

June 15, 1965

W. L. BROWN

3,189,701

ROTARY SWITCH ASSEMBLY

Filed Nov. 5, 1963

3 Sheets-Sheet 1

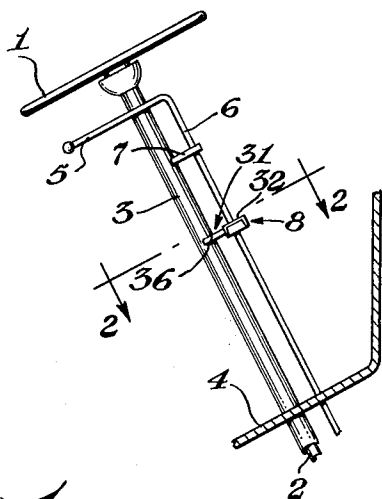


Fig. 1

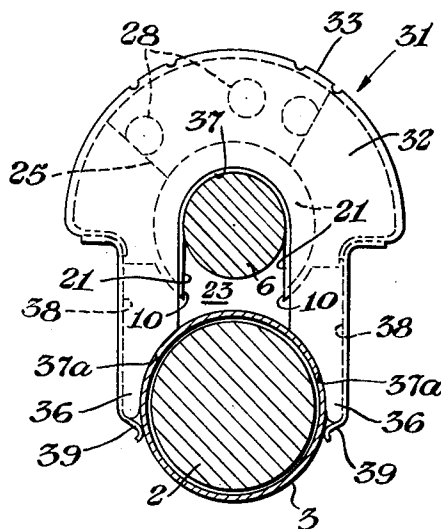


Fig. 2

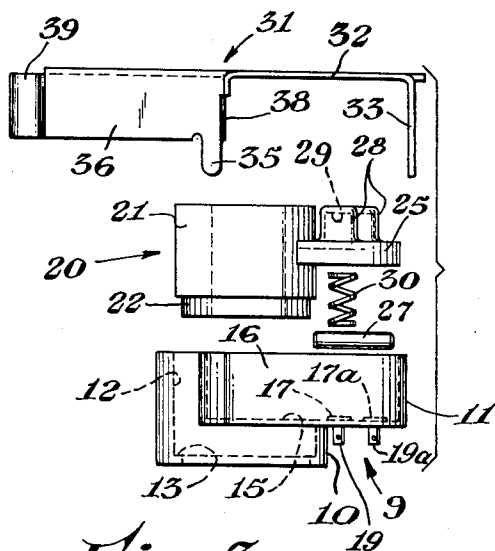


Fig. 3

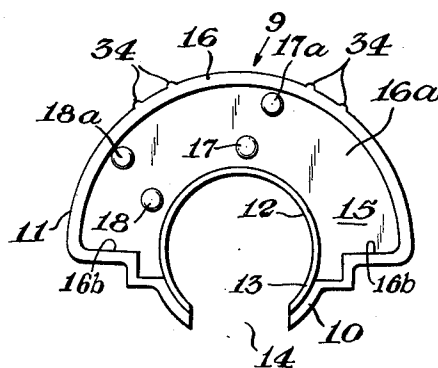


Fig. 4

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3 Sheets-Sheet 2

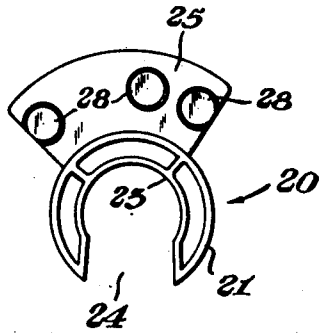


Fig. 5

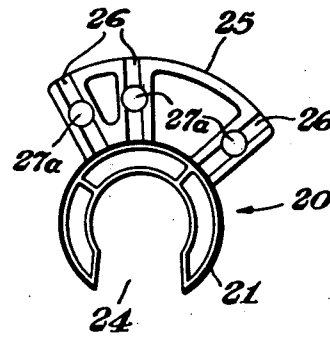


Fig. 6

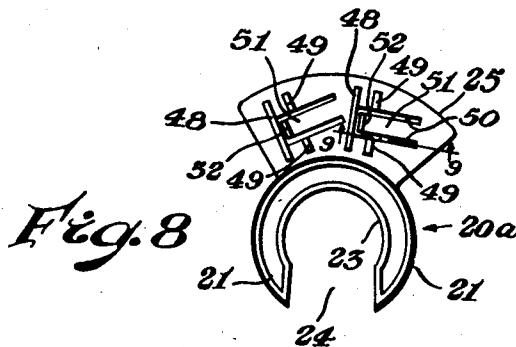


Fig. 8

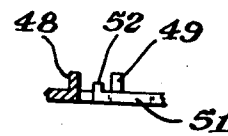


Fig. 9

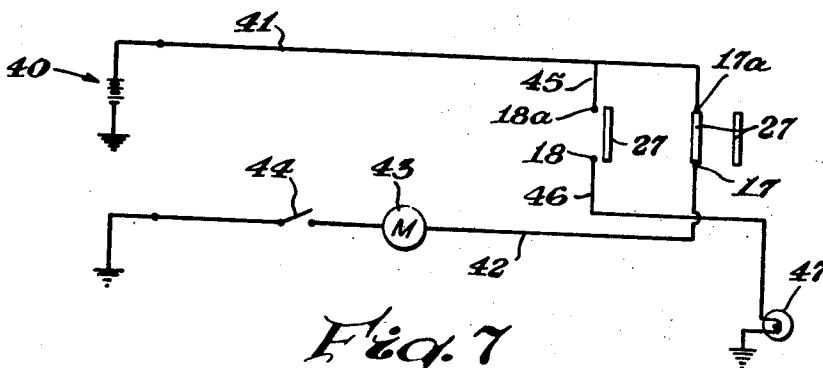


Fig. 7

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3 Sheets-Sheet 3

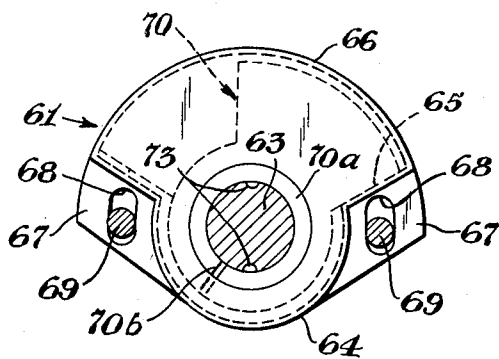


Fig. 10

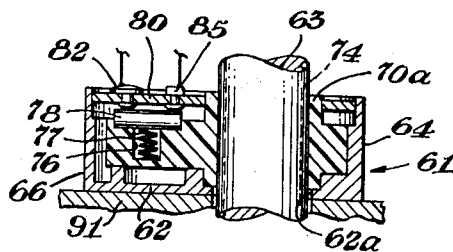


Fig. 12

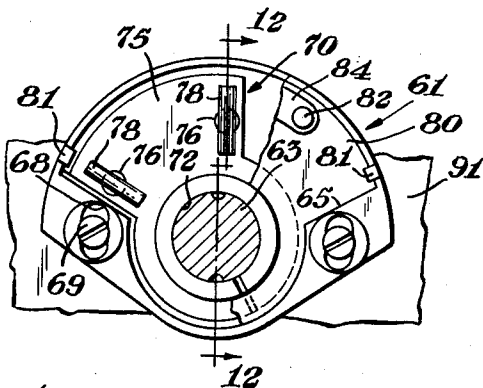


Fig. 11

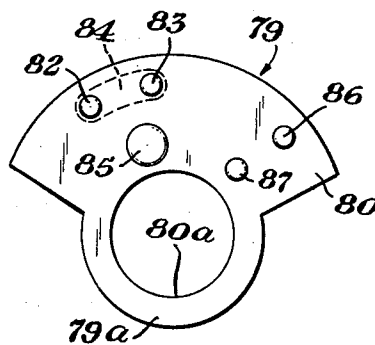


Fig. 13

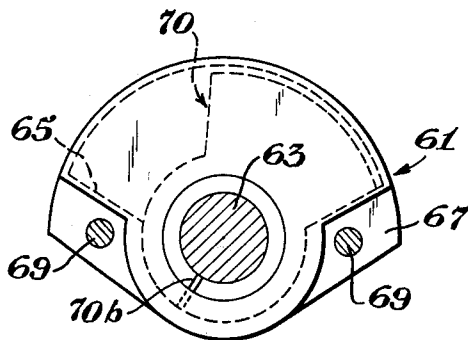


Fig. 14

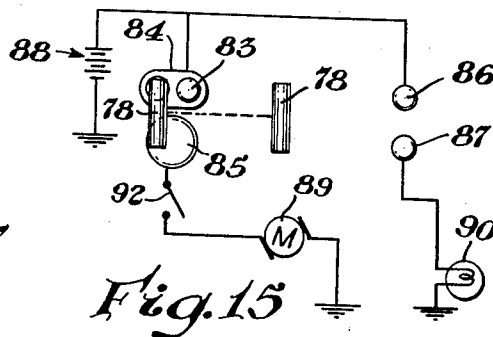


Fig. 15

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ROTARY SWITCH ASSEMBLY

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Filed Nov. 5, 1963, Ser. No. 321,640

27 Claims. (Cl. 200—61.88)

This application is a continuation in part of applications Serial Nos. 73,347, filed December 2, 1960, now abandoned, and 236,013, filed November 7, 1962, now abandoned.

This invention relates to rotary switch assemblies and more particularly to a switch assembly adapted for use with automotive vehicles having starting motor and back-up light circuits adapted to be energized only when the vehicle's gear selector lever is shifted to predetermined positions.

In the manufacture of automotive vehicles having automatic or semiautomatic transmissions it has been the practice to provide switching means associated with the gear selector lever and operable to permit energization of the engine's starting circuit only when the transmission is in a neutral or non-drive transmitting condition. This condition of the transmission usually is established