United States Patent

Miller

[15] **3,676,617**

[45] **July 11, 1972**

[54] SWITCH HAVING SPIDER-SHAPED CONTACT CARRIER

[72] Inventor: **Martin P. Miller**, New York, N.Y.

[73] Assignee: **General Automotive Specialty Company, Inc.**, Carlstad, N.J.

[22] Filed: **Oct. 16, 1970**

[21] Appl. No.: **81,451**

[52] **U.S. Cl.** .....**200/44**, 200/116, 200/166 J

[51] **Int. Cl.** **H01h 1/28**

[58] **Field of Search** .....200/42, 44, 116, 166 BH, 166 J, 200/16 R, 11 H, 11 K, 11 D

[56] **References Cited**

UNITED STATES PATENTS

3,346,708	10/1967	Moora	200/116
3,546,402	12/1970	Spaeth	200/16 R
2,440,690	5/1948	Jacobi	200/44
3,143,605	8/1964	Gaynor	200/5 F
1,754,754	4/1930	Jacobi	200/116

Primary Examiner—Robert K. Schaefer
Assistant Examiner—William J. Smith
Attorney—Darby & Darby

[57] **ABSTRACT**

A movable contact shorting device is disclosed which may constitute an electrical component of a switch. The device is interposed between a fixed contact member and a movable actuator and includes a contact plate having a plurality of contact portions protruding from one surface and engageable with corresponding contact elements on the fixed member. A plurality of spring fingers integral with the plate depend longitudinally therefrom to bear against the actuator. The fingers may be formed from arcuate portions of the plate and serve to bias the plate against the fixed member. The contact portions may be arranged in any convenient pattern depending upon the requirements of the switch circuit. An open-ended enclosure or boot is sealably mountable on the switch to shield against adverse weather conditions and ambient foreign matter. The boot includes a transverse portion to overlie part of the switch and contains a passage through this portion having resilient walls to form a substantially weather-proof seal. The walls separate under pressure, as for example when a key is inserted, but conform to the shape of the key so as to maintain the seal. The boot may be rotatably mounted on the switch to turn with the key thereby minimizing any deformation tending to interfere with the seal.

