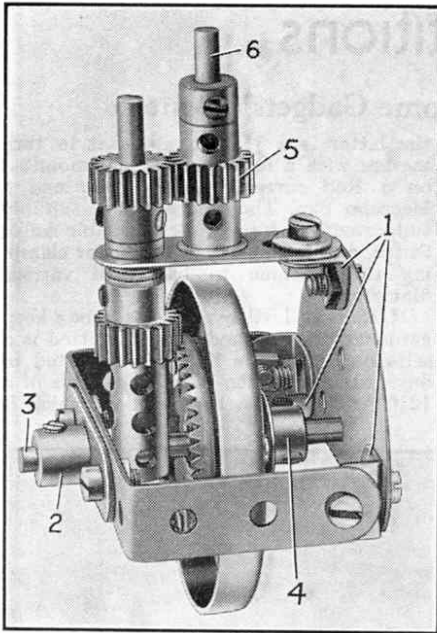


Fig. 480.

(480) Pivoted Front Wheel Drive

(K. H. Pritchard, Brook's Green)

The mechanism seen in Fig. 480 is designed as a pivoted front wheel drive for use in three-wheeled vehicles, such as mobile cranes and mechanical horses. It is suggested by K. H. Pritchard, Brook's Green.

The device is constructed by bolting three Angle Brackets 1 to a $2\frac{1}{2}$ " Semi-Circular Plate. To two of these Angle Brackets are bolted $2\frac{1}{2}$ " x $1\frac{1}{2}$ " Double Angle Strips, and the other ends of these are joined by a Double Arm Crank 2. A $2\frac{1}{2}$ " Rod 3, passed through the Double Arm Crank and the Semi-Circular Plate, carries a Wheel Flange to which a $1\frac{1}{2}$ " Contrate Wheel is bolted by four $\frac{3}{8}$ " Bolts. Four Washers on each Bolt space the Contrate Wheel from the Wheel Flange, both of which are free on the Rod. The Rod 3 also carries a Coupling and is held rigidly in place by tightening the Grub Screw in the Double Arm Crank. A $\frac{1}{2}$ " fast Pulley 4 which is held to the Rod 3 by its Grub Screw spaces the Contrate Wheel and Wheel Flange from the $2\frac{1}{2}$ " Semi-Circular Plate.

The Coupling provides a bearing for one end of a 2" Rod, the other end of which is journaled in one hole of a Double Arm Crank attached to the Semi-Circular Plate by the third Angle Bracket. The 2" Rod carries a $\frac{1}{2}$ " Pinion that meshes with the $1\frac{1}{2}$ " Contrate Wheel, the Pinion being spaced from the Crank by three Washers. A second $\frac{1}{2}$ " Pinion is carried on this Rod above the Double Arm Crank, and is also spaced from it by Washers. This Pinion meshes with a third $\frac{1}{2}$ " Pinion 5 which is carried on a $1\frac{1}{2}$ " Rod 6. The Pinion is loose on the Rod, which is fixed in the boss of the Double Arm Crank by its Grub Screw.

(481) Right Angle Drive Reversing Gear

(T. A. Wade, Johannesburg)

The frame of this Reversing Gear consists of two $5\frac{1}{2}$ " and two 3" Angle Girders bolted together to form a rectangle. Two further 3" Angle Girders are bolted across the frame 2" from each end. Bearings for

the shafts 1 and 2 consist of a Trunnion bolted to the right hand 3" Girder, a Flat Trunnion held to the left-hand girder by $\frac{1}{2}$ " Bolts, with a Collar on each Bolt to act as a spacer, and a $1\frac{1}{2}$ " Angle Girder held to one of the 3" Girders by a $1\frac{1}{2}$ " Angle Girder. A 1" Corner Bracket is bolted to the Flat Girder. A Double Bent Strip is bolted to the back of the other 3" Angle Girder to provide a bearing for a $1\frac{1}{2}$ " Rod that carries a Collar at one end and a $1\frac{1}{2}$ " Contrate Wheel 4 at the other. This Rod represents the driven shaft.

