Aug. 11, 1942. R. L. MORTON 2,292,537

COMMUTATOR SHORT CIRCUITING DEVICE

Filed July 17, 1940 2 Sheets-Sheet 1

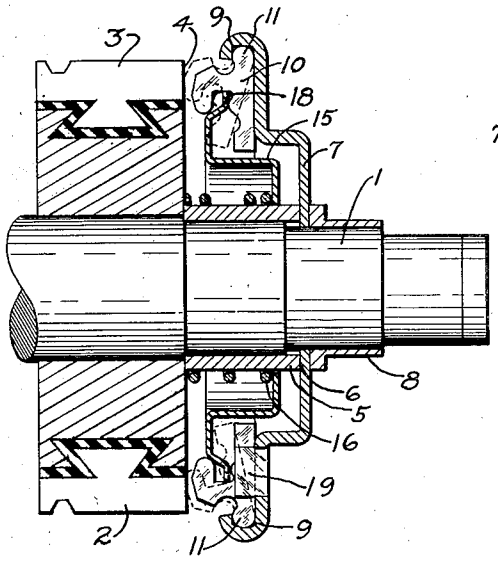


FIG. 1.

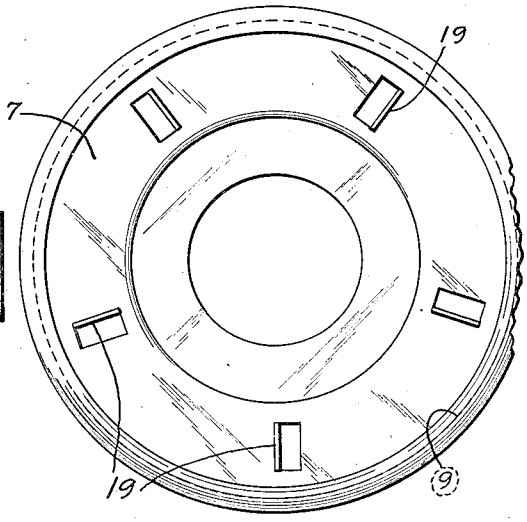


FIG. 2.

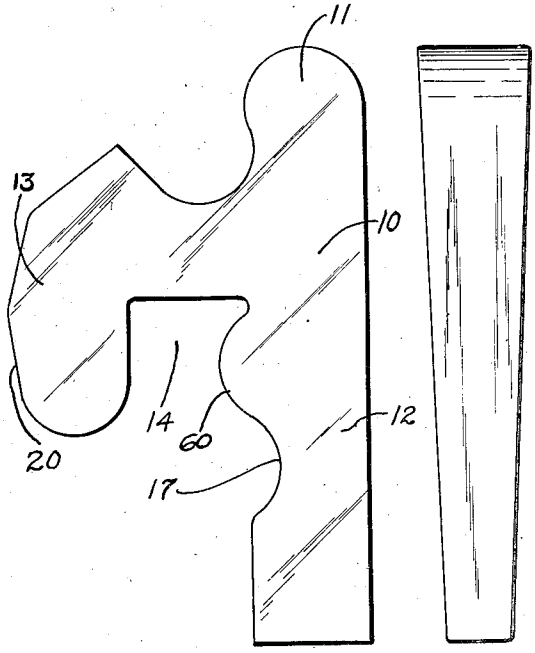


FIG. 4.

FIG. 5.

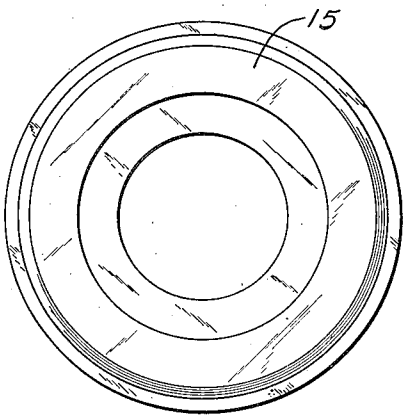


FIG. 3.

