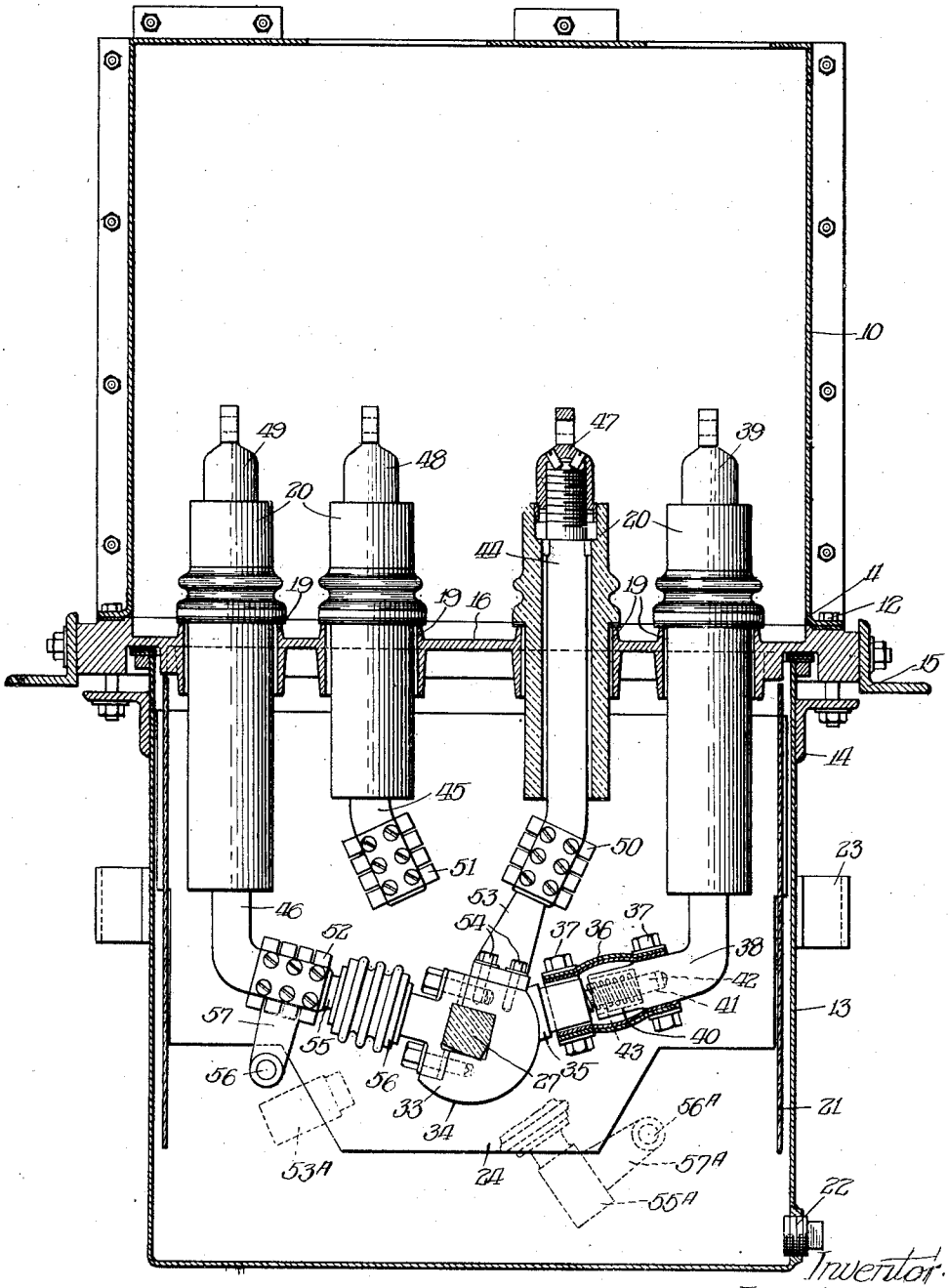
Nov. 24, 1931. J. RAH 1,833,176

SWITCH

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Fig. 1.



Inventor.
Joseph Rah,
By Wilkinson, Huxley, Byron & Knight
Attys

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Fig. 3.

