Jan. 25, 1949. W. Z. WEST, JR., ET AL. 2,459,984

CENTRIFUGAL FORCE OPERATED SWITCH

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FIG. 1.

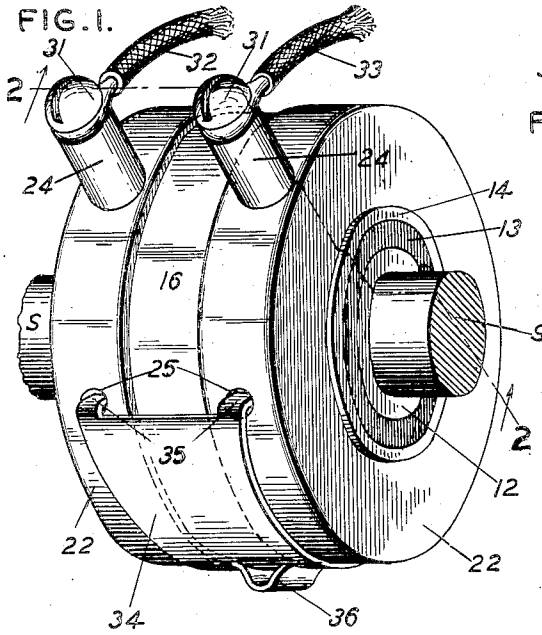


FIG. 2.

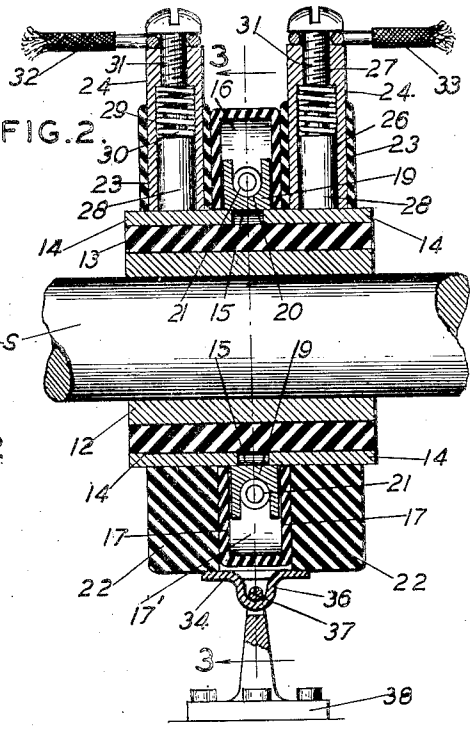


FIG. 3.

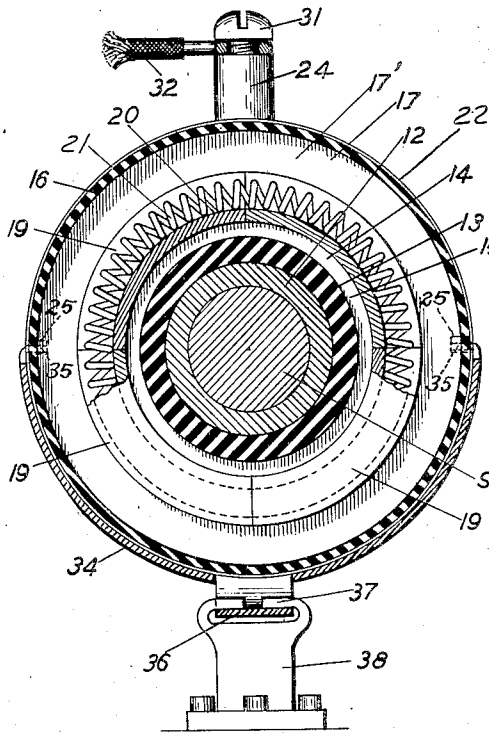
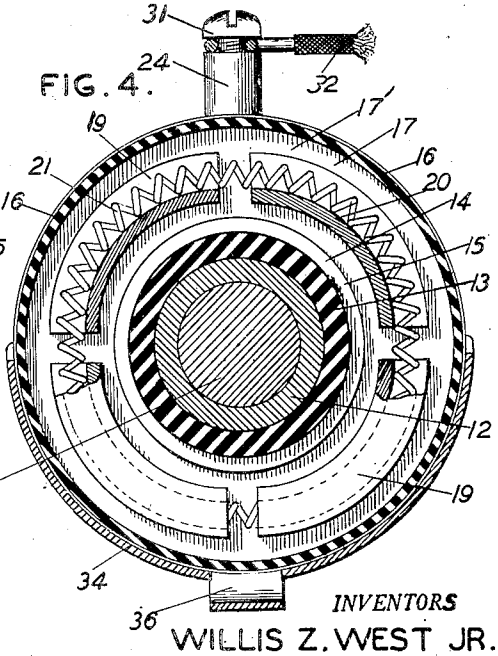