The Contrate Wheel is spaced from the Girder by Washers. The Rod also carries a Bush Wheel, a Socket Coupling, two $\frac{1}{2}$ " Pinions and a Collar, and is slideable in its bearings. One of the Pinions is gripped in the boss of the Socket Coupling as shown in the illustration. The Rod 2 is $1\frac{1}{2}$ " long and carries a Collar and a Bush Wheel. The Bush Wheel is fitted with two $1\frac{1}{2}$ " Rods 5 and 6 which fit into holes in the other Bush Wheel so that the shafts 1 and 2 turn together.

The direction of rotation of the driven shaft is determined by bringing one of the two Pinions into engagement with the Contrate. This is done by sliding the shaft 1 to right or left, as desired, by means of a slideable $3\frac{1}{2}$ " Rod 5. This Rod carries a Coupling, in one end of which is a 1" Rod that engages the groove of the Socket Coupling.

(482) Three Speed and Reverse Gear-Box

(G. T. Parkyn, Barnet)

G. T. Parkyn, Barnet, has provided me with details of a compact three-speed and reverse gear-box that he designed with the object of reproducing as closely as possible the constructional method of operation of the gear-boxes usually fitted to small cars. An illustration of the gear-box is shown in Fig. 482 on the opposite page.

The frame in which the gears are housed consists of two $3\frac{1}{2}$ " and two $1\frac{1}{2}$ " Angle Girders bolted together to form a rectangle with their slotted holes horizontal. The space in the middle is filled in with a $3\frac{1}{2}$ " Strip. The sides are $3"$ x $1\frac{1}{2}"$ Flat Plates bolted to the $3\frac{1}{2}"$ Angle Girders. To each Flat Plate is bolted a $1\frac{1}{2}"$ Corner Bracket that supports a $1\frac{1}{2}"$ Angle Girder that is held to the Corner Brackets by Angle Brackets. The ends of the frame are $1\frac{1}{2}"$ Flat Girders, which form bearings for the various

shafts. Two $1"$ x $1"$ Angle Brackets are bolted to the $3\frac{1}{2}"$ Strip, so that the projecting lugs are $1\frac{1}{2}"$ apart, and so that each lug is $1"$ from the end of the $3\frac{1}{2}"$ Strip.

The driving Rod 1 is a $3\frac{1}{2}"$ Rod and it carries a Collar, two Washers, a 1" Triangular Plate, a $\frac{3}{4}"$ Pinion 2 as shown. It is passed through one of the $1"$ x $1"$ Angle Brackets and carries on the other side of the Bracket a $\frac{1}{2}"$ Pinion 3, two Washers, and another 1" Triangular Plate. The Rod projects nearly $\frac{3}{8}"$ beyond the 1" Triangular Plate. The driven Rod 14 is $2\frac{1}{2}"$ long and carries a Collar and a $\frac{3}{4}"$ Pinion 5. It passes through the other $1"$ x $1"$ Angle Bracket and there is a $\frac{1}{2}"$ Pinion 4 on the portion on the other side of the Bracket. The Rod projects about $\frac{1}{4}"$ into the bore of the Pinion 4. The projecting end of the driving rod fits into the other half of the bore of the Pinion. The right-hand layshaft 11 is $5"$ long and passes through the other hole in the 1" Triangular Plate and carries a $\frac{1}{2}"$ Pinion 13. Then it passes through a hole in the other Triangular Plate and carries on the other side of it a Pinion 10 taken from a No. 2 Clockwork Motor, and a $\frac{1}{2}"$ fast Pulley.

The left-hand layshaft 12 is a 5" Rod and carries a No. 2 Clockwork Motor Pinion 7, a $\frac{1}{2}"$ Pinion 6 and a $\frac{1}{2}"$ fast Pulley.