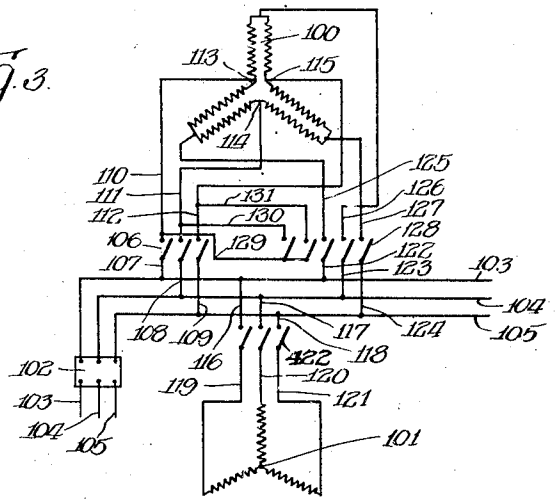
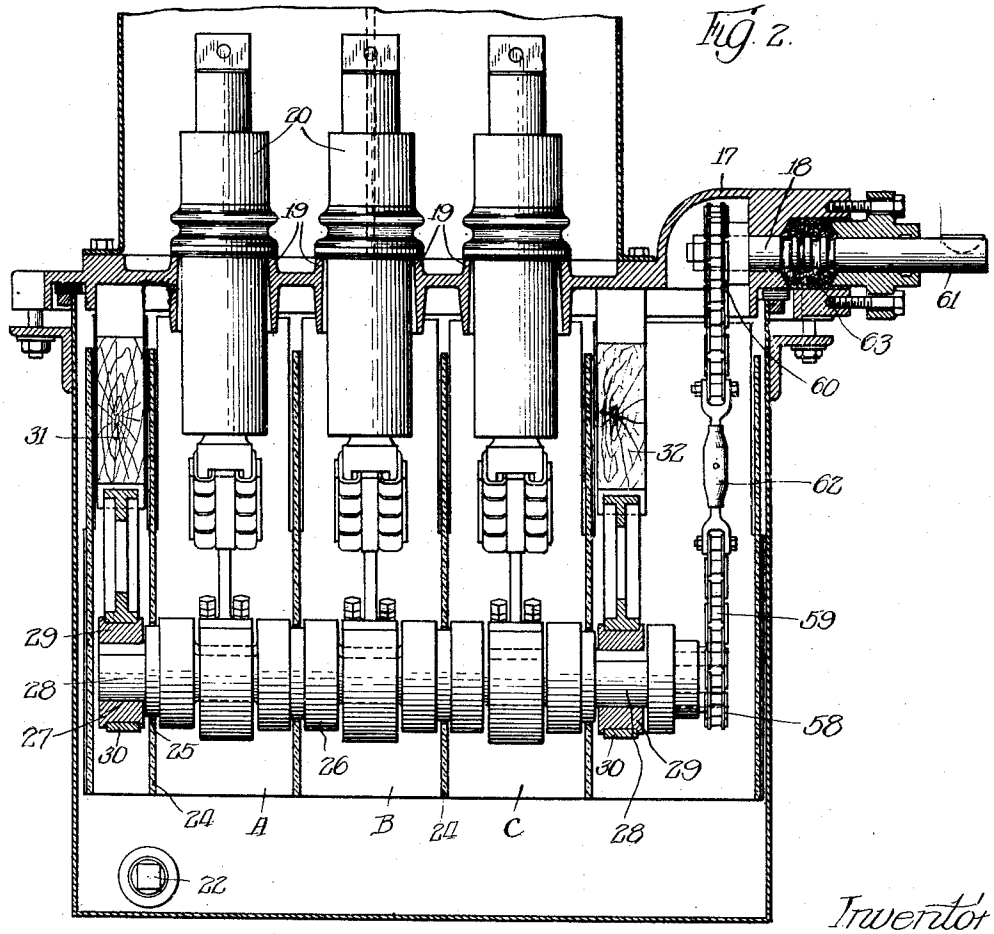


Fig. 2.



Inventor
Joseph Rah
By Atkinson, Hurley, Byron & Knight
Attys

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SWITCH

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Fig. 4.

