

[54] **DIRECTIONAL SIGNAL WITH CAM SWITCH ACTUATORS**

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[58] Field of Search **200/61.27, 153 L, 153 LB, 200/166 SD, 6 BB**

[56] **References Cited**

UNITED STATES PATENTS

2,774,926	12/1956	Gilman et al.	200/153 LB X
3,591,740	7/1971	Kolster.	200/61.27
3,198,893	8/1965	Mapelsden	200/153 L X
2,720,619	10/1955	James	200/153 LB X
2,454,646	11/1948	Gates.	200/6 BB

FOREIGN PATENTS OR APPLICATIONS

1,564,490 3/1969 France 200/153 L

Primary Examiner—Robert K. Schaefer

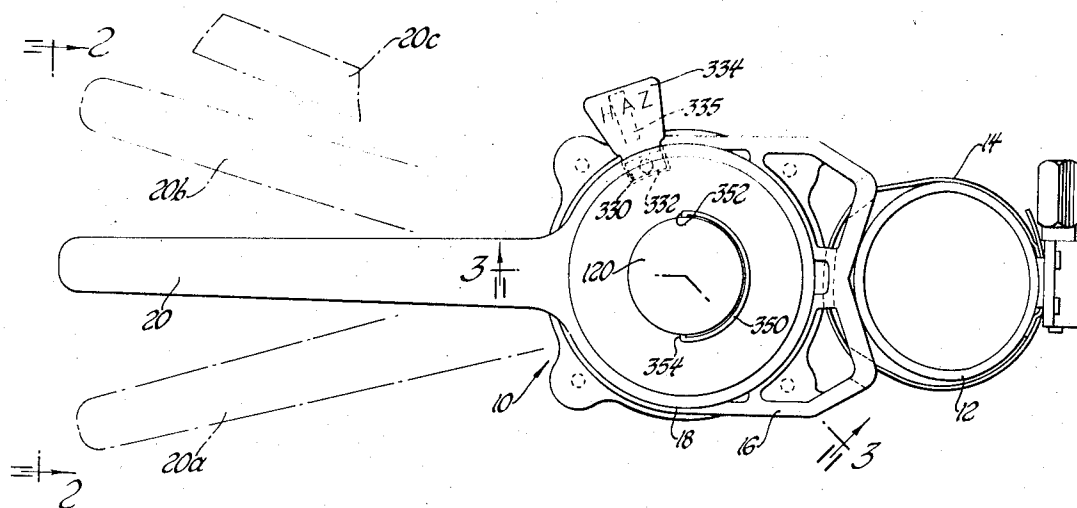
Assistant Examiner—Robert A. Vanderhye

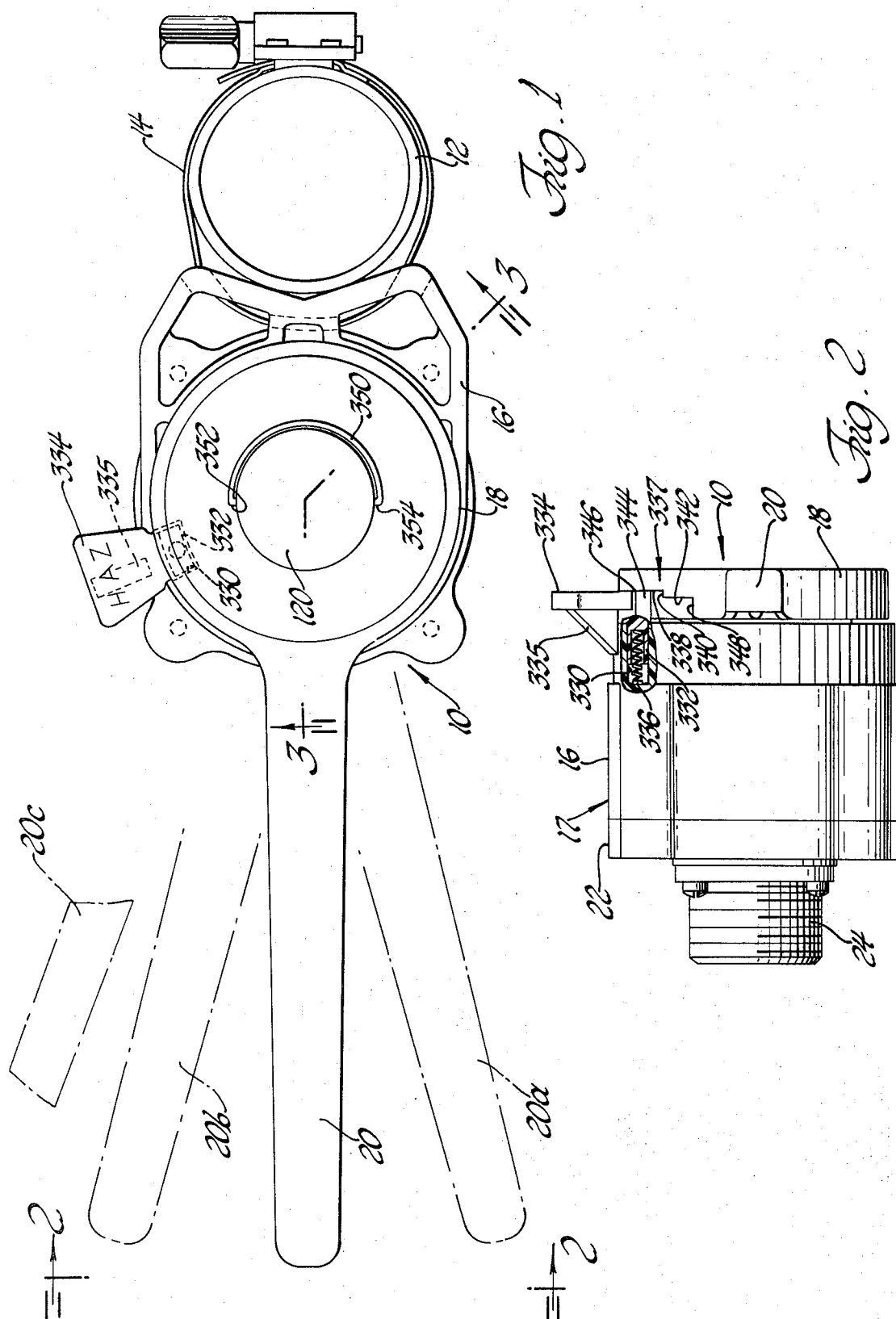
Attorney, Agent, or Firm—Lon H. Romanski

