May 15, 1945. H. C. BOLLEY 2,375,891

RESISTANCE SWITCH

Filed Dec. 19, 1941

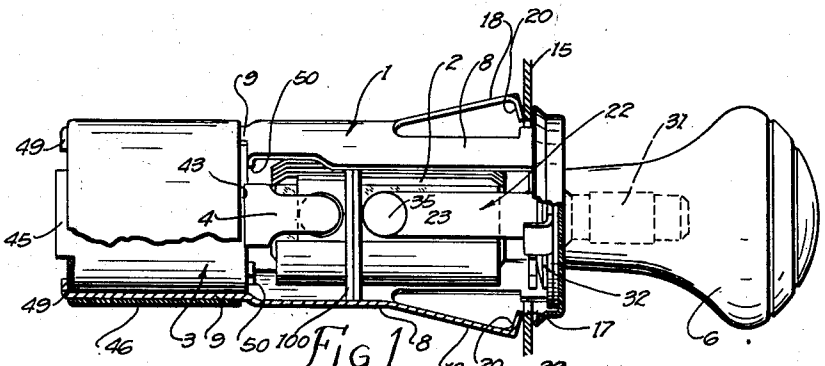


FIG. 1.

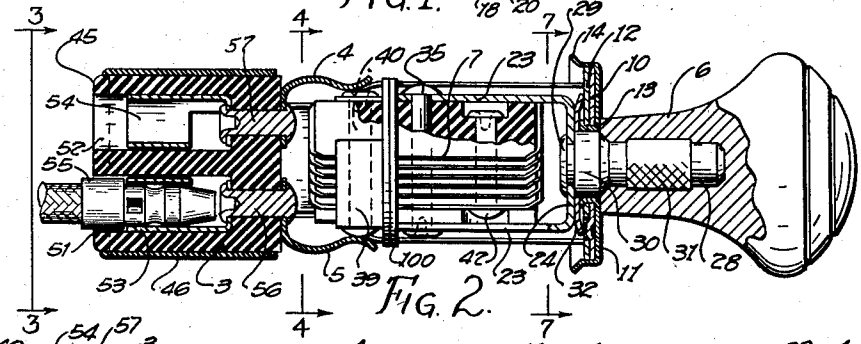


FIG. 2.

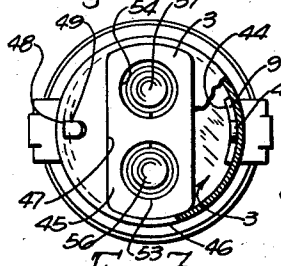


FIG. 3.

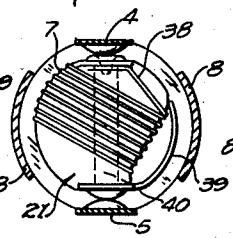


FIG. 4.

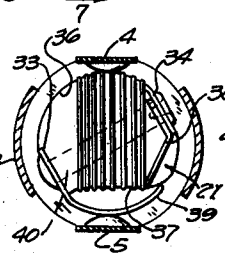


FIG. 5.

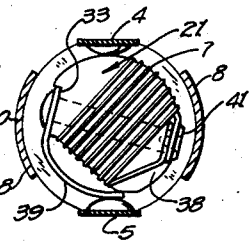


FIG. 6.

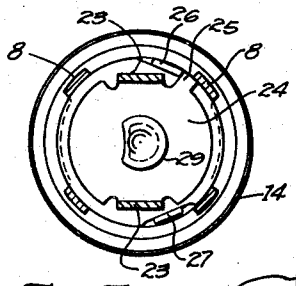


FIG. 7.

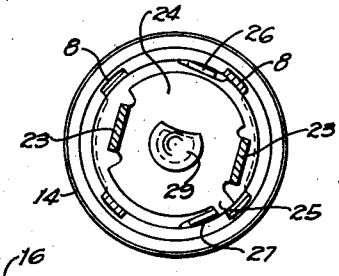


FIG. 8.

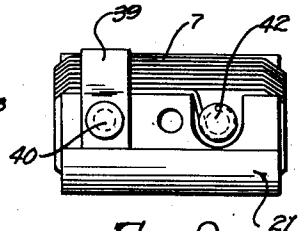


FIG. 9.

