Oct. 16, 1934. C. H. THORDARSON 1,976,814

COMMUTATOR

Original Filed Feb. 16, 1932 3 Sheets-Sheet 1

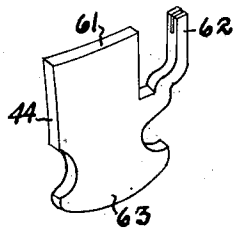

Fig. 3.

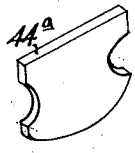

Fig. 4.

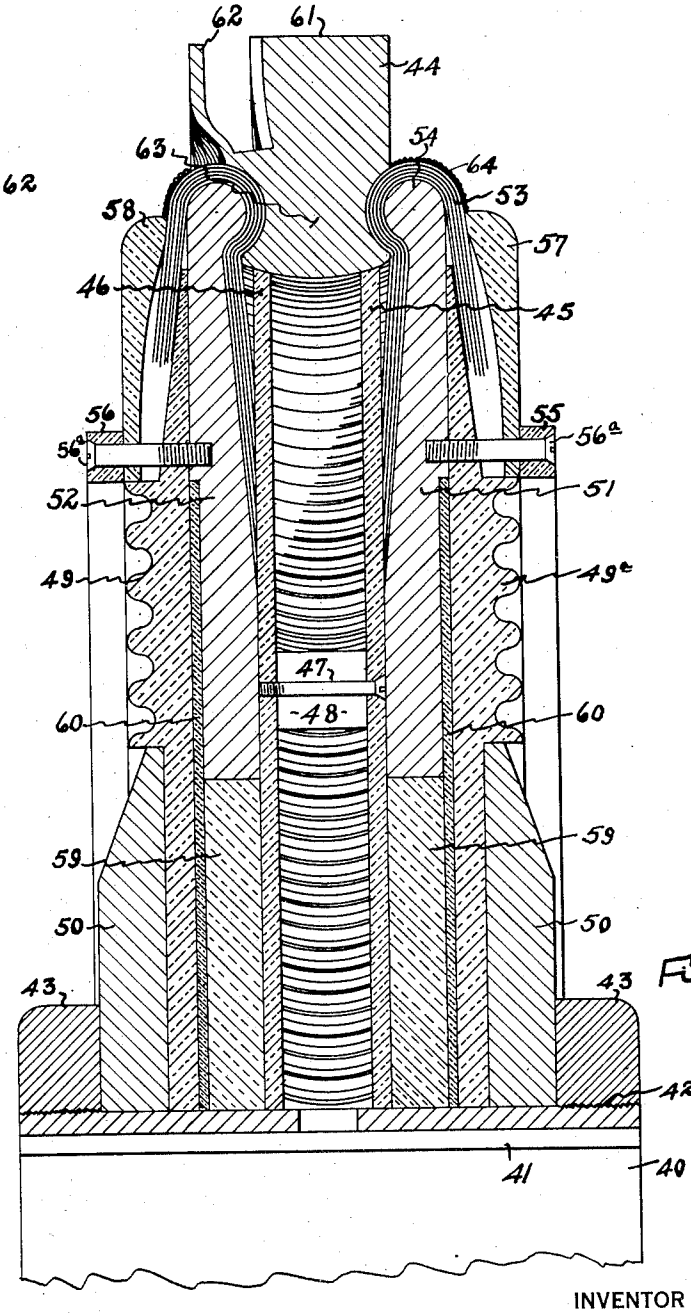

Fig. 1.

