United States Patent [19]

Kiessling

[11] **3,733,451**

[45] **May 15, 1973**

[54] **ELECTRIC SWITCH ASSEMBLY FOR CONTROL STATIONS HAVING RECTILINEARLY OR ROTATABLY MOVABLE SWITCH OPERATORS LOCATED AT DIFFERENT CENTERS**

[75] Inventor: **Rudolf H. Kiessling,** Milwaukee, Wis.

[73] Assignee: **Square D Company,** Park Ridge, Ill.

[22] Filed: **Mar. 23, 1972**

[21] Appl. No.: **237,382**

[52] **U.S. Cl.** .....**200/168 R,** 174/53

[51] **Int. Cl.** **H01h 9/02**

[58] **Field of Search** .....200/168 R, 168 B, 200/168 C, 168 D, 153 G; 174/53, 55, 66, 56

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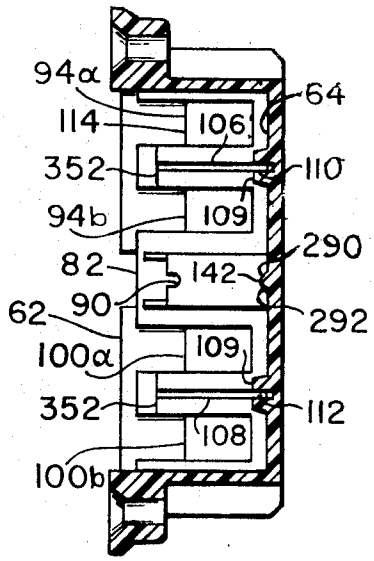
Primary Examiner—Robert K. Schaefer
Assistant Examiner—William J. Smith
Attorney—Harold J. Rathbun et al.

[57] **ABSTRACT**

An electrical switch assembly having its component parts arranged so a maximum number of the common parts can be used in a flush mounted control station or a surface mounted control station with either of the control stations having rectilinearly moving or rotatable switch operators. The assembly includes components which operate on selected centers so the components may be selectively arranged to be used with two different switch covers, two different type switch actuators and with or without a pilot light. The components also are arranged so the rectilinearly movable operators may be interlocked or made to operate alternately and the rotary operator to be programmed to operate in a two or three position mode of operation.

18 Claims, 48 Drawing Figures



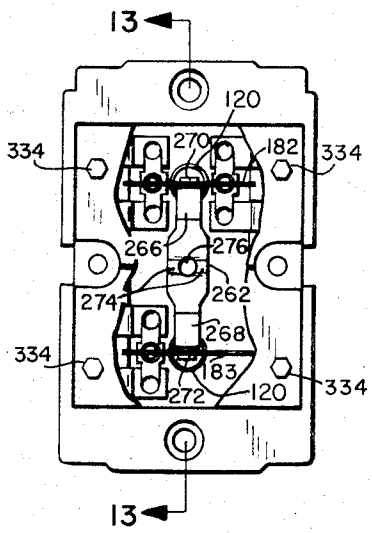


FIG. 14

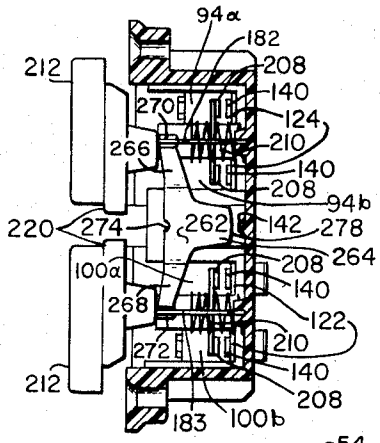


FIG. 13

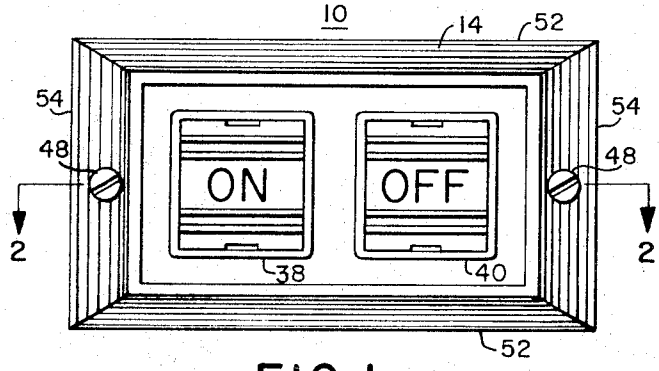


FIG. 1

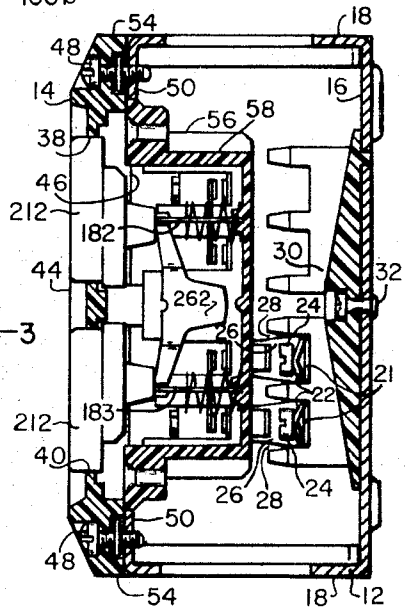


FIG. 2

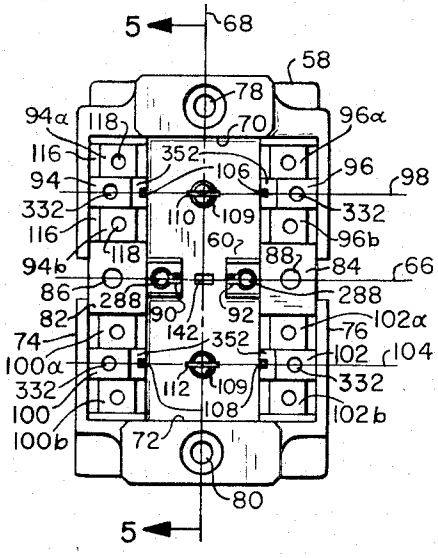


FIG. 4

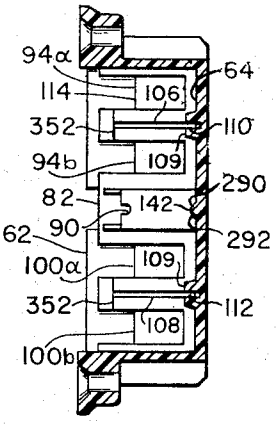


FIG. 5

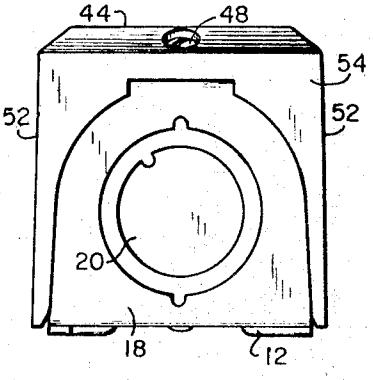


FIG. 3

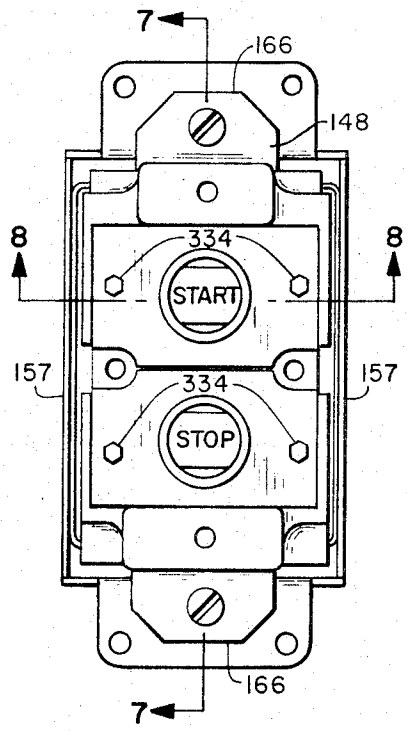


FIG. 6

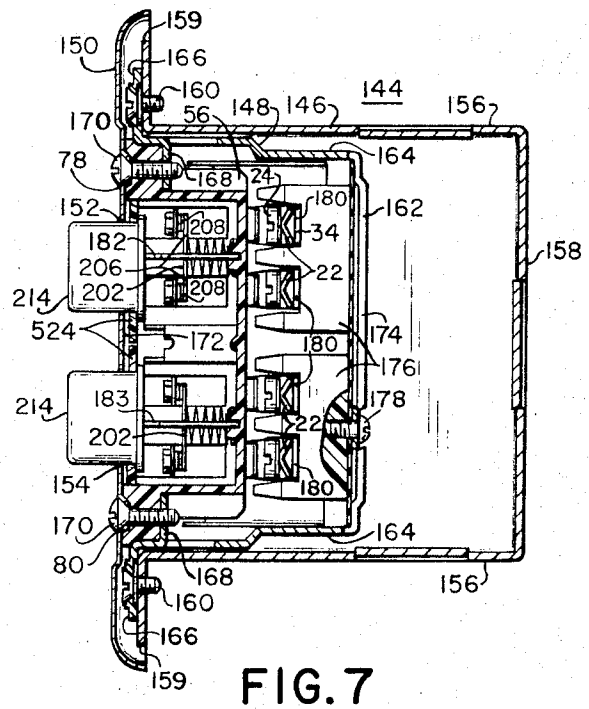


FIG. 7

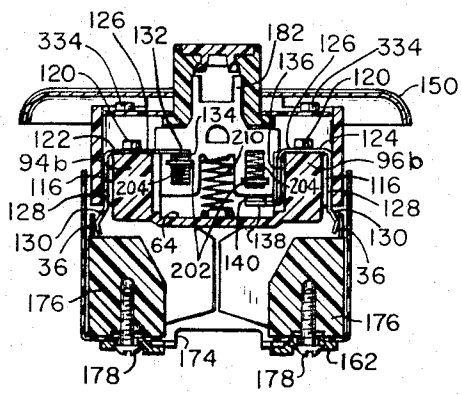


FIG. 8

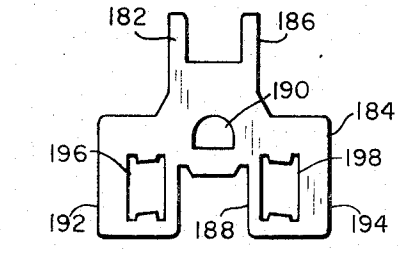


FIG. 8A

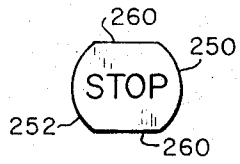


FIG. 11

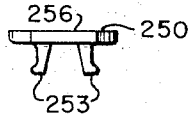


FIG. 12

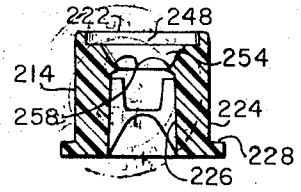


FIG. 9

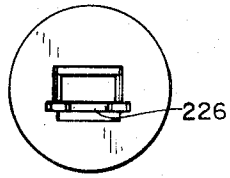
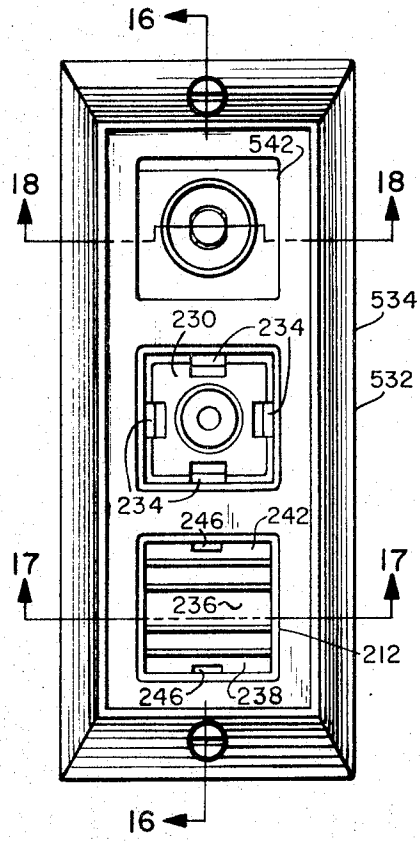