FIG. 4.



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FIG. 6.

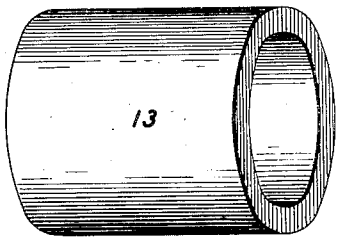


FIG. 5.

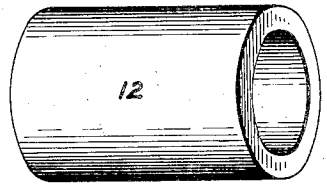


FIG. 7.

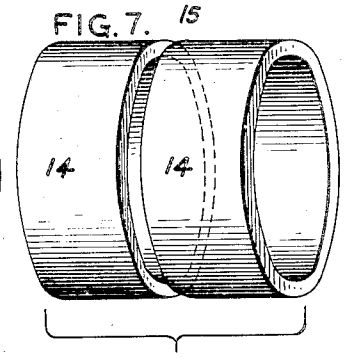


FIG. 8.

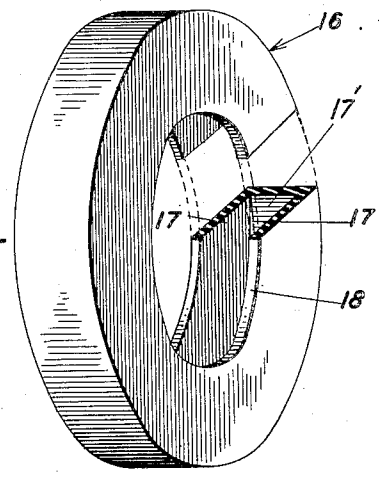


FIG. 9.

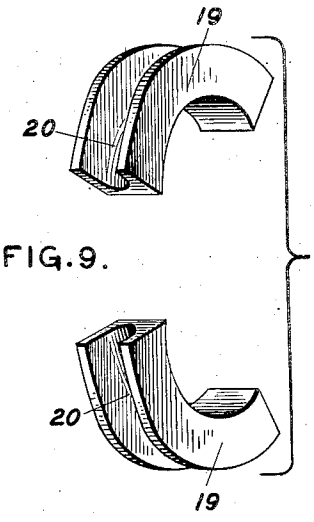


FIG. 10.

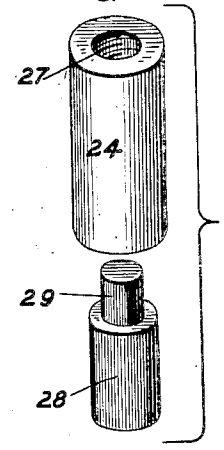
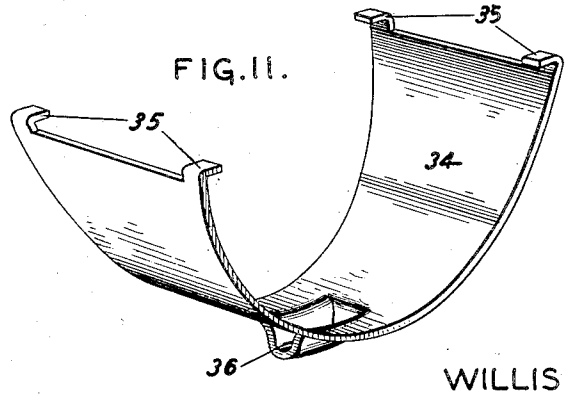


FIG. 11.