when the gear selector lever is placed in neutral or park position, such positions of the gear selector lever usually being indicated by the letters N and P, respectively. In either of these positions of the gear selector lever, the engine is disengaged from the vehicle's drive shaft so as to permit the engine to be started without any possibility of thereby causing movement of the vehicle.

Vehicles of the kind currently being manufactured frequently are provided with electrical circuitry adapted to illuminate lamps mounted at the rear of the vehicle and commonly referred to as back-up lights for lighting the area behind the vehicle when it is being backed. In order to illuminate the back-up lights when they may be needed, it has been customary heretofore to provide a normally inactive electric circuit and switching means actuated when the gear selector is moved to its reverse position, commonly indicated by the letter R, so as to activate the circuit to the back-up lights only during backing of the vehicle.

Various kinds of switch devices have been proposed heretofore but have not been altogether satisfactory for a number of reasons. For example, the switch constructions heretofore in use have been composed of a fixed part and a relatively movable part, with both the fixed part and the movable part being rigidly secured to its own mounting member. Fixing the parts of the switch assembly to supporting devices has necessitated the use of securing means such as screws, bolts, rivets, and the like, and the use of such fastening devices has taken an inordinate amount of time on the vehicle assembly lines. The use of fixed fastening devices such as screws, bolts, and the like is further objectionable for the reason that they have necessitated the exercise of considerable care in the mounting of the switch parts in order to assure proper engagement of the switch contact elements. The required degree of care is not always given to the mounting of the switch parts, with the result that the switch operation may be erratic.