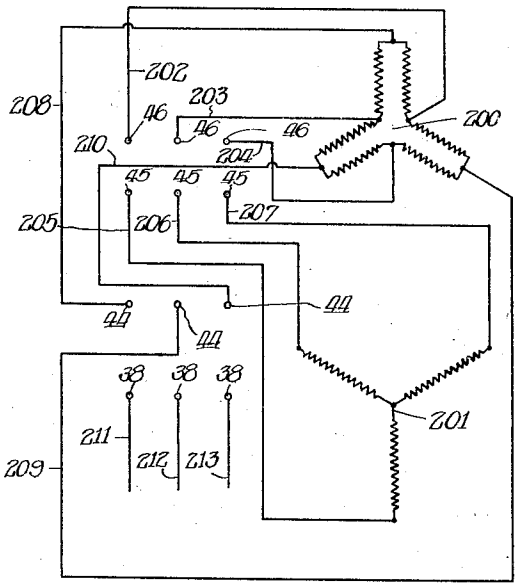


Fig. 6.

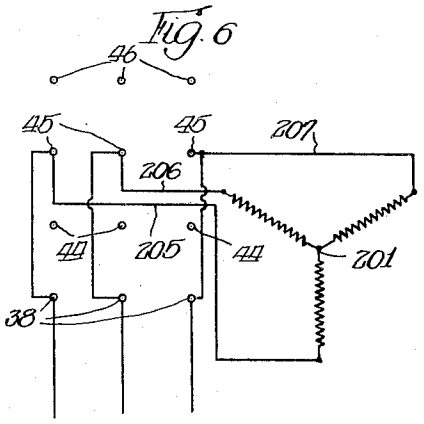


Fig. 5.

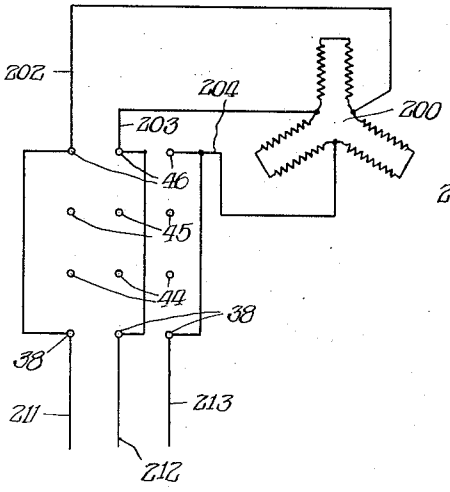
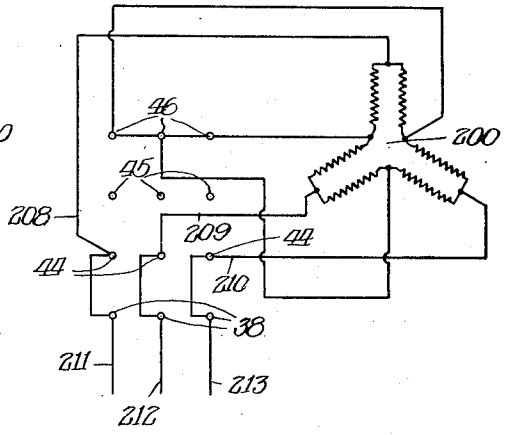


Fig. 7.



Inventor:
Joseph Rah,
By Wilkinson, Huxley, Byron & Knight
Attys.

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UNITED STATES PATENT OFFICE

JOSEPH RAH, OF CHICAGO, ILLINOIS, ASSIGNOR TO G. & W. ELECTRIC SPECIALTY COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS

SWITCH

Application filed May 16, 1928. Serial No. 278,066.

This invention pertains to switches and switch systems, and more particularly to three-speed oil switches and systems for progressive and successive connection.

It is the usual practice in systems of distribution, especially in those for controlling the speed or performance of a two-winding three-speed induction motor, to provide elaborate multiple connection means, such as interconnected switches operable at a number of points in sequence to effect the change in operation required in the system. This, it will be appreciated, is not entirely satisfactory due to the cost of installation and the cost of the elaborate connections between the switches, and also due to the fact that such switches must be successively operated, there is the danger of effecting wrong and conflicting connections, with the attendant danger of damage to the system, to the operator and the expense of repair or replacement.

It is therefore an object of this invention to provide a switch for progressive and successive connection use.

Another object is to provide a switch which may be operated from a single point for effecting progressive and successive use.

Still another object is to provide a switch for use with a two-winding three-speed induction motor.

A further object is to provide a simple, effective, efficient and inexpensive switch which will fulfill all requirements of manufacture and service.