[57] **ABSTRACT**

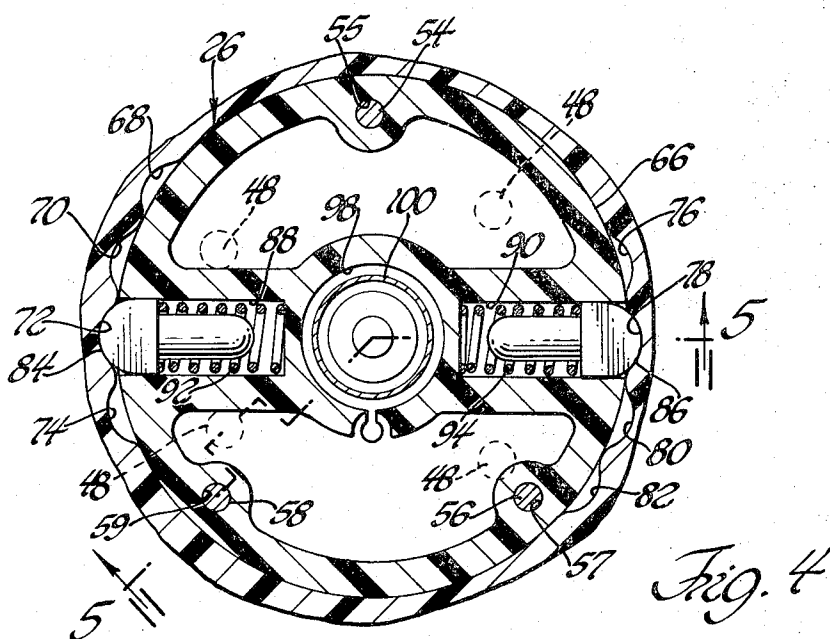
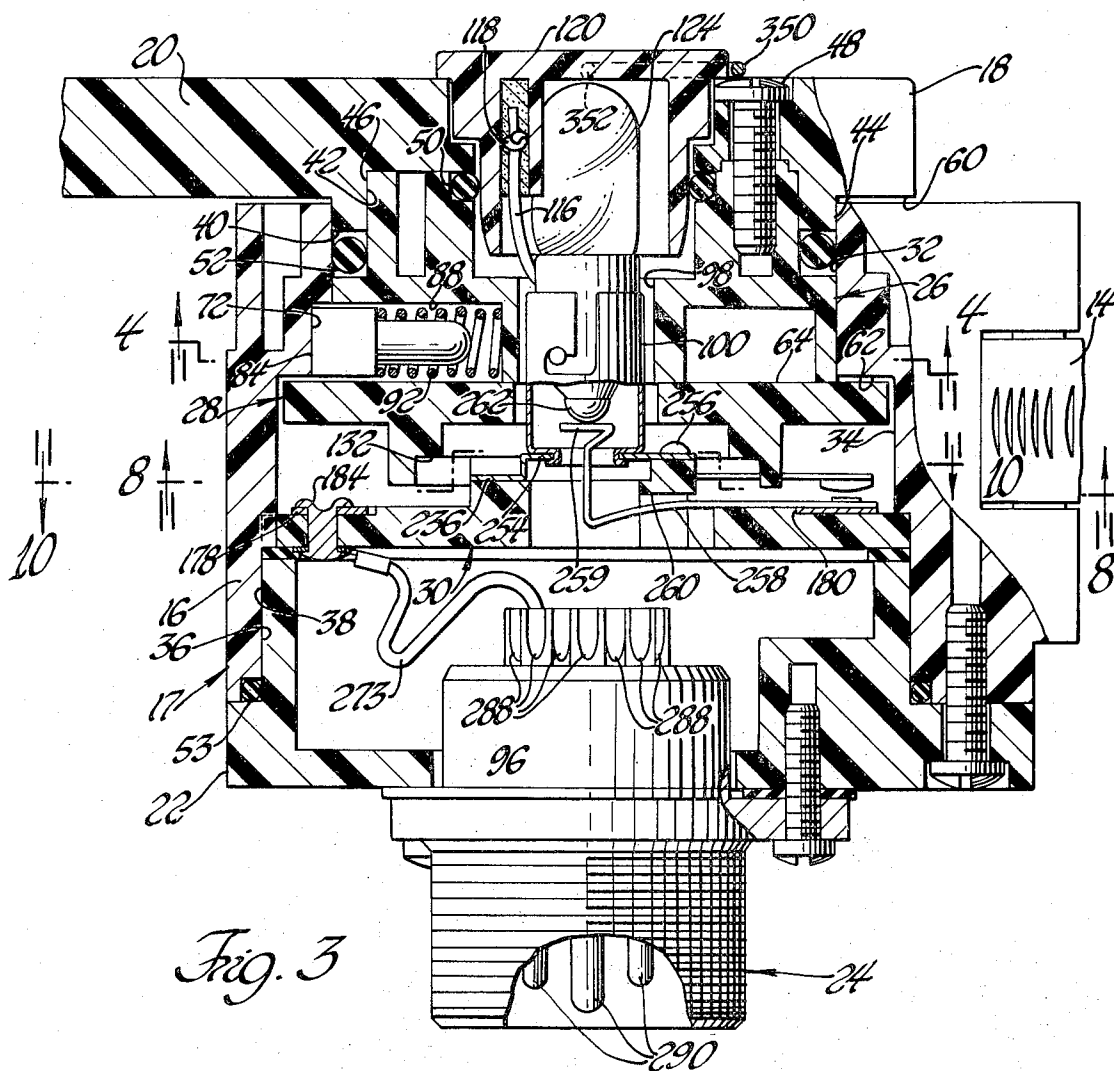
A switch assembly has an outer housing containing a rotatable detent carrying body, a rotatable cam-carrying body, a relatively fixed electrical contact plate assembly; an outer end cover-like member fixedly secured to the detent body and cam-carrying body also carries an actuator handle which when rotated either clockwise or counter-clockwise causes selective closure of electrical contacts carried by the contact plate assembly to thereby close associated electrical circuitry; the detents carried by the detent-carrying body serve to maintain the components in any selected operating position as well as in a neutral position.

