Oct. 18, 1960 L. R. GUTE 2,957,056

SWITCH ASSEMBLIES

Filed July 10, 1957

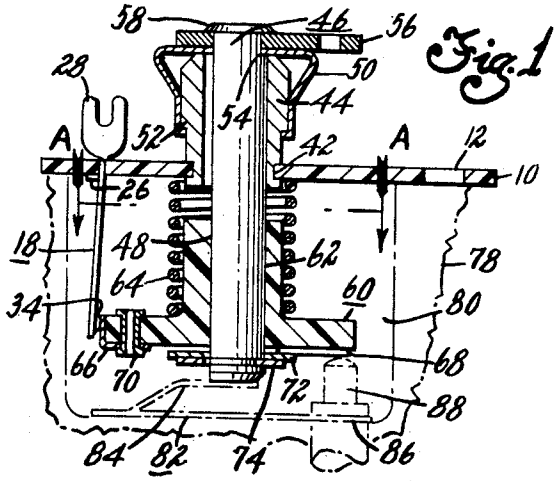


Fig. 1

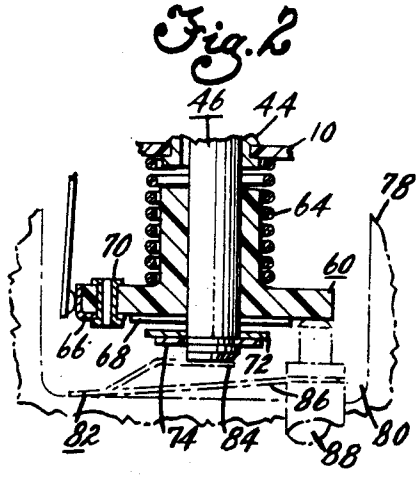


Fig. 2

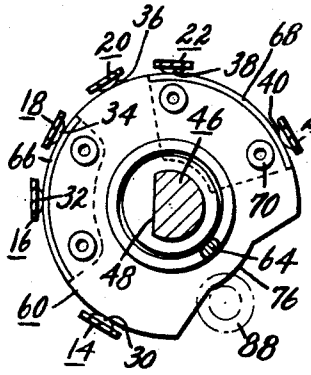


Fig. 3

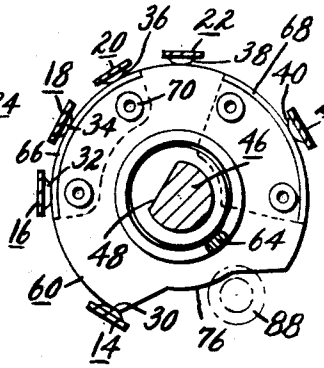


Fig. 4

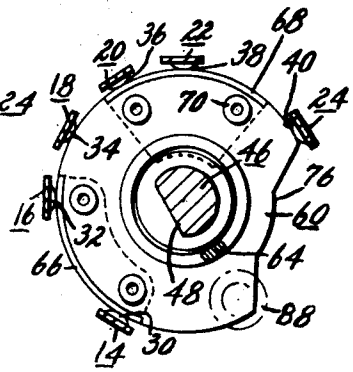


Fig. 5

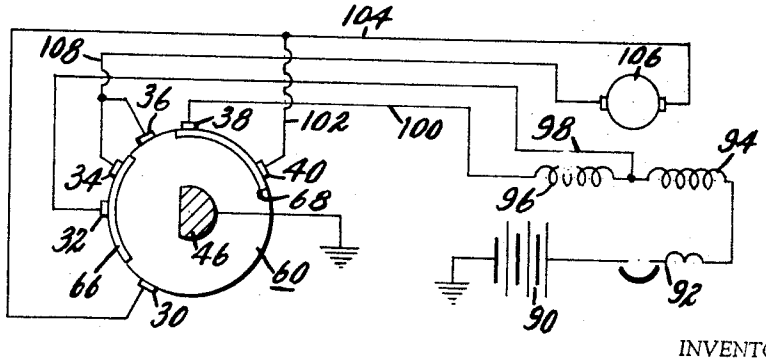


Fig. 6

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SWITCH ASSEMBLIES

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16 Claims. (Cl. 200—4)

This invention pertains to electric switches, and particularly to an electric switch having rotatable and axially movable contact means.