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CENTRIFUGAL FORCE OPERATED SWITCH

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Application February 13, 1947, Serial No. 728,350

7 Claims. (Cl. 200—80)

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Our invention relates to a switch of the type actuated by centrifugal force.

An important object of our invention is to provide a switch of the character mentioned, to be mounted upon the armature shaft of a motor, and having means for electrically connecting the switch terminals when the armature shaft is at rest, or rotating slowly, and to break the electrical connection between the terminals when the rotational speed of the armature shaft increases.

A further object of the invention is to provide a centrifugal force actuated switch which is extremely simplified in design, constituting a completely self-contained unit, well adapted for installation without adjustment, thereby dispensing with the necessity of the services of a skilled mechanic.

A further object of the invention is to provide a normally closed switch, having mechanical means actuated by centrifugal force for opening the switch.

A further object of the invention is to provide a switch which is adapted to operate properly when mounted upon the armature shaft of a motor, irrespective of the position which such armature shaft assumes.

A still further object of the invention is to provide a switch of the above mentioned character, which is designed to be strong and durable, thereby enabling it to have an exceptionally long and useful life.

Other objects and advantages of the invention will be apparent during the course of the following description.

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

Figure 1 is a perspective view of an assembled switch embodying our invention, and showing the same applied to the armature shaft of a motor, parts omitted,

Figure 2 is a central vertical section taken on line 2—2 of Figure 1, and showing a stationary holding bracket,

Figure 3 is a vertical transverse section taken on line 3—3 of Figure 2,

Figure 4 is a vertical transverse section, similar to Figure 3, and showing the switch in the open position,

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Figure 5 is a perspective view of a metal sleeve,

Figure 6 is a perspective view of an insulating sleeve,

Figure 7 is a perspective view of slip rings,

Figure 8 is a perspective view of an annular housing, part in section,

Figure 9 is a perspective view of conducting segments,

Figure 10 is a perspective view of a carbon brush and brush holder, and,

Figure 11 is a perspective view of a brush holder ring bracket.

In the drawings, where for the purpose of illustration, is shown a preferred embodiment of our invention, the numeral 12 designates a cylindrical tubular bushing or sleeve, preferably formed of steel, or the like. This sleeve 12 is shown in the drawings as being rigidly mounted upon the armature shaft S of a motor, and having a press fit thereon. Rigidly mounted upon the outer surface of the sleeve 12, and having a tight press fit thereon, is a cylindrical tubular insulating sleeve 13, formed of a suitable insulating material, such as fiber, plastics, or the like. The insulating sleeve 13 and the metal sleeve 12 are of the same length, and their ends are flush. Rigidly mounted upon the insulating sleeve 13 are contact or slip rings 14, formed of any suitable electrical conducting material, such as copper or steel. These slip rings 14 have a tight press fit upon the insulating sleeve 13, and their outer ends are flush with the ends of the sleeves 12 and 13. The slip rings 14 may be staked in place upon the insulating sleeve 13, if desired, to further assure an integral assembly of the sleeves 12 and 13 with the slip rings. The slip rings 14 are of the same length, and their inner ends are spaced apart, forming an annular passage or groove 15 between them, at the longitudinal center of the sleeve 12. The numeral 16 designates an annular ring or housing, formed of suitable insulating material. This annular housing 16 includes a circumferential wall and parallel annular ends 17, formed integral therewith, and forming an annular recess 17'. The annular housing 16 has a main axial opening or bore 18, for receiving the adjacent inner ends of the

slip rings 14, and the slip rings have a press fit within this bore, for causing the annular housing 16 to rotate with them. The ends 17 of the annular housing 16 are arranged equidistantly upon opposite sides of the groove 15.