16 Claims, 17 Drawing Figures





SHEET 2 OF 6



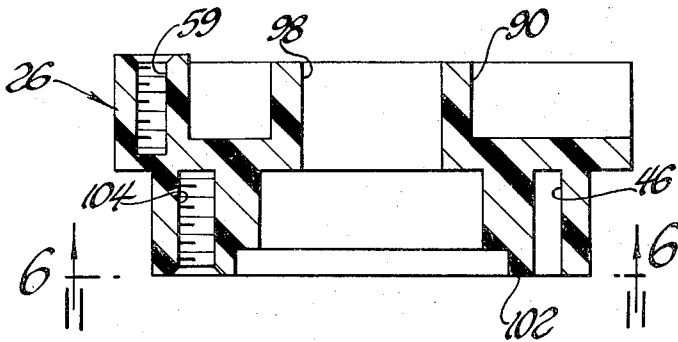


Fig. 5

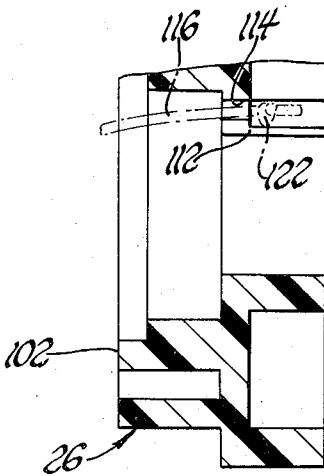


Fig. 7

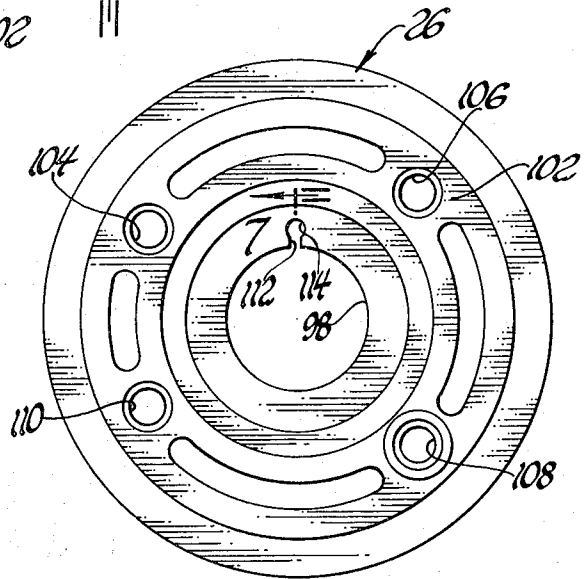


Fig. 6

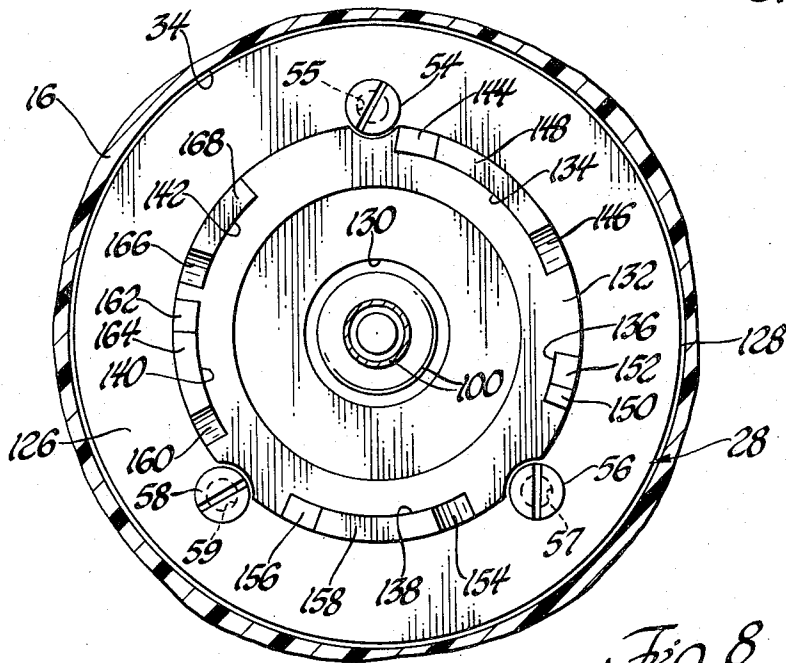


Fig. 8

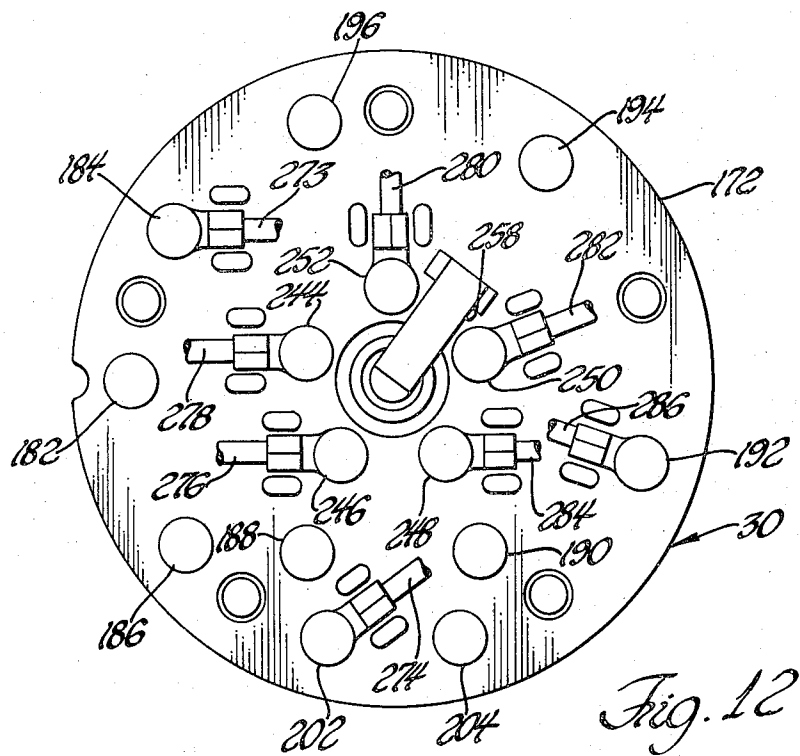
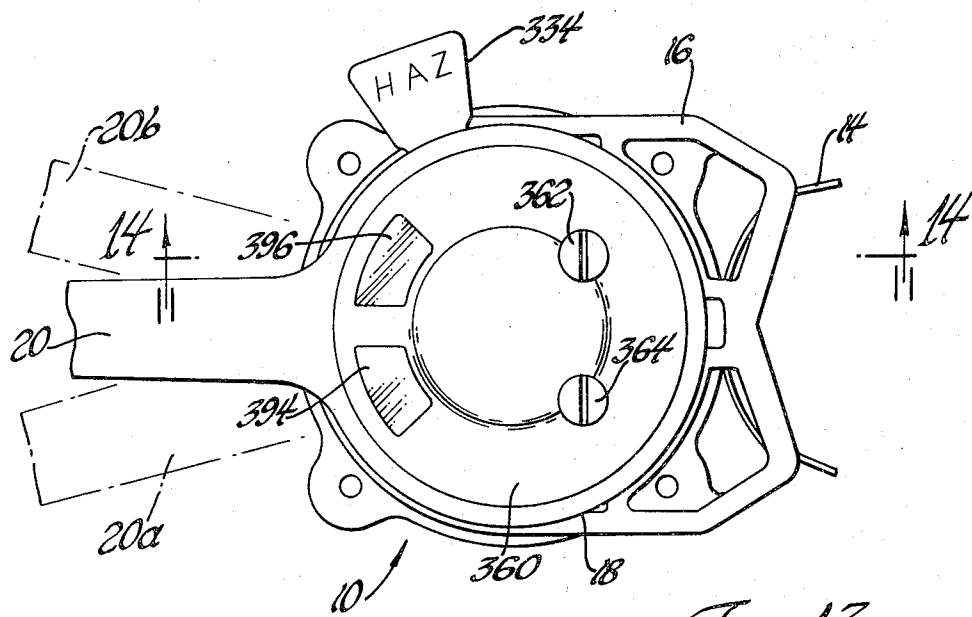


Fig. 13



DIRECTIONAL SIGNAL WITH CAM SWITCH ACTUATORS

BACKGROUND OF THE INVENTION

Electrical switch assemblies of the prior art employed, for example, as turn indicator and emergency warning switch assemblies for use in automobile, trucks and the like have been relatively complicated and costly structures usually capable of serving the required functions of only one particular line of vehicles without having inherent capability of being able to be adapted, as by slight changes or substitutions of components, to meet the requirements of another line of vehicles.

Accordingly, the invention as herein disclosed and described is directed primarily to the solution of the above as well as other related problems of the prior art.

SUMMARY OF THE INVENTION

According to the invention, an electrical switch assembly comprises outer housing means, cam means carried within said housing means, lever means operatively connected to said cam means for moving said cam means to and from various operating positions as well as a neutral position, a plurality of electrical switches carried within said housing means and arranged as to be in the general path of travel of said cam means as said cam means is moved to selected ones of said operating positions, said plurality of electrical switches being effective for completing related electrical circuitry, resilient resistance means effective for resiliently resisting movement of said cam means by said lever means towards any of said positions, said resilient resistance means being effective to progressively increase the magnitude of resilient resistance as said cam means is moved toward any of said positions, and additional means effective for resiliently latching said cam means in any one of said positions when said cam means has been moved to said any one of said positions.

Various general and specific objects and advantages of the invention will become apparent when reference is made to the following detailed description considered in conjunction with the accompanying drawings.

DESCRIPTION OF THE DRAWINGS

In the drawings, wherein for purposes of clarity certain details and/or elements may be omitted from one or more views:

FIG. 1 is a top plan view of a turn signal switch assembly embodying the teachings of the invention;

FIG. 2 is an end elevational view taken generally on the plane of line 2—2 of FIG. 1 and looking in the direction of the arrows;

FIG. 3 is an enlarged cross-sectional view taken generally on the plane of line 3—3 of FIG. 1 and looking in the direction of the arrows;

FIG. 4 is a fragmentary cross-sectional view taken generally on the plane of line 4—4 of FIG. 3 and looking in the direction of the arrows;

FIG. 5 is a cross-sectional view taken generally on the plane of line 5—5 of FIG. 4 and looking in the direction of the arrows;

FIG. 6 is a top end elevational view of one of the elements (shown also in FIG. 3) taken generally on the

plane of line 6—6 of FIG. 5 and looking in the direction of the arrows;

FIG. 7 is a fragmentary cross-sectional view taken generally on the plane of line 7—7 of FIG. 6 and looking in the direction of the arrows;

FIG. 8 is a fragmentary cross-sectional view taken generally on the plane of line 8—8 of FIG. 3 and looking in the direction of the arrows;

FIG. 9 is a perspective view of the main element shown in FIG. 8;

FIG. 10 is a fragmentary cross-sectional view taken on the plane of line 10—10 of FIG. 3 and looking in the direction of the arrows;

FIG. 11 is a cross-sectional view taken generally on the plane of line 11—11 of FIG. 10 and looking in the direction of the arrows;

FIG. 12 is an end elevational view taken generally on the plane of line 12—12 of FIG. 11 and looking in the direction of the arrows;

FIG. 13 is a view similar to FIG. 1 but illustrating a modification of the invention shown in FIG. 1;

FIG. 14 is an enlarged fragmentary cross-sectional view taken generally on the plane of line 14—14 of FIG. 13 and looking in the direction of the arrows;

FIG. 15 is a bottom view of the structure shown in FIG. 14 with the view taken generally on the plane of line 15—15 of FIG. 14 and looking in the direction of the arrows;

FIG. 16 is a schematic wiring diagram of circuitry employable by the invention; and

FIG. 17 is a fragmentary portion of the circuitry shown in FIG. 16, but illustrating a modification thereof.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now in greater detail to the drawings, FIG. 1 illustrates, in top plan view, a turn signal switch assembly 10 detachably secured to the vehicular steering column housing 12 as by a metal strap clamp 14 which passes through suitable apertures in the main housing portion 16 of switch assembly 10.