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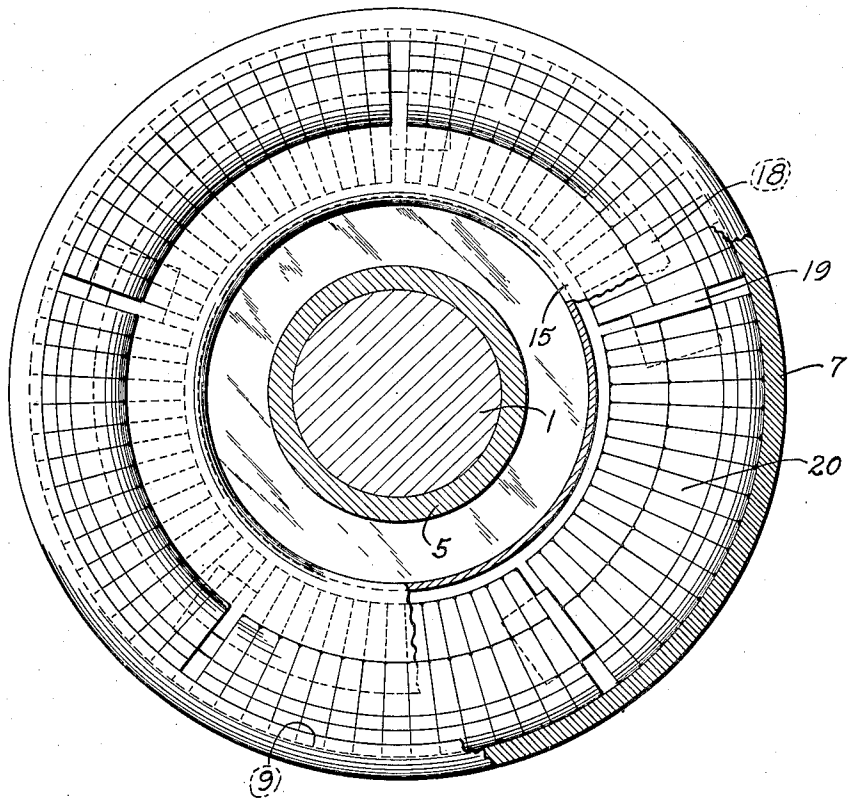


FIG. 6.

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2,292,537

COMMUTATOR SHORT CIRCUITING DEVICE

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Application July 17, 1940, Serial No. 345,927

6 Claims. (Cl. 172—279)

This invention relates, generally, to electromotive devices, and particularly to a mechanism for short circuiting commutators such as are commonly employed in connection with single phase alternating current motors.

Many efforts have been made to provide a commutator short circuiting device which will be actuated by centrifugal force when the motor upon which it is employed attains a predetermined speed, and while a great variety of such commutator short circuiting devices have heretofore been produced, such devices have as a rule presented some difficulty either from the standpoint of manufacturing, assembling, or operation. An especial disadvantage of many such devices heretofore employed has resided in the fact that the multiplicity of parts has rendered difficult the assembly of the devices on the motor shaft; and while special skill has largely overcome such difficulties in original manufacture, it has been extremely difficult to replace such devices upon motors.

The present invention contemplates a commutator short circuiting device in which the difficulties heretofore encountered are substantially overcome, and provides an arrangement which is sufficiently compact and self contained that the same may be packed and shipped separate and distinct from the motor, anad assembled therewith without difficulty.

The object of the present invention, generally stated, is to provide a commutator short circuiting device which may be readily manufactured and assembled, and which is positive and certain in its action.

Another object of the present invention is to provide a commutator short circuiting device in which the contactor elements are so formed as to take maximum advantage of centrifugal force in effecting their movement into short circuiting position.

Other objects will become apparent to those skilled in the art when the following description is read in connection with the accompanying drawings, in which:

Figure 1 is a sectional view, showing the arrangement of the commutator short circuiting device of the present invention in position upon a motor shaft adjacent a commutator.

Figure 2 is a plan view of a supporting member forming a part of the commutator short circuiting device.

Figure 3 is a plan view of a pressure plate, forming a part of the commutator short circuiting device of the present invention.

Figure 4 is a plan view of a contacting element, a number of which are employed in the commutator short circuiting device of the present invention.

Figure 5 is an edge view of the contacting member shown in Figure 4.

Figure 6 is a view constituting an inside plan view of the commutator short circuiting device, part being broken away to reveal the relation of the parts.

In accordance with the present invention, generally stated, a supporting member in the form of a disc having a peripheral channel, is fixed upon the shaft of a motor for rotation therewith. Loosely arranged in the peripheral channel of the supporting member is a series of contact elements, arranged to swing outwardly about a circumferential axis located within the channel of the supporting member. The contacting elements are sector-shaped, being thicker at their outward extremities, which are nested in the aforesaid channel, than at their inner extremities; and are arranged in series substantially around the entire circumference of the supporting member above mentioned. The sector shape of the elements and the arrangement thereof so that the thicker portion is adjacent the axis of swinging provides a construction in which the respective contact elements become progressively freer of each other as they swing outwardly. The commutator contacting portion of the contact elements is axially displaced, toward the commutator, from the plane of the peripheral axis about which the series of contact elements swing under centrifugal force. Each contact element is provided with a bearing area against which the rim of a pressure plate is biased in a direction tending to maintain the contact elements out of engagement with the commutator.

