May 18, 1943 M. L. GLOGAU 2,319,503

MULTIPOSITION SWITCH

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FIG. 1.

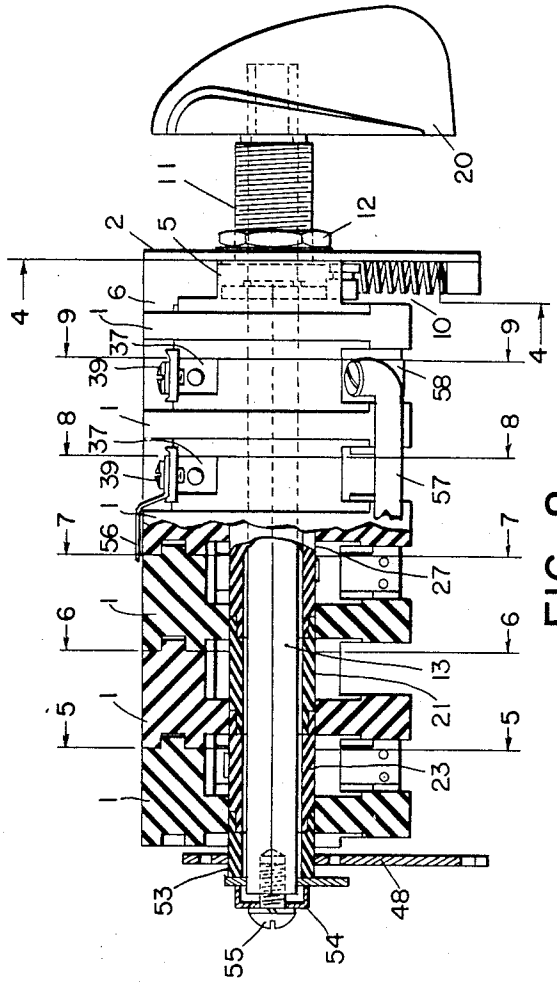


FIG. 2.

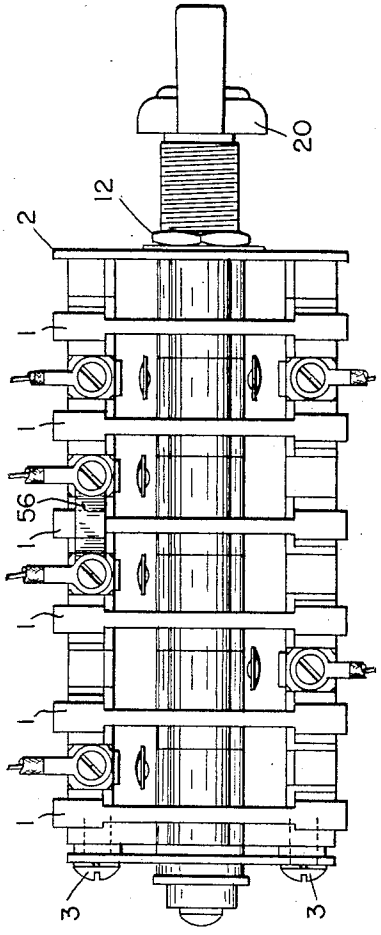


FIG. 3.

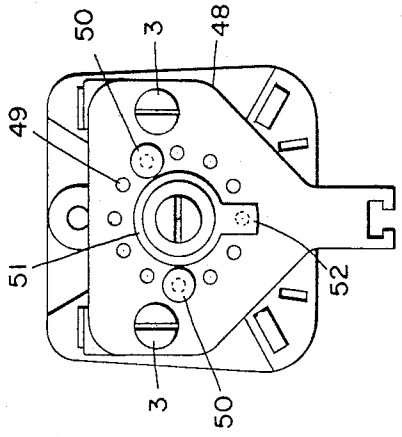
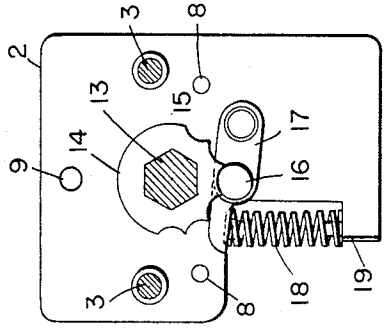


FIG. 4.



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MULTIPOSITION SWITCH

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FIG. 5.

