R. VARLEY.

ELECTRICAL SWITCH DEVICE.

APPLICATION FILED NOV. 15, 1920.

1,438,003.

Patented Dec. 5, 1922.

2 SHEETS—SHEET 1.

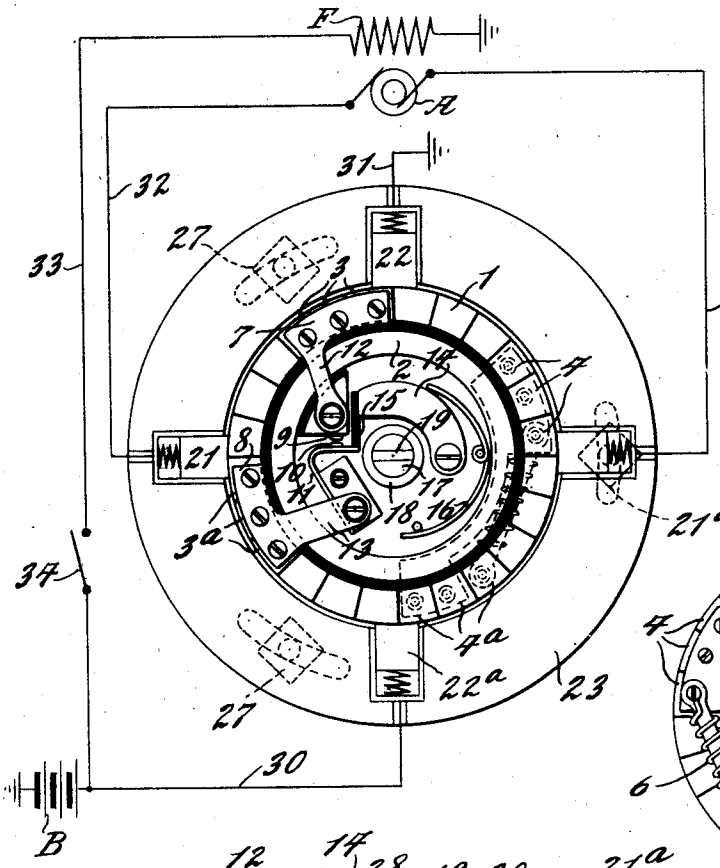

Fig. 1.

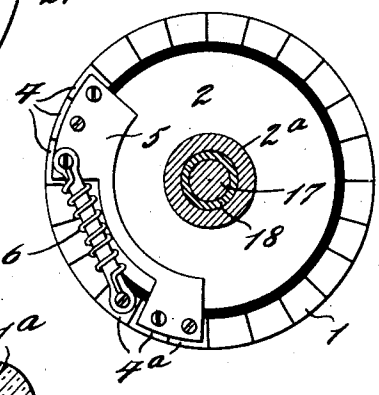

Fig. 3.

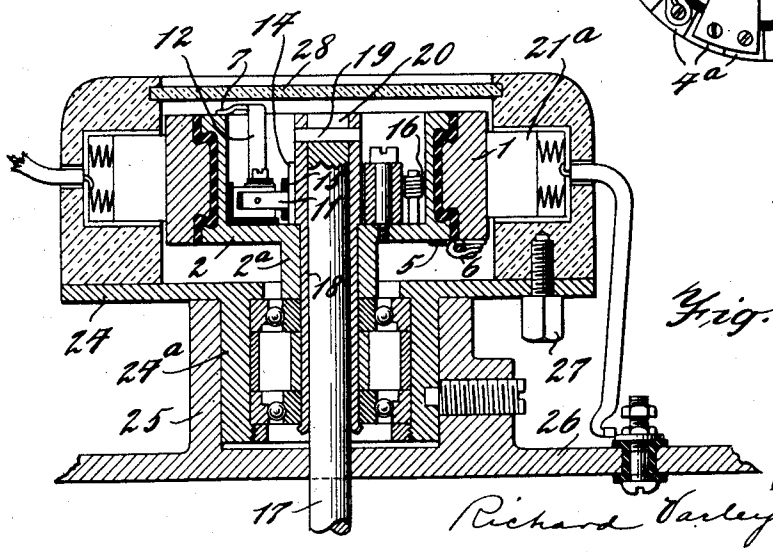

Fig. 2.

