March 31, 1970 H. R. ATKINSON 3,504,140

HEATER AND AIR CONDITIONING SWITCH

Filed Nov. 12, 1968 2 Sheets-Sheet 1

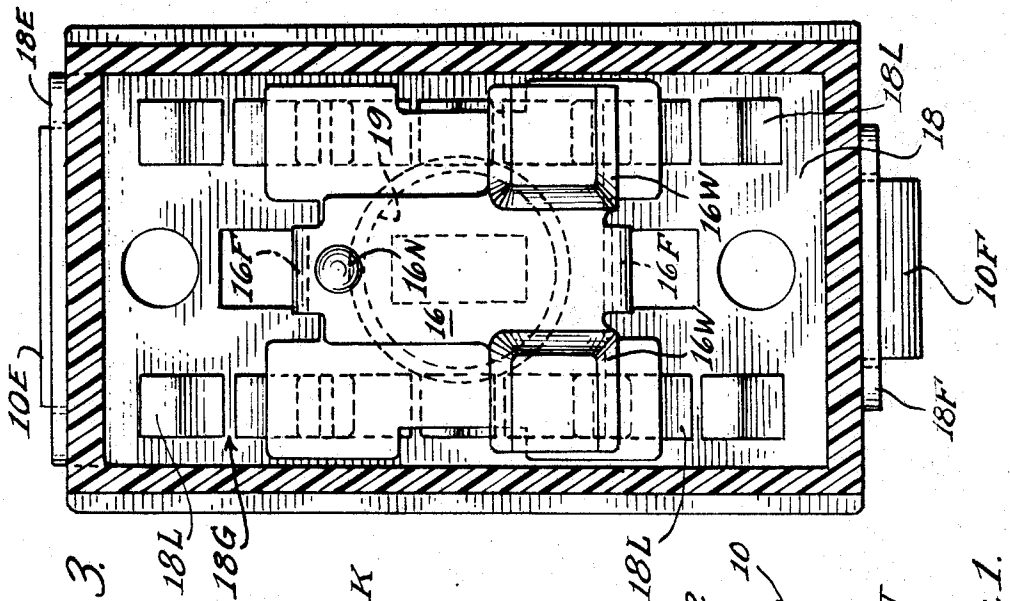


Fig. 3.

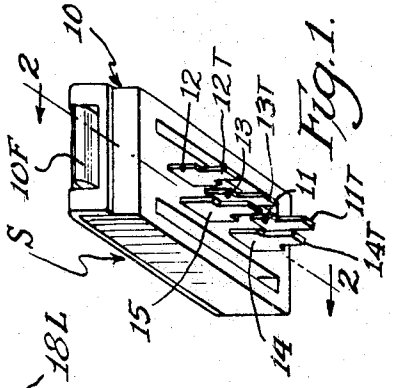


Fig. 1.

Fig. 2.

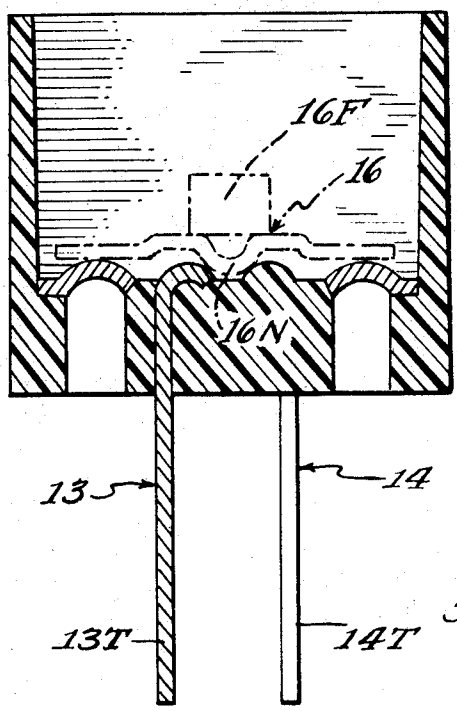
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Fig. 5.