FIG. 10



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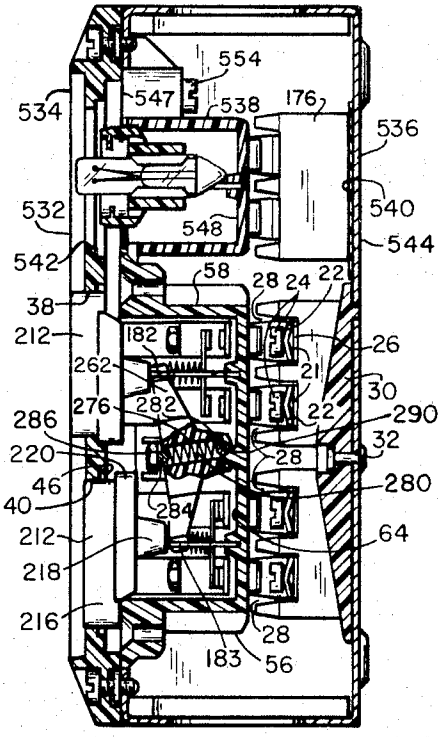
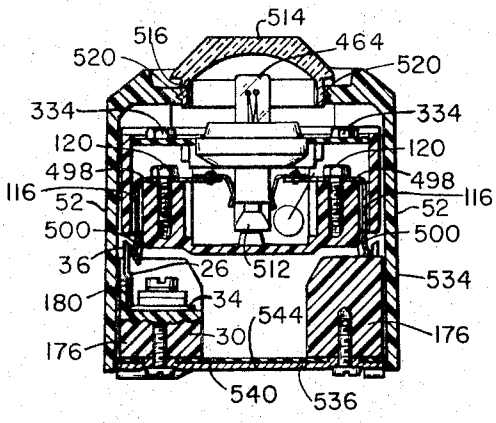


FIG. 16



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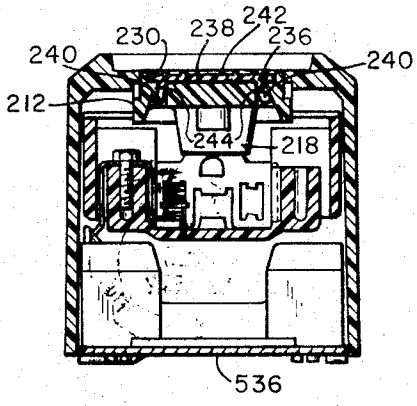


FIG. 17

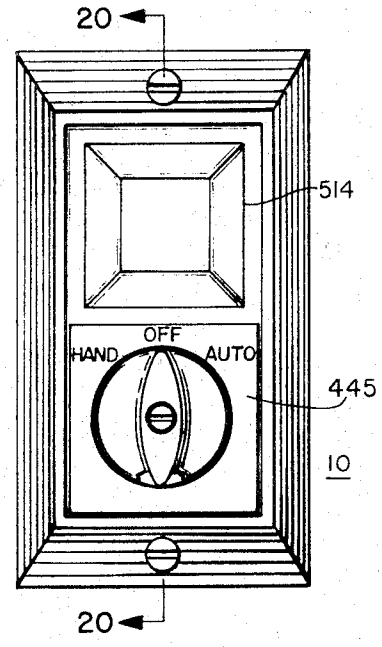


FIG. 19

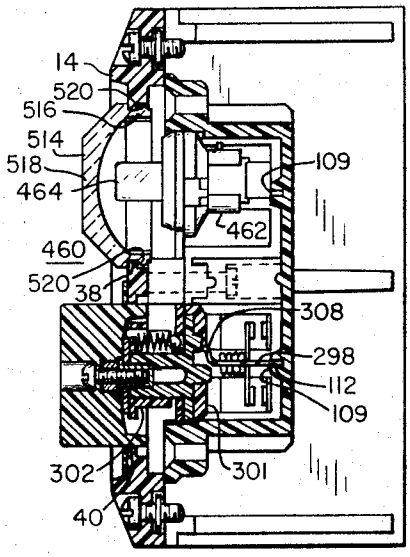


FIG. 20

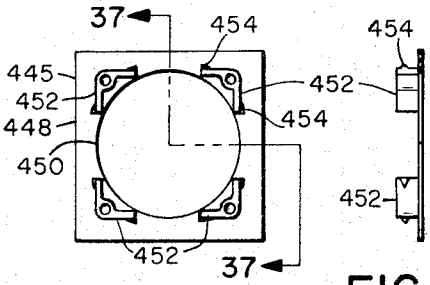
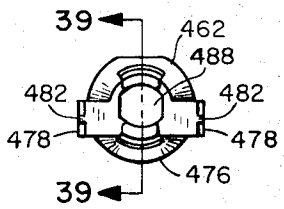


FIG. 36

FIG. 37



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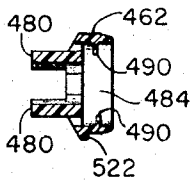


FIG. 39

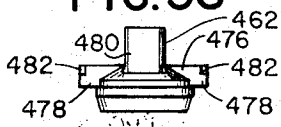
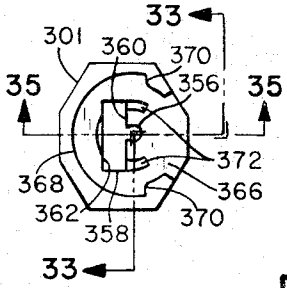


FIG. 38A



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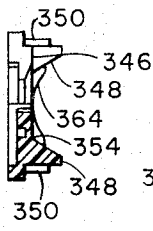


FIG. 33

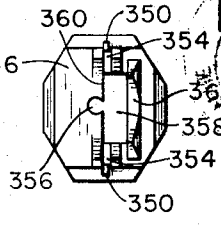


FIG. 34

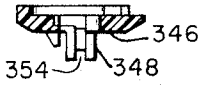


FIG. 35

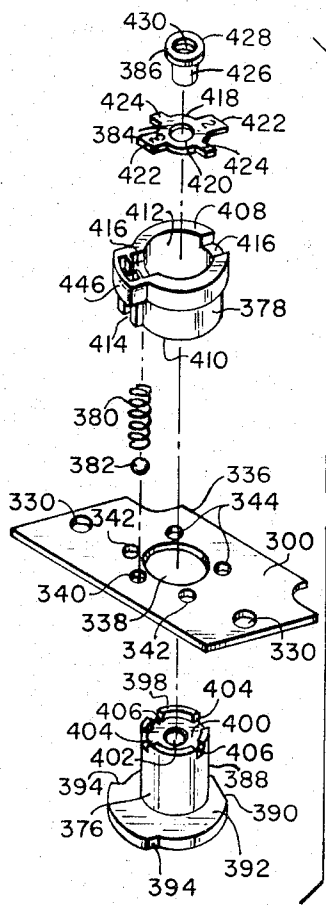


FIG. 22

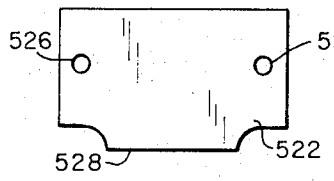


FIG. 21A

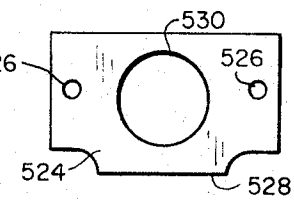


FIG. 31A

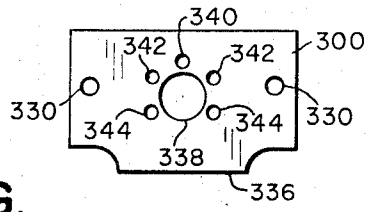


FIG. 21B

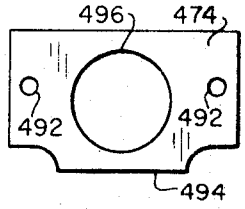


FIG. 31B

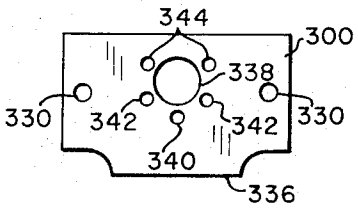
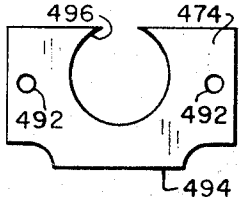


FIG. 21C



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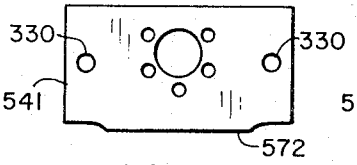

FIG. 21D

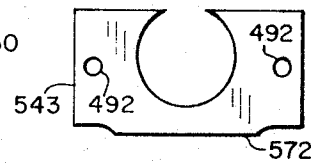

FIG. 31D

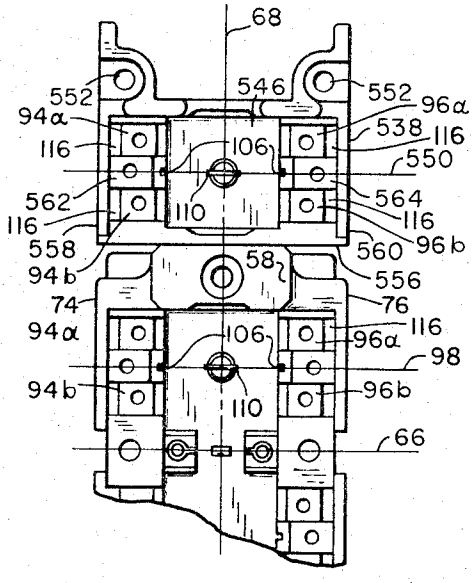

FIG. 40

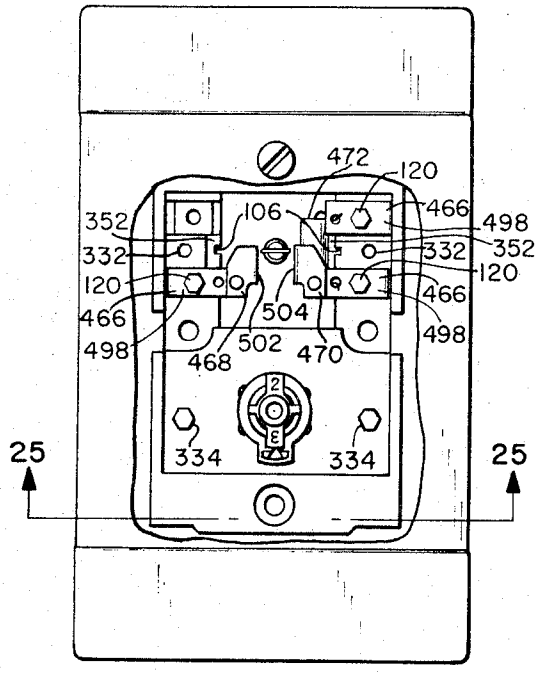

FIG. 23

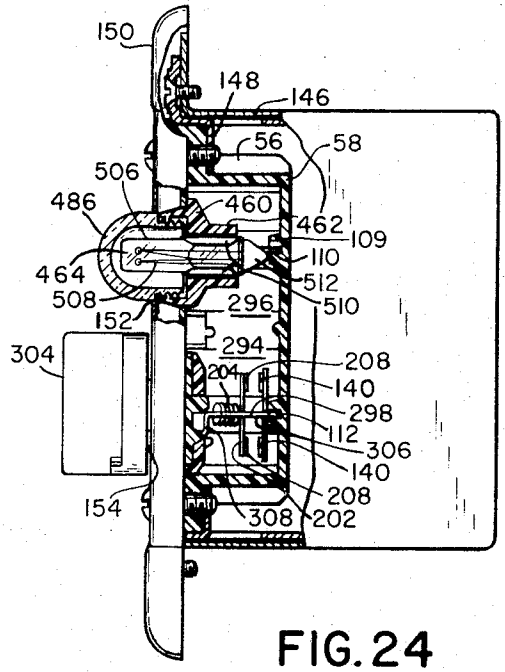

FIG. 24

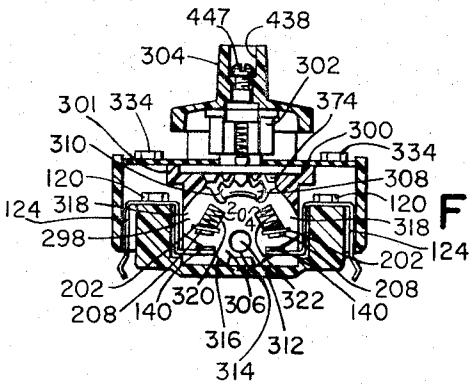

FIG. 25

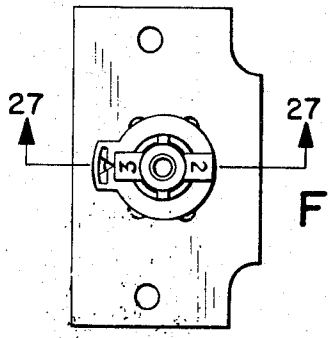

FIG. 26

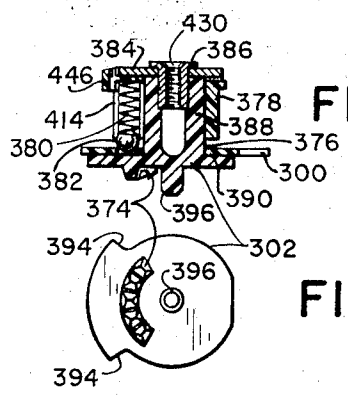

FIG. 27

FIG. 28

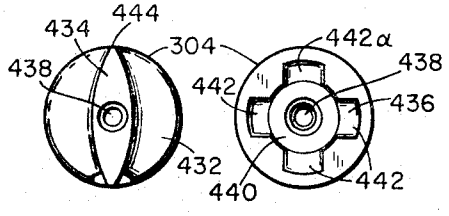

FIG. 29 FIG. 30

ELECTRIC SWITCH ASSEMBLY FOR CONTROL STATIONS HAVING RECTILINEARLY OR ROTATABLY MOVABLE SWITCH OPERATORS LOCATED AT DIFFERENT CENTERS

This invention relates to manually operated electric switches and is more particularly concerned with a switch structure which may be used with two different type switch covers with the covers having unequally spaced openings and with the switch structure having either a rectilinearly movable or a rotatable operator which extends through the openings in the covers.