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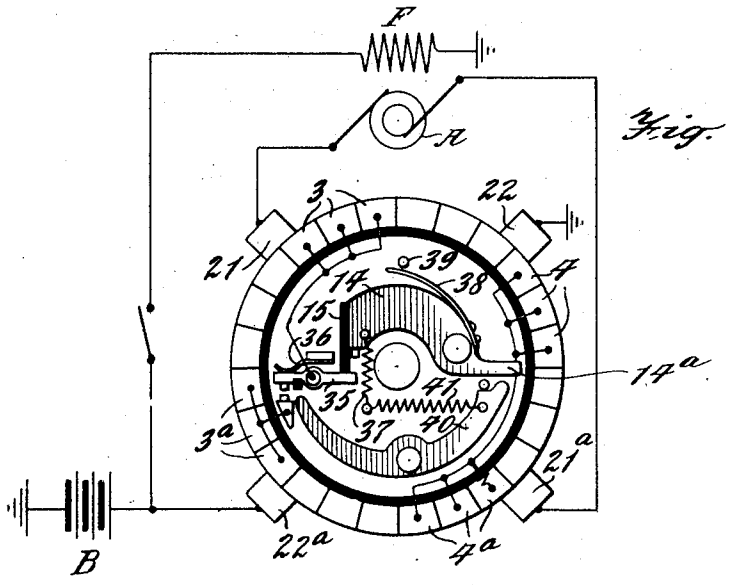

Fig. 4.

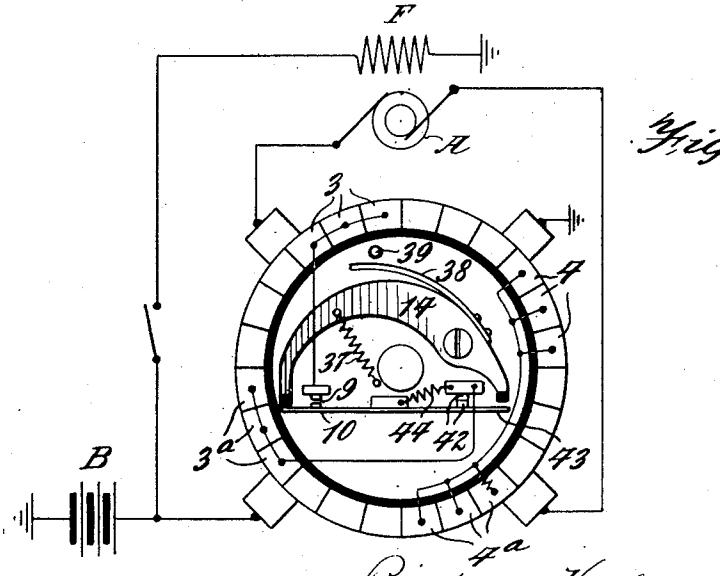

Fig. 5.

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UNITED STATES PATENT OFFICE.

RICHARD VARLEY, OF ENGLEWOOD, NEW JERSEY, ASSIGNOR TO VARLEY DUPLEX MAGNET COMPANY, A CORPORATION OF NEW JERSEY.

ELECTRICAL-SWITCH DEVICE.

Application filed November 15, 1920. Serial No. 424,257.

To all whom it may concern:

Be it known that I, RICHARD VARLEY, a citizen of the United States, residing at Englewood, in the county of Bergen and State of New Jersey, have invented certain new and useful Improvements in Electrical Switch Devices, of which the following is a full, clear, and exact description.

My invention relates to electrical switch devices and embodiments of my invention are well adapted for rectifying current from low frequency generators, and where it is desired to utilize only a portion of the wave above a minimum voltage, as for example in the charging systems of automobiles and the like.

One object of my invention is the reduction of commutator losses to a minimum. Another object is facility in applying the device to or removing it from the drive shaft. Other objects are compactness, simplicity and cheapness of construction and reliability of operation. Still other objects and advantages of my invention will appear from the following description.

