Nov. 11, 1930. E. M. HEWLETT ET AL 1,781,178

ELECTRIC SWITCH

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Fig. 1.

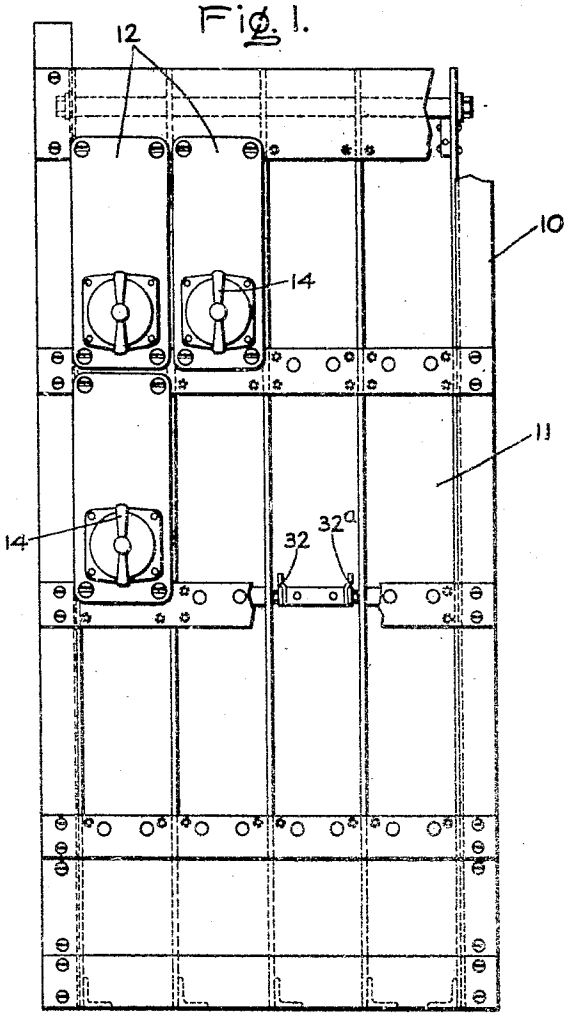


Fig. 2.

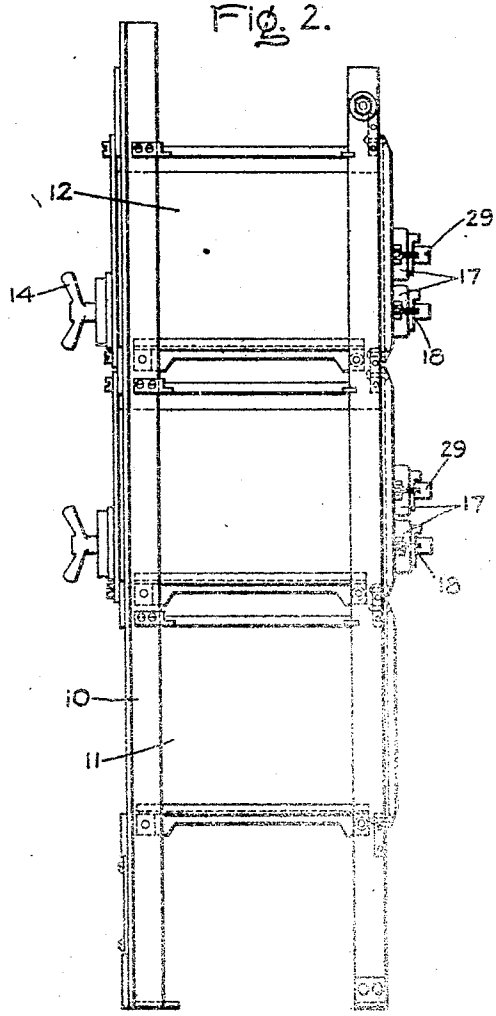
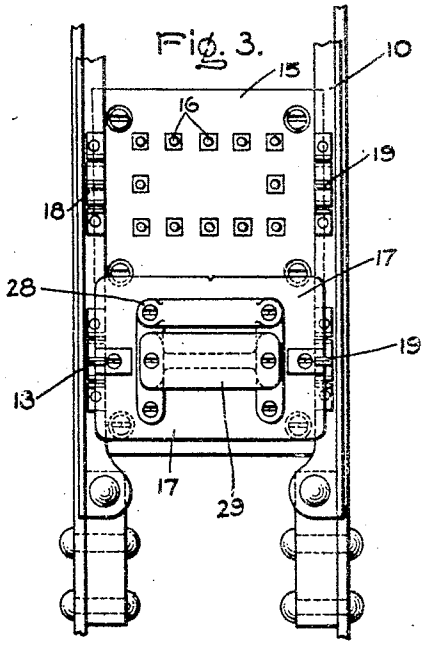


Fig. 3.



