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COMMUTATORS FOR ELECTRIC MACHINES

Filed Sept. 8, 1958

Fig. 1

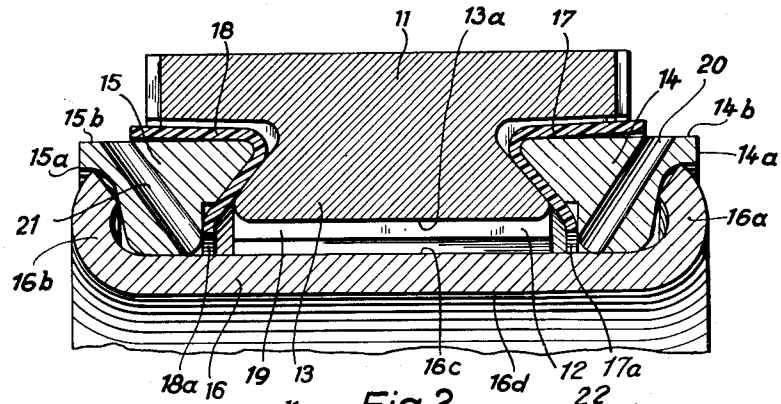


Fig. 2

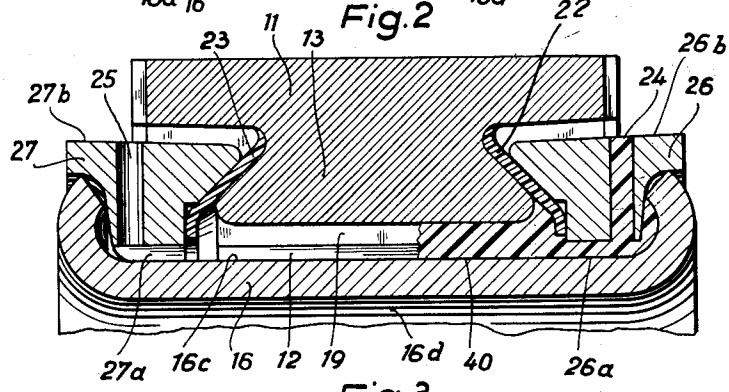
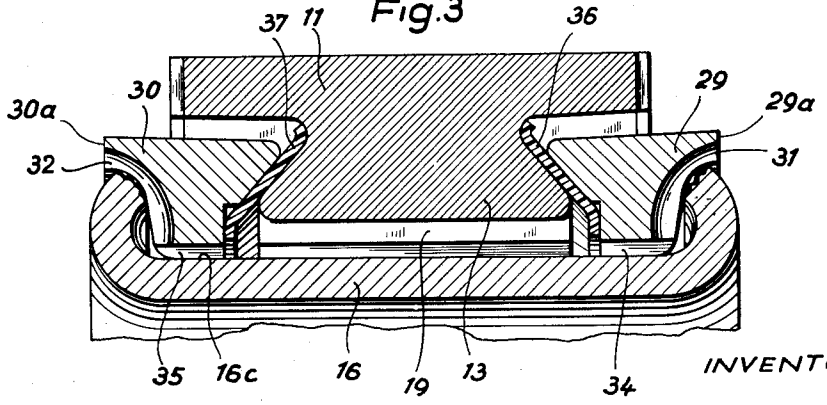


Fig. 3



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COMMUTATORS FOR ELECTRIC MACHINES

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6 Claims. (Cl. 310—235)

The present invention relates to commutators for electric machines, especially small electric machines, and more particularly to improvements in commutators of the type in which the annulus consisting of dovetailed insulated segments is held together by a pair of clamping rings and by a tubular core or rivet whose ends are deformed or swedged to bear against the end faces of clamping rings and to thereby hold the segments in proper position with respect to the axis about which the commutator revolves.