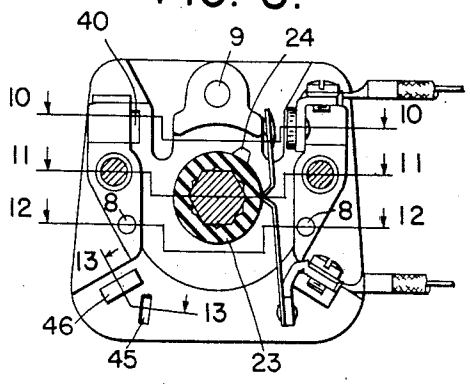


FIG. 8.

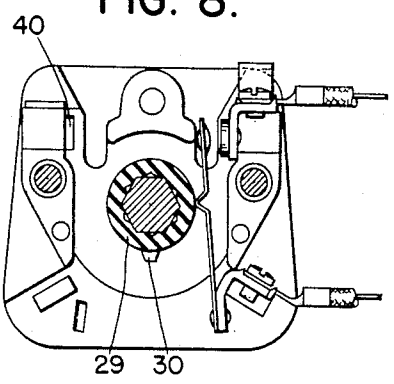


FIG. 6.

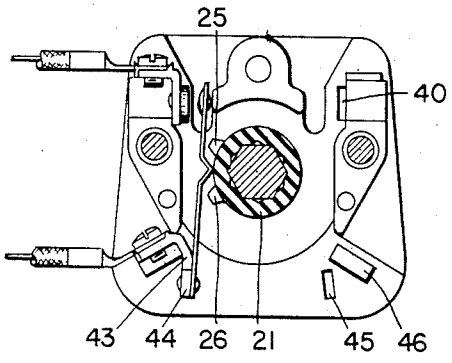


FIG. 9.

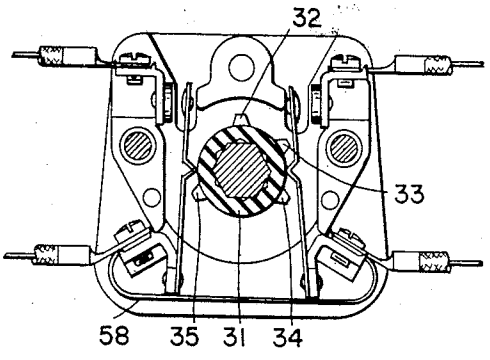


FIG. 7.

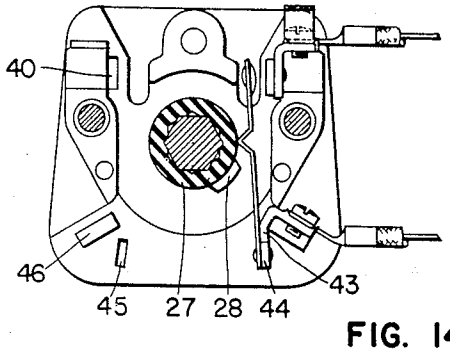


FIG. 10.

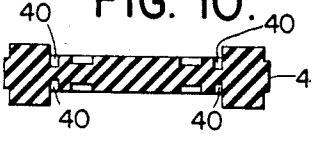


FIG. 11.

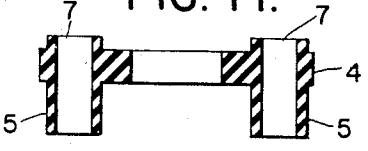


FIG. 14.

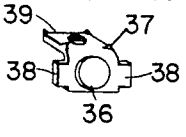


FIG. 13.

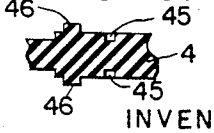


FIG. 12.

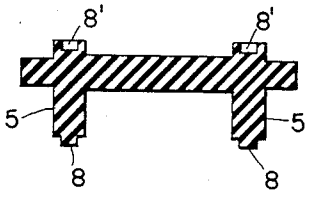
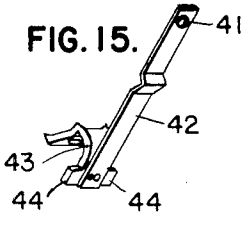


FIG. 15.



