July 1, 1958 M. A. TABET 2,841,660

ROTARY SWITCH WITH REMOVABLE UNITS

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Fig. 1.

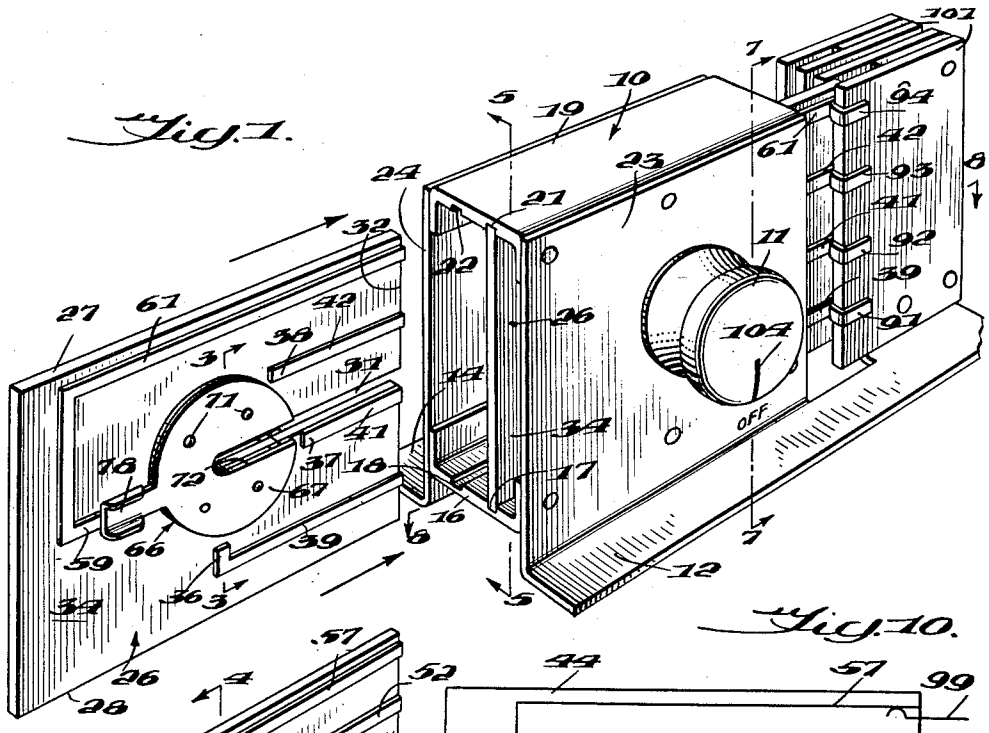


Fig. 10.

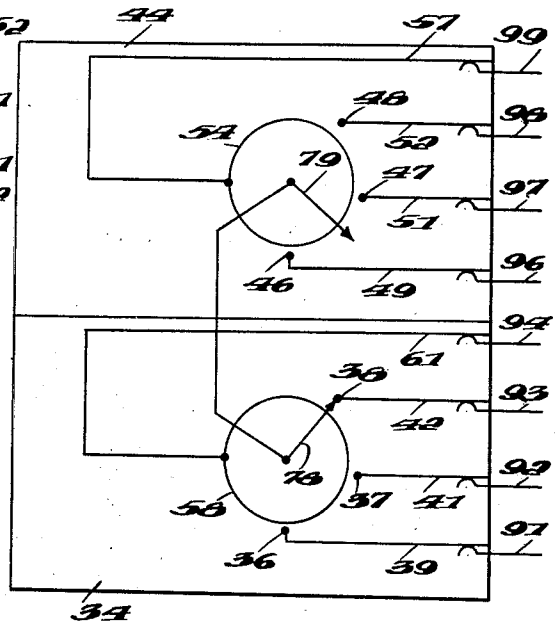


Fig. 2.

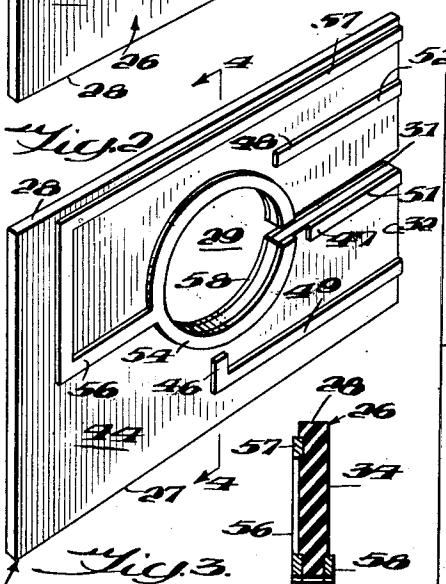


Fig. 3.