The disadvantageous characteristics of rigidly mounting switch parts of the kind under consideration are compounded in those instances where repair or replacement of the switch parts is required, for the reason that as much time is required to dismount the switch parts as is required to mount them. Furthermore, it ordinarily has been necessary heretofore to mount the parts of known switch constructions at the terminal end of one of the

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members on which the parts are mounted. Consequently, it has been fairly common to mount the switch parts forwardly of the vehicle fire wall in a zone inconvenient to be reached by a repairman and which is susceptible to the accumulation of road dirt and grime.

In some motor vehicles the gear selector lever is mounted adjacent the steering wheel and rotates a shaft that parallels the steering shaft so as to actuate the switch mechanisms. In other vehicles, however, the switching apparatus is adapted to be actuated by a rotatable member which need not necessarily parallel the steering shaft. Switches that have been utilized heretofore on automotive vehicles of the kind indicated conventionally have included a casing mounted on a fixed support and a rotor mounted on a rockable support, the casing and the rotor having engageable and disengageable contacts for respectively making and breaking circuits in response to rocking of the rotor. Heretofore, all of the known switches have required both the casing and the rotor to be fixedly mounted on their respective supports. As a result, considerable care had to be exercised in mounting the switch parts on the vehicle in such manner as to assure proper operation of the switch in accordance with the position of the gear selector lever.

An object of this invention is to provide a switch assembly operable in response to manipulation of a vehicle gear selector lever to condition various circuits of the vehicle's electrical system for operation and which is free from the objections hereinbefore noted.

Another object of the invention is to provide a switch assembly of the kind referred to wherein the parts of the switch may be mounted on their respective vehicle parts in any desired position.

A further object of the invention is to provide in a switch assembly of the kind described yieldable mounting means for the switch parts which frictionally hold the switch parts in any desired position of adjustment on their respective vehicle mounting parts.

Another object of the invention is to provide a switch assembly having improved electrical characteristics and greater durability than switches in use heretofore.

A further object of this invention is to provide a rotary switch construction which initially is self-adjustable so as to condition the relatively movable contacts for proper operation.

Another object of the invention is to provide a switch construction of the character referred to which is adaptable for use on vehicles and other machines of different manufacturers.

A further object of the invention is to provide a rotary switch construction wherein either the rotor or the casing may be movable relatively to the other.

Other objects and advantages of the invention will be pointed out specifically or will become apparent from the following description when it is considered in conjunction with the appended claims and the accompanying drawings, in which:

FIGURE 1 is a view partly in side elevation and partly in section of a typical vehicle steering column and gear selector lever to which the parts of the switch assembly may be applied;

FIGURE 2 is an enlarged, sectional view taken on the line 2—2 of FIGURE 1;

FIGURE 3 is an exploded view of the parts of the switch assembly;

FIGURE 4 is a top plan view of a part of the switch assembly;

FIGURE 5 is a top plan view of another part of the switch assembly;

FIGURE 6 is a bottom plan view of the part shown in FIGURE 5;

FIGURE 7 is a schematic wiring diagram of a typical automobile circuit;

FIGURE 8 is a view similar to FIGURE 6, but illustrating a modified form of the invention;

FIGURE 9 is an enlarged sectional view taken on the line 9—9 of FIGURE 8;

FIGURE 10 is a bottom plan view, partly in section, of apparatus constructed in accordance with another embodiment of the invention;

FIGURE 11 is a top plan view of the apparatus shown in FIGURE 10 with certain parts broken away for purposes of illustration;

FIGURE 12 is a transverse sectional view taken on the line 12—12 of FIGURE 11;

FIGURE 13 is a plan view of a contact carrying member forming part of the apparatus;

FIGURE 14 is a view similar to FIGURE 10, but illustrating a modified form of the invention; and

FIGURE 15 is a schematic diagram of a typical circuit.

A switch assembly constructed in accordance with either of the embodiments of the invention disclosed in FIGURES 1-9 is adapted for use in an automotive vehicle having a steering wheel 1 that is keyed or otherwise suitably secured to a rotatable steering post 2 that is housed within a fixed, tubular column or housing 3 of known construction and which extends through the floor board 4 of the vehicle for connection to the steering mechanism (not shown). Adjacent the steering wheel 1 is a gear selector lever 5 that is connected at one end to an operating rod or post 6 which parallels the column 3 and also extends through the floor board 4 for connection to the vehicle's transmission (not shown) in the conventional manner. The lever 5 is adapted to be moved in an arc by the vehicle driver and the post 6 is suitably journaled in bearing supports 7 for rotation about its own longitudinal axis in response to manipulation of the lever 5.

A switch assembly constructed in accordance with the embodiment of the invention shown in FIGURES 1-6 is indicated generally by the reference character 8 and comprises a first carrier member or housing 9 having a generally cylindrical socket member 10 to which is secured a substantially semicircular flange 11. The socket member 10 is provided with a bore 12 having an inwardly extending shoulder 13 adjacent one end. The wall of the bore 12 is cut away at one side of the socket portion so as to provide a lateral or generally diametral opening 14 into the bore 12 for a purpose presently to be explained. The material from which the carrier 9 is made preferably is a moldable, non-conductive plastic such as nylon, Bakelite, or any other suitable material having usable flexibility of a nature to be explained hereinafter.