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May 18, 1943 M. L. GLOGAU 2,319,503

MULTIPOSITION SWITCH

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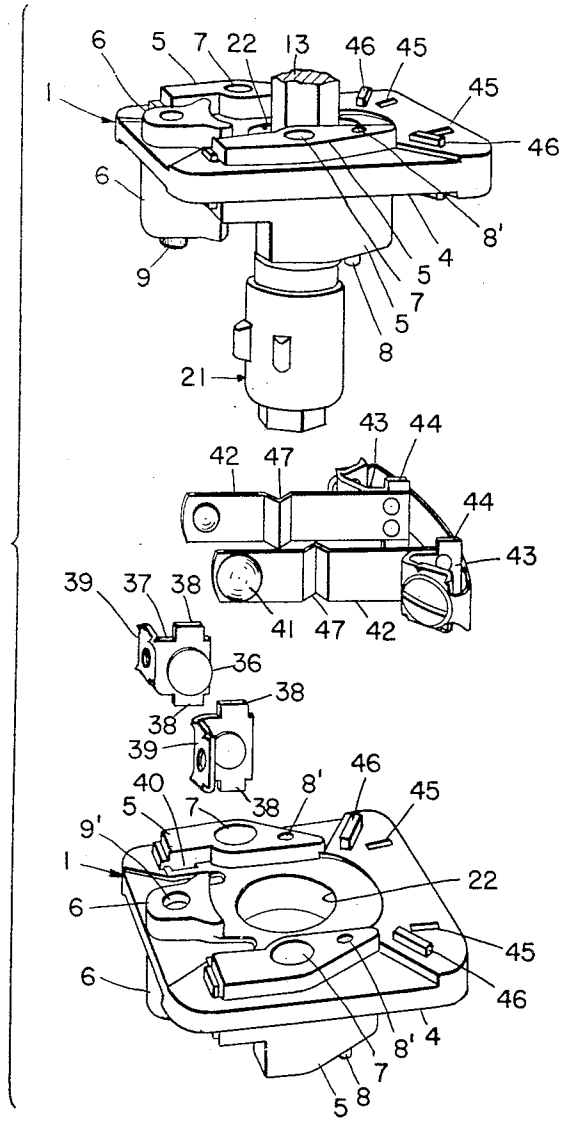
FIG. 16.



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UNITED STATES PATENT OFFICE

2,319,503

MULTIPOSITION SWITCH

Manfred L. Glogau, Milwaukee, Wis., assignor to Allen-Bradley Company, Milwaukee, Wis., a corporation of Wisconsin

Application October 23, 1941, Serial No. 416,143

16 Claims. (Cl. 200—6)

This invention relates to multifunction, multiposition switches and resides in a novel construction thereof which is capable of ready rearrangement to alter the sequences of switching functions and which is sectionally extensible by adding compartments so that the number of switching functions can be readily increased or decreased.

The field in which multiposition switches find useful application is characterized by the wide diversity of requirements to be met. Any single multifunction, multiposition switch design is limited in its usefulness to certain specific requirements. A switch adapted for starting, stopping, and reversing a single phase induction motor is not adapted for similar control of motors of other types. The number of separate and distinct circuit arrangements calling for separate and distinct multiposition, multifunction switch designs is therefore large and is constantly being extended as the electrical art grows more complex. To design and construct a separate switch to meet each different class of requirements involves a great deal of expense for tooling and the like and large quantities of different parts must be stocked for assembling the assorted designs.

One method of attempting to overcome this difficulty is to construct switches capable of a large variety of functions and to supply such switches for both simple and complex requirements. Where such switches are applied to simple requirements, a considerable part of the switch structure is dead and useless. Such a practice is not economical and does not permit of compacting of the design in such situations where the requirements are simple and a switch of small bulk should be feasible. This difficulty has been overcome to a small extent in some cases by omitting the dead parts from the switch frame. While some economy is effected in this way, the space requirements of the frame remain and the switches furnished for simple installations are nevertheless excessively bulky.

The difficulties and limitations heretofore experienced are overcome and eliminated to a large extent by the apparatus of this invention, in which a sectionally extensible frameless construction is employed. In the construction of this invention a multiposition switch specifically adapted to each requirement may be quickly assembled from standardized elements. No unnecessary, useless part need be assembled in the switch and the bulk of the switch is directly related to the complexity of the requirements to be met. In addition, the switch construction of this invention, by reason of the method of assembly employed, is of greatly simplified design, requiring a reduced number of parts.

The switch of this invention is herein described by reference to the accompanying drawings, which form a part hereof and in which there is set forth by way of illustration and not of limitation one form of the apparatus of this invention.