In accordance with my invention I employ a rotative cylindrical switch element having four equally spaced insulated segments which are electrically connected in pairs, one connection being through a centrifugally controlled contact, and this element is wiped by four equally spaced brushes, two opposing brushes being connected to the armature windings and the intermediate brushes being connected to the consumption circuit. The cylindrical member is connected to be driven in synchronism with the armature, and may and preferably will be composed of the usual commutator bars, the four segments being formed by electrically connecting the desired number of bars at the four points.

The shell or brush for the commutator bars will preferably be hollow or cup-shaped to accommodate the centrifugal contact-operating parts, and the drive shaft can fit within an axial sleeve to which it is rotatively connected by means of a transverse pin which slips into a slot in the end of the shaft, thereby permitting the device to be easily applied to or removed from the shaft. The open end may be closed by a glass cover plate which facilitates inspection of the operating parts.

The brushes will preferably be carried in an annular brush holder of insulating material which is carried by the bearing for the shaft and is angularly adjustable thereon for proper adjustment of the brushes. My invention also includes other features of construction as will hereinafter more fully appear.

I shall now describe the illustrated embodiments of my invention and shall thereafter point out my invention in claims.

Fig. 1 is a plan of one embodiment of my invention with the cover removed and the brush holder in section, and showing in diagram an electrical circuit in which it may be used;

Fig. 2 is a longitudinal central section of the same;

Fig. 3 is an inverted plan of the rotative switch element;

Fig. 4 is a diagrammatic representation of a modified embodiment, and

Fig. 5 is a similar representation of another modification.

The illustrated device consists generally of a rotative cylindrical switch member and a brush holder surrounding the cylindrical member. The cylindrical member is preferably composed of a segmental commutator member 1 of usual construction, having in the form shown twenty-four insulated segment bars of copper or other good conducting material and a cup-shaped bush or shell 2 preferably of iron or steel which is so attached to the segment boss as to retain them against centrifugal force.

The preferred mode of attaching the segment bars to the shell 2 is illustrated in Fig. 2. One of the members, which in the form shown, is the segment bar, is provided with a dove-tail or undercut tongue or projection while the other member is provided with a complementary groove, which, however, is of sufficient width to receive the tongue or projection by a radial movement. The cylindrical segmental member 1 is formed by assembling the bars side by side with suitable insulation interposed between them and with their projections extending partially within the groove on the outer periphery of the shell. Interposed between the faces of the bar and shell is a suitable insulating composition, such as bakelite or micanite which is plastic at the time of the assembly

of the members, but which hardens and sets and serves as a key to lock the tongue and grooved members together.

Four equally spaced segments or groups of segments are employed as contact segmental portions of the cylindrical switch member. In the construction shown each of the four groups is shown as consisting of three segment bars, but it is manifest that the number of bars joined together in each group will be determined by the portion of the wave of the generated current which it is desired to collect and transmit to the consuming circuit. For identification the four groups are numbered 3, 3a, 4 and 4a. Since there are 24 segment bars in the cylindrical member 1, each bar is 15° in length and therefore each group is 45° in length.

In the illustrated construction the three bars of each group are electrically joined by means of a conductive strip which is secured, as by screws, upon one end of the cylindrical member. Groups 4 and 4a are electrically joined by the conductive strip 5 secured upon the bottom of the cylindrical member and having two enlargements at the ends joined by a narrow neck portion. One of the enlargements is sufficiently wide to connect the three bars of group 4 while the other is only of sufficient width to connect the two leading bars of group 4a, the third or trailing bar of this group being connected to the conductor 5 through a suitable resistance 6 which serves to absorb the spark at the instant that the circuit is broken, since this trailing bar of the group 4a is always in the circuit at the conclusion of each switching operation.

The bars of groups 3 and 3a are electrically joined by arcuate strips 7 and 8 which are attached to the bars at the outer or open end of the cylindrical member and which are adapted to be electrically coupled through the centrifugally controlled contact. Secured upon the bottom of the cup member 2 and suitably insulated therefrom are two contacts 9 and 10, the former of which is fixed and the latter of which is carried by a flat spring 11. When unrestrained spring 11 will move the contact 10 into engagement with the contact 9. The contact 9 is connected to the strip 7 through an arm 12 on the strip 7 which extends down into the cup member 2, and the contact 10 and spring 11 are electrically connected to the strip 8 through a similar arm 13 of the strip 8.