Still further object is to provide a system of distribution for effecting connections from a single source.

With these and various other objects in view, the invention may consist of certain novel features of construction and operation as will be more fully described and particularly pointed out in the specification, drawings and claims appended hereto.

In the drawings, which illustrate an embodiment of the device and wherein like reference characters are used to designate like parts—

Figure 1 is a front elevational view through one phase of the switch, showing the parts in high or third speed position;

Figure 2 is a fragmentary sectional side elevation of the switch shown in Figure 1;

Figure 3 is a schematic diagram of connections for two-winding three-speed induction motor, showing the same in off position;

Figure 4 is a schematic diagram of a connection embodying the device illustrated in Figures 1 and 2 for a two-winding three-speed induction motor, showing the same in off position;

Figure 5 is a schematic diagram of a connection embodying the device illustrated in Figures 1 and 2 for a two-winding three-speed induction motor, showing the same in first speed position;

Figure 6 is a schematic diagram of a connection embodying the device illustrated in Figures 1 and 2 for a two-winding three-speed induction motor, showing the same in second speed position, and

Figure 7 is a schematic diagram of a connection embodying the device illustrated in Figures 1 and 2 for a two-winding three-speed induction motor, showing the same in high speed position.

Referring first of all to the switch illustrated in Figures 1 and 2, consisting essentially of an upper housing 10 preferably made in a plurality of parts connected by any convenient means, as bolts, the same being provided with a lower flange 11 for the reception of securing means, such as the bolts 12, securing the tank or insulation container 13 thereto, the same being provided with any means such as brackets 14 for the reception of the bolts 12. Any convenient supporting means, such as a bracket 15, may be provided for supporting the device in convenient position on a frame or other support (not shown).

Interposed between the top and the tank is a supporting member 16, provided with an external housing 17 for supporting operating mechanism 18, to be later described. The member 16 is also provided with a suitable number of bosses 19 for supporting insulating bushings 20. Tank 13 may be provided with an insulating lining 21 on each side of said tank, it being understood that the tank is provided with the usual drain or fill plug 22 and handles 23. Any number of insulat-

ing partitions 24 may be provided in the tank, said partitions extending to a point adjacent the bottom of said tank but disposed to provide sufficient clearance for the operation of the switch members, said partitions being apertured as at 25 for the reception of partition centering members 26 formed on the shaft 27, which shaft is preferably made of any suitable insulating material. The shaft may be conveniently rounded at its ends 28 and disposed in bearings 29 and 30, said bearings being secured to and carried by the member 16 through members 31 and 32 made of suitable material, such as wood impregnated with an insulating substance such as oil, paraffin or the like. In the embodiment of the device shown, it will be seen that three phases—A, B and C—are illustrated, but as the cooperating parts of each of said phases are alike, it is thought that it is sufficient to describe only one of said phases.

Shaft 27 is provided with a switch member 33 which takes the form of a contact ring provided with an arcuate portion 34 adapted to have contacting relation with a contact brush 35. Brush 35 is flexibly connected through members 36 and 37 (preferably braided wire and bolt connections) to the incoming connector 38, said connector being disposed in an insulating bushing 20 and connected to a cable lug 39 for the convenient reception of the incoming cable lead. The end of connector 38 adjacent one end of the brush 35 is apertured as at 40 and 41 for the reception of brush pilot or guide 42, a spring 43 being provided in recess 40 disposed between brush 35 and the end of connector 38 normally urging the brush toward the contact ring 33. The bushings 20 adjacent the incoming connector supporting bushings are provided with connectors 44, 45 and 46, suitably placed with respect to the switch member, each being provided with contact lugs 47, 48 and 49 and each connector being preferably provided with spring clips 50, 51 and 52, respectively, adapted to progressively cooperate with switch fingers of the switch mechanism. Switch blade 53 is connected for electrical connection with the switch member 33 through any suitable means, such as the bolts 54, and the switch member is also provided with a blade 55 carried by an insulating support 56, in turn connected as by bolts to the switch member 33. The blades 55 in each of the phases are electrically connected through a rod 56 connected to each blade through a depending finger 57 provided on each blade.

It will be noticed that the insulating barriers 24 are so disposed with respect to the rods 56 that they permit a limited rotation or oscillation of the switch blades from the position illustrated by the full lines in Figure 1 to the positions illustrated in the dotted lines 53^a and 55^a illustrated in said Figure 1.

