

Aug. 6, 1929.

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1,723,010

COMMUTATOR MOTOR

Filed Jan. 10, 1927

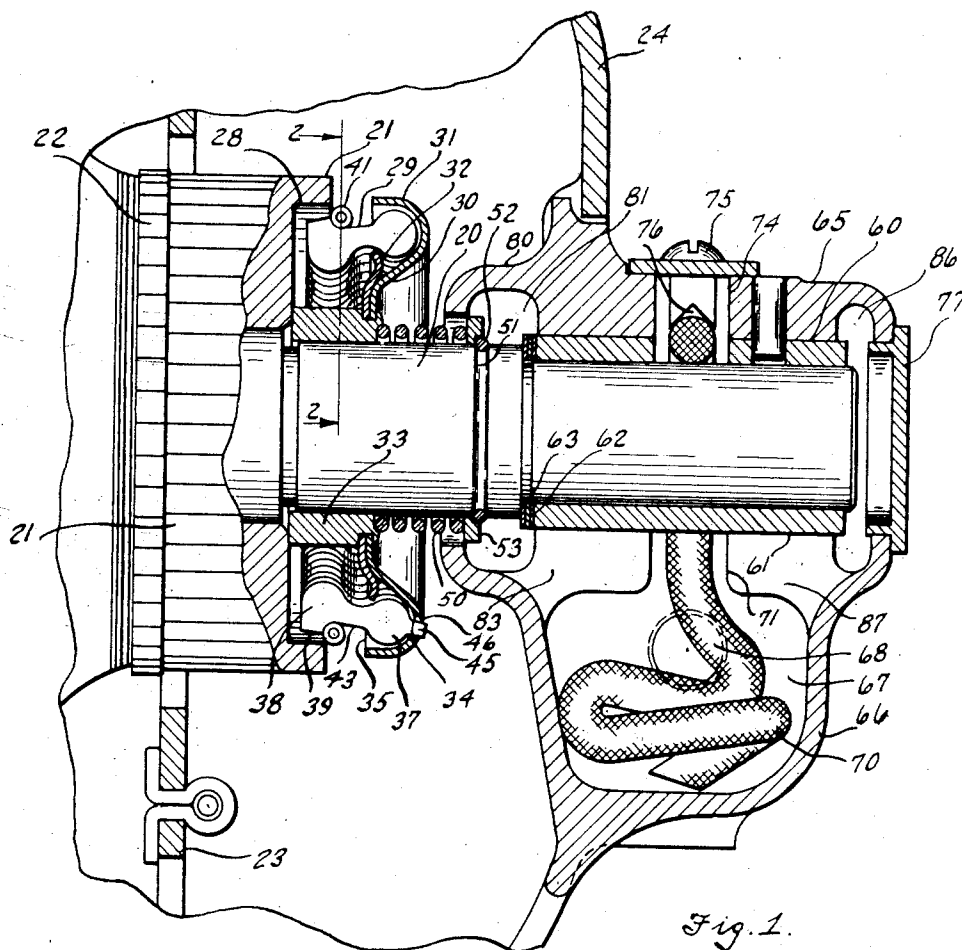


Fig. 1.

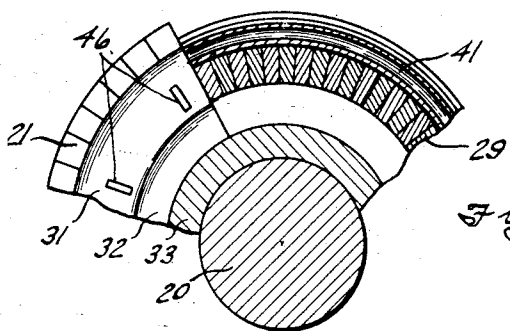


Fig. 2.

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COMMUTATOR MOTOR.

Application filed January 10, 1927. Serial No. 160,130.

This invention relates to electric commutator motors and more particularly an automatic switch for short-circuiting the commutator segments of such motors.

One of the principal objects of this invention is to provide a motor of this character which is simple, efficient, and operates with a minimum of attention, and in which the contact members of the short-circuiting device are capable of rotational movement independently of the commutator, and move easily into and out of their contact-making positions and function reliably under all operating conditions.

Another object of this invention is to provide an efficient and effectively operating bearing construction for supporting the armature shaft which carries the short-circuiting device of the motor.

Other objects of the invention will be apparent from the following description when taken in connection with the accompanying drawing.

In the drawing in which like characters of reference designate like parts throughout the several views thereof,

Fig. 1 is a longitudinal sectional view through one end of the armature shaft of an alternating current commutator motor showing the centrifugally operated mechanism carried by said shaft and one of the bearings for this shaft; and

Fig. 2 is a fragmentary vertical sectional view taken on the plane of the line 2—2 of Fig. 1, certain parts being broken away to more clearly illustrate the construction thereof.