Arranged within the annular recess 17' of the housing 16, are a plurality of circularly curved current conducting segments 19, having circumferential grooves 20 provided therein. The conducting segments 19 are preferably four in number, and when they are disposed inwardly, and in engagement with the inner ends of the slip rings, they constitute a substantially continuous annular conducting element, see Figure 3. The conducting segments 19 have free sliding engagement between the ends 17 of the annular housing 16, and are adapted to move radially within the annular recess 17'. Arranged within the circumferential grooves 20 of the segments 19, is an annular helical extension spring 21. This annular spring 21 holds the conducting segments 19 in the innermost position, as shown in Figures 2 and 3, and in engagement against the inner ends of the slip rings 14, see Figure 2. This is the position of the conducting segments 19 when the switch is in its normally closed condition.

The numeral 22 designates annular brush holder rings, slidably mounted upon the slip rings 14, and arranged upon opposite sides of the annular housing 16, in close spaced relation thereto. The brushing holder rings 22 are free to rotate with respect to the housing 16. The brush holder rings 22 are formed of a suitable insulating material, and are of slightly larger outside diameter than the annular housing 16, see Figure 1. Each brush holder ring 22 has a cylindrical radial opening 23 formed therein, for receiving in tight press fit engagement a cylindrical tubular brush holder 24. Each brush holder ring 22 is further provided with a pair of small diametrically oppositely arranged openings 25, for a purpose to be described. These openings 25 are preferably arranged at right angles to the axis of the opening 23. Each brush holder 24 is preferably formed of copper, or the like, and has a main cylindrical opening 26 formed in its inner end and this opening 26 leads into a smaller screw threaded opening 27, which extends through the outer end of the brush holder. Arranged within each main opening 26, is a cylindrical carbon brush 28, having a small outer cylindrical extension 29. Each brush 28 is free to move radially within the recess 26. Also disposed within each recess 26 is a small helical compression spring 30, preferably formed of a copper alloy, or the like. Each spring 30 engages over the cylindrical extension 29 of the brush 28, and the inner end of the spring engages against the outer end of the cylindrical brush 28. The outer end of each spring 30 engages against outer end of the main opening 26, and the spring forces its associated brush 28 radially inwardly, to hold the same in contact against outer periphery of the adjacent slip ring 14. Each screw threaded opening 27 receives a binding post or terminal screw 31, under the heads of which may be connected the ends of the wires 32 and 33, to be connected to the terminals of the switch. Each terminal screw 31 is electrically connected with its associated brush 28, through the spring 30, and also through the brush holder 24.

Disposed upon the external cylindrical surfaces of the brush holder rings 22, and spaced slightly radially from the annular housing 16 (see Figure 2), is a substantially semi-cylindrical or

U-shaped bracket 34. The bracket 34 is preferably formed of sheet metal, and it therefore possesses a required degree of resiliency, permitting it to be mounted upon the brush holder rings 22. The bracket 34 has diametrically oppositely disposed and laterally spaced pairs of radial extensions or fingers 35 at its ends, and formed integral therewith. These fingers 35 engage within the small openings 25 of the brush holder rings 22, and thereby secure the rings 22 together, as a unit, which is slidable or rotatable upon the slip rings 14. The bracket 34 prevents axial movement of the brush holder rings 22 upon the slip rings. The bracket 34 is spaced radially outwardly from the annular housing 16, sufficiently to allow the housing to rotate freely with the sleeve 12, and associated elements. The bracket 34 is provided with a depending or radial knuckle 36, spaced equidistantly from its ends; and this knuckle 36 receives portions or extensions 37 of a suitable stationary holding device or bracket 38, which is rigidly secured to the associated motor casing, not shown.