In the drawings:

Fig. 1 is a side elevation, partly in section, of a switch constructed in accordance with this invention;

Fig. 2 is a plan view of the switch shown in Fig. 1;

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

Fig. 4 is a sectional view, in elevation, viewed through the plane 4—4 indicated in Fig. 1;

Fig. 5 is a sectional view, in elevation, viewed through the plane 5—5 indicated in Fig. 1;

Fig. 6 is a sectional view, in elevation, viewed through the plane 6—6 indicated in Fig. 1;

Fig. 7 is a sectional view, in elevation, viewed through the plane 7—7 indicated in Fig. 1;

Fig. 8 is a sectional view, in elevation, viewed through the plane 8—8 indicated in Fig. 1;

Fig. 9 is a sectional view, in elevation, viewed through the plane 9—9 indicated in Fig. 1;

Fig. 10 is a plan view, in section, of a segment without associated parts, viewed through the plane 10—10 indicated in Fig. 5;

Fig. 11 is a plan view, in section, of a segment without associated parts, viewed through the plane 11—11 indicated in Fig. 5;

Fig. 12 is a plan view, in section, viewed through the plane 12—12 indicated in Fig. 5;

Fig. 13 is a fragmentary sectional view taken at the broken plane 13—13 indicated in Fig. 5;

Fig. 14 is a detail view, in perspective, of a fixed contact and its mounting means and terminal;

Fig. 15 is a detail view, in perspective, of a fixed contact and its mounting means and terminal; and

Fig. 16 is an expanded view, in perspective, showing the parts which go together to form a single compartment of the switch of this invention.

Referring now to the drawings, there is illustrated a switch of five compartments, but this number may be readily increased or reduced, depending upon the switch requirements to be met. The compartments of the switch are made up of several identical segments, designated by the numeral 1. These are secured to a mounting plate 2 by means of through-bolts 3 which pass therethrough into threaded engagement with the mounting plate 2. As shown more clearly in Fig. 16, the segments 1 are composed of relatively thin, flat, transverse partition portions 4. Extending perpendicularly with respect to the partition portions 4 are side spacing bosses 5 and top spacing bosses 6. The bosses 5 and 6 extend away from the partition portion on both sides thereof, but

the major projection of the same is in the direction of the mounting plate 2, the minor projection thereof being of much smaller extent. Passing directly through the bosses 5 are openings 7 located to accommodate the through-bolts 3 heretofore referred to.

Extending from the end faces of the major extensions of the side spacing bosses 5 are locating dowels 8 and extending from the corresponding top spacing bosses 6 are locating dowels 9. In registry with the dowels 8 and 9 are dowel-receiving indentations 8' located in the faces of the minor side spacing bosses on the opposite side of the partition 4. Dowel-receiving indentations 9' are likewise provided on the rear faces of minor extensions of the top spacing bosses 6. In this way the insulating segments 1 are capable of being accurately and firmly positioned with respect to one another when the through-bolts 3 are tightened. The several segments thus serve the function of a frame, providing a construction which is frameless in the sense that the insulating segments themselves form the principal supporting structure. In this way the number of segments employed determines the size of the complete switch.

The segment 1 lying adjacent to the mounting plate 2 is likewise accurately positioned and firmly held by locating dowels 8 and 9 which engage holes in the plate 2, provided for that purpose. The major spacing bosses 5 and 6 which engage the plate 2 are of sufficient extent to provide an indexing compartment or cell 10 between the first partition 4 and the mounting plate.

Mounted upon and securely attached to the mounting plate 2 is a shaft supporting bushing 11 having a long threaded portion, as shown, upon which there is provided a locking-nut 12. Mounted to turn within the bushing 11 is a cam-actuating shaft 13 having a rounded shank portion at the point where it passes through the bushing 11 and a hexagonal portion commencing within the indexing compartment 10 and extending from there through and beyond the several segments 1. Mounted upon the shaft 13 to turn therewith is an indexing cam 14 having a hexagonal hole therein for engagement with the shaft 13, as appears more clearly in Fig. 4.

The cam 14 is provided with a series of indexing indentations 15, which are located to be engaged by the indexing roller 16. The roller 16 is mounted upon the lever 17 which is pivotally carried upon the mounting plate 2. The outer end of the lever 17 engages a compression spring 18 interposed between said lever and the inwardly bent ear 19 which is a part of the mounting plate 2. In this way the shaft 13 can be moved to the several positions corresponding to the indentations 15. A handle 20 is securely attached to the end of the shaft 13 so that the shaft 13 may be turned as required.

A series of contact-actuating cams corresponding to the several compartments or cells formed by the several segments 1 are mounted upon the shaft 13. The contact-actuating cams are sleeve-like in form with a reduced portion at one end and a recessed portion at the opposite end so that they engage and interfit with one another. One of these cams, designated by the numeral 21, appears clearly in Fig. 16. The ends of the contact-actuating cam pass into and are accommodated within a central opening 22 provided in the partition portion 4 of the several segments 1.