13 Claims, 11 Drawing Figures

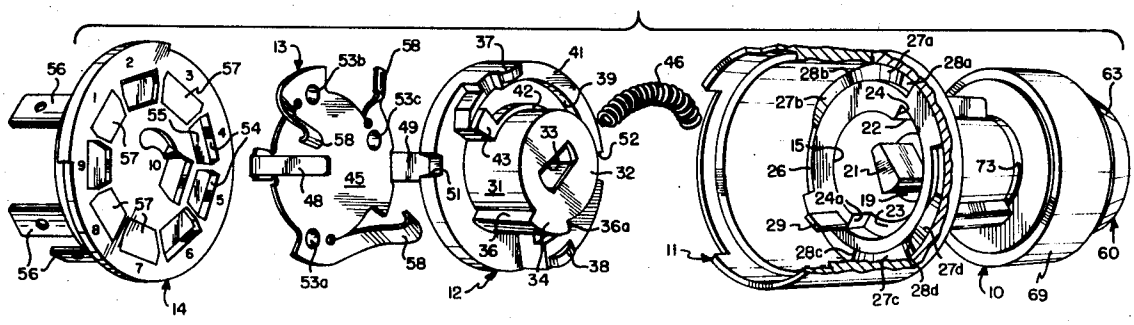


FIG. 1

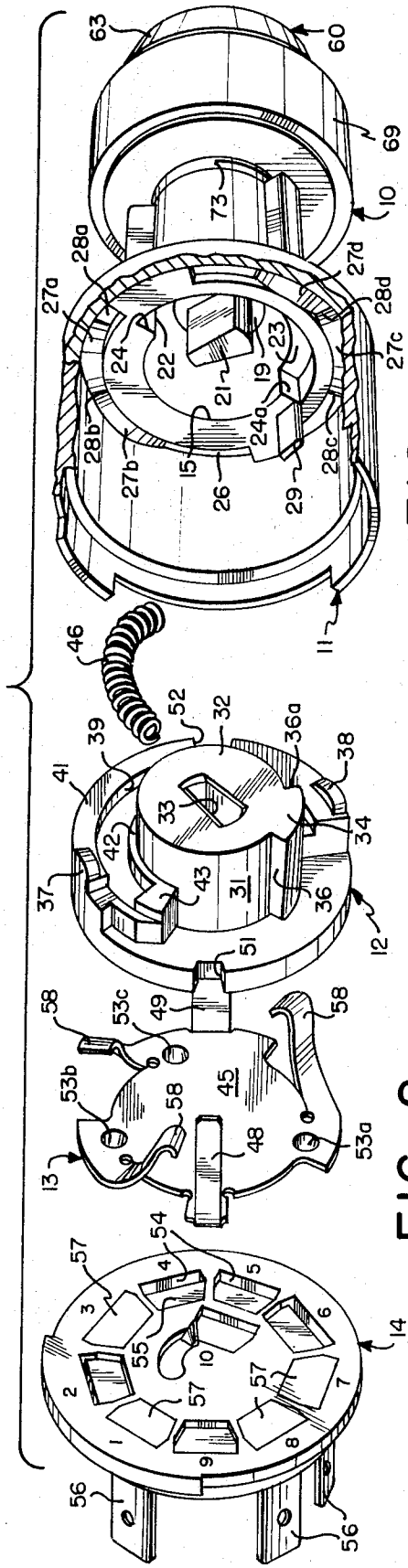


FIG. 3

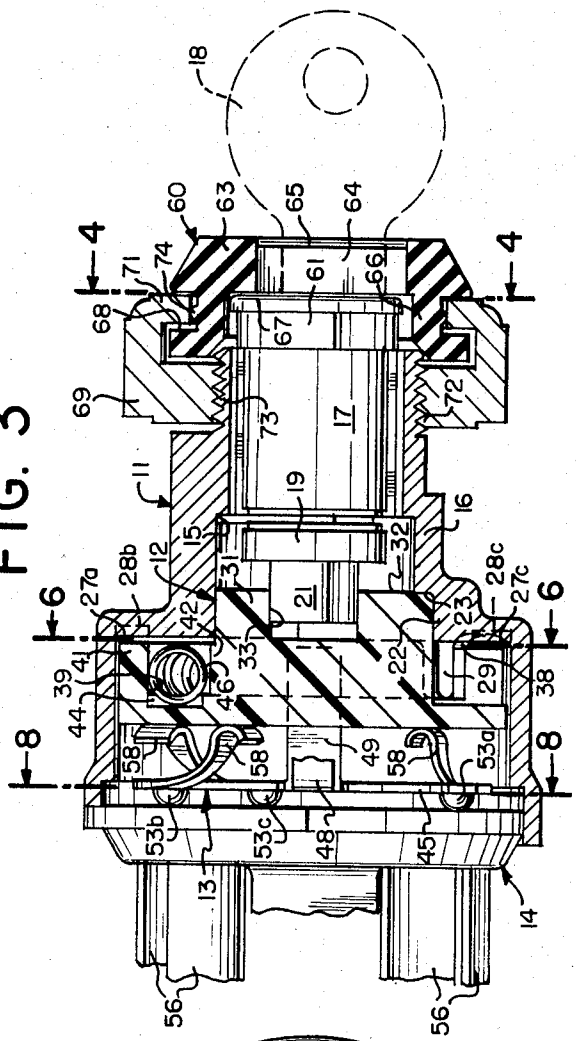
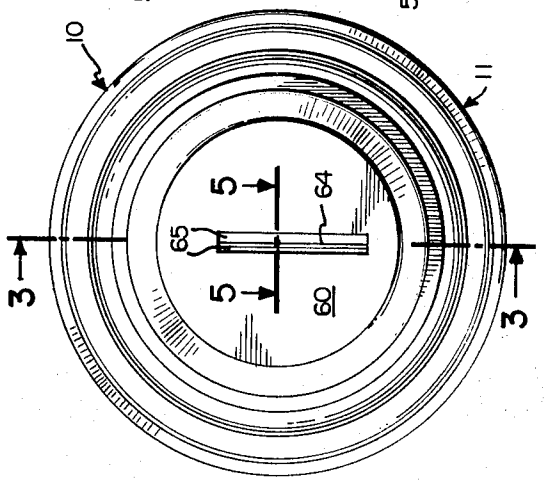


