July 7, 1931. G. C. WILSON 1,813,333

MOLDED COMMUTATOR ASSEMBLY

Filed April 28, 1928

Fig. 1

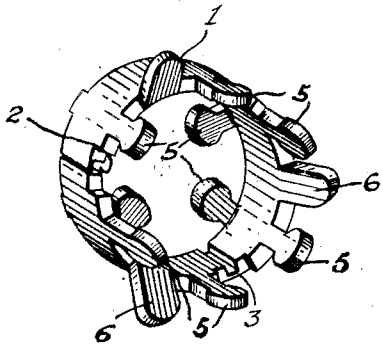



Fig. 2.

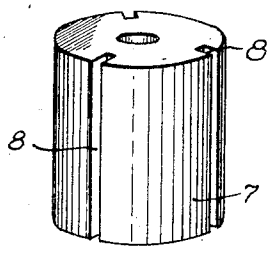



Fig. 3

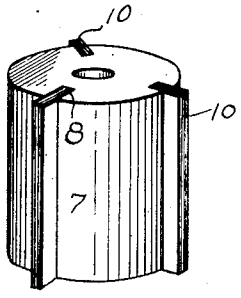



Fig. 4.

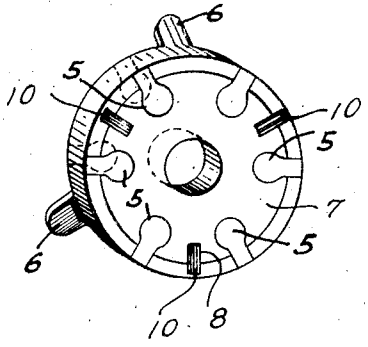
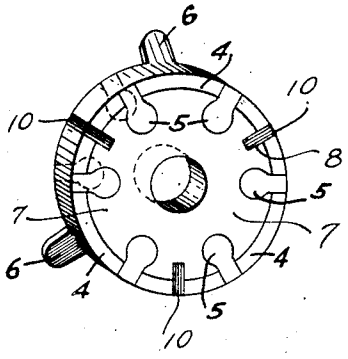



Fig. 5.




INVENTOR.
GARDNER C. WILSON

BY Newell & Spencer

ATTORNEYS.

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# UNITED STATES PATENT OFFICE

GARDINER CUSHING WILSON, OF LOCKPORT, NEW YORK

## MOLDED COMMUTATOR ASSEMBLY

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This invention relates to commutators for electric apparatus such as motors, dynamos and the like. Commutators used in electric apparatus of this character ordinarily consist of a plurality of conducting segments assembled in a ring with the segments separated from each other by insulation material. It is necessary to provide proper insulation between the segments in order that arcing between the segments will be reduced to a minimum and at the same time it is necessary to provide insulation which will resist wear so that it will not be destroyed by the friction of the commutator brush in passing over the insulation and will not be pitted out or removed by any arcing which may take place between the commutator segment and the brush when contact is made or broken between these two members. If the insulation material employed is not of the proper wear resisting character it may be dragged from the spaces between the commutator segments and coat the faces of the segments, causing improper or poor contact between the segments and the commutator brush.

In order to overcome these disadvantages and provide a commutator in which the conducting segments are separated from each other by wear-resisting insulation material a commutator is provided in which a core of insulation material such as a phenol condensation product has embedded therein wear-resisting insulating material such as sheets of mica or similar material positioned between the commutator segments.

It is an object of the present invention to provide a commutator having a core formed of molded insulation material and provided with insulation composed of material having suitable wear-resisting characteristics separating the commutator segments.

Another object of the invention is to provide a simple method of constructing commutators of this character.

Other important features and objects of the invention will be apparent from the accompanying description and drawings setting forth a preferred embodiment of the invention;

In the drawings:

Figure 1 is a perspective of a rough commutator ring used in assembling the commutator in its preferred form;

Figure 2 is a perspective of an insulating core member for such a commutator;

Figure 3 illustrates the core shown in Figure 2 with wear-resisting insulation members in place;

Figure 4 is a cross section of a commutator ring and core assembled; and

Figure 5 is a perspective of a finished commutator.

In accordance with the form of the invention as illustrated a cylindrical member 1 of conducting material, such as copper, is broached or formed with recesses 2 in the inner surface of the member and extending almost entirely through the member so as to leave only a thin connecting band 3 holding the segments 4 of the member together. Each segment 4 may be provided with in-turned lugs 5 to be embedded in the insulation material, making up the core of the commutator and with an outwardly-extending lug 6 to which conductors may be attached.

The cylindrical member 1 may be formed in any desired manner as by stamping the metal from a strip or sheet. The recesses 2 may be formed in the stamping operation or by a separate operation and with or without deformation of the external surface of the member. In some instances the commutator segments may be separately formed and embodied in a commutator in a manner and arrangement as defined by the claims. In the preferred form, however, the cylindrical member 1 is formed by stamping the metal from a sheet of copper and forming the stamping into a cylindrical member, after which the recesses are cut in the inner face of the member leaving the thin connecting bands 3.

The core of insulation material 7 shown in Figure 2, is preferably formed of insulation which may be molded and hardened or solidified, such as one of the synthetic resins advantageously phenol-formaldehyde condensation products. I have used the term "vulcanize" herein to refer to this hardening under heat

and pressure. The core material is preferably powdered and pressed cold so as to produce a pre-formed core which may be handled in assembling the commutator. The core 7 is provided with recesses 8 positiond at points corresponding to the recesses 2 on the inner surface of the commutator ring shown in Figure 1 and preferably extending the full length of the core. The wear-resisting insulation may be formed of any suitable material and may be laminated.