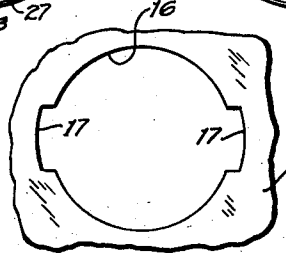


FIG. 10.

INVENTOR.
HERSCHEL C. BOLLEY

BY
Charles S. Penfield ATTORNEY

Patented May 15, 1945

2,375,891

UNITED STATES PATENT OFFICE

2,375,891

RESISTANCE SWITCH

Herschel C. Bolley, Bronson, Mich., assignor to H. A. Douglas Mfg. Co., Bronson, Mich., a corporation of Michigan

Application December 19, 1941, Serial No. 423,619

13 Claims. (Cl. 201—48)

This invention relates generally to electric switches and more particularly a rather small manually controlled rotary switch having a resistance element associated therewith.

More specifically, the switch is of a character adapted to be mounted on the instrument panel of an automotive vehicle for controlling the amount of illumination directed to the various instruments carried by the panel.

One object of the invention is to provide a switch having improved means for securing a part of the switch mechanism to the operation means or knob so as to assist in maintaining a part on said mechanism in an axial position within the switch casing or frame.

Another object is to provide an improved carrier of insulating material and means for securing the resistance element thereto.

A further object is to provide an improved contact carrier, including the contact means associated therewith, and the means employed for attaching the contact carrier with respect to the switch frame.

A still further object is to provide a switch consisting of a very few parts, which may be easily and quickly assembled, and economically manufactured on a production basis.

Other objects and advantages of the invention will appear after considering the description hereinafter set forth in conjunction with the drawing annexed hereto.

Referring to the drawing wherein one embodiment to which the invention is susceptible is illustrated:

Figure 1 is a horizontal view in elevation of the switch, certain parts of which are shown in the section for the purpose of clarification;

Figure 2 is a horizontal sectional view of the switch clearly illustrating the switching mechanism and parts related thereto;

Figure 3 is an end view of the switch looking to the right in the direction of the arrows designated 3—3 in Figure 2;

Figure 4 is a section taken substantially on line 4—4 of Figure 2, showing the switch in its complete "on" position;

Figure 5 is a transverse section similar to Figure 4, showing the switch in an intermediate "on" position with the resistance in the circuit;

Figure 6 is a similar section, showing the switch in the "off" position;

Figure 7 is a section taken substantially on line 7—7 of Figure 2, illustrating the means employed for limiting the rotative positions of the switch;

Figure 8 is a section similar to Figure 7, showing certain of the switch parts in a different position;

Figure 9 is a horizontal view in elevation of the carrier of insulating material or insulator to which is connected the resistance element; and

Figure 10 is a fragmentary view of a support such as an instrument panel having an opening therein for receiving the switch.

The switch, among other things, includes a casing or frame 1, switching mechanism 2, a contact carrier 3 supporting contacts 4 and 5, and operating means 6 in the form of a knob for moving the mechanism 2 with respect to the contacts 4 and 5 to control the circuit. The switching mechanism includes an insulator to which is connected a resistance element 7, which element functions to control the amount of electric current passing through a line to the lamp or lamps which control the illumination directed to the various instruments carried by the instrument panel of an automotive vehicle. Obviously, the switch has applications other than that just mentioned.

The switch casing 1 is preferably in the form of a generally tubular U-shaped frame. The generally parallel sides of the frame include portions 8 and 9. The portions 8 are preferably of a greater circumferential extent than the portions 9 and form a housing for the switching mechanism. The portions 9 are preferably elongated continuations of the portions 8 and receive the contact carrier 3.

The generally circular end wall 10 of the frame 1 integrally connecting the sides of the frame together is provided with a cap member 11 of a diameter somewhat greater than the diameter of the end wall 10. A reinforcing member in the form of a circular washer 12 is preferably arranged in the frame and engages the inner surface of the end wall 10. The wall 10 and the washer 12 are each provided with an aperture of corresponding size, and the cap member 11 is provided with a protuberance 13 which extends through the apertures just referred to, and is flanged over against the inner surface of the washer 12 for securing the cap member and washer to the wall 10 of the frame. The cap member 11 is preferably made concave or dished so as to receive the end wall 10 and the washer 12, and is also flanged outwardly as indicated at 14 to engage the front side of a support or instrument panel 15, as clearly illustrated in Figure 1.