FIG. 2



INVENTOR.
MARTIN P. MILLER

BY

Darby & Darby

ATTORNEYS

FIG. 4

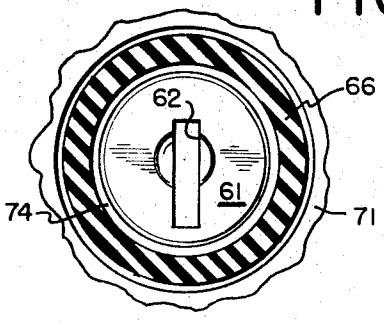


FIG. 5

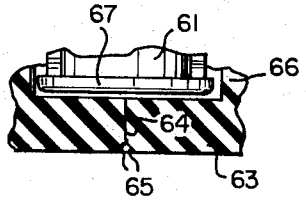


FIG. 6

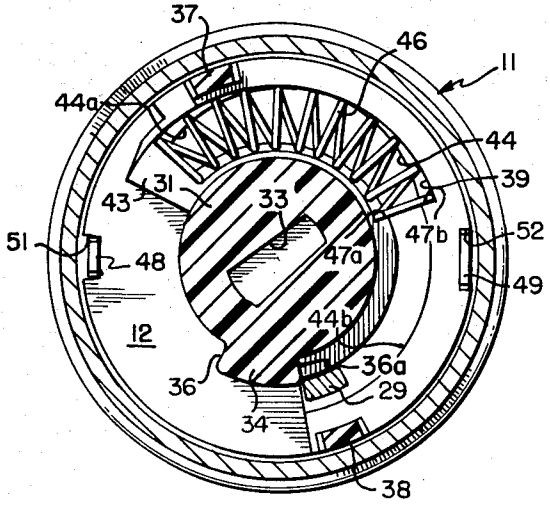


FIG. 7

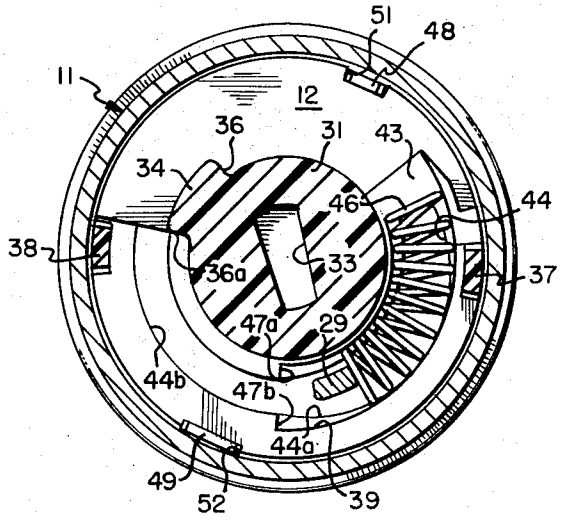


FIG. 8

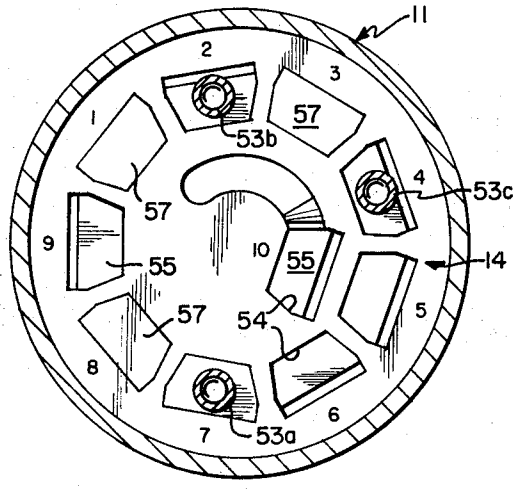
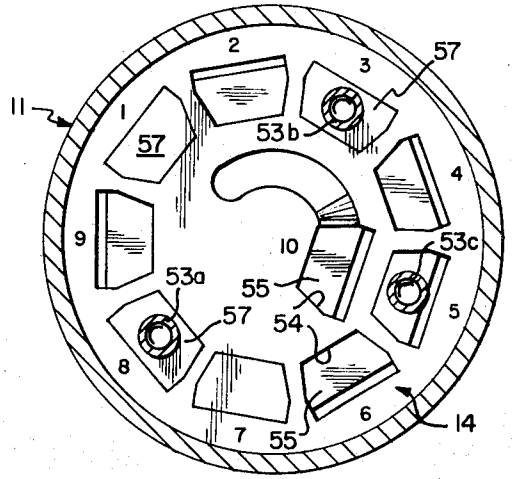


FIG. 9



INVENTOR.
MARTIN P. MILLER

BY

Darby & Darby

ATTORNEYS

FIG. 10

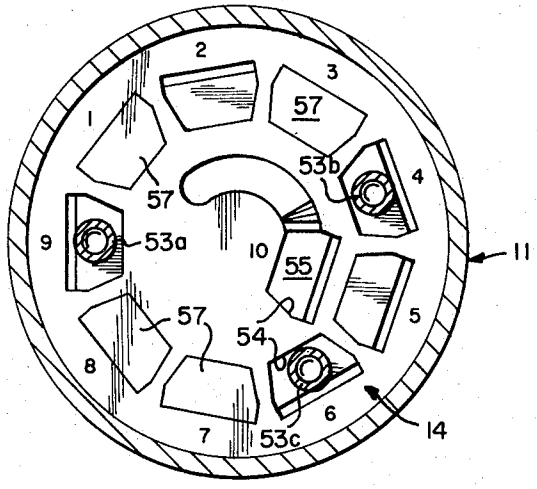
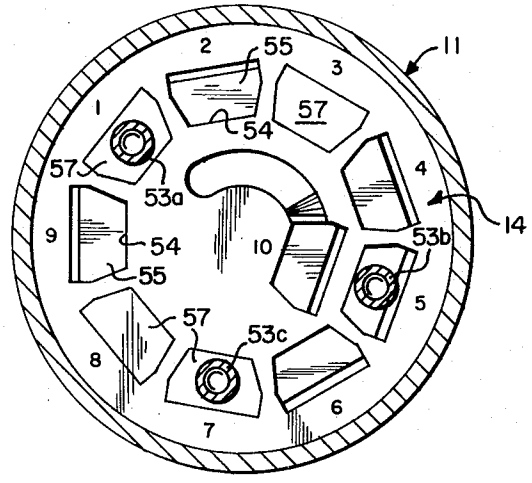


FIG. 11



INVENTOR.
MARTIN P. MILLER

BY

Darby & Darby

ATTORNEYS

SWITCH HAVING SPIDER-SHAPED CONTACT CARRIER

BACKGROUND OF THE INVENTION

The invention relates to switches, and in particular to movable contact shorting members interposed between and simultaneously engageable with fixed and movable switch components for the purpose of maintaining continuous electrical contact, with the former when the latter moves. The invention further relates to weather-proof enclosures for key-actuated switches having a tendency to become impaired by ambient foreign matter.