The operation of the switch is as follows:

The sleeve 12 is applied to the armature shaft S of a motor. The motor may be of the split phase type, or of the capacitive type. The split phase motor has a starting stator winding, and a running stator winding. As is well known, in starting a motor of this type, the current is first supplied to the starting and running stator windings, and when the motor speed increases, the current to the starting stator winding is cut off. The present switch is employed to supply current to the starting stator winding, to start the motor, and to cut the current off when the motor speeds up.

When the motor armature shaft is at rest, the switch embodying this invention is in the normally closed position, Figure 3. The annular spring 21 forces the conducting segments 19 radially inwardly and against the inner spaced ends of the slip rings 14, thus closing the circuit between these rings, and supplying current to the starting stator winding. The starting winding is, of course, connected into the circuit by means of the wires 32 and 33. As the speed of the armature shaft S increases, the unit including the slip rings 14 has its rotational speed correspondingly increased, and the conducting segments 19 are thrown radially outwardly, within the annular housing 16, by centrifugal force. The segments 19 move outwardly against the force of the spring 21, and assume positions as shown in Figure 4 of the drawings. The conducting segments are now out of electrical contact with the slip rings 14, and the circuit through these rings is broken. The starting stator winding is now cut out of the circuit, and remains cut out as long as the motor remains up to speed.

The switch is a completely self contained unit, as all the parts are permanently assembled, when the sleeve 12 is pressed on to the armature shaft S. The knuckle 36 of the bracket 34 is secured to the stationary holding bracket 38, and the wires 32 and 33 are connected to the terminal screws 31. These are the only manipulations which need be made, and they do not require the services of a skilled mechanic or electrician. It is entirely immaterial what radial positions the brush holders 24 assume, with respect to the slip rings 14. Since the brushes 28 are arranged longitudinally exteriorly of the annular housing 16, there is no tendency for the switch to short circuit across the inner ends of the slip rings, due to

carbon dust, or the like. Further, the brushes 28 are enclosed, and there is substantially no tendency for sparks to be produced, due to improper contact between the brushes and slip rings, if improper contact should occur. By virtue of the brush holder rings 22 slidably rotatably engaging the slip rings 14, these rings are kept clean for proper contact with the brushes 28. The switch is extremely simple in construction, strong and durable; it comprises few parts, and these are not liable to derangement.

It is to be understood that form of our invention herewith shown and described, is to be taken as a preferred example of the same, and that various changes in the shape, size, and arrangement of parts may be resorted to, without departing from the spirit of our invention, or the scope of the subjoined claims.

Having thus described our invention, what we claim is:

1. A centrifugal force actuated switch, comprising axially spaced slip rings to be mounted upon the armature shaft of a motor, means to insulate the slip rings from such armature shaft, an annular insulating housing mounted upon the slip rings to rotate therewith and to bridge the space between the same and providing an annular recess, conducting segments arranged within the annular recess and adapted to move radially therein, an annular spring arranged within the annular recess and engaging upon the conducting segments to hold the same in electrical contact with the spaced slip rings, brush holder rings slidably mounted upon the slip rings axially outwardly of the annular housing, brush holders carried by the brush holder rings, and brushes arranged within the brush holders for engagement against the slip rings.

2. A centrifugal force actuated switch, comprising a sleeve to be pressed on to the armature shaft of a motor to rotate therewith, an insulating sleeve rigidly mounted upon the sleeve, axially spaced slip rings rigidly mounted upon the insulating sleeve flush with the outer ends of the insulating sleeve and sleeve and forming an annular recess between their inner ends, an annular insulating housing mounted upon the slip rings for rotation therewith and covering the annular recess, circularly curved conducting segments disposed within the annular housing and adapted to move radially outwardly when acted upon by centrifugal force, resilient means associated with the annular housing and engaging the conducting segments to counteract the effect of centrifugal force, brush holder rings slidably mounted upon the slip rings upon opposite sides of the annular housing, brushes mounted upon the brush holder rings to slidably engage the slip rings while the same rotate, and a U-shaped bracket mounted upon the brush holder rings to secure the rings together as a unit and to hold the rings against rotation while the armature shaft rotates.

