

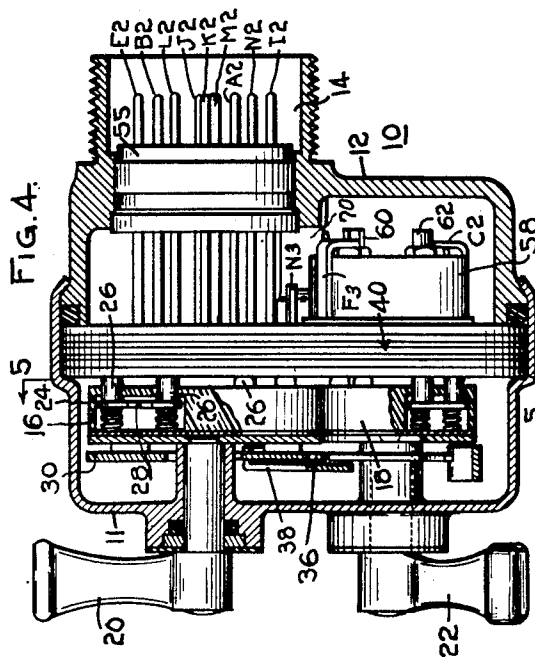
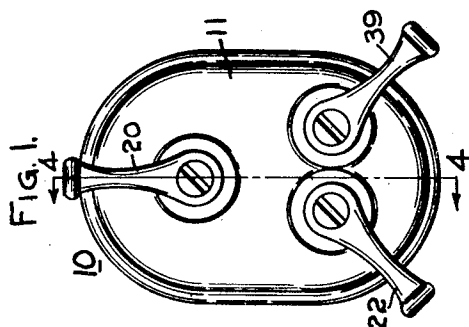
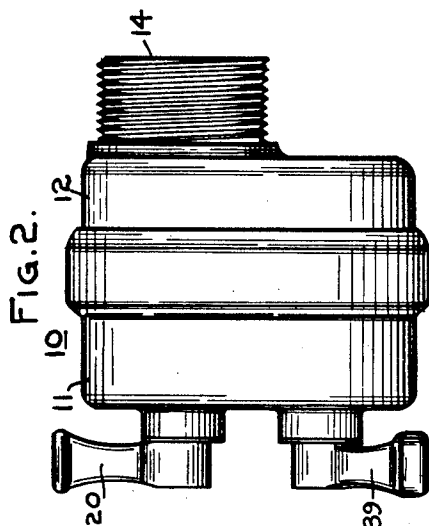
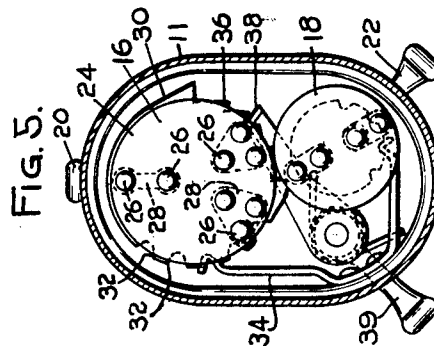
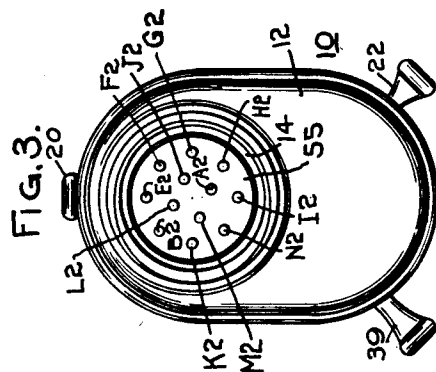
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V. R. HERTERICK
ELECTRICAL ASSEMBLY