Shaft 27 is provided with a sprocket and chain connection 58 and 59 to sprocket 60 carried by a jack shaft or operating shaft 61 adapted for the reception of suitable key or operating tool. The chain 59 is kept in tight operative relation with respect to the sprockets through turn buckles 62. Jack shaft 61 may be of any suitable construction and carried by the bearing or stuffing box 63 of any suitable or preferred construction.

Referring now to Figure 3, a plurality of windings 100 and 101 of a three-speed induction motor is shown, the same being connected so as to form delta and star connections, respectively. In this embodiment, an oil circuit breaker 102 is interposed in the conductors 103, 104 and 105 for the control of current to be introduced to the windings 100 and 101. Conductors 103, 104 and 105 are electrically connected to a switch 106 through conductors 107, 108 and 109, said switch forming a connection between the last mentioned conductors and conductors 110, 111 and 112, said last named conductors being in turn electrically connected to the mid or neutral points 113', 114 and 115 of the winding 101. Conductors 103, 104 and 105 are also connected to conductors 116, 117 and 118, in turn electrically connected to conductors 119, 120 and 121 through switch 422, said last named conductors being in turn electrically connected to respective ends of the star winding 101. Conductors 103, 104 and 105 are also connected through conductors 122, 123 and 124 with conductors 125, 126 and 127 through three of the poles of a five-pole single throw switch 128, the remaining two poles of said switch being electrically connected through conductor 129 with conductor 110 and forming an electrical connection through conductors 130 and 131 with conductors 111 and 112 respectively. Conductors 125, 126 and 127 are each connected to the ends of the winding 100.

Referring now to Figures 4 to 7 inclusive, 200 and 201 show the windings corresponding to windings 100 and 101 of Figure 3. Connectors 46, corresponding to connectors 46 in Figures 1 and 2, are connected through conductors 202, 203 and 204 to the mid points of winding 200, corresponding substantially to the connections of conductors 110, 111 and 112 in Figure 3. Connectors 45 are connected through conductors 205, 206 and 207 with the ends of the winding 201 corresponding substantially to the connections of conductors 119, 120 and 121 of Figure 3. Connectors 44, corresponding to connectors 44 of Figure 1, are connected through conductors 208, 209 and 210 with the ends of winding 200, corresponding substantially to the connections of conductors 125, 126 and 127 of Figure 3. Connectors 38 are in electrical connection with the incoming conductors 211, 212 and 213, corresponding substantially to the con-

ductors 103, 104 and 105 of Figure 3. It will be noticed that Figure 4 illustrates the switch in off position, corresponding substantially to the position of the blades 53ª and 55ª of Figure 1.

It may be well to note at this point that switches 106, 422 and 128 must be suitably interlocked so that only one switch can be closed at one time. In order then to operate the motor at low or first speed, it is necessary to close switch 106, in which case the three phases, 103, 104 and 105, will be connected through conductors 107, 108 and 109, and 110, 111 and 112 to the mid points of the winding 100. To operate the motor at second speed, it is necessary to close the switch 422, switches 106 and 128 remaining or being moved to open position, in which case current will be supplied from the phases 103, 104 and 105 through conductors 119, 120 and 121 to the winding 101. Again, in order to operate the motor at third speed, it is necessary to close switch 128, switches 106 and 422 remaining open or being opened by such operation, in which case current will be supplied from phases 103, 104 and 105 through conductors 122, 123 and 124 to conductors 125, 126 and 127, in turn connected and supplying current to winding 100. At the same time, operation of switch 128 establishes connection between conductor 110 through conductor 129 to conductor 130, in turn connected to the mid point 114 of winding 100. At the same time, connection is established through conductor 129 with the conductor 131, in turn connected to conductor 112, thereby establishing connection with mid point 115 of winding 100, said point 113 being electrically connected with the conductor 110.

Referring now to Figure 5, connection may be established with winding 200 by simply operating the jack shaft 61 to move the blade 53 to establish contact between connector 38 and connector 46, thereby establishing connection between the incoming leads 211, 212 and 213 with the conductors 202, 203 and 204.