According to the invention disclosed in a copending application of Karl Wick, Serial No. 759,695, now abandoned, displacements of dovetailed segments in commutators having a rivet like core are prevented by introducing a hardenable plastic insulating substance into the space defined by the exposed surfaces of dovetailed portions and the peripheral zone of the core or rivet which latter, as above stated, urges a pair of clamping rings against the annulus of insulated segments and thus constitutes the locking means for all component parts. According to said invention, the insulating substance is introduced through at least one aperture which constitutes a communicating passage between said space and the axial bore of the commutator's core. The apparatus for introducing the insulating substance, preferably a material of good heat conductivity such as Bakelite or another synthetic product, comprises a pair of rams extending into the axial bore of the core, the rams compressing the insulating substance therebetween sufficiently to transform the latter into a plastic mass which enters the space between dovetailed portions of the segments and the core through the aforementioned aperture or apertures and fills the space to prevent, after hardening thereof, any tilting of segments about the clamping rings. The tilting of segments is undesirable as it would cause rapid destruction of the runway (i.e. the peripheral zone of the annulus of segments) which is in contact with customary carbon brushes or wipers when the commutator is put to use. Since the insulating substance is introduced into the annulus of segments through the core, the step must be performed before the commutator is mounted onto the spindle of an armature because the spindle, too, passes through the axial bore of said core.

An object of the present invention is to provide a commutator of the above described characteristics which is so constructed that the insulating material may be introduced into the space between dovetailed portions of segments and the peripheral zone of the core while the commutator is already mounted on the spindle of an armature, that is, after the armature wires are already soldered to the segments of the commutator.

Another object of the invention is to provide a commutator of the type above set forth which is so constructed that the insulating substance which prevents tilting of segments about their clamping rings may be introduced simultaneously with the step of coating the armature coil with the same insulating substance, i.e. that the coating of armature coil and the filling of annulus with a view to prevent tilting of segments may be performed simultaneously.

The above and certain other objects of the invention are attained by the provision of a commutator in which at least one clamping ring is formed with one or more bores and/or grooves constituting channels or communicating passages between the surrounding atmosphere and the space defined by dovetailed portions of segments and by the peripheral zone of the commutator's core, whereby the insulating material need not be introduced through the axial bore in the core. Accordingly, the introduction of insulating material into the aforementioned space need not precede the step of mounting the commutator on the spindle of an armature as the material may be introduced at any time due to accessibility of one end of each channel in the clamping rings regardless of whether the axial bore in the core is filled or not.

It is preferred to provide at least three channels in each clamping ring and to angularly space the channels from each other. The channels in clamping rings may consist of bores perpendicular or inclined with respect to the axis of a commutator, or each channel may consist of an arcuate groove and an axially parallel groove, the latter having one of its ends in communication with the space between the annulus of segments and the core of the commutator.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of three specific embodiments when read in connection with the accompanying drawing, in which:

FIG. 1 is an axial section through approximately one-half of a commutator constructed in accordance with my invention wherein the bores in clamping rings are inclined with respect to the axis about which the commutator rotates;

FIG. 2 is a similar section through a commutator whose clamping rings are provided with radial bores perpendicular to the axis of rotation; and

FIG. 3 is a similar sectional view of a commutator in which the channels in clamping rings consist of arcuate and axially parallel grooves.

Referring now in greater detail to FIG. 1, the commutator therein shown comprises an annulus of wedge-shaped segments **11** insulated from each other by interposed layers or sheets **12** of non-conducting material, e.g. mica; a pair of clamping rings **14**, **15** so shaped as to extend into the axial bore of annulus and into the V-shaped annular recesses defined by dovetailed portions **13** of segments **11**; a pair of insulating rings **17**, **18** which prevent short-circuiting of segments **11** by clamping rings **14**, **15**; and a cylindrical core or rivet **16** whose ends **16***a*, **16***b* are bent over or swedged and extend into the recesses provided in the end faces **14***a*, **15***a* of respective clamping rings. Surfaces **13***a* on dovetailed portions **13** and similar surfaces on the dovetailed portions of non-conducting intermediate members **12** define with the peripheral zone **16***c* of core **16** an annular space **19** which communicates with bores or channels **20** and **21** in respective clamping rings **14**, **15**. As shown, there are annular clearances **17***a*, **18***a* between inserts **17**, **18** and the periphery **16***c* of the core. Bores or channels **20**, **21** are inclined with respect to the longitudinal axis of the commutator and terminate in the peripheral surfaces **14***b*, **15***b* of respective clamping rings. To that end, rings **14**, **15** extend somewhat beyond the longitudinal ends of annular body constituted by members **11** and **12**. Thus, the peripheral zones of rings **14**, **15** are partly received in the axial bore of annulus consisting of members **11**, **13** and extend partly beyond the adjacent ends of the annulus. Outer ends of channels **20**, **21** terminate in the peripheral zones of respective rings **14**, **15** beyond the adjacent ends of the annulus.