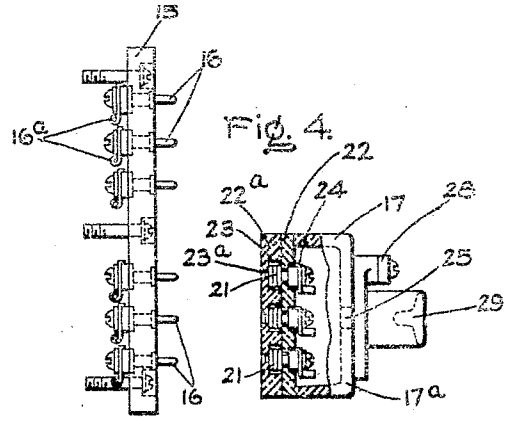


Fig. 4.

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ELECTRIC SWITCH

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Fig. 5.

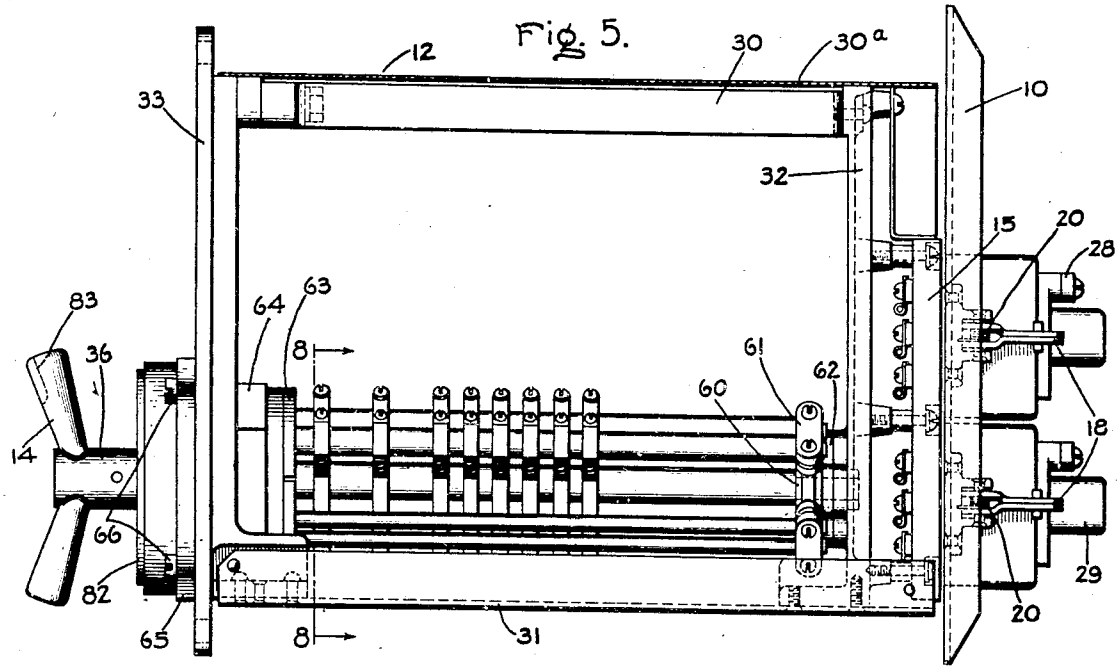


Fig. 6.

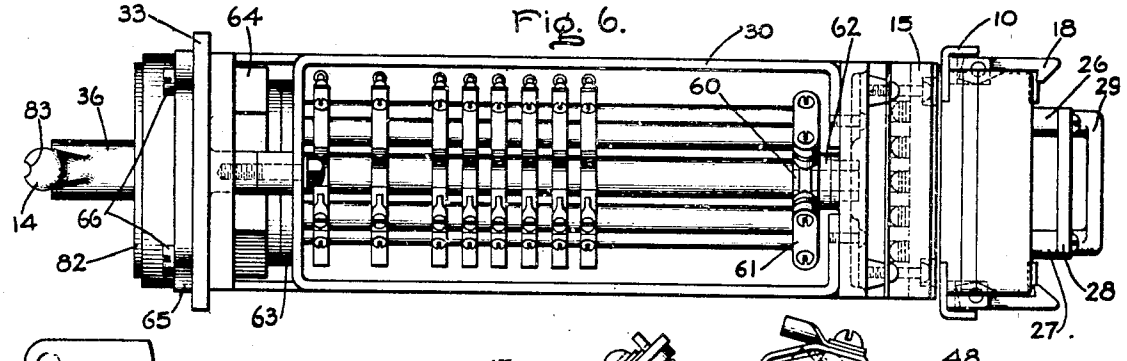


Fig. 7.

