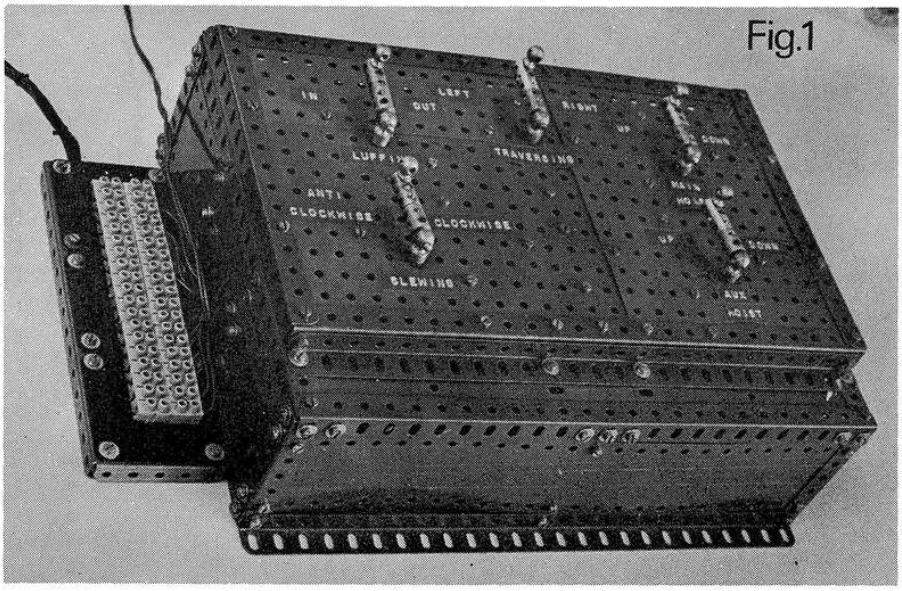


Fig.1

REMOTE CONTROL CONSOLE

* * *

A useful piece of electrical equipment – and the ultimate in reader participation!

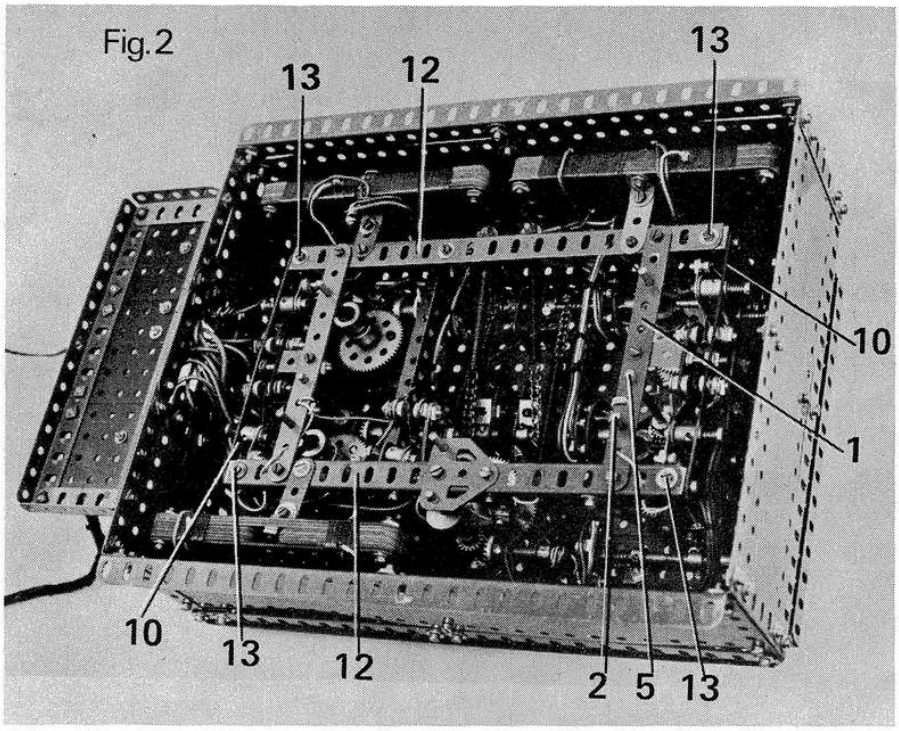


Fig.2

EVER SINCE its launch in 1973, we have made the point that the MMQ is the Meccano Modeller's *own* Magazine; *your* subscriptions pay for its production and *you* provide a lot of the featured material. Now, in this article, we take the participation theme one stage further:

As regular readers know, it is not unusual for us to print the illustrations for a model in the Magazine, but to make the written building instructions for that model available separately. We continue here along similar lines by printing the illustrations for a Remote Control Console designed and built by Mr. Colin Cohen of Cape Town, South Africa – but, instead of asking you to write to Binns Road for the necessary building instructions, we are asking you to write direct to Mr. Cohen in Cape Town. How's that for reader participation and co-operation within the international Meccano fraternity?!

In featuring the Remote Control Console, it is important to stress that the unit is not so much a Meccano model as a piece of Meccano-built electrical equipment. As such, it is perhaps more suitable as a constructional project for advanced modellers, with some knowledge of electrics, than for the electrically inexperienced. It is, however, "safe" in that it is not *(under any circumstances)* connected to the Mains, but operates from a low voltage power source such as a transformer/rectifier, a transformer alone, or batteries, depending upon individual requirements. As to a more detailed description of the Console – what it is and what it does – this is best provided by Mr. Cohen, himself:

"The unit," writes Mr. Cohen, "which may be described more as a piece of electro/mechanical equipment than a Meccano model, is made from standard parts except for the resistance wire. It provides a very convenient, simple and reliable method for operating multi-motored Cranes and similar models, and a single module may be used to propel vehicles. It is suited to both D.C. and A.C. commutator-type motors and is superior to most other controllers designed in Meccano in that each operation – on/off, reversing and speed control – is performed entirely with one lever.

"With overall dimensions of 12½" by 9½" by 4" high, the Console contains five modules as it was designed for a five-movement Crane, but the number of modules is quite immaterial. Rotating the handles either clockwise or anti-clockwise operates an "on" and "off" and reversing switch and, at the same

time, it also controls the speed in both directions. There are five resistance steps. Movement to the first step in either direction, against light spring resistance, allows for "inching", and further movement against heavier spring resistance increases the speed of the motor. The handle returns automatically to the 'off' position when released.

"All five modules operate in exactly the same manner and are entirely independent of each other. Thus only one is described in the separately-available building instructions. A section of the instructions is devoted to adjustments to the unit which are tricky and critical, but time and patience spent on this will reward the constructor with a degree of reliability that will make operating a pleasure for him. So far, the Console has directed my Crane through several exhibitions, two of a week's duration each, and has also been operated by non-meccanomen, including children"

The building instructions to which Mr. Cohen refers are lengthy and, unfortunately, we do not have sufficient space at our disposal to include them here. However, Mr. Cohen has kindly offered to make copies of his own instructions available upon request, therefore interested readers wishing to obtain a copy should contact Mr. Colin Cohen at 3 Bellair Road, Vredehoek, Cape Town 8001, South Africa, enclosing the equivalent of R2.50 for surface mail postage or R4.00 for air mail postage. (Please note that these figures are quoted in Rands – not Pounds!)

In passing on this offer we ask readers to remember that Mr. Cohen is an 'ordinary' (no offence!) enthusiast who does not have our facilities at his disposal. We therefore request that only readers who are genuinely interested in building the Console apply for the instructions – otherwise. Mr. Cohen will soon regret his generosity!

Although Mr. Cohen did not specifically request it, incidentally, we suggest from our own experience that conversion of the necessary remittance to South African currency should be arranged by the person applying for the instructions, before sending away for them. Most banks level pretty hefty charges for processing cheques payable in a currency different to that applicable in the Country in which the cheque is being cashed, and it would be unfair to expect Mr. Cohen to stand these charges. (We find International Money Orders ideal for making payment).