Generally, as shown in FIGS. 1 and 2, the switch assembly 10 is comprised of an integrally formed top cover portion 18 and handle 20, the main housing 16, a lower cover or end closure member 22 and an electrical terminal type connector 24.

Further, as shown in FIG. 3, the switch assembly 10 also comprises a detent housing 26, an annular cam carrying plate 28 and a contact plate assembly 30 each of which is situated internally of the housing assembly 17. The interior of main housing 16 has a first cylindrical opening 32, which closely received the detent housing 26 therein, a second cylindrical opening 34, of somewhat greater diameter than opening 32, which receives the cam body member 28 therein, and a third cylindrical opening 36, of a diameter larger than opening 34, which receives the contact plate assembly 30 and a tubular portion 38 of bottom end member 22.

The underside of upper cover portion 18 is provided with a tubular-like extension 40 having inner 42 and outer 44 cylindrical surfaces with the other surface 44 being rotatably received within the receiving opening 32 of housing section 16 while the inner surface 42 closely receives therein a cylindrical projection 46 of detent body 26. When in assembled relationship, the detent body 26 is fixedly secured to the cover portion

18 as by a plurality of screws, one of which is typically illustrated at 48, so as to thereby experience rotation in unison with cover portion 18 whenever such cover portion is angularly positioned through said handle 20. Suitable sealing means such as O-ring type seals 50, 52 and 53 may be provided and received within cooperating seating recesses formed therefor.

Further, as will become apparent, the cam carrying body 28, when in assembled relationship illustrated in FIG. 3, is also fixedly secured to the detent body or housing 26 as by screws 54, 56 and 58 shown in transverse cross-section in FIG. 4. Accordingly, any rotative motion of handle 20 and cover 18 is transmitted directly to the detent housing 26 and cam carrying member 28. It should be noted that because of such fastening of the elements into a rotatively unitary structure, downward axial movement is prevented by the underside flange-like surface 60 of cover 18 while upwardly axial movement is prevented by the annular shoulder-like surface 62 of housing section 16 being juxtaposed to surface 64 of cam carrying member 28.

Referring to FIG. 4, it can be seen that the outer cylindrical surface 66 of the lower portion of detent housing 26 is closely rotatably confined within the receiving opening 32 of outer housing section 16. Diametrically opposed detent recesses 68, 70, 72, 74 and 76, 78, 80, and 82 are also formed in the wall of outer housing section 16 so as to be adapted to sequentially receive therein the radially outermost portions of detent members 84 and 86, respectively.

Detent members 84 and 86 are slideably received within radially directed guide slots or recesses 88 and 90 which also respectively contain springs 92 and 94 which continually resiliently urge the detent members 84 and 86 radially outwardly. In view of the above, it should be apparent that as handle 20 and cover 18 are angularly rotated about axis 96 detent body or housing 26 is correspondingly rotated causing the detents 84 and 86 to be first forced radially inwardly, against the resistance of springs 92, 94, as the detents are being rotated out of registry with, for example, recesses 72, 78 and toward registry with, for example, recesses 70 and 80 at which time springs 92 and 94 again force detents 84 and 86 into the next succeeding resiliently seated condition thereby resiliently maintaining that particular selected angular position of lever 20 and associated elements. Detent housing or body 26 also has a centrally located clearance passage or aperture 98 in order to accommodate the free passage therethrough of a suitable electrical bulb socket or base 100.

In FIGS. 5, 6 and 7, views additionally illustrating the detent carrying member 26, it can be seen that the upper end face 102 has a plurality of apertures 104, 106, 108 and 110 formed therein for the threadable reception therein of cooperating screws 48. As shown in FIG. 4, screws 54, 56 and 58 are respectively threadably received in apertures 55, 57 and 59. Such threads as are typically illustrated in apertures 59 and 104 of FIG. 5 may actually be initially formed by the screws which are engaged therein in a manner generally cutting or otherwise forming a thread therein.

An axially extending slot 112, opening into an enlarged passageway 114, is formed generally in the wall of clearance aperture 98 of detent housing 26. The purpose of slot 112 and passageway 114 is to provide suitable anchor means for a lanyard 116 which, as illustrated in FIG. 3, has its upper end 118 suitably re-

tained, as by cementing, within a portion of a cooperating lens 120 frictionally retained as by the sealing member 50. The lanyard 116 is preferably elastomeric and has its other end knotted as at 122 (FIG. 7). When assembled the lanyard body can be pushed through the slot 112 and into passageway 114 so that the knot 122 is generally on the underside of detent housing 26. Therefore, when the lamp lens 120 has to be removed to replace the bulb 124 the lanyard resiliently holds the lens 120 to prevent misplacement or loss thereof.

FIG. 8 is a bottom plan view, of the cam carrying body 28, taken generally on the plane of line 8—8 of FIG. 3. In FIG. 8 it can be seen that in the preferred form, cam carrying body 28 comprises a main disc-like plate portion 126 having an outer diameter 128 closely approaching the clearance passageway 34 of main housing section 16. A clearance aperture 130, formed through plate 126, accommodates the free passage therethrough of bulb socket 100. An annular raised portion 132 (actually depending downwardly as viewed in FIG. 3) is carried by plate section 126 and, in turn, carries a plurality of cam lobes of bodies 134, 136, 138, 140 and 142. From both FIGS. 8 and 9, it can be seen that: (a) cam body 134 comprises oppositely disposed cam ramp surfaces 144 and 146, and an actuating or cam surface 148 therebetween; (b) cam body 136 comprises a cam ramp surface 152 and a cam surface 150; (c) cam body 138 comprises oppositely disposed cam ramp surfaces 154 and 156, and an actuating or cam surface 158 therebetween; (d) cam body 140 comprises oppositely disposed cam ramp surfaces 160 and 162, and an actuating or cam surface 164 therebetween; and (e) cam body 142 comprises a cam ramp surface 166 and joining actuating or cam surface 168.

FIG. 10, a view taken generally on the plane of line 10—10 of FIG. 3, illustrates in top plan view the contact plate assembly 30. As can be seen, in the preferred form, the assembly 30 comprises a generally disc-like plate or body 170 having an outer diameter 172 closely received by the passageway 36 of main housing section 16. Further, a cut-out locator 174 formed in plate 170 receives therein a fixed projection 176 formed in the housing section 16 in order to thereby assure a predetermined relationship of the contact plate assembly 30 when assembled to the other components comprising the switch assembly 10. The plate or disc body portion 170 carries arcuate electrical plate-like conductors 178 and 180 which are secured to the disc body 170 as by rivets 182, 184 and 186, 188, 190, 192, 194 and 196. A third arcuate plate type electrical conductor 198 is situated atop a pedestal-like extension 200 carried on the disc plate 170 and secured thereto as by rivets 202 and 204. The elevated plate type conductor 198 has oppositely disposed overhanging portions which respectively carry fixed or stationary electrical contacts 206 and 208 suitably secured thereto.

The lower larger arcuate plate conductor 180 has secured thereto fixed or stationary electrical contacts 210, 212, 214 and 216 with contacts 214 and 216 being generally juxtaposed to contacts 208 and 206, respectively, while the smaller arcuate plate conductor 178 has a stationary electrical contact 218 secured thereto.