The contact elements of the present invention are especially shaped so that when in normal position (out of contact with the commutator) a substantially long portion of the element extends generally normal to the shaft of the motor. The mass center is slightly displaced from the plane of the peripheral axis about which such contact elements swing, but the form is such that when the contact elements have moved slightly from their normal position, further movement is accomplished with a snap to the extreme outward position, in which the contact elements are in engagement with the commutator, thereby short circuiting the same.

When each of the contact elements is furcated as in the embodiment to be more fully describe

18 hereinafter, the furcation of the assembled group of contact elements provides a circumferential groove into which the edge of the pressure plate is received. The diameter of the pressure plate is such, with reference to the diametrical distance between the extremities of opposite contact elements, however, that when the contact elements are in normal position (at rest) the pressure plate is trapped in the circumferential groove just mentioned. This prevents the individual contact elements from being swung outwardly, independently of the others, and thereby prevents removal of the pressure plate unless at least half of the contact elements are swung outwardly from their normal positions. With this arrangement of parts, the pressure plate retains the contact elements in position, and the contact elements retain the pressure plate in position, all within the supporting member, thereby facilitating handling and assembling of the arrangement; as the parts cannot release themselves from each other so long as at least two opposite contact elements are held in normal position, as by pressure of the fingers, regardless of the position of the assembly.

Referring now to the drawings for an illustrative embodiment, the commutator short circuiting device of the present invention is shown in position upon the shaft 1 of a motor having a commutator 2 whose conductor elements 3 are arranged with their end faces 4 exposed for engagement with the commutator short circuiting device of the present invention. It is of course understood that the conducting elements 3 of the commutator are suitably insulated from each other and from the shaft and core thereof in the usual manner.

In the embodiment illustrated, a collar 5 is arranged upon the shaft 1 so as to rotate therewith and provide a shoulder 6 against which a disk 7 may be seated. It will be understood, of course, that the collar 5 may be formed as an integral part of shaft 1.

In order to fix disk 7 upon the shaft so that it rotates therewith, a bushing 8 may be driven over the shaft against disk 7, and, if desired, further positive connections may be provided. The disk 7 constitutes the supporting member for the various elements of the commutator short circuiting device of the present invention, and is provided at its outer periphery with an inwardly opening channel 9.

Arranged in channel 9 is a series of contacting elements 10 shown in detail in Figure 4, and each provided with an outer rounded portion 11 sized and shaped to be fitted loosely in channel 9, so as to swing about an axis within channel 9. In the embodiment illustrated, the interior cross-sectional shape of channel 9 is square, with filleted corners, and the rounded portion 11 of the contact element 10 is formed so as to provide a play of 0.006–7 inch within channel 9 in a direction axially of the motor.

The contact elements 10 are furcated, providing a long leg or weighted part 12, and a short leg or contact part 13 with a space 14 therebetween. With the contact elements so shaped, they may be supported in a manner such that the elemental mass center of the long leg 12 lies substantially in a plane normal to the shaft 1, in which the axis of swinging also lies; and accordingly the weight of leg 12 is substantially ineffective as far as centrifugal action is concerned until the centrifugal force is sufficient to displace the contact elements from their normal position. When the contact elements are displaced from their normal position, however, the mass of leg 12 is acted upon by centrifugal force, and accelerates the outward swinging movement of the contact elements, thus giving the desirable snap of operation.

When the series of contact elements 10 is assembled on supporting member 7, it will be apparent that the spaces 14 produce together a circular groove into which is fitted a pressure plate 15. The pressure plate 15 is freely movable axially relative to shaft 1 and is provided with a coil spring 16 arranged on shaft 1 so as to bias pressure plate 15 in a direction away from the commutator. The exterior diameter of pressure plate 15 is in excess of the diametrical distance between the inner extremities of short legs 13 of contact elements 10, when the latter are in their normal position, illustrated in full lines in Figure 1; and is arranged with respect to the contact elements and channel 9 so as to provide an abutment limiting the inward radial movement of contact element 10 under the force of gravity when the apparatus is at rest.