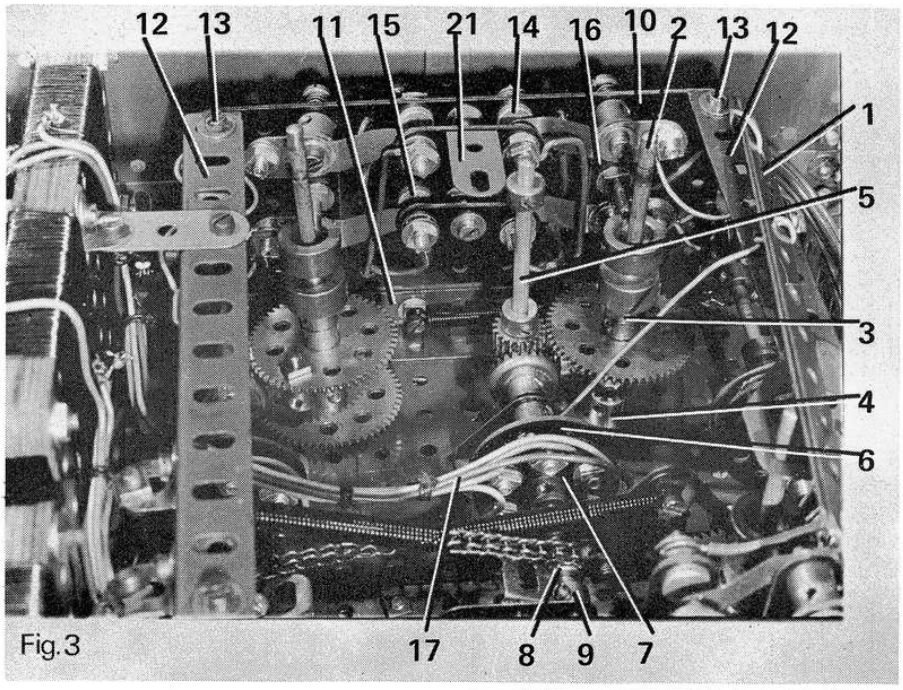


Fig. 3

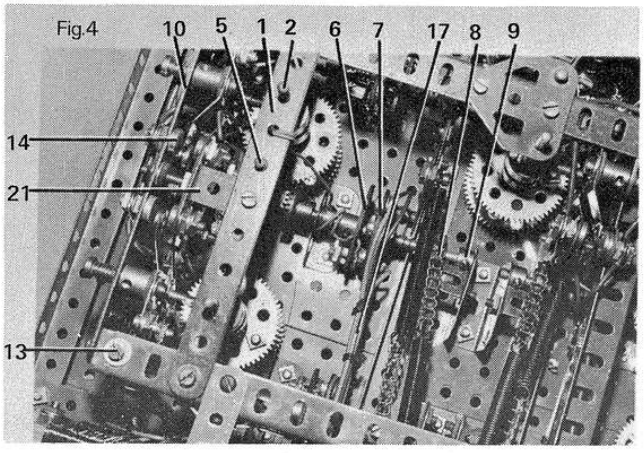
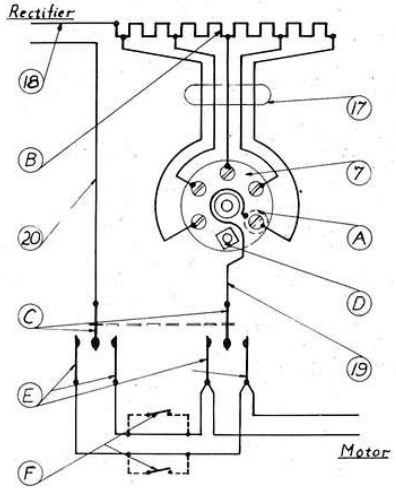


Fig. 3, above, shows the on/off and reversing contacts of the Remote Control Console, as well as the gearing for two of the controls. Fig. 4, right, shows another view of the switches, including the resistance tapping selector shaft. General views of the Console, from above and below, appear on the opposite page.

Fig. 5



In fig. 5, left, A = Contact Stud on Bush Wheel G; B = Resistance; C = Moving Contacts; D = Threaded Pin; E = Fixed Contacts; F = Limit Switches.

In Fig. 6, below, the gears are shown in the "OFF" position. One gear is shown with solid lines, the other with broken lines.