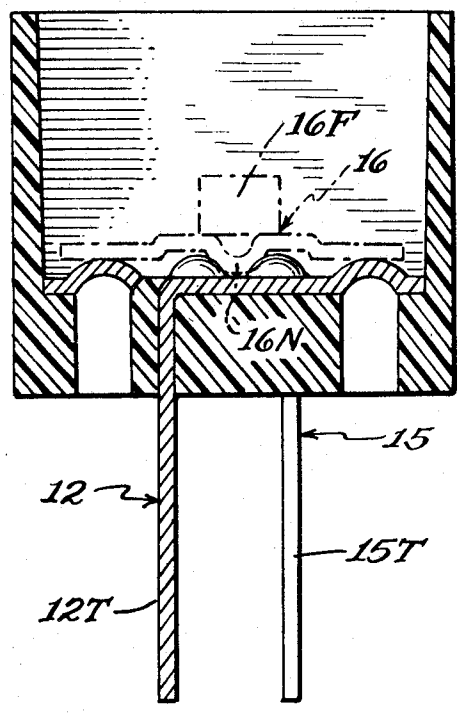


Fig. 4.

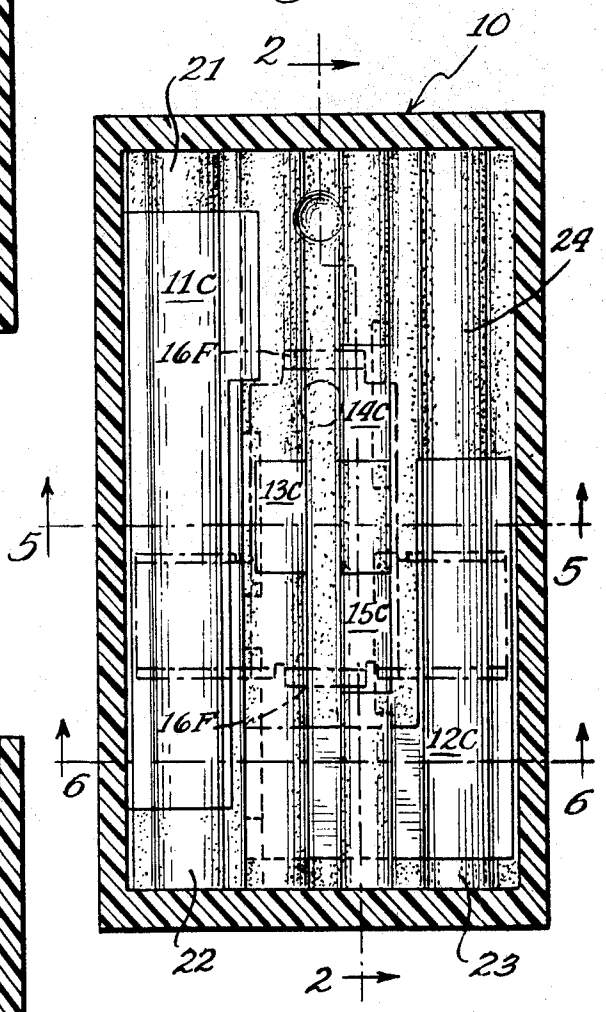


Fig. 6.

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HEATER AND AIR CONDITIONING SWITCH

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U.S. Cl. 200—16 10 Claims

ABSTRACT OF THE DISCLOSURE

A multi-position electrical selector switch is illustrated wherein one piece copper inserts are molded in situ in the base wall of a box-shaped plastic mounting in a configuration defining a set of four side-by-side treadways. Each treadway is defined in part by contact surface portions of the copper inserts and by insulated guide surface portions of the base wall, all correspondingly rounded and disposed flush and in alignment to define each treadway with a lengthwise uniform profile. A spring wire actuator arm is engageable with a carrier block and slider assembly to impart snap action movement thereto. A detent plate is engageable with the carrier block to determine the various switch positions.

Background of the invention

This invention relates to multi-position electrical selector switches wherein a contactor in the form of a slider is movable along a guide track to provide switching control between contact surfaces disposed along such track. More particularly, the invention is concerned with a slider and guide track type of selector switch for use in the control of the conventional heater and air conditioning circuits of automobiles.