Core **16** has an axial bore **16***d* which receives the

spindle of an armature (not shown) when the commutator is put to use. It will be readily understood that, since the hardenable insulating material **40** (shown in FIG. 2) may be introduced in plastic state through bores or channels **20**, **21** in clamping ring **14** or **15**, the filling of annular space **19** with such substance may occur before or after the segments are soldered to the wires of an armature. It is preferred to provide at least three spaced bores in each clamping ring.

Insulating material **40** is of such characteristics that it will become plastic under sufficient pressure and will harden in the annular space **19**. While the plastic material is introduced through the bores in one clamping ring, air is free to escape from space **19** through the bores in the other clamping ring. The purpose of hardenable substance **40** is to prevent the tilting of segments **11** about inwardly extending V-shaped portions of clamping rings **14**, **15** which could upset the arrangement of segments with respect to the axis of a commutator and would rapidly destroy the latter after relatively short periods of use. The substance **40**, after hardening, counteracts radially inwardly directed components of force which acts between rings **14**, **15** and the dovetailed portions **13** of commutator segments **11**. Axial movements of annulus consisting of members **11**, **12** are prevented by the deformed end portions **16***a*, **16***b* of core **16** which act against the end faces **14***a*, **15***a* of rings **14**, **15**. Any radial movements of segments **11** and of non-conducting members **12** are prevented by the hardened insulating body **40** on the one hand, and by the V-shaped inwardly facing extensions of clamping rings **14**, **15** on the other hand. Thus, segments **11** and members **12** are prevented from any movements with respect to the commutator axis and maintain their truly radial position.

The provision of bores or channels in both clamping rings is particularly important if the insulating material in space **19** is an epoxy resin or if said space is filled by immersing the commutator in vacuo into a suitable hardenable insulating plastic material.

Referring now to FIG. 2, the construction of members **11**, **12** and **16** is identical with those shown in FIG. 1. Insulating inserts **22**, **23** are slightly modified in that they extend only between the inclined surfaces of dovetailed portions **13** and of respective clamping rings **26**, **27**. Bores or channels **24**, **25** in rings **26**, **27**, respectively, are radial, i.e. perpendicular to the axis of core **16**, and communicate with the annular space **19** through clearances **26***a*, **27***a* between respective members **26**, **27** and the peripheral zone **16***c* of core **16**. Instead of providing clearances **26***a*, **27***a* between the clamping rings and the core **16**, members **26**, **27** are preferably provided with suitable axially parallel grooves in the walls surrounding their axial bores through which the insulating material **40** may pass from respective bores **24**, **25** into the space **19**. In this embodiment, too, outer ends of bores or channels **24**, **25** terminate at the peripheral zones **26***b*, **27***b* of the clamping rings and beyond the ends of members **11**, **12** to permit introduction of hardenable insulating material regardless of whether or not the spindle of an armature passes through the axial bore **16***d* of the commutator's core **16**.

The embodiment of my invention shown in FIG. 3 differs from that illustrated in FIG. 2 only in the construction of clamping rings **29**, **30**. Arcuate grooves **31**, **32** in respective members **29**, **30** terminate at the latter's end faces **29***a*, **30***a*. In addition, there are provided axially parallel cutouts or grooves **34**, **35** in respective members **29**, **30**, these cutouts constituting communicating passages between the inner terminals of arcuate grooves or bores **31**, **32** and the annular space **19**. As shown, grooves **34**, **35** are formed by removing layers of material from the walls surrounding the axial openings of clamping rings **29**, **30**, respectively. Insulating inserts **36**, **37** correspond to and serve the same purposes as members **22**, **23** shown in FIG. 2. Grooves **31**, **34** and **32**, **35** constitute channels communicating with space **19** at one end and with surrounding atmosphere at the other end.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic and specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be secured by Letters Patent is:

