

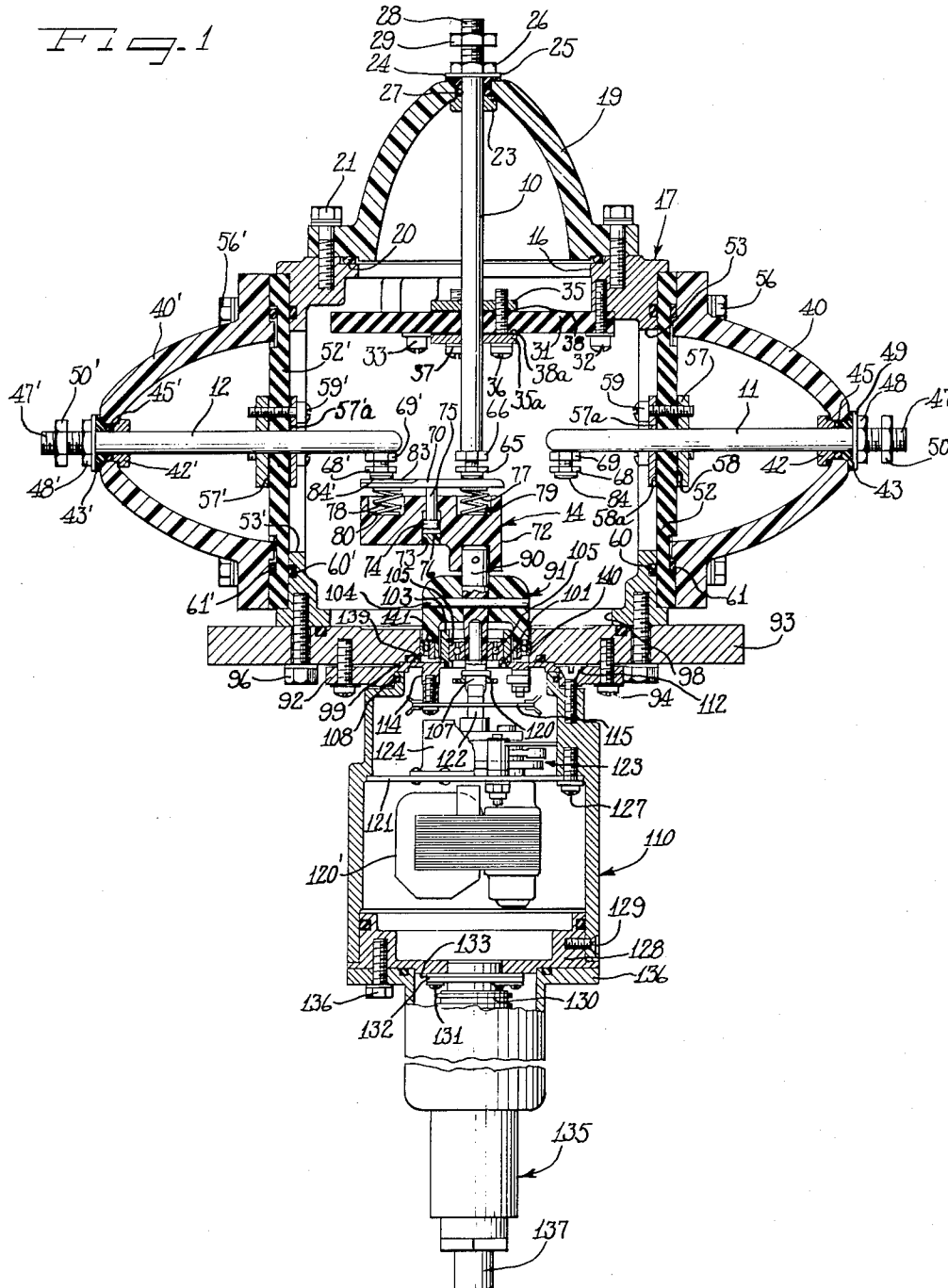
April 10, 1956

C. F. SCHUNEMANN ET AL

2,741,671

HIGH VOLTAGE HEAVY DUTY SWITCH

Filed Feb. 10, 1953



Inventors
Carl F. Schunemann
Richard L. Gates

Wm. Sherman, Merwin Chase & Simpson Attys

1

2,741,671

HIGH VOLTAGE HEAVY DUTY SWITCH

Carl F. Schunemann, Cleveland, and Richard L. Gates, Eastlake, Ohio, assignors to Thompson Products, Inc., Cleveland, Ohio, a corporation of Ohio

Application February 10, 1953, Serial No. 336,058

16 Claims. (Cl. 200—6)

This invention relates to an electric switch and more particularly to a high voltage heavy duty switch for selectively interconnecting two or more conductors.