In the automobile application, the switch has several operating positions including an OFF position and separate positions for each of a set of different speed control circuit paths, there being a further circuit which is ON for each separate switch position corresponding to one of the speed control circuit paths. A switch suited for this typical automobile circuit application is shown in Hoy et al. Patent No. 3,223,794. The particular switch disclosed therein utilizes multi-piece riveted terminal and contact structures which are anchored in an insulated mount so that the terminal portions are connected to the external circuit paths and so that the contact portions serve both as conductive rails of a guide track and as stationary contacts for cooperation with a slider at selected positions along the track. The insulated mount is formed with bosses to also assist in stabilizing the slider. Riveted constructions can result in high resistance current paths between the contacts and terminals causing excessive heat that may damage the unit.

Summary of the invention

In accordance with the present invention there is provided an electrical selector switch having a guide track including stationary contact portions to cooperate with selector means having a slider operable along the track to establish circuit connections between the contact portions, the switch being comprised of mounting structure including a base wall of molded plastic material having a plurality of conductive inserts embedded by being molded in situ therein, the base wall and the inserts having endwise aligned raised surface portions presenting a pair of treadways of uniform lengthwise surface profile to constitute the guide track. Each of the conductive inserts is a one-piece element having an integral terminal portion projecting through the mounting structure in positively

interlocked relation, each insert being free of high resistance joints and free of vibration problems.

The conductive inserts present contact surfaces flush with and aligned with contoured guide surfaces on the base wall in an arrangement constituting a set of four side-by-side treadways along which the slider is operable.

In the particular multi-position selector switch illustrated for purposes of disclosure, a detent plate overlies the slider and presents spaced detent lobes to positively locate the slider at each predetermined intermediate position and the selector means includes a cantilever actuator arm resiliently engageable with the slider in a manner to absorb and release the energy necessary to advance the slider past the crests of the detent lobes. Thus, the actuator arm **20** acts with a snap movement to make it impossible for the slider to stop between the intermediate rest positions. The actuator arm is comprised of spring wire and is rotatable about an axis location intermediate of the ends of the guide track.

Thus, while preferred constructional features of the invention are embodied in the structure illustrated herein, it is to be understood that changes and variations may be made by those skilled in the art without departing from the spirit and scope of the appended claims.

Brief description of the drawings

In the accompanying drawings forming a part of the specification, and in which like numerals are employed to designate like parts throughout the same:

FIG. 1 is a perspective view of a multi-position selector switch in accordance with the present invention and specifically adapted for use as a heater and air conditioning switch for automobiles;

FIG. 2 is a lengthwise section taken approximately as indicated on the lines **2—2** of FIGS. 1 and 4;

FIG. 3 is an inverted plan section through the switch and is taken as indicated on the line **3—3** of FIG. 2 to show the relationship of the slider to the detent plate;

FIG. 4 is a top plan section through the switch taken as indicated on the line **4—4** of FIG. 2 to show the contact and guide surface arrangement; and

FIGS. 5 and 6 are transverse sectional views taken, as indicated, on the lines **5—5** and **6—6** of FIG. 4.

Description of preferred embodiment

Referring now to the drawings, a multi-position electric selector switch as shown at S in FIG. 1 hereof is intended to perform a multi-step operating sequence for controlling the conventional heater and air conditioner circuitry utilized in automobiles, this sequence being old and well known and forming no part of the present invention. In general, the sequence requires an OFF position and a set of four different ON positions, there being one circuit which is ON at all four of the intermediate positions and there being three separate circuits each individually associated with a different intermediate position.