1. A commutator comprising, in combination; an annulus of insulated segments having two ends, an axis, and a coaxial bore, each segment having a dovetailed portion extending toward said bore and each dovetailed portion having a surface turned toward the axis of said annulus; a core coaxially received in said bore, said core having a pair of deformed end portions and a peripheral zone defining an annular space with the surfaces of said dovetailed portions; a pair of clamping rings, one at each end of said annulus, each ring having an end face engaged by one end portion of said core, a V-shaped extension engaging with said dovetailed portions in such manner as to urge said segments toward the axis of said annulus, and an axial opening surrounding the peripheral zone of said core, at least one of said rings defining at least one channel having one terminal in communication with said space and another terminal in the end face of the respective ring, each channel comprising a first groove having one end terminating in the end face and another end communicating with the opening of the respective ring, and a second groove having one end communicating with the last mentioned end of said first groove and another end communicating with said space; and a hardenable insulating substance filling said space.

2. A commutator comprising, in combination: an annulus of insulated segments having two ends, an axis, and a coaxial bore, each segment having a dovetailed portion extending toward said bore and each dovetailed portion having a surface turned toward the axis of said annulus; a core coaxially received in said bore, said core having a pair of deformed end portions and a peripheral zone defining an annular space with the surfaces of said dovetailed portions; a pair of clamping rings, one at each end of said annulus, each ring having an end face engaged by one end portion of said core, a V-shaped extension engaging with said dovetailed portions in such manner as to urge said segments toward the axis of said annulus, and an axial opening surrounding the peripheral zone of said core, each ring defining at least one channel having one terminal in communication with said space and another terminal in the end face of the respective ring, each channel comprising a first groove having one end terminating in the end face and another end communicating with the opening of the respective ring, and a second groove having one end communicating with the last mentioned end of said first groove and another end communicating with said space; and a hardenable insulating substance filling said space.

3. A commutator comprising, in combination: an annulus of insulated segments having two ends, an axis, and a coaxial bore, each segment having a dovetailed portion extending toward said bore and each dovetailed portion having a surface turned toward the axis of said annulus; a core coaxially received in said bore, said core having a pair of deformed end portions and a peripheral zone defining an annular space with the surfaces of said dovetailed portions; a pair of clamping rings, one at each end of said annulus, each ring having an end face engaged by one end portion of said core, a V-shaped extension engaging with said dovetailed portions in such manner as to urge said segments toward

the axis of said annulus, and an axial opening surrounding the peripheral zone of said core, at least one of said rings defining at least one channel having one terminal in communication with said space and another terminal in the end face of the respective ring, each channel comprising a first groove having one end terminating in the end face and another end communicating with the opening of the respective ring, and a second groove parallel with the axis of said annulus and formed in the material of the respective ring surrounding said opening, said second groove having one end communicating with the last mentioned end of said first groove and another end communicating with said space; and a hardenable insulating substance filling said space.

4. A commutator comprising, in combination, an annulus of insulated segments having two ends, an axis, and a coaxial bore, each segment having a dovetailed portion extending toward said bore and each dovetailed portion having a surface turned toward the axis of said annulus; a core coaxially received in said bore, said core having a pair of deformed end portions and a peripheral zone defining an annular space with said surfaces of said dovetailed portions; a pair of clamping rings, one at each end of said annulus, each ring having an end face engaged by one end portion of said bore, a V-shaped extension

engaging with said dovetailed portions in such a manner as to urge said segments toward the axis of said annulus, and an axial opening surrounding the peripheral zone of said bore, each clamping ring defining at least one channel having one end communicating with the surrounding atmosphere and another end communicating with said space; and a hardenable insulating material in said space.

5. A commutator as defined in claim 4 in which each of said channels is formed by a bore through the respective clamping ring and extending inclined to the axis of said annulus.

6. An arrangement as defined in claim 4 in which each of said channels is formed by a radial bore through the respective clamping ring and extending at substantially right angle to the axis of said annulus.

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