Heretofore switches of the present type have included contact shorting devices disposed between appropriate switch components, which devices have been biased for continuous electrical contact by means of a separate coil spring or the like. The spring is mounted between an electrically conductive component and an actuator member for the purpose of absorbing any fluctuation in the movement of the latter while maintaining continuous pressure on the former. Such an arrangement was found to be complex and necessitated intricate configurations for mounting and securing the spring in proper position. In addition, since only one spring was involved, pressure on the electrically conductive component was localized and non-uniform, with the result that certain contact areas of the component were less reliably engaging than others, therefore reducing the over-all efficiency of the switch.

Accordingly, the present invention provides for a contact shorting device which includes a contact plate having a plurality of integral spring fingers depending therefrom to bear against a proximal actuator member and to establish a continuous bias on the plate notwithstanding any fluctuating or reciprocating movement of the actuator. These fingers are located to insure that the bias is uniform across the plate, thereby to maximize the efficiency of the switch.

Certain switches, similar to the type described herein, are particularly designed for use with automobiles and the like, and more particularly may be used in connection with snowmobiles, dune-buggies, land-rovers, etc. which may be driven in adverse or other unusual environments. Key-actuated switches are especially vulnerable under such conditions, since ice, sand or dust particles may enter the access slot of the lock cylinder and prevent or interfere with the use of the key.

The present invention provides an open-ended enclosure or boot to fit over the exposed key-access portion of the switch and to be fastened to the switch in a substantially weather-proof seal. The boot contains a transverse portion to overlie the exposed area of the switch and has a slit extending through the transverse portion which is alignable with the key slot and which has resilient converging walls to form a substantially weather-proof seal. The walls are separable under pressure from the key and conform to the shape of the latter to maintain the seal. An annular groove may be provided near the open end to be engaged by an annular ledge projecting from a nut connectable to the switch housing. Where desirable the boot may rotate relative to the switch when the key is turned thus avoiding excessive deformity and maintaining the seal.

One object of the present invention is to provide a movable contact shorting member for a switch which member provides continuous and uniformly distributed pressure upon a plurality of fixed contact elements to maintain a reliable electrical contact.

Another object of the present invention is to provide a relatively simple and economical contact shorting member for a switch.

Still another object of the present invention is to provide a one piece contact shorting device for a switch.

A further object of the present invention is to provide an enclosure for the exposed portion of a key-actuated switch to protect the switch from fouling due to ambient foreign matter.

A still further object of the present invention is to provide a one-piece flexible enclosure for the exposed portion of a key-actuated switch.

Yet another object of the present invention is to provide an enclosure for the exposed portion of a key-actuated switch to maintain a substantially weather-proof seal when the key is inserted.

A still further object of the present invention is to provide an enclosure for the exposed portion of a key-actuated switch to maintain a substantially weather-proof seal when the key is turned.

BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding of the present invention, reference may be had to the accompanying drawings in which:

FIG. 1 is an exploded view of a key-actuated switch incorporating the movable contact shorting member of the present invention;

FIG. 2 is a front elevational view of a switch provided with the enclosure of the present invention;

FIG. 3 is a longitudinal cross sectional view of the switch of FIG. 1 shown in its assembled form;

FIG. 4 is a transverse cross-sectional view taken along the line 4—4 of FIG. 3;

FIG. 5 is a transverse cross-sectional view taken along the line 5—5 of FIG. 2;

FIG. 6 is a transverse cross-sectional view taken along the line 6—6 of FIG. 3 showing one switch position;

FIG. 7 is a view similar to that of FIG. 6 showing another switch position;

FIG. 8 is a transverse cross-sectional view taken along the line 8—8 of FIG. 3;

FIG. 9 is a view similar to that of FIG. 8, showing another switch position;

FIG. 10 is a view similar to that of FIG. 8 showing still another switch position;

FIG. 11 is a view similar to that of FIG. 8 showing the switch position of FIG. 7.

BRIEF DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings, and in particular to FIG. 1, there is illustrated a switch, generally indicated by reference numeral 10, which includes a housing portion 11, an actuator or driver rotor member 12, a contact shorting member 13 and a fixed contact member or base 14. The components 12-14 are operably interconnected, as will be described in detail below, and fit together within the housing 11 in the manner illustrated in FIG. 3.

Referring collectively to FIGS. 1 and 3, the housing 11 is a substantially hollow cylinder which is intended to contain the driver rotor 12 and the shorting member 13. The base 14 serves to close the open end of the housing 11 and to retain the driver rotor and shorting member therein. The other end of housing 11 contains a central bore 15 which passes through a substantially narrower cylindrical portion 16 within which may be disposed a conventional lock cylinder 17 actuated by a usual type of key 18. The lock cylinder may be of any convenient type, the central feature of which is a rotatable plug 19 which is operated by the key 18 in the usual way.

The inner end of the plug 19 contains a longitudinally directed lug 21 which may have a substantially pie-segment shaped cross-section. The axial bore 15 opens at the base of the housing 11 and, as shown in FIG. 1, the radius of this opening may vary. For example, there may be provided an arcuate offset portion 22 which forms a ledge or supporting surface 23, the purpose of which will be described below. Radially directed abutment surfaces 24 and 24*a* terminate this offset portion, and their purpose will likewise be explained below. The base of the housing portion 11 contains a substantially lateral surface 26 having a plurality of undulations forming rounded peaks 27*a*–27*d* which are located in predetermined areas adjacent the wall 25. For percent purposes these peaks are arranged so that one pair or set, 27*a* and 27*b*, is located diametrically opposite the other pair or set, 27*c* and 27*d*. Each

set of peaks defines a valley, one of which is indicated by reference numeral **28***a*, and the other by reference numeral **28***b*. These peaks and valleys form part of a detent mechanism, to be described in detail below, which aids in defining the various switch positions.