2,644,045

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3 Sheets-Sheet 1



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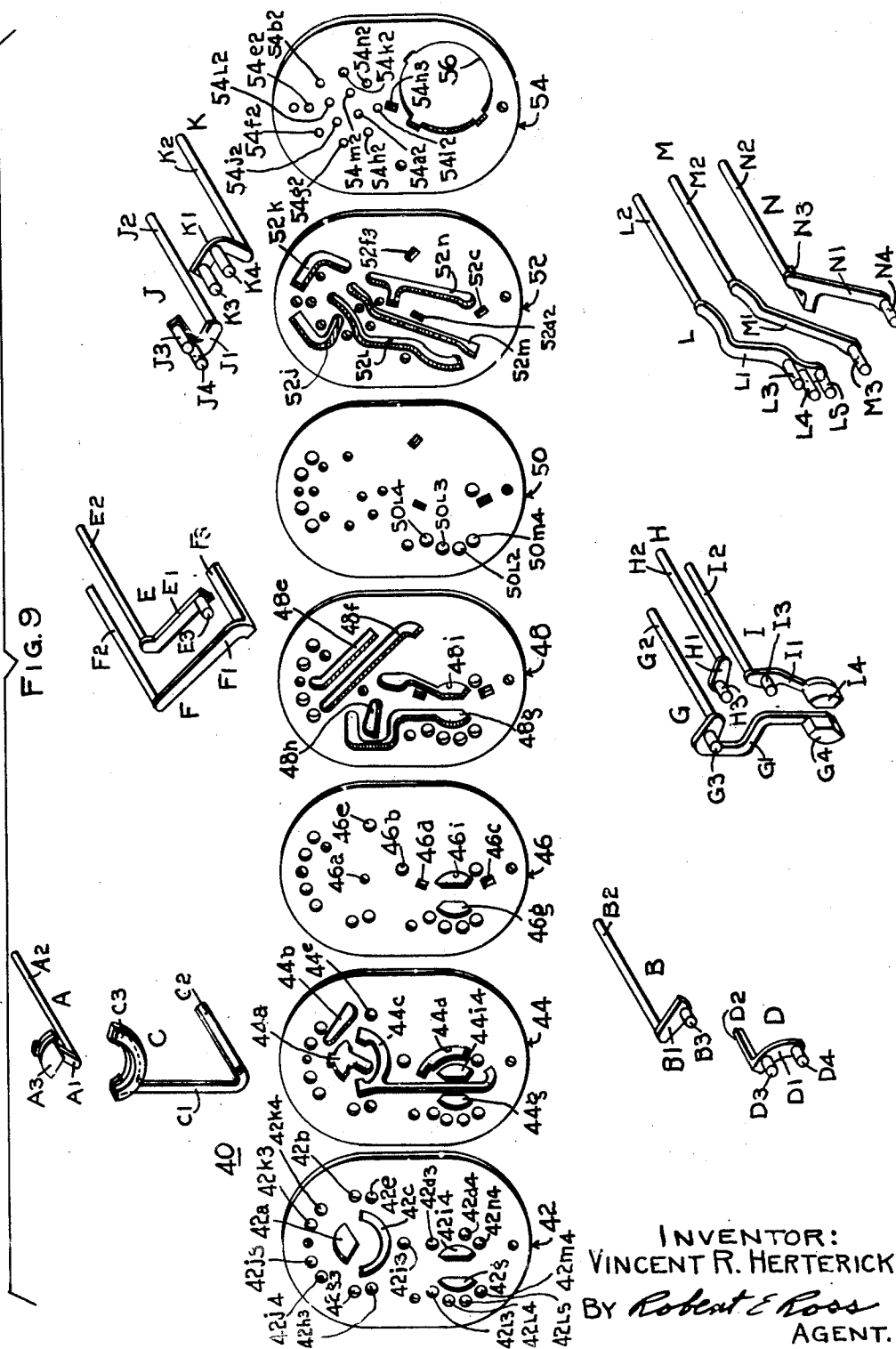
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UNITED STATES PATENT OFFICE

2,644,045

ELECTRICAL ASSEMBLY

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This invention relates generally to electrical assemblies, and has particular reference to circuit continuing member such as an electrical switch or the like.