A generally centrally located annular pedestal-like portion 220 is carried by plate 172, a plurality of

notches or cut-out slots 224, 226, 228, 230 and 232 formed in the upper end of pedestal 220 serve to receive the respective radially inward ends of movable contact arms 234, 236, 238, 240 and 242 so as to thereby maintain such contact arms in a generally cantilevered position as by cooperating securing means such as rivets 244, 246, 248, 250 and 252. Additionally, as can be seen in FIGS. 3, 10 and 11, movable contact arm 234 includes an arcuate portion 254 which is engaged by the lower end of bulb socket 100 and which may be further secured to the pedestal as by a fastener 256. A resiliently deflectable contact member 258, secured at one end to plate contact 180 as by rivet 194, has its other end 259, passing through a clearance opening 260 in pedestal 220, extending upwardly within socket 100 as to be in position to electrically engage terminal 262 of bulb 124. (See FIG. 3.)

The movable contact arms 234, 236, 238, 240 and 242 are respectively provided with electrical contacts 264, 266, 268, 270 and 272, as also generally typically illustrated by 266 and 270 in FIG. 11.

As clearly illustrated in FIG. 12, a bottom plan view of the contact plate assembly 30, a plurality of electrical leads or conductors are electrically connected to selected rivets. That is, rivets 184, 202, 246, 244, 252, 250, 248 and 192 are respectively electrically connected to conductors 273, 274, 276, 278, 280, 282, 284 and 286. Such conductors are, in turn, electrically connected to selected terminals 288 of the conductor assembly 24 so as to thereby through the connector pins, some of which are shown at 290, complete selected electrical circuits with related structure.

OPERATION OF THE INVENTION

When all of the components and elements described have been assembled as indicated, and the handle 20 and cover 18 are in the position shown in solid line in FIG. 1, all of such elements will be in a neutral position or condition. At this time, the relationship of the cam means and cam carrying body 28 will be such as to place: cam bodies 140 and 142 on opposite sides of movable contact arm 234 (FIG. 10); cam body 134 generally between movable contact arms 242 and 240; cam body 136 generally between movable contact arms 240 and 238; and cam body 138 generally between movable contact arms 238 and 236.

Because of the positions of such cam bodies, the following pairs of coacting electrical contacts will be open: 218, 264; 210, 272, 212, 270; 214, 268; and 216, 266. However, at this time contact 266 carried by arm 236 will be closed against contact 206 carried by the upper plate conductor 198 and contact 268 carried by arm 238 will be closed against contact 208 carried by the opposite end of the same plate conductor 198. With such contacts 266, 206, and 268, 208 being normally closed, it can be seen that thereby an electrical circuit defined generally by conductor 276, rivet 246, contact arm 236, movable contact 266, fixed contact 206, plate conductor 198, fixed contact 208, movable contact 268, contact arm 238, rivet 248 and conductor 284; further, the circuit also includes conductor 274, and rivet 202 which is, in turn, electrically connected to plate conductor 198.

When the various rotatable elements comprising the switch means 10 in a counter-clockwise direction to a point where handle 20 assumes a position as generally depicted at 20a, the various contacts are actuated in

the manner to be described as to result in an indication of the vehicle operator's intention to turn to the left. That is, cam carrying body 28 is correspondingly rotated about axis 96, relative to contact plate assembly 30, thereby causing: cam body 140 to engage the depress contact arm 234 resulting in cam surface 164 holding contacts 218 and 264 closed against each other; cam body 138 to engage the depress contact arm 236 resulting in cam surface 158 holding contacts 266 and 216 closed against each other while simultaneously holding previously normally closed contacts 266 and 206 open; and cam body 134 to engage and depress contact arm 240 resulting in cam surface 148 holding contacts 212 and 270 closed. As a consequence of the above, it can be seen that a circuit portion is completed from conductor 273 (FIG. 12), rivet 184, plate conductor 178, fixed contact 218, movable contact 264, contact arm 234, rivet 244, conductor 278, annular extension 254 (FIGS. 3, 10 and 11), socket 100, the bulb or lamp 124, bulb contact 259, 258, rivet 194, plate conductor 180, fixed contact 212, movable contact 270, contact arm 240, rivet 250 and conductor 282. Another circuit portion is completed from the same plate conductor 180, fixed contact 216, movable contact 266, contact arm 236, rivet 246 and conductor 246, while the previously established circuit portion defined by conductor 274, rivet 202, upper plate conductor 198, fixed contact 208, movable contact 268, contact arm 238, rivet 248 and conductor 284 still continues to exist.

When the handle 20, along with such related elements connected thereto, is rotated past the neutral position and to a position depicted generally at 20b, thereby indicating that the vehicle operator intends to turn to the right, the relationship of the elements is as follows. That is, cam carrying body 28 is correspondingly rotated about axis 96, relative to contact plate assembly 30, thereby causing: cam body 142 to engage and depress contact arm 234 resulting in cam surface 168 holding contacts 218 and 264 closed against each other; cam body 138 to engage and depress contact arm 238 resulting in cam surface 158 holding 268 and 214 closed against each other while simultaneously holding previously normally closed contacts 208 and 268 open; and cam body 134 to engage and depress contact arm 242 resulting in cam surface 148 holding contacts 210 and 272 closed.

As a consequence of the above, it can be seen that a circuit portion is completed from conductor 273 (FIG. 12), rivet 184, plate conductor 178, fixed contact 218, movable contact 264, contact arm 234, rivet 244, conductor 278, annular extension 254 (FIGS. 3, 10, 11), socket 100, the bulb or lamp 124, bulb contact 259, 258, rivet 194, plate conductor 180, fixed contact 210, movable contact 272, contact arm 242, rivet 252, and conductor 280 (FIG. 12). Another circuit portion is completed from the same plate conductor 180, fixed contact 214, movable contact 268, contact arm 238, rivet 248 and conductor 284, while the previously established normal circuit portion defined by conductor 274, rivet 202, upper plate conductor 198, fixed contact 206, movable contact 266, contact arm 236, rivet 246 and conductor 276 still continues to exist.

If the handle 20 and corresponding elements are further rotated clockwise from the above-described position depicted at 20b to a third operating position as depicted generally at 20c, the positions of contact arms

234, 238 and 242 remain as that described with reference to position 20b. However, such further clockwise rotation of the cam body 28 enables cam body 140 to now engage and depress contact arm 236 resulting in cam surface 164 holding contacts 266 and 216 closed while simultaneously holding the previously normally closed contacts 206 and 266 open (this now places the arm 236 and related contacts and circuit portions in the same position and condition as described with reference to lever 20 having been moved to a first operating position 20a.) and cam body 136 to engage and depress contact arm 240 resulting in cam surface 150 holding contacts 212 and 270 closed. (This now places arm 240 and related contacts and circuit portions in the same position and condition as described with reference to lever 20 having been moved to a first operating position 20a.)

Referring to FIG. 16, a schematic wiring diagram of the circuitry of switch assembly 10, a source of electrical potential 300 has one of its terminals connected to conductor means 302 which, in turn, is electrically connected, in parallel, to a plurality of vehicular indicator or signal lamps 304, 306, 308 and 310. The other terminal of source 300 is electrically connected via conductor means 313 to a terminal 312 of a vehicular brake actuated switch assembly 314. A suitable flasher type switching assembly or means 316 has one of its terminals in circuit via conductor means 317 with conductor 313 with switches 318 and 234 serially connected therebetween. In practice, switch 318 comprises the vehicular ignition switch while switch member 234 is, of course, the movable contact arms 234 in FIG. 10.

While the exception of switch 234 which is shown without, those elements schematically illustrated within the phantom-line box comprise, electrically, the switch assembly 10. Accordingly, such schematically represented elements which correspond to certain elements in the previously discussed Figures are identified with like reference numbers. In the schematic diagram of FIG. 16: lamp 304 would be the vehicular left front indicator lamp; lamp 308 would be the vehicular left rear indicator lamp; lamp 306 would be the right front indicator lamp; and lamp 310 would be the vehicular right rear indicator lamp.

When the brake actuated switch assembly 314 closes the circuit through contacts 312 and 315, and the switch assembly is in its neutral condition, a circuit is completed from source 300, conductor means 274, plate conductor 198, contacts 206, 208, conductors 284, 276, lamp bulbs 308, and 310, respectively, and through conductor means 302 back to source 300 thereby energizing both rear indicator lamps 308, 310 and warning others that the vehicular brakes are being applied.