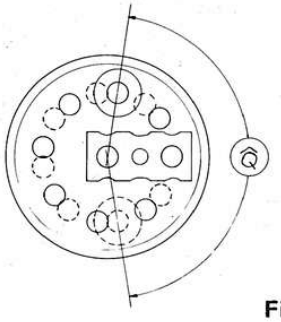


Fig. 6

REMOTE CONTROL CONSOLE

by Colin Cohen

It is important to stress that the Remote Control Console is not so much a Meccano model as a piece of Meccano-built electrical equipment. As such, it is perhaps more suitable as a constructional project for advanced modellers, with some knowledge of electrics, than for the electrically inexperienced. It is, however, 'safe' in that it is not (under any circumstances) connected to the Mains, but operates from a low voltage power source such as a transformer/rectifier, a transformer alone, or batteries, depending upon individual requirements.

The unit is made from standard parts except for the resistance wire. It provides a very convenient, simple and reliable method for operating multi-motored cranes and similar models, and a single module may be used to propel vehicles. It is suited to both D.C. and A.C. commutator-type motors and is superior to most other controllers designed in Meccano in that each operation - on/off, reversing and speed control - is performed entirely with one lever.

With overall dimensions of 12½" by 9½" by 4" high, the Console contains five modules, as it was designed for a five movement crane; but the number of modules is quite immaterial. Rotating the handles either clockwise or anti-clockwise operates an 'on' and 'off' and reversing switch and, at the same time, it also controls the speed in both directions. There are five resistance steps. Movement to the first step in either direction, against light spring resistance, allows for 'inching'; and further movement against heavier spring resistance increases the speed of the motor. The handle returns automatically to the 'off' position when released.

All five modules operate in exactly the same manner and are entirely independent of each other. Thus only one is described in these building instructions. A section of the instructions is devoted to adjustments to the unit which are tricky and critical, but time and patience spent on this will reward the constructor with a degree of reliability that will make operating a pleasure for him. The Console has directed a crane through several exhibitions, two of a week's duration each, and has also been operated by non-Meccanomen, including children.

BUILDING INSTRUCTIONS

GENERAL

USES

For starting and stopping electric motors which are designed to run in either direction, and for controlling their speed. The unit is suitable for both A.C. and D.C. motors and provides a very convenient, simple and reliable method for operating cranes, excavators, etc., where a separate motor is provided for each movement.

GENERAL DESCRIPTION

Fig.1 shows a grouping of five controls built into a console 12½" x 9½" x 4". By rotating the handle either to the left or to the right, five step speed control can be obtained in either direction of the motor. The handle springs back automatically to the 'off' position when released.

CONNECTIONS TO THE MODEL

The wires from the model should be brought out together and tied into a loom. It is a good idea to provide two or three spare wires in the loom in case of a wire breaking.

It may not be convenient to leave the Console coupled permanently to the model, especially if the latter is very large and has to be moved around. As may be seen in Fig. 1 the wires come out of the left hand side of the console and terminate on a strip of 5 amp. connectors which is fixed to an Insulating Plate with 6 BA or 1/8" screws. The connectors are obtainable at any electrical shop, and the screws at hardware shops. The loom terminates in a second set of connectors, identical to the first, and each connector holds the shank of a nail, the head having been cut off. This then plugs into the fixed strip of connectors, and the screws of the latter are tightened onto the nails.

INTERNAL ARRANGEMENTS

Fig. 2 shows the internal workings. This particular Console was designed to control a crane with five movements. (The prototype was featured in 'Meccano Magazine', September 1960, page 438.) It thus has five controls, all functioning in exactly the same manner, although the construction of the centrally situated control

(traversing) varies slightly, the fixed contacts being mounted on an Angle Girder instead of an Insulating Plate. The resistance tapping selector shaft is also somewhat longer.

There are five sets of resistances altogether, four extending along one side on two sets of 5½" x 2½" Insulating Plates, and the fifth on its own on the other side, on one set of Insulating Plates, the latter resistance being divided into two sections connected in parallel. The reason for this is that it controls two 6-speed Power Drive Units simultaneously for traversing, and thus has to be of heavier section as it carries more current than the others. The other resistances control one Power Drive Unit each.