Ordinarily the surface of the finished commutator should be continuous so that the commutator brush will not drop into the spaces between the segments or bump over insulation extending beyond the surface of the segments and for this reason the insulation chosen should have substantially the same wearing qualities as the metal from which the segments are made. However, where the noise of the commutator brush in passing from one segment to another is not objectionable or where the wearing qualities of the insulation are not so important, the insulation material employed between the segments may be of any desired character, although it should not be composed of a material which may be dragged from the spaces between the segments so as to coat the surface of the commutator segments or the contacting surface of the commutator brush with insulating material. Mica is well suited for this use and when employed the mica is preferably pressed and cut into rectangular sheets 10 which are inserted in the recesses 8 in the insulating core 7 so as to extend from the outer surface of the core 7 and project into the recesses 2 of the cylindrical member 1 when the member 1 and core 7 are assembled as shown in Figure 4. The core 7 with the mica 10 in place is solidified or hardened in any suitable manner as by subjecting the core to heat and pressure. The mica sheets 10 are thus embedded in the insulating core 7 and the lugs 5 projecting inwardly from the member 1 are also embedded in the core material so as to form a permanent structure.

The outer surface of the member 1 is then cut or ground away until the segments 4 of the member 1 are separated from each other and the thin connecting portion 3 has been entirely removed. The commutator thus formed comprises a plurality of commutator segments 4 separated from each by wear-resisting insulation material 10 and the insulation material 10 and the segments 4 are permanently secured to the molded core material 7.

The commutator assembly is preferably made by first placing the commutator segments in a die preferably in the form of a cylindrical member broached as suggested. The pre-formed core 7 may be formed by pressing a powdered phenol condensation product or other material in a die. The core and the mica sheets 10 are then positioned in the die within the member 1 and the core solidified as by subjecting it to heat and pressure and the outer surface of the commutator is removed in any suitable manner.

The process of making the commutator as well as the specific construction of the commutator is capable of numerous variations. For example, the commutator segments and the mica may be assembled before the core is inserted in the die and the material forming the core may be inserted in the die in powdered form if desired. Various other modifications in the construction and method of making the commutator are contemplated and it is therefore not intended to limit the invention except as defined by the claims.

What is claimed as new is:

1. The method of making a commutator which comprises forming a cylindrical member with recesses on its inner surface, placing said cylindrical member in a die, placing mica and other insulation material in said die and within said cylindrical member with the mica projecting into the recesses on the inner surface of said member, subjecting said insulation material to heat and pressure to solidify the same, and cutting said cylindrical member so as to separate it into segments at the points where it is recessed.

2. The method of forming a commutator which comprises forming a cylinder of conducting material with recesses on the inner surface of said cylinder, inserting mica and other insulation material within said cylinder with the mica positioned within said recesses, securing the parts in position with reference to each other and cutting away the outer portion of said cylinder until the cylinder is separated into segments at said recessed portions.

3. The method of making a commutator which comprises cutting and shaping a piece of metal so as to form a hollow body roughly cylindrical in shape, having recesses defining the portions of the metal which are to be segments of the commutator and constituting the spaces which will separate said segments but not then completely separating said segments, preforming a pressed mass of plastic insulating material to a size and shape adapted to fit into said metal cylinder and having recesses adapted to register with the recesses in the cylinder, placing insulating strips in said registering recesses so as to extend into the recesses in the metal and for a substantial distance into the pressed mass of plastic insulation, thereafter molding said insulation under pressure so as to secure said parts in the desired relation, and thereafter removing a portion of the surface metal so as to separate the segments, expose the insulating strips.

4. The method of making a commutator which comprises assembling strips of mica between connected metal portions which are to form the contact segments of the commuta-

tor, said strips being of such size and so placed as to extend between and for a substantial distance below the inner surface of the metal portions from substantially the geometrical surface which is to be the contact surface of the commutator when finished molding a plastic insulating material into firmly securing relation to the metal portions and insulating strips, and separating the connections between the metal segments other than the molded insulation.

5. The method of making a commutator which comprises forming a generally cylindrical hollow body of conducting material having recesses extending completely across it on its inner side and to a substantially uniform distance from the outer surface thereof forming spaces between the segments of the finished commutator, said body having a portion adjacent its outer surface left uncut so as to form an integral connection adapted to hold the segments in the desired relation during the assembling and molding operations, placing within said body a mass of plastic adapted to form an insulating material when molded, molding said plastic into contact with the conducting material so as to secure the segments thereof firmly together and thereafter cutting away the connection between said segments.

6. The method of making a commutator which comprises forming a generally cylindrical hollow body of conducting material having recesses completely across the inner side thereof so as to define the contact segments of the finished commutator and having a continuous portion of the conducting material left adjacent the outer surface of the cylinder so as to form an integral connection adapted to hold the segments in the desired relation during the assembling and molding operations, placing within said cylindrical body a mass of plastic adapted to form an insulating material when molded, molding said plastic into contact with the conducting segments so as to secure them firmly together and thereafter removing the surface of said conducting body to the depth of the uncut connections and so as to make the resulting surface accurately circular in cross section.

Signed at 342 East Ave., Lockport, N. Y., this 21st day of April 1928.

GARDINER CUSHING WILSON.