In certain types of electrical switches, where a great many different circuits are to be controlled, it is customary to provide a housing having one or more circuit-completing rotors disposed therein which are operable from outside the housing, and a contact plate disposed opposite the rotors having a plurality of contact members disposed thereon for electrical contact with shorting members mounted on the rotors. Wires are commonly attached to the contacts on the plate and extend rearwardly therefrom to a rear opening in the housing. When the switch is required to complete a great many circuits in various combinations, as is the case, for example, in the master lighting switch in a military vehicle such as a truck or a tank, a great many wires are required to be assembled onto the plate, which necessitates a relatively large housing. Such an assembly also is relatively expensive, due to the cost of labor involved in assembling the wires thereon, and if the device is to carry large amounts of current, there is always the danger that the heat generated thereby will damage the insulation on the wiring and cause short circuits to develop between the wires, which are usually crowded closely together. Since the wires extending from the rear of the housing must be arranged in a predetermined manner to fit into a mating connector which has the connections to the various circuits disposed thereon in a predetermined arrangement, it is easily possible for errors to occur in wiring the switch.

The object of the invention is to provide an electrical switch assembly in which no internal wiring is required.

A further object of the invention is to provide an electrical switch in which the internal portions thereof are so designed that it is possible to assemble the switch only with the various circuit-completing members disposed in the proper relation to one another.

A still further object of the invention is to provide an electrical assembly providing a plurality of electrical paths from one end of the assembly to the other so that the position of the paths relative to each other is changed in passing through the assembly, having a stacked series of insulating plates to support a plurality of rigid conductor bars, in which some plates are provided with elongated transverse openings to receive transverse portions of said conductor bars.

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In the drawing:

Fig. 1 is a view in front elevation of a switch embodying the features of the invention;

Fig. 2 is a view in side elevation of the switch of Fig. 1;

Fig. 3 is a view in elevation of the rear of the switch of Fig. 1;

Fig. 4 is a view in section taken on line 4—4 of Fig. 1;

Fig. 5 is a view in section taken on line 5—5 of Fig. 4;

Fig. 6 is an exploded view of the connector stack and the rear portion of the housing;

Fig. 7 is a view in elevation of the rear of the stack illustrated in Fig. 6;

Fig. 8 is a front plan view of the connector stack, with the relative position of the rotor contacts superimposed thereon to show the relative arrangements of the connector stack contacts and the rotor contacts; and

Fig. 9 is an exploded view of the component parts of the connector stack.

Referring to the drawing, there is illustrated a switch assembly 10, which comprises generally a housing having a front portion 11 and a rear portion 12 with a rear opening 14, and circuit-completing means assembled in the housing which comprises a pair of contact rotors 16 and 18 which are operable from outside the housing by suitable levers 20 and 22.

The rotor 16 comprises an insulating support 24 having a plurality of contact members 26 assembled thereon. Certain of said contact members may be joined at the rear portion by shorting plates 28, so that said contact members may complete electrical circuits in a manner to appear hereinafter. A metallic support plate 30 is disposed on the rear of the support 24 and is provided with suitable peripheral notches 32 for engagement with a spring arm 34, to stop the rotation of the rotor in various predetermined positions. If a lock mechanism is desired on the rotor, the periphery may also be provided with suitable ratchet teeth 36 for engagement with a pawl 38. The pawl 38 may be operated by a lever 39 on the outside of the housing, and the pawl and teeth may be so arranged that the rotor 16 may not be operated until the lever 39 is moved to disengage the pawl. The rotor 18 is generally similar in construction to the rotor 16, with the exception that the contact members have a different arrangement to suit the requirements of the individual switch.