It is therefore apparent that the Console is designed to suit a particular case, and thus there is no point in giving a Bolt by Bolt description of it. Meccanomen will in any case find plenty of scope for improvement. These instructions will therefore describe the construction and adjustment for one unit only. 'Open Correspondence' OC146 in 'Meccanoman's Journal' No.21, October 1970, Page 596, and articles on electricity and motors in various issues, should lead to a clearer understanding of the remote control of motors.

CONSTRUCTION

(Note:- Perforated Strip 1 in Figs. 2 and 4 has been removed in Fig. 3, and may be seen lying on the extreme right hand side.)

MECHANICAL

A 4" Axle Rod 2 (Figs. 3 and 4) is supported in one of the Flat Plates forming the top of the Console, and in the Perforated Strip 1. A Handrail Coupling fitted to the Axle Rod carries the Control Handle (Fig. 1), whilst the components on the inside of the Console consist of a Washer and Collar against the Flat Plate, followed in order by a 1½" Gear Wheel, its boss facing away from the Collar; a Coupling, the Axle Rod passing through a cross-bore at one end (Fig. 6); two Washers; a second 1½" Gear Wheel, boss facing in the same direction as the first; a Collar 3 and a Socket Coupling with a further Collar in one end to secure it to the Axle Rod. The Gear Wheels only must be free to rotate on the Axle Rod.

Each Gear Wheel carries one Rod Socket or Threaded Boss; one of these may be seen at 4. The spacing between the Gears should now be such that upon rotating them, the Threaded Bosses will not strike one another, but will both contact the Coupling.

Meshing with each Gear is a ½" Pinion mounted freely on a common 3½" Axle Rod 5, and these in turn mesh with one 3/4" Contrate Wheel carried on at least a 3" Axle rod. (Axle Rod 5 of the left hand unit (Fig. 3) is hidden under the Angle Girder frame). The 1½" Gears will thus rotate in opposite directions. Note at this stage that when the Operating Handle is turned either to the left or to the right, the Coupling, by pushing against one of the Threaded Bosses, causes the Gears, and hence the Contrate Wheel, to rotate always in the same direction. Careful adjustment of the Trunnion is necessary to prevent the Coupling from striking the teeth of the Contrate Wheel.

The Resistance Tapping Selector Shaft on which the Contrate Wheel is mounted, carries between journals (Fig. 4) a Collar and Insulating Bush Wheel 6, in one of the holes of which is fitted a Contact Stud, a 6-hole Insulating Bush Wheel 7 fitted with five 7/32" Bolts (Contact Screws may also work, but sufficient were not on hand at time of construction) and a Threaded Pin (Fig. 5), a Compression Spring and finally two Collars 8 and 9. The sole function of the Threaded Pin is to prevent the Bush Wheel from rotating as it must be loose on the Axle Rod. On this particular Console the Threaded Pin is located in a hole in the Angle Girder hidden partially by the Tension Spring. The standard Grub Screw in Collar 9 is replaced by a 7/32" Grub Screw or a Set Screw, and the adjacent journal supports a ½" X ½" Angle Bracket arranged so that the Screw strikes against it. One end of a Tension Spring is anchored to the framework of the Console, whilst the other end is attached via a short length of Sprocket Chain (not less than 8 links) to Collar 8. If it is not desired to distort a link to enable it to fit over the Bolt shank screwed into Collar 8, Meccano Cord may be used, but this frays after a time and may well choose to break at the most awkward moment. Collar 8 also adjusts the pressure on the Compression spring.

REVERSING SWITCH

The fixed and moving contacts of the Reversing Switch are supported on a 5½" x 2½" Insulating Plate 10. The Plate 10 does not overlap Angle Girder 11 (Fig. 3), but butts against its edge and is attached by means of a Flat Girder. The distance between Plate 10 and Strip 1 has to be adjustable within small limits, however, and this is effected by attaching the Plate to Angle Girder 12 by means of ½" x ½" Angle Brackets, Bolt 13 passing through the elongated hole of the Angle Bracket (Fig. 2). Angle Girders 12 are braced to Flat Plates 10 by means of Perforated Strips and Angle Brackets, not seen in any of the illustrations.