The instrument panel 15 more clearly illus-

trated in Figure 10, is preferably provided with a circular aperture 16 of a diameter slightly greater than the diameter of the frame or casing 1 so as to receive the latter. The aperture is provided with oppositely disposed outwardly extending notches 17. The side portions 8 of the frame are preferably provided with integral outwardly extending spring tongues or fingers 18, having angular in-turned abutments 20 at their free ends. The tongues and abutments 20 are so constructed and arranged that when the switch is inserted rearwardly into the aperture 16, the tongues 18 will contract and when the flange 14 on the cap 11 engages the front side of the support 15 the tongues 18 will snap outwardly to a position whereby the angular abutments 20 will engage the arrises formed by the notches 17 to detachably hold the switch against rotation with respect to the support.

The switching mechanism 2 includes, among other things, a generally cylindrical insulator 21, which supports the resistance element 7. This insulator 21 is preferably rotatably supported within the switch frame by a bifurcated member 22. This bifurcated member is similar to the frame 1, and is comprised of a pair of rather narrow legs 23 which engage the sides of the insulator 21. The legs 23 are integrally connected together by a generally circular end portion 24 as illustrated in Figures 2 and 7. The portion 24 is provided with an outwardly extending projection 25, and the washer 12, above referred to, is preferably provided with axially extending stops 26 and 27 between which the projection 25 is adapted for movement to limit the rotative positions of the switch, all of which will be described more in detail later.

The circular wall portion 24 of the bifurcated member 22 supporting the insulator 21 is preferably provided with a generally central aperture, and one end of a shaft 28 projects through this aperture and is flanged over against the inner surface of the wall as clearly indicated at 29 in Figures 2 and 7. As indicated by the dotted lines in Figure 7, provision is made to prevent rotation between the shaft and member 22. This shaft is preferably provided with an enlarged but rather short cylindrical portion 30 which fits within the protuberance 13 of the cap 11 in order to provide a better bearing surface, and the outer extremity of the shaft is preferably provided with a serrated or knurled portion 31, which is firmly pressed into an aperture provided therefor in the knob. The knob 6 is preferably made of a material of sufficient ductility to permit the shaft to permanently seat itself into the aperture.

In order to improve the action of the switch and assist in holding the switching mechanism in its various rotative positions, a dished spring disk 32 is carried by the shaft 28, and is adapted to engage the wall portion 24 of member 22 and the washer 12. This disk also functions to prevent vibration between the various parts and at the same time permits very slight axial movement of the knob 6, member 22, and insulator 21 as a unit with respect to the switch frame.

Referring now to the insulator 21 and resistance carried thereby, it will be evident that the opposite sides of the insulator are preferably flat and recessed as indicated at 33 and 34, which recesses receive the legs 23 of the bifurcated member 22 whereby to prevent rotation of the insulator 21 with respect to the member. A rivet 35 passes through the insulator and the legs 23 for permanently securing the member 22 to the insulator. The curved side wall 36 of the insulator 21 between the recesses 33 and 34 is provided with longitudinally extending shallow grooves. The opposite side wall 37 is made rather flat and is also provided with similar grooves. These grooves spirally receive the wire resistance element 7 to maintain the convolutions of the wire in spaced apart relation. In other words, the wire is wound longitudinally about the sides and ends of the insulator. As clearly illustrated, the end 38 of the wire is electrically connected to a yieldable contact arm 39 by means of a contact rivet 40 passing through the insulator and a metal washer 41. The end 38 is preferably located in the recess 34 of the insulator and is caught around the rivet and under the washer 41. Thus, it will be evident that current may pass from the wire through the contact rivet 40 to the yieldable contact 39, or vice versa. One end of the yieldable contact is seated within the recess 33 provided on the insulator to prevent rotation of the contact with respect thereto, and its opposite end is arranged to engage the insulator when the contact is depressed beyond certain limits. It will be noted that this contact is circumferentially arranged about a part of the insulator, and is arched in order to clear the resistance wire 7. The other end of the wire is secured to the insulator by means of a rivet 42, the ends of which are countersunk as clearly illustrated in Figures 2 and 9 in order to prevent a short circuit between the wire and the remainder of the switch. It will be noted that the sides of the insulator are spaced apart from the switch frame and its ends from the wall portion 24 of member 22 and the carrier 3. This arrangement has been found very desirable for the reason that it permits the air to circulate through the open sides of the switch frame and about the resistance to cool the latter and prevent undue heating of the switch parts. One or more annular insulating rings such as 100 are preferably secured to the insulator 21 between the rivets 35 and 40, which rings more or less slidably engage the inner walls of the switch frame in order to assist in centering or positioning the insulator axially within the frame.