It is an important object of the present invention to provide a switch which will satisfactorily accommodate voltages up to 15,000 volts R. M. S. at 15 amperes and 30 megacycles.

It is a further important object of the present invention to provide a novel improved electric switch suitable for use as a shipboard antenna transfer switch.

It is a further object of the present invention to provide a novel rotor assembly for an electric switch.

It is a further important object of the present invention to provide a novel contact mounting arrangement for a heavy duty switch.

Other objects, features and advantages of the present invention will be readily apparent from the following detailed description of a preferred embodiment thereof, taken in conjunction with the accompanying drawings, in which:

Figure 1 is a fragmentary longitudinal sectional view with certain parts shown in elevation illustrating a heavy duty electric switch according to the present invention.

The switch illustrated is a shipboard antenna transfer switch and is adapted to connect a central switch conductor 10 selectively with switch branch conductors 11 and 12 by means of a rotor contact assembly 14. The central conductor 10 is mounted concentrically of an upper opening 16 in the switch body 17 by means of a cup-shaped insulator 19 closing the opening and protruding outwardly from the top of the switch body. The insulator cup 19 is sealed to the body by means of an O ring 20 in conjunction with screws 21, and the central conductor 10 is sealed to the apex of the insulator 19 by means of metal bushing 23 and dielectric bushing 24 in conjunction with an O ring 27 therebetween. A washer 25 and nut 26 are carried on the threaded end 28 of the conductor 10 and the nut 26 may cooperate with a nut 29 to clamp a connecting lead to the switch central conductor 10. A support plate of insulating material 31 extends below the top opening 16 in the switch body and is secured to the switch body as by means of screws 32 and 33. It has been found that corona effects can be materially reduced by selecting the material of plate 31 to have a low dielectric constant. A high pressure laminate manufactured under the name "Spauldite" has been found to give the desired reduction of corona. Collars 35 and 35a are secured centrally of the support 31 by means of screws 36, and 37 for positioning the central conductor in the switch body. For affording a smooth no-corona juncture between the metal collars 35, 35a and the "Spauldite" plate 31, an alkyd resin material such as manufactured under the name "Glyptal" is interposed between the collars and the plate as indicated at 38 and 38a.

The right side conductor 11 is mounted by means of a cup insulator 40 having a metal bushing 42 and a di-

2

electric bushing 43 at its apex and O ring 45 therebetween for sealing the connection between the insulator 40 and the conductor 11. The threaded outer end 47 of the conductor 11 receives nut 48 and washer 49 for securing the bushing 43 against the insulator 40, and has a nut 50 for securing a connecting lead to the switch conductor 11. A support plate 52, which may be of the same high pressure laminate with low dielectric constant as plate 31, is clamped over the side opening 53 of the switch body between the insulator 40 and the switch body 17 by means of screws 56. Collars 57 and 57a are secured to the support 52 by means of screws 59, and may have alkyd resin material between the collars and plate 52 as indicated at 58 and 58a for reducing corona. The left side conductor 12 is mounted by parts similar to those just described and their corresponding parts have been given corresponding primed reference numerals in the drawings so that specific description thereof is unnecessary. Since the side support and side insulators are sealed to the switch body by means of O-rings 60, 61 and 60', 61', it will be appreciated that the upper portion of the switch is substantially moistureproof. The cup-shaped insulators in cooperation with the adjacent support serve to furnish spaced two point support for each of the conductors so as to rigidly position their inner ends within the switch body 17, and also to insulate the conductors from the switch body.

The central conductor 10 carries a contact 65 at its lower end comprising a screw threaded into the conductor and a nut 66 for locking the contact at the desired level. The contact 65 preferably has rounded lateral surfaces to reduce corona. The side conductors 11 and 12 have screws threaded transversely through the ends of the conductors 11 and 12 and fixed relative thereto by means of nuts 69 and 69'. It will be observed that the contacts 68 and 68' are equally spaced from the central contact 65 and have rounded heads at the same level in the switch body 17. The rotor contact assembly 14 includes a contact plate 70 having continuous electrical connection with the center contact 65 and rotatable about a central axis for selective electrical contact with the branch contacts 68 and 68'.