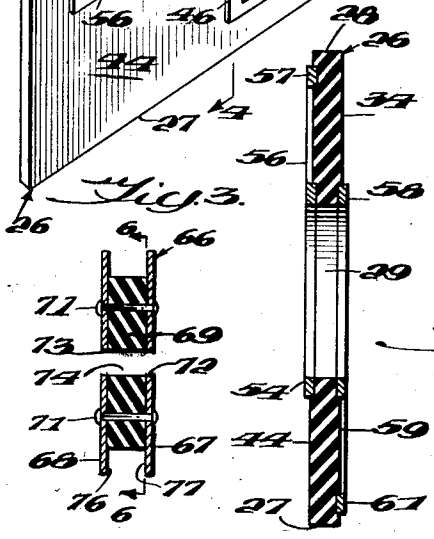


Fig. 4.

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Fig. 5.

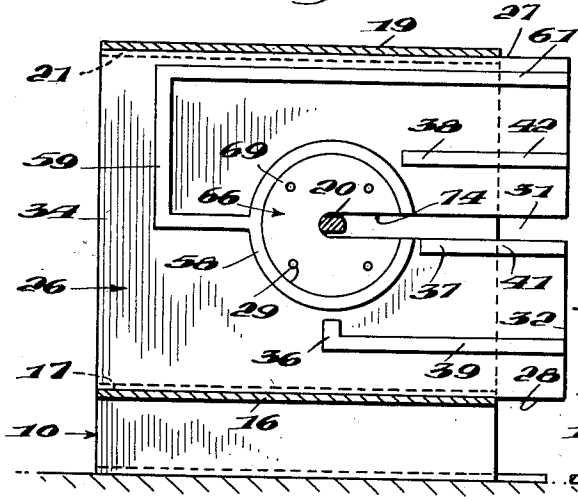


Fig. 7.

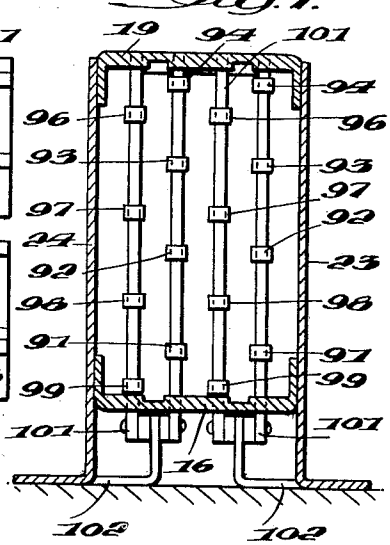


Fig. 8.

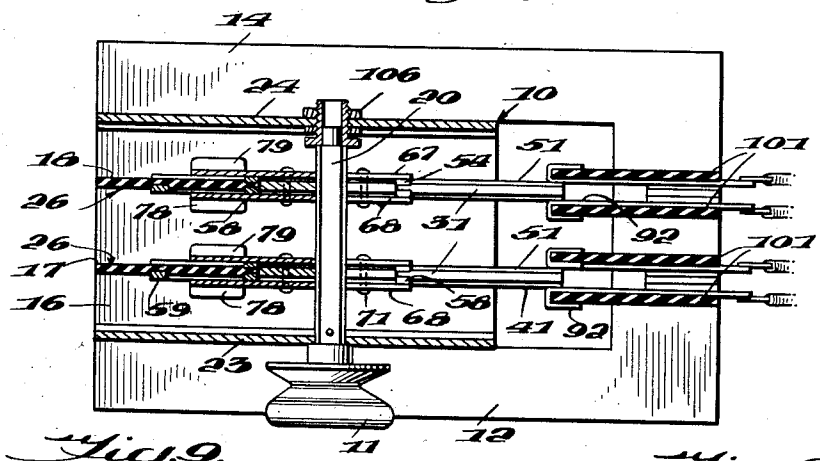


Fig. 9.

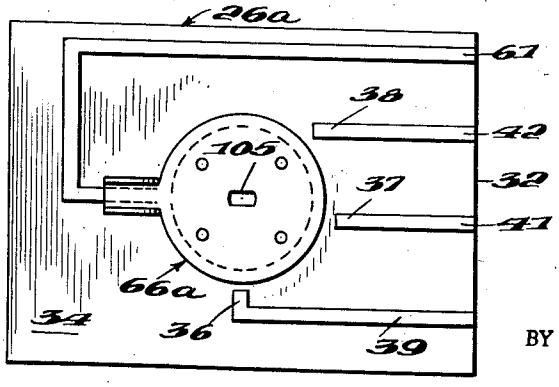
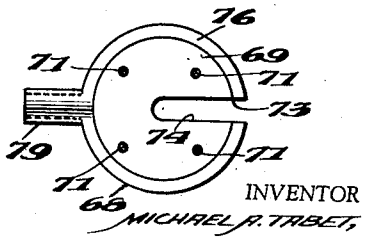


Fig. 6.