The contact-actuating cams are variously formed to perform the several switching functions required and for this reason they are separately designated herein by several separate numerals. The cam positioned in the compartment most remote from the mounting plate 2 is designated by the numeral 23 and is provided with a single projection 24. The cam adjacent to cam 23 is designated by the numeral 21 and this cam, as appears more clearly in Fig. 6, is provided with two projections 25 and 26. The cam adjacent to cam 21, on the side thereof nearest to the mounting plate 2, is designated by the numeral 27. Cam 27, as appears more clearly in Fig. 7, is provided with a projection 28 of greater angular extent than the projections heretofore referred to. The cam adjacent to cam 27, on the side thereof nearest to the mounting plate 2, is designated by the numeral 29. As appears more clearly in Fig. 8, the cam 29 is provided with a single projection 30. The cam adjacent to cam 29 on the side thereof closer to the mounting plate 2 is designated by the numeral 31. As appears more clearly in Fig. 9, the cam 31 is provided with projections 32, 33, 34 and 35.

The contact-actuating cams are composed of insulating material and have dodecagonal longitudinal openings therethrough so that the same may be positioned upon the shaft 13 in any of twelve angular positions corresponding to the indexing angle of the indexing cam 14. In this way the contact-actuating cams can be positioned to operate in any sequence which the indexing cam permits.

The several switching compartments may be provided with either a single pair or a double pair of stationary and movable contacts. The stationary contacts 36 are carried upon mountings 37, which mountings are provided with laterally extending lugs 38 and terminal portions 39. As appears more clearly in Fig. 16, the lugs 38 are positioned to be received in sockets 40 in the partition portion 4 of the segments 1. The engagement of the lugs 38 with the sockets 40 and the engagement of the side surfaces of the mountings 37 with abutting surfaces at the upper ends of spacer bosses 5 serve to securely lock the stationary contacts in position when the segments 1 are in position as shown in Fig. 1.

Movable contacts 41 are carried upon spring fingers 42, which in turn derive their support from movable contact carriers 43. The movable contact carriers 43 are provided with laterally extending lugs 44, as appears more clearly in Fig. 15. The lugs 44 are dimensioned to closely engage the slots 45 in the lower portion of the segments 1 and in this manner to securely lock the carriers 43 in position. Lateral surfaces of the carriers 43 are arranged to engage abutments 46, which serve to reinforce the support furnished by the slots 45.

The spring fingers 42 carry an inwardly deflected corrugation 47 disposed approximately on a level with the center line of shaft 13 in position to be engaged by the projections carried on the contact-actuating means. When one of the projections is brought into registry with the corrugations 47 the finger 42 is deflected outwardly, firmly pressing the movable contact 41 into engagement with the corresponding stationary contact 36.

Secured to the rear segment 1 by means of the through-bolts 3 heretofore referred to, is a stop-plate 48 through which the shaft 13 projects. The stop-plate 48 carries a series of perforations 49 arranged in a circular path surrounding the end of shaft 13. Stop-pins 50 are pro-

vided in such form that they may be securely fastened within the holes 49. A washer 51, having a hexagonal perforation and a lateral extension 52, is mounted upon the shaft 13 to turn therewith. The washer 51 is held firmly in place between a spacer sleeve 53 and a cup-washer 54. The cup-washer 54 in turn is held in place by means of a screw 55 which engages a longitudinally tapped hole in the end of the shaft 13. In the event an indexing cam 14 is selected having fewer indexing positions, the stop-pins 50 may be accordingly moved to limit the scope of travel of the lateral projection 52, or, if the cam 14 is provided with additional indexing positions, the stops 50 can be accordingly repositioned.

The terminal portions 39 of the stationary contact carriers 37 are in effect held in pockets formed by the partition portions 4 and are upwardly exposed, as appears clearly in Fig. 2, so that wiring connections can be readily made. The movable contact carriers 43 are provided with terminal portions which are exposed upwardly through upwardly inclined slots formed by adjacent partition portions 4 and the lower inclined outer faces of spacer bosses 5. The movable contact terminals therefore are accessible from a position above and slightly to one side of the switch assembly.

In order to relate the functions of the switch to the variety of purposes which may be required, stationary contacts 36 may be readily bridged by small jumper bars 56 In like manner, movable contact terminals may be joined by similar jumper bars 57. If it is desired that two movable contacts within a given switch compartment be electrically joined, a transversely extending jumper bar 58 may be employed, as shown. It will be noted that the bar 58 is recessed and protected within a transverse groove formed by adjacent partition portions 4. This flexibility in the interconnection of switching elements further enhances the reversibility of the switch not only as to functions which it will perform, but also as to the load which it will carry. For example, two or more pairs of contacts can be readily joined in series if one pair is insufficient to interrupt the load to be accommodated.