Contact elements 10 are each formed with a rounded portion 60 arranged to receive the thrust from pressure plate 15, and below convex portion 60 is a concavity 17 formed in leg 12 of the contact element. The concavity 17 is provided so as to prevent engagement of the flat rim 18 of pressure plate 15 with the contact element at regions other than the convex bearing portion 60; and pressure plate 15 is flared so as to accommodate the tail of long leg 12 of the contact elements when the same swing outwardly. With the arrangement just described, pressure transmitted from plate 15 to the contact elements is limited to a line bearing at convex portion 60, regardless of the position of the contact element, and friction between the moving parts is thereby reduced. With this arrangement the thrust applied through plate 15 exerts itself upon contact elements 10 through a torque arm of substantially constant length irrespective of the angular position of the contact elements.

The disk 7 is provided, on its interior face, with a plurality of radially extending lugs 19 formed, in the embodiment shown, by punching and deforming. While in the embodiment shown in the drawings the disk 7 is provided with five such lugs, it will be understood that any desired number may be provided; such lugs 19 provide abutments through which the rotating force of disk 7 is transmitted direct to contact elements 10, in order to positively drive the same.

When the contact elements are fitted with sufficient closeness, however, and at least three such lugs 19 are provided, displacement of the contact elements from channel 9 by radially inward movement is prevented at times during the assembly of the device when pressure plate 15 is absent. It will be observed that the sector or wedge shape of the respective contact elements precludes the radially inward movement of one or more of the same independent of the others, beyond a point where the contact elements become wedged against lug 19. When at least three such lugs 19 are provided, the contact elements may be assembled into channel 9 of disk 7 with sufficient looseness to permit the desired freedom of movement for convenient assembly, but nevertheless without sufficient play that the contact elements will become completely displaced from channel 9 by axially inward movement. This arrangement facilitates handling and as-

sembling of the device, at stages where pressure plate 15 is not in position. As pointed out hereinbefore, however, when pressure plate 15 is in position, the outer edge thereof is arranged so so as to limit radial inward movement of those contact elements which tend to move radially inward under the force of gravity, thus preventing the same from becoming wedged against lug 19 after installation of the assembly upon a motor.

It will be observed that the diameter of pressure plate 15 is in excess of the diameter of the circle formed by the inner termini of the series of short legs 13 of contacting elements 10. Accordingly, in assembling the commutator short circuiting device of this invention, the entire series of contacting elements is swung outwardly about the peripheral axis extending in channel 9, so that the inner termini of legs 13 are more greatly spaced than in the positions illustrated in full lines in Figure 1. When the contact elements are thus all swung out, the distance between the inner termini of the short legs 13 of opposite contact elements 10 is great enough to permit pressure plate 15 to be inserted. When the device is arranged upon a motor shaft, however, the parts are so positioned that the maximum outward movement of contact elements will not permit release of the margin 18 of pressure plate 15 from the furcation in the respective contact elements, and consequently there is no possibility of displacement of parts when in position on the motor. In certain installations, where it is of no particular importance to trap pressure plate 15 with reference to the contact elements as hereinbefore described, the short leg 13 of the contact elements may be arranged so as to permit free insertion and removal of pressure plate 15. In this case, the leg 13 is formed so as not to overhang the rim of pressure plate 15, and accordingly the confined space 14 of the furcated element shown in the drawing would then become an open space for the reception of pressure plate 15.

When a motor is equipped with the commutator short circuiting device of the present invention, the parts in the position illustrated in full lines in Figure 1; but in view of the axial displacement of the mass centers of contact elements 10 from the plane of the peripheral axis of rotation thereof (in channel 9), as the motor gains speed, centrifugal force acts upon contact elements 10, tending to swing the same outwardly. When the speed of the motor has reached a predetermined point, depending upon the compression strength of spring 16, the force of spring 16 will be overcome, and pressure plate 15 moved axially toward the commutator 3, thus permitting the contact elements 10 to swing outwardly to an extent such that contact portions 20 engage the adjacent faces 4 of the commutator conductors. The shape of the engaging face 20 of contact element 19 is such that a wiping contact with the commutator face is effected, and the centrifugal force acting upon the individual contact elements maintains the same in fixed engagement with the commutator face. The respective elements are, however, fitted in the adjunct parts with such freedom that all may accommodate themselves to irregularities, and thus maintain a firm contact at the commutator face.

When the speed of the motor is being reduced, however, the centrifugal force acting upon contact elements 10 gradually reduces to a point where the centrifugal action is overcome by the pressure of spring 16, at which time the contact elements 10 are conjunctively restored to the position illustrated in full lines in Figure 1.