The reversing layshaft is a 2" Rod and carries two $\frac{1}{2}"$ Pinions 8 and 9 and a Collar and is journaled in the remaining holes of the 1" Triangular Plates.

The gear changing lever is a $3\frac{1}{2}"$ Rod that carries at one end an End Bearing, the arms of which fit into the grooves of the $\frac{1}{2}"$ Pulley.

The gear-change lever is universally mounted in a Swivel Bearing which is held by a Pivot Bolt that passes through a Collar fixed to the rear end of the gear-box frame.

The layshafts are retained in the neutral position by Pendulum Connections, which are bent to engage the grooves of the $\frac{1}{2}"$ Pulleys.

The various gear trains are as follows. The lowest gear is brought into operation by moving the control lever so that Pinion 3

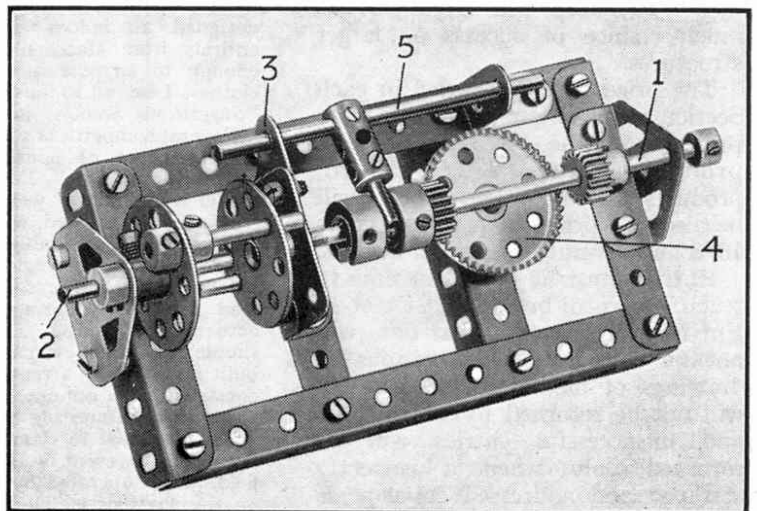


Fig. 481.

engages the Pinion 13 on the Shaft 11 and Pinion 10 engages Pinion 5. For second gear the lever is moved to the left and backward. This movement brings into mesh the Pinions 6, 4 and 3, giving a gear ratio of 1:1. The highest gear is brought into operation by moving the lever to the left and forward. This brings into mesh Pinions 2 and 7 and Pinions 6 and 4, giving a gear ratio of 3:1. Reverse drive is provided by Pinions 3, 9, 8, 13, 10 and 5.

(483) Steering Gear for Creeper Tracks

("Spanner")

Tanks, tractors, and other forms of transport in which creeper track is employed are often steered by employing separate power units to drive the tracks and varying the speeds of these units. This is not always practicable, however, and this mechanism is a Meccano model of another device.

The power is transmitted from the

with two $1\frac{1}{2}$ " Gears that drive through 2" Sprocket 49.

If both sets of gears are in mesh, the vehicle proceeds on a straight course, because the creeper tracks are in line with the frame of the vehicle. The tracks can be rotated independently at will by sliding $\frac{1}{2}$ " Pinions in and out of mesh with their respective Gears.

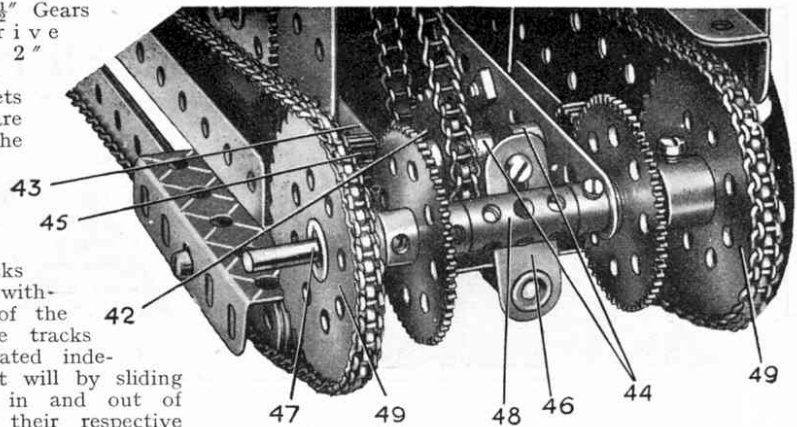


Fig. 483.