An integral promontory **29** may be located near one of the abutment surfaces **24** or **24***a* and, for purposes of the present embodiment, is illustrated as being near the abutment surface **24***a*. The promontory **29** extends longitudinally toward the open end of the housing **11**, and its function will be explained below. It is important to note that this configuration of the interior of the housing **11** as described is merely illustrative.

The driver rotor **12** is provided with a cylindrical promontory **31** having a substantially flat end surface **32** with an axial slot **33** which is engaged by the lug **21** of the lock cylinder **17**. Promontory **31** is also provided with a radially extending portion or stop **34**. The diameter of the promontory **31**, including the lateral dimension of the stop **34**, is slightly less than the diameter of the bore **15** so that the former may protrude into the bore **15** until the stop **34** engages the lateral ledge or support surface **23**. Radial edges **36** and **36***a* of promontory **31** are adapted to abut, respectively at either end position of the driver rotor **12**, against the radial surfaces **24** and **24***a* formed by the bore **15**. As shown in FIG. **3**, when the promontory **31** is inserted into the bore **15**, the lug **21** of the lock cylinder **17** extends into the slot **33** so that the driver rotor **12** will rotate with plug **19**.

The driver rotor **12** is also provided with a pair of knobs or bumps **37** and **38** which protrude longitudinally from diametrically opposite circumferential positions. These bumps, together with the undulations **27***a*–**28***b*, complete the detent mechanism. When the switch is assembled, the rotor is biased against the lateral surface **26**, in a way which will be described below, so that rotation of the driver rotor causes the bumps **37** and **38** to follow the configuration of the undulations **27***a*–**28***a*. Since peak positions are unstable, the valleys will determine the different switch positions.

The switch illustrated is designed particularly to provide four positions, although variations in switch design may be made to accommodate two, or three positions, depending upon the use to which the switch may be put. In the present switch, one of these positions is illustrated in FIGS. **1** and **3**, and may be designated for purposes of illustration as the first position. In the first position the bumps **37** and **38** engage the surface **26** at points respectively to the right and left of peaks **27***a* and **27***c*, the points of contact being defined by slight depressions **28***a* and **28***c*. This position is also characterized by contact between the radial edge **36***a* of the promontory **31**, and the corresponding abutment surface **24***a* within the bore **15**. When the key **18** is turned to rotate the drive lug **21** counterclockwise, as viewed from FIG. **1**, the bumps **37** and **38** respectively, of the driver rotor **12**, will leave the depressions **28***a* and **28***c* and ride over the peaks **27***a* and **27***c* to rest within valleys **28***b* and **28***d*. This position is relatively stable and defines a second switch position. If the key is turned farther, bumps **37** and **38**, respectively, will leave the valleys **28***b* and **28***d* and ride over the next successive set of peaks, **27***b* and **27***d* to define a third switch position. The fourth position of the present switch is described in greater detail below. The limit to the number of switch positions is defined by the arcuate length of the offset portion **22** of housing **11**, since one end position of the rotor **12** is determined by contact between the radial edge **36** of the stop **34** and the radial surface **24** of the housing **11**. The arc-length of the offset **22** may be varied depending upon the number of switch positions desired.

The driver rotor **12** is further provided with an arcuate trough **39** located adjacent the promontory **31** (FIGS. **1**, **6** and **7**). This trough may be formed in any convenient way including, for example, providing raised walls **41** and **42**. At least one end of the trough is closed with an abutment head **43**. A portion of the trough **39** is undercut to form a second trough or groove **44** which extends beyond the other end of trough **39** for a predetermined distance. The groove **44** is slightly narrower than the trough in the region of the latter, as indicated by reference numeral **44***a*, and is substantially narrower beyond the trough, as indicated by reference numeral **44***b*. Radial surfaces **47***a* and **47***b* are formed, therefore, at the junction. A coil spring **46**, having a diameter substantially equal to the width of the trough **39**, but greater than the width of the groove **44**, inhabits the trough **39**. The arcuate length of the spring is substantially equal to the length of the trough **39** so that when the spring is at rest one end lies against the head **43** while the other bears upon the radial surfaces **47***a* and **47***b*. The promontory **29** of the housing portion **11** extends into the groove **44** far enough to reach below spring **46** but not to the bottom of the groove. In the first position, shown in FIG. **6**, the promontory is located at one end of the groove **44** relatively far from the spring **46**. For each of the second and third positions the promontory **29** will have moved, relative to the rotor **12**, successively closer to the spring.