The illustrated switch assembly includes a molded box-shaped housing **10** serving as a mounting structure for a set of conductive inserts **11** through **15** embedded by being molded in situ therein and presenting contact surface portions **11C** through **15C** disposed flush with and in aligned relation with guide surface portions of the housing for providing a set of four treadways which are partly defined by the non-conductive surface material of the housing and partly by the conductive contact portions of the inserts. A slider **16**, of one-piece construction, is movable along the treadways and includes a central contact nub **16N** operating in the narrow gauge track defined by the two centermost treadways and a pair of contact wings **16W** riding the broad gauge track defined by the outermost treadways to hold the remainder of the slider

in elevated bridging relation above the narrow gauge track. The slider **16** has upstanding end flanges **16F** that embrace a carrier block **17** of insulating material which is provided with a set of four upstanding detents **17D** located adjacent top corner regions thereof. A detent plate **18** covers the open top of the housing **10** and has end flanges **18E**, **18F** engageable with locking ears **10E**, **10F**, respectively, that project integrally from opposite ends of the housing to seat the detent plate in a fixed predetermined position. A coiled wire spring **19** (FIG. 2) nests in an annular recess provided in the carrier block **17** and engages the slider **16** normally to hold the slider towards the tracks and to hold the carrier block **17** towards the detent plate **18** to allow the detents **17D** to engage in the grooves **18G** between the detent lobes **18L** on the underface of the detent plate.

The carrier block **17** has a central socket **17S** to receive the free end of a cantilever actuator arm **20** which is mounted to rotate about an axis disposed intermediately of the ends of the guide tracks. The actuator arm **20** is of spring wire, having a coiled free end **20C** for convenient seating within the socket **17S** of the carrier block. The arm is free of stress when the slider and carrier block are at the center position along the guide track as illustrated in FIG. 2. When the actuating knob K and shaft S for the wire arm **20** are rotated, the arm partly winds up to act as a spring lever that absorbs and releases the energy necessary to advance the carrier. In cooperation with the detent engagement between the carrier block **17** and the detent plate **18**, the arm **20** gives a snap action movement to the travel of the carrier block and slider. The grooves **18G** in the detent plate **18** determine a set of five stable positions for the carrier block **17**, such positions being determined by the seating of the detents **17D** on the block within the detent grooves **18G** and also serving to determine the circuit bridging functions of the conductive slider plate. The snap action movement imparted by the wind up of the spring arm **20** assures against the slider plate stopping between detent positions. The snap action provides a fast make and break characteristic for the various electrical circuits associated with the detent positions.

In the illustrated switch arrangement, the inserts **11–15** are pre-formed copper elements embedded in the base wall of the box-shaped mounting housing by being molded in situ therein. The housing **10** is a high impact reinforced thermoplastic material such as styrene acrylonitrile. Each of the one-piece copper inserts **11** through **15** includes an integral spade terminal **11T** through **15T** leading directly through the base wall, these terminal portions having intermediate shoulders and side notches which afford positive mechanical interlocking with the base wall material during the molding operation.

The particular configuration of the contact and insulating guide surfaces that constitute the four side-by-side treadways is best shown in FIG. 4. The copper insert **11** has an elongated contact surface **11C** of rounded tread profile extending substantially the full length of the left hand treadway as shown in FIG. 4, with there being short guide surfaces **21**, **22** at opposite ends. The slider **16** has one of its wing portions **16W** engageable with the contact surface **11C** with such engagement being maintained at all five switch positions. The copper insert element **12** has a contact surface **12C** exetnding approximately one-half the length of the right hand outer treadway, with there being a short guide surface **23** at one end and an elongated guide surface **24** at the other end flush with and aligned with the contact surface **12C** to present a uniform lengthwise profile. The surfaces **23**, **24** are correspondingly rounded and cooperate to provide mechanical guidance to the wing portion of the slider.

Contact between the wing portion **16W** and the contact surface **12C** is established at all positions other than the OFF position. As viewed in FIG. 2, the OFF position for the slider is shown in phantom lines at the left end of the housing. The outer treadways which have the contact surfaces **11C**, **12C** of inserts **11** and **12** interposed therein constitute a wide gauge track which is bridged by the wings of the slider with the forward end of the slider normally being held elevated above the center treadways.

The conductive insert **13** has its contact surface interposed in the left center treadway and the conductive inserts **14** and **15** are interposed in the right center treadway spaced apart approximately the length of the contact surface **13C**.