In view of the previous detailed discussions, it should be apparent that during each of the operating conditions, respectively designated by 20a, 20b and 20c, switch or contact arm 234 is made closed so as to thereby complete a circuit as between the associated flasher means 316 and the source of potential 300 (assuming, of course, that ignition switch 318 is closed).

Therefore, when the switch assembly 10 is in a condition designated by 20a, (a left turn signal) switch 240 will be closed against contact 212 and switch 236 will be closed against contact 216. Consequently, an elec-

trical circuit is completed from flasher 316, plate conductor 180, contact 212, switch contact 240, conductor 282, lamp 304 as well as through contact 216, switch contact 236, lamp 308 and from both lamps 304 and 308 through conductor means 302 to source 300. The rate of frequency of energization of bulbs 304 and 308 in this mode of operation will, of course, be dependent upon the cycle time of flasher 316. If, at this time, the brake actuated switch 314 is closed, lamp 310 will be energized by the circuit through the brake switch 314 previously described.

If the switch assembly 10 is in a condition designated by 20b, (a right turn signal) switch 242 will be closed against fixed contact 210 and switch 238 will be closed against contact 214. Consequently, an electrical circuit is completed from flasher 316, plate conductor 180, contact 210, switch contact 242, conductor 280, lamp 306 as well as through contact 214, switch contact 238, conductor 276, lamp 310 and, from both lamps 306 and 210 through conductor means 302 to source 300. Again, the frequency of or cycle time of energization of bulbs 306 and 310 in this mode of operation will be dependent upon the cycle time of flasher means 316. If, at this time, the brake actuated switch 314 is closed, lamp 208 will be energized by the circuit through the brake switch 314 previously described.

If the switch assembly 10 is in a condition or position designated by 20c, (a hazard warning signal) switch 240 will be closed against fixed contact 212, switch 242 will be closed against fixed contact 210, switch 236 will be closed against fixed contact 216, and switch 238 will be closed against fixed contact 214. As should be evident, at this time circuits are completed through each of the lamps 304, 306, 308 and 310 which, because of the control exercised by flasher means 316, are intermittently energized thereby indicating a hazard or emergency condition to all in the area.

With regard to the hazard mode of operation (designated as position 20c), reference is again made to FIGS. 1 and 2 which illustrate displaceable abutment means for preventing the unintentional rotation of the lever 20, and associated elements, to the position designated 20c when in fact the vehicle operator intended only to rotate the lever 20 to the 20b position.

FIGS. 1 and 2 illustrate that the upper end of main switch housing 16 has a generally axially extending guide recess or opening 330 formed therein which slidably receives a locking body 332 which may be integrally formed with a laterally extending tab-like portion 334. If desired, a downwardly depending reinforcing portion 335 may be formed integrally with tab 334. A spring 336 carried generally within opening or chamber 330 continually resiliently urges the lever 334 and body 332 upwardly to the position best shown in FIG. 2.

An arcuate recess 337 formed in one side of the switch assembly cover 18 has a first upper flange-like surface 338 against which the top end of body 332 resiliently slidably abuts during positions of the handle 20, as shown in solid line as well as indicated at 20a and 20b. However, recess 337 also defines a radially and downwardly depending abutment surface 340 which terminates at its lower end in a second flange-like surface 342 lower than the first flange surface 338.

Therefore, when lever 20 is rotated to position 20b, side 344 of locking body becomes juxtaposed to abutment surface 340 thereby preventing any further clock-

wise rotation of handle 20. In order to be able to turn handle 20 to the hazard mode of operation (position 20c) the locking body 332 must be depressed, as by action against tab 334, against the resilient resistance of spring 336 until the top end surface 346 of locking body 332 attains a level below that of the second flange portion 342 at which time lever 20 may be rotated further clockwise to the 20c position. A second abutment surface 348 is preferably provided as means for positively preventing the clockwise rotation of handle or lever 20 beyond the positive designation 20c. In such instance, abutment surface 348 would, of course, engage side 344 of the locking body 332.

As illustrated in FIGS. 1 and 3 the lens 120 is also provided with a handle 350 which is journaled at its opposite ends 352, 354 in order to thereby provide a means for removing the lens enabling replacement of the pilot bulb 124.

Various modifications of the invention are, of course, possible. Among such modifications is the use of separate pilot lamp means as generally shown in FIGS. 13, 14 and 15.

FIG. 13 illustrates the switch assembly 10 being modified by the provision of a raised dome-like housing 360 carried atop the cover portion 18. In this particular modification, screws 362 and 364 are longer than and replace two of the screws 48 of FIG. 3 so as to be able to hold dome housing 360 secured to the related components while, at the same time serving to secure the detent body 26 to cover 18.

In FIGS. 14 and 15 it can be seen that the interior of the generally circular housing 360 has a first relatively large chamber 366 formed therein which receives electrically conductive plates 368, 370 and 372 which, in turn, are retained therein as by extensions 374, 376, 378 and 380 in cooperation with holding or securing means 382 which, in fact, may be a suitable cement. Additionally smaller chambers 384 and 386 generally defined on opposite sides of a radially extending downwardly depending separating wall 388 contain bulbs or damp means 390 and 392, respectively. Lenses 394 and 396, carried within suitable cut-out portions formed in the housing 360 are so situated as to be respectively in light-transmitting relationship to bulbs 390 and 392, respectively.

As will be noted in FIGS. 14 and 15, contact or conductor plates 368 and 370 are separated from each other while the upper conductor plate 372 (which has an outer configuration generally that as defined by both lower conductor plates 369 and 370) is electrically and physically separated from both conductor plates 368 and 370 as by an electrical insulator 398.

Bulbs 390 and 392 are of the wedge base type wherein the stem of the bulb has a pair of exposed leads leading to the bulb filament. Accordingly, when the stem of bulb 392 is wedged between the spring-like contact portions 400 of conductor plate 370 and juxtaposed contact portions 402 of upper contact plate 372 such exposed leads complete the circuit path from plate 370, through the bulb filament and to plate 372. Similarly, when the stem of bulb 390 is wedged between the spring-like contact portions 404 of plate 368 and juxtaposed contact portions 402 of upper contact plate 372 such exposed leads complete the circuit path from plate 368, through the filament of bulb 390, and to plate 372.

As best seen in FIG. 15, electrical leads or conductors 406, 408 and 410 are respectively electrically connected at their one ends to conductor plates 370, 372 and 368. The other ends of conductor 406, 410 and 408 are respectively electrically connected as to rivet 252 (FIGS. 10 and 12), rivet 250 (FIGS. 10 and 12), and ground 302 (FIG. 17). FIG. 17, fragmentarily illustrates a modification of the schematic wiring diagram of FIG. 16. That is, as can be seen, pilot bulbs 390 and 392 are respectively in parallel circuit with indicator lamps 304 and 306. Consequently, when handle 20 of FIG. 13 is rotated to position 20b to indicate a right hand turn, lamp 392 is energized with lamp 306; conversely, if handle 20 is rotated to position 20a, lamp 390 is energized along with lamp 304. In the modification of FIG. 17, the single pilot lamp 100 of FIG. 16 would not be employed.

Another modification is also contemplated. For example, it has been determined that in certain instances instead of a connector terminal assembly 24, it is desirable to provide electrical wire leads extending from the switch assembly 10 and terminating in a polarized plug for connection to a mating plug of the vehicle.

Additionally, as is apparent in view of the description provided thus far, switch arm 234 and related contacts 218, 264 are employed merely for completing the circuit to a related source of power whenever the switch assembly 10 has been actuated to one of the described operating positions. However, in some situations it is conceivable that such a switch arm 234 and contacts 218, 264 may be dispensed with and effectively replaced by a closed conductor as between the ignition switch 318 and flasher 316. If this is the case, switch arm 234, rivet 244, plate conductor 178, rivets 182, 184 and contacts 218 and 264 may be eliminated from the contact plate assembly 30 thereby reducing the cost thereof.

In view of the preceding, it can be seen that the invention provides a structure which can be easily adapted to accept varying components which may differ from each other by the number of switch arms and/or contacts as well as varying means for creating a pilot-light indication to the vehicle operator.