The flange 11 includes a base 15 and an upstanding peripheral wall 16 having its ends joined to the socket portion 10 so as to provide an arcuate slideway 16a terminating at its opposite ends in abutments 16b formed by the wall 16. Mounted in the base 15 are a first pair of electrical contacts 17, 17a and a second set of contacts 18, 18a. The contacts 17 and 18 conveniently may be formed of current conducting rivets or the like having crowned heads projecting somewhat above the level of the base 15 and their opposite ends provided with fittings 19, 19a adapted for connection to wires in a manner later to be explained.

The switch assembly 8 also includes a second carrier member or rotor 20 comprising a hub 21 of such size as rotatably to be received in the bore 12 of the carrier member 9, the hub having a reduced diameter portion 22 at one end adapted to nest with the shoulder portion 13 of the socket 10. The hub 21 is provided with an axial bore 23 and one section of the wall of the bore is laterally cut away to provide an opening 24. The member 20 preferably is made from a moldable plastic

substance such as that previously referred to and having the same properties.

Attached to and extending laterally from the hub portion 21 is a segment-shaped carrier portion or flange 25 having a plurality of substantially radially extending slots 26 formed in its lower surface of such size as snugly but rotatably to receive a current conductive switch element 27 having a length sufficient to bridge either set of contacts 17, 17a or 18, 18a. The base of each slot 26 is provided with an opening 27a and each opening communicates with the interior of a hollow bell housing 28 having a closed end 29. Each bell housing 28 is adapted to receive a spring 30 that may be interposed and compressed between the closed end 29 and the associated roller contact 27.

The construction and arrangement of the parts thus far described are such that the hub portion 21 of the member 20 may be rotatably received within the bore 12 of the socket 10 of the housing 9 with the segment-shaped carrier portion 25 of the rotor overlying the flange 11. The size of the flange 25 is such that it is located radially inwardly of the wall 16 of the flange 11 and the shoulder 13 is so located that the flange 25 will lie in the slideway 16a with the contact elements 27 urged by their springs 30 towards and into engagement with the base 15. When the parts 9 and 20 are thus assembled, the roller contacts 27 will bear against the base 15 with sufficient force to cause rotation of the rollers 27 about their own axes during rotation of the rotor 20 relatively to the housing 9. The depth of the slots 26 should be sufficient, however, to enable vertical displacement of the rollers 27 against the force of their springs 30 when the rollers engage the crowned contacts 17, 17a or 18, 18a. The yieldable biasing of the contact elements 27 in a direction towards the contacts mounted on the carrier part 11, coupled with the ability of the contacts 27 to rotate about their own axes, assures the maintaining of the contact elements clean and bright and the springs 30 assure firm contact between the elements 27 and the contact elements supported on the carrier part 11.

Means is provided for maintaining the parts 9 and 20 in assembled relation and comprises a cover plate 31 having an arcuate shaped portion 32 of such size as to overlie completely the carrier portions 11 and 25 so as to prevent the entry of dirt to the slideway 16a. The peripheral edge of the portion 32 of the cover plate 31 is provided with a pair of fingers 33 which are adapted to be received between pairs of ribs 34 provided on the peripheral surface of the wall 16. The fingers 33 are of such length that their terminal ends may be bent under the base 15 so as securely to clamp the cover plate to the member 9 with the rotor member 20 interposed therebetween. Preferably, additional fingers 35 are provided on the cover plate to grip other portions of the carrier portion 9 so as to fasten the cover plate more securely to the other parts of the switch assembly.

As is most clearly shown in FIGURE 2, the cover plate 31 includes a pair of spaced apart, substantially parallel legs 36 that are adapted to straddle the rod 6 and the column 3. The legs are joined to one another at their inner ends along an arc 37. The radius of the arc 37 and the spacing of the legs 36 from one another should be slightly greater than the radius of the rod 6 so as to enable the latter to be received between the legs without interference. The length of the legs 36 should be such as to enable their terminal ends to extend beyond the longitudinal axis of the steering post housing 3 and it is preferred that the confronting surfaces of the terminal portions of the legs be formed on arcs 37a corresponding to the curvature of the column 3 so as to provide a snug engagement therebetween and limit movement of the terminal ends of the legs 36 more than a predetermined distance beyond the longitudinal axis of the column 3.

The cover plate 31 also is provided with means for

mounting it and the switch assembly parts on the steering column housing 3. The mounting means comprises a pair of generally L-shaped spring elements 38 that are supported by the legs 36 of the cover plate. The terminal ends 39 of the springs 38 project beyond the ends of the legs 36 and are deformed towards one another an amount such that the distance between them in their unstressed positions is less than the diameter of the column 3. The springs 38 are sufficiently yieldable, however, to permit their terminal ends 39 to be sprung apart so as to permit the column 3 to pass therebetween. After the terminal ends of the springs pass the portion of greatest diameter of the column 3, the springs 39 return toward their unstressed positions and yieldably grip the column between themselves and the arcuate portions 37a of the legs 36.

The parts 9, 20 and 31 of the switch assembly are adapted to be mounted on the members 3 and 6 as a unit. This may be done by aligning the openings 14 and 24 in the members 9 and 20, respectively, with one another and with the slot between the legs 36. When the openings and the slot are aligned, the unit may be assembled with the members 3 and 6 by introducing the rod 6 between the legs 36 and then moving the unit toward the column 3. As the unit is moved toward the steering column, the opening 24 of the rotor member 20 will receive the rod 6. The size of the opening 24 is slightly less than the diameter of the rod 6 so that the passage of the latter into the bore 23 is yieldably resisted by the edges of the hub 21 bordering the opening 24. It is for this reason that the material from which the member 20 is made should be flexible and resilient. During the time the unit is being moved in such direction as to cause the rod 6 to be received in the bore 23 of the hub member, the spring fingers 39 will be cammed apart by the steering column 3 until such time as the fingers pass the diametral dimension of the column 3. When the rod 6 is fully received within the bore 23, the natural resilience of the material forming the hub member will cause the opening 23 to be reduced in size so that the wall of the bore 23 tightly grips the rod 6. The spring fingers 39 then will tightly grip the column 3.