The contact nub **16N** rides between the center treadways which define a narrow gauge track for its guidance and it has five separate rest positions beginning with the top OFF position as shown in FIG. 4, and including the first ON position wherein the wings bridge the contact surfaces **11C** and **12C**. The second ON position is established through the slider from the insert **11** to the insert **14**, the third ON position is established through the slider from the insert **11** to the insert **13**, and the final ON position is established from the insert **11** to the insert **15**. The positioning of the contact portions **11C** to **15C** relative to the slider nub and wings is selected to provide a make before break switch function as the slider is moved between successive positions.

It may be noted that the terminal portions **11T**, **12T** and **13T** lead through the base wall in lengthwise alignment between the outer and left center treadways whereas the terminal portions **14T** and **15T** lead through the base wall in lengthwise alignment between the outer and right center treadways. The molded insert arrangement of this invention is suited for direct plug-in mounting in automobile circuit panels.

Other switch applications are contemplated for the switch construction features shown herein. The stable guidance for the slider movement, as afforded by the uniform tread profile, offers reliable contacting engagement at all positions and allows more positive guidance of slider travel. The one-piece inserts eliminate high resistance joints and the molded in situ insert mounting made possible by the unique configurations of the inserts simplifies manufacture and insures sturdiness of the final product.

Although there has been described a preferred embodiment of this novel invention, many variations and modifications will now be apparent to those skilled in the art. Therefore, this invention is to be limited not by the specific disclosure herein but only by the appending claims.

The embodiments of the invention in which an exclusive privilege or property is claimed are defined as follows:

1. In an electrical selector switch having a guide track including stationary contact portions and selector means including a slider operable along said track to establish circuit connections between said contact portions, mounting structure including a base wall of molded plastic material having a plurality of conductive inserts embedded therein, said base wall and said inserts having endwise aligned raised surface portions presenting a pair of treadways of uniform lengthwise surface profile to constitute said guide track.

2. In an electrical selector switch, mounting structure including a base wall of molded plastic material having a plurality of conductive inserts embedded therein, each conductive insert including a portion presenting a contact surface flush with and aligned with a contoured guide surface portion of said base wall to constitute, collectively therewith, a treadway of uniform surface profile along its length.

3. In a switch in accordance with claim **2** and wherein each conductive insert is a one-pice element having an integral terminal portion projecting through said housing structure.

4. In a switch in accordance with claim **3** and wherein said base wall and said inserts have guide and contact surface portions, respectively, in an arrangement constituting a set of four side-by-side treadways, each insert having an integral terminal portion projecting through

said base wall at a region intermediate an outer treadway and a treadway adjacent thereto.

5. In an electrical selector switch having a guide track including stationary contact portions and selector means including slider means operable along said track to establish circuit connections between said contact portions at intermediate positions therealong and detent plate means engageable with said slider means to provide positive location thereof at said intermediate positions, said selector means including a cantilever actuator arm of flexibly resilient material engageable with said slider means to absorb and release the energy necessary to advance the slider with snap-movement between said intermediate positions.

6. In an electrical selector switch in accordance with claim **5** and wherein said actuator arm is rotatable about an axis location disposed intermediately of the ends of the guide track.

7. In an electrical selector switch in accordance with claim **5** and wherein said actuator arm comprises an elongated resiliently deflectable element rotatable about an axis location disposed intermediately of the ends of the guide track.

8. In an electrical selector switch in accordance with claim **5** and wherein said actuator arm comprises a spring wire element having a coiled free end snugly engageable within said slider means, said spring wire element being swingable about an axis location disposed intermediately of the ends of the guide track.

9. In a switch having spaced stationary contacts, a

movable contactor shiftable therebetween to establish individual circuit connections therewith and detent means intermediate said stationary contacts and engageable with said movable contactor to provide positive location thereof at each circuit connection position and to resist movement thereof between circuit connection positions, said switch having a cantilever actuator arm comprising an elongated resiliently deflectable element terminating in a free end that is engageable with the movable contactor to impart shiftable movement thereto by absorbing and releasing the energy necessary to advance the contactor between circuit connection positions.

10. In a switch in accordance with claim **9** and wherein said actuator arm has a coiled free end snugly engageable with the movable contactor, the actuator arm being swingable about an axis location disposed intermediately of the stationary contacts.

References Cited

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U.S. Cl. X.R.

200—67, 172