Electric motor driven windshield wipers including mechanism for effecting depressed parking of the wiper blades necessarily include switch means for deenergizing the motor when the wiper blades arrive at the parked position. Heretofore, it has been the practice to have separate manual and automatic parking switches, the parking switch being actuated mechanically to deenergize the motor when the wiper blades arrive at the parked position. The present invention relates to an improved switch assembly including a unitary contact carrier which can be actuated by the operator and by the wiper mechanism. Accordingly, among my objects are the provision of a switch assembly including rotatably and axially movable contact means; the further provision of a switch assembly having a contact carrier which is movable in two planes at right angles to each other to perform switching operations; and the still further provision of a multiple contact rotary switch including a rotatable and axially movable contact carrier.

The aforementioned and other objects are accomplished in the present invention by supporting a rotary contact carrier for axial movement relative to a control shaft so that switching operations can be performed both by rotation of the shaft and carrier, and by axial movement of the carrier relative to the shaft. Specifically, the switch assembly includes a base of insulating material having a plurality of circumferentially spaced arms attached thereto having stationary contacts at one end and terminals at the other end. The terminals and contacts on the arms are disposed on opposite sides of the switch base. A bushing is attached to the insulating base, and a shaft is rotatably journalled within the bushing, the shaft being restrained against axial movement relative to the bushing by a retainer. The upper end of the shaft has a crank arm attached thereto which can be connected to one end of a Bowden wire, or other suitable linkage, for effecting movement of the crank arm so as to rotate the shaft. The shaft is formed with a flat along one side thereof which is received in a complementary hole in a contact carrier whereby the contact carrier is rotatable with the shaft but movable axially relative thereto. The contact carrier is composed of insulating material and has a pair of peripheral bridging contact segments attached thereto. One of the peripheral bridging contact segments has a radially inward extending portion arranged to engage a washer, or contact member, which is retained in fixed position relative to the shaft by means of a snap ring. A coil spring encircles a hub portion of the contact carrier, one end of the coil spring bearing against the insulating base, and the other end of the spring bearing against the contact carrier so as to normally maintain the contact carrier in an axial position relative to the shaft wherein the radially inwardly extending portion of the one peripheral bridging contact engages the washer carried by the shaft.

The switch assembly of this invention is particularly adapted for use in an electric windshield wiper motor of the type disclosed in copending application Serial No. 653,665 filed April 18, 1957, in the name of Loren R. Gute et al., and assigned to the assignee of this invention. Thus, the insulating base is designed for attachment to a switch housing having a cavity therein within which the rotary contact carrier is disposed. In addition, the housing cavity has a spring disposed in the bottom thereof having a portion engaging the shaft so as to electrically ground the shaft. When the contact carrier is in its lower axial position so that one bridging contact engages the washer, this bridging contact will be electrically grounded. However, upon movement of the carrier towards the switching base, the electric ground connection of the one bridging contact will be broken. In a windshield wiper motor installation, axial movement of the contact carrier can be effected by a reciprocable plunger, or operator, mounted in the switch housing and engageable with the contact carrier in only one predetermined angular position thereof. To accomplish this result, the contact carrier has a portion of its otherwise circular periphery removed.