Four fixed Contacts are required. Two are attached directly to Plate 10, one is seen at 14, and the other is two holes lower down in a similar position to 15 of the left hand unit (Fig. 3). The other two fixed Contacts must be mounted opposite the first two. On this particular unit they were supported on separate 1½" Insulating Strips, but there is no reason why they should not be on a common Strip positioned vertically and attached to the Plate by means of a 3/4" bolt and Nuts. The distance between the contact faces should be about quarter of an inch, though this is very approximate for the moment.

The next stage is the construction of the moving Contacts. 1½" Insulating Strip 16 carries a Threaded Pin in its centre hole (the Washer under the shoulder is not essential) and a 1" Radius Wiper Arm and Fishplate in each of its outer holes, the Wiper arm and Fishplate being in metallic (electrical) contact with one another. Each Bolt securing the Wiper Arms is screwed tightly into a Threaded Boss, and thus no Nuts are used. The Wiper Arms will have to be shaped as in Fig. 4, though the final adjustment comes later.

A Pivot Bolt with a Compression Spring under its head is screwed into each Threaded Boss so as to attach the assembly to Plate 10. The tip of the Threaded Pin should protrude about 1/32" into the slot of the Socket Coupling, though this will also be adjusted later.

RESISTANCE

DETERMINING THE LENGTH OF THE RESISTANCE WIRE

For the 6-speed Power Drive Unit running on 10 - 12 volts, proceed as follows:-

Taking three or four yards of insulated resistance wire of about two ohms per yard, scrape off one inch of the insulation at one end with knife or sandpaper, or burn it off with a match and sandpaper clean afterwards, and connect this to one terminal of the battery or rectifier. Connect one wire of the Motor to the other terminal of the battery. Remove the insulation from the free end of the resistance wire and hold it to the other wire of the Motor. The resistance should now be in series with the Motor. The Motor, which of course should be set to drive the Model, will probably not run, meaning that the resistance wire is too long. The wire should now be shortened by about a foot at a time, and later shorter amounts, till the Motor is running at a suitable minimum speed. This will then be the length of the resistance wire required.

Note: i) The Motor must be capable of starting under full load in either direction with this maximum resistance in the circuit.

ii) As each Motor will probably be loaded differently, it will be best to measure out a resistance for each individual Motor rather than make them all the same value.

MAKING UP THE RESISTANCE

Fold the resistance wire in half and then in half again. There should now be two ends and three intermediate folds. Remove the insulation from each of these folds and twist up the folds for about half an inch so that they will stand out when wound around the former.

The former consists of two Insulating Plates spaced apart about half an inch by Insulating Strips, and the wire is wound tightly around this. As the wire is insulated, it does not matter if adjacent turns touch each other. There should now be five points to connect to the corresponding five Bolts on the Bush Wheel 7.

WIRING CONNECTIONS

The resistance tappings are connected in consecutive order to the above mentioned Bolts by loom 17 (Figs. 4 and 5), but the wire 18 for the battery connection is not attached at this stage. The connecting wires 17 may be twisted around the resistance wire, but preferably either soldered or secured with the type of connector referred to earlier (under the heading 'Connections to the Model').

A very flexible stranded wire 19 is connected to the Contact Stud on Bush Wheel 6, wound around the boss and Collar two or three times, and is then connected to a Fishplate attached to one of the Wiper Arms. The other Wiper Arm is connected, by means of its Fishplate and the same type of flexible wire 20, to the battery.

The fixed contacts are interconnected as in Fig. 5 as well as to the Motor. Limit switches may, if desired, be inserted as shown dotted. In this case of course, the interconnecting wires must be extended to the limit switches on the Model.