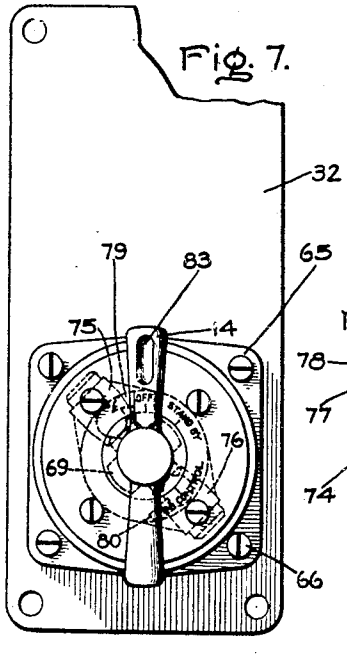


Fig. 9.

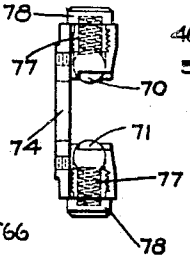
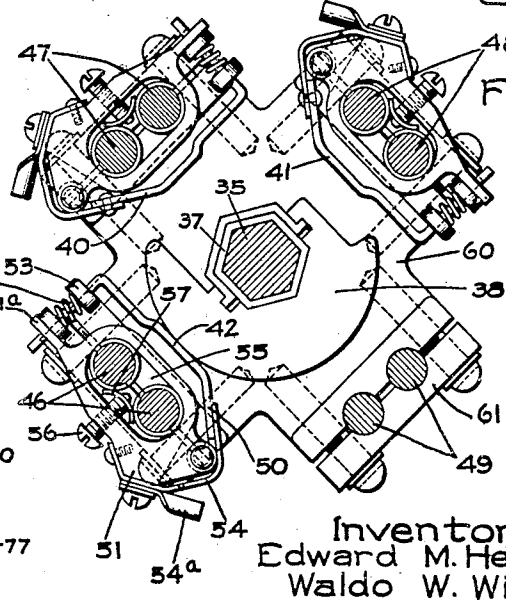


Fig. 8.



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Nov. 11, 1930. E. M. HEWLETT ET AL 1,781,178

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Fig. 10.

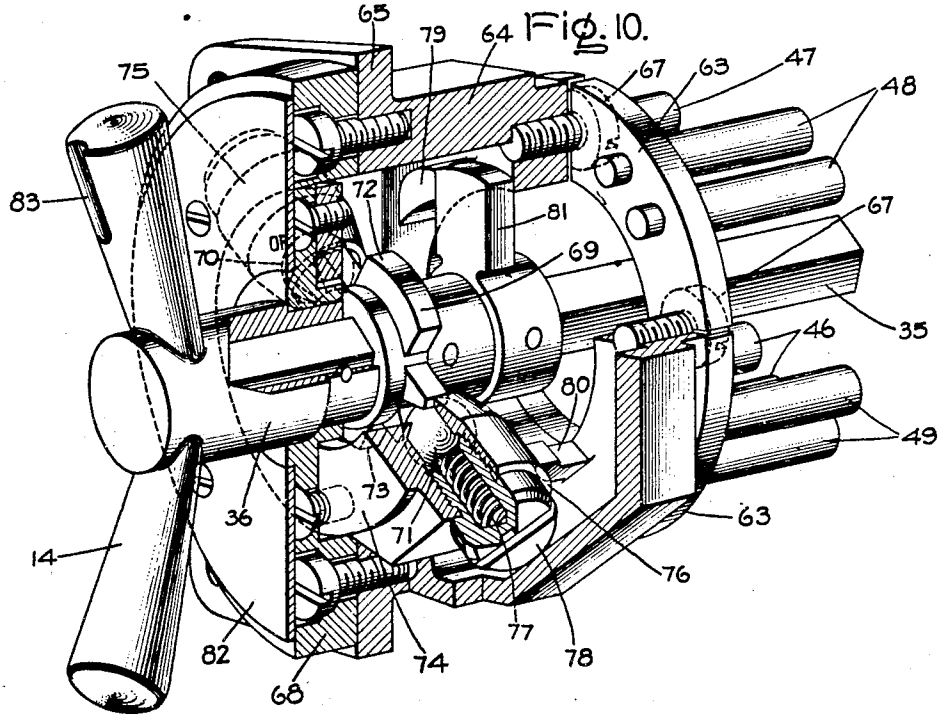


Fig. 11.

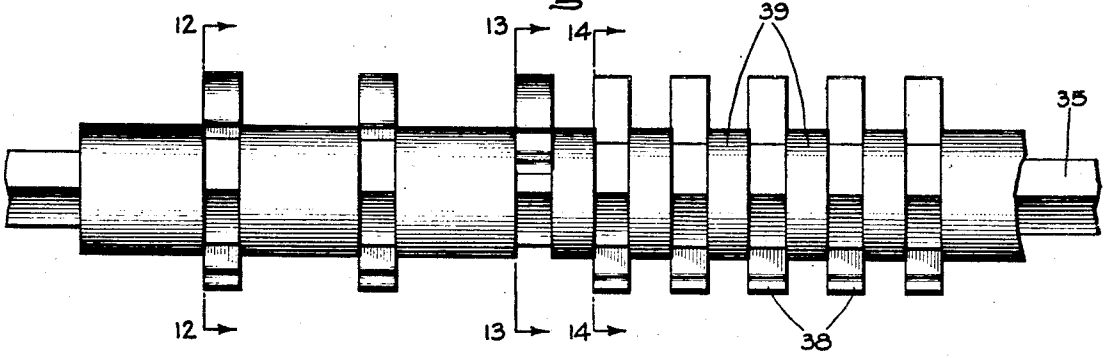


Fig. 12.