When the switch assembly has been mounted on the members 3 and 6 in the manner described, rocking or rotation of the rod 6 by manipulation of the gear selector 5 will cause the rotor 20 to rock with the shaft 6 about the longitudinal axis of the latter and relatively to the carrier member 9. Thus, the switch contacts 27 will be moved relatively to the stationary contacts carried on the member 9. The member 9 and the cover plate 31 will have no tendency to be rocked with the rotor inasmuch as neither the cover plate nor the member 9 is in engagement with the rod 6. In addition, the arcuate portions 37a of the legs 36 that engage the column 3 will, in cooperation with the spring fingers 39, deter any tendency of the cover plate to rotate.

The arcuate length of the slideway 16a is so related to the arcuate length of the rotor flange 25 and to the throw of the gear selector lever 5 that when the latter is at one limit of its throw one side edge of the flange 25 bears against the adjacent end wall 16b of the slideway 16a, and when the lever 5 is at the other limit of its throw the opposite edge of the rotor flange engages the opposite end wall 16b of the slideway. Partly as a result of these relationships and partly because the rotor 20 is frictionally mounted on the rod 6 in such manner as to enable it to be rocked relatively to the rod upon the application of force, any slight misalignment of the parts 9 and 20 which may take place upon assembly can be corrected merely by moving the gear selector through a full sweep from one limit of its movement to the other.

A portion of a typical automobile electrical system is disclosed in FIGURE 7 and comprises a source of electric energy such as a battery 40 having one of its terminals connected to ground and its other terminal connected to the contact 17a by means of a wire 41. The companion

contact 17 is connected by a wire 42 to a starting motor 43 of known construction and thence through a normally open starting switch 44 to ground. Branching off the wire 41 is a lead 45 which is connected to the contact 18a, and the companion contact 18 is connected by a wire 46 through a back-up light 47 and thence to ground.

The positions of the bridging contacts 27 shown in FIGURE 7 correspond to the positions they occupy when the gear selector lever is in its neutral position. In the neutral position the center contact 27 bridges the contacts 17, 17a so as to enable a circuit to be completed from the battery to the starting motor when the switch 44 is closed. FIGURE 2 illustrates the rotor member 20 in the position it occupies when the gear selector lever is in its neutral position. In the neutral position of the gear selector lever, therefore, it will be possible to start the vehicle engine.

Should the rotor member 20 be moved counterclockwise from its position shown in FIGURE 2, the left hand bridging contact 27 will be moved to the left from the position shown in FIGURE 7 to a position where it bridges the contacts 18, 18a so as to complete a circuit to the back-up light 47. These positions of the parts correspond to the reverse position of the gear selector lever. In the reverse position of the parts, the contacts 17, 17a will not be bridged, so it will not be possible to energize the starting motor 44.

Further counterclockwise movement of the rotor member will cause the right hand bridging contact 27 to bridge the contacts 17, 17a and disengage the left hand contact 27 from the contacts 18, 18a. These positions of the parts correspond to the park position of the gear selector lever and in such position the starting motor may be energized.

FIGURES 8 and 9 illustrate a modified rotor member 20a and parts which are similar to the rotor member 20 previously described are identified by the same reference characters. The rotor 20a has a number of generally radially extending, upstanding ribs 48 projecting from its lower face and adjacent each rib 48 is a pair of aligned shorter ribs 49. The spacing between each rib 48 and its associated ribs 49 is sufficient to provide a slot having a width to accommodate one of the bridging contacts 27. The carrier flange 25 is cut along parallel lines 50 from each rib 48 so as to form a finger 51 having an upstanding projection 52 located in the slot between the ribs 48 and 49. The height of each projection 52 is less than the height of the associated ribs 48, 49 and the purpose of the projection is to bear against the associated bridging contact 27 when rotor 20a is assembled with the housing 9 and deflect the finger 51, thereby tensioning the finger and causing it to exert a biasing force on the member 27 yieldably urging the latter in the direction of the stationary contacts 17-18.

The rotor 20a is disclosed as being adapted to accommodate only two contact members 27. Such a rotor nevertheless can be used in the circuit shown in FIGURE 7, but the starting motor then could be energized only when the gear selector lever is in its neutral position. It is to be understood, however, that the principles of the rotor 20a may be embodied in other rotors having means for accommodating more or fewer than two bridging contacts.

Apparatus constructed in accordance with the embodiment of the invention illustrated in FIGURES 10-13 comprises a casing member 61 formed either of metal or of a nonconductive material such as nylon, and having a base 62 that is provided with an opening 62a for loose reception of a rotary shaft 63. Secured to the base and extending part way around the shaft opening is an arcuate wall 64 forming a socket and terminating at its ends in outwardly diverging wall portions or abutments 65 which are joined to one another at their outer ends by an arcuate wall 66. The member 61 includes mounting flanges 67 at opposite sides of the latter hav-

ing arcuate slots 68 formed therein for the reception of mounting screws 69.