The fourth switch position is illustrated in FIG. **7**. The driver rotor **12** is rotated clockwise from the position illustrated in FIG. **6** until the radial edge **36** of the stop **34** comes into contact with the radial surface **24a** located within the bore **16**, but not shown in FIG. **7**. Since the driver rotor **12** has been rotated with respect to the housing **11**, the promontory **29** has moved along the groove **44** and partway into the trough **39**. As the promontory **29** moves into the trough, it presses against diametrically opposite points of the circular end of the spring and compresses the spring to store energy therein until the movement is stopped by contact between the radial edge **36** and the radial surface **24**. Because of the energy stored in the spring, this position is unstable and, upon release of the key **18**, the spring discharges its energy to return the driver rotor **12** to the nearest stable position, which, in the present switch, is the third position. The switch illustrated, therefore, is particularly useful in connection with automobiles and other vehicles in which the fourth position corresponds to starting the engine, and where it is essential for the starter circuit to de-energize once the engine has begun to run under its own power.

The contact shorting member **13** includes an abutment portion or contact plate **45**, from which a pair of polarizing arms or posts **48** and **49** (FIGS. **1** and **3**) depend toward the rotor **12** to engage corresponding slots or grooves **51** and **52**, respectively, formed in the perimeter of the rotor. The arms **48** and **49** may extend from diametrically opposite locations along the perimeter of the plate **45** and may have a dual function. When, for example, it is important for the shorting member **13** to be oriented in a particular way relative to the base **14**, the arms may have unequal width dimensions so that the shorting member and the rotor fit together in only one way. Since each arm is contained within its corresponding slot, the shorting member and rotor will turn together when the switch is operated. The arms **48** and **49**, therefore, serve both to orient the plate **45** vis-a-vis the base **14** and to connect the shorting member and rotor together so that rotational movement of the latter is transmitted to the former.

The contact plate **45** may be constructed of an electrically conductive material and may contain a plurality of contact portions or bumps **53**, seen best in FIG. **3**. Each of these bumps is arranged to make electrical contact, successively, with predetermined ones of a plurality of contact elements, defined below, which are carried by the base **14** and connected to an external circuit. It should be noted that providing the electrically conductive plate **45** with contact bumps **53** is only one way to utilize the advantages of the present invention, and that modifications may be made in the configuration or pattern of the contact portions, where desired.

The base **14** may be provided with a plurality of slots **54** arranged in a substantially circular pattern, as shown in FIG. **1**. Each of the slots may have a substantially polygonal depression **55** associated with it, and these slot-depression combinations have been indicated, for purposes of illustration only, by reference numerals **1** through **10**. The purpose of these depressions is to provide means for anchoring to the base a

plurality of contact tabs **56** which may be inserted through the slots **54** and crimped over to fit into a depression so that a relatively flat surface **57** of each of the tabs may be exposed to the contact bumps **53**. For present purposes, contact tabs **56** have been connected to the base **14** at slot-depression combinations **1, 3, 7** and **8** (FIG. **1**), although it should be understood that others may be utilized, or not, as desired.

In operation, the contact plate **45** serves as a shorting member electrically connecting two or more of the contact tabs **56**. When, for example, appropriate contacts are engaged by the bumps **53**, current may flow through the plate **45** from one tab to another to energize predetermined circuit components. As the plate is rotated, different tabs may be engaged to achieve different results. Since for present purposes the plate **45** is arranged to be rotated relative the base **14**, the slots **54** and depressions **57** are arranged in a circular pattern, although it is to be understood that the number, configuration and arrangement of both the stationary contacts and the contact bumps may be varied as desired.

As has been mentioned above, operation of the switch induces a slight axial movement in the rotor **12** relative to the base **14** when the former passes over one or more of the peaks **27***a* – **27***c*. In operation, the contact bumps of plate **45** must remain in continuous contact with the base, and therefore plate **45** is mounted independently of this reciprocating motion. The arms **48** and **49**, for example, are slidable longitudinally in their respective slots **51** and **52** so that the rotor may move in one direction, longitudinally, without affecting the shorting member **13**, while transmitting its movement in a second direction, e.g. rotationally, to the shorting member, as has been described above. To provide for continuous contact between the plate **45** and the base **14** notwithstanding the longitudinal or reciprocating movement of the rotor relative to the base, a plurality of spring fingers **58** are connected to the plate **45** (preferably being integrally formed therewith) and protrude substantially longitudinally to bear against the rotor **12**. In the assembled position illustrated by FIG. **3**, the rotor presses against the ends of the fingers **58** to urge the plate **45** and therefore its protruding bumps into contact with the corresponding electrically conductive surfaces **57** on the base **14**. The force produced by the spring fingers also serves to bias the rotor against the lateral housing surface **26**, as described above. Any reciprocating motion of the rotor relative to the plate which results from turning the key **18** will be absorbed by the spring fingers **58** which apply a continuous pressure to the plate **45** so that the bumps **53** maintain continuous electrical contact with the surfaces **57**.

The fingers **58** may be formed from arcuate portions of the plate **45**, and may be located at its perimeter. In this instance, the length of each finger is measured by approximately 70° of arc length. The free end of each finger is curved as indicated by reference numeral **59**, to provide a convex portion for contact with the rotor **12** to minimize any friction resulting from slight lateral movement occurring when the finger is flexed. Each finger contains a further bend or curved portion so that its flection will result in a longitudinal force being applied between the plate **45** and the rotor. It should be noted that forming the fingers **58** from arcuate portions of the plate **45** is only one way to implement the present invention, and that any longitudinally extending fingers or arms capable of supplying a longitudinal bias between the plate and the rotor will suffice.