When the switch is used for certain purposes, as for example in battery charging system of automobiles, it is desirable that the circuit be kept open until a certain minimum speed is attained. To accomplish this a centrifuge 14 is employed which is pivoted upon the bottom of the cup 2 and has a fiber operating member 15 on its free end which is arranged to bear against the free end of the spring 11. Spring 16 engages the centrifuge 14 and tends to hold the centrifuge in such a position that the operating member 14 restrains contact 10 to open position, as shown in Fig. 1. The tension of the spring 16 is adjusted to permit the centrifuge 14 to fly out at a predetermined speed and thus close the connection between segmental groups 3 and 3a through the contacts 9 and 10. Since the operating parts are included within the length of the switch by being disposed within the cup or shell, the device is rendered compact and the parts are well protected.

The shell 2 is provided with an axial hub portion 2a for the reception of the driving shaft 17. For attachment to this shaft a central axial sleeve 18 is secured in the hub portion 2a which extends outwardly to substantially the plane of the outer face of the switch member and also extends inwardly sufficiently far to accommodate the bearings. This sleeve is of proper size to fit snugly over the shaft 17 and is provided near its outer end with a transverse pin 19, the end of the shaft 17 being provided with a slot 20 for the reception of this pin. It is thus manifest that the switch member may be applied to the shaft by merely dropping the pin 19 in the slot 20, and may be as easily removed therefrom as a unit.

In the system shown four equally spaced brushes 21, 21a, 22, 22a, wipe the surface of the segmental cylindrical member 1. These are shown as carried within a cylindrical brush holding member 23 which is composed of suitable insulating material, such as bakelite, and which closely surrounds the cylindrical switch member. This brush holder 23 is secured upon the top of the plate 24 having a hub portion 24a which forms the bearing for the shaft 17 and the sleeve 18, suitable anti-friction bearings being shown at this point. The hub 24a is shown as secured within a suitable cylindrical flange 25 on a fixed base plate 26. In order to permit an angular adjustment of the brush holder upon the plate 25 it is shown as provided with arcuate slots into which the fastening screws 27 engage. In order to enclose the operating parts while at the same time permitting inspection of them the glass cover plate 28 may be employed which is retained in a slot in the outer end of the brush holder 23.

In the electrical system shown in Fig. 1, a suitable alternator A is employed for charging a storage battery B. The switch member will be operated in synchronism with the generator and for this purpose may be conveniently mounted upon the armature shaft, the switch serving to reverse the polarity of the connection between the generator and the battery for each alterna-

tion of the current and to maintain this connection for a period determined by the length of the segmental contact portions of the switch member. The brushes 21 and 21ª are connected to the armature terminals of the alternator and the brushes 22 and 22ª are connected to the opposite terminals of the battery. The circuit may, therefore, during one alternation, be traced from the right-hand brush of the generator through wire 29, brush 21ª, segment 4, conductor 5, segment 4ª, brush 22ª, wire 30, battery B to ground, and thence through wire 31 to brush 22, to segment 3 and thence through the centrifugally controlled contacts to segment 3ª and thence through brush 21 and wire 32, back to the generator. When the switch has rotated 90°, during which time the generated current has reversed its polarity, the circuit may be traced from the left-hand brush of the generator through wire 32, brush 21, segments 4ª, conductor 5, segments 4, brush 22ª, wire 30, and battery B to ground, thence through wire 31, brush 22, segment 3ª and the centrifugally controlled contacts to segment 3, and thence through brush 21ª and wire 29 back to the generator. The field F of the generator is energized from the battery through the wire 33 in which a switch 34 may be provided, the other terminal of the field being grounded.