In the embodiment of the invention illustrated in the drawing, 20 designates the armature shaft of an alternating current commutator motor, the commutator segments of which are indicated at 21. The commutator segments 21 are mounted upon the armature shaft 20 in any suitable or well-known manner, and are insulated from one another and from certain other parts of the motor in the usual manner, insulating segments being indicated at 22. The motor is of the repulsion-induction type, or the like, such a motor having different starting and operating characteristics as is well understood in the art. A brush plate is partially indicated at 23, which plate carries the brushes which cooperate with the commutator segments 21. The casing or frame of the motor is indicated at 24.

The commutator is undercut to provide an inner cylindrical surface 28 which is adapted to be engaged by a series of contact members 29. The inner cylindrical surface of the commutator presents, in effect, a series of contacts for engagement by the contact members 29.

Carried by the armature shaft 20 is a support indicated generally at 30 which is adapted to pivotally support the contact members 29. This support comprises a pair of disc-like plates 31 and 32, the outer or peripheral portions of which are formed to provide an annular supporting channel 34 of substantially circular cross section for pivotally supporting the contact members 29, and a hub 33 to which the plates 31 and 32 are attached in any suitable manner. The edges of the disc members 31 and 32 are evenly spaced so as to provide an annular slot 35 at one side of the supporting channel. Each contact member 29 is formed as a plate and is provided at one end with a circular enlargement 37 which is adapted to fit loosely in the channel 34 and to form a pivot for the contact member. The other end of the contact member 29 is enlarged to form a comparatively heavy head or hammer-like portion 38 of such weight that when the armature shaft reaches a predetermined speed of rotation the contact member will move outwardly about its pivot in the channel 34 under the influence of centrifugal force into engagement with the contacts or commutator segments 21. The hammer-like portion of each contact member 29 is provided with a suitable contact surface 39 for engagement with the commutator segments.

Outward movement of the contact members is resisted by a circular spring or annular resistance device 41. This annular resistance device is preferably in the form of a garter spring, the turns of which are closely wound. The contact members 29 are yieldingly held in their innermost or non-contacting positions by means of the circular spring 41, and in their innermost position they are stopped by the peripheral edge of the disc-supporting plate 32. When the armature shaft reaches a predetermined speed of rotation the contact members 29 move outwardly under centrifugal force which overcomes the resisting force of the spring 41, into engagement with the armature segments or contacts 28.

Each contact member 29 is provided at 43 with a bearing edge or surface for the annular spring 41. This bearing surface 43 is so shaped that when the contact member 29 is in its innermost position the left end of the bearing surface, as indicated in Fig. 1, slopes inwardly toward the armature shaft 20. But when the contact member 29 is in its outermost position the right-hand end of the bearing surface 43 slopes toward the shaft 20. As a consequence of this construction the annular spring 41, which bears freely on the bearing surface 43, moves to a point on the bearing surface 43 as far as possible from the pivot 37 when the contact members 29 are in their inner or non-contacting position, such position being shown in Fig. 1. In this position of the spring 41 it exerts its maximum pressure or resistance to the outward movement of the contact members 29 inasmuch as the spring is at a maximum distance from the pivots of these members. When the contact members 29 begin to move outwardly, and as soon as the bearing surface 43 moves past a position parallel to the shaft 20, the spring 41 shifts to a position closer to the pivot of the contact members 29, in fact to a position adjacent the ends 37 of these members. In this latter position the effective pressure of the spring 41 tending to resist the outward movement of the contact members is greatly reduced.

As a consequence of the shifting of the spring towards the pivot of the contact ends of members 29, it will be perceived that as soon as the contact members 29 begin to move outwardly under centrifugal force the resistance of the spring 41 is decreased so that the contact members 29 move into engagement with the contacts with great certainty and rapidity. And by reason of the reduced pressure of the spring 41 upon the contact members 29 in their contacting position, the latter are enabled to exert greater contact-making pressure against the contacts 21. As the speed of rotation of the shaft, and therefore the centrifugal force, decreases, the spring 41 will move the contact members inwardly and this movement is equally as positive and rapid as the outward movement of the contact members 29.

In assembling the device the contact members 29 are preferably placed in position between the disc plates 31 and 32 after which a flange is turned or pressed up from the hub 33 to rigidly clamp the plates to the hub. The contact members are loosely held in the supporting channel 34 and there is a slight amount of looseness between the contact members themselves in order to give sufficient freedom of operation and to avoid unnecessary friction between the several parts. By forming or punching the contact members 23 from a strip of metal of tapered thickness, the contact members may be made wedge-

shaped or tapered toward the center of the shaft whereby a greater number of them may be introduced in the supporting channel 34 and yet maintain a sufficient looseness between the contact members in their innermost position. This wedge-shaped construction also has the advantage that it provides a relatively large contact surface 39 on each contact member.