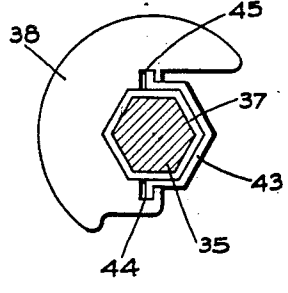


Fig. 13.

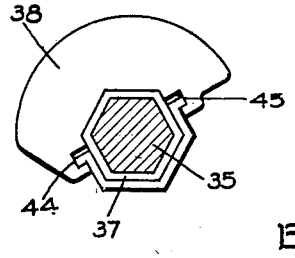
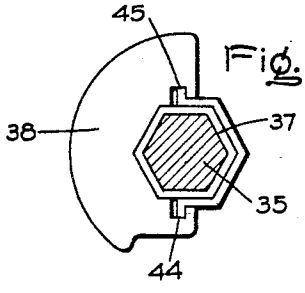


Fig. 14.



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ELECTRIC SWITCH

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Fig. 15.

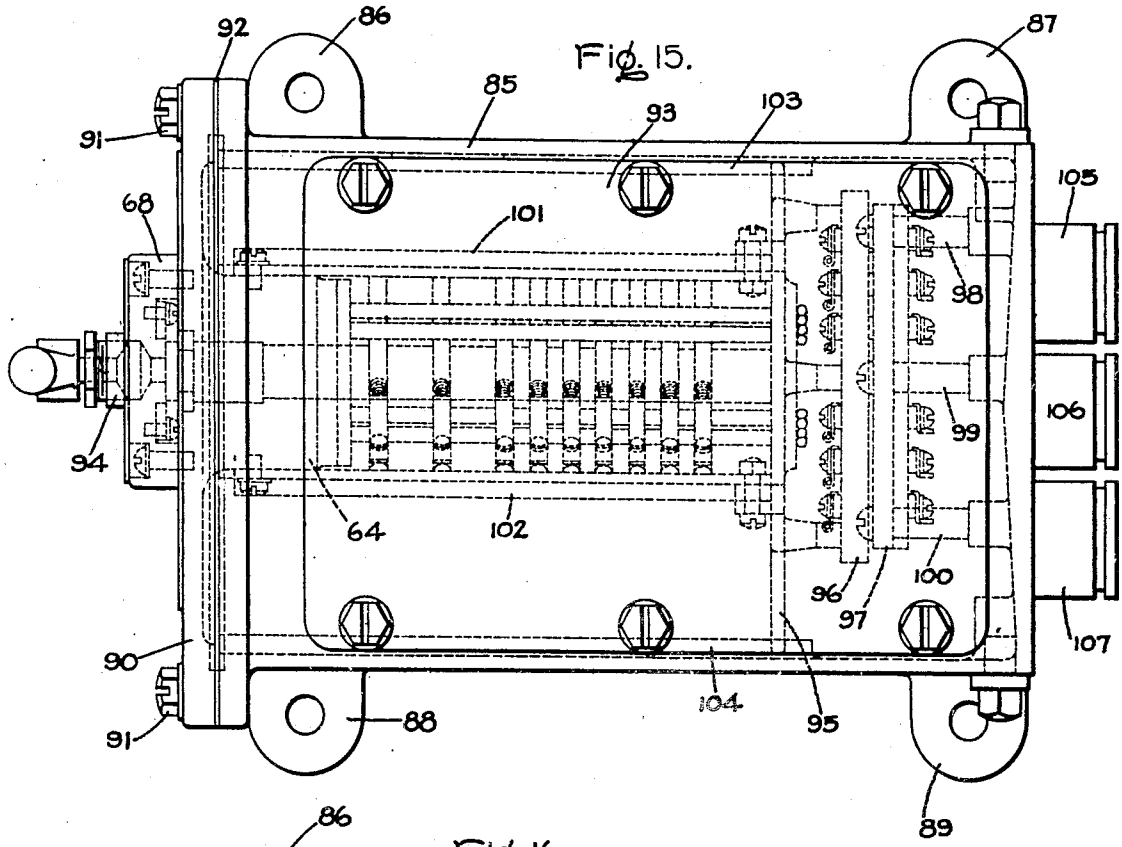
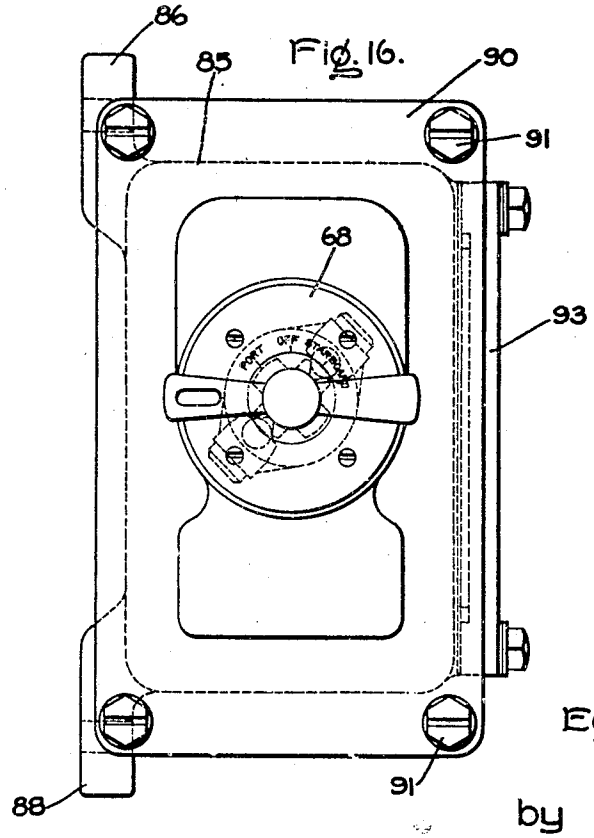