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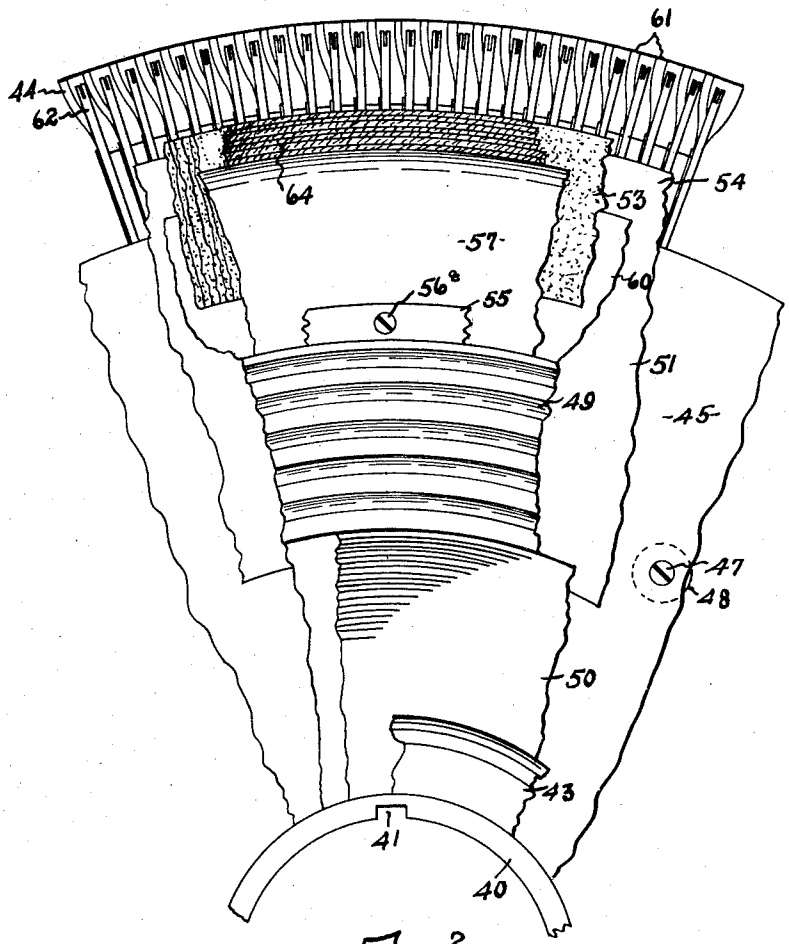

Fig. 2.

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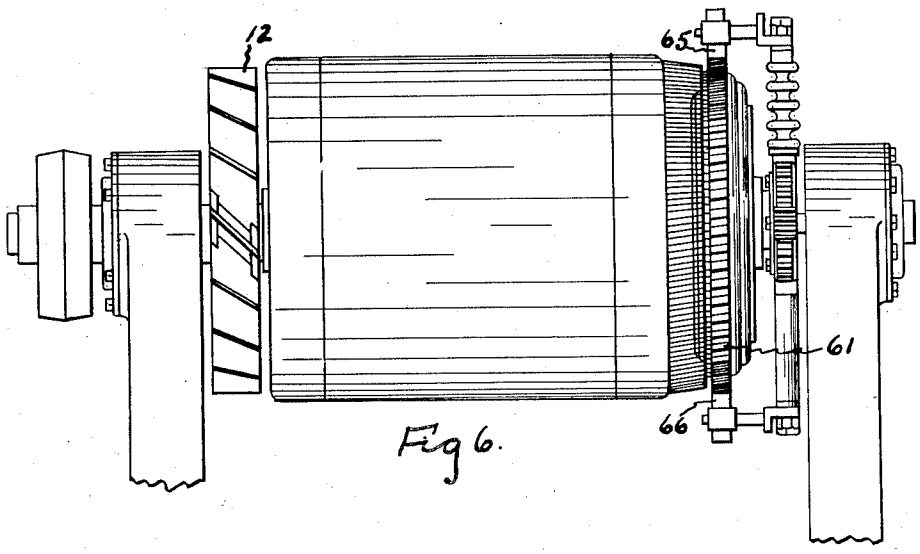

Fig 6.

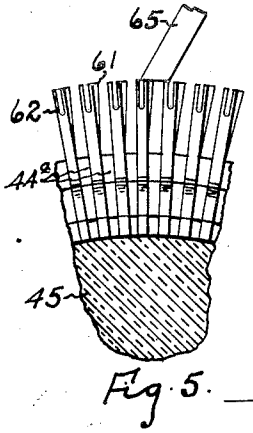

Fig. 5.

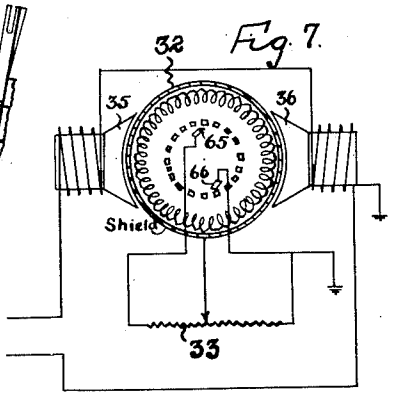

Fig. 7.