The carrier 3 supporting the axially extending yieldable contacts 4 and 5 will now be described. The carrier 3 is preferably generally cylindrical in shape and the contacts 4 and 5 are preferably diametrically arranged in spaced apart relation adjacent the inner extremity of the carrier and project in a direction whereby to receive the inner extremity of the insulator 21 and resistance element 7. The base portions of the contacts 4 and 5 are preferably seated within a transverse recess 43 whereby to prevent rotation of the contacts with respect to the carrier. The longitudinal side walls on the carrier 3 are preferably provided with shallow grooves 44, one of which is shown in Figure 3. These grooves receive the continuations 9 forming a part of the switch frame to prevent rotation of the carrier with respect to the frame. The outer extremity of the carrier is preferably provided with a generally rectangular outwardly extending boss or projection 45. A tubular member or ferrule 46, as clearly illustrated in Figures 1 through 3, surrounds the continuations 9 and the carrier 3. The end wall of the ferrule is provided with an opening 47 which receives the boss 45 whereby to assist in preventing rotation of the carrier with

respect to the switch frame. The end wall is also provided with a pair of oppositely disposed apertures 48, one of which is shown in Figure 3. Lugs 49 provided on the continuations 9 project through these apertures and are bent over against the end wall of the ferrule to secure the same in place. As clearly shown in Figure 1, the junction between the portions 8 and 9 of the frame are provided with inwardly extending stop portions 50 which engage the inner end of the carrier 3 whereby to maintain the carrier in a predetermined position with respect to the switching mechanism. The junctions also provide shoulders or abutments which are engaged by the inner end of the ferrule.

The yieldable contacts 4 and 5 carried by the carrier are bowed outwardly, inwardly and thence outwardly. The inwardly extending portions are preferably provided with indentations so that there is at least a single point of contact between the yieldable contact 4 and the resistance wire.

The carrier 3 is also provided with a pair of spaced apart longitudinally extending cylindrical pockets 51 and 52 which receive plug conductor receptacles 53 and 54, clearly illustrated in Figures 2 and 3. These receptacles 53 and 54 are preferably split and tubular in form and of a length somewhat less than the depths of the pockets so that the outer exremities of the receptacles are positioned inwardly with respect to the outer surface of the boss 35. This arrangement is desirable because the plug terminals such as 55 will not be exposed for contact with some other part of the automobile to cause a short circuit. A rivet 56 passes through a part of the carrier 3 and through the base portions of the receptacles 53 and contact 5 to secure the latter to the carrier, and a rivet 57 likewise secures the receptacle 54 and contact 4 to the carrier.

Referring now to the operation of the switch, it will be apparent by reference to Figures 1, 2 and 4, that the contacts 4 and 5 are in engagement with the opposite ends of the rivet contact 40 carried by the insulator 21. In this position the resistance element is not included in the circuit because the current will pass directly between the yieldable contacts 4 and 5 through the intermediation of the rivet 40. In other words, the lamp or lamps employed to illuminate the various instruments carried by the panel support will be completely illuminated and not dimmed. This position of the switch is predetermined by the projection 25 on the end wall portion 24 of the bifurcated member 22 which engages the stop 26 formed on the washer 12, as evidenced in Figure 7. When the insulator 21 and wire are rotated in an opposite direction to the fullest extent so that the projection 25 will engage the stop 27, the switch will be in a completely "off" position so that current will not pass between the contacts 4 and 5 to the receptacles 53 and 54. In this "off" position, it will be evident, by reference to Figure 6, that the free extremity of the arched contact 39 engages the contact 5 carried by the carrier 3, and that the contact 4 engages a wall of the insulator 21. When the insulator 21 and wire are rotated to one of its intermediate positions, between the positions just referred to, as illustrated in Figure 5, the lamp or lamps used for illumination will be dimmed about fifty per cent. Thus, the illumination may be increased or diminished as desired. It will be noted that the contact 5 is at all times in contact with the rivet contact 40 or the arch contact 39, and that when contact 4 is not engaging the rivet 40, it is either in contact with the resistance element or the insulator.