The construction of the device of the present invention is such that the contact elements 10 cannot individually operate to an extent such that the commutator is engaged, but through the medium of pressure plate 15 the action of the contact elements 10 is conjugated, and consequently when one container is in engagement with the commutator, all contactors are in engagement; and vice versa. As hereinbefore stated, however, the parts are assembled with such individual freedom of action that centrifugal force acts individually upon the contact elements 10, and the individual elements may move relative to each other and to the adjacent parts to an extent sufficient to assure firm electrical contact with the commutator face.

From the foregoing description it should be apparent that the present invention accomplishes its objects, and provides a commutator short circuiting device which may be manufactured and assembled with facility and that the device is so self-contained that displacement of the parts during handling is not liable to occur.

While in the foregoing description a full disclosure of the present invention has been made with respect to the embodiment illustrated in the accompanying drawings, it is to be understood that such disclosure is by way of illustration, and not limitive. It is apparent that many modifications and variations of the commutator short circuiting device herein disclosed will present themselves to those skilled in the art without departing from the spirit of this invention; and it is therefore to be distinctly understood that such modifications and variations, although not specifically described herein, are contemplated by and within the scope of the appended claims.

Having thus described the invention, what is claimed is:

1. A commutator short-circuiting unit comprising, a disk having a circumferential flange, a plurality of furcated sector shaped contactor elements arranged around said disk and confined by said flange against translatory movement in all directions except radially inward, and at least three radially extending lugs on said disk and extending between certain of said contactor elements in substantially equal circumferential displacement, said elements being circumferentially held by said lugs sufficiently spaced for free independent movement but insufficiently spaced to permit radially inward translation of any one element sufficient to free said flange without rotation.

2. A commutator short-circuiting unit comprising, a disk having a circumferential flange and an inwardly bent lip forming a channel, a plurality of furcated sector shaped contactor elements arranged around said disk each having a rounded part disposed in said channel and held thereby against translatory movement in all directions except radially inward, and at least three radially extending lugs on said disk and extending between certain of said contactor elements in substantially equal circumferential displacement, said elements being circumferentially held by said lugs sufficiently spaced for free independent movement but insufficiently spaced to permit radially inward translation of any one element sufficient to free said flange without rotation.

3. A commutator short-circuiting unit comprising, a disk having an internally open peripheral channel, a series of contactors arranged about said disk, said contactors having a rounded part freely fitting in said channel and a commutator engaging part radially inward thereof, said rounded part of the contactors being embraced by said channel on three sides so that said contactor may be removed from said channel only by radially inward translation, and a pressure plate arranged for engagement with each of said contactors, said contactors having a rounded bearing part arranged to receive thrust from said plate.

4. A commutator short-circuiting unit comprising, a disk having an internally open peripheral channel, a series of contactors arranged about said disk, said contactors having a rounded part freely fitting in said channel and a furcated part radially inward thereof, and a plate arranged in the circumferential groove formed by the series of furcated parts, the portion of said furcated part between said plate and said disk being longer than the other portion thereof, and the elemental mass center of said longer part being substantially in the plane of said channel when in normal position.

5. A contact element for a commutator short-circuiting device comprising, a substantially long leg having at one end thereof of a rounded hinge portion, a commutator engaging portion extending laterally from said long leg, said long leg having a rounded bearing surface radially inward of said commutator engaging part the distance between said hinge portion and the end of said long leg being substantially greater than the distance between said hinge portion and the commutator engaging part.

6. The combination with an electromotive device having a commutator on a shaft, of a commutator short circuiting device comprising, a support fixed on the shaft in axially spaced relation to the commutator, a series of contact elements each having a substantially long leg with a hinge portion at one end thereof and a shorter leg displaced axially from said longer leg, and means for mounting the hinge portions of said elements on said support with said long leg extending substantially radially and substantially perpendicular to the axis of said shaft.

ROBERT L. MORTON.

CERTIFICATE OF CORRECTION.

ent No. 2,292,537. August 11, 1942.

ROBERT L. MORTON

It is hereby certified that error appears in the printed specification the above numbered patent requiring correction as follows: Page 1, first lumn, line 29, for "anad" read --and--; page 3, second column, line 11, or the word "container" read --contactor--; line 33, for "limitive" read limitative--; page 4, second column, line 3, claim 5, strike out "of" fore "a"; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in ie Patent Office.

Signed and sealed this 15th day of September, A. D. 1942.

Henry Van Arsdale,
Acting Commissioner of Patents.

Seal)