Fig. 16.



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Patented Nov. 11, 1930

1,781,178

UNITED STATES PATENT OFFICE

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ELECTRIC SWITCH

Application filed March 23, 1926. Serial No. 96,854.

Our invention relates to electric switches, more particularly to rotary switches, and has for its object the provision of a simple and reliable switch whereby great flexibility of control may be obtained as regards both the number of circuits operated upon and the variety of the switching operations performed.

In carrying out our invention we provide a rotary member which may be turned to various positions to selectively control the electric circuits. This rotary member is provided with segmental bridging contacts which cooperate with stationary contacts in various relations when the rotary member is turned.

For a more complete understanding of our invention reference should be had to the accompanying drawing in which Fig. 1 is a front elevation view of an electric switch embodying our invention; Fig. 2 is a side elevation view of Fig. 1; Fig. 3 is an enlarged fragmentary rear elevation view; Fig. 4 is a view showing details of construction; Fig. 5 is a side elevation view of a switch unit; Fig. 6 is a plan view with the casing removed of the device shown in Fig. 5; Fig. 7 is a front elevation view of the device shown in Figs. 5 and 6; Fig. 8 is a sectional view taken along the line 8—8 of Fig. 5 looking in the direction of the arrows; Fig. 9 is a view showing details of construction; Fig. 10 is an enlarged fragmentary perspective view partially in section of a switching unit; Fig. 11 is a side elevation view of the switching bar; Figs. 12, 13 and 14 are views showing details of construction taken along the lines 12—12, 13—13 and 14—14 of Fig. 11, looking in the direction of the arrows; while Figs. 15 and 16 are views showing modified forms of our invention.

Referring to the drawing, in one form of our invention we provide a metallic supporting framework 10 arranged with tiers or apertures 11 into which unitary switching devices 12 are inserted. By suitable means, hereafter to be described, the switching units are electrically connected in the circuit or circuits to be controlled when they are slipped in place in the framework, and on being withdrawn they are disconnected. The switch operations are performed by rotating a handle 14 which is provided on each unit.

As shown in Figs. 3 and 4, each unit is provided at its inner end with a terminal board 15 made of a suitable insulating material, such as bakelite, in which is secured a plurality of contact pins 16 connected to terminal connectors 16^a in the opposite side of the board 15. These contact pins are arranged to enter contact receptacles carried by a receptacle support 17 which in turn is carried by the framework 10 in positions opposite the inner end of the unit. As shown, each board 15 is provided with an upper and lower group of terminals 16, a receptacle support 17 being provided for each group. The receptacle supports 17 are also removable and are detachably secured to the rear of the framework 10 by means of pivoted latching members 18 and 19 carried by the framework. As shown a latching member is provided on each side of the receptacle supports and when the receptacle supports are put in place the latching members, which are pressed inward toward the receptacle supports by suitable springs 20, hook over the receptacle supports to hold them in place. This is clearly shown in Figs. 5 and 6.