When the switch is used in conjunction with the aforedescribed electric windshield wiper motor, the rotary carrier can be rotated manually to a low speed forward position wherein two of the stationary contacts are bridged by one of the bridging contacts on the carrier; and another two of the stationary contacts are connected to ground by the other bridging contact. The switch can also be moved to a high speed forward position wherein three of the stationary contacts are bridged by one of the bridging contacts, and only one stationary contact is connected to ground through the other bridging contact. In addition, the switch can be moved to a parking position wherein the motor is energized in the reverse direction at low speed by connecting two of the stationary contacts through one or the bridging contacts and connecting another two stationary contacts to ground through the other bridging contact. When the wiper motor arrives at the parked position, the plunger will be mechanically actuated and will move the contact carrier axially to break the ground connection and thus deenergize the motor. When the switch is again turned to either the high or low speed forward running positions, the contact carrier is rotated so that the peripheral relieved portion thereof is aligned with the plunger thereby allowing the spring to move the carrier to a position where the one bridging contact of the carrier is again electrically grounded.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawing, wherein a preferred embodiment of the present invention is clearly shown.

In the drawing:

Figure 1 is a sectional view of a switch assembly constructed according to this invention in combination with a housing and plunger assembly shown in phantom.

Figure 2 is a fragmentary sectional view similar to Figure 1 with the contact carrier displaced axially relative to the shaft by the plunger.

Figures 3, 4 and 5 are sectional views taken along line A—A of Figure 1 depicting the rotary carrier in different angular positions.

Figure 6 is a schematic wiring diagram of an electric motor driven windshield wiper embodying the switch of this invention.

With particular reference to Figure 1, the switch assembly of this invention includes a base **10** of insulating material having a plurality of holes such as indicated by numeral **12** for attaching the base **10** to a suitable support. The base **10** has attached thereto a plurality of cir-

cumferentially spaced resilient arms, 14, 16, 18, 20, 22 and 24. Each arm extends through a slot in the base 10 and is retained in position by a tang 26, shown in Figure 1, engaging the under side of the base 10, and a terminal portion 28 located at right angles to the plane of the arm 18 and disposed on the upper side of the base 10. In addition, the arms 14, 16, 18, 20, 22 and 24 carry stationary contacts 30, 32, 34, 36, 38 and 40, respectively.

The base 10 is also formed with a central aperture 42 within which a stationary bushing, or sleeve, 44 is supported. A shaft 46 is rotatably supported within the bushing 44, the shaft 46 having a flat 48 on one side thereof. The shaft 46 is restrained against axial movement relative to the bushing 44 by a retainer 50, one end of which engages a shoulder 52 on the bushing, and the other end of which engages a shoulder 54 on the shaft. The upper end of the shaft 46 receives a crank arm 56, the shaft being peened over the crank arm as indicated by numeral 58. Accordingly, angular movement of the crank arm 56 will impart angular movement to the shaft 46 relative to the bushing 44 and the base 10.

The lower end of the shaft 46 slidably receives a contact carrier 60 of insulating material, the contact carrier 60 having a hole 62 therethrough of a shape complementary to the cross-section of the shaft 46. Accordingly, the carrier 60 is connected to rotate with the shaft 46 but is slidable axially relative thereto. The hub portion of the carrier 60 is encircled by a coil spring 64, one end of the coil spring 64 engaging the carrier 60 and the other end of the coil spring engaging the lower side of the base 10.

As seen in Figures 1 and 3, the contact carrier 60 has a pair of bridging contact segments 66 and 68 attached thereto by rivets 70. The bridging contacts are of substantially L-shape as seen in Figure 1, and the bridging contact 68 extends radially inward towards the shaft 68 more than the bridging contact 66. This inwardly extending portion of the bridging contact 68 is arranged to engage a washer 72 which is retained in a fixed axial position relative to the shaft 46 by a snap ring 74 having a portion disposed in an annular groove in the shaft 46. The bridging contact 68 and the washer 72 constitute an electrical ground switch for the bridging contact 68 which is closed in Figure 1 and open in Figure 2.