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2,841,660

ROTARY SWITCH WITH REMOVABLE UNITS

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Application April 11, 1956, Serial No. 577,533

16 Claims. (Cl. 200—14)

The present invention relates to an electrical switch assembly wherein a swingable arm is adapted to individually engage each contact of a group arranged in circular outline and circumferentially spaced from each other and the invention pertains to the construction and mounting of an insulating plate or wafer carrying such contacts so that it may be removed from the association with the other parts of the switch assembly and from circuit making engagement with terminals for the switch.

The prior art includes rotary type switches wherein a large number of contacts are arranged in circular outline and carried by an insulating wafer with a rotary arm adapted to engage each of the contacts as a shaft is rotated. Such switch structures often include a plurality of wafers assembled in stacked or juxtaposed relationship and the rotary arms of all of the wafers are rotated in unison. Such switch structures have the disadvantage that when there is a mechanical or electrical failure in any one of the assembled wafers the entire switch must be dismantled in order to remove and replace the defective unit. It is accordingly an object of the present invention to provide a switch structure wherein each wafer unit may be removed from association with the switch assembly and from the circuit making engagement with terminals of the switch so that any one of the wafers and the contact making elements thereon may be readily replaced.

Another object of the invention is to provide a plurality of adjacent wafer or panel type of switch units which may be operated by a shaft common to all of the units with the panels carrying contacts for the switch being mounted for sliding movement with respect to the supporting structure of the switch and the terminal contacts therefor so that any of the panel units of the switch assembly may be readily withdrawn and another unit slipped into a position so as to be operated by the shaft.

A more specific object of the invention is to provide a switch structure which includes a plurality of panels or plates mounted in face-to-face relation each having a group of contacts thereon arranged in circular outline with each group adapted to be engaged by a swingable arm mounted for rotation on each panel so as to engage any one contact of one group and to provide a slot in the panel and in the rotary structure so that any panel may be withdrawn from engagement with its terminal contacts and from an operative position in relation to the operating shaft.

Other objects and features of the invention will be appreciated by those skilled in the art to which the invention pertains as the present disclosure proceeds and upon consideration of the following detailed description taken in connection with the accompanying drawings wherein several exemplary embodiments of the invention are disclosed.

In the drawings:

Fig. 1 is a perspective view of a switch assembly exhibiting the invention showing one of the plates in a removed position.

Fig. 2 is a perspective view of one of the plates in a position turned one hundred and eighty degrees from the position shown in Fig. 1 and with the rotor removed.

Fig. 3 is a sectional view of the rotor for one of the plates taken on the line 3—3 of Fig. 1.

Fig. 4 is a sectional view of a plate with the rotor removed and taken on the line 4—4 of Fig. 2.

Fig. 5 is a sectional view through the switch frame with the terminal structure removed and taken on the line 5—5 of Fig. 1.

Fig. 6 is a sectional elevation of a rotor taken on the line 6—6 of Fig. 3.

Fig. 7 is a transverse section of the frame taken on the line 7—7 of Fig. 1 and showing the terminal structure in elevation.

Fig. 8 is a sectional plan view with the plates in position and taken on the line 8—8 of Fig. 1.

Fig. 9 is a front elevation of a modified plate and rotor therefor.

Fig. 10 is a diagrammatic view showing the circuits that may be made through the contacts and conductors carried by both faces of one plate.

The invention is directed to a switch assembly including a plurality of plates or wafers each of which carries a rotary blade and each wafer or plate is so mounted in a frame that it may be removed from the frame or housing and from circuit making engagement with fixed terminal contacts. The contacts on each wafer are arranged in a circular outline and adapted to be engaged by an arm or blade of the rotor. The plates may have a group of contacts on each face thereof and a second rotary arm or blade adapted to successively engage the contacts on the second face. The plates or wafers are supported in side-by-side relationship so that each may be removed and replaced and the rotary contact making device carried by each plate are adapted to be rotated in unison. The assembly may if desired be so constructed that the wafers or plates may be withdrawn only when the rotors are in the "off" position and the wafers may be so constructed that they may be inserted in the frame in one position or when the plate is rotated through one hundred and eighty degrees.