Rotatably mounted in the socket of the casing member 61 is a rotor member 70 formed of flexible, resilient insulating material, such as nylon, and comprising an annular mounting hub or sleeve 70a provided with an integral, laterally extending flange 71. The mounting sleeve 70a has a bore 72 which is somewhat smaller in diameter than the diameter of the shaft 63 and is provided with one or more inwardly projecting ribs 73 that are adapted to be received in a corresponding number of axially extending grooves 74 formed in the shaft 63. The sleeve 70a preferably is split axially as at 70b so as to enable the sleeve clampingly to be mounted on the shaft. The arrangement is such that the member 70 is snugly mounted on the shaft 63 and is fixed against rotation relative to the latter by means of the cooperating parts 73 and 74 so as to rotate with the shaft 63. The rotor is slideable longitudinally of the shaft, however, for a purpose presently to be explained.

The flange 70a of the rotor member 70 merges with a segment-shaped contact support or flange 75 that is slideably received in the casing 61 between the abutments 65. The size of the flange 75 is such as to permit the rotor to be rocked back and forth in the casing, and the extent of such rocking of the rotor is limited by engagement of the ends of the flange 75 with the abutments 65. The rotor flange 75 is provided with a pair of blind bores 76 in each of which is mounted a compression spring 77. Intersecting each of the bores 76 is a radial slot that is adapted to receive a roller 78 which is formed of electrically conductive material. The depth of each radial slot corresponds substantially to the radius of a conductor 78 so as to enable the latter to extend beyond the plane of the face of flange 75.

A contact carrier member 79 (see FIGURE 13) formed of nonconductive material includes a mounting ring 79a that is joined to an arcuate flange 80 of such size as to close the open side of the casing 61. The member 79 is provided with an opening 80a of such size as rotatably to receive the mounting sleeve 70a of the rotor member. The member 79 may be maintained in assembled relation with the other switch components by means of tabs or ears 81 provided on the casing 61 and which are bent over the flange 80.

Mounted on the member 79 is a pair of electrically conductive contacts 82 and 83 that are connected to one another by a conductive spanner bar 84. Adjacent the contacts 82 and 83 is mounted another electrically conductive contact 85 of substantially greater diameter than either of the contacts 82 and 83. Circumferentially spaced from the contacts 82, 83 and 85 is a pair of contacts 86 and 87. Preferably, all of the contacts are formed by rivets having rounded heads that extend into the casing, as illustrated in FIGURE 12. The contact carrying member 79 is assembled with the casing 61 and the rotor member 70 in such manner that the rounded heads of the contacts 82, 83, 85, 86 and 87 project into the casing for engagement by the respective roller contacts 78 during rotation of the rotor.

In a typical construction, the spanner bar 84 and the contact 86 will be connected to a source of electric energy such as a battery 88 and thence to a suitable ground such as the vehicle frame. The contact 85 may be connected to ground through the ignition switch 92 and the starting motor 89 of a vehicle, and the contact 87 may be connected to ground through a back-up light 90.

To assemble the apparatus thus far described for operation, the members 61, 70 and 79 may be mounted on the shaft 63 and slid longitudinally along the latter, as permitted by the frictional fit of the rotor member on the shaft, toward a suitable support 91 which is fixed relative to the shaft 63 in the sense that the support 91 does not rotate with the shaft 63. The screws 69 then

may be screwed into openings formed in the support 91 under hand pressure so as frictionally to hold the casing 61 against the support but permit the casing to be rocked relatively to its support upon the application of torsional sufficient force. In these positions of the parts, rocking of the shaft 63 by manipulation of a gear selector lever (not shown) will cause rotation of the rotor member 70 relative to the members 61 and 79 so as to cause the contact rollers 78 to move relatively to the stationary contacts.

When the rotor member is in proper adjustment with respect to the members 61 and 69, rocking of the rotor within the casing in response to movement of the gear selector lever will locate one of the roller contacts 78 in such position as to enable a circuit to be completed to the appropriate device 89 or 90. In the disclosed construction the position of the rotor illustrated in FIGURE 11 causes the roller contact 78 to bridge the contacts 86 and 87 so as to energize the back-up lamp 90. This position of the rotor corresponds to the reverse position of the gear selector lever. At the opposite extreme position of the rotor, the other roller contact 78 will be located in a position to bridge the contacts 82 and 83 so as to enable a circuit to be completed through the ignition switch 92 to the starting motor 89. This position of the rotor member corresponds to the park position of the gear selector lever. At an intermediate position of the rotor, the same roller contact 76 will be in a position to bridge the contacts 83 and 85. In this position of the roller, the starting motor 89 also can be energized, and this position of the rotor corresponds to the neutral position of the gear selector lever.

During assembly of the apparatus on a vehicle, the casing 61 may be mounted on the support member 91 in such position that movement of the gear selector lever toward one of its extreme positions of adjustment will cause engagement between the rotor and one of the casing abutments 65, before the shaft 63 has completed its rotation to the desired gear selector lever position. The shaft 63, therefore, will be capable of additional rotation, even though the rotor is in abutting engagement with the casing wall. Continued rotation of the shaft will cause the rotor to bear against the casing and rock the casing relatively to the support 91, as permitted by the arcuate slots 68 formed in the mounting flanges 67. Relative rocking of the casing and the fixed support 91 will continue until the shaft 63 and the rotor have been rocked to their extreme position of adjustment. Thereupon the screws 69 may be turned down tightly to lock the casing in place on the support 91. When the casing has been fixed on its support 91, the shaft 63 may be rocked to any of its positions as determined by the gear selector lever and the rotor will be rocked a corresponding amount so as to position the contacts 76 for operation of the devices 89 and 90 in accordance with the position of the gear selector lever.