The number of fingers in the embodiment illustrated is three. It has been found that in general the electrical contact between the bumps **53** and the tabs **56** is most efficient when there is one spring finger associated with each bump. For example, in the embodiment shown in FIG. **1**, each bump is located substantially at the juncture between the plate **45** and a spring finger **58**. In this way, pressure is substantially uniform across each of the bumps so that continuous and effective electrical contact may be maintained. The number of fingers may be varied, however, along with the number of bumps. In the event that more than three contact bumps become necessary, it may not be feasible to provide one finger for each bump. In such a circumstance it may be preferable to arrange the fingers so that the pattern formed by the location of each finger describes a substantially regular polygon having its center substantially at the center of the plate **45**. Where each finger is equidistant from each adjacent finger and from the center of the plate, the pressure applied by the finger to the plate is uniformly distributed across the plate to maximize the efficiency of the electrical contact between the plate **45** and the base **14**.

If necessary, insulation may be provided at the edge of the contact shorting member **13**, or at any other convenient and effective location, to avoid electrical contact between the member and any proximal conductive surfaces, other than those associated with the base **14**. In this regard, the rotor **12** is generally constructed of a substantially electrically inert material.

The present switch is preferably used in connection with a magnetoelectric device such as may be used for starting the engines of certain types of vehicles, namely, snowmobiles, and the like. Accordingly the switch position illustrated in FIG. **8**, **9** and **10**, are particularly adopted for such use, but it should be understood that the invention is not limited to the specific configuration shown. For present purposes, the contact tabs **56** have been anchored to the base **14** at the slot-depression combinations **1, 3, 7** and **8** shown in FIG. **1**. Contact plate **45** has been provided with three contact bumps **53** to engage successively certain combinations of the contact surfaces **57**. For example, the position shown in FIG. **8** may be arbitrarily designated as the "off" position. The orientation of the switch components in the drive mechanism for the "off" position is shown in FIG. **6**, while FIG. **8** depicts the orientation of the electrical components. In this position the coil of the magnetoelectric device is grounded, and the position may be characterized by contact between at least one bump **53***a* and one base contact, illustratively designated by reference numeral **7**. In this arrangement, the contact plate **45** may itself serve as a ground, although it should be understood that the bumps **53** could be arranged to contact at least two base contacts for this purpose, if necessary.

The second switch position is shown in FIG. **9**, and may be arbitrarily designated as "run with lights." In this position the engine of the vehicle is running under its own power and an electrical circuit is established between the battery and the headlamps by contact between at least two base contacts and a corresponding pair of the contact bumps. Bump **53***a* has moved to engage base contact **8** while bump **53***b* engages base contact **3** to close the circuit. The third bump **53***c* may not be necessary in this switch position and accordingly is shown disengaged from any base contact.

The third switch position is shown in FIG. **10**, and may be designated as "run without lights." In this position the engine is running under its own power and since there are no electrical accessories operating, it is not necessary for the contact bumps to engage any of the base contacts.

The fourth switch position is shown in FIG. **11**; and may be termed the "start" position. In this position the battery is connected to the coil of the magnetoelectric device and the engine of the vehicle is started in the usual way. The bump **53a** engages the base contact **1**, while bump **53***c* is in contact with the base contact **7** to close the circuit. As described above in connection with FIG. **7**, which depicts the orientation of the drive components for the "start" position, this position is unstable, and upon release of the key **18**, the switch returns to the previous position, or "run without lights," for normal daytime operation of the vehicle.

In the present switch, each of these switch positions is reached by turning the key **18** continuously in one direction beginning with the "off" position and ending with "start." This arrangement is presented only by way of example however, since the number and continuity of the switch positions may vary, as has been mentioned above, depending upon the circuit requirements.

The switch described herein may be employed in connection with snowmobiles and other vehicles, the instrument panels of which are often exposed to harsh weather conditions, such as snow, freezing rain, ice, etc. This type of switch may also be used in dune buggies and may be exposed therefore to salt water spray, sand particles and other foreign objects. A common problem with such exposure is that snow or rain may enter the key slot and freeze, thereby jamming the lock. Similar results may obtain from prolonged exposure to salt spray and sand which have the tendency to corrode and block the lock cylinder. The same situation often occurs with respect to conventional automobile door locks which are exposed to a full spectrum of weather conditions and may be easily impaired with ice or other foreign matter.

Accordingly, the invention contemplates an open-ended enclosure or boot **60**, seen in FIGS. **1** through **5**, to encompass the exposed lateral member or portion **61** of the lock cylinder **17** which contains a key slot **62**. It is important to note that while the boot **60** is shown in connection with a particular switch, it is not intended to be limited to such use, and may be adapted to and used with any appropriate lock mechanism.

The boot **60** may be substantially cylindrically shaped and is constructed of a generally flexible material, such as pure gum rubber, which will maintain its flexibility to a temperature of approximately −40° Fahrenheit. Silicone rubber may also be used but is somewhat expensive. A generally transverse portion **63** is arranged to overlie the slotted portion of the lock mechanism, and it contains a slit **64** extending completely through it and which is alignable with the key slot **62**. The walls of the slit **64** are resilient and converge, in the absence of the key **18**, to form a substantially weatherproof seal. When the key is inserted these converged walls separate to admit the key toward the slot **62**. The resiliency of the material forming the side walls of the slit **64** causes the walls to grip the key and to serve substantially to wipe water and other foreign matter from the key before it reaches the cylinder slot **62**. A further advantage is that the side walls tend to conform to the shape of the key while the key is in place, thus continuing the weatherproof seal.