Cam means carried radially inwardly of the electrical contacts serve to selectively open and close such electrical contacts, depending on the degree and direction of rotation of the cam means. Such cam means, by virtue of being carried by a separate cam body, can be quickly and easily interchanged with other cam-carrying bodies in order to achieve desired or altered patterns of actuation.

Although only a preferred embodiment and selected modifications of the invention have been disclosed and described, it is apparent that other embodiments and modifications of the invention are possible within the scope of the appended claims:

We claim:

1. An electrical switch assembly, comprising outer housing means, cam means carried within said housing means, lever means operatively connected to said cam means for moving said cam means to and from various selected positions, a plurality of electrical switches carried within said housing means and arranged as to be in the general path of travel of said cam means as said cam means is moved from one of said selected positions to any other of said selected positions, said plurality of electrical switches being effective for at times complet-

ing related electrical circuitry, resilient resistance means effective for resiliently resisting movement of said cam means by said lever means toward any of said selected positions, said resilient resistance means being effective to progressively increase the magnitude of resilient resistance as said cam means is moved toward any of said positions, and additional means effective for resiliently latching said cam means in any of said selected positions when said cam means has been moved to said any of said selected positions, said housing means comprising internally defined cylindrical passage means, a rotatable end cover portion generally closing the upper end of said cylindrical passage means, said lever means being operatively connected to said cover portion, said resilient resistance means comprising at least one plunger-like detent member carried by a detent body, said detent body being situated within said cylindrical passage means and fixedly secured to said cover portion for rotation therewith within said cylindrical passage means about the axis of said cylindrical passage means, said detent body comprising at least one guide opening carried thereby for slideably receiving therein said detent member, said guide opening being so positioned as to be generally radially extending with respect to said axis, at least one spring member received within said guide opening for continuously resiliently urging said detent member radially outwardly with respect to said axis, said cam means comprising a cam-carrying body situated within said cylindrical passage means and fixedly secured to said cover portion through said detent body for rotation therewith within said cylindrical passage means about said axis, said cam-carrying body carrying a plurality of cam bodies angularly spaced about said axis and situated on said cam-carrying body on a side thereof opposite to said cover portion and extending generally axially away from said side of said cam-carrying body, said plurality of electrical switches being carried as a part of a switch contact assembly, said switch contact assembly comprising a mounting member situated within said cylindrical passage means and axially spaced away from said cam-carrying body in a direction on the opposite side of said cam-carrying body with respect to said cover portion, said mounting member being operatively secured to said housing means as to be fixed against rotation about said axis, said mounting member comprising a generally annular support portion extending axially toward said cam-carrying body, a plurality of recesses formed in said annular support so as to be generally radially directed with respect to said axis, a first generally arcuate plate-like electrical conductor carried by said mounting member on a side thereof generally juxtaposed to said cam-carrying body and radially outwardly of said annular support; a pedestal-like portion carried by said mounting member and extending therefrom in a direction toward said cam-carrying body, a second plate-like electrical conductor carried by said pedestal-like portion so as to have at least a portion thereof generally juxtaposed to at least a portion of said first plate-like electrical conductor and spaced therefrom, said plurality of electrical switches comprising a plurality of fixed electrical contacts and a plurality of movable electrical contacts respectively carried by deflectable portions of deflectable electrically conductive arm members, at least two of said fixed electrical contacts being carried by said portion of said second plate-like conductor as to be generally on the side thereof juxtaposed to said portion of said first plate-like conductor,

posed to said portion of said first plate-like conductor, other of said fixed electrical contacts being carried by said first plate-like conductor on a side thereof opposite to said mounting member, said other of said fixed electrical contacts being angularly spaced from each other generally about said axis, at least two of said fixed electrical contacts being carried by said portion of said first plate-like conductor in a manner as to be generally respectively juxtaposed to said two fixed electrical contacts carried by said portion of said second plate-like conductor, and said arm members being respectively anchored within said radially directed recesses so as to place the movable electrical contacts carried thereby generally in juxtaposed relationship to said fixed electrical contacts.

2. An electrical switch assembly according to claim 1 wherein said additional means comprises a plurality of angularly spaced second recesses carried by said housing means for selectively receiving therein said detent member in order to maintain said lever means, cover portion and cam-carrying body in any of said positions selected.

3. An electrical switch assembly according to claim 1 wherein said cam bodies are radially spaced with respect to said axis as to be effective for operatively engaging said arm members generally between said annular support and said movable electrical contacts carried by said arm members.

4. An electrical switch assembly according to claim 1 wherein said additional means comprises a plurality of angularly spaced second recesses carried by said housing means for selectively receiving therein said detent member in order to maintain said lever means said cover portion and cam-carrying body in any of said portions selected, and wherein said cam bodies are radially spaced with respect to said axis as to be effective for operatively engaging said arm members generally between said annular support and said movable electrical contacts carried by said arm members.

5. An electrical switch assembly according to claim 1 wherein two of said arm members are so disposed as to respectively have the movable electrical contacts carried thereby positioned generally between the two fixed electrical contacts carried by said second plate-like conductor and the two fixed electrical contacts carried by said first plate-like conductor and normally closed against said two fixed electrical contacts carried by said second plate-like conductor.

6. An electrical switch assembly according to claim 5 wherein said two of said arm members when normally closed against said two fixed electrical contacts carried by said second plate-like conductor are effective for completing an electrical circuit leading to a vehicular brake system actuated switch means effective when energized to a closed condition for in turn energizing related vehicular warning lamps.

7. An electrical switch assembly, comprising outer housing means, said outer housing means comprising a generally axially extending body having generally cylindrical passage means formed therethrough and opening into an upper open end and a lower open end, transversely extending first end closure means detachably secured to said axially extending body as to thereby close said lower open end, first aperture means formed in said first end closure means for accommodating the extension therethrough of at least a portion of related electrical connection means, transversely extending

second end closure means at least partially received within said cylindrical passage means as to thereby be rotatable therewithin and in respect thereto while simultaneously effectively closing said upper open end, a manually actuatable lever carried by said second end closure means and extending radially outwardly therefrom with reference to the axis of rotation of said second end closure means, a detent-carrying body received within said cylindrical passage means axially inwardly of said second end closure means, said detent-carrying body being detachably secured to said second end closure means and directly rotatable therewith about said axis, first and second radially directed slot-like recesses formed in said detent-carrying body, each of said recesses having an open radial end and an open side with such open side being at an axial end of said detent-carrying body opposite to said second end closure means, said recesses being so located as to have their respective open radial ends in substantially diametrically opposed relationship, a first plunger-like detent member slidably received in said first radially directed recess, first spring means situated in said first radially directed recess operatively engaging said first detent member and urging said first detent member to extend through said open radial end of said first radially directed recess, a second plunger-like detent member slidably received in said second radially directed recess, second spring means situated in said second radially directed recess operatively engaging said second detent member and urging said second detent member to extend through said open radial end of said second radially directed recess, a first plurality of detent recesses carried internally of said axially extending body adapted for sequential engagement by said first detent member, a second plurality of detent recesses carried internally of said axially extending body adapted for sequential engagement by said second detent member, cam means carried within said cylindrical passage means and detachably secured to said detent-carrying body for rotation therewith at an axial side thereof opposite to said second end closure means, said cam means comprising a cam-carrying body extending transversely of said axis and having at least portions thereof extending radially beyond the periphery of said detent carrying body, said cam-carrying body being situated against said detent-carrying body as to thereby close both of said open sides of said first and second radially directed recesses, generally arcuately positioned angularly spaced cam portions carried by said cam-carrying body at a side thereof opposite to said detent-carrying body, and a switch contact assembly situated and carried within said cylindrical passage means, said switch contact assembly comprising a mounting member extending transversely of said axis, means for preventing angular rotation of said mounting member about said axis, said mounting member being located at an axial side of said cam means opposite to said detent-carrying body and axially spaced away from said cam means, said mounting member comprising a generally centrally disposed support portion extending generally toward said cam means, a first outer platelike electrical conductor carried by said mounting member on a side thereof generally juxtaposed to said cam means and generally radially outwardly of said support portion, a pedestal portion carried by said mounting member and extending therefrom generally toward said cam means, a second plate-like conductor carried by said pedestal-