Surface mounted and flush mounted control stations are frequently used with magnetic motor starters to govern the starting, stopping or reversing of all types of electric motors. Because control stations are used in a large variety of different installations and are required to provide a variety of different switching functions, manufacturers of control stations are required to furnish control stations having push button operators, selector switch operators and pilot lights.

Flush mounted control stations are commonly installed in walls of buildings and include a conventional receptacle and an ornamental cover plate for the receptacle. The dimensions of the receptacle and cover plate have standardized by the electrical industry and require that a pair of openings in the cover plate for the operators for a switch mechanism mounted within the receptacle be located on centers one inch apart and be circular to accept cylindrical push buttons having a diameter of five-eighths inches.

While the use of flush mounted control stations in buildings has been accepted, their use in factories and machines and in pendant control installations to control the operation of machines and hoists is objectionable because the relatively small size and close spacing of the operating buttons causes the operation of the control station to become more difficult when an attempt to operate the control station is made by a person wearing gloves. Accordingly, surface mounted control stations, which are intended for use in factories, are furnished with operating buttons which are spaced and have surface areas designed so that they can be conveniently operated by persons wearing gloves. Thus surface mounted control stations have larger operating buttons which are spaced further apart than the buttons in flush mounted control stations.

Conventional surface mounted and flush mounted control stations may have either a pair of push buttons or a rotary selector switch and may or may not include pilot lights. The push buttons of the control stations may or may not be interlocked and may be interlocked so that the pair of push buttons are maintained in their latest operated positions. The rotary selector switch may have either two or three indexed operating positions. The contacts within the switches operated by the push buttons or selector switch may be of the normally open or normally closed type. The control stations may be mounted in either a horizontal position or a vertical position requiring that the information, such as ON and OFF on the push buttons and selector switch, be properly oriented when the control station is mounted in either a vertical or horizontal position and finally it is desirable that the control station components be arranged so the control station may be conveniently mounted, wired and serviced without disturbing the wiring after the control station has been wired.

The present invention is directed to a switch structure which will permit the same switch housing to guide the movement of a pair of rectilinearly movable contact carriers or a rotatable contact carrier and position a pilot light and the contact carriers so the switch structure may be used in either a flush mounted or a surface mounted control station. The structure further is arranged so that the same member, when positioned in the housing, may be used to provide the push button type control station with a maintained push button function or an interlocked push button function.

It is an object of the present invention to provide a switch assembly which has its component parts constructed and arranged so a maximum number of parts are common in all versions of a flush mounted and a surface mounted control station.

An additional object is to minimize the number of individual component parts required to provide all versions of a flush mounted and surface mounted control station.

Further objects and features of the invention will be readily apparent to those skilled in the art from the following specification and from the appended drawings illustrating certain preferred embodiments, in which:

FIG. **1** is a front plan view of a surface mounted control station when mounted in a horizontal position.

FIG. **2** is a cross-sectional view taken along line **2—2** in FIG. **1** when the control station is mounted in a vertical position.

FIG. **3** is an end view of the control station in FIG. **1** taken in the direction of the arrow **3.**

FIG. **4** is a front plan view of a housing for a switch assembly as used in the control station in FIG. **1.**

FIG. **5** is a cross-sectional view taken along line **5—5** in FIG. **4.**

FIG. **6** is a front plan view of a flush mounted control station with a cover for the control station removed.

FIG. **7** is a cross-sectional view taken along line **7—7** in FIG. **6** with the cover secured to the control station.

FIG. **8** is a cross-sectional view taken along line **8—8** in FIG. **6.**

FIG. **8A** is a plan view of a movable contact carrier.

FIG. **9** is a cross-sectional view of an operating button for the control station in FIG. **6.**

FIG. **10** is a rear view of the button in FIG. **9.**

FIGS. **11** and **12** are front and side plan views of an insert for the button in FIG. **9.**

FIG. **13** is a cross-sectional view of the switch assembly as used in the control station in FIG. **1** with the components of the switch arranged so the switch assembly will provide a momentary contact operating action and prevent the simultaneous operation of both operating buttons of the switch.

FIG. **14** is a front plan view of the switch assembly in FIG. **13** with the switch operating buttons removed.

FIG. **15** is a front plan view of a **3** unit surface mounted control station with the lens and bulb for a pilot light and an insert for one of the operating buttons removed.

FIG. **16** is a cross-sectional view taken along line **16—16** in FIG. **15** with the switch assembly including components which will interlock the switch buttons and cause the switch to provide a maintained contact function.

FIG. **17** is a cross-sectional view taken along line **17—17** in FIG. **15.**

FIG. 18 is a cross-sectional view taken along line 18—18 in FIG. 15 with the pilot light lens and bulb installed.

FIG. 19 is a front plan view of a surface mounted control station including a selector switch and a pilot light.

FIG. 20 is a cross-sectional view taken along line 20—20 in FIG. 19 with the base of the control station removed.

FIGS. 21B–D are front plan views of indexing plates and FIG. 21A is a front plan view of a cover plate as may be used with the switch assembly according to the present invention.

FIG. 22 is an exploded view showing in perspective the components of a rotary operator for the switch in FIG. 19.

FIG. 23 is a front plan view of a flush mounted control station with portions of the cover broken away and a rotary knob for a selector switch and portions of a pilot light assembly removed.

FIG. 24 is a cross-sectional view of the control station in FIG. 23 with the pilot light and knob installed in the assembly and a terminal block for the assembly removed.

FIG. 25 is a cross-sectional view taken along line 25—25 in FIG. 23 when the switch assembly is detached from the control station.

FIG. 26 is an enlarged plan view showing the front of an operating and indexing mechanism as used in the switch assembly in FIG. 23.

FIG. 27 is a cross-sectional view taken along line 27—27 in FIG. 26.

FIG. 28 is a rear plan view of an operator as used in the assembly in FIG. 27.

FIGS. 29 and 30 respectively are front and rear plan views of the knob used in the switch assembly in FIGS. 19 and 24.

FIGS. 31B–D are front plan views of different supports for a pilot light, and FIG. 31A is a view of a guide for a cylindrical button as may be used with the switch assembly according to the present invention.

FIGS. 32, 33, 34 and 35 respectively are front, rear and side plan views of a guide plate as used in a selector switch version of the switch assembly according to the present invention.

FIGS. 36 and 37 are respectively rear and end plan views of a legend plate as used in the control station in FIG. 19.

FIGS. 38 and 38A are rear and side plan views of a pilot light socket as used in the control stations in FIGS. 20 and 24.

FIG. 39 is a cross-sectional view taken along line 39—39 in FIG. 38, and

FIG. 40 is a front plan view of a housing for a switch assembly as used in the control station in FIG. 15 as mounted adjacent a broken-away portion of the housing shown in FIG. 4.

A surface mounted control station 10, as shown in FIGS. 1–3, includes a metal base 12 and a cover 14. The base 12 has a rear wall 16 and end walls 18 at the opposite ends of the rear wall 16. The rear wall 16 is provided with openings, not shown, which are used to secure the control station 10 to a support and each of the end walls 18 is provided with a conventional knockout 20 which may be removed when an electric conduit is connected to the control station 10. The base 12 is formed without side walls to provide a maximum access to wire connecting terminals 21, each of which comprises a wire clamp 22, a screw 24, and terminal 26. The wire connecting terminals 21 are positioned in spaced compartments 28 along opposite sides of an insulating terminal block 30. The terminal block 30 is secured to the rear wall 16 by a rivet 32, as shown in FIG. 16. The terminals 26 are L-shaped and each has a portion 34 secured to threaded inserts, not shown, that are embedded in the material of the block 30 and a portion 36 extending forwardly of the front side edges of the block 30.

The cover 14 is preferably formed of a molded insulating material and, in the embodiment shown in FIG. 1, includes a pair of openings 38 and 40 extending between a front wall 44 and a rear wall 46. The openings 38 and 40 are square-shaped and are located on centers that are spaced a preselected distance apart, which, in the embodiment shown in FIG. 1, is equal to 1.320 inches and herein designated as Y inches. The cover 14 is secured to the base 12 by a pair of screws 48 which are threaded into openings in ears 50 extending from the forward edges of the end walls 18. The cover 14 also includes side walls 52 extending rearwardly of the front wall 44 to close the open sides of the base 12 and ends 54 which receive the end walls 18.

A switch assembly 56 according to the present invention includes a housing 58 and the various components as will be hereinafter described as may be used with the housing 58.

The housing 58 is formed of a molded insulating material and, as shown in FIGS. 4 and 5, has an internal cavity 60. The cavity 60 has an open side 62 facing and positioned adjacent the rear wall 46 of the cover 14 and a rear wall 64 extending in a plane parallel and spaced from the rear wall 46. The cavity 60 is centered about a transverse plane 66. The plane 66 extends perpendicular to the rear wall 64 and is equidistantly spaced between the centers of the openings 38 and 40. The cavity 60 is also centered about a longitudinal plane 68. The plane 68 extends perpendicular to the rear wall 64 and passes through the centers of the openings 38 and 40. The housing 58 has an upper wall 70 and a lower wall 72 extending perpendicular to the rear wall 64 and parallel and equidistantly spaced at opposite sides of the plane 66 and parallel side walls 74 and 76 extending perpendicular to the rear wall 64 and equidistantly spaced at opposite sides of the plane 68. A pair of bores 78 and 80 are located at the upper and lower ends of the housing 58. The bores are centered in the plane 68 and are equidistantly spaced at opposite sides of the plane 66. Projecting forwardly from the rear wall 64 adjacent the respective side walls 74 and 76 are projections 82 and 84 which are centered in the plane 66 and spaced equidistantly at opposite sides of the plane 68. The projections 82 and 84 have bores 86 and 88 extending from a front surface of the respective projections 82 and 84 to an external rear surface side of the housing 58. The bores 86 and 88 are centered in the projections 82 and 84 and receive suitable screws, not shown, which are threaded in internal surface portions of the cover 14 to secure the housing 58 on the rear wall 46. The projections 82 and 84 respectively have grooves 90 and 92 centered in the plane 66 and extending parallel to the rear wall 64. The grooves 90 and 92 are spaced equidistantly at opposite sides of the plane 68.

Projecting forwardly from the rear wall **64** adjacent the respective side walls **74** and **76** are a pair of projections **94** and **96.** The projections **94** and **96** extend perpendicular to the rear wall **46** and are centered in a plane **98** that extends parallel to the plane **66** at the upper half of the cavity **60.** Similarly projecting forwardly from the rear wall **64** adjacent the respective side walls of the lower half of the cavity are a pair of projections **100** and **102.** The projections **100** and **102** extend perpendicular to the rear wall **46** and are centered in a plane **104** that extends parallel to the plane **66.** The planes **98** and **104** are parallel to each other and are equidistantly spaced a predetermined distance at opposite sides of the plane **66,** as will be hereinafter described.

Each of the projections **94** and **96** has an individual groove **106** therein which faces the axis **68** and is centered in the plane **98.** The grooves **106** extend perpendicular to the rear wall **64** and extend from the rear wall **64** to a front end on the respective projections **94** and **96.** Similarly, each of the projections **100** and **102** has an individual groove **108** therein which faces the plane **68.** The grooves **108** are centered in the plane **104** and extend from the rear wall **64** to a front end on the respective projections **100** and **102.** Extending forwardly from the rear wall **64** are a pair of bosses **109** which provide a pair of grooves **110** and **112.** The groove **110** extends and is centered in the plane **98** and the groove **112** extends and is centered in the plane **104.** A pair of stationary contact supports are associated with each of the projections **94, 96, 100** and **102** with the pair of supports associated with the respective projections designated by the numerical designation of its associated projection and suffixes a and b, as illustrated in FIGS. **4** and **5.** The supports **94a** and **94b** are respectively located adjacent the up and lower sides of the projection **94** and are provided by projections extending forwardly from the rear wall **64** to a front surface **114** and are spaced from the side wall **74** to provide a passage **116** between each support **94a** and **94b** and the side wall **74.** The passages **116** extend through the rear wall **64.** Each of the supports has a bore **118** extending from the front surface **114** which receives a self-tapping screw **120,** in a manner illustrated in FIG. **25.**

The pair of supports **100***a* and **100***b* are respectively located at the upper and lower sides of the projection **100** in spaced relation to the side wall **74.** Similarly, the supports **96***a* and **102***a* are located adjacent the upper side of the projections **96** and **102** respectively adjacent the side wall **76** and the supports **96***b* and **102***b* are located adjacent the lower side of the projections **96** and **102** respectively. The supports **94***a–b*, **96***a–b*, **100***a–b*, and **102***a–b* are identical and each has a front surface **114,** a bore **118** and an associated passage **116** which correspond to the description of like elements of the supports **94***a* and **94***b* with the front surfaces **114** on all the supports extending in a common plane that extends parallel to the rear wall **64** and is spaced rearwardly of the front edges of the side walls **74** and **76.**

Either of two types of stationary contacts may be secured on the supports **94***a–b*, **96***a–b*, **100***a–b*, and **102***a–b* in the manner illustrated in FIG. **8,** wherein one type of stationary contact **122** is secured on the support **94***b* and a second type of stationary contact **124** is secured on the support **96***b*. However, each pair of adjacent supports are required to have the same type of stationary contacts **122** or **124** secured thereon.