To conduct the electrical circuits from the rear opening 14 to the rotors, a circuit-contin-

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ing assembly 40 is provided in the housing adjacent the rotors, which comprises a series of stacked insulating plates with a plurality of conductor bars assembled therewith (see Figs. 6 through 9). In the illustrated embodiment, there is provided a front or contact surface plate 42, template plates 44, 48 and 52, spacer plates 46 and 50 disposed between adjacent template plates, and a rear plate 54. The conductor bars are designated by letters A through N, and are formed of relatively rigid material so as to be adapted for the assembly operation to be described hereinafter. A typical connector bar comprises a medial portion having a thickness substantially equal to the thickness of the template plate, with one or more front contact members disposed thereon in spaced relation which extend generally at right angles to the medial portion for electrical contact with the rotor contacts, and a rear connector member also disposed on the medial portion for extending toward the rear of the housing when assembled. For example, connector bar A comprises a medial portion A1, a front contact surface A3 disposed at one end thereof, and a rear connector A2 disposed at the other end and extending in the opposite direction. As a further example, conductor bar L comprises a medial portion L1, a rearwardly extending connector L2, and three forwardly extending contacts L3, L4, and L5. The portions of the other bars have similar designations. In each case the medial portion of a conductor bar is indicated by the designating letter of the bar of which it is a part, followed by the number 1, such as A1, B1, C1, and so forth. In each case the letter of the bar followed by the number 2 indicates a rearwardly extending connector, such as A2, B2, C2, and so forth. With two exceptions, the letter of the bar followed by the number 3, 4, or 5 indicates a forwardly extending contact, such as A3, D4, and L5. The two exceptions are F3 and N3, which indicate a second rearwardly extending connector on the bars F and N respectively.

The template plates are provided with elongated openings of various shapes, each of which conforms to the shape of the medial portion of a particular conductor bar. For example, template 44 is provided with an opening 44a to receive conductor bar A, opening 44b to receive conductor bar B, and so on. Each plate is necessarily provided with other openings, some of which, for purposes of simplifying the drawing, have not been numbered. The function of these other openings will become apparent hereinafter.

To assemble the stack, the front face plate 42 is placed on a suitable work space with the rotor contact side down, and the template 44 is superimposed in aligned relation thereon. Connector bars A, B, C, and D are then assembled into the template 44. Connector A is assembled into opening 44a in plate 44 so that the medial portion thereof is disposed in the opening, and the front contact portion A3 protrudes therefrom into an opening 42a provided in the front plate, and the rear connector A2 extends upwardly in a generally perpendicular direction to the plate 44. Connector B is assembled in a similar manner, so that the medial portion B1 is disposed in opening 44b, and the front contact member B3 extending through a suitably positioned opening 42b in the front plate 42. After connectors C and D have been assembled in like manner into their respective openings in the plate 44, the

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upper surface thereof presents a smooth uninterrupted surface except for the rear connector portions extending upwardly therefrom.

The insulating spacer plate 46 may then be superimposed onto the plate 44, and for this purpose is provided with a group of openings 46a, 46b, 46c and 46d, which are appropriately spaced thereon to allow the assembled rear connector portions to pass therethrough. The spacer 46 is also provided with suitable openings for receiving front contacts of conductor bars to be later assembled, to allow them to pass therethrough into the front plate.

Template plate 48 is then assembled in the same manner as the spacer 46, and is also provided with suitable openings having a spacing corresponding to those in the spacer to receive the rear connector portions of the four conductor bars previously assembled. Template 48 is also provided with five elongated slots, to receive the medial portions of conductor bars E, F, G, H, and I.

This second group of conductor bars are assembled in the manner described hereinbefore. For example, the conductor bar E is assembled so that the medial portion E1 is disposed in the slot 48e, and the front contact end E3 extends through openings 46e, 44e, and 42e in the plates 46, 44 and 42 respectively. After the conductor bars of this group are assembled, the spacer 50 is assembled in a manner hereinbefore described in connection with the spacer 46. The spacer 50 is provided with suitable openings to receive the rear connector portions of the previously assembled conductor bars A through I, and also is provided with openings to receive the front contact portions of conductor bars to be assembled subsequently.

Template 52, connectors J through N, and the rear plate 54 may then be assembled in a similar manner, and the entire stack may then be fastened together with rivets or other suitable means.