In the form of apparatus shown in the drawings and described above, the parts are arranged to perform certain switch functions in a certain sequence. However, if it is desired to provide a switch which will perform functions other than those exhibited by the switch shown, it is possible to alter the number of indexing positions by selecting a cam 14 of different configuration. It is also possible, simply by providing a shaft 13 and through-bolts 3, of greater or less length, to add or subtract switching compartments, utilizing therefor the same standardized parts as are employed in making up of all of the other switching compartments. The contact-moving cams may be provided and stocked in a limited number of forms sufficient to accomplish any result of which such a switch is capable. It is necessary, therefore, only to select the proper cam and to position the same in the proper angular position upon the shaft 13. In this way complete flexibility in design of a multiposition multifunction switch is available, dispensing with the necessity for stocking a large variety of sizes and designs of switches and without including unnecessary, nonfunctioning parts.

While this invention has herein been described by reference to one specific embodiment thereof, it is intended that the protection of Letters Patent to be granted hereon be not unnecessarily limited thereby, the intent being that the protection to be granted extend to the full limit of the inventive advance disclosed herein as defined by the claims hereto appended.

That which I claim as my invention is:

1. In a multiposition switch, the combination comprising a shaft, means for rotatably mounting the same, indexing means associated with said shaft, a plurality of separate insulating segments secured to one another in aligned face-to-face relationship with aligned openings therein forming a canal for accommodation of said shaft, each of said segments being made up of a partition portion having spacing bosses extending normally with respect thereto, said bosses having locating tenons projecting therefrom, said segments also being provided with mortises on the sides thereof opposite said tenons for interfitting engagement with the tenons of the adjacent segments, said segments also having sockets for accommodation of movable and stationary contact carriers on both sides of their partition portions with contact supporting ledges adjacent thereto, stationary contact carriers positioned between successive segments, lugs projecting from the edge surfaces of said contact carriers into said stationary contact-accommodating sockets to secure said carrier in position in abutting relation with said ledges, stationary contacts mounted on said carriers, movable contact carriers positioned between successive segments in socketed engagement therewith, said movable contact carriers having movable contact portions movable to and from corresponding stationary contacts, cams mounted on said shaft between successive segments positioned to cause said movable contacts to move into and out of engagement with corresponding stationary contacts, and through-bolts passing through said segments to secure the same to said mounting means and to clamp the same securely against one another.

2. In a multiposition switch, the combination comprising a shaft, means for rotatably mounting the same, indexing means associated with said shaft, a plurality of separate insulating segments secured to one another in aligned face-to-face relationship with aligned openings therein forming a canal for accommodation of said shaft, each of said segments being made up of a partition portion having spacing bosses extending normally with respect thereto, said bosses having locating means thereon, said segments also being provided with locating means on the opposite sides thereof in registry with the first-mentioned locating means for interfitting engagement with the locating means of the adjacent segment, said segments also having sockets for accommodation of movable and stationary contact carriers on both sides of their partition portions with contact supporting ledges adjacent thereto, stationary contact carriers positioned between successive segments, lugs projecting from the edge surfaces of said contact carriers into said stationary contact-accommodating sockets to secure said carriers in position in abutting relation with said ledges, stationary contacts mounted on said carriers, movable contact carriers positioned between successive segments in socketed engagement therewith, said movable contact carriers having movable contact portions movable to and from corresponding stationary contacts, cams

mounted on said shaft between successive segments positioned to cause said movable contacts to move into and out of engagement with corresponding stationary contacts, and through-bolts passing through said segments to secure the same to said mounting means and to clamp the same securely against one another.

3. In a multiposition switch, the combination comprising a shaft, means for rotatably mounting the same, indexing means associated with said shaft, a plurality of separate insulating segments secured to one another in aligned face-to-face relationship with aligned openings therein forming a canal for accommodation of said shaft, spacing means for maintaining said segments in spaced relation, each of said segments having sockets on both sides thereof for accommodation of movable and stationary contact carriers, contact supporting ledges adjacent said sockets, stationary contact carriers positioned between successive segments, lugs projecting from the edge surfaces of said contact carriers into said stationary contact-accommodating sockets to secure said carriers in position in abutting relation with said ledges, stationary contacts mounted on said carriers, movable contact carriers positioned between successive segments in socketed engagement therewith, said movable contact carriers having movable contact portions movable to and from corresponding stationary contacts, cams mounted on said shaft between successive segment members positioned to cause said movable contacts to move into and out of engagement with corresponding stationary contacts, and through-bolts passing through said segments to secure the same to said mounting means and to clamp the same securely against one another.