Each receptacle support 17 is provided with a plurality of small receptacle contacts 21 arranged to receive the pins 16 of a group. To facilitate the engagement of the pins the contact receptacles 21 are loosely mounted in the support 17, as indicated in Fig. 4, so as to readily conform to the pin and adapt themselves to any small variations in the spacing of the pins. The support 17 comprises a plate 22 made of insulating material, such as bakelite, in which the contact receptacles 21 are loosely mounted in apertures in the plate 22 provided for them. A face plate 22^a made of insulating material, such as bakelite, is placed over the contact receptacles. This plate is provided with recesses 23 in which the inner ends of the contact receptacles loosely fit, and with apertures 23^a which form guides for the contact pins 16. The support 17 also comprises a cap member 17^a which encloses the contact terminals 24

to which the contact receptacles 21 are secured. The conducting leads, not shown, are brought in through an aperture 25 in the cap 17ª and are connnected to the terminals 24. After being secured to the terminals, the leads are bent upward on the outside of the cap between two projections 26 and 27 (Fig. 6). A cross-bar 28 is then secured by suitable screws to the projections so as to hold the leads in place between the projections. A handle 29 is provided on the cap 23 whereby the receptacle support may be pulled away from the contact pins if desired, after first releasing the latching members 18 and 19. This makes it possible to easily test out the circuits by simply removing the receptacle support and inserting suitable contact pins temporarily into the contacts 21.

As shown in detail in Figs. 5, 6 and 7, each switch unit is mounted in a suitable rectangular framework 30 and this framework is enclosed at the top and sides by means of a casing 30ª. At the bottom the framework is closed by a plate 31 bent upward at the sides, which forms a shoe in which the framework with its contained mechanism slides. This arrangement provides a smooth surface for the unit both at the bottom and at the sides whereby the unit can be easily and accurately slipped in place in the framework 10. Suitable guides 32 and 32ª (Fig. 1) are provided on the framework 10 on each side of the unit.

The framework 30 for each unit consists, briefly, of a front plate 33 and rear plate 33ª on the outer side of which the terminal board 15 is secured. These plates are normally vertical and secured to each other at the top by horizontal bars and at the bottom by the plate 31. The switching element which is turned by means of the handle 14 comprises a hexagonal bar 35 (Fig. 11). The handle 14 is secured to the outer end of this bar, and the bar is rotatably mounted in suitable bearings supported by the plates 33 and 33ª. Preferably the inner end of the bar is provided with a cylindrical bearing while a bearing is provided for the outer end by means of a sleeve 36 (Fig. 10) integral with the handle 14. The intermediate length of the bar 35 between its bearings is encased in a layer 37 of bakelized paper insulating material, and at suitable intervals segmental electrical bridging contacts 38 are secured to the bar on the outside of the layer of insulating material. Between the bridging contacts are spaced sleeves 39 of bakelized paper which prevent displacement of the bridging contacts on the bar 35. It will be observed that the bridging contacts are electrically insulated from the bar 35 and from each other.

As shown in Fig. 8, each bridging contact 38 is arranged to cooperate with a plurality of fixed contacts. In the embodiment shown three fixed contacts 40, 41 and 42 are provided, the contacts 41 and 42 being diametrically opposite each other, while the contact 40 is spaced 90° from them. Obviously any desired number of fixed contacts may be used and different numbers of fixed contacts may be provided for the various movable bridging contacts.

By suitably selecting the circumferential size of the bridging contact and by suitably arranging these bridging contacts about the axis of the bar 35 an almost unlimited variety of switching operations may be performed. Figs. 12, 13 and 14 illustrate various shapes of bridging contacts which may be used. It will be observed that the contact shown in Fig. 12, which is the same as the contact shown in Fig. 8, is arranged to bridge any two of the fixed contacts or all three of them, while the contacts shown in Figs. 13 and 14 are arranged to bridge not more than two fixed contacts at any one time.

The bridging contacts are preferably formed by punching them from suitable sheet material, such as brass or copper, and they are each secured to the bar 35 by means of a strap 43 extending substantially half way around the bar 35. The ends of the strap 43 project outward at right angles and hook into recesses or notches 44 and 45 provided for them in the contact segment. The straps may be stamped from sheet metal and are made short enough so that when their ends are slipped in the notches in the contact a tight fit is formed so that the contact is held securely in place. In assembly, one end of the strap may be inserted in a notch, for example, and the other end forced in the opposite notch by means of a hammer.

The fixed contacts are arranged on pairs of rods 46, 47, 48 and 49 extending parallel with the bar 35. These rods are provided with insulating jackets of bakelized paper. Each fixed contact constitutes a conducting strip 50 which is pivoted at one end on a member 51, extends crosswise of the pair of supporting rods, and has its opposite end bent outward at right angles and passed through an aperture formed in a projection 51ª on the member 51. As shown, the free end of the strip 50 is forced toward the bridging contact by means of a helical spring 52 which surrounds it and bears at one end against the projection 51ª and at the other against the cup 53 carried by the contact strip. A flexible conductor member 54 connected with the contact strip near its pivot leads around to a connection terminal 54ª. The member 51 is provided with an elongated aperture 55 which receives the pair of supporting rods 46 and the member 51 is secured in place by a screw 56 the inner end of which engages a wedge-like clamping member 57 situated between the rods. Preferably the members 51 are formed by stamping them of sheet brass by means of suitable dies.