To further insure good contact between the contacts or commutator segments 21 and the contact members 29, the latter are made relatively thin or in the form of plates. That is, the contact members 29 are preferably more numerous than the commutator segments so that a number of them may engage a single commutator segment. In this manner the contact members may follow any irregularities in the cylindrical contact surface of the commutator segments, and any slight tilting of the contact members 29 in their supporting channel as a result of looseness in mounting will not prevent contact of one or more contact members with each commutator segment.

In order to prevent any possibility of the contact members 29 bunching together in one portion of the supporting channel 34, and perhaps some of the contact members falling over and piling up or binding on each other, the contact members are separated into groups and each group is restricted to a definite part of the supporting channel 34. This is accomplished by providing certain of the contact members with rearwardly projecting lugs or tongues 45 which are adapted to be received in radial slots or grooves 46 formed in the plate 31, the lugs 45 and slots 46 being so proportioned and fitted as to prevent any objectionable tipping or sidewise movement of the contact members 29 in the supporting channel 34. Two of the slots 46 are shown in Fig. 2, and a contact member 29 provided with a lug 45 cooperating with a slot 46 is shown in the lower portion of Fig. 1. The contact members 29 on which the tongues 45 are formed may be regarded as spacing members which not only space and maintain the contact members 23 in groups but also themselves function as contact members.

In order to prevent binding of the contact members due to sudden angular acceleration of the armature shaft 20, such as upon starting, and to insure smooth and reliable operation at all times of the contact members, the hub 33 is loosely mounted upon the shaft 20, such loose mounting permitting both angular and longitudinal slippage of the hub 33 on the shaft 20. As a consequence of this construction the rotation of the support for the contact members 29 gradually increases to the speed of the armature shaft so that the contact members remain at all times free to operate in their normal manner. Any sudden acceleration of the shaft 20 does not af-

fect these contact members, as such sudden acceleration is not positively imparted to the support for the contact members but results in slippage of the hub 33 about the shaft 20.

5 The loose mounting of the plates 31, 32 and the sleeve 33 to which the plates are attached furthermore has the added function of keeping the contacts and co-acting parts of the commutator segments clean and free from

10 pitting and dirt, inasmuch as the contacts slide relatively over the commutator segments at the instant they are thrown into engagement with the commutator by centrifugal force. At this instant the motor shaft is

15 rotating rapidly while the sleeve 33 and contact plates are rotating at a slightly less speed and still being accelerated by the driving force imparted through the frictional engagement with the rotor shaft. The relative

20 difference in speed at the time the contact members engage the commutator segments will result in a slight rubbing action of the engaging parts which will keep the contact surfaces clean and remove pit marks and dirt.

25 The relative difference in speed of the commutator and contact members, at the instant they are centrifugally thrown into engagement, will cause a slight twisting of the contact members as the members and their supporting discs and sleeve are suddenly pulled

30 by the commutator at an increased speed. This twisting or inclination of the contact members from a true radial direction serves to equally space all of the members so that an instant later, after the inertia of the contact member and disc assembly has been overcome the contact members will all straighten

35 out to extend radially and each contact member will have the proper spacing between each adjacent member. In order to normally hold the support for the contact members in operative position, a spring 50 is provided which bears at one end against the hub 33.

40 The shaft 20 is provided with a portion 51 of reduced diameter about which is positioned a lock ring 52. The opposite end of of the spring 50 is retained in place by the lock ring 52, an oil-throwing ring 53 being held in position between the lock ring 51 and

45 this end of the spring.

Positioned adjacent the short-circuiting device is a bearing indicated generally at 60, the bearing supporting one end of the armature shaft 20. This bearing comprises a

50 bearing sleeve 61 within which a portion of the shaft 20 of reduced diameter rotates. Suitable washers 62 are interposed between the end of the bearing sleeve 61 and a shoulder 63 of the shaft. The frame 24 of the motor is suitably extended as at 65 to form

55 a housing for the bearing 60. The housing extension 65 is formed with a hollow depending portion 66 adapted to provide a lubricant pocket or well 67 therein. A passage 68 leads

60 to the exterior of the housing for supplying

lubricant to the pocket 67, a suitable closure being provided for the end of the passage. Positioned within the lubricant in the pocket 67 is a wick 70 of suitable absorbent material, which extends upwardly around the shaft 20. As shown the housing 65 is formed with

70 a passage 71 therein, and the sleeve 61 is provided with a cut-away portion 72, the passage 71 and the cut-away portion 72 forming a channel for the wick 70. The housing 65 is

75 also provided with an opening 74 within which is positioned a plug 75 having a hollowed-out portion 76 therein which receives the wick 70, this construction permitting ready assembling of the oiling device and

80 easy access thereto. The end of the housing is closed by a cap 77 which is made removable to provide access to the bearing.