like portion so as to have at least a portion thereof generally juxtaposed to at least a portion of said first plate-like electrical conductor and spaced therefrom, a plurality of electrical switches, said plurality of electrical switches comprising a plurality of fixed electrical contacts carried by said plate-like conductors and a plurality of movable electrical contacts adapted for opening and closing electrical circuits through said fixed electrical contacts, said movable contacts being respectively carried by resiliently deflectable electrically conductive arms each having one end secured in a generally cantilevered fashion to said centrally disposed support portion, said conductive arms being so positioned as to radiate in a generally spoke-like configuration from said centrally disposed support portion with said centrally disposed support portion thereby assuming a hub-like configuration, each of said movable electrical contacts being carried respectively by said conductive arms at least near the free deflectable end thereof opposite to said one ends of said conductive arms, at least two of said fixed electrical contacts being carried by said portion of said second plate-like conductor as to be generally on the side thereof juxtaposed to and spaced away from said portion of said first plate-like conductor, other of said fixed electrical contacts being carried by said first plate-like conductor on a side thereof opposite to said mounting member and angularly spaced from each other generally about said axis, at least two of said other fixed contacts being carried by said portion of said first plate-like conductor in a manner as to be generally respectively juxtaposed to said two fixed electrical contacts carried by said portion of said second plate-like conductor, said movable contacts being respectively positioned at radial distances away from said axis greater than the radial distances at which said cam portions are positioned from said axis, and each of said conductive arms having at least portions thereof generally in the path of movement of said cam portions when said cam portions are rotated about said axis to selected angular positions so as to thereby cause certain of said cam portions to engage said conductive arms and move said movable contacts relative to respective cooperating certain fixed contacts.

8. An electrical switch assembly according to claim 7 and further comprising axially extending aperture means formed through and substantially centrally of said detent-carrying body and said cam means mounting member, said aperture means being effective to at least partly receive therein electric lamp socket means, and wherein said second end closure means comprises a chamber formed therein and closed at one end by light-passing lens means, whereby a lamp situated within said lamp socket once energized is effective for causing a visual signal by having light radiated thereby pass through said lens.

9. An electrical switch assembly according to claim 8 whereby said lamp socket is affixed to said switch contact assembly and remains angularly stationary with respect to said axially extending housing as said cam means undergoes angular rotation about said axis.

10. An electrical switch assembly according to claim 9 wherein said lamp socket is electrically conductive and is affixed to said switch contact assembly by electrically conductive connecting means carried by said centrally disposed support portion.

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11. An electrical switch assembly according to claim 10 and further comprising additional lamp contact means carried by said switch contact assembly and electrically connected at one end to said first plate-like conductor, an other end of said lamp contact means passing into and received within said lamp socket as to thereby be effective to in combination with said lamp socket complete an electrical circuit as through said lamp received by said lamp socket.

12. An electrical switch assembly according to claim 8 wherein said lens is generally telescopingly received within said chamber, and further comprising resilient restraining means for restraining accidental withdrawal of said lens from said chamber.

13. An electrical switch assembly according to claim 7 and further comprising abutment means for preventing angular rotation of said second closure means about said axis beyond a first angular position, said abutment means comprising a plurality of abutment surfaces carried by said second end closure means and a manually depressible abutment member carried by said axially extending body, spring means normally urging said abutment member to a position whereat said abutment member is in the general path of movement of a first of said abutment surfaces so that upon sufficient angular rotation of said second end closure means said first of said abutment surfaces engages said abutment member to thereby establish said first angular position and prevent continued unidirectional angular rotation of said second end closure means, said abutment member being capable of being resiliently depressed as to thereby move out of the path of movement of said first of said abutment surfaces and into the path of movement of a second of said abutment surfaces thereby permitting said second end closure means to be continued to be further rotated in the unidirectional angular rotation until said second of said abutment surfaces engages said depressed abutment member.

14. An electrical switch assembly according to claim 7 wherein said first end closure means has a portion thereof telescopingly received within said cylindrical passage means, wherein said cylindrical passage means comprises a shoulder portion having an abutment surface in a plane generally transverse to said axis, wherein said mounting member is positioned generally between said abutment surfaces and said telescoping portion of said first end closure means, and further comprising resiliently deflectable gasket-like means situated between said mounting member and said telescoping portion of said first end closure means whereby the holding energy of said telescoping portion of said first end closure means is transmitted through said gasket-like means and into said mounting member to thereby hold said mounting member against said abutment surface.

15. An electrical switch assembly according to claim 7 and further comprising additional lamp housing means carried by said second end closure means out-

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wardly thereof, first and second lamp chambers formed within said lamp housing, first and second lamps respectively situated in said first and second lamp chambers, first and second lens members respectively forming an exterior wall of said first and second lamp chambers, and electrical circuitry selectively completed depending on the direction of angular rotation of said second end closure means to in accordance therewith selectively energize said first and second lamps to thereby cause the emitting of light rays through respectively said first and second lens members.

16. In a manually actuatable turn signal switch assembly having electrical contacts selectively openable and closeable in response to movement of a manually positionable control member to thereby indicate an anticipated turning maneuver of an associated vehicle as well as to at times indicate a flashing hazard warning to others in the vicinity of said associated vehicle, the improvement of providing a plurality of angularly spaced fixed electrical contacts leading to first associated electrical circuit portions, a plurality of movable electrical contacts, each of said plurality of movable electrical contacts comprising a resiliently deflectable electrically conductive arm having a first end deflectably swingable and carrying an electrical contact member thereon, each of said electrically conductive arm having an other functional end secured to a related mounting structure as to thereby cause said electrically conductive arm to be cantilevered from said mounting structure, each of said other ends of said electrically conductive arms leading to second associated electrical circuit portions, said electrically conductive arms being angularly spaced as to respectively assume a radiating spoke-like configuration about an axis with said other ends being radially innermost and said first ends being radially outermost, and cam means operatively connected to said manually positionable control member, said cam means being effective to selectively engage said resiliently deflectable electrically conductive arms and cause deflection thereof generally in a direction parallel to said axis whenever said manually positionable control member and said cam means have undergone a selected rotational motion in a direction angularly about said axis and in a plane transverse to said axis, said cam means including portions for maintaining a resiliently deflectable electrically conductive arm in a deflected condition as said manually positionable control member and said cam means are angularly rotated from a first selected position to a second selected position so as to thereby minimize the total number of times that said switch assembly has to experience the opening and closing of electrical contacts when changing from said first selected position to said second selected position and consequently minimize mechanical and electromotive wear thereof and prolong the life of such electrical contacts.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Page 1 of 2

Patent No. 3,809,833

Dated May 7, 1974

Inventor(s) Gerald K. Miller and Norman A. Rautiola

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 3, line 18, change "upwardly" to --- upward ---.

Column 4, line 22, after "lobes" change "of" to --- or ---.

Column 5, line 49, after "272" change the comma (,) to a semicolon (;).

Column 6, line 5, after "engage" cancel "the" and substitute therefor --- and ---.

Column 6, line 8, after "engage" cancel "the" and substitute therefor --- and ---.

Column 7, line 37, after "10" delete the comma (,) and substitute therefor a period (.).

Column 7, line 41, change "from" to --- front ---.

Column 8, line 15, before "contact 214" insert --- fixed ---.

Column 8, line 20, change "210" to --- 310 ---.

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Page 2 of 2

Patent No. 3,809,833 Dated May 7, 1974

Inventor(s) Gerald K. Miller and Norman A. Rautiola

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 8, line 25, change "208" to --- 308 ---.

Column 9, line 51, change "369" to --- 368 ---.

Claim 4, line 7 thereof, delete "portions" and substitute therefor --- positions ---.

Claim 9, line 2 thereof, change "whereby" to --- wherein ---.

Claim 16, line 5 thereof, change "vahicle" to --- vehicle ---.

Claim 16, line 15 thereof, change "arm" to --- arms ---.

Signed and Sealed this

Fifth Day of December 1978

[SEAL]

Attest:

RUTH C. MASON
Attesting Officer

DONALD W. BANNER
Commissioner of Patents and Trademarks