Referring to the drawings there is shown at **10** in Figs. 1, 5 and 8 a frame which may be formed so as to provide for substantially encasing or housing other parts of the switch assembly. If the switch is to be supported so that its actuating knob **11** is to rotate about a horizontal axis the frame **10** may be provided with lateral horizontally extending flanges **12** and **14**. The frame includes a wall **16** having a plurality of longitudinally extending grooves **17** and **18** therein. These grooves are in parallel relationship and extend lengthwise of the wall **16**. Another wall **19** is provided with grooves **21** and **22** (Fig. 1) which are arranged in parallel relationship and extend lengthwise of the frame. If the switch is to be mounted so that the actuating knob **11** to turn about a horizontal axis the grooves **17** and **21** are desirably in the same vertical plane and the grooves **18** and **22** are likewise in a common vertical plane.

The frame **10** is designed to support a plurality of plates or panels **26** which are formed of insulating material. One of such plates is shown in a removed position in Fig. 1 while another is arranged within the frame **10** and removably supported therein by having is longitudinal edges accommodated in the grooves **17** and **21**. The plates **26** are desirably of rectangular shape having a straight longitudinal top edge **27** and a straight bottom edge **28** which is parallel to the top edge **27**.

The frame structure includes side walls **23** and **24** which form support for the walls **16** and **19** and also provide support for bearings for a shaft **20** actuated by the knob **11**. The side wall **24** may be spaced a greater

distance from the side wall 23 than shown in Figs. 1 and 8 and the walls 16 and 19 extended accordingly and provided with additional grooves to accommodate any suitable number of plates or wafers in a position so that they may be removed as described below.

The plates 26 are of identical construction and the electrical conductors thereon and the contacts carried by each plate including the rotary switch arm which makes selective engagement with each of the contacts are the same and a description of one will serve to disclose the character of all of the wafers or panels and the switch parts carried thereby including the conductors which extend from the contacts to make circuit engagement with terminal contacts. Each plate 26 is provided with a rather large circular opening 29 and in the embodiment illustrated in Figs. 1 to 8 a slot 31 extends lengthwise of the plate from the central opening 29 to the forward edge 32 of the plate. This slot is for the purpose of permitting the transverse shaft 20 having a generally flat cross section to escape from the plate when it is withdrawn from the position within the frame 10.

The face 34 of each plate 26 is provided with a plurality of contacts 36, 37 and 38. These contacts are arranged in circular outline about the central opening 29 and the contacts are circumferentially spaced from each other. Each plate 26 is preferably formed of plastic material having electrical insulating characteristics and also being relatively rigid. The contacts may be partially embedded in the face 34 of the plate and a conductor 39 extends from the contact 26 and terminates flush with the edge 32 of the plate. This conductor may be embedded in the plastic material forming the plate 26 and suitably anchored. A conductor 41 extends from the contact 37 and terminates flush with the edge 32. A conductor 42 extends from the contact 38 and terminates flush with the edge 32 of the plate 26.

The opposite face 44 of a plate 26 as shown in Fig. 2 is provided with a plurality of contacts 46, 47 and 48 arranged in circular outline and circumferentially spaced from each other. A conductor 49 extends from the contact 46 and terminates flush with the edge 32 of the plate. A conductor 51 extends from the contact 47 and terminates at the edge 32. A conductor 52 extends from the contact 38 and terminates flush with the edge 32. The contacts carried by the face 44 are arranged in staggered relationship to the contacts carried by the face 34.

The face 44 of each plate 26 carries a ring shaped conductor strip 54 which extends around the perimeter of the opening 29. The ends of the conductor 54 are flush with the edges of the slot 31 as shown in Fig. 2. A conductor 56 extends from the ring 54 and a portion 57 extends parallel with the edge 28 of the plate and the portion 57 terminates flush with the edge 32 of the plate or wafer. A similar ring-shaped conductive member 58 (Fig. 5) is arranged around the perimeter of the opening 29 and is carried by the face 34 of the plate 26. A conductor 59 extends from the ring 58 and this conductor includes a portion 61 which extends parallel with the edge 27 of the plate 26 and terminates flush with the edge 32. The conductor 61 is in electrical circuit relationship with the ring-shaped electrically conductor 58.

The plates 26 and the contacts carried on the opposite faces thereof as well as the conductors extending from the contacts including the ring-shaped conductors 54 and 58 and the conductors leading therefrom may be partially embedded in the plastic material forming the plates 26. These plates and the electrical conductive members may be formed by printed circuit technique. The partial embedding of these conductive members is shown in Fig. 4.