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UNITED STATES PATENT OFFICE

1,976,814

COMMUTATOR

Chester H. Thordarson, Chicago, Ill., assignor to Thordarson Electric Manufacturing Company, Chicago, Ill., a corporation of Illinois

Original application February 16, 1932, Serial No. 593,251. Divided and this application August 4, 1933, Serial No. 683,587

3 Claims. (Cl. 171—321)

This invention relates in general to improvements in commutators, particularly adapted for use on high tension dynamo electric machinery such as disclosed in my copending application Serial No. 593,251, filed February 16, 1932, of which this is a division.

An object of this invention is to provide in a simple structure an improved form of commutator in which the individual commutator segments move past the brushes at an angle with respect thereto.

A still further object of the invention is to provide a simplified commutator structure by means of which a large number of segments may be bound together and securely held in position.

These and many other objects as will appear from the following disclosure are secured by means of this invention.

This invention resides substantially in the combination, construction, arrangement and relative location of parts, all as will be described in the following specification.

Referring to the drawings,

Fig. 1 is a partial sectional view of the commutator structure of this invention;

Fig. 2 is a partial end view in elevation of the commutator structure;

Figs. 3, 4 and 5 are detail views of the commutator bars and spacers; and

Fig. 6 is a plan view showing the relationship between the armature, the commutator and the brushes.

Fig. 7 is a schematic diagram illustrating one preferred way of maintaining by means of a shield, the maximum potential stress on the armature and commutator at a value less than the maximum brush potential.

The preferred construction of commutator to be used with the armature is shown in detail in Figs. 1 to 6. This commutator structure comprises an annular metal hub 40, which is provided with a keyway 41 for keying the said hub to the shaft. The other ends of the hub 40 are threaded as indicated by the numeral 42 to receive the metallic clamping rings 43 for rigidly holding the commutator assembly together as a unit on the shaft. The commutator bars 44 are supported on the outer edges of a pair of insulator rings or discs 45, 46, of Bakelite or other similar insulating material. The discs 45 and 46 are fastened together in proper spaced relation by means of a series of bolts 47 and spacer members 48 through which the said bolts pass. Also mounted on the hub 40 are another pair of insulator discs 49 and 49ª of Bakelite, glass or other suitable insulating material. Preferably the members 49 and 49ª have their exposed faces channeled or corrugated to increase the discharge path in accordance with accepted engineering practice. Mounted respectively between the discs 45, 49ª and the discs 46, 49, are annular metallic rings 51 and 52 of steel or other suitable material. Likewise, between the members 43 and the discs 49, 49ª, are metal rings 50.

For the purpose of insulating the commutator bars 44 from the rings 51 and 52, there are provided superposed layers of insulating material such as mica or Micanite, indicated in Figs. 1 and 2 by the numeral 53. Preferably the insulation 53 is in the form of superposed strips of mica or insulating cloth. It will be noted that the outer circular edge of the rings 51 and 52 are provided with lips or beads 54 and that the commutator bars 44 are correspondingly cut away to correspond to the curvature of the beads 54. The rims 54 of the rings 51, 52 are adapted to be clamped against the insulation 53 by means of rings 55, 56, and rings 57, 58; the latter rings being preferably of Bakelite and fastened to the rings 51 and 52 by screws 56ª. As the rings 55 and 56 are tightened the insulation 53 is clamped between the commutator bars and the rims 54, thus maintaining the commutator assembly together, as a rigid unit. In order to properly hold the insulation strips 53 in position there are provided the two rings of insulation 57 and 58 which are of slightly greater diameter than the rings 49 and 49ª, so that when the screws 56ª are tightened the rings 57 and 58 grip the insulation strips 53 and the said strips are thus firmly held between the edges of the said rings 49 and 49ª and the rings 57 and 58. This method of clamping the insulation causes the same to be uniformly tensioned between the commutator bars and the rings 57 and 58, and at the same time provides a rigid assembly which is capable of accurate assembly adjustment. If desired, the spaces 59 may be filled with a Bakelite compound or other insulating material and discs of mica 60 may be interposed between the rings 49ª and 51 and the rings 40 and 52.