Both types of stationary contacts **122** and **124** have a portion **126** secured on the surface **114** by the screw **120** which passes through an opening in the portion **126** and is threaded into the bore **118** and a portion **128** which extends rearwardly through the passage **116** to a curved terminal portion **130** that extends rearwardly of the rear exterior of the rear wall **64.** The terminal portions **130** are located to tightly engage a surface portion on the portions **36** on the wire connecting terminals which are carried by the terminal block **30** when the cover **14** is secured to the base **12.**

The stationary contacts **122** have portions **132** carrying stationary contact tips **134** extending in a common plane with portions **126.** The tips **134,** which are preferably formed of a noble metal, are secured on the portions **132** so the tips **134** face rearwardly in the cavity **60.** The stationary contacts **124** have a portion **136** extending rearwardly along a side of the projections on which they are mounted to a portion **138** which has a contact tip **140** secured thereon. The portion **138** extends normal to the portion **136** and supports the tip **140,** which is formed of a noble metal, so the tip **140** is positioned adjacent the rear wall **64** and faces forwardly in the cavity **60.** As shown in FIGS. **4** and **5,** the housing **58** also includes a ridge **142** formed on the rear wall **64** having its line of intersection extending in the plane **66.**

A flush-mounted type control station **144,** shown in FIGS. **6** and **7,** includes a standard outlet box **146** as may be mounted in a wall of a building, a mounting bracket **148,** and a cover **150.** The outlet box **146** and the cover **150** are standard items of commerce and have fixed dimensions. The cover **150** includes a pair of circular openings **152** and **154** which are spaced 1.000 inches apart, and sized to receive a ⅝ inch diameter cylindrical button. The 1.000 inch dimension is herein designated as *x* inches.

The outlet box **146** has a standard depth and is provided with knock-outs in its top and bottom walls **156,** to side walls **157,** its rear wall **158** and outwardly extending ears **159** at the front ends of the walls **156** which have threaded openings to receive screws **160** which secure the mounting bracket **148** within the interior of the box **146.** The distance between the openings receiving the screws **160** is also fixed by standards. The mounting bracket **148,** which permits the switch assembly **56** to be used in the flush-mounted control station **144,** is U-shaped and has a rear wall **162,** a pair of arms **164** extending forwardly from the rear wall **162,** apertured ears **166** extending outwardly at the front ends of the arms **164** and apertured ears **168** extending inwardly from the arms **164.** The apertures in the ears **166** are spaced to receive the screws **160.** The ears **168** are spaced rearwardly a slight distance from the front ends of the arms **164** and have threaded openings to receive screws **170** which pass through the bores **78** and **80** to secure the switch assembly **56** to the bracket **148** and the cover **150** to the switch assembly **56.** The openings receiving the screws **170** are also spaced a standard distance apart and when the cover **150,** the mounting bracket **148** and the switch assembly **56** are assembled, as shown in FIG. **7,** the open side **62** of the cavity **60** will be adjacent a rear wall side **172** of the cover **150.**

As shown in FIGS. 7 and 8, the rear wall 162 has a rectangular opening 174 therein. Positioned on opposite sides of the opening 174 are terminal blocks 176 which are secured to portions of the rear wall 162 by screws 178. In the embodiment shown, four terminal blocks 176 are positioned at the sides of the opening 174 with two blocks positioned adjacent each longitudinal side of the opening 174. Each of the blocks 176 provides a support for a pair of wire connecting terminals 180 which are identical to the wire connecting terminals 21 previously described. The terminals 180 are positioned on the blocks 176 so the wire clamp portions 22 face the opening 174 to permit conduit wires to be passed from the rear portions of the outlet box 146 through the opening 174 where they may be readily secured when a bared end of the wire conduit is inserted between clamp 22 and the portion 34 and the screw 24 is tightened.

The housings 58, used in the switch assemblies in the control stations 10 and 144, are identical. As previously described, the openings 38 and 40 in the cover 14 are located on centers spaced Y or 1.320 inches apart, and the openings 152 and 154 in the cover 150 are located on centers spaced X or 1.000 inches apart. The planes 98 and 104 are spaced (X+Y/2), or 1.160 inches apart, which permits the housing 58 to be used with either of the two covers 14 or 150.

A pair of movable contact carriers 182 and 183 may be positioned in the cavity 60. The contact carriers 182 and 183 are identical, with the contact carrier 182 positioned by the pair of grooves 106 for movement in the plane 98 and the contact carrier 183 positioned by the grooves 108 for movement in the plane 104. As the contact carriers 182 and 183 are identical, a description of the contact carrier 182 and its associated movable contacts will apply to the contact carrier 183 and its associated movable contacts. As shown in FIGS. 7 and 8, the contact carrier 182 is formed as a substantially flat stamped metal part and includes a portion 184 which has its outer side edges positioned within the grooves 106 and a portion 186 which extends forwardly from the portion 184 and the open side 62 of the cavity 60. The portion 184 has a central notch 188 and an opening 190 therein. The notch 188 and the opening 190 are centered in the plane 68. Disposed on opposite sides of the notch 188 are portions 192 and 194 which have rectangular openings 196 and 198 respectively located therein and spring seats located at the opposite ends of each of the openings 196 and 198. A movable contact assembly, including a movable contact 202 and a spring 204, may be positioned in either of two positions in each opening 196 and 198. Each movable contact 202 has a suitably notched central portion positioned within its associated opening 196 or 198 and arm portions 206 extending in opposite directions from the contact carrier 182 along an axis that is parallel to the plane 68. Each of the arm portions 206 has a noble metal contact tip 208 secured thereon which is located to engage the contact tips 134 when the movable contact 202 is in one of its two positions on the contact carrier 182 and the tips 140 when the movable contact 202 is at its other position on the carrier 182.

The movable contacts 202 in the openings 196 and 198 are arranged to engage and bridge a pair of stationary contacts 122 or 124 which are mounted on the adjacent pairs of projections 94*a–b* and 96*a–b*, respectively. For example, as shown in FIG. 8, a movable contact 202 is arranged to engage a pair of stationary contacts 124 which are mounted on the supports 96*a* and 96*b*, and a movable contact 202 is arranged to engage a pair of stationary contacts 122 that are mounted on the supports 94*a* and 94*b*. When the movable contact 202 is positioned in an opening 196 to engage the stationary contacts 122, the spring 204 associated therewith will be positioned between the movable contact 202 and the rear end of the opening 196. When the movable contact is positioned in the opening 198 to engage the stationary contacts 124, the spring 204 is positioned between the movable contact 202 and the front end of the opening 198. As shown in FIG. 8, when required, a spring 210 positioned within the notch 188 between the front end of the notch 188 and the rear wall 64, constantly urges the movable contact carrier 182 forwardly to a position wherein the movable contacts 202 engage the stationary contacts 122 to provide the switch assembly 56 with a normally closed type of contact function and to be disengaged from the stationary contacts 124 to provide a normally open type of contact function. The spring is positioned on the rear wall 64 by the boss 109.

A pair of buttons 212 having a square shape, as in FIG. 2, or a pair of buttons 214 having a cylindrical shape, as shown in FIG. 7, may be mounted on the portions 186 of the movable contact carriers 182 and 183. The buttons 212 are mounted on the portions 186 when the switch assembly 56 is mounted in a surface mounted control station 10 and the buttons 214 are mounted on the portions 186 when the switch assembly is mounted in a flush mounted type control station 144. The buttons 212, which are mounted on the contact carriers 182 and 183, are identical and therefore only the button 212 which is mounted on the carrier 183 will be described. As shown in FIGS. 15–17, the button 212 has a square shaped front end 216 which is received in one of the square shaped openings 38 or 40 and a portion 218 which extends rearwardly from the front end 216. The portion 218 includes a forwardly extending recess which receives the portion 186 on the movable contact carrier 183. The recess in the portion 218 extends forwardly in the portion 218 in a plane that is displaced (Y−X/4) inches from a plane perpendicular to the front and through the center of the front end 216. The button 212 also has a rim portion 220 which surrounds at least a portion of the rear end of the front portion 216. The rim portion 220 is provided to engage the rear wall 46 to limit the forward movement of the button 212 in the opening 38. The buttons 212, when installed on the contact carriers 182 and 183 will have the centers of their respective front end portions 216 displaced a greater distance from the plane 66 than the planes 98 and 104 are respectively displaced from the plane 66 which will permit the switch assembly 56, including a pair of buttons 212 which are mounted on the carriers 182 and 183, to be combined with the cover 14.

The buttons 214 which are mounted on the carriers 182 and 183 are identical, and therefore only the button which is mounted on the carrier 182 will be described.

The button 214, as shown in FIGS. 9–12, has a cylindrical front end 222 which is received in one of the circular openings 152 or 154 and a portion 224 which extends rearwardly from the cylindrical end 222. The portion 224 includes a forwardly extending recess 226.

The recess **226** receives the portion **186** on the movable contact carrier **182** and extends forwardly in the portion **224** along a plane that is displaced (Y−X/4) inches from the central axis of the cylindrical end **222.** The button **214** is also provided with a cylindrical rim **228** which surrounds the rear end of the cylindrical end **222.** The rim **228** is provided to engage a rear side of a mounting plate **524,** shown in FIG. **31A** as will be later described, to limit the forward movement of the buttons **214** in the openings **152.** The pair of buttons **214,** when respectively installed on the carriers **182** and **183,** will have the centers of their respective cylindrical ends **222** displaced a lesser distance from the plane **66** than the planes **98** and **104** respectively are displaced from the plane **66** which will permit the switch assembly **56,** including the buttons **214,** to be combined with the cover **150.**

As shown in FIGS. **15** and **17,** each button **212** has a square shaped recess **230** extending rearwardly in the front surface of the front end **216** and passages **234** at the centers of each of the four sides of the square recess **230** which extend rearwardly through the front end **216** with a removable insert **236** positioned in the recess **230.** The insert **236** has a square shaped body portion **238** which is positioned in the recess **230** and a pair of fingers **240** which are received in two of the passages **234** when the body portion **238** is installed in the recess. The body portion **238** has a front surface **242** substantially flush with the front surface of the front end **216.** A suitable legend, e.g., START or STOP, may be placed on the front surface **242** to indicate the switching function of the button **212.** The fingers **240** are receivable in either a pair of vertically aligned passages **234** or a pair of horizontally aligned passages **234** so that when the control station **10** is mounted in either a vertical position or a horizontal position, the legend on the front surface **242** may be oriented to extend horizontally. The fingers have portions which are received rearwardly of a ledge **244** in each passage to prevent displacement of the insert **236** from the recess **230** after the insert **236** is installed in the recess **230.** The insert **236** is formed of a relatively stiff material which is capable of being flexed and the body portion is provided with at least one notch **246** on one of its sides which will accept a screwdriver tip to permit the insert to be pried from its position within the recess **230** when a re-orientation of the position of the insert **236** within the recess **230** is required.

As shown in FIGS. **9–12,** each button **214** has a circular recess **248** extending rearwardly in the front end **222** and a removable insert **250** positioned in the recess **248.** The insert **250** has a substantially circular body portion **252** which is positioned in the recess and a pair of fingers **253** which are received in a passage **254** that extends rearwardly through the front end **222.** The body portion **252** has a front surface **256** substantially flush with the front surface of the front end **222.** A suitable legend, e.g., START Or STOP, may be placed on the front surface **256** to indicate the switching function of the button **214.** The fingers **253** have ends which hook behind ledges **258** in the passage **254** to maintain the insert **250** against displacement from the recess **248.** The insert **250** is formed of a relatively stiff material which is capable of being flexed. A linear portion **260** is provided on the periphery of the substantially circular body portion **252** to provide a space wherein a screwdriver tip may be inserted to permit the insert **250** to be pried from its position within the recess **248** when replacement of the insert **250** is required.