(484) Epicyclic Gear Clutch

(C. Potter, Streatham, S.W.16)

An efficient clutch movement that permits the driving power to be applied gradually makes an interesting and necessary addition to a large number of Meccano models such as roundabouts, traction engines and other structures in which heavy loads have to be taken up. The majority of the mechanisms of this type depend for their action upon the friction created between two revolving surfaces, one of which may be pressed against the other with varying force. On the other hand there is another form of clutch that employs spur gearing with which to obtain the required results. This is known as an epicyclic or gear clutch, and an efficient version of it can be constructed from Meccano parts, as shown in Fig. 484.

Two Rods are mounted in line with one another in any suitable bearings. One of the Rods serves as the driving shaft and the other as the driven shaft. The former is gripped by the set screw of a $1\frac{1}{2}$ " Contrate Wheel, the teeth of which engage with $\frac{1}{2}$ " Pinions 4 mounted on 1" Axle Rods secured in the ends of a Coupling 5. The Pinions are free on their axles, but they are held in place by the Collars 6.

The Rod forming the driven shaft passes through the bosses of a $1\frac{1}{2}$ " Pulley Wheel and a second $1\frac{1}{2}$ " Contrate Wheel 8, and its inner end is secured in the centre transverse hole of the Coupling 5. The Pulley and the Contrate Wheel 8 are both free to turn independently of the driven Rod. They are secured by means of two $\frac{1}{2}$ " Bolts, each of which is equipped with three Nuts, one immediately behind the Pulley and one on each side of the Contrate Wheel 8.

The unit formed by the Pulley and Contrate Wheel 8 is so placed upon the Rod that the teeth of the Contrate Wheel are in constant engagement with the $\frac{1}{2}$ " Pinions 4.

The movement of the Pulley Wheel is controlled by a friction brake consisting

of a length of cord, one end of which is tied to an Angle Bracket bolted to the base of the model and the other to a Threaded Boss 10 mounted on a Threaded Rod journaled in a convenient position near the Wheels. This Rod carries a hand wheel 11.

When the brake is in the "off" position, the Pulley unit is free to revolve. Hence if power is applied to the right-hand Contrate Wheel the Pinions 4 commence to turn upon their axles, driving the Contrate Wheel 8 in an opposite direction and no movement is imparted to the Rod passing through its boss. If the hand wheel 11 is rotated in a clockwise direction, the Contrate Wheel 8 becomes increasingly difficult to turn, and the Pinions 4 commence to climb round its teeth, thereby rotating the Coupling 5 and its Rod.

It will be seen from the above that by means of this clutch the power can be applied to the load very smoothly and without shock, for the left-hand Rod commences to rotate immediately the resistance on the Pulley becomes greater than the load. The speed of the latter Rod increases in proportion to the increase in the resistance on the Pulley and maximum speed is reached when the movement of the Pulley ceases altogether.

The type of brake used may vary, of course, according to the requirements of the particular model on which the device is incorporated, but the screw-operated brake is the best in nearly all cases, for it permits of the gradual application of the retarding effect.