The embodiment of the invention disclosed in FIGURE 14 is similar to the previously described embodiment but differs from the latter in that the sleeve 70a of the rotor 70 is not keyed to the shaft 63. Instead, the rotor is frictionally mounted on the shaft, due to the resiliency of the material from which the sleeve is made. Upon abutting engagement of either end of the rotor with the adjacent casing side wall 65, the rotor will be capable of rotation relative to the shaft 63, thereby self-positioning the rotor for proper registration of the fixed and movable contacts in a manner similar to that previously described. In the FIGURE 14 embodiment of the invention it is not necessary that the openings for reception of the mounting screws 69 be arcuate. Instead, they can be cylindrical bores.

In both of the embodiments disclosed in FIGURES 10 and 14 the springs 77 constantly bias the roller contacts 78 toward the contact carrier 80 so as to assure excellent electrical contact between the fixed and movable contacts

and to effect rotation of the rollers about their own axes in response to movement of the rotor. The rotation of the rollers 78 keeps them bright and clean and minimizes wear.

The slitting of the rotor sleeve as at 70b not only enables the sleeve to be clampingly, but frictionally, mounted on the shaft 63. It also enables the rotor to be mounted on shafts of different size, thereby enabling apparatus constructed in accordance with the invention to have wide applicability.

The disclosed embodiments are representative of presently preferred forms of the invention, but the disclosure is intended to be illustrative rather than definitive of the invention. The invention is defined in the claims.

I claim:

1. A switch construction comprising a first carrier member having an arcuate wall forming a socket therein and an electrical contact supporting portion adjacent said socket; a rotatable second carrier member having an arcuate wall forming a hub rotatably received in said socket and an electrical contact supporting portion secured to said wall and extending adjacent said portion of said first carrier member, the walls of said socket and said hub being concentric, each of said walls being interrupted to provide an opening therethrough, said openings being capable of being aligned with one another in one relative position of said carrier members; and mounting means secured to said first carrier member for mounting both of said members on a support.

2. The construction set forth in claim 1 including electrically conductive contact elements mounted on the supporting portions of each of said carrier members, the contact elements of one of said carrier members being arranged on an arc of a circle having a center substantially at the center of said hub and the contact elements of the other carrier member being arranged to engage selected contact elements of said one carrier member upon relative rotation of said carrier members.

3. The construction set forth in claim 2 including biasing means reacting between one of said carrier members and its contact elements and exerting a constant force thereon in a direction toward the contact elements of the other carrier member.

4. The construction set forth in claim 3 wherein said biasing means comprises coil springs.

5. The construction set forth in claim 3 wherein said biasing means comprises spring fingers forming part of said one carrier member.

6. In combination, a fixed, elongated member; an elongated member rotatable about its own axis spaced from but substantially parallel to said fixed member; a first carrier member having a hub portion snugly but slideably receiving said rotatable member and being rotatable therewith about the axis thereof; electrical contact means supported by said first carrier member; a second carrier member having a socket portion journaling said hub portion for rotation about said axis; second electrical contact means supported by said second carrier member adjacent the electrical contact means supported by said first carrier member; and means connected to said second carrier member and snugly but slideably mounting the latter on said fixed elongated member.

7. In combination, a fixed elongated member; a rotatable, elongated member spaced from said fixed member but substantially parallel thereto; a hub member mounted on said rotatable member and being rotatable therewith; a first flange member secured to said hub member and projecting laterally therefrom, said first flange member being rotatable with said hub member; electrical contact elements mounted on said flange member; a socket member rotatably receiving said hub member; a second flange member secured to and projecting laterally from said socket member, said first and second flange members being arranged in superposed relation; electrical contact elements mounted on said second flange member and

adapted to engage selected contact elements of said first flange member; means connected to said socket member and mounting the latter on said fixed member; and yieldable means reacting between one of said flange members and the contact elements mounted thereon and yieldably biasing the latter contact elements toward the contact elements mounted on the other flange member.

8. The combination set forth in claim 7 wherein said hub member is frictionally mounted on said rotatable elongated member and wherein said mounting means for said socket member frictionally engages said fixed elongated member.

9. A switch assembly comprising a rotor member having a wall defining a hub having a bore therethrough, a portion of said wall being cut away to form a substantially diametral opening into said bore; a housing member having a wall defining a socket in which said hub is rotatably received, a portion of the wall of said socket being cut away to form a substantially diametral opening therethrough adapted to be aligned with the opening into said bore in one relative position of said members; a number of spaced, electrical contact elements fixedly mounted on one of said members; at least one electrically conductive contact element movably mounted on the other of said members and being adapted to bridge selected contact elements on said one of said members; and spring means reacting between said movably mounted contact element and the member on which it is mounted, said spring means constantly biasing said movable contact element in the direction of said fixed contact elements.

10. A switch construction adapted for use with a rotatable support member and a fixed support member, said construction comprising a first carrier member having an opening therein forming a socket and an electrical contact supporting portion adjacent said socket; means on said first carrier member for mounting the latter on said fixed support member; a second carrier member rotatably journaled in the socket of said first carrier member and having an electrical contact supporting portion extending adjacent said portion of said first carrier member; electrically conductive contacts carried by said portions; and resilient, frictional means on said second carrier member for maintaining the latter on said rotatable support member for rotation with the latter and for sliding movements relative to said rotatable support member.

11. The construction set forth in claim 10 including yieldable means reacting between one of said supporting portions and the electrically conductive contacts carried thereby and yieldably biasing such contacts toward the other supporting portion.

12. The construction set forth in claim 11 wherein said yieldable means comprises spring means.

13. The construction set forth in claim 11 wherein said yieldable means comprises a spring finger struck out from said one supporting portion.