4. In a multiposition switch, the combination comprising a shaft, means for rotatably mounting the same, indexing means associated with said shaft, a plurality of separate insulating segments secured to one another in aligned face-to-face relationship with aligned openings therein forming a canal for accommodating said shaft, spacing means for maintaining said segments in spaced relation, each of said segments having sockets on both sides thereof for accommodation of movable and stationary contact carriers, stationary contact carriers positioned between successive segments and having portions projecting into said stationary contact-accommodating sockets to secure said carriers in position, stationary contacts mounted on said carrier, movable contact carriers positioned between successive segments in socketed engagement therewith, said movable contact carriers having movable contact portions movable to and from corresponding stationary contacts, cams mounted on said shaft between successive segments positioned to cause said movable contacts to move into and out of engagement with corresponding stationary contacts, and through-bolts passing through said segments to secure the same to said mounting means.

5. In a multiposition switch, the combination comprising a shaft, means for rotatably mounting the same, indexing means associated with said shaft, a plurality of separate insulating segments secured to one another and to said mounting means to form a frame having a series of successive switching cells, openings through said segments to accommodate said shaft, each of said segments having contact carrier locating abutments on both sides thereof, stationary contact carriers positioned in the cells between successive segments held in place by engagement with some of said locating abutments, movable contact carriers positioned in said cells between successive segments held in place by engagement with others of said locating abutments, said movable contact carriers having movable contact portions movable to and from corresponding stationary contacts, and cams mounted on said shaft between successive segments positioned to cause said movable contacts to move into and out of engagement with said stationary contacts.

6. In a multiposition switch, the combination comprising a plurality of parallelly disposed spaced insulating segments, fixed and movable contact units positioned between successive segments and secured therebetween by socketed engagement with adjacent segments, means for maintaining said segments in alignment with one another and for clamping said segments securely together, a cam-operating shaft passing through said segments, and cams mounted thereon adapted to selectively engage movable contact units.

7. In a multiposition switch, the combination comprising a mounting member, a switch body secured thereto, a shaft rotatably mounted in said mounting member and extending through said switch body to a position beyond the rear thereof, a stop-plate secured to the rear of said switch body surrounding the end of said shaft, a stop-finger secured to the end of said shaft projecting laterally therefrom, a plurality of stop-accommodating means in said stop-plate surrounding said shaft, and stops adapted to be selectively secured to said stop-accommodating means in position to be engaged by said stop-finger.

8. In a multiposition switch, the combination comprising a mounting member, a switch body, a shaft rotatably mounted in said mounting member and extending through said switch body to a position beyond the rear thereof, a stop-plate secured to the rear of said switch body surrounding the end of said shaft, a through-bolt passing through said stop-plate and said switch body engaging said mounting means, a stop-finger secured to the end of said shaft projecting laterally therefrom, a plurality of stop-accommodating means in said stop-plate surrounding said shaft, and stops adapted to be selectively secured to said stop-accommodating means in position to be engaged by said stop-finger when said shaft is rotated.

9. In a multiposition switch, the combination comprising a plurality of parallelly disposed spaced insulating segments forming an elongated switch frame, fixed contact units with terminals positioned between successive segments and secured therebetween by socketed engagement with adjacent segments, said fixed contact terminals being exposed on the upper face of said frame, movable contact units with terminals also positioned between successive segments and secured therebetween by socketed engagement with adjacent segments, said movable contact units having upwardly-facing terminals disposed along the sides of said switch frame, connecting means exterior to said frame for connecting predetermined terminals to one another, a cam-operating shaft passing through said frame, and cams mounted on said shaft adapted to selectively engage movable contact units.

10. In a multiposition switch, the combination comprising a plurality of parallelly disposed, relatively flat, rectangular, spaced insulating seg-

ments forming a compartmented insulating switch frame with outwardly-facing terminal recesses along the sides of said frame opposite the several compartments, fixed and movable contact units positioned within the compartments between successive segments and secured therebetween by socketed engagement with the adjacent segments, terminals secured to said contact units located within said terminal recesses, a cam-operating shaft passing through said segments, and cams mounted thereon adapted to selectively engage movable contact units.