In the modifications of Figs. 4 and 5 are shown constructions for preventing overcharge of the battery at excessive speeds, means being provided to modify the current conducting capacity of the charging circuit when such speed is attained. In the construction of Fig. 4 the current conducting capacity is decreased by opening the circuit. The movable contact of the centrifugally controlled pair of contacts is carried by a pivoted lever 35 which is normally moved to contact closing position under the influence of the flat spring 36. The operating fibre piece 15 on the centrifuge 14 is arranged under the influence of a coiled spring 37 to bear against the outer end of the lever 35 and rotate it against the tension of the spring 36 to open contact position, as shown in Fig. 4. When the minimum engine speed is attained the centrifuge 14 will fly out against the tension of the spring 37 and permit the spring 36 to close the contacts. This movement of the centrifuge will bring the flat spring 38 on the centrifuge against a stop 39 and further outward movement of the centrifuge is restrained by this spring 38 until the centrifugal force becomes sufficient to overcome the tension of this spring 38. This occurs at a predetermined maximum engine speed and such further outward movement of the centrifuge 14 causes a projection 14ª on the centrifuge to strike against the end of an arcuate pivoted lever 40 which is normally restrained by a coiled spring 41, and thereby cause the lever 40 to rotate against the tension of the spring 41. Such rotation of the lever 40 causes the opposite end of this lever to engage underneath the lever 35 and open the contacts against the tension of spring 36.

The same result in effect is accomplished by the modification shown in Fig. 5. In this construction the charging circuit is not entirely opened but the current is cut down by the insertion of an electrical resistance when the excessive speed is attained. In this construction the spring 37 tends to hold the centrifuge 14 in position to open the contacts 9 and 10 and its first outward movement permits these contacts to close and brings the spring 38 against the stop 39. The connection between the contact 10 and the segment 3ª has two parallel paths, one of which paths includes the contacts 42, one being movable and carried by the flat spring 43, and the other of which paths includes a resistance 44. The flat spring 43 will normally hold the contacts 42 closed but as the centrifugal force at excessive speed overcomes the tension of the flat spring 38 the further rotation of the centrifuge 14 causes a projecting tip to strike the end of the flat spring 43 and open the contacts 42, thereby compelling the current to pass through the resistance 44.

It is obvious that various modifications may be made in the constructions shown in the drawings and above particularly described within the principle and scope of my invention.

I claim:

1. An electrical switch device comprising a cylindrical member having two electrically continuous segmental portions, occupying spaced circumferential portions of the cylindrical member and means including a centrifugally controlled contact for electrically connecting the two segmental portions.

2. An electrical switch device comprising a plurality of insulated segment bars cylindrically arranged, means electrically connecting the bars contained within two circumferential portions to form two relatively wide segments, and means including a centrifugally controlled contact for electrically connecting the two wide segments.

3. An electrical switch device comprising a plurality of insulated segment bars cylindrically arranged, means electrically connecting the bars contained within two circumferential portions to form two relatively wide segments, means for electrically connecting the two wide segments, and means including a resistance for electrically connecting one of the wide segments to an insulated bar next adjacent to the other wide segment.

4. An electrical switch device comprising a plurality of insulated segment bars cylin-

drically arranged, means electrically connecting the bars contained within four substantially equally spaced circumferential portions to form four relatively wide segments, means electrically connecting two adjacent wide segments, and means including a centrifugally controlled contact for electrically connecting the other two wide segments.

5. An electrical switch device comprising a plurality of insulated segment bars cylindrically arranged, means electrically connecting the bars contained within four substantially equally spaced circumferential portions to form four relatively wide segments, means electrically connecting two adjacent wide segments, means including a centrifugally controlled contact for electrically connecting the other two wide segments, a brush holder surrounding the commutator, and four substantially equally spaced brushes carried by the brush holder and wiping the cylindrical surface.

6. An electrical switch device comprising a cylindrical member having two conductive segmental portions, a cup-like shell disposed within and serving as a holder for the cylindrical member, a pair of relatively movable co-operative contacts within the shell having a biased position, a centrifugal switch within the shell operative to close the contacts under the influence of centrifugal force, and a conductor connecting each contact with one of the segmental portions.