The contact plate 70 is mounted by means of an insulating block 72 having a recess 73 opening into the bottom thereof for receiving the head 74 of a pin 75 connected to the contact plate 70. The recess 73 is closed by means of a dielectric plug 76 cemented to the block. The pin 75 extends in a reduced bore for guiding reciprocating movements of the contact plate 70 at the top of the block 72. For urging the contact plate 70 outwardly from the block 72, a pair of springs 77 and 78 are mounted in recesses 79 and 80 at the top face of the block and bear on the underside of the contact plate at a distance from the central axis of the switch body corresponding to the spacing between the central contact 65 and the branch contacts 68 and 68'. The leading upper edge of the contact plate 70 is beveled as indicated at 83 and the contacts 68 and 68' are rounded at their lower ends as indicated at 84 and 84' so as to cam the contact plate 70 downwardly as the outer end of the contact plate is moved into contact with one of the branch contacts 68 and 68'. The springs 77 and 78 serve to continuously urge the contact plate into firm electrical connection with the contacts.

The contact assembly 14 is rotatably supported on a shaft 90 of dielectric material by means of a collar 91 also of dielectric material, the shaft 90 being connected with the collar 91 by means of a dielectric pin 104. A plate 92 is secured to a closure plate 93 at the lower end of the switch body by means of bolts 94 and the

3

closure plate 93 is secured to the switch body 17 by means of bolts 96 to close a switch body opening 98 opposite to the upper opening 16. The plate 92 has a center boss 99 nesting within a recess in the closure plate 93, and has a central opening receiving an inwardly offset end portion 101 of the sleeve 103. A bearing assembly 105 is interposed between the sleeve 103 and the shaft 90, the outer race of the assembly being positioned by a shoulder at the lower end of the sleeve provided by end portion 101 thereof. The plate 92 thus serves to center the shaft 90 centrally of the switch body 17.

For supporting shaft 90 and collar 91, the plate 93 is provided with an annular shoulder 139 at the lower end of the central opening therein. The shoulder 139 bottoms thrust bearing assembly 140, the outer race of bearing assembly 140 seating edgewise on the shoulder 139, and the inner race abutting the annular face provided by a rabbet groove 141 in the collar 91.

The contact assembly shaft 90 is interlocked with a shaft 107 extending upwardly into the sleeve. The bearing mounting plate 92 has a recess 108 which receives a reduced portion of the actuating housing 110 in telescoping relation therein, the housing being retained with the bearing mounting plate 92 by means of screws such as 112. The bearing mounting plate 92 has a depending boss 114 which has a threaded hole for mounting a wafer switch 115 which may be utilized for controlling the indexing of the rotor contact assembly in a manner well known to the art. The bearing plate also has a threaded opening for receiving a mounting structure for a detent mechanism including spring actuating ratchet arms carrying roller (not shown) for cooperation with the detent gear 120 fixed to the shaft 107, also well known in the art. The function of the detent mechanism is to accurately position the rotor contact assembly at the switching stations.

A motor 120 mounted within the actuating housing 110 by means of a mounting plate 121 drives a shaft 122 through a drive train 123 which is enclosed by a casing 124 secured to the mounting plate 121. This drive train need not be described in detail as it may be any conventional type. The mounting plate 121 is secured to the actuating housing by means of bolts such as 127. A cap 128 closes the lower end of the actuating housing 110 and is secured thereto by means of bolts such as 129. The cap 128 has a central aperture and a pressurized receptacle 130 is secured therein by means of screws 131, the receptacle having a flange 132 cooperating with a gasket 133 to seal the receptacle to the cap 128. A stuffing box 135 has a flange 136 secured to the outer periphery of the cap 128 by means of screws such as 136. A cable tube 137 is secured at the lower end of the stuffing box for receiving the power cable for supplying the motor 120.

There is thus provided a novel switch structure which is adapted for heavy duty, high voltage operation and yet which is suitably compact and economical in construction.

It will be understood that modifications and variations may be effected without departing from the scope of the novel concepts of the present invention.