3. A centrifugal force actuated switch, comprising axially disposed slip rings having their inner ends spaced, means to support the slip rings and to insulate the same, an annular insulating housing mounted upon the slip rings for rotation therewith and covering the inner spaced ends of the slips rings and providing an annular recess adjacent to the inner spaced ends of the rings, electrical conducting elements arranged within the annular recess and adapted to move radially therein when acted upon by centrifugal force, yielding means associated with the annular housing and engaging the conducting elements to oppose the effect of centrifugal force upon the conducting elements, brush holders arranged outwardly of the annular housing and mounted upon the slip rings, brushes carried by the brush holders and engaging the slip rings, yielding means associated with the brush holders to move the brushes inwardly, and a bracket mounted upon the brush holders and spaced from the annular housing to secure the brush holders together as a relatively stationary unit.

4. A centrifugal force actuated switch, comprising axially disposed slip rings having their inner ends spaced apart, means to support the slip rings and to insulate the same, an annular insulating housing mounted upon the slip rings for rotation therewith and covering the inner spaced ends of the slip rings and providing an annular recess, an electrical conducting element arranged within the annular recess and adapted to move radially therein when acted upon by centrifugal force, yielding means associated with the annular housing and engaging the conducting element to oppose the effect of centrifugal force, brush holders arranged axially outwardly of the annular housing and slidably mounted upon the slip rings, brushes carried by the brush holders and engaging the slip rings, springs arranged within the brush holders and engaging the brushes to move the same inwardly, a cylindrically curved bracket mounted upon the brush holders and spaced radially from the annular housing to secure the brush holders together as a unit, and means including a projection integral with the bracket for holding the unit stationary relative to the slip rings.

5. A centrifugal force actuated switch, comprising a rotatable insulating sleeve, axially spaced slip rings mounted upon the sleeve, an insulating housing having opening means to receive parts of the slip rings and rotatable therewith, parts of the slip rings being uncovered within the housing, a radially movable conducting element mounted within the insulating housing to co-act with the slip rings, resilient means to oppose the outward radial movement of the conducting element, brush holder members having openings for rotatably receiving the slip rings and disposed upon opposite sides of said housing, and brushes carried by the brush holder members to engage the slip rings.

6. A centrifugal force actuated switch, comprising a rotatable insulating sleeve, axially spaced slip rings mounted upon the sleeve, an insulating housing having opening means to receive parts of the slip rings and rotatable with the slip rings, parts of the slip rings being uncovered within the housing, a radially movable conducting element mounted within the insulating housing for coaction with the slip rings, resilient means to oppose the outward radial movement of the conducting element, brush holder members having openings for rotatably receiving the slip rings and disposed upon opposite sides of said housing, brushes carried by the brush holder members to engage the slip rings, and means to prevent the outward axial movement of the brush holder members.

7. A centrifugal force actuated switch, comprising axially disposed slip rings having their inner ends spaced apart, means to support the slip rings and to insulate the same, an annular insulating housing mounted upon the slip rings for rotation therewith and covering the inner spaced ends of the slip rings and providing a recess, an electrical conducting element arranged

within the recess and adapted to move radially therein when acted upon by centrifugal force, yielding means associated with the annular housing and engaging the conducting element to oppose the effect of centrifugal force, brush holders arranged axially outwardly of the annular housing and slidably mounted upon the slip rings, brushes carried by the brush holders and engaging the slip rings, springs arranged within the brush holders and engaging the brushes to move them inwardly, and a bracket mounted upon the brush holders to secure them together as a unit.

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The following references are of record in the file of this patent:

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