As seen in Figures 3 through 5, the carrier 60 has a portion 76 of its otherwise circular periphery removed, the purpose of which will be pointed out hereinafter. The switch assembly of this invention is particularly designed for use with a windshield wiper motor of the type disclosed in the aforementioned copending application Serial No. 653,665, and thus the base 10 is arranged to be attached to a housing as indicated in phantom by numeral 78 with the carrier 60 and the stationary contacts disposed in a cavity 80. The housing 78 is electrically grounded and has attached thereto a leaf spring 82 having an arm 84 engaging the shaft 46 and an arm 86 normally biasing a reciprocable plunger 88 to the position shown in Figure 1. The plunger 88 can be mechanically moved to the position of Figure 2. Since the housing 78 is electrically grounded, the arm 84 of the leaf spring 82 electrically grounds the shaft 46. Moreover, since the snap ring 74 engages the shaft 46, and the washer 72 engages the snap ring 74, when the bridging contact 68 engages the washer 72 as shown in Figure 1, the bridging contact 68 is electrically grounded. However, upon axial movement of the carrier 60 to the position of Figure 2, wherein the contact 68 does not engage the washer 72, the ground connection of the bridging contact 68 is broken. The plunger 88 is not engageable with the carrier 60 when the relieved portion 76 thereof is in alignment with the plunger 88 as seen in Figures 3 and 4. However, when the carrier 60 is rotated in the position of Figure 5, upward movement of the plunger 88 will break the ground connection between the bridging contact 68 and the washer 72. However, with the plunger 88 extended upwardly as shown in Figure 2, upon rotation of the carrier to either the position of Figure 3 or Figure 4, the spring 64 will move the carrier 60 relative to the shaft 46 from the position of Figure 2 to the position of Figure 1 since in either of these positions the plunger 88 is aligned with the relieved portion 76 and therefor cannot axially displace the carrier.

With particular reference to Figure 6, the manner in which the switch assembly of this invention can be used to control the electric motor of the windshield wiper disclosed in the aforementioned copending application Serial No. 653,665, will be described. The circuit includes a battery 90, one terminal of which is grounded, and the other terminal of which is connected through a thermal overload switch 92 to one end of the series field winding 94 of a reversible electric motor. The other end of the series field winding 94 is connected to one end of a shunt field winding 96 as well as to a wire 98. The wire 98 is connected to a stationary switch contact 32. The other end of the shunt field winding 96 is connected by wire 100 to stationary switch contact 38. Switch contact 40 is connected by wire 102 to a wire 104, the wire 104 being connected to one brush of the armature 106 as well as to switch contact 30. Switch contacts 34 and 36 are connected to a wire 108 which is connected to the other brush of the armature. The shaft 46 of the switch is shown connected to ground.

When the carrier 60 is in the position depicted in Figures 3 and 6, the motor is energized for low speed rotation in the forward direction, since both the series and shunt field windings, 94 and 96, are energized and wire 104 is connected to ground. Thus, the circuit from the battery 90 is through overload switch 92, the series field winding 94, the wire 98, switch contacts 32 and 34 which are bridged by contact 66, wire 108, the armature 106, wire 104, wire 102 and contact 40 which is connected to ground through passage contact 68 and the shaft 46. The shunt field winding 96 is energized through the series field winding 94, wire 100, contact 38, bridging contact 68 and the shaft 46 to ground.

When the carrier 60 is moved to the position of Figure 4, the motor is energized for high speed rotation in the forward direction since the shunt field winding 96 is deenergized by movement of the bridging contact 68 out of engagement with the stationary contact 38. When the carrier 60 is moved to the position of Figure 5, the motor is energized for low speed rotation in reverse direction due to reversal of the direction of current flow through the armature 106. The energizing circuit for the motor in reverse direction is from the battery 90, through overload switch 92, series field winding 94, wire 98, switch contact 32, bridging contact 66, switch contact 30, wire 104, through the armature 106, wire 108, contact 36, bridging contact 68 and shaft 46 to ground. During reverse rotation the shunt field winding 96 is energized through the series field winding 94 by wire 100, contact 38, bridging contact 68 and the shaft 46 which is connected to ground. When the wiper blades arrive at the parked position, the plunger 88 will be moved upwardly from the position of Figure 1 to the position of Figure 2 thereby moving the carrier 60 from the position of Figure 1 to the position of Figure 2 so as to separate bridging contact 68 from the washer 72, and thus interrupt the ground connection to the motor.