We claim as our invention:

1. An electric switch comprising a housing including at least two laterally extending dome-like wall portions and one upwardly extending dome-like wall portion, a conductor having an exterior terminal portion and extending downwardly through the apex of said upwardly extending dome and terminating in a downwardly facing contact, a conductor having an exterior terminal portion and extending through the apex of each of said lateral domes and each terminating within said housing in a downwardly facing contact, a bridging contact mounted for rotation on a shaft substantially coaxial with said downwardly extending conductor, said bridging contact having a portion which lies in abutting relation with said contact of

4

said downwardly extending conductor, irrespective of its angular position, and having another portion which selectively engages one of said contacts of said lateral conductors depending upon its angular position with respect to said shaft.

2. An electric switch comprising a housing including at least two laterally extending dome-like wall portions and one upwardly extending dome-like wall portion, a conductor extending downwardly through said upwardly extending dome and terminating in a downwardly facing contact, a conductor extending through each of said lateral domes and each terminating within said housing in a downwardly facing contact, an arm mounted for rotation on a shaft substantially coaxial with said downwardly extending conductor, a bridging contact mounted on said arm for limited upward movement, resilient means biasing said bridging contact upwardly, said bridging contact having a portion which lies in abutting relation with said contact of said downwardly extending conductor, irrespective of its angular position, and having another portion with a downwardly sloping edge which selectively engages one of said contacts of said lateral conductors depending upon its angular position with respect to said shaft, the sloping edge serving to depress said bridging contact against the action of said resilient biasing means as said edge moves into engagement with said contacts of said lateral conductors.

3. An electric switch comprising a housing including at least two laterally extending dome-like wall portions and one upwardly extending dome-like wall portion, a conductor extending downwardly through said upwardly extending dome and terminating in a downwardly facing contact, a conductor extending through each of said lateral domes and each terminating within said housing in a downwardly facing contact, a bridging contact mounted for rotation on a shaft substantially coaxial with said downwardly extending conductor, said bridging contact having a portion which lies in abutting relation with said contact of said downwardly extending conductor, irrespective of its angular position, and having another portion which selectively engages one of said contacts of said lateral conductors depending upon its angular position with respect to said shaft, a subsidiary housing projecting downwardly from said first housing, an electric motor in said subsidiary housing for rotating said shaft, and indexing means in said subsidiary housing for accurately positioning said shaft in each of a plurality of angular positions wherein said bridging contact is in engagement with one of said contacts of said lateral conductors.

4. An electric switch comprising a housing including at least two laterally extending dome-like wall portions and one upwardly extending dome-like wall portion, a conductor having an exterior terminal portion and extending downwardly through said upwardly extending dome and terminating in a downwardly facing contact, a conductor having an exterior terminal portion and extending through each of said lateral domes and each terminating within said housing in a downwardly facing contact, an arm mounted for rotation on a shaft substantially coaxial with said downwardly extending conductor, a bridging contact mounted on said arm for limited upward movement, resilient means biasing said bridging contact upwardly, said bridging contact having a portion which lies in abutting relation with said contact of said downwardly extending conductor, irrespective of its angular position, and having another portion which selectively engages one of said contacts of said lateral conductors depending upon its angular position with respect to said shaft, a subsidiary housing projecting downwardly from said first housing, means in said subsidiary housing for rotating said shaft, the interior of said lateral dome-like wall portions being separated from the central portion of said first housing by additional inner wall portions through which said lateral conductors also extend, said inner wall portion having metal collars on opposite sides

5

thereof and closely engaging said lateral conductors, and a layer of an alkyd resin material interposed between each collar and the associated inner wall portion for affording a smooth no corona juncture between the collars and the inner wall portions.

5. A heavy duty switch comprising a housing having a top central and side openings, cup-shaped insulators closing each of said openings and projecting outwardly from said housing, conductors extending centrally through said cups into said housing, insulating supports interposed between said housing and said insulators for said side openings for positioning the side conductors, a top conductor support extending below said top opening and spaced above said side conductors for positioning said top conductor, contacts depending from the inner ends of the conductors and terminating in transverse alignment, with the contacts of the side conductors substantially equally spaced from the contact of the central upper conductor, a closure plate extending across the lower end of said housing having a central aperture, an actuating shaft extending into said housing through said aperture and terminating below said contacts, an actuating housing secured to said closure plate, an actuating mechanism in said actuating housing and in driving connection with the lower end of said shaft, an insulation block mounted on the upper end of said shaft having a central recess aligned with said shaft and with said central contact and having a further recess displaced from said central recess the distance between the central contact and the side contacts, a contact arm overlying said recesses and having a pin depending therefrom, said insulation block having a bore therein between said recesses receiving said pin for guiding said arm in reciprocating movement above said block, spring means seated in said recesses and acting on said arm to urge said contact arm away from said block and into contact with said contacts, and shoulder means in said bore and on said pin limiting displacement of said arm from said block to retain said contact arm in operative relation to said contacts, said arm being in constant contact with said central contact as said shaft is rotated.