Preferably the commutator bars 44 are made of copper or other conducting material ordinarily employed for this purpose, and it is preferred to assemble the bars so that their exposed contactor surfaces 61 are at an angle to the axis of the machine, as shown clearly in Fig. 6. Each of the commutator bars 44 is provided with a connecting lug 62, preferably in the same plane as the portion 63 of the commutator bar, the upper

portions of each commutator bar, however, being bent at an angle, it being understood, of course, that the adjacent commutator bars are separated from each other by suitable insulating spacers 44a in accordance with the usual practice.

In order to properly hold the insulation layers 53 in place and prevent their wearing or flaking, these layers are provided with a binding covering of suitable material such as insulating fabric or cord 64.

One of the important practical features of the above described arrangement of commutators is this that the commutator bars being at an angle to the axis of rotation and the brushes 65 being substantially parallel to the axis of rotation the spark or arc that may be formed is at an angle to the machine axis. Consequently, because of the disposition of the fan blades 12 a current of air is blown through the interior of the armature and thus blows the arc outwardly from the commutator. It has been found that this particular arrangement of commutator bars and fan reduces the chances of break-down due to the commutator sparking and effects a more rapid extinction of the arc or spark at the commutator.

The invention also contemplates a structure by means of which the potential stress on the commutator parts may be kept at a value less than the maximum brush potential and at a value somewhere around one-half that of the brush potential. This is accomplished as illustrated diagrammatically in Fig. 7 by enclosing the armature in an electrostatic shield. The field poles are shown diagrammatically at 35 and 36, preferably tapered in the manner shown to more uniformly distribute the flux over a major portion of the periphery of the armature. The field poles are of course constructed of any well known magnetic material and are supported on a field frame, not shown, which is grounded as diagrammatically illustrated in Fig. 7. The armature is surrounded by a metal shield which may be constructed in a number of different ways, as set forth in the above mentioned application of which this application is a division. The shield is diagrammatically illustrated in Fig. 7 at 32. If the shield 32 is uniformly distributed along the length of the armature and the magnetic field of the machine is substantially uniform, then the shield will itself assume a potential value which is one-half the maximum brush potential. However, instead of relying upon the inherent action of the machine to maintain the shield at the intermediate potential other means may be provided for positively maintaining the said shield at any predetermined potential. For example, a resistance or impedance 33, preferably noninductive may be connected across the brushes and the shield may be adjustably connected to the impedance preferably at the midpoint thereof, so that the shield assumes one-half the brush potential. It will be noted, however, that this additional connection is not absolutely necessary and that the shield of itself in assuming its inherent potential acts to reduce the maximum electrostatic strain on the insulation of the armature and commutator.

It is to be understood that various modifications and changes may be made in the structure of this invention without departing from the spirit and scope thereof. I do not, therefore, desire to be strictly limited to the disclosure as given for purposes of illustration, but rather to the scope of the appended claims.

What I seek to secure by United States Letters Patent is:

1. A commutator structure comprising a rotatable support, a pair of spaced insulating discs mounted on said support, a plurality of segments disposed around the periphery of the discs in contact therewith, insulation between all segments, a pair of plates on the outer faces of said insulating discs having peripherical beads, said segments having side notches, layers of flexible insulation interposed between said beads and notches and overlying the outer faces of the plates, means for clamping the insulation against said plates and means for securing all of said parts together and to said support.

2. A commutator structure comprising a rotatable support, a pair of spaced insulating discs mounted on said support, a plurality of segments disposed around the periphery of the discs in contact therewith, insulation between all segments, a pair of plates on the outer faces of said insulating discs having peripherical beads, said segments having side notches, layers of flexible insulation interposed between said beads and notches and overlying the outer faces of the plates, means for clamping the insulation against said plates, a pair of insulating discs overlying the plates and means for clamping the parts together and to said support.

3. A commutator structure comprising a rotatable support, a pair of spaced insulating discs mounted on said support, a plurality of segments disposed around the periphery of the discs in contact therewith, insulating means between the adjacent faces of each segment, an extension on each segment extending parallel to the length thereof in a plane disposed in spaced relation thereto, each segment having a pair of notches at its side near the end contacting with the insulating discs, a pair of plates on the outer faces of said discs having inwardly projecting beads on their peripheries, layers of flexible insulation interposed between the notches in the segments and said beads and means for clamping all of said parts together and to said support.

CHESTER H. THORDARSON.