7. An electrical switch device comprising a plurality of insulated segment bars cylindrically arranged, two spaced conductive strips secured upon one end of the cylindrical members and serving to conductively connect the bars covered thereby to form two spaced relatively wide segmental portions, a cup-like shell disposed within and serving as a holder for the cylindrical member, a pair of relatively movable co-operative contacts within the shell having a biased position, a centrifugal switch within the shell operative to close the contacts under the influence of centrifugal force, and a conductor connecting each contact with one of the conductive strips.

8. An electrical switch device comprising a cylindrical member having two pairs of electrically connected conductive portions, a driving shaft axially secured to the cylindrical member, a bearing for the shaft, a cylindrical brush holder surrounding the cylindrical member and carried by the bearing and angularly adjustable thereon, and four brushes carried by the brush holder having the same angular spacing as the conductive portions and arranged to wipe the surface of the cylindrical member.

9. An electrical switch device comprising a plurality of insulated segment bars cylindrically arranged, a cup-like shell disposed within said cylinder and serving as a holder for the bars, a pair of relatively movable co-operative contacts within the shell having a bias to closed position, a centrifugal switch within the shell having a bias to a position to hold the contacts open and movable from said position under the influence of centrifugal force, a pair of conductive strips spaced substantially 90° apart and secured upon one end of the said cylinder and serving to conductively connect the bars covered thereby, an electrical conductor connecting said strips, a second pair of conductive strips spaced substantially 90° apart and from the first mentioned strips and secured upon the open end of said cylinder and serving to conductively connect the bars covered thereby, and a conductor connecting each of the pair of contacts with one of the strips of the last mentioned pair.

10. An electrical switch device comprising a plurality of insulated segment bars cylindrically arranged, a cup-like shell disposed within said cylinder and serving as a holder for the bars, a pair of relatively movable co-operative contacts within the shell having a bias to closed position, a centrifugal switch within the shell having a bias to a position to hold the contacts open and movable from said position under the influence of centrifugal force, a pair of conductive strips spaced substantially 90° apart and secured upon one end of the said cylinder and serving to conductively connect the bars covered thereby, an electrical conductor connecting said strips, a second pair of conductive strips spaced substantially 90° apart and from the first mentioned strips and secured upon the open end of said cylinder and serving to conductively connect the bars covered thereby, a conductor connecting each of the pair of contacts with one of the strips of the last mentioned pair, a driving shaft axially secured to the shell, a bearing for the shaft, a cylindrical brush holder surrounding the said cylinder and carried by the bearing and angularly adjustable thereon, and four substantially equally spaced brushes carried by the brush holder and arranged to wipe the surface of said cylinder.

11. An electrical switch device comprising a cylindrical member having two conductive segmental portions, conductor means arranged to electrically connect the segmental portions, and means responsive to the speed of rotation of the cylindrical member and arranged in control of the conductor means and operative to effect the electrical connection when a predetermined minimum speed is attained and to modify the current conducting capacity of said connection when a predetermined maximum speed is attained.

12. An electrical switch device comprising a cylindrical member having two conductive segmental portions, conductor means

arranged to selectively include a resistance and operative to electrically connect the segmental portions, and means responsive to the speed of rotation of the cylindrical member and arranged in control of the conductor means and operative to effect the electrical connection and exclude the resistance when a predetermined minimum speed is attained and to include the resistance when a predetermined maximum speed is attained.

13. An electrical switch device comprising a cylindrical member having two conductive segmental portions, a pair of relatively movable contacts carried by the member and having electrical connection one with the one segmental portion and the other with the other, a resistance arranged to be included in one of said connections, and a centrifuge arranged in control of the contacts and of the resistance and operative to close the contacts when a predetermined minimum speed has been attained and to include the resistance when a predetermined maximum speed has been attained.

14. An electrical switch device comprising a cylindrical member having segmental contact portions, an internal shell for the cylindrical member having an axial sleeve provided near its outer end with a radial locking element and a drive shaft adapted to fit in the sleeve and having a slot at its outer end shaped to receive the locking element of the sleeve as the device is applied axially on the shaft and rotatively lock the sleeve and shaft together.

In witness whereof, I hereunto subscribe my signature.

RICHARD VARLEY.