A rotor 66 is mounted for rotation on each plate 26. The rotor 66 includes two metal discs 67 and 68 having good electrical conductive characteristics and these discs have a diameter slightly greater than the diameter of the opening 29. The discs may be secured to each other in spaced relationship by providing an insulating disc 69

therebetween as shown in Fig. 3. The diameter of the disc 69 is such as to fit within the opening 29 as shown in Fig. 5. After the discs 67 and 68 are applied to opposite faces of a plate 26 and to opposite faces of the insulating disc 69 they may be rigidly secured to each other in any suitable manner such as by means of rivets 71. These rivets also provide electrical connection between the discs 67 and 68. The discs 67 and 68 are provided with slots 72 and 73 which are in radial alignment with a slot 74 formed in the disc 69. The slots 72, 73 and 74 are of the same width as the slot 31 in the plate 26. The slot structure in the rotor extends from the periphery of the discs 67 and 68 in a radial direction beyond the axis of the rotor assembly as shown in Fig. 1 so that the shaft 20 may be accommodated at the axis of the rotor structure when each plate 26 is in the position within the switch frame 10 (Fig. 5). In this position portions of the conductors carried by each face adjacent the edge 32 are in circuit engagement with terminal contacts for the switch. The peripheral portion 76 of the disc 68 is in circuit making contact with the ring-shaped contacts 54 carried by the face 44 of the plate 26. The peripheral portion 77 of the disc 67 is in engagement with the ring-shaped conductive member 58 carried by the face 34 of the plate 26.

The disc 67 carries a radially disposed blade 78 which may be formed integral with the disc 67. The blade 78 swings during turning of the rotor to engage the contacts 36, 37 and 38. During rotating movements the outer peripheral portion 77 of the disc 67 remains in engagement with the ring-shaped conductor 58. Thus a circuit may be completed between the conductor 59 and any one of the conductors 39, 41 or 42 by turning the rotor which swings the blade 78. The disc 68 carries a radially disposed arm or blade 79 which is adapted to swing over the face 44 of the plate 26. The blade 79 is adapted to engage the contacts 46, 47 and 48. The outer peripheral portion 76 of the disc 68 remains in engagement with the ring-shaped conductor 54. In view of the fact that the contacts on the face 34 of the plate 26 are circumferentially displaced from the contacts on the face 44 when the switch blade 78 is in engagement with the contact 38 the switch blade 79 is in an intermediate position between the contacts 46 and 47 as shown in Fig. 10. Further rotation of the rotor to swing the blade 78 in clockwise direction in Fig. 10 will cause the blade 79 to engage the contact 47 and the blade 78 will be in a position between the contacts 38 and 37. The blade 79 breaks engagement with each contact before the contact blade 78 moves into engagement with one of its contacts.

When the rotor 66 is turned so that the swingable blade 78 is in the position shown in Fig. 1 the blade 79 will be in a corresponding radial position and the slot in the rotor 66 will be in radial alignment with the slot 31. This represents the "off" position when the blade 78 overlies the conductor 59 which serves to complete a circuit to the rotor structure. In a similar manner the blade 79 will overlie the conductor 56. Any one of the plates with its rotor in the "off" position as shown in Fig. 5 may be withdrawn from the frame 10. The shaft 20 which is of substantially rectangular shape in cross section and which is provided for operating the rotor 66 of each of the plates is then in position so that any one of the plates and the elements carried thereon may be withdrawn from the frame. During such sliding movement of a plate the shaft 20 is accommodated in the slot structure of the rotor 66 and in the slot 31 of the plate being withdrawn.

When the plates are in a position within the frame 10 as is the case with one plate 26 shown in Fig. 1 end portions of the conductors carried by the opposite faces of the plates are in circuit making engagement with terminal contacts maintained in fixed relationship with respect

to the frame 10. The conductor 39 is in frictional engagement with a terminal contact 91. The conductor 41 is in engagement with a terminal contact 92 and the conductor 42 is in frictional engagement with a terminal 93. The conductor 61 is in engagement with a terminal contact 94. The conductor 49 carried by the opposite face of the plate 26 is in engagement with a terminal contact 96 while the conductor 51 is in engagement with a terminal contact 97. The conductor 52 is in engagement with a terminal contact 98 and the conductor 57 is in engagement with a terminal contact 99.