After such assembly, the front connectors of the conductor bars extend into the openings in the front plate and terminate so as to be substantially flush with the surface thereof, to enable them to make electrical contact with appropriate contact members on the rotors 16 and 18. The rear connectors A2, B2, E2, F2, G2, H2, I2, J2, K2, L2, M2, and N2 protrude a substantial distance from the rear plate 54, and are so positioned in a single group thereon as to enter the rear opening 14 in the housing when the assembly 40 is assembled (see Fig. 6).

To provide rigidity to the ends of the rear connectors, an insulating member 55 may be provided in the rear opening 14, which supports and positions the rear connectors and also provides a watertight seal in the opening.

In the illustrated embodiment, the front connectors of the conductor bars are disposed in the front plate 42 so as to form two separate groups of contacts, for contact with the rotors 16 and 18. However, the configuration of the conductor bars in the stack of plates permits the rear connectors to protrude rearwardly from the stack in a single group, for entering the rear opening of the housing for engagement with a suitable junction box or connector (not shown) with said rear connectors disposed in a predetermined desired relation to each other. This feature is particularly desirable where a switch embodying the features of the invention must be designed not only for use in new construction,

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but also to replace units already in service, where the switch must mate with a junction connector having electrical circuits connected thereto which it would be inconvenient or impossible to change.

In electrical circuits passing through the switch, it is usually desirable to provide a circuit breaker, and the switch of the invention is particularly adapted for permitting the circuit breaker to be assembled inside the switch housing. For example, the rear plate 54 may be provided with a relatively large opening 56, shaped to allow a circuit breaker 58 to seat therein. The circuit breaker is provided with a pair of contacts 60 and 62 on the rear side, and in the particular switch illustrated, connection is made to the circuit breaker by the rear connector portions F3 and C2 of conductor bars F and C, which are of a suitable length to be bent over the contacts 60 and 62 and secured thereto by soldering, which also retains the circuit breaker in place. Some circuits of the switch may require that a resistor be included therein, and the present assembly is readily adapted to allow such a unit to be assembled inside the housing. For example, in the illustrated embodiment, a stack rivet 64 may be provided with a resilient portion 66 on the end thereof, to enter the bore 68 of a hollow resistor 70 for frictional engagement therewith. The resistor is provided with a pair of leads 72 and 74 which may be soldered to rear connector portions D2 and N3 of conductor bars D and N respectively, which are of such a length as to protrude beyond the rear plate 54 only far enough to permit such a connection. To assist in maintaining the resistor in position a resistor mounting post 76 may be provided on the rear wall of the housing, to enter the rear end of the resistor bore. The post 76 may conveniently be formed as an integral part of the housing, and also serves to absorb heat generated in the resistor and transmit it to the outside of the housing.

It is, of course, obvious that since the medial portions of the conductor bars are designed to allow the various connections from the front plate to be transposed laterally from one position to another in passing through the assembly, the configuration of the medial portions in the template plates must be such as to avoid the other openings therein. It will also be noted that any particular conductor bar will fit properly into only one particular elongated opening of the templates, thereby greatly simplifying the assembly operation. It is also impossible to assemble the switch with the template plates in the wrong order, since in such a case the correct number of openings in adjacent plates for the front contacts and rear connectors will not be provided.

Hence, it is impossible to assemble any portion of the switch improperly, and this feature provides a major advantage over prior types of switches which use flexible wires to make the connections from the rear of the switch to the contact plate.

The illustrated device shows a particular embodiment of the features of the invention, however the teachings of the invention may be applied to other electrical devices, such as connectors, plugs, and the like. In such a case, where it is desired to rearrange the relative position of the circuits passing therethrough, or to combine various circuits in a predetermined manner, a stack of insulating template plates and spacer

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plates with conductor bars assembled therewith generally in the manner illustrated may be used, and the conductor bars may either terminate so as to be flush with each end of the stack for contact with rotors at each end, or may be provided with either male or female connectors at either end, depending on the application in which it is to be used.