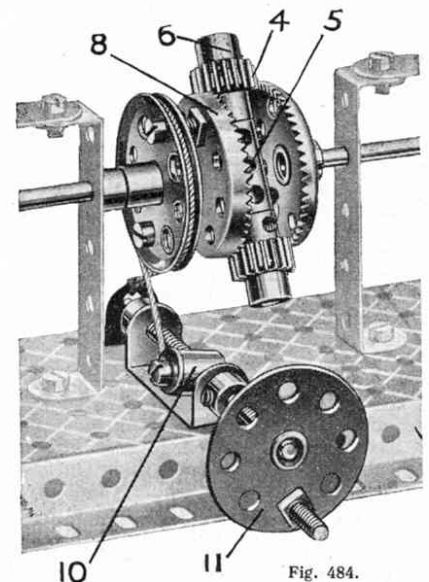


Fig. 484.

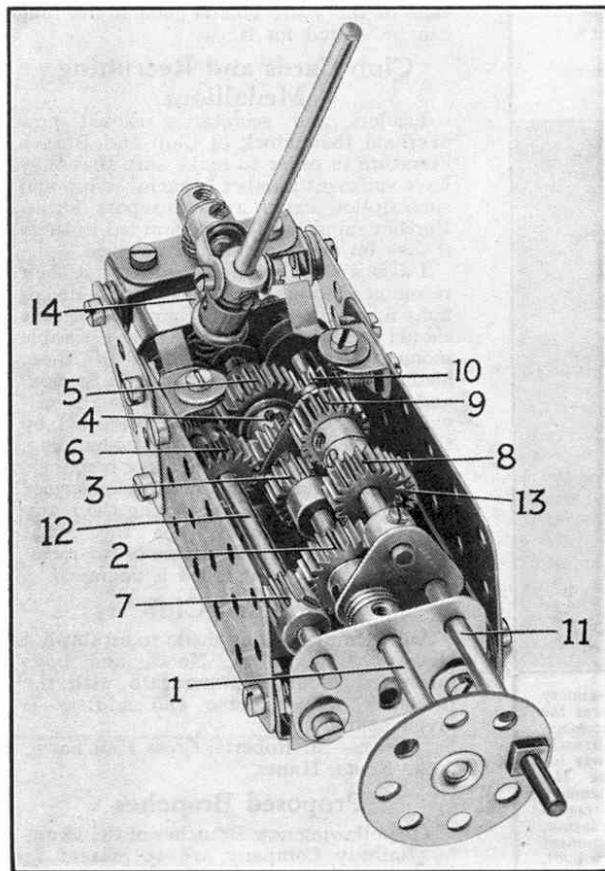


Fig. 482.

Motor by a single length of Sprocket Chain that drives a 1" Sprocket Wheel 42 (Fig. 483) secured on a lay shaft, as shown in the illustration. This shaft is journaled in a suitable framework and is moved from side to side by means of a Crank 46. A Bolt in the end of this Crank is accommodated between two Collars 44 on the lay shaft, and the boss of the Crank is secured on a long Rod running the entire length of the tank or vehicle in which this mechanism is fitted. This Rod is fitted with a handle at the point from which the model is controlled.

A $\frac{1}{2}$ " Pinion 45 is secured on each end of the lay shaft and these Pinions may be engaged or disengaged at will

Suggestions Section

By "Spanner"

(485) Automatic Motor Brake

In Fig. 485 is shown a novel type of automatic brake designed to apply a retarding force to the armature of an Electric Motor immediately the current supply is cut off. A brake of this kind is useful in model cranes and lifts and other types of hoisting machinery.

The rotating member of the brake is a 1" fast Pulley shod with a 1" Rubber Tyre and secured to the armature spindle of

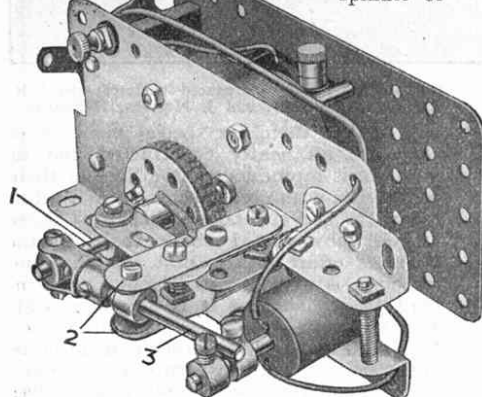


Fig. 485.

the Motor. The fixed portion of the brake consists of a Bush Wheel on a Rod 1 that is free to slide in a Collar, which is fixed rigidly between the ends of a pair of Simple Bell Cranks. The latter are bolted to 2" Strips 2, which are secured to the arms of a Single Bent Strip on the motor sideplate.