When required, the switch assembly **56** may be provided with a lever **262** which will interlock the pair of movable contact carriers **182** and **183** and cause the switch assembly **56** to operate in either a maintained contact or a momentary contact closing mode of operation. The lever **262,** as shown in FIGS. **13** and **14,** is T-shaped, and has a leg portion **264** extending rearwardly in the cavity **60** and a pair of arm portions **266** and **268** extending in opposite directions along the axis **68** from the front end of the leg portion **264.** A free end **270** on the arm **266** is received in the opening **190** in the carrier **182** and a free end **272** on the arm **268** is received in the opening **190** in the carrier **183.** The front end of the leg portion **264** has a groove **274** therein and, as shown in FIG. **16,** a bore **276** extending forwardly in the leg portion **264** from the rear end **278** of the leg portion **264.**

When the lever **262** and the pair of springs **210** are included in the switch assembly, as shown in FIG. **13,** the switch assembly **56** will function as an interlocked momentary contact closing switch. The springs **210** constantly urge the contact carriers **182** and **183** forwardly in the cavity **60** to a deactuated position wherein the contact tips **208** are separated from the contact tips **140.** The lever **262** will be in effect floating in the cavity **60** with the free ends **270** and **272** supported in the openings **190** in respective contact carriers **182** and **183.**

Either of the contact carriers **182** and **183** may be moved rearwardly in the cavity **60** to an actuated position when a manual force, which is applied to their associated buttons **212,** overcomes the bias of the spring **210** on its associated carrier. The rearward movement of the contact carriers **182** and **183** is limited when the rear edges of the portions **192** and **194** engage the rear wall **64.** A movement of one of the carriers **182** or **183,** i.e., carriers **182,** to its actuated position will cause the contact tips **208** to tightly engage the contact tips **140** as the movable contact **202** moves in its associated opening **196** or **198** against the bias provided by its associated spring **204.** The engagement between the tips **208** and **140** will complete a circuit between the stationary contacts **124** that are mounted on the pair of supports **94***a* and **94***b.* The movement of the carrier **184** will cause the free end **270** to move rearwardly and the lever **262** to rotate in a clockwise direction in FIG. **13** as the free end **272** remains stationary. The clockwise movement of the lever **262** causes the rear end **278** to engage the rear wall **64** and prevents the carrier **183** from being moved rearwardly to its actuated position in the cavity **60** during periods when the carrier **182** is at its actuated position. The release of the manual force on the carrier **182** will permit the spring **210** associated with the carrier **182** to move the carrier **182** forwardly to its deactuated position in the cavity **60** where the rims **220** on the button **212** or the rim **228** on the button **214** engage the rear wall of the covers **14** or the rear surface of the plate **524,** respectively. The forward movement of the carrier **182** causes the tips **208** to move out of engagement with the tips **140** and the lever **262** to rotate in a counterclockwise direction to the position which will permit the contact carrier **183** to be moved rearwardly to its actuated position in the cavity **60.**

The movement of the carrier **183** rearwardly in the cavity to its actuated position will cause the contact tips **208** to tightly engage the contact tips **140** as the movable contact **202** moves in its associated opening **196** or **198** against the bias provided by its associated spring **204.** The engagement between the tips **208** and **140** will complete a circuit between the stationary contacts **124** that are mounted on the pair of supports **100***a* and **100***b*. The movement of the carrier **183** to its actuated position will cause the free end **272** to move rearwardly and the lever **262** to rotate in a counterclockwise direction in FIG. **13** as the free end **270** remains stationary. The counterclockwise movement of the lever **262** causes the rear end **278** to engage the rear wall **64** and prevents the carrier **182** from moving rearwardly to its actuated position in the cavity **60** during periods when the carrier **183** is at its actuated position. The release of the manual force on the carrier **183** will permit the spring **210** associated with the carrier **183** to move the carrier **183** forwardly in the cavity **60** to its deactuated position where the rims **220** or **228** engage the rear wall of the covers **14** or the plate **524,** respectively. The forward movement of the carrier **183** causes the tips **208** to move out of engagement with the tips **140** and the lever **262** to rotate in a clockwise direction to the position which will permit the contact carrier **182** to be moved to its actuated position in the cavity **60.**

The switch assembly shown in FIG. **16** will provide a maintained contact mode of operation. The springs **210** are omitted from the assembly in FIG. **16** and a spring **280** and a ball **282** are positioned in the bore **276.** The spring **280** constantly urges the ball **282** against the rear wall **64** and biases the lever **262** forwardly in the cavity. The lever **262** is pivoted on a pin **284.** The pin **284** is received in the grooves **274, 90** and **92** and is held captive in the grooves **90** and **92** by screws **286** which are threaded into the bores **288.**

The interlocking lever arrangement including the lever **262,** the pin **284** and the ball **282** and the spring **280** will cause the carriers **182** and **183** to remain in their latest operated condition and prevent the carriers **182** and **183** from being simultaneously moved to their actuated positions. A movement of either of the carriers **182** and **183** rearwardly to its actuated position by a manual force which is applied their associated buttons **212** or **214** will cause the lever **262** to rotate in the cavity **60.** When the carrier **183** is moved to its actuated position, the lever **262** will be rotated counterclockwise about the pin **284** to a position where the ball **282,** which is biased by the spring **280,** is positioned against a sloping portion **290** of the ridge **142,** as shown in FIG. **5.** The engagement between the ball **282** and the portion **290** will maintain the lever **262** in its counterclockwise position of rotation so that the carrier **183** is maintained in its activated position after the manual force on its associated button **212** or **214** is removed. The lever **262** will rotate in a clockwise direction when the carrier **182** is moved to its actuated position by a manual force which is applied to its associated button **212** or **214.** The lever **262** will rotate about the pin **284** and during the clockwise rotation of the lever **262,** the spring **280** will be compressed as the ball **282** passes over the apex of the ridge **142** and engages a sloping portion **292** of the ridge **142.** The engagement between the ball **282** and the portion **292** causes the lever **262** to remain in its clockwise position of rotation after the manual force which caused the carrier **182** to move to its actuated position is removed. The spring **280** and the ball **282** act as a detent mechanism and cause the lever **262** to move with a snap action as the ball **282** moves over the apex of the ridge **142** during the rotation of the lever **262.** The lever **262,** when pivoted on the pin **284** and provided with the spring biased ball **282,** will cause one of the contact carriers **182** or **183,** i.e., carrier **183,** to be maintained in its actuated position and the other carrier **182** to be in its de-actuated position while preventing both carriers **182** and **183** from being simultaneously moved to their actuated positions.

The housing **58** may be used with a rotary selector switch in either a surface mounted control station **10** or a flush mounted type control station **144.** The flush mounted control station **144,** as shown in FIG. **24,** includes the housing **58** which positions a rotary selector switch mechanism **294** and a pilot lamp assembly **296** relative to the cover **150.** The selector switch mechanism **294,** as shown in FIG. **25,** includes a rotatable contact carrier **298,** an indexing plate **300,** a guide plate **301,** an indexing operator **302** for the carrier **298,** and an operating knob **304.**

Contact carrier **298** includes a body portion **306** and a portion **308** carrying gear teeth **310.** The carrier has a center of rotation, when mounted in the cavity **60,** located as a center **312** of an opening **314** in the portion **306.** The body portion **306** has a thickness less than the width of the grooves **106, 108, 110** and **112.** A contact carrier **298** may be mounted in the pair of grooves **106** and the groove **110** or in the pair of grooves **108** and the groove **112.** In FIG. **24,** the carrier **298** is shown as mounted in the pair of grooves **108** and the groove **112,** it being understood that if desired a carrier **298** may be also mounted in the pair of grooves **106** and the groove **110.** The body portion **306** has an arcuate rear edge **316** received in the groove **112** and arcuate opposite side edges **318** received in the pair of grooves **108.** The arcuate edges **316** and **318** are formed as arcs of circles having their centers located at the center **312.** The body portion **306** has a pair of openings **320** and **322.**

As shown in FIG. **25,** when the carrier **298** is at a centered position with the center of the portion **308** centered in the plane **68,** the openings **320** and **322** will be located and spaced equidistantly on opposite sides of the plane **68.** The openings **320** and **322** are substantially rectangular and have rear ends which extend along radii through the center **312** and are inclined so that the openings **320** and **322** will be substantially perpendicular to the rear wall **64** when the carrier **298** is respectively rotated counterclockwise and clockwise to its actuated positions in FIG. **25.** Each of the openings **320** and **322** has a movable contact **202** and a spring **204** positioned therein. The movable contacts **202** are positioned so their contact tips **208** face rearwardly and will engage the contact tips **140** on a stationary contact **124** and thereby bridge two adjacent stationary contacts **124** when the carrier **298** is rotated to a proper position within the cavity **60.**

As most clearly seen in FIG. **24,** the portion **308** extends forwardly of the body portion **306** and extends in a plane that is parallel and spaced a predetermined distance from the plane in which the body portion **306** extends. In the embodiment shown, the distance between the planes of the body portion **306** and the portion **308** equals 0.12 inches. The gear teeth **310** face forwardly

and have a root and tip diameter defined by radii through the center **312.**

The indexing plates **300,** shown in FIGS. **21C** and **21B,** are respectively mounted on the front end of the housing **58** when a selector switch version of the switch assembly **56** respectively is used in a surface mounted control station **10** and in a flush mounted control station **144.** The plates **300** are formed of a relatively thin and rigid sheet of insulating material to have a pair of openings **330** which are aligned with bores **332** in the housing, see FIG. **4.** The openings **330** and bores **332** are provided to receive screws **334** to secure the plates **300** on the front end of the housing **58,** as shown in FIG. **25.** As shown in FIG. **4,** a pair of bores **332** are centered in the plane **98** and a pair of bores **332** are centered in the plane **104.** The plates **300** in FIGS. **21B** and **21C** have an edge **336** which is positioned along the plane **66** when the plates **300** are mounted on the housing **58.** The plates **300** have an opening **338** which receives a portion of the operator **302.** The opening **338** in the plate **300,** shown in FIG. **21C,** is located on a center 0.08 inches from an axis passing through the centers of the pair of openings **330** and is located on the side of the axis that is remote from the edge **336.** Similarly, the opening **338** in the plate **300** in FIG. **21B** is located on a center 0.08 inches from the axis passing through the centers of the pair of openings **330** and is located on the edge **336** side of axis.

The plates **330** in FIGS. **21B** and **21C** each have five detent openings therein which are equidistantly spaced from the center of the opening **338,** with one of the openings **340** centered about the plane **68.** The opening **340** in the plate **300,** shown in FIG. **21B,** is located on the side of the axis through the centers of the pair of openings **330** that is remote from the edge **336.** The opening **340** in the plate **300,** shown in FIG. **21C,** is located between the axis through the centers of the pair of openings **330** and the edge **336.** Each plate **300** has two openings **342** located on centers that are displaced 60° clockwise and counterclockwise respectively from the center of the opening **340** and two openings **344** located on centers that are displaced **120** degrees clockwise and counterclockwise from the center of the opening **340,** so that each plate has the opening **340** and the pair of openings **342** located on one side of the axis through the centers of the openings **330** and a pair of openings **344** on the other side of the axis through the centers of the openings **330.** The opposite ends of the edge **336** are notched to provide clearance for the bores **86** and **88** when the plates **300** are mounted on the front side of the housing **58.**

The guide plate **301,** shown in FIGS. **32–35,** is formed as a molded part and may be positioned in either of two positions within the cavity **60** which will permit the guide plate to be used in a surface mounted control station **10** or in a flush mounted control station **144.** The guide plate **301** has a rear surface **346** with a pair of projections **348** extending rearwardly from the rear surface **346.** Each of the projections **348** has an outwardly projecting rib **350.** The pair of ribs **350** provided by the pair of projections are received in the forward portions of the pair of grooves **106** and **108,** while portions of the rear surface **346** rest upon the front surface portions **352** of the projections wherein the grooves **106** and **108** are located. Each of the projections **348** also has an inwardly extending groove **354** which is arcuate in shape and centered in the planes **98** or **104** when the guide plate **301** is installed in portions of the cavity **60** associated with the pair of grooves **106** and the pair of grooves **108,** respectively. As the guide plates **301** may be installed in either pair of grooves **106** or **108,** only the position of the guide plate in grooves **108** will be described, it being understood that the position of the guide plate is reversed from that described when the guide plate is installed in the grooves **106.** The guide plate **301** has a circular opening **356** extending therethrough which is centered 0.08 inches from the plane **104** and a rectangular opening **358** therethrough. The opening **358** has a straight side **360** located to guide the portion **306** on the contact carrier **298** and a straight side **362** located to guide the portion **308** of the contact carrier **298.** An arcuate rib **364** extending from the rear surface **346** has an edge aligned with the side **362** also provides a guide for the side edge on the portion **308.** A front surface **366** on the guide plate **301** has an arcuate recess **368** therein which has a curvature defined by a radius centered in the center of the opening **356,** and which terminates in a pair of stops **370** at the opposite sides of the recess **368.** The recess **368** also has a pair of arcuate notches **372** which extend from the straight side **360.** The notches **372** provide clearance for gear teeth **374** on a portion of the operator **302** as will now be described.