It is to be noted that the wick 70 comes in direct contact with the shaft 20 intermediate the ends of the bearing. In operation

85 lubricant is supplied from the well 67 by capillary attraction through the wick 70 to the shaft, and passes from this point along the shaft to both ends of the bearing, providing effective lubrication.

In order to prevent leakage of the lubricant into the short-circuiting device and other parts of the motor the housing 65 is constructed with an inwardly extending

90 portion 80 forming a lubricant groove 81. The inwardly extending portion 80 forms an enclosing member about the lock ring 52 and the oil-throwing ring 53, the enclosing member and the oil-throwing ring cooperating

95 with each other to prevent leakage of lubricant from the groove 81. Any lubricant which passes along the shaft to the ring 53 is thrown off of said ring by centrifugal force into the oil groove 81, the ring 53 thus

100 serving as an oil-throwing ring and effectively preventing leakage of lubricant past said ring to the exterior of the oil groove. A passage 83 is formed in the housing which provides communication between the groove

105 81 and the lubricant pocket 67 for the return of lubricant from the groove 81 to the pocket 67. The oil-throwing ring 53 effectively assists in returning this lubricant to the pocket 67, whereby a steady circulation

110 of lubricant to the bearing is maintained. The end or shoulder of the short-circuiting device thus cooperates with the bearing to prevent leakage of the lubricant from the bearing and to assist in the circulation of this

115 lubricant. At the opposite end of the bearing the housing 65 is provided with a lubricant groove 86 and a passage 87 for the return of lubricant from the groove 86 to the pocket 67, thus providing for the circulation of

120 the lubricant at this end of the bearing.

While the form of apparatus herein described constitutes a preferred embodiment of the invention, it is to be understood that the invention is not limited to this precise

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form of apparatus, and that changes may be made therein without departing from the scope of the invention which is defined in the appended claims.

5 What is claimed is:—

1. In an apparatus of the character described, a rotatable shaft, contacts arranged about said shaft, a short-circuiting mechanism for said contacts carried upon said
10 shaft, a bearing for said shaft positioned adjacent to said short-circuiting mechanism, said short-circuiting mechanism having a shoulder forming an oil-throwing ring adjacent one end of said bearing, an enclosing
15 member surrounding said shaft and forming a lubricant groove about said oil-throwing ring, a lubricant reservoir, means for supplying lubricant from said reservoir to said bearing, a portion of said lubricant being adapted
20 to pass from said bearing to said oil-throwing ring and lubricant groove, and a passage providing communication between said lubricant groove and said reservoir for the return of lubricant thereto.
2. In an apparatus of the character described, a rotatable shaft, contacts arranged about said shaft, a short-circuiting mechanism for said contacts carried upon said
25 shaft, a bearing for said shaft positioned adjacent to said short-circuiting mechanism, said short-circuiting mechanism having a shoulder forming an oil-throwing ring adjacent one end of said bearing, an enclosing
30 member surrounding said shaft and forming a lubricant groove about one end of said bearing and said oil-throwing ring, a second enclosing member forming a lubricant groove

about the other end of said bearing, a lubricant reservoir, means for supplying lubricant from said reservoir to said bearing intermediate the ends thereof, said lubricant being
40 adapted to pass along said bearing to said lubricant grooves, and passages providing communication between each of said lubricant grooves and said reservoir for the re-
45 turn of lubricant thereto.

3. In an apparatus of the character described, a rotatable shaft, contacts arranged about said shaft, a short-circuiting mechanism for said contacts carried upon said
50 shaft, said short-circuiting mechanism having a shoulder forming an oil-throwing ring, and an enclosing member surrounding said shaft and forming a lubricant groove about said oil-throwing ring.

4. In an apparatus of the character described, a rotatable shaft, contacts arranged about said shaft, a bearing for said shaft, a short-circuiting assembly carried loosely on
60 said shaft at one side of the bearing, said shaft having a groove therein between the bearing and the assembly, a lock ring in said groove, a collar forming an oil-throwing ring abutting said lock ring, a spring between the
65 collar and the assembly, an enclosing member surrounding said shaft and forming a lubricant groove about said oil-throwing ring, a lubricant reservoir below said bearing and a passage from said groove to said reservoir for returning oil thrown by said oil-
70 throwing ring to said reservoir.

In testimony whereof I hereto affix my signature.

HERBERT L. BRUMP.