The arrangement of the elements is such that the bar 35 can be removed by itself, or the bar 35 and the stationary contacts can be removed together. The inner ends of the rods 46, 47, 48 and 49 are secured to a member 60, for example, by means of clamping members 61 as indicated in Fig. 8. This member 60 has a central hub 62 (Fig. 5) which fits in a suitable aperture in the plate 33a. At their outer ends each pair of bars is secured to a 90° segment 63 and the four segments to which the four pairs of rods are secured, are in turn secured to the inner end of a member 64. This member 64 is mounted in a suitable aperture in the plate 33. It is provided with a flange 65 (Fig. 10) on its outer end which rests against the plate 33 and is secured to the plate by suitable screws 66. Preferably the ends of the rods project through the segments 63 slightly and fit in depressions provided for them in the end of the member 64, whereby the segments are properly located. The segments are secured to the member 64 by screws 67 between the ends of the segments. In other words, each segment 63 is provided with a semi-circular depression at each end and the screws 67 pass through the holes formed by the two depressions in abutting segments. The inner end of the bar 35 is provided with a bearing which is journaled in the member 60 while the outer end of the bar 35 is rotatably supported in a plate 68 which is secured by suitable screws against the outer end of the member 64.

The member 64 is somewhat elongated to provide a chamber in which is mechanism for determining the various desired positions of the switch. On the bar 35 is a member 69 (Fig. 10) provided with notches in which fit spring pressed balls 70 and 71. As shown this member 69 is provided with two diametrically opposite projections 72 and 73 of considerable width and with four narrow projections, two on each side of the large projections. The balls 70 and 71 are carried in seats provided for them carried by a ring 74 which is secured by suitable screws to the inner face of the plate 68. In other words, the ring 74 is provided with integral lateral projections 75 and 76 (Fig. 7) in which the seats for the balls are formed. It will be observed from Fig. 7 that these lateral projections 75 and 76 extend radially beyond the periphery of the ring 74, but the member 64, which is hexagonal, is of such size as to provide space for them. Each ball is pressed inwardly by a helical spring 77 which is held in a suitable recess provided for it in a screw plug 78 fitting into threaded bores provided in the projections 75 and 76

In the relative positions of the parts shown in the drawing each ball rests between two of the narrow notches. It will be observed that when the handle 14 is turned in a clockwise direction as viewed in Fig. 10, it will move 45° to the next position, and in coming to the next or third position in a clockwise direction the balls will move over the wide projections 72 and 73 through an arc of 90°. Stops 79 and 80 (Figs. 7 and 10) are provided to limit the positions of the switch, the bar 35 carrying a projection 81 which in the position shown in the drawing rests against the stop 79. Upon movement of the handle 14 in a clockwise direction to the third position the projection 81 comes to rest against the stop 80. It will be obvious, however, that any suitable number of positions of the bar 35 can be provided by suitably arranging the stops and the projections on the member 69.

As thus constructed it will be observed that by removing the plate 68 the bar 35 with the bridging contacts can be pulled out or by removing the screws 66 to release the member 64 the stationary and movable contacts can be removed as a unit.

Preferably a plate 82 provided with suitable markings to indicate the possible positions of the switch is secured to the plate 68. These markings are chosen with reference to the uppermost arm of the handle 14 when in the position shown in the drawing, and this arm is provided with a depression 83 for designating it to the operator in case it is desired to operate the switch without suitable illumination.

As will be observed from Fig. 5, considerable space is provided in each unit 12 above the rotary switching element. Various auxiliary devices may be mounted in this space, such as fuse holders, overload relays, resistors, under voltage relays, lamps, etc.

In Figs. 15 and 16 we have shown a modified form of our invention in which the switching mechanism is enclosed in a water-tight casing. In this form of our invention, each switching unit is provided with an individual casing 85 which is substantially rectangular in outline and provided with projections 86, 87, 88 and 89 by means of which the casing can be secured to a wall by suitable screws passing through apertures provided for them in the projections. Access is had to the interior of the casing 85 at one end by means of a cover plate 90 which is secured in place by suitable screws 91, a gasket 92 being used so as to provide a water-tight joint. A second cover plate 93 is provided, this plate being on the front side of the casing and secured in place by suitable screws in the same manner as plate 90, a gasket being used to give a water-tight joint.