The operator **302,** as most clearly seen in FIGS. **22** and **26–28,** includes an operating member **376,** a member **378** which causes the selector switch to have indexed positions, a spring **380,** a ball **382,** and a means including a member **384** and a bushing **386** which will releasably maintain the members **376** and **378** in either of two relative positions so the switch assembly **294** will act as a two or a three position selector switch. The operating member **376** is formed as a molded insulating part to have a cylindrical stem **388** received in the opening **338** in a selected one of the two indexing plates **300** and a plate-like portion **390** at the rear end of the stem **388.** The portion **390** is generally circular and has a flat front surface **392** engaging a rear surface on the selected indexing plate **300** with an extension extending from the periphery of the circular portion providing a pair of stops **394** on the periphery of the portion **390.** Extending rearwardly from the rear surface of the portion **390** is a cylindrical projection **396** and the gear teeth **374.** The projection **396** and the stem **388** are axially aligned and the gear teeth are rack-like and are centered between the stops **394** about a radius extending from the axis of the projection **396** which in the embodiment shown equals .21 inches.

Extending rearwardly from the forward end **398** of the stem **388** and axially aligned with the stem **388** is a circular recess **400** and a bore **402** with a pair of notches **404** extending rearwardly in the front end **398** along a plane equidistant between the stops **394** and defined by the axis of the stem **388** and a pair of notches **406** extending rearwardly in the front end **398** and circumferentially spaced **90** degrees from the notches **404.**

The indexing member **378** is substantially cylindrical, having a front end **408,** a rear end **410** and a cylindrical bore **412** extending therethrough. The bore **412** receives the stem **388** with a rotatable fit. Extending outwardly from a side wall of the member **378** are a pair of spaced projections which provide a socket **414** which receives the spring **380** and the ball **382** with the ball **382** positioned at the rear end of the member to be

received in any one of the openings **340, 342,** or **344** with a detent-like action. The front end **408** is provided with a pair of notches **416** which are centered in a plane passing through the axis of the member **378** and the center of the ball **382.**

The member **384** has an annular body portion **418,** a circular opening **420** in the body portion **418** and four arms extending from the periphery of the body portion. The arms are spaced 90° apart with two of the arms **422** extending in opposite directions having a greater length than the other two arms **424.** The bushing **386** has a cylindrical body **426,** a rim **428** on one end of the body **426** and a threaded bore **430** extending through the body.

As shown in FIG. **27,** a selected indexing plate **300,** the operating member **376** and the indexing member **378** are maintained as an assembly by the member **384** and the bushing **386.** The operating member **376** has its plate-like portion **390** positioned against the rear surface of the selected plate **300** and its stem **388** extending through the opening **338.** The stem portion **388** is received in the bore **412.** The member **384** has its body portion **418** received in the recess **400** and is maintained against rotation in the recess **400** by the pair of arms **424** which are received in the notches **406.** The member **384** is secured on the front end **398** by the bushing **386** which has its cylindrical body extending through the opening **420** and is received in the bore **402** with a press fit. When the parts are thus assembled, the arms **422** will be received in the notches **404** and the notches **416.** The member **378** has an axial length that is shorter than the length of the portion of the stem **388** that projects forwardly of the plate **300.** The ball **382** is maintained in engagement with portions of the front surface of the selected indexing plate **300** by the spring **380.** The spring **380** constantly biases the member **378** forwardly on the stem **388.** The member **378** is maintained against rotation in either of two positions on the stem **388** by the arms **422** which are received in the notches **404** and **416.** When the member **378** is in one of its positions on the stem **388,** the ball **382** will be positioned to be received in either of the three openings **340** and **342.** When the member **378** is in its second position on the stem **388,** the ball **382** will be positioned to be received by either of the pair of openings **344.** The ball **382** and the spring **380,** together with the openings in the selected plate **300,** provide a detent mechanism which releasably positions the operating member **376** and the indexing member **378** on the selected indexing plate **300.** In FIG. **22,** the parts are oriented so the ball **380** may be moved to either of three indexing positions which are defined by the opening **340** and the pair of openings **342.** The position of the indexing member **378** on the stem **388** is changed by manually forcing the indexing member **378** against the force of the spring **380** toward the selected plate **300** to a position where the arms **422** are positioned forwardly of the front end **408** so that the member **378** may be rotated **180** degrees on the stem **388** to a position whereat the arms **422** are again aligned with the notches **416.** When the manual force is released, the arms **422** will be received in the notches **416** and the member **378** will be held against rotation on the stem **388** and the ball **382** will be positioned to be received in either of the pair of openings **344** to releasably maintain the member **376** in the other of its two indexing positions.

As shown in FIGS. **29** and **30,** the operating knob **304** has a cylindrically shaped body portion **432,** a finger grip portion **434** extending forwardly of the body portion, a cruxiform recess **436** extending forwardly in the rear end of the body portion **432** and a bore **438** extending through the finger grip portion **434** and the body portion **432.** The recess **436** has a circular central portion **440** with four radially extending arms **442** which are spaced 90° apart about the periphery of the central portion **440.** The finger grip portion **434** has a lenticular shape with one of its ends **444** being pointed to indicate the rotative position of the knob relative to a legend plate **445** which may be mounted in the opening **40** in the cover **14.** Any one of the four arms **442** are sized to receive a portion **446** which projects from the side at the front end of the member **378** to provide a non-rotatable connection between the knob **304** and the member **378** when the front end **408** of the member **378** is received in the recess **436.** The knob **304** and the member **378** are secured together by a screw **447** which is received in the bore **438** and the threaded bore **430.** The portion **446** may be received in any one of the arms **442.** One of the arms, e.g., arm **442***a*, is centered along a plane that passes through the center of the pointed end **444.** As will be later described, the legend plate **445** may be mounted in at least two positions in the opening **40** and may be provided with legends such as MAN - OFF - AUTO, when the switch assembly is to operate as a three position selector switch or RUN - JOG, if the assembly is to provide a two position selector switch operation. The legends are arranged on the legend plate **445** so that the end **444** points to the appropriate legend when the contacts of the switch are positioned to provide the indicated function. The 90° spacing between the arms **442** permits the knob **304** to be positioned on the indexing member **378** so the lenticular finger grip portion **434** extends vertically independently of the position of the indexing member. This arrangement permits the legends on the legend plate **445** and the pointed end **444** to be properly oriented when the control station **10** is mounted in a horizontal or a vertical position.

The legend plate **445,** shown in FIGS. **36** and **37,** is formed of a relatively stiff molded insulating material to have a square shaped body portion **448** that is larger than the size of the square openings **38** and **40.** The body portion **448** has a circular opening **450** centered therein which is sized to receive the body portion **432** of the knob **304** with clearance. The aforementioned legends may be applied to the front surface of the body portion **448.** Extending rearwardly from the rear surface of the body portion **448** at each of the four corners of a square which has substantially the same size as the square openings **38** and **40** is projection **452.** The projections **452** are received in the openings **38** or **40** and each includes an outwardly extending dimple **454** which engages the rear wall **46** to maintain the position of the legend plate **445** on the front wall **44** of the cover **14.**

When the switch assembly **56** is assembled to provide a rotary selector switch operation in a flush-mounted type control station **144,** as shown in FIGS. **24** and **25,** the movable contact **298** is positioned in the pair of grooves **108** and the groove **112** to have the portion **308** carrying the gear teeth **310** extending in a plane that is displaced a greater distance from the plane **66** than the plane **104.** The guide plate **301** is then in-

stalled in the cavity **60** with the ribs **350** received in the grooves **108** and the center of the opening **356** located between the planes **66** and **104.** The assembly, including an indexing plate **300** as shown in FIG. **21B**, the operator member **376,** the indexing member **378,** a spring **380,** a ball **382,** a member **384** and a bushing **386,** is then secured on the front side of the cavity **60** by the screws **334** as shown in FIG. **23.** The switch assembly **56** is then combined with the outlet box **146,** the mounting bracket **148** and the cover **150** with the indexing member **378** extending through the opening **154** in the cover **150.** The indexing member **378** is then programmed so the ball **382** will be received in the opening **340** if a three position selector switch operation is desired, or in the pair of openings **342** if a two position selector switch operation is desired, as previously described. The knob **304** is then positioned on the member **378** so the pointed end **444** points upwardly. The knob **304** is secured to the member **378** when the screw **447** is tightened in the bore **430.**

When the switch assembly **56** is assembled to provide a rotary selector switch operation in a standard duty type control station **10,** as shown in FIGS. **19** and **20,** the movable contact **298** is positioned in the pair of grooves **108** and the groove **112** to have the portion **308** carrying the gear teeth **310** extending in a plane that is displaced a lesser distance from the plane **66** than the plane **104.** The guide plate **301** is then installed in the cavity **60** with the ribs **350** received in the grooves **108** with the center of the opening **356** located a greater distance from the plane **66** than the plane **104** is spaced from the plane **66.** The assembly, including an indexing plate **300** as shown in FIG. **21C**, the operator member **376,** the indexing member **378,** the spring **380,** the ball **382,** the member **384** and a bushing **386,** is then secured on the front side of the cavity **60** by the screws **334.** The legend plate **445** is then inserted into the opening **40** and the switch assembly is then combined with the cover **14** with the indexing member **378** extending through the opening **450** in the legend plate **445.** The indexing member **378** is then programmed so the ball **382** will be received in the opening **340** if a three position selector switch operation is desired, or in the pair of openings **342** if a two position selector switch operation is desired, as previously described. The knob **304** is then positioned on the member **378** so the pointed end **444** points upwardly. The knob **304** is secured to the member **378** when the screw **447** is tightened in the bore **430.**

As previously described, the planes **98** and **104** are spaced 1.160 inches apart, the openings **38** and **40** are spaced 1.320 inches apart, and the openings **152** and **154** are spaced 1.000 inches apart. Thus the centers of the pair of grooves **108** and the groove **112** are displaced 0.58 inches from the plane **66** and the centers of the openings **40** and **154** are respectively displaced 0.66 and 0.5 inches from the plane **66.** The center of the opening **356** in the guide plate **301** is displaced 0.08 inches from the centers of the ribs **350.** Thus, when the guide plate **301** is installed in one of its two positions in the cavity **60,** the center of the opening **356** will be displaced 0.50 inches from the plane **66** and be aligned with the center of the opening **154.** When the guide plate **301** is installed in the other of its two positions in the cavity **60,** the center of the opening **356** will be displaced 0.66 inches from the plane **66** and be aligned with the center of the opening **40.**

The centers of the openings **338** in the indexing plates **300,** shown in FIGS. **21B** and **21C**, are also displaced 0.08 inches from a line of centers through the openings **330.** The openings **330** are centered in the plane **104** when either of the plates **300** is mounted on the front side of the housing **58.** Thus the centers of the openings **338** will be aligned with the openings **40** and **154** when the plates respectively shown in FIGS. **21C** and **21B** are mounted on the housing **58.**

The gear teeth **310** are centered in a plane which is displaced 0.12 from the plane **104** when the body portion **306** is positioned in the pair of grooves **108** and the groove **112.** Thus, when the movable contact carrier **298** is positioned in the pair of grooves **108** and the groove **112,** as shown in FIG. **24,** the plane in which the gear teeth **310** extend will be displaced 0.70 inches from the plane **66.** When the carrier **298** is positioned in the air the pair of grooves **108** and the groove **112,** as shown in FIG. **20,** the plane in which the gear teeth **310** extend will be displaced 0.46 inches from the plane **66.**

The arcuate gear teeth **374** are centered on radius of 0.21 inches from central axis of the projection **396.** The projection **396** is received in the opening **356** in the guide plate **301.** The operating member **302** when assembled in a flush mounted control station **144,** as shown in FIG. **24,** will be positioned so the gear teeth **374** are movable about a radius which is centered 0.50 inches from the plane **66.** Thus the gear teeth **374** will be displaced 0.71 inches from the plane **66** and be located to mesh with the gear teeth **310** which are displaced 0.70 inches from the plane **66** when the carrier **298,** the indexing plate **300,** the guide plate **301** and the operating member **302** are positioned by the housing **58,** as shown in FIG. **24.** The operating member **302** when positioned in a surface mounted control station **10,** as shown in FIG. **20,** will be positioned so the gear teeth are movable about a radius which is centered 0.66 inches from the plane **66.** Thus the gear teeth **374** will be displaced 0.45 inches from the plane **66** and be located to mesh with the gear teeth **310** which are displaced 0.46 inches from the plane **66** when the carrier **298,** the indexing plate **300,** the guide plate **301** and the operating member **302** are positioned by the housing, as shown in FIG. **20.**

The pair of indexing openings **342** in the indexing plates shown in FIGS. **21B** and **21C** are spaced 120° apart and the pair of indexing openings **344** are spaced 120° apart. The stationary contacts **124** are used in the selector switch version of the switch assembly **56.** When the indexing member **378** is programmed to provide a three indexed position mode of operation and the knob **304** is positioned so the ball **382** is received in the opening **340,** as in FIG. **25,** the carrier **298** will be positioned so that both sets of contact tips **208** are separated from both pairs of stationary contact tips **140.** When the knob **304** is rotated 60° in a clockwise direction, the carrier **298** will rotate counterclockwise and cause the tips **208** to engage the pair of stationary contacts **140** on the left side of the housing **58** to complete a circuit therebetween. When the knob **304** is rotated 60° counterclockwise, the carrier **298** will rotate clockwise and cause the tips **208** to engage the pair of tips **140** on the right side of the housing to complete a circuit therebetween.