SETTING UP AND ADJUSTING

SWITCHING (ON/OFF & REVERSING) CONTACTS

When the handle is rotated, the Socket Coupling will push the Threaded Pin to one side and out of the slot, thereby causing the Wiper Arms to make contact with one set of Contact Studs. Further rotation will cause the Threaded Pin to slide on the outer face of the Socket Coupling, so maintaining the switch closed in one direction. The contacts must remain closed as the Socket Coupling is rotated back towards the 'off' position, and only when the Threaded Pin actually re-enters the slot must the contacts open.

Rotation of the Socket Coupling in the opposite direction must cause the Wiper Arms to close to the other Contact Studs in exactly the same manner. The height of the Socket Coupling must be adjusted so that the path of travel of the Threaded Pin lies between the tapped hole and the outer edge, because the Socket Coupling will rotate through an angle of about 130^{o} in each direction.

If the Threaded Pin does not slide, but catches on the surface of the Socket Coupling and lifts when the latter is rotated back to the 'off' position, thereby causing the contacts to open prematurely and possibly close in the reverse direction, then the tip of the Threaded Pin must be moved further into the slot of the Socket Coupling. this adjustment is done at the nearest Bolt 13 in the slotted hole of the Angle Bracket. The trouble may also be due to the Plate 10 flexing, and the Plate must thus be supported very rigidly - note the 1" x ½" Angle Bracket 21 fitted for this purpose.

A certain amount of adjustment may also be made by screwing out the Pivot Bolts a few turns, thus reducing the Compression Spring pressure, but sufficient pressure must be maintained in order to return the switch positively to the 'off' position.

RESISTANCE CONTROL

Rotate Bush Wheel 6 so that the Contact Stud on it makes contact with one of the Bolts adjacent to the Threaded Pin on Bush Wheel 7. Collar 9 is then set so that by means of the Screw in it striking against the Angle Bracket, the Contact Stud cannot move any further towards the Threaded Pin. The Tension Spring causes the assembly to return to this position when rotated away so that the Stud may make contact with the other resistance tappings. The Sprocket Chain winds itself around Collar 8, and at this stage see to it that the Bolt in the Collar does not push against the far end of the Chain. The pressure

set up by the Compression spring must not be too great, otherwise it will impair the smooth operation of the Tapping Selector Shaft. If necessary file the heads of the Bolts into a slightly rounded form (or use old or latest type dome head Bolts) so that the Stud will pass easily from one to the other. Here again Contact Screws may be more suitable, or five Contact Studs may be fitted to Bush Wheel 7 and one Contact Screw to Bush Wheel 6 instead of the Stud.

In the position now retained by the Compression Spring, all the resistance must be in as shown in Fig. 5, and by rotating the Shaft, resistance will be cut out till the Contact Stud reaches the Bolt on the other side of the Threaded Pin. It is to the end of the resistance wired to this latter Bolt that wire 18 is connected.

The 1½" Gear Wheels must be set so that the Threaded Bosses are arranged in the positions as indicated in Fig. 6, with the Coupling IN BETWEEN. In this position all the resistance must be in, i.e. the Screw in Collar 9 must be stopped up against the Angle Bracket. In this position too, the Socket Coupling must hold the switch in the 'off' position, the moving contacts being situated centrally between the fixed contacts.

Rotation of Rod 2 will now cause the Coupling to move towards one of the Threaded Bosses, but before actually making contact, the on/off switch must close in one direction, thereby causing the Motor to start running at minimum speed. The Threaded Pin must not yet have entirely left the slot of the Socket Coupling, and thus upon releasing the handle, the controller will return to the 'off' position under the action of the Compression Springs on the Pivot Bolts. For positive contact, and to prevent arc-ing and burning, the Wiper Arms should be seen to bend slightly, thereby setting up pressure, and the contact point will also slide across the face of the Stud.

Further rotation of Rod 2 must rotate Bush Wheel 6 against the heavier spring tension, thus cutting out resistance. If the Bush Wheel is now found to rotate in the wrong direction, then reverse the positions of the Gear Wheels.

When all the resistance has been cut out, further rotation of the handle must be stopped, otherwise Bush Wheel 6 will rotate too far, causing the Contact Stud to strike the Threaded Pin. This stop comes about very conveniently by the fact that the Gear Wheel which is not being driven by the Coupling rotates in the opposite direction, and

the Threaded Boss on it meets the Coupling around the back and thus prevents further movement. The angle through which Rod 2 rotates is thus limited and within this limit the contacts have first to close, being followed by the Contact Stud moving to the other four resistance tappings.