The terminal contacts structure as shown to the right in Fig. 1 and in Fig. 7 may be constructed in any suitable manner. In the embodiment illustrated it includes insulating strips 101 which are spaced from each other as shown in Figs. 7 and 8 sufficiently to permit the forward edge portion of each plate 26 to extend therebetween. The leaf spring type of terminal contacts are carried by the insulating strips 101 which may be supported by angle brackets 102 carried by the frame. Any suitable structure may be employed for holding the terminal contact structure in fixed relation to the frame 10 so that the conductors carried by the faces of insulating plates 26 will make circuit establishing engagement therewith when the plates are in a position within the frame.

One of the advantageous features of the present invention is that it is impossible to insert any one of the plates 26 improperly in the frame 10. The plate 26 shown at the left in Fig. 1 may be inserted in the frame in the oriented position shown by moving it to the right. The edge 27 of the plate then enters the groove 22 and the edge portion 28 enters the groove 18. The plate is guided by the grooves as it moves to the right and into the frame. When the knob 11 is in the "off" position shown in Fig. 1 the shaft 20 is so disposed that its major dimension is in the position shown in Fig. 5. Thus during movement of the plate 26 the shaft is accommodated in the slot 31 as the plate continues its movement into the frame. The slot structure in the rotor structure 66 when it is disposed in alignment with the slot 31 accommodates the shaft 20 and the plate may occupy the position with the conductors thereof engaging the terminal contacts and with the shaft 20 disposed along the axis of the rotor 66. The end portion of the conductor 61 will then engage the terminal contact 94 which may be utilized as one side of a circuit or circuits to be controlled. The plate 26 may be inverted from the position shown at the left in Fig. 1 and with the plate in the oriented position shown in Fig. 2 it may be inserted in the frame 10 when the rotor structure 66 is in the position with its slot structure aligned with the slot 31. The edge 28 of the plate 26 then enters the groove 22 and the edge 27 enters the groove 18. Under such circumstances the conductor 57 will engage the terminal contact 94 and the same side of a circuit or circuits to be controlled will again be connected to the rotor structure 66. Electrical connection is maintained between the discs 67 and 68 of the rotor through the conductive rivets 71 or the like. Accordingly it is impossible to insert any one of the plates 26 in an incorrect manner in the switch assembly.

The knob 11 is secured to the shaft 20 and serves to rotate the shaft and thereby actuate all of the rotors 66 carried by the respective plates. The knob 11 may be provided with an index 104 so that it may be readily aligned with the "off" position shown in Fig. 1.

It is not necessary to provide each of the plates 26 with a slot 31. A modified plate 26*a* is shown in Fig. 9 where the rotor 66*a* is devoid of a radial slot. In this embodiment the rotor 66*a* is provided with an opening 105 therethrough at the axis thereof which is of elongated rectangular shape in cross sectional area for accommodating the shaft 20. In this embodiment the shaft 20 and its bearing 106 (Fig. 8) is so constructed that the shaft 20

may be withdrawn from the bearing 106 and through the side wall 23. Thus any one of the plates 26*a* may be removed from the frame 10 and from circuit making engagement with the terminal contacts of the switch assembly. The shaft 20 is desirably withdrawn when the rotors 66*a* are in an "off" position as shown in Fig. 9 when the index 104 on the knob 11 will be radially opposite the "off" position.

While the invention has been shown and described in connection with specific structural characteristics of a frame and a particular type of terminal structure and one outline of conductors on the face of the insulating plates it will be appreciated that changes may be made in all of these elements as well as the overall assembly. Modifications in the details as well as the general organization may be made without departing from the spirit and scope of the invention as set forth in the appended claims.

What I claim and desire to secure by Letters Patent is:

1. An electrical switch assembly comprising, plates of insulating material arranged in face-to-face spaced relationship, a group of contacts arranged in circular outline on each plate with the contacts of each group circumferentially spaced from each other, a blade mounted for rotation on each plate, said blades being adapted to successively engage the contacts of one group during rotation thereof, conductors carried by each plate extending from the respective contacts thereon, means supporting said plates for guided movements in the plane of each plate, terminal contacts mounted in fixed relationship with respect to said supporting means engaging the conductors carried by each plate, means for actuating said blades in unison when the plates are in positions with the conductors thereon engaging said terminal contacts, and each plate having a slot for accommodating a portion of the actuating means during movement of a plate from a position engaging its terminal contacts.

2. An electrical switch assembly comprising a frame, a plate of insulating material mounted for movement on said frame, said plate having an opening therethrough and a slot extending lengthwise of the plate from said opening to one edge thereof, a group of contacts arranged in circular outline on said plate and circumferentially spaced from each other around said opening, conductors carried by the plate with one conductor extending from each contact to said edge of the plate, terminal contacts mounted in fixed relationship with respect to the frame engaging said conductors, a rotor mounted for turning movements in said opening including a blade for engaging said contacts, said rotor having an opening adjacent the axis thereof, a shaft supported for rotation on said frame and extending through said opening for turning the rotor, and said rotor having a radially disposed slot therein extending from said opening to the periphery of the rotor adapted to be aligned with the slot in said plate.