Although the illustrated device is provided with a plurality of template plates, in switches in which the circuit arrangement is not so complicated, it may be possible to accomplish the circuit rearrangement in a single template.

Since certain other obvious modifications may be made in the device without departing from the scope of the invention, it is intended that all matter contained herein be interpreted in an illustrative and not in a limiting sense.

I claim:

1. An electrical assembly comprising a series of stacked support plates and a series of conductor members assembled therewith to provide a series of electrical paths from one end of the assembly to the other such that the position of the paths in relation to each other is changed in passing through the assembly, said assembly having end plates with openings suitably positioned to receive ends of said conductor members and maintain them in a different predetermined position relative to each other at the opposite ends of the assembly, and an intervening plate having a series of elongated slots disposed therein, said conductor members having ends disposed in said openings in said end plates, and intermediate transversely extending portions disposed in said slots in the intervening plate and joining said end portions.

2. An electrical assembly comprising a series of stacked support plates and a series of rigid conductor bars assembled therewith to provide a series of electrical paths from one end of the assembly to the other, said assembly having end plates with openings to receive ends of said conductor bars, and an intervening insulating template plate having suitably positioned elongated slots, each slot extending generally from a position opposite an opening in one end plate to a position opposite an opening in the other end plate which is out of alignment with the opening in said one plate, said conductor bars having ends disposed out of alignment with each other and extending into appropriate openings in said end plates, and intermediate portions connecting said ends which are disposed in said slots in the intervening plate.

3. An electrical connector assembly comprising insulating support means and a series of conductor members assembled therewith to provide a series of electrical paths from one end of the support to the other such that the position of the paths in relation to each other is changed in passing through the support, said support having openings at each end positioned to receive ends of said conductor members and maintain them in a different predetermined position relative to each other at the opposite ends of the support, said support having internal apertures extending angularly in relation to the plane of the ends and connecting to appropriate openings in opposite ends of the support, said conductor members having ends disposed in said openings in the opposite ends of the support, and intermediate portions extending through said apertures joining said ends.

4. An electrical assembly, comprising a series

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of stacked support plates and a series of rigid conductor bars assembled therewith to provide a series of electrical paths from one end of the assembly to the other such that the position of the paths in relation to each other is changed in passing through the assembly, said assembly having end plates with openings to receive ends of said conductor bars, a series of intermediate template plates having elongated slots disposed therein, and insulating spacer plates disposed between said template plates, said conductor bars having medial portions disposed in an elongated slot of a template plate, and connector portions extending from spaced points on said medial portion toward opposite ends of the stack and extending through aligned openings in any intervening template plates and insulating spacer plates into the openings in said end plates.

5. An electrical assembly comprising a stack of insulating plates comprising end plates, template plates disposed therebetween, and insulating spacer plates disposed between adjacent template plates, said template plates having elongated apertures of various shapes disposed therein, said plates having aligned openings disposed therethrough to connect to said elongated apertures at predetermined positions, and a series of conductor bars assembled with said plates, said bars having flat elongated medial portions disposed in and conforming to the shape of said various apertures in the template plates, and having connector portions extending from appropriate points thereon through said aligned openings into an exposed position at the end of the stack.

6. An electrical assembly, comprising a series of stacked support plates and a series of rigid conductor bars assembled therewith to provide a series of electrical paths from one end of the assembly to the other, said assembly having end plates, intermediate template plates, and spacer plates disposed between adjacent template plates, one of said end plates having at least two groups of openings disposed therein to receive ends of said conductor bars so that said ends are grouped to make electrical contact with a corresponding number of circuit-completing means, the other end plate having only a single group of openings disposed therein, said template plates each having a series of elongated slots disposed therein, the plates intervening between any template plate and each end plate having openings aligned with an opening in an end plate and an appropriate point on one of said slots, said conductor bars having flat medial portions disposed in and generally corresponding to the shape of said slots, and connector portions extending from appropriate points on said medial portion through said aligned openings into the openings in said end plates, whereby electrical paths are provided through said assembly from said plurality of groups at one end to said single group at the other end with said paths being disposed in a different predetermined relation to each other at each end.