The construction of the switching mechanism itself is substantially the same as previously described in connection with Figs. 1–14 inclusive. The member 64, however, is carried by the plate 90, while the disk-like member 68 is secured to the outside of the plate 90, a tight gasket being used. It will be understood that the plate 90 is provided

with an aperture registering with the aperture in the member 64. The plate 90 may, in fact, be considered as an extension of the flange 65 (Fig. 10) of the member 64. For the purpose of forming a water-tight joint a packing gland 94 is provided around the outer end of the switch bar 35, the portion of the bar extending through the packing gland being cylindrical.

At the inner end of the switching device a transversely extending support 95 is provided in the casing, this support corresponding to the end member 33a of Fig. 5. This support carries a terminal board 96 to which are secured a plurality of contact pins. These contact pins cooperate with contact receptacles secured in a receptacle support 97 which is supported on suitable studs 98, 99 and 100 secured in turn to the back end of the casing 85. The parts 96 and 97 correspond respectively with the slab 15 and the receptacle support 17 of Fig. 4. In this case, however, the receptacle support, member 97, is not detachable, it being secured rigidly to the casing 85. The support 95 is secured to the member 64 by means of bars 101 and 102 and it is slidable in the casing, guides 103 and 104 being provided to maintain the contact pins carried by the board 96 in alignment with the contact receptacles. Packing glands 105, 106 and 107 are provided at the back end of the casing around the apertures through which conductors are led into the interior of the casing and connected to the contact receptacles carried by the support 97. It is contemplated that the conductors will be in the form of armoured multiple conductor cables so that water-tight joints can be formed by means of the packing glands.

With this construction it will be observed that after removing the screws 91 to loosen the plate 90 the switching mechanism can be removed as a unit, this unit corresponding to the individual units 12 of the form shown in Figs. 1 and 2. The switch bar with its movable contacts can be removed after loosening the member 68 as previously described in connection with the form shown in Figs. 1–14 inclusive. The removable plate 93 affords direct access to the switch mechanism when this mechanism is in operative position.

Certain features of my invention disclosed in this application relating to the combination with a switching device of a framework into which the switching device is slidably movable into operative position, together with contacts carried by the switching device and contacts carried by the framework positioned so as to be engaged by the contacts on the switching device when the switching device is inserted in the framework, are described and claimed in my co-pending application, Serial No. 388,838, filed August 27, 1929, which application is a division of this application.

While we have described our invention as embodied in concrete form and as operating in a specific manner in accordance with the provisions of the patent statutes, it should be understood that we do not limit our invention thereto, since various modifications thereof will suggest themselves to those skilled in the art without departing from the spirit of our invention, the scope of which is set forth in the annexed claims.

What we claim as new and desire to secure by Letters Patent of the United States, is:—

1. In a switching device, a rotary insulating member having a polygonal cross-section, a contact member provided with recesses arranged to fit on one side of said rotary member, and a strap passing around the opposite side of said rotary member having its ends locked in said recesses so as to secure said contact member on said rotary member.

2. A rotary switch comprising a rotary insulating member, a contact member provided with recesses arranged to fit on one side of said rotary member, and a strap passing around the opposite side of said rotary member having its ends located in said recesses so as to secure said contact member on said rotary member.

3. A rotary switch comprising a rotary insulating member, a contact member provided with recesses, a strap passing around said member having its ends locked in said recesses so as to secure said contact member on said rotary member, and stationary contact members arranged to be engaged by said rotary contact member.

4. A rotary switch comprising a rotary member, a jacket of insulating material, on said member, a plurality of contacts provided with recesses, straps passing around said member having their ends locked in said recesses so as to secure said contacts on said member, and stationary contacts arranged to be engaged by said rotary contact members.

5. A unitary switching device comprising end members, a plurality of pairs of bars connecting said end members, stationary contacts secured to said pairs of bars, a rod rotatably mounted in said end members, and contact members carried by said rod cooperating with said stationary contact members.

6. A unitary switching device comprising end members, a plurality of pairs of bars connecting said end members, stationary contacts secured to said pairs of bars, a rod rotatably mounted in said end members, contact members carried by said rod cooperating with said stationary contact members, and a support for said switching device

to which said end members are removably secured.

7. A unitary switching device comprising end members, a plurality of pairs of bars connecting said end members, stationary contacts, and means for securing each stationary contact to a pair of said bars comprising a supporting member, said member being provided with an aperture for receiving said pair of bars, a wedge-like clamping member positioned between said bars and means cooperating with said member and said wedge-like clamping member for forcing said clamping member between said bars.

8. A unitary switching device comprising end members, a plurality of pairs of bars connecting said end members, stationary contacts, means for securing each stationary contact to a pair of said bars comprising a supporting member, said member being provided with an aperture for receiving said pair of bars, a wedge-like clamping member positioned between said bars and a set screw passed through said member to engage said wedge-like clamping member, a rod rotatably mounted in said end members, and contact members carried by said rod cooperating with said stationary contact members.

In witness whereof, we have hereunto set our hands this 22nd day of March, 1926.

EDWARD M. HEWLETT.
WALDO W. WILLARD.