From the foregoing it is apparent that the present invention provides a unique switch assembly of the rotary type including a rotatable and axially movable contact carrier for performing switching operations. The present switch assembly eliminates the necessity for incorporating separate manual and automatic parking switches in an electric windshield wiper control circuit.

While the embodiment of the invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted, as may come within the scope of the claims which follow.

What is claimed is as follows:

1. In an electric switch, a movable contact carrier having a plurality of bridging contacts thereon, a plurality of spaced stationary contacts engageable with said bridging contacts during movement of said carrier in one plane, a contact member normally engaging one of said bridging contacts for completing a circuit through said stationary contacts, and means permitting relative movement between said contact member and said carrier in a plane normal to said one plane to disengage said contact member and said one bridging contact and interrupts said circuit.

2. In an electric switch, a movable contact carrier having at least one bridging contact thereon, a plurality of spaced stationary contacts engageable with said bridging contact during movement of said carrier in one plane, a contact member normally engaging said bridging contact for completing a circuit through said stationary contacts, and means permitting relative movement between said contact member and said carrier in a plane normal to said one plane to disengage said contact member and said bridging contact and interrupt said circuit.

3. In an electric switch, a movable contact carrier having at least one contact thereon, at least one stationary contact engageable with said movable contact during movement of said carrier in one plane, a contact member normally engaging said one movable contact for completing a circuit through said stationary contact, and means permitting relative movement between said contact member and said carrier in a plane normal to said one plane to disengage said contact member and said movable contact and interrupt said circuit.

4. In an electric switch, a rotatable contact carrier having at least one contact thereon, at least one stationary contact engageable with said movable contact during rotation of said carrier, a contact member normally engaging said movable contact for completing a circuit through said stationary contact, and means permitting relative axial movement between said contact member and said carrier to disengage said contact member and said movable contact and interrupt said circuit.

5. In an electric switch, a rotatable and axially movable contact carrier having at least one contact thereon, at least one stationary contact engagement with said movable contact during rotation of said carrier, and a stationary contact member engageable with said movable contact in one axial position of said carrier for completing a circuit through said stationary contact whereby movement of said carrier to a second axial position disengages said contact member and said movable contact and interrupt said circuit.

6. In an electric switch, a rotatable contact carrier having a plurality of contact bridging segments thereon, a plurality of circumferentially spaced stationary contacts engageable with said bridging segments, a contact member normally engaging one of said contact segments for completing a circuit through said stationary contacts, and means permitting relative axial movement between said carrier and said contact member to disengage said contact member and said one contact segment and interrupt said circuit.

7. In an electric switch, a base, a contact carrier rotatably supported by said base having a plurality of contact bridging segments thereon, a plurality of circumferentially spaced stationary contacts supported on said base and engageable with said contact segment during rotation of said carrier, a contact member engageable with one of said bridging segments for completing a circuit through said stationary contacts, and means permitting relative axial movement between said contact member and said one bridging segment to disengage said contact member and said one bridging segment and interrupt said circuit.

8. In an electric switch, a base, a contact carrier supported for rotation and axial movement relative to said base, said carrier having at least one contact bridging segment thereon, a plurality of circumferentially spaced stationary contacts supported on said base and engageable with said bridging segment during rotation of said carrier, and a contact member engageable with and disengageable from said bridging segment dependent upon the axial position of said carrier relative to said base.

9. In an electric switch, a base, a shaft rotatably supported by said base, a carrier connected to rotate with said shaft but movable axially relative thereto, resilient means disposed between said carrier and said base and normally positioning said carrier in a predetermined axial position, said carrier having at least one contact bridging segment thereon, a plurality of circumferentially spaced stationary contacts supported on said base and engageable with said bridging segment during rotation of said carrier, and a contact member carried by said shaft and engageable with said bridging segment in said predetermined axial position of said carrier whereby axial movement of said carrier to a second predetermined position effects disengagement between said contact member and said bridging segment.