6. A heavy duty switch comprising a housing having a top central and side openings, cup-shaped insulators closing each of said openings and projecting outwardly from said housing, conductors having terminal portions exteriorly of said cups and extending centrally through the apexes of said cups and into said housing, insulating supports extending transversely to the respective conductors adjacent said openings for positioning said conductors relative to said housing, contacts depending from said conductors within said housing and terminating in transverse alignment, and a contact assembly rotatably mounted in said switch housing for rotation on an axis substantially coincident with the axis of said central conductor for selectively interconnecting the contact of central conductor with the contacts of the other conductors.

7. A heavy duty switch comprising a switch body having an opening at one side thereof into said body, and a plurality of contacts disposed in transverse alignment within said body, a closure plate secured to said body over said opening and having a central aperture there-through and having a recess surrounding said aperture, a bearing mounting plate having an annular boss nesting within said recess and having a central aperture, said bearing mounting plate being secured to said closure plate, a bearing structure having a reduced end portion nesting within the aperture in said bearing mounting plate and extending through the closure plate aperture into said switch body, a shaft journaled in said bearing structure, a contact assembly carried by said shaft for selectively interconnecting said contacts within said switch body upon rotation thereof, an actuating housing having an end portion for connection with said switch body, said bearing mounting plate having an annular recess receiving said end portion in nesting relation, and an electric motor

6

carried in said actuating housing in driving connection with said shaft for selectively positioning said contact assembly.

8. An electric switch comprising a switch body having side openings, cup-shaped insulators closing said openings and protruding outwardly from said body, rigid elongated conductors extending centrally through said insulators into said housing, insulating supports interposed between said housing and said insulators for said side openings for positioning the side conductors, each conductor extending through the apex of one of said cup-shaped insulators and through the associated insulating support, said insulators and supports thereby providing spaced insulating support for rigid positioning of said conductors, contacts carried by said conductors within said switch body in transverse alignment, and a contact assembly mounted within said body for rotation about a longitudinal axis for selective electrical connection with said contacts.

9. An electric switch comprising a switch body having side openings, cup-shaped insulators closing said openings and protruding outwardly from said body, conductors extending centrally through said cups into said housing, insulating supports interposed between said housing and said insulators for said side openings for positioning the side conductors, each conductor extending through the apex of one of said cup-shaped insulators and through said insulating support, said insulators and supports thereby providing spaced insulating support for rigid positioning of said conductors, contacts carried by said conductors within said switch body in transverse alignment, a contact assembly mounted within said body for rotation about a longitudinal axis for selective electrical connection with said contacts, said contact assembly comprising an insulation block extending transversely within said switch body, a contact arm having a pin extending therefrom and reciprocally mounted by said block, said pin having a head opposing a shoulder in said block for retaining said pin with said block, and compression springs urging said arm outwardly from said block into operative relation with said contacts.

10. A high voltage heavy duty switch comprising a switch body having side openings, cup-shaped insulators closing said openings and protruding outwardly from said body, conductors extending centrally through said cups into said housing, insulating supports interposed between said housing and said insulators for said side openings for positioning the side conductors, each conductor extending through the apex of one of said cup-shaped insulators and through the associated insulating support, said insulators and supports thereby providing spaced insulating support for rigid positioning of said conductors, contacts carried by said conductors within said switch body in transverse alignment, and a contact assembly mounted within said body for rotation about a longitudinal axis for selective electrical connection with said contacts, and said insulating supports being made of a high pressure laminate material for reducing corona effects.

11. A high voltage heavy duty switch comprising a switch body having side openings, cup-shaped insulators closing said openings and protruding outwardly from said body, conductors extending centrally through said cups into said housing, insulating supports interposed between said housing and said insulators for said side openings for positioning the side conductors, each conductor extending through the apex of one of said cup-shaped insulators and through the associated insulating support, said insulators and supports thereby providing spaced insulating support for rigid positioning of said conductors, contacts carried by said conductors within said switch body in transverse alignment, and a contact assembly mounted within said body for rotation about a longitudinal axis for selective electrical connection with said contacts, and said insulating supports being made of a high pressure

laminate material for reducing corona effects, metal collars carried on opposite sides of each of said supports and closely engaging said conductors, and a layer of an alkyd resin material interposed between each collar and the associated support for affording a smooth no corona juncture between the collars and the supports.