It should be noted that the passage **64** need not be limited to a slit and may take on any configuration consistent with the type of key required by the lock cylinder, provided that its side walls conform to a suitable seal both in the absence and the presence of the key.

The outer edges of the passage **64** may be beveled, as indicated by reference numeral **65**, to aid in inserting the key, so that the passage is quickly locatable and accessible.

The open end of the boot **60** is adapted to fit over the lateral portion **61** of the lock cylinder **17**. In general, side wall **66** of the boot will extend for a certain distance, depending upon the configuration of the protected mechanism, alongside the cylinder **17**, although it should be noted that this need not occur, especially for example where the switch housing covers the lock cylinder to a greater extent than that shown herein. The boot may be fastened to the switch mechanism in several ways. A known type of friction grip acting behind a lip **67** on the cylinder **17** would be sufficient to provide a satisfactory seal. The cylinder slot **62** would thereby be protected from ambient foreign matter. This arrangement would be sufficient where the shaft of the key **18** is cylindrical and no rotational forces are transmitted to the boot when the key is turned.

Where the more usual type of flat key is turned, however, a rotational force will be applied to the boot causing a deformation which may break the seal and allow foreign matter to enter. Accordingly, the invention provides for the boot to rotate with the key. This may be accomplished by providing an annular groove **68** in the lateral exterior surface of the side wall **66** of the boot near the open end. A cylindrical nut **69** having an annular and radially projecting ledge or lip **71** to engage the groove **68** may be either frictionally mounted on the lock cylinder **17** or have a threaded portion **72** to engage with a corresponding threaded portion **73** on the housing **11**. The width of the lip **71** is slightly less than the width of the groove **68** so that the boot is free to rotate relative to the nut **69** and to the lock cylinder **17**.

The inner lateral surface of the groove **68** is provided with an annular projection **74** having a substantially convex cross section. The area of contact between the lip and the boot is therefore minimized to reduce friction, although there is sufficient frictional force to maintain alignment between the slit **64** and the slot **62** in the absence of the key **18**.

It should be noted that, although the lip **71** and the boot do not connect in a tight seal, the opportunity for ambient foreign matter to enter the lock cylinder **17** is minimized by the continuous contact between the projection **74** and the lip **71**. Ice forming in the groove **68** will likewise have a minimal inhibitive affect, owing to the inherent flexibility of the material from which the boot is formed.

It will be understood that the invention relates to movable electrical components and weather-proof enclosures adapted for multi position or key-operated electrical switches. The particular switch disclosed herein has been described by way of example only and the foregoing detailed description is intended to facilitate understanding of the invention by demonstrating its interrelationship with one appropriate environment.

What is claimed is:

1. In a switch having a first member and a second member movable relative thereto to a plurality of switch positions, the first member having a plurality of fixed contact elements, the improvement which includes a movable contact shorting device comprising: a substantially spider-shaped member having an upper body portion engaging the first member of the switch, and a plurality of spring fingers depending from said body portion to bear against the second member of the switch, said spider member being adapted to be rotated by the second member about an axis perpendicular to said body portion and having a plurality of electrically interconnected contact nodules protruding from said body portion toward the first member of the switch, each of said nodules engaging a corresponding one of the fixed contact elements to complete a circuit when the switch is in one switch position, and disengaging said contact elements to break said circuit as the second member is moved toward another switch position.

2. The device as recited in claim **1** wherein the number of said contact nodules and said spring fingers is three.

3. The device as recited in claim **1** wherein the distal ends of each of said spring fingers is upturned to form a substantially rounded surface area for engagement with the second member of the switch.

4. The device as recited in claim **1**, wherein the number of said contact nodules is equal to the number of said spring fingers.

5. The device as recited in claim **1**, wherein each of said contact nodules is located respectively adjacent the point from which each of said fingers extends from said body portion.

6. The device as recited in claim **1** wherein each of said spring fingers is substantially equidistant from fingers adjacent thereto, and all of said spring fingers are symmetrical about the center of said body portion.

7. The device as recited in claim wherein each of said spring fingers is formed from an integral part of said body portion.

8. The device as recited in claim **7** wherein each of said spring fingers is formed from an arcuate portion of said body portion.

9. The device as recited in claim **8** wherein each of said arcuate portions is located along the perimeter of said body portion.

10. The device as recited in claim **9** wherein the number of said fingers is three and each of said arcuate portions is measured by substantially **70°** of arc length.

11. The device as recited in claim **1**, wherein said body portion is electrically conductive, and each of said contact nodules comprises an integral substantially convex protuberance on said body portion.

12. The device as recited in claim 1, which comprises, in addition, polarizing means connected to said body portion for orienting said nodules relative to the fixed elements.

13. The device as recited in claim 12 wherein said polarizing means comprises a pair of arms integral with said body portion and extending from diametrically opposite locations on the perimeter of said body plate, the arms having unequal width dimensions and being engageable with said second member.

* * * * *