10. In an electric switch, a base, a contact carrier supported by said base for rotary and axial movement relative thereto, said carrier having a plurality of contact bridging segments thereon, a plurality of circumferentially spaced stationary contacts supported by said base and engageable with said bridging segments during rotation of said carrier, and a contact member engageable with one of said bridging segments in one axial position of said carrier and disengageable from said one bridging segment in a second axial position of said carrier.

11. In an electric switch, a base, a shaft rotatably supported in said base, a contact carrier connected to rotate with said shaft but capable of axial movement relative thereto, said contact carrier having a plurality of peripheral contact bridging segments thereon and a relieved portion, resilient means disposed between said base and said carrier for normally maintaining said carrier in said first axial position, a plurality of circumferentially spaced stationary contacts engageable with said bridging segments during rotation of said carrier, and a contact member carried by said shaft and engageable with one of said bridging segments when said carrier is in said first axial position, said contact member being disengaged from said one bridging segment when said carrier is moved to a second axial position by an operating element normally aligned with said relieved portion of said carrier whereby said operating element can only effect axial movement of said carrier in predetermined angular positions of said carrier.

12. In an electric switch, a movable contact carrier having a plurality of contacts thereon, a plurality of stationary contacts engageable with said movable contacts during movement of said carrier in one plane, a contact member normally engaging one of said contacts for completing a circuit through said stationary contacts, and means permitting relative movement between said contact member and said one contact in a plane normal to said one plane to disengage said contact member and said one contact and interrupt said circuit.

13. In an electric switch, a movable contact carrier having at least one contact thereon, at least one stationary contact engageable with said movable contact during movement of said carrier in one plane, a contact member normally engaging one of said contacts for completing a circuit through said stationary contact, means permitting relative movement between said contact member and said one contact in a plane normal to said one plane to disengage said contact member and said one contact and interrupt said circuit.

14. In an electric switch, a base, a contact carrier rotatably supported on said base and having a plurality of contacts thereon, a plurality of circumferentially spaced stationary contacts supported on said base and

engageable with the contacts on said carrier during rotation of said carrier, a contact member engageable with one of said contacts for completing a circuit through said stationary contacts, and means permitting relative axial movement between said contact member and said one contact to disengage said contact member and said one contact and interrupt said circuit.

15. In an electric switch, a base, a contact carrier rotatably supported by said base and having a plurality of contacts thereon, a plurality of circumferentially spaced, stationary contacts supported on said base and engageable with the carrier contacts during rotation of said carrier, a contact member engageable with one of said contacts for completing a circuit through said stationary contacts, and resilient means normally maintaining said contact member in engagement with said one contact but permitting relative axial movement therebetween to disengage said contact member and said one contact and interrupt said circuit.

16. In an electric switch, a base, a shaft rotatably supported in said base, a contact carrier of insulating material connected to rotate with said shaft but capable of axial movement relative thereto, at least one contact on said carrier, a plurality of stationary contacts supported

on said base and engageable with said carrier contact upon rotation thereof, a contact washer carried by said shaft and engageable with said carrier contact, and resilient means disposed between said base and said carrier for normally maintaining said carrier contact in engagement with said contact washer but permitting axial movement of said contact carrier relative to said shaft to disengage said carrier contact and said contact washer.

References Cited in the file of this patent

UNITED STATES PATENTS

1,630,359	Scott	May 31, 1927
1,746,887	Douglas	Feb. 11, 1930
1,835,780	Jacobi	Dec. 8, 1931
1,919,208	Douglas	July 25, 1933
1,977,707	Weitzer	Oct. 23, 1934
2,517,506	Riggs	Aug. 1, 1950
2,664,473	Brown	Dec. 29, 1953
2,758,181	Crouch	Aug. 7, 1956
2,876,302	Flocken	Mar. 3, 1959

FOREIGN PATENTS

108,365	Austria	Dec. 15, 1926