Having thus described my invention, it is obvious that various modifications may be made in the same without departing from the spirit of the invention; and, therefore, I do not wish to be understood as limiting myself to the exact forms, constructions, arrangements, and combinations of parts herein shown and described.

I claim:

1. An electric switch including, a frame, contact means carried by said frame, switching mechanism and means for supporting same within said frame, a cap member engaging the outer surface of a wall of said frame, a washer provided with stops for predetermining the movement of said mechanism engaging the opposite surface of said wall, a protuberance provided on said cap member projecting through said wall of said frame and through said washer and flanged over upon the latter for securing said wall between said cap and said washer, means projecting through said protuberance and connected to said means for supporting said mechanism for moving the mechanism within the frame and with respect to said contact means, and resilient means disposed between said supporting means and said washer permitting slight axial thrust of said mechanism within the frame.

2. An electric switch including, a frame, switching mechanism disposed in said frame, means for operating said mechanism, a carrier of insulating material supporting contact means disposed in a part of said frame, and means surrounding said part and said carrier assisting to hold said carrier within said part.

3. An electric switch including, a frame, contact means carried by said frame, switching mechanism and means for supporting same within said frame, a cap member engaging the outer surface of a wall of said frame, a washer engaging the opposite surface of said wall, said cap member and said washer each being provided with an aperture, means projecting through said apertures and connected to said means for supporting said mechanism for moving the mechanism within the frame and with respect to said contact means, and resilient means disposed between said supporting means and said washer permitting a slight axial thrust of said mechanism within said frame.

4. An electric switch including, a frame, contact means carried by said frame, switching mechanism and means for supporting same within said frame, a cap member engaging the outer surface of a wall of said frame, a washer engaging the opposite surface of said wall, a protuberance provided on said cap member projecting through said wall of said frame and flanged over and upon the latter for securing said wall between said cap and said washer, means projecting through said protuberance and connected to said means for supporting said mechanism for moving the mechanism within the frame and with respect to said contact means, and resilient means acting on said supporting means permitting slight axial thrust of said mechanism within said frame.

5. An electric switch including, a frame, contact means carried by said frame, switching mechanism and means for supporting same within said frame, a member engaging the outer surface of a wall of said frame, a washer engaging the opposite surface of said wall, a pro-

tuberance provided on said member projecting through said wall of said frame and through said washer and flanged over and upon the latter for securing said wall between said member and said washer, means projecting through said protuberance and connecting to said means for supporting said mechanism for moving the mechanism within the frame and with respect to said contact means, resilient means acting on said supporting means permitting slight axial thrust of said mechanism within said frame, and a ring of insulation surrounding said mechanism engageable with said frame assisting to maintain said mechanism in an axial position within said frame.

6. An electric switch including, a frame, a generally cylindrical insulator carrying contact means disposed within one end of said frame, switching mechanism and means for supporting same within said frame, a member engaging the outer surface of a wall of said frame, a washer engaging the opposite surface of said wall, tubular means projecting through said wall of said frame and through said washer for securing said wall between said member and said washer, means projecting through said tubular means and connected to said means for supporting said mechanism for moving said mechanism within the frame and with respect to said contact means, means acting on said supporting means permitting slight axial thrust of said mechanism within said frame, and means surrounding the said one end of said frame including said cylindrical insulator acting to prevent spreading of said end of said frame and at the same time retain said cylindrical insulator for said contact means within said frame.

7. An electric switch including, a frame, contact means carried by said frame, switching mechanism and means for supporting same within said frame, a cap member engaging the outer surface of a wall of said frame, a washer provided with stops for predetermining the movement of said mechanism engaging the opposite surface of said wall, a protuberance provided on said cap member projecting through said wall of said frame and through said washer and flanged over upon the latter for securing said wall between said cap and said washer, means projecting through said protuberance and connected to said means for supporting said mechanism for moving the mechanism within the frame and with respect to said contact means, resilient means disposed between said supporting means and said washer, and knob means engaging the outer surface of said cap member and connected to said projecting means in a manner whereby said mechanism is held substantially axially within the frame and at the same time permits slight axial thrust of said mechanism within the frame.