If the last resistance tapping is not reached, then rotate Bush Wheel 6 on the Axle Rod so that it does reach the appropriate Bolt. If now the Contact Stud does not return to the first Bolt, then this means that the Gear wheels are not rotating through a large enough angle. This is adjusted by loosening the Contrate Gear, being careful not to unmesh it from the Pinions, and rotating it so as to reduce the angle Q. This may now result in the Coupling striking the Threaded Bosses before the switch contacts have closed. To rectify this now, the distance between the faces of the fixed Contact Studs should be reduced so as to reduce the travel of the Wiper Arms. It is important that in the 'off' position the Wiper Arms must be exactly central between the fixed Contacts.

The Tension Spring must be adjusted so as to return the entire unit back to the inching position, from where the Compression Springs on the Pivot Bolts can take over. Thus if the handle be released in any position, it will automatically return to the 'off' position.

Adjustments are tricky and critical and require a great deal of patience, but the reliability and ease of operation that can be obtained to make a Model a pleasure to operate will be well worth the time spent on careful adjustment.

LUBRICATION

The Gears and pinions should each receive a drop of oil to enable them to rotate easily on the Axle Rods. An electrical lubricant such as 'Evolube' should be placed sparingly on all electrical contacts and may also be used to lubricate the Threaded Pin where it slides against the Socket Coupling, if grease or 'Vaseline' is not available. Never use grease or oil on the contacts as the arc-ing will cause it to burn and this will eventually damage the contacts, thereby rendering the unit unreliable.

APPENDIX A

RESISTANCE WIRE

Resistance Wire is obtainable from good radio and electronic equipment shops and is packed on reels from a few ounces upwards. It

should be insulated so that spacing between turns is not necessary.

If the current passing through the wire is too great, then it will heat up, but wire of about 2 ohms/yard (22 S.W.G. 80/20% Nickel Chrome Wire) is suitable for the Power Drive Unit and will probably do for the Emebo Motor. E15R and E20R Motors draw considerably more current (see 'Meccanoman's Journal' No.31 pages 897 - 899) and this wire will heat up if wound into a compact coil. Thus either a longer length of heavier gauge and thus lower resistance will be required, e.g. gauge 16; or several lengths of gauge 22 can be connected in parallel, but this reduces the resistance and hence a longer length will be necessary to give the desired resistance. For example, using wire of 2 ohms/yard to give a total resistance of 6 ohms, three yards of a single strand will be necessary. Two three yard lengths in parallel however will only provide a resistance of 3 ohms, and therefore 12 yards will be necessary to give a 6 ohm resistance. Similarly, 3 wires in parallel will require 27 yards to give 6 ohms. This paralleling method thus calls for an enormous amount of space and wire, and if the wire does heat up excessively, it will be better to buy a heavier gauge wire.

Instead of purchasing this special resistance wire, there is no reason from an electrical point of view why an old oven or heater element may not be used, this being placed in a suitable container on the floor. The wires 17 must then be extended out of the Console. In this case it will not matter if the resistance wire heats up. Referring then to the section headed 'Resistance', connect one end of the element to the battery or rectifier, and a wire from the Motor can then be moved along the element till a position is found to give a suitable minimum speed. The resistance wire between these two points is then subdivided into four equal parts, giving three intermediate points for the other tappngs.

APPENDIX B:

SECURING THE COMPONENTS TO AXLE ROD 2

To prevent slipping, the Handrail and ordinary Coupling should be attached very securely to Axle Rod 2. Special pointed Grub Screws can be used which dig into the Rod, but concave faced, toughened Grub Screws are obtainable at engineering supply firms, and these are stronger than the Meccano version. Ask for 5/32" Whitworth Screws. Alternatively, 'flats' may be filed on the Axle Rod onto which the Screws will grip. In this case the Handrail Coupling should be reversed so that its rounded head fits onto Rod 2.