7. An electrical assembly as set forth in claim 1 in which the ends of said conductor bars are substantially flush with the surface of one end plate, and protrude a substantial distance from the end plate at the other end of the assembly.

8. An electrical assembly as set forth in claim 6, in which the connector portions of said conductor bars are substantially flush with the end plate of the assembly having at least two groups of openings, and protrude a substantial distance

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from the end plate at the other end of the assembly having only a single group of openings.

9. An electrical assembly, comprising a series of stacked insulating plates, said series comprising a front plate having a series of openings disposed therein, template plates disposed behind said front plate, and spacer plates disposed between adjacent template plates, each template plate having a series of elongated slots disposed therein which extend generally between predetermined positions thereon, intervening plates between any template plate and said front plate having openings therethrough aligned with appropriate openings in the front plate and appropriate points on said elongated slots, and a series of conductor bars assembled with said plates, said conductor bars having medial portions disposed in said slots in said template plates, and connector portions extending therefrom through said aligned openings into appropriate openings in said front plate.

10. An electrical assembly, comprising a series of stacked insulating plates, and a series of relatively rigid conductor bars assembled therewith to provide a series of electrical paths from one end of the assembly to the other such that the position of the paths relative to each other is changed in passing through the assembly, said assembly having end plates with openings to receive ends of said conductor bars and maintain them in different predetermined positions relative to each other at each end of the assembly, template plates disposed between said end plates having elongated slots disposed therein which extend generally between points thereon which are opposite the position of two or more openings in the end plates, spacer plates disposed between adjacent template plates, said conductor bars having medial portions disposed in and conforming generally to the shape of said elongated slots, and a first series of connector members extending from the medial portions toward one of said end plates, said connector members passing through suitably spaced aligned openings in any intervening plates and extending into appropriate openings in said one end plate, and terminating so as to be substantially flush with the surface thereof, and a second series of the connector members extending from the medial portions into the other end plate and protruding a substantial distance therebeyond.

11. An electric switch assembly, comprising a housing, a circuit-completing means disposed at one end of the housing which is operable from outside the housing, and a connector assembly disposed in the housing adjacent the circuit-completing means, said connector assembly comprising a series of stacked insulating plates and a series of relatively rigid conductor bars assembled therewith, said stack of plates comprising a face plate and a rear plate having suitable openings disposed in predetermined positions to receive ends of said connector bars, and at least one template plate disposed between said face plate and said rear plate, said template plate having elongated slots disposed therein which extend generally between points thereon opposite non-aligned openings in said front plate and said end plate between which it is desired to provide an electrical path, said conductor bars having flat medial portions disposed in and conforming to the shape of said elongated slots, connector members extending from appropriate points thereon into said openings in the face plate and terminating in ends which are substantially

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flush with the front surface thereof for electrical contact with the circuit-completing means, and other connectors extending from said medial portions rearwardly into the openings in said rear plate.

12. An electric switch assembly, comprising a housing, a rotatable circuit completing member disposed in the housing and operable from outside the housing having circuit-completing contact members disposed therein, and a connector assembly disposed in the housing adjacent the circuit-completing means, said connector assembly comprising a series of stacked insulating plates and a series of relatively rigid conductor bars assembled therewith, said stack of plates comprising a face plate and a rear plate, a series of template plates disposed therebetween, and spacer plates disposed between the template plates, said face plate and said rear plate having openings therein to receive ends of said conductor bars, said template plates having series of elongated slots disposed therein which extend generally between points thereon oppo-

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site predetermined openings in the front and rear plates between which it is desired to provide an electrical path, said conductor bars having flat medial portions disposed in and conforming generally to the shape of said slots, and connector portions extending therefrom through suitably spaced and aligned openings in any intervening plates into the connector openings in the front plate to terminate in ends which are substantially flush with the front face thereof, and other connectors extending from other points on said medial portions rearwardly through aligned openings in any intervening plates into said openings in the rear plate.

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