When the indexing member **378** is programmed to provide a two indexed position mode of operation, the

knob **304** and carrier **298** will be maintained in either of two extreme positions from which they may be rotated to alternately complete circuits between the pairs of contact tips **140** at the right and the left sides of the cavity **60.** The knob **304** and the contact carrier **298** will be maintained at the two selected indexed positions by the indexing mechanism that includes the spring biased ball **382** and the respective openings **344** in the indexing plate **300.**

A selector switch version of a surface mounted control station **10** or a flush mounted control station **144** may be furnished with a pilot lamp assembly **460,** as will now be described. The pilot light assembly **460,** as shown in FIGS. **23** and **24,** includes a lamp socket **462,** a lamp **464,** three terminals **466,** a pair of contact members **468** and **470,** a resistor **472** and a selected mounting plate **474,** as shown in FIGS. **31B** and **31C.**

The lamp socket **462,** as shown in FIGS. **38, 38A** and **39,** is formed of a rigid molded insulating material to have a body portion **476,** a pair of projections **478** extending in opposite directions from the body portion and a pair of spaced projections **480** extending rearwardly from the body portion **476.** Each of the projections **478** has a rib **482** at its free end which is received in one of the grooves **106** while portions of the free ends of the projections **478** on opposite sides of the ribs **482** rest upon the surfaces **352** on the front ends of the projections **94** and **96.** The body portion **476** has a circular recess **484** having a diameter sufficient to receive a commercially available lens **486** when the pilot light assembly **460** is used in a flush mounted control station **144.** The center of the recess **484** is displaced 0.08 inches from an axis extending through the center of the ribs **482.** The rear wall of the body portion **476** has an opening **488** and the projections **480** extend rearwardly from opposite sides of the opening **488** and are centered in the plane **68** when the socket **462** is positioned in the cavity **60.** The opposite walls of the recess **484** are provided with ribs **490** which receive threads on the lens **486** to position the threaded end of the lens **486** in the recess **484.**

The mounting plates **474,** shown in FIGS. **31C** and **31B,** are mounted on the front end of the housing **58** when a pilot light assembly **460** is respectively included in a surface mounted control station **10** and a flush mounted control station **144.** The plates **474** are formed of a relatively thin and rigid sheet of insulating material to have a pair of openings **492** which are aligned with the bores **332.** The openings **492** and the bores **332** receive the screws **334** to secure the plates **474** on the front end of the housing **58.** The plates **474** in FIGS. **31B** and **31C** have an edge **494** which is positioned in the plane **66** when the plates **474** are mounted on the housing **58.** Each of the plates **474** has an opening **496** which receives the body portion **476.** The opening **496** in the plate shown in FIG. **31C** is located 0.08 inches from an axis passing through the centers of the pair of openings **492** and is located on the side of the axis that is remote from the edge **494.** Similarly, the opening **496** in the plate **474** in FIG. **31B** is located on a center 0.08 inches from the axis passing through the centers of the openings **492** and is located on the edge **494** side of the axis.

The three terminal members **466** are identical and, as illustrated by FIG. **18,** each includes a portion **498** secured on a surface **114** of the housing **58** by a screw **120** which passes through an opening in the portion **498** and is threaded into the bore **118** and a portion which extends rearwardly through the passage **116** to a curved terminal portion **500** that extends rearwardly of the rear exterior of the rear wall **64.** The terminal portions **500** are located to tightly engage a surface portion on the portions **36** on the wire connecting terminals which are carried by the terminal block **30** in the standard duty control station **10,** or the terminals carried by the terminal block **176** in the flush-mounted control station **144.** As shown in FIG. **23,** a contact member **468** and **470** iS secured to the portions **498** of the terminal members **466** that respectively rest on the projections **94***b* and **96***b* of the housing **58.** The member **468** has a contact portion **502** extending upwardly in the cavity **60** to be received between the projections **480** on the socket **462** when the socket is installed in cavity **60** for use in a control station **144.** Similarly, the member **470** has a contact portion **504** extending upwardly in the cavity **60** to be received between the projections **480** when the socket **462** is positioned to be used in a control station **144.** The resistor **472** is connected between the portions **498** of the terminal members **466** which are mounted on the projections **96***a* and **96***b.* When the terminal members **466** are mounted as shown, the contact portions **502** and **504** will be spaced on opposite sides of the plane **68** and be centered along an axis that is spaced between the planes **66** and **98.**

When the pilot lamp assembly **460** is to be used in a control station **10,** the terminal member **466** carrying the contact member **468** is secured on the projection **96***a* and the terminal member **466** carrying the contact member **470** is secured on the projection **94***a* so that the contact portions **502** and **504** extend downwardly in the cavity and are spaced on opposite sides of the plane **68** and are centered along an axis that is spaced between the plane **98** and the top wall **70.** The resistor **472** will be connected between the terminal members **466** that are respectively mounted on the projections **96***a* and **96***b.* When the terminals **466** are mounted in the cavity **60** for use in a control station **10,** the contact portions **502** and **504** will be received between the projections **480** when the socket **462** is positioned to be used in a control station **10** and a mounting plate **474,** as shown in FIG. **31C,** is secured to the front side of the housing **58.**

The lamp **464** is a commercially available type having a sealed tubular glass envelope **506** with a filament **508** at a front end of the envelope **506,** a pair of terminals **510** extending along the opposite surface sides of the envelope **506** from a rear end of the envelope **506** and an insulating pointed tip **512** at the rear end of the envelope **506.** The ends of the filament **508** are respectively connected to the pair of terminals **510.**

The control station **10** also includes a lens **514,** shown in FIG. **20,** which is formed of a light transmitting plastic to have a square shape which will permit a portion **516** to be received in the opening **38** while the perimeter of a front end portion **518** engages portions of the front wall **44.** The portion **516** preferably includes a pair of nibs **520** which snap behind portions of two opposite sides of the opening **38** to maintain the lens **514** in the opening **38.**

The switch assembly **56** is assembled to provide a pilot light in a control station **144** by mounting the three terminal members **466,** the two contact members **468** and **470,** and the resistor **472** in the cavity **60,** as shown in FIG. **23** and previously described. The socket

462 is then positioned in the cavity 60 with the ribs 482 received in the grooves 106 and portions on the projections 478 resting on the surfaces 352. The socket 462, when positioned in the cavity 60, will have the center of the recess 484 centered in the plane 68 and displaced 0.08 inches from the plane 98 in a direction which will cause the center of the recess 484 to be displaced 0.50 inches from the plane 66. The positioning of the socket 462 as described will cause the contact portions 502 and 504 to be positioned in the space between the projections 480. The mounting plate 474, as shown in FIG. 31B, when secured on the front side of the cavity 60 by screws 334 which pass through the openings 492 and into the bores 332, will be positioned so that the body portion 476 extends through the opening 496 and a rim 522 at the rear end of the body portion 476 engages rear surface portions on the mounting plate 474 to maintain the socket 462 within the cavity 60. The lamp 464, when inserted into the socket 462, will have its terminals 510 engaging the contact portions 502 and 504 and its pointed tip 512 engaging the boss 109. The switch assembly 56 is then combined with the outlet box 146, mounting bracket 148 and cover 150 with the center of the recess 484 aligned with the center of the opening 152 and the filament end of the lamp 464 extending through the opening 152. The lens 486 is then positioned in the opening 484 when a threaded end on the lens engages the ribs 490.

The switch assembly 56 is assembled to provide a pilot light in a control station 10 by mounting the terminal members 466 on the housing 58 so that the contact portions 502 and 504 extend downwardly, as previously described. The socket 462 is then positioned in the cavity 60 with the ribs 482 received in the grooves 106 and portions on the projections 478 resting on the surfaces 352. The socket 462, when positioned in the cavity 60, will have the center of the recess 484 centered in the plane 68 and displaced 0.08 inches from the plane 98 in a direction which will cause the center of the recess 484 to be displaced 0.66 inches from the plane 66. The positioning of the socket 462, as described, will cause the contact portions 502 and 504 to be positioned in the space between the projections 480. The mounting plate 474, as shown in FIG. 31C, when secured on the front side of the cavity 60 by screws 334 which pass through the openings 492 and into the bores 332, will be positioned to have the body portion 476 extending through the opening 496 and a rim 522 on the body portion 476 engaging rear surface portions on the mounting plate 474 to maintain the socket 462 within the cavity 60. The lamp 464, when inserted into the socket 462, will have its terminals 510 engaging the contact portions 502 and 504 and its pointed tip 512 engaging the boss 109.

The switch assembly 56, having the pilot light assembly 460 positioned therein, is then combined with the cover 14 which has a lens 514 previously installed in the opening 38 as previously described. When the switch assembly 56 is mounted on the rear wall 46, the filament end of the lamp 464 will extend through the opening 38, as shown in FIG. 20, where it will be visible through the lens 514.

The lamp 464, as used in the pilot light assembly 460, preferably has a rating of 120 volts. Thus the pilot light may be connected in a 120 volt circuit when electrical connections are made directly to the terminals 466 on which the contact members 502 and 504 are mounted. When the lamp is to be energized from a higher voltage source, a connection to the terminal 466 which will place the resistor 472 in series with the lamp is utilized.

The plates 522 and 524, respectively shown in FIGS. 21A and 31A, are mounted on the front end of the housing 58 when the switch assembly 56 is used in a control station 144. The plates 522 and 524 are formed of a relatively thin rigid sheet of insulating material to have a pair of openings 526 which are aligned with the bores 332. The openings 526 and the bores 332 receive the screws 334 to secure either of the plates 522 or 524 on the front end of the housing 58. The plates 522 and 524 have an edge 528 which is positioned in the plane 66 when the plates are mounted on the front surface of the housing 58. The plate 522 does not have a central opening therein and is used when the control station 144 is of the single unit type. For example: the control station 144 may be assembled to include a single selector switch, push button or pilot lamp which extends through one of the two openings in cover 150 with the remaining opening being unused. The plate 522 provides a cover for the portion of the cavity 60 located rearwardly of the unused opening. The plates 524 are used to provide a guide for the cylindrical buttons 214 and to maintain the components of the switch assembly 56 within the housing 58 prior to the installation of the cover 150 on the control station 144. The plate 524 has an opening 530 which receives the cylindrical button 214. The opening 530 in the plate shown in FIG. 31A is located 0.08 inches from the axis passing through the center of the pair of openings 526 and is located on the edge 528 side of the axis. The plates 524 are mounted in the control station 144, as shown in FIGS. 7 and 8.

The control stations 10 and 144, as previously described, are known as one or two unit type control stations as the maximum number of switching units or pilot lights that could be accommodated by the stations is two pilot lights, two selector switches, two push buttons or combinations thereof. However, three unit surface mounted control stations are frequently required to provide switching functions in an installation. For example, a control station may be required to have three buttons, i.e., an UP button, a DOWN button and a STOP button. A control station may be required to have a selector switch and two buttons or a control station may be required to have two buttons and a pilot light. A control station 532, as shown in FIGS. 15–18, will accommodate three units and is basically an elongated version of the control station 10 and therefore the numerical designations which are used to describe the structure of the control station 10, where appropriate, will be used to describe the structure of the control station 532.

The control station 532 includes a cover 534 and a base 536 which respectively replace the cover 14 and the base 12 as used in the control station 10. Also, for purposes of economy of manufacture, the control station 532 includes an additional housing 538, an insulating member 540, and an indexing plate 541, shown in FIG. 21D, or a mounting plate 543, shown in FIG. 31D, which are required when the control station 532 is assembled from the components previously described in connection with the control station 10. The cover 534, in addition to the openings 38 and 40, includes an additional opening 542 which has the same shape and size as the openings 38 and 40 and has its center located in the plane 66 and spaced 1.320 inches from the center

of the opening **38.** The base **536,** in addition to providing a support for the insulating block **30,** which supports the terminals **26** as previously described, includes a portion which provides a support for a pair of terminal blocks which are identical to the terminal blocks **176** which are used in the control station **144.** The blocks **176** are mounted on a rear wall **544** of the base **536** with the insulating member **540** positioned between the blocks **176** and the metal rear wall **544.** The blocks **176** have terminals **180** thereon which are oriented relative to the opening **542** in the control station **532** in the same manner as the terminals **26** are positioned relative to the openings **38** and **40** by the block **30.**

The housing **538** is formed of a molded insulating material and, as shown in FIG. **40,** includes an internal cavity **546.** The cavity **546** is centered about the plane **68** and has an open side facing and positioned adjacent a rear wall **547** of the cover **534.** The cavity **546** has a rear wall **548** extending coplanar with the rear wall **64** and is centered about a plane **550** which extends perpendicular to the rear wall **548** and extends parallel to and is spaced 1.320 inches from the plane **98** when the housing **538** is mounted adjacent the upper end of the housing **58.** The housing **538** is provided with a pair of ears at its upper end, each of which has a bore **552.** The bores **552** receive suitable screws **554** which are threaded into portions of the cover to secure the housing **538** on the rear wall **547** in a position where a lower wall **556** is positioned adjacent a top end of the housing **58** to maintain the **1.320** inch spacing between the planes **98** and **550.** The housing **538** has a pair of side walls **558** and **560** coplanar with the respective side walls **74** and **76** and projections **562** and **564** extending perpendicular to the rear wall **548** and centered in the plane **550.** The housing also has projections, bosses, grooves and openings which provide the equivalent function in the housing **538** as the pair of grooves **106,** the groove **110,** the openings **116,** the supports **94***a–b* and **96***a–b* provide in the upper portion of the cavity **60.** Thus the same components used in connection with the control station **10** which were installed in the portion of the cavity **60** associated with the pair of grooves **106** and the groove **110** may be installed in the cavity **546** to provide a switch assembly which will permit a push button, a pilot light or a selector switch to be present in the opening **542** in the same manner as similar components were assembled to be present in the opening **38** in the control station **10.** The indexing plate **541,** shown in FIG. **21D,** and the mounting plate **543,** shown in FIG. **31D,** are substantially identical to the indexing plate **300** and the mounting plate **474** which are respectively shown in FIGS. **21C** and **31C.** The only difference between the plates **541** and **543** and the plates **300** and **474** is that a bottom edge **572** on the plates **541** and **543** is spaced a lesser distance from an axis through the corresponding mounting holes **330** and **492** in the plates **541** and **543** respectively than the edges **336** and **494** are spaced from the axis through the mounting holes **330** and **492** in the plates **300** and **474,** respectively.