14. A rotary switch construction comprising first and second relatively movable members each having switch contacts thereon; means on said first member for mounting the latter on a fixed support; means on said second member for mounting the latter on a rotary support, the mounting means of one of said members enabling relative rotation between the latter and its support, and the mounting means of the other of said members precluding relative rotation between the latter and its support; and abutment means on said first member engageable by said second member in response to rotary movement of the latter, engagement of said abutment means by said second member disabling relative rotation of said members but enabling relative rotation of said one of said members and its support in response to continued rotary movement of said second member.

15. A rotary switch construction comprising a first member; a second member rotatably journaled on said first member; switch contacts on each of said members;

means on said first member for fixedly mounting the latter on a fixed support; frictional means on said second member for mounting the latter on a rotary support for rotation therewith; and abutment means carried by said first member and located in the path of rotary movement of said second member, said frictional means permitting relative rotary movement between said rotary support and said second member upon engagement between the latter and said abutment means.

16. A rotary switch construction comprising a first member; a second member rotatably journaled on said first member; switch contacts on each of said members; means on said first member for rockably mounting the latter on a support; means on said second member for mounting the latter on a rotary support for rotation with the latter; and abutment means carried by said first member and located in the path of rotary movement of said second member, the mounting means for said first member enabling rocking of the latter upon engagement of said abutment means by said second member.

17. A rotary switch construction comprising a first body member having an opening therein for reception of a rotary shaft; a second body member having an opening therein aligned with the opening in said first body member for reception of said shaft; engageable and disengageable switch contacts supported by each of said body members; means on said first body member for mounting the latter on a fixed support; means on said second body member for mounting the latter on said rotary shaft for rotation therewith; and abutment means carried by said first body member for engagement by said second body member upon predetermined rotation thereof, the mounting means of one of said body members enabling rotation thereof relative to its support upon engagement between said abutment means and said second body member, and the mounting means of the other of said body members precluding rotation thereof relative to its support.

18. A rotary switch construction comprising a first body member having an opening therein for reception of a rotary shaft; a second body member having an opening therein aligned with the opening in said first body member for reception of said shaft; switch contacts supported by each of said body members; means on said first body member for fixedly mounting the latter on a fixed support; means on said second body member for frictionally mounting the latter on said shaft for rotation therewith and for rotation relative thereto; and abutment means carried by said first body member and located in the path of rotation of said second body member for engagement by the latter, the frictional mounting means for said second body member enabling relative rotation of said shaft and said second body member upon engagement of the latter with said abutment means.

19. A rotary switch construction comprising a first body member having an opening therein for reception of a rotary shaft; a second body member having an opening therein aligned with the opening in said first body member for reception of said shaft, switch contacts supported by each of said body members; means on said first body member for rockably mounting the latter on a fixed support; means on said second body member for mounting the latter on said shaft for rotation therewith; and abutment means carried by said first body member and located in the path of rotation of said second body member for engagement by the latter, the mounting means for said first body member enabling rotation thereof in response to rotation of said second body member following engagement between the latter and said abutment means.

20. A rotary switch construction comprising a rotary support rotatable about an axis; a first body member; means mounting said first body member on said rotary support for rotation therewith about said axis; a fixed support; a second body member; means mounting said second body member on said fixed support coaxial with and adjacent to said first body member; contact means

supported by each of said body members for engagement and disengagement in response to relative rotation of said body members; and abutment means carried by said second body member in the path of rotation of said first body member for engagement by the latter, the mounting means of one of said body members mounting said one of said body members on its said support for rotation relative thereto about said axis upon engagement between said first body member and said abutment means.

21. A rotary switch construction comprising a fixed support; a first body member; rockable means mounting said first body member on said fixed support for rocking movement about an axis; a rotary support; a second body member; means mounting said second body member on said rotary support adjacent said first body member for rotation with said rotary support about said axis; contact means supported by each of said body members for engagement and disengagement in response to relative rotation of said body members; and abutment means carried by said first body member and located in the path of rotation of said second body member for engagement thereby, the rockable mounting means enabling rocking movement of said first body member upon engagement of said second body member and said abutment means.

22. A construction as set forth in claim 21 wherein said first and second body members and said rotary support are rotatable about a common axis.

23. A construction as set forth in claim 21 wherein said second body member is slideable on said rotary support in a direction toward and away from said first body member.

24. A construction as set forth in claim 21 wherein said second body member is formed of resilient material and is yieldably clamped on said rotary support.

25. A rotary switch construction comprising a fixed support; a first body member; means mounting said first body member on said fixed support; a rotary shaft; a second body member; resilient means on said second body member frictionally clamping the latter on said shaft for rotation relative to said first body member in response to rotation of said shaft; contact means supported by each of said body members for engagement and disengagement in response to relative rotation of said body members; and abutment means carried by said first body member and located in the path of rotation of said second body member for engagement thereby, the mounting means of one of said members enabling relative rotation of said shaft and said one of said members upon engagement of said second body member and said abutment means, the mounting means of the other body member precluding relative rotation of said shaft and said other body member.

26. The construction set forth in claim 25 wherein said mounting means on said second body member comprises a split annulus having an opening therein smaller in size than the size of said shaft.

27. A switch construction adapted for use with a rotatable support member and a fixed support member, said construction comprising a first carrier member having an opening therein forming a socket and an electrical contact supporting portion adjacent said socket; means on said first carrier member for mounting the latter on said fixed support member; a second carrier member having a hub rotatably journaled in the socket of said first carrier member and having an electrical contact supporting portion extending adjacent said portion of said first carrier member; and electrically conductive contacts carried by said portions, said hub having a bore therethrough of such size as to receive said rotatable support and be rotatable therewith but to permit relative sliding movement of said second carrier member on said rotatable support.

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