11. In a multiposition, multifunction switch construction, a plurality of insulating segments each comprising relatively flat partition portions with integral spacing bosses projecting from the front faces thereof, said segments being arranged in superimposed series in front-to-back relation to one another, with the spacing bosses thereof in engagement with the rear faces of the next succeeding segments to form a series of switching cells with spacing bosses extending from the front face of the front segment in said series, a mounting plate in engagement with said front segment bosses forming therewith a cell for accommodation of an indexing mechanism, a switch-actuating shaft passing through said mounting plate and said segments and the cells formed thereby, switching means mounted in said switching cells adapted to be actuated by said shaft, and indexing means mounted in said indexing cell in cooperative indexing engagement with said shaft.

12. In a multiposition, multifunction switch construction, a plurality of insulating segments each comprising relatively flat partition portions with integral major spacing bosses projecting from the front faces thereof and minor integral spacing bosses projecting a substantially smaller distance from the rear faces thereof, said major and minor spacing bosses being in registry with one another, said segments being arranged in superimposed series in front-to-back relation to one another with said major bosses in engagement with said minor bosses of the next succeeding segment to form a series of switching cells with major spacing bosses extending from the front face of the front segment in said series, a mounting plate in engagement with said major bosses of said front segment forming therewith a cell for accommodation of an indexing mechanism, a switch-actuating shaft passing through said mounting plate and said segments and the cells formed thereby, switching means mounted in said switching cells to be actuated by said shaft, and indexing means mounted in said indexing cell in cooperative indexing engagement with said shaft.

13. In a multiposition, multifunction switch construction, a plurality of insulating segments each comprising relatively flat partition portions with integral spacing bosses projecting from the front faces thereof, interlocking means on the ends of said bosses, interlocking means on the rear faces of said partition portions in registry with said interlocking means on said front face bosses, said segments being arranged in superimposed series in front-to-back relation to one another, with said interlocking means on said bosses in engagement with the interlocking means on the rear faces of the next succeeding segments to form a series of switching cells with spacing bosses extending from the front face of the front segment in said series, a mounting plate in engagement with said front segment bosses, forming therewith a cell for accommodation of an indexing mechanism, a switch-actuating shaft passing through said mounting plate and said segments and the cells formed thereby, switching means mounted in said switching cells adapted to be actuated by said shaft, and indexing means mounted in said indexing cell in cooperative indexing engagement with said shaft.

14. In a switching unit adapted for combination with like switching units to form a multifunction switch, the combination comprising an insulating support formed of two spaced parallel roughly quadrangular insulating partition walls, spacer members cooperating therewith to define a switching cell, said walls extending beyond said cell to provide an outwardly exposed terminal-accommodating groove, two pairs of engageable contacts within said cell, a terminal for each of said contacts in electrical connection therewith, terminals for one of said pairs of contacts being disposed adjacent to the two corners on one side of said support and the terminals for the other pair of contacts being disposed adjacent to the two corners on the other side of said support, all of said terminals being mounted within said groove facing outwardly therefrom, whereby a jumper-bar for connecting said pairs of contacts in series may be disposed entirely within said groove in electrical connection with adjacent terminals on the opposite sides of said support.

15. In a switching unit adapted for combination with like switching units to form a multifunction switch, the combination comprising an insulating support formed of two spaced roughly parallel insulating partition walls, spacer members cooperating therewith to define a switching cell, said walls extending beyond said cell to provide an outwardly-exposed terminal-accommodating groove, a plurality of pairs of contacts cooperatively engageable in pairs disposed within said cell, a terminal for each of said contacts in electrical connection therewith, said terminals being mounted within said groove facing outwardly therefrom for accesses from without said groove, said terminals being grouped by pairs corresponding to said pairs of contacts whereby a jumper-bar for connecting adjacent terminals of adjacent pairs of contacts for connecting said pairs of contacts in series may be disposed entirely within said groove.

16. In a switching unit adapted for combination with like switching units to form a multifunction switch, the combination comprising an insulating support formed of two spaced parallel roughly quadrangular insulating partition walls, spacer members cooperating therewith to define a switching cell, the corners of said walls extending beyond said cell to provide two upper and two lower outwardly exposed terminal-accommodating pockets, said spacer members having downwardly and inwardly inclined outer side faces to provide access to said lower terminal pockets from points above and to one side of the same, two pairs of engageable contacts within said cell, a terminal in each of said pockets, each of said terminals being in electrical connection with one of said contacts, and a groove joining said lower pockets for accommodation of a jumper-bar for connecting the terminals in said lower pockets.

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