While certain preferred embodiments of the invention have been specifically disclosed, it is understood that the invention is not limited thereto, as many variations will be readily apparent to those skilled in the art and the invention is to be given its broadest possible interpretation within the terms of the following claims.

What is claimed is:

1. In an electric switch assembly that is selectively usable with either of two switch covers with a first of said two covers having a pair of openings therein spaced equidistantly on opposite sides of a center of the cover on centers X inches apart and a second of said two covers having a pair of openings therein spaced equidistantly on opposite sides of a center of the second covers on centers Y inches apart and wherein X is less than Y, said assembly including: a housing mounted adjacent a rear wall and rearwardly of the pair of openings in a selected one of the pair of covers, said housing having an internal cavity with said cavity having an open side facing the rear wall, a center located on an axis extending through the center of the cover and portions extending rearwardly of the openings in the cover, and a pair of movable contact carriers in said cavity spaced equidistantly on opposite sides of the center of the cavity and movable in parallel planes spaced (X+Y/2) inches apart in the portions of the cavity that extend rearwardly of the pair of openings in the cover.

2. The switch assembly as recited in claim **1** wherein the openings in the first cover are circular and the openings in the second cover have a square shape.

3. The switch assembly as recited in claim **1** including an operator having an actuating portion centered on an axis through the center of one of the openings in the cover and an operating portion disposed at the rear wall side of the cover and located (Y−X/4) inches from the axis providing a connection between the actuating portion and the movable contact carrier in the portion of the cavity that extends rearwardly of the said one opening.

4. The switch assembly as recited in claim **3** wherein the operator is a linearly movable push button.

5. The switch assembly as recited in claim **1** wherein the movable contact carrier that is movable in the cavity in one of the pair of openings is replaced by an assembly that includes a pilot light.

6. The switch assembly as recited in claim **1** wherein the portions of the cavity that extend rearwardly of the pair of openings have spaced stationary contacts therein which are engaged by contacts that are carried by the movable contact carrier.

7. An electric switch assembly that is selectively usable with either of two covers with a first of said two covers having a pair of openings spaced equidistantly on opposite sides of a center of the cover on centers X inches apart and a second of said two covers having a pair of openings therein spaced equidistantly on opposite sides of a center of the second cover on centers Y inches apart wherein X is less than Y, said switch assembly comprising: a selected one of the two covers, a housing mounted adjacent a rear wall of the selected cover, said housing having walls which provide a first contact chamber that extends rearwardly of a first of the two openings in the selected cover, a second contact chamber extending rearwardly of a second of the two openings in the selected cover, a pair of slots in each contact chamber centered in a plane perpendicular to the rear wall of the cover and an axis passing through the centers of the openings and located so the planes are (X+Y/2) inches apart and are spaced equidistantly from an axis extending perpendicular to the rear wall and through the center of the selected cover, a first movable contact support movable in the pair of slots in the first chamber, a second movable contact

support movable in the pair of slots in the second chamber, a first push button having an actuating portion centered on an axis through the center of the first opening in the selected cover and an operating portion disposed at the rear wall side of the cover located (Y−X/4) inches from the axis of the actuating portion providing a connection between the actuating portion and the first contact support for moving the first contact support when the actuating portion of the first push button is moved in the first opening, a second push button having an actuating portion centered on an axis through the center of the second opening in the selected cover and an operating portion disposed at the rear wall side of the cover located (Y−X/4) inches from the axis of the actuating portion providing a connection between the actuating portion and the second contact support for moving the second contact support when the actuating portion of the second push button is moved in the second opening, and a lever having its opposite ends connected respectively to the first contact support and the second contact support and a mid-portion engageable with a projection on a rear wall of the housing providing a mechanical interlock between the first and the second contact supports for preventing simultaneous actuation of the first and the second contact supports by the first and the second push buttons.

8. The switch assembly as recited in claim **7** including a first return spring positioned between the rear wall of the housing and the first contact support constantly biases the first contact support and the first push button to a deactuated position and a second return spring positioned between the rear wall of the housing and the second contact support constantly biases the second contact support and the second push button to a deactuated position.

9. The switch assembly as recited in claim **8** wherein the lever is pivoted on a portion of the housing and includes a detent mechanism carried by the mid-portion of the lever and engageable with the rear wall of the housing.

10. The switch assembly as recited in claim **7** wherein the lever is pivoted on a portion of the housing and prevents simultaneous actuation of the first contact support and the second contact support from a deactuated position to an actuated position and includes a detent mechanism carried by the midportion of the lever and engageable with a portion of the rear wall of the housing for maintaining a selected one of the first and the second contact supports in its actuated position and the unselected contact support in its deactuated position.

11. An electric switch assembly comprising: a cover having a front side, a rear side and a pair of openings extending between the front and the rear sides, a molded housing mounted on the rear side, said housing having a pair of side walls and a rear wall extending between the side walls providing the housing with a first open-sided chamber that extends rearwardly of a first of the pair of openings and a second open-sided chamber that extends rearwardly of a second of the pair of openings, a pair of slots in the side walls of the first chamber extending in a plane perpendicular to the side walls and parallel and spaced a predetermined distance from an axis perpendicular to the rear side through the center of the first opening, a movable contact support positioned by the slots in the first chamber for rotation about an axis perpendicular to the plane between two positions, a pair of stationary contacts positioned by one of the side walls in spaced relation on opposite sides of the plane in the first chamber adjacent the one side wall side of the first chamber, a movable contact carried by the contact support and engaging the pair of stationary contacts when the contact support is at a first of its two positions and spaced from the pair of stationary contacts when the contact support is at a second of its two positions, an actuator positioned at the open side of the first chamber, said actuator having an operating position extending through the first opening and rotatable about the axis centered in the first opening, an actuating portion including rearwardly facing gear teeth arranged in an arc having a radius centered on the axis through the center of the first opening engageable with gear teeth on the contact support for rotating the contact support to the two positions, and detent means yieldably maintaining the actuator in either of two selected positions, an adjustment knob positioned on the operating portion of the actuator on the front side of the cover, and a pilot light assembly positioned in the second chamber.

12. The switch assembly as recited in claim **11** wherein the pilot light assembly includes a pair of terminals respectively positioned by the side walls of the housing and positioned at opposite sides of an axis perpendicular to the rear side through the second opening, a receptacle for the pilot light positioned at the open side of the second chamber, a pilot light positioned in the receptacle to have terminal portions engaging the terminals within the chamber and a bulb portion extending through the second opening in the cover, and a lens providing a cover for the second opening in the cover.

13. An electric switch assembly that is selectively usable with either of two switch covers with a first of the two covers having a pair of openings therein spaced equidistantly on opposite sides of a center of the cover on centers X inches apart and a second of the two covers having a pair of openings therein spaced equidistantly on opposite sides of a center of the second cover on centers Y inches apart and wherein X is less than Y, said assembly including: a selected one of the two covers, said selected cover having a front side and a rear side, a molded housing mounted adjacent the rear side, said housing having a pair of parallel side walls spaced equidistantly on opposite sides of an axis through the centers of the openings and a rear wall extending between the side walls providing the housing with a first open-sided chamber that extends rearwardly of a first of the pair of openings in the selected cover and a second open-sided chamber that extends rearwardly of a second of the pair of openings in the selected cover, a pair of slots in the side walls of the first chamber extending in a plane perpendicular to the side walls and parallel and spaced (X+Y/4) inches from an axis perpendicular to the rear side through the center of the selected cover, a pair of stationary contacts positioned by one of the side walls in spaced relation on opposite sides of the plane in the first chamber adjacent the said one side wall of the chamber, a movable contact assembly in the first chamber, said contact assembly including a movable support having a contact support portion positioned by the pair of slots in the first chamber for rotation about an axis perpendicular to the plane between two positions and an actuating portion spaced a predetermined distance and extending parallel to the plane, said actuating portiOn having gear teeth thereon

arranged in an arc having a radius centered on the axis of rotation of the support and facing the rear wall of the selected cover, and a movable contact carried by the support and engaging the pair of stationary contacts when the support is at a first of its two positions and spaced from the stationary contacts when the support is at a second of its two positions, an operator assembly comprising: a selected one of a pair of plate-like members usable selectively with the two switch covers with a first plate-like member mounted on the open side of the first chamber when the first cover is the selected cover to have an opening therein centered on the axis through the center of the first opening in the first cover and with a second plate-like member mounted on the open side of the first chamber when the second cover is the selected cover to have an opening therein centered on the axis through the center of the first opening in the second cover, an actuator positioned on a front side of the selected plate-like member, said actuator having an operating portion extending through the first opening and rotatable about the axis centered in the first opening and an actuating portion rotatable on the rear surface of the selected plate-like member and including rearwardly facing gear teeth arranged in an arc having a radius centered on the axis through the center of the first opening and engageable with the gear teeth on the contact support for rotating the support to its two positions when the operating portion is rotated to two positions, means including a detent on the operating portion and a pair of spaced openings in the plate-like member for resiliently maintaining the operating portion against rotation from either of the two positions and an operating knob positioned on the operating portion on the front side of the cover.

14. The switch assembly as recited in claim **12** including a pilot light assembly positioned in the second chamber, said pilot light assembly including a pair of terminals respectively positioned by the side walls of the housing at opPosite sides of an axis perpendicular to the rear side through the center of the second opening, a receptacle for the pilot light positioned at the open side of second chamber, a pilot light positioned in the receptacle to have terminal portions engaging the terminals within the chamber and a bulb portion extending through the second opening in the cover, and a lens providing a cover for the second opening in the cover.

15. The switch assembly as recited in claim **13** including a second pair of stationary contacts positioned by the other of the pair of side walls on opposite sides of the plane in the first chamber adjacent the other of said pair of side walls, and a second movable contact carried by the support and engaging the second pair of contacts when the support is at the second of its two positions and spaced from the second pair of stationary contacts when the support is at the first of its two positions.

16. The switch assembly as recited in claim **15** wherein the means for resiliently maintaining the operating portion against rotation includes a third opening in the plate-like member which is engaged by the detent and maintains the operating portion in a position intermediate the two positions and the first and the second movable contacts in spaced relation to their associated stationary contacts.

17. The switch assembly as recited in claim **15** wherein the operating portion is selectively positionable in either of two maintained positions relative to the actuating portion of the actuator and the plate-like member includes said pair of spaced openings which resiliently maintain the operating portion against rotation from either of two positions when the operating portion is in one of its selected positions relative to the actuating portion and a set of three spaced openings which resiliently maintain the operating portion against rotation from either of three positions when the operating portion is in the other of its two selected positions relative to the operating portion.

18. An electric switch assembly that is selectively usable with either of two switch covers with a first of the two covers having a pair of openings therein spaced equidistantly a predetermined distance apart on opposite sides of a center of the cover and a second of said two covers having a pair of openings therein spaced equidistantly on opposite sides of a center of the second cover a predetermined distance apart with the distance between the openings in the first cover being less than the distance between the openings in the second cover, said assembly including: a housing mounted adjacent a rear wall and rearwardly of the pair of openings in a selected one of the pair of covers, said housing having an internal cavity with said cavity having an open side facing the rear wall, a center located on an axis extending through the center of the cover and portions extending rearwardly of the openings in the cover, and a pair of movable contact carriers in said cavity spaced equidistantly on opposite sides of the center of the cavity and movable in parallel planes with said planes spaced apart a distance greater than the distance between the center of the openings in the first cover and less than the distance between the center Of the openings in the second cover.

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