One end of a Rod 3 is attached pivotally by a Swivel Bearing to the Rod 1, while its other end rests between Collars spaced about $\frac{3}{8}$ " apart on the end of the solenoid plunger. A small piece of Spring Cord bolted to the Strip 2 presses on the upper part of the boss of a Bush Wheel on the Rod 1, and a second piece of Spring Cord is attached to the lower side of the Strip 2 to press similarly on the lower half of the Bush Wheel.

The solenoid is composed of a Bobbin

wound with four layers of No. 23 S.C.C. wire. One end of the winding is attached to a Terminal that is insulated from the Motor side plate by an Insulating Bush and an Insulating Washer, and the other end is secured so that it is in metallic contact with the plate. One of the Motor terminals is treated in a similar manner, and connection is made to a $3\frac{1}{2}$ -volt current supply from the terminal on the Motor side plate and the remaining Motor terminal.

When the Motor is running current flows through the turns of the solenoid, which pulls its plunger in. When the current is cut off the solenoid becomes inoperative and the plunger is freed. The Springs then pull the face of the Bush Wheel into contact with the Tyre on the 1" fast Pulley.

(486) Independently Sprung Wheels for Motor Vehicles

(P. Swan, Rangoon)

The mechanism shown in Fig. 486 is based on a special system of front wheel suspension used in some motor vehicles. The two wheels are sprung independently, so that each can give on passing over an obstacle in the road without affecting the other. The result is smoother riding than with a suspension system of the more usual kind.

The frame of the Meccano mechanism is made up from two $3\frac{1}{2}$ " Angle Girders 1 joined together to form an inverted U-shaped girder. On each side of this girder are bolted two Flat Trunnions 5, which form the upper components of the road wheel coupler. On each side of the Girder, between the Trunnions 5, there are also Two Trunnions 2. Each Road Wheel is mounted by bolting it to a Face Plate that carries a $1\frac{1}{2} \times \frac{1}{2}$ " Double Angle Strip as shown. A 2" Axle Rod is passed through the ends of this Double Angle Strip and a second one bolted in the position shown in Fig. 486. The Rod is held in place by Collars. The lower end of the second Double Angle Strip is coupled to the Trunnions 2 by a pair of $2\frac{1}{2}$ " Strips, while its upper end is held by a Double Bracket on the top of the $1\frac{1}{2}$ " Double Angle Strip. This Double

Bracket is linked by $1\frac{1}{2}$ " Strips to the Trunnions 5.

The unit is completed by putting Springs in such a position that the mechanism gives the highest degree of riding ease and better distribution of the weight of the motor vehicle. This is attained by bolting the Springs 4 between the Angle Girders and the $2\frac{1}{2}$ " Strips. This method gives the wheels a knee-action.

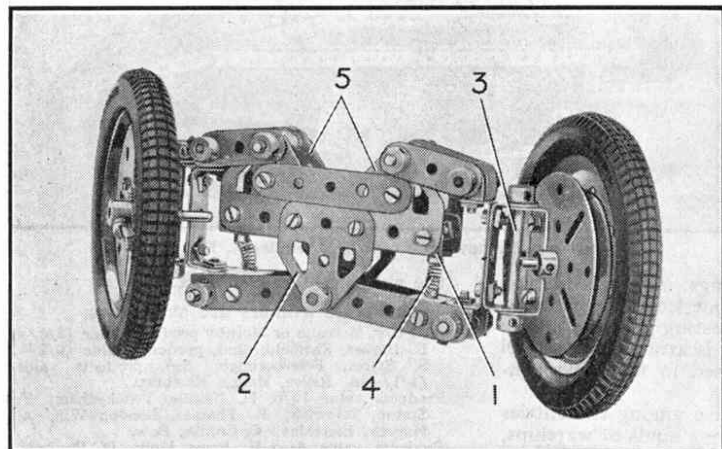


Fig. 486.