12. A heavy duty switch comprising a switch body having an opening at one side thereof into said body, and a plurality of contacts disposed in transverse alignment within said body, a closure plate secured to said body over said opening and having a central aperture therethrough and having a recess surrounding said aperture, a bearing mounting plate having an annular boss nesting within said recess and having a central aperture, said bearing mounting plate being secured to said closure plate, a bearing structure having a reduced end portion nesting within the aperture in said bearing mounting plate and extending through the closure plate aperture into said switch body, a shaft journaled in said bearing structure, and a collar for supporting said shaft secured to said shaft and having an annular skirt with an interior recess accommodating said bearing structure, said closure plate having an annular shoulder projecting into the central aperture thereof, said collar annular skirt telescoping into the central aperture of said closure plate and providing an annular shoulder opposing said closure plate shoulder, thrust bearing means interposed between the shoulders of said closure plate and collar to support the collar from said closure plate, and a contact assembly carried by said shaft for selectively interconnecting said contacts within said switch body upon rotation of said shaft.

13. A heavy duty switch comprising a housing having a plurality of openings into a central chamber, cup-shaped insulators closing each of said openings and projecting outwardly from said housing, conductors extending centrally through said cups and into said housing, insulating supports extending transversely to the respective conductors adjacent said openings for positioning said conductors relative to said housing, said insulating supports being made of a high pressure laminate material for reducing corona effects, contacts carried by said conductors within said housing, and a contact assembly rotatably mounted in said housing for selectively interconnecting the contacts of said conductors.

14. A heavy duty switch comprising a housing having a plurality of openings into a central chamber, cup-shaped insulators closing each of said openings and projecting outwardly from said housing, conductors extending centrally through said cups and into said housing, insulating supports extending transversely to the respective conductors adjacent said openings for positioning said conductors relative to said housing, said insulating supports being made of a high pressure laminate material for reducing corona effects, contacts carried by said conductors within said housing, and a contact assembly rotatably mounted in said housing for selectively interconnecting

the contacts of said conductors, metal collars carried on opposite sides of each of said supports and closely engaging the conductor extending therethrough, and a layer of an alkyd resin material interposed between each collar and the associated support for affording a smooth no corona juncture between the collars and the supports.

15. A heavy duty switch comprising a housing having a plurality of openings in the side walls thereof communicating with a central chamber, cup-shaped insulators closing each of said openings and projecting outwardly from said housing, rigid rod-like conductors each associated with one of said cup-shaped insulators and having a threaded terminal portion exteriorly of the insulator and extending through the apex of the insulator and into the housing central chamber, insulating supports extending transversely to the respective conductors adjacent said openings for receiving the conductors therethrough, said insulators and said supports providing spaced two point support for said rod-like conductors, contacts threadedly engaging the respective conductors within the housing central chamber, and a contact assembly rotatably mounted in said housing for selectively interconnecting the contacts of said conductors.

16. A heavy duty switch comprising a switch body having an opening at one end thereof into a central chamber of said body, a plurality of contacts disposed within said body including a central contact and further contacts lying in a common transverse plane with said central contact and equally spaced therefrom, a closure plate secured to said body over said opening having a central aperture and an annular shoulder coaxial with said aperture, a shaft extending through said aperture, a collar of insulating material for supporting said shaft secured to said shaft and having an annular skirt providing an annular shoulder opposing said closure plate annular shoulder, thrust bearing means interposed between the shoulders of said closure plate and said collar to support the collar from the closure plate, a block of insulating material mounted on said shaft and extending transversely within said switch body, a contact arm mounted by said block having a planar upper surface of length equal to the spacing between said central contact and said further contacts and in continuous engagement with said central contact and for bridging between the central contact and a selected further contact, and spring means interposed between said contact arm and said block for urging said arm outwardly into operative relation with the central contact and the selected further contact.

References Cited in the file of this patent

UNITED STATES PATENTS

889,305	Heinze	June 2, 1908
1,978,161	Martin	Oct. 23, 1934
2,020,405	Ford	Nov. 12, 1935