8. An electric switch including, a frame, switching mechanism disposed in said frame, means for operating said mechanism, a carrier of insulating material supporting contact means disposed in a part of said frame, and generally tubular means surrounding said part and said carrier assisting to hold said carrier within said part, said generally tubular means being provided with an end wall engaging said carrier, said end wall being provided with apertures, and said frame being provided with means projecting through said apertures and clinched over and against the outer surface of said end wall for locking said generally tubular means in place

9. The structure defined in claim 8, in which the end wall of the generally tubular means is provided with an opening and the carrier is provided with projecting means received in said opening.

10. An electric switch including, an elongated generally U-shaped frame, a contact carrier secured within one extremity of the frame between the free ends of the legs constituting portions of the U, a pair of spaced apart yieldable contacts secured to the inner side of said carrier and extending forwardly longitudinally in the space between the legs of the U, an aperture provided in the base of the U receiving an operating member, a bifurcated member permanently secured to said operating member, the legs of said bifurcated member extending rearwardly into the frame, a generally cylindrical insulator of which one extremity thereof is secured between the rearwardly extending legs of the bifurcated member so that the insulator will be rotated with the operating member, a contact member secured to the free rearwardly extending extremity of the insulator, a pin passing through one end of said contact member and substantially diametrically through the said free extremity of the insulator, said yieldable contacts said contact member and said pin being so constructed and arranged that when the insulator is in one position one of said yieldable contacts will engage the insulator and the other yieldable contact will engage the contact member in which position the switch is off, and when moved to another position said yieldable contact engaging said contact member will remain in contact therewith and the other yieldable contact will engage the pin whereby current may pass through the pin to close an electric circuit between the yieldable contacts.

11. An electric switch including, an elongated generally U-shaped frame, a contact carrier secured within one extremity of the frame between the free ends of the legs constituting portions of the U, a pair of spaced apart yieldable contacts secured to the inner side of said carrier and extending forwardly longitudinally in the space between the legs of the U, an aperture provided in the base of the U receiving an operating member, a bifurcated member permanently secured to said operating member, the legs of said bifurcated member extending rearwardly into the frame, a generally cylindrical insulator of which one extremity thereof is secured between the rearwardly extending legs of the bifurcated member so that the insulator will be rotated with the operating member, an arcuate shaped resilient contact secured to and partially around the free rearwardly extending extremity of the insulator, a pin passing through one end of said arcuate contact and substantially diametrically through the said free extremity of the insulator, said yieldable contacts said arcuate contact and said pin being so constructed and arranged that when the insulator is moved to one position one of said yieldable contacts will engage the insulator and the other yieldable contact will engage the arcuate contact in which position the switch is off, and when moved to another position said yieldable contact engaging said arcuate contact will remain in contact therewith and the other yieldable contact will engage the pin whereby current may pass through the pin whereby to close an electric circuit between the yieldable contacts.

12. A control device for controlling the current transmitted through a circuit, said device comprising a frame having an oblong insulator therein, a resistance coil in said frame wound helically lengthwise entirely about said insulator, a yieldable contact carried by the insulator connected to the coil and having a part overlying a portion of the coil in spaced apart relation thereto, a contact carrier spaced axially from said insulator and having elongated contacts projecting into the frame whereby one of the elongated contacts is adapted for electrical engagement with said resistance coil and said yieldable contact, and means for moving said insulator and coil as a unit with respect to said elongated contacts so that more or less of said resistance may be included in the circuit.

13. In combination: a switch frame provided with an opening, an oblong insulator mounted in said frame, a resistance coil wound lengthwise on said insulator and engaging its ends, a carrier supported on said frame and spaced axially from said insulator, said carrier carrying contacts straddling said insulator, and means projecting through said opening connected to said insulator for rotating the insulator and coil with respect to said contacts so that at least one of said contacts will engage the coil to include the latter in an electrical circuit.

HERSCHEL C. BOLLEY.