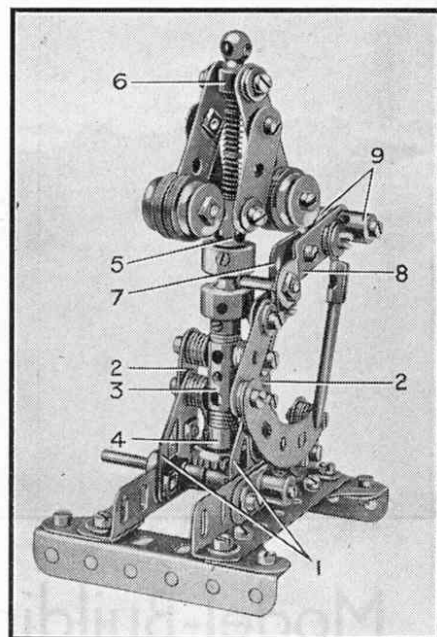


Fig. 487.

(487) Centrifugal Speed Indicator

(G. Woolfenden, Liverpool 11)

A sturdily built indicator, by means of which it is possible to determine the speed of revolving shafts and wheels, is shown in Fig. 487. It was designed by G. Woolfenden, Liverpool 11. To construct it two 3" Angle Girders are bolted at right angles to two $3\frac{1}{2}$ " Girders to form a base. Trunnions 1 carrying $1\frac{1}{2}$ " Strips 2 are bolted in the centre of each $3\frac{1}{2}$ " Girder. Each $1\frac{1}{2}$ " Strip 2 carries two $\frac{3}{8}$ " Bolts fitted with five Washers, the Bolts being screwed into a Coupling 3 that forms a bearing for a vertical 5" Rod on the lower end of which is a $\frac{3}{4}$ " Contrate Wheel. This Contrate engages a $\frac{1}{2}$ " Pinion on a 2 $\frac{1}{2}$ " Rod, which is journaled in reinforced bearings consisting of Double Arm Cranks bolted to the $3\frac{1}{2}$ " Angle Girder. The 2 $\frac{1}{2}$ " Rod forms the driving shaft. The upper end of the vertical Rod carries a Socket Coupling in which a Coupling 5 is gripped, a Compression Spring and a Handrail Coupling 6. To each side of the Handrail Coupling a 2" Strip is bolted as shown, and these carry at their lower ends weights consisting of two $\frac{1}{2}$ " loose Pulleys and about six $\frac{3}{4}$ " Discs. The Coupling 5 is connected by two $1\frac{1}{2}$ " Strips to the 2" Strips, the connections being made by means of lock-nutted bolts.

A 1" Corner Bracket 7 has a second similar part secured to it, and lock-nutted to this is a $2\frac{1}{2}$ " Strip 8 that is curved slightly and is fitted with two Threaded Bosses 9 carried on a $\frac{1}{2}$ " Bolt. A Threaded Pin in the other end hole of this Strip engages the groove of the Socket Coupling on the 5" Rod. To the other 1" Corner Bracket a $1\frac{1}{2}$ " Strip is bolted, and this in turn is extended by a $2\frac{1}{2}$ " Cranked Curved Strip arranged as shown. The indicator pointer is a 2" Rod attached by means of a Rod and Strip Connector to the $2\frac{1}{2}$ " Strip 8.

Before the device can be used for speed indication it must be fitted with a scale, which is calibrated by connecting the governor to shafts that revolve at known speeds. The positions of the pointer are then marked. The scale should be glued to the $2\frac{1}{2}$ " Cranked Curved Strip.