3. An electrical switch assembly comprising a frame having grooves therein, a plate of insulating material mounted for sliding movement in said grooves, said plate having an opening therethrough and a slot extending lengthwise of the plate from said opening to one edge thereof, a group of contacts arranged in circular outline on a face of said plate and circumferentially spaced from each other around said opening, conductors carried by said face of the plate extending from said contacts to said edge of the plate, terminal contacts mounted in fixed relationship with respect to the frame in alignment with said grooves for engagement by end portions of said conductors, a rotor mounted for rotating movement in said opening including a blade for engaging said contacts, said rotor having an opening at the axis thereof, said rotor having a radially disposed slot therein in communication with said opening adapted to be aligned with the slot in said plate, and a shaft mounted for rotation on said frame and extending through said opening in the rotor when the plate is in a position with end portions of the conductors engaging said terminal contacts.

4. An electrical switch assembly comprising, a frame, a plate of insulating material mounted for movement on said frame, said plate having a slot therethrough extending from one edge of the plate, conductors on said plate terminating at said edge of the plate, terminal contacts mounted in fixed relationship with respect to the frame engaging end portions of said conductors, a switch member mounted for movement on said plate for bridging any two of said conductors, means carried by said frame for actuating said switch member, and said slot accommodating a portion of said means during movement of the plate away from said terminal contacts.

5. An electrical switch assembly comprising, a frame, a plate of insulating material mounted for guided movements on said frame in the plane of said plate, said plate having a slot therethrough extending from one edge of the plates to an intermediate portion thereof, conductors carried by said plate terminating at said edge of the plate, terminal contacts mounted in fixed relationship with respect to the frame engaging end portions of said conductors, switch means mounted on said intermediate portion of the plate for bridging any two of said conductors, a shaft carried by said frame engaging and adapted to actuate said switch means when the plate is in a position with the end portions of said conductors engaging said terminal contacts, and said slot accommodating said shaft during movement of the plate away from said terminal contacts.

6. An electrical switch assembly comprising, a frame, a plurality of plates of insulating material arranged in face-to-face spaced relationship and mounted on said frame for movement with respect thereto with each plate movable in the plane thereof, each plate having a slot therethrough extending from an edge of the plate to an intermediate portion thereof, conductors carried by each plate terminating at said edge of the plate, terminal contacts mounted in fixed relationship with respect to the frame engaging end portions of the conductors carried by the respective plates, switch means mounted on the intermediate portion of each plate for bridging any two of the conductors thereon, a shaft carried by said frame engaging and adapted to actuate all of said switch means when the plates are in positions with the end portions of the conductors thereon engaging said terminal contacts, and said slot accommodating said shaft during movement of any one or all of the plates away from the terminal contacts.

7. An electrical switch assembly comprising, a frame, a plate of insulating material mounted for movement on said frame, said plate having an opening therethrough and a slot extending from said opening to one edge of the plate, circuit making and breaking means mounted for rotation on said plate within said opening with conductors extending therefrom and carried by said plate terminating at said edge of the plate, terminal contacts mounted in fixed relationship with respect to the frame engaging said conductors, an operating shaft supported for rotation on said frame engaging said circuit making and breaking means when the plate is in position with said conductors engaging said terminal contacts, and said slot accommodating said shaft during movement of the plate from a position engaging said terminal contacts.

8. An electrical switch assembly comprising, a frame having a first wall and a second wall parallel to the first wall, said first wall having a plurality of parallel grooves therein, said second wall having a plurality of parallel grooves therein aligned respectively with the grooves in the first wall, a plurality of plates of insulating material, one edge of each plate guided slidably within a groove in the first wall and a second edge of each plate slidable in an aligned groove in the second wall, each plate having an opening therethrough, conductors on each plate extending to a forward edge thereof, a plurality of groups of terminal contacts carried by said frame adjacent the forward edges of said plates with each group engaging end portions of the conductors carried by one plate, a rotor mounted within the opening in each plate for rotation with respect to the associated plate, switch blade means carried by each rotor for engaging the conductors on the associated plate, and means for actuating all of said switch blade means including a shaft detachably engaging all of said rotors whereby any one or all of said plates may be withdrawn from its terminal contacts and the frame while guided by the associated grooves.