Similarly in Figure 6, operation of the jack shaft 61 to establish contact between connector 38 with connector 45 establishes connection through said connectors with conductors 205, 206 and 207, in turn connected to the winding 201 to thereby operate the motor at second speed. In order to operate the motor at third speed, it is necessary only to again operate the jack shaft to move blade 53 into an electrical connection with the connectors 44, thereby establishing connection between conductors 211, 212 and 213 with conductors 208, 209 and 210 connected to the ends of winding 200. At the same time, blades 55 are moved into connection with spring clips 52, and due to the connection through fingers 57 and rod 56 of blades 55, connectors 46 are electrically connected, and due to their connection to the mid points of the winding 200, neutral points are established in said winding to correspond to the operation of switch 128 connecting conductors 129, 130, 131, 110, 111 and 112.

It will therefore be seen that with applicant's device it is possible to make electrical connections in and for controlling a motor of the character described in order to operate said motor at variable speed.

It will, of course, be understood that this switch may be put to any number of uses where progressive or successive connections are required, and it is also to be understood that the device is not to be limited by the embodiment or use shown, which is by way of illustration and not limitation, but applicant contemplates all modifications and uses coming within the scope of the claims, the specification and the drawings appended hereto.

I claim:

1. In a device of the character described, the combination of a casing, an insulation carrying container secured thereto, a support disposed between said casing and container, barriers in said container dividing the same into phases, insulating bushings extending through said support and between said barriers, connectors carried by said bushings, a switch including members insulated from each other and in constant connection with a connector in each phase, members on said switch for selectively electrically connecting other connectors to said constantly connected connector, and means on said switch for connecting certain of said connectors in different phases.

2. In a device of the character described, the combination of a casing, an insulation carrying container secured thereto, a support disposed between said casing and container, barriers in said container dividing the same into phases, insulating bushings extending through said support and between said barriers, connectors carried by said bushings, certain of said connectors being provided with contacts in said container, a switch including members insulated from each other and in constant connection with a connector in each phase, members on said switch insulated from each other for selectively electrically connecting other connectors to said constantly connected connnector, and means on said switch insulated from the switch members for connecting certain of said connectors in different phases.

3. In a device of the character described, the combination of a casing, an insulation carrying container secured thereto, a support disposed between said casing and container, barriers disposed in said container dividing the same into phases, insulating bushings extending through said support and between said barriers, connectors carried by said bushings, certain of said connectors being provided with contacts in said container,

other of said connectors having a contact brush, a switch member disposed in said container and provided with contact rings in each phase and insulated from each other, each of said rings being in electrical contact with one of said brushes, a switch member connected to each of said rings and adapted to have selective electrical connection with said contacts in each phase, and switch members in each phase adapted for electrical connection to certain of said contacts, said members being insulated from said rings and carried thereby, said members in each phase being electrically connected to each other to thereby establish selective contact between certain of said connectors.

4. In a device of the character described, the combination of a casing, an insulation carrying container secured thereto, a support disposed between said casing and container, barriers disposed in said container dividing the same into phases, insulating bushings extending through said support and between said barriers, connectors carried by said bushings, certain of said connectors being provided with contacts in said container, other of said connectors having a contact brush normally urged from said connectors, a switch member disposed in said container and provided with contact rings in each phase and insulated from each other, each of said rings being in electrical contact with one of said brushes, a switch member connected to each of said rings and adapted to have selective electrical connection with said contacts in each phase, and switch members in each phase adapted for electrical connection to certain of said contacts, said members being insulated from said rings and being electrically connected to each other to thereby establish selective contact between certain of said connectors.

5. In a device of the character described, the combination of a casing, an insulation carrying container secured thereto, a support disposed between said casing and container, barriers disposed in said container dividing the same into phases, insulating bushings extending through said support and between said barriers, connectors carried by said bushings, certain of said connectors being provided with contacts in said container, other of said connectors having a contact brush normally urged from said connectors, an oscillatable switch member disposed in said container and provided with contact rings in each phase and insulated from each other, each of said rings being in electrical contact with one of said brushes, a switch member connected to each of said rings and adapted to have selective electrical connection with said contacts in each phase, and switch members in each phase adapted for electrical connection to certain of said contacts, said members being insulated from said rings and carried thereby, said members in each phase being electrically connected to each other to thereby establish selective contact between certain of said connectors.

Signed at Chicago, Illinois, this 2nd day of May, 1928.

JOSEPH RAH.