9. An electrical switch assembly comprising, a frame including two parallel walls, a terminal structure having an elongated space therein extending substantially at right angles to said walls, each wall having a groove therein confronting the other wall with said grooves aligned with said space, contacts carried by said terminal structure spaced from each other along both sides of said space, a plate of insulating material having edge portions within said grooves with an end directed towards said terminal structure and supported for sliding movement into said space, spaced conductors carried by both faces of said plate extending to said end of the plate and adapted to respectively engage said contacts when said end of the plate enters said space, rotary switch means carried by the plate for bridging any two of said conductors, and actuating means for said switch means including a shaft in detachable engagement therewith.

10. An electrical switch assembly comprising, a frame including two parallel walls, a terminal structure having an elongated space therein extending substantially at right angles to said walls, each wall having a groove therein confronting the other wall with said grooves aligned with said space, contacts carried by terminal structure spaced from each other along said space, a plate of insulating material having edge portions within said grooves with an end directed towards said terminal structure and supported for sliding movement into said space, spaced conductors carried by a face of said plate extending to said end of the plate and adapted to respectively engage said contacts when the plate is pushed into said space, switch means carried by the plate for bridging any two of said conductors, and actuating means for said switch means in detachable engagement therewith.

11. An electrical switch assembly according to claim 9, wherein the conductors on one face of the plate at the ends thereof are staggered with respect to the ends of the conductors on the other face of the plate.

12. An electrical switch assembly comprising, a frame including a first wall and a second wall parallel to the first wall, a first terminal structure having an elongated space therein extending substantially at right angles to said walls, each wall having a groove therein confronting the other wall said set grooves aligned with said space, a second terminal structure arranged laterally of the first terminal structure and having an elongated space therein extending substantially at right angles to said walls, each wall having another groove therein confronting the other wall with the second set of grooves aligned with the space of said second terminal structure, contacts carried by each terminal structure, a plate of insulating material having edge portions within the first set of grooves with an end directed towards the first terminal structure, a second plate of insulating material having edge portions within the second set of grooves with an end directed towards the second terminal structure, said plates being slidable in said grooves with the ends movable into the respective spaces, conductors carried by a face of each plate adapted to engage the contacts of the associated terminal structure, rotary switch means carried by each plate for bridging any two of the conductors thereon, and actuating means for said switch means including a shaft extending through all of said switch means in detachable engagement with each.

13. An electrical switch assembly comprising, a frame having grooves therein, a plate of insulating material arranged for sliding movements in said grooves, conductors

carried by a face of said plate terminating at one edge of the plate, terminal contacts mounted in fixed relationship with respect to said frame and in a plane defined by said plate engaging end portions of said conductors, switch means mounted for rotation on said plate for making and breaking circuits to said conductors, a knob mounted for rotation on said frame, and a shaft connected to the knob detachably engaging said switch means whereby the plate may be retracted while guided by said grooves to disconnect said conductors from said terminal contacts and withdrawn from said frame.

14. An electrical switch assembly comprising, a frame having grooves therein, a plate of insulating material mounted for sliding movements in said grooves, said plate having an opening therethrough, a group of contacts arranged in circular outline on a face of said plate and circumferentially spaced from each other about said opening, conductors carried by said face of the plate extending from said contacts terminating at one edge of the plate, terminal contacts mounted in fixed relationship with respect to said frame and in a plane defined by said grooves engaging end portions of said conductors, a rotor mounted within said opening for rotating movements, a blade on said rotor for engaging said contacts, a knob mounted for rotation on said frame, and a shaft connected to the knob detachably engaging said rotor whereby the plate may be retracted while guided by said grooves to disconnect said conductors from said terminal contacts and withdrawn from said frame.

15. An electrical switch assembly comprising, a frame, a plurality of plates of insulating material arranged in face-to-face spaced relationship and mounted on said frame for sliding movement with respect thereto with each plate movable in the plane thereof, conductors carried by each plate extending to one edge thereof, terminal contacts mounted in fixed relationship with respect to the frame engaging end portions of the conductors carried by the respective plate, rotary switch means mounted on each plate for bridging any two of the conductors thereon, a shaft detachably mounted on the frame for rotation with respect thereto extending through and engaging all of said switch means when the plates are in position with end portions of the conductors thereof engaging said terminal contacts, and said shaft being detachable so that any one or all of the plates may be withdrawn from the frame and from association with its terminal contacts.

16. An electrical switch assembly according to claim 2, wherein the contacts are so arranged that the blade does not engage any contact when the slot in the rotor is aligned with the slot in the plate.

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