T. W. VARLEY.

COMMUTATOR CONSTRUCTION.

APPLICATION FILED MAR. 5, 1920.

1,430,866. Patented Oct. 3, 1922.

Fig. 1

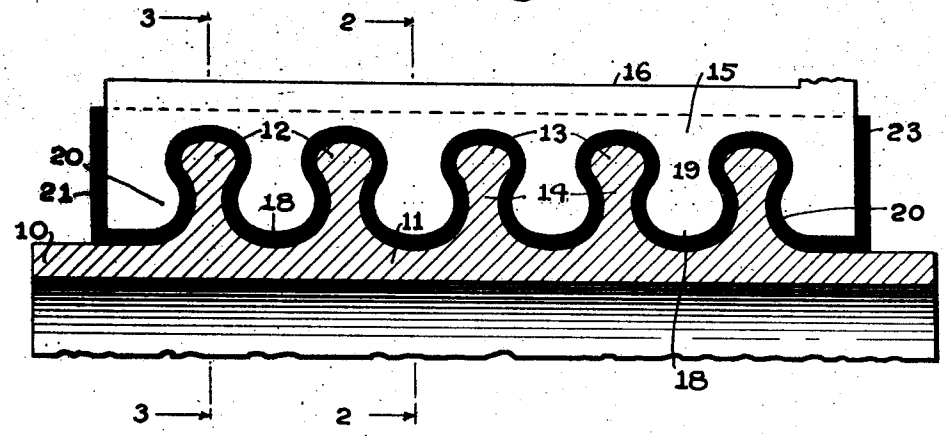


Fig. 2

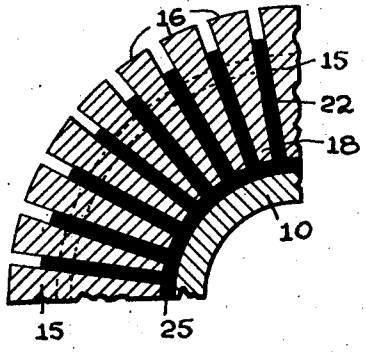
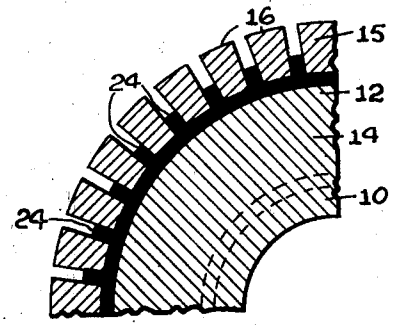


Fig. 3



Inventor

Thomas W. Varley

By Lucey, Verney, Blair & Hogsett

Attorney

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UNITED STATES PATENT OFFICE.

THOMAS W. VARLEY, OF NEW YORK, N. Y., ASSIGNOR TO SAFETY CAR HEATING & LIGHTING COMPANY, A CORPORATION OF NEW JERSEY.

COMMUTATOR CONSTRUCTION.

Application filed March 5, 1920. Serial No. 363,534.

To all whom it may concern:

Be it known that I, THOMAS W. VARLEY, a citizen of the United States, and a resident of the borough of Manhattan, city, county, and State of New York, have invented an Improvement in Commutator Construction, of which the following is a specification.

This invention relates to the construction of commutators and the like. One of the objects thereof is to provide a practical device of the above nature of strong and durable construction and efficient action. Another object is to provide a device of the above nature well suited to withstand high speed even though constructed of large size. Another object is to provide a device of the above nature of simple form and inexpensive of construction. Other objects will be in part obvious and in part pointed out hereinafter.

The invention accordingly consists in the features of construction, combinations of elements and arrangement of parts which will be exemplified in the structure hereinafter described and the scope of the application of which will be indicated in the following claims.

In the accompanying drawings, in which is shown one of various possible embodiments of this invention.

Figure 1 is a side elevation of a commutator segment mounted in position on the commutator;

Figure 2 is a sectional view taken along the line 2—2 of Figure 1; and

Figure 3 is a similar view taken along the line 3—3 of Figure 1.

Similar reference characters refer to similar parts throughout the several views of the drawings.

As conducive to a clearer understanding of certain features of this invention, it may be noted that although the securing of small size commutator segments in position to efficiently resist the effects of centrifugal force at reasonably high speeds has been achieved, nevertheless as the size of the commutator increases, the problem becomes more difficult. For example, if securing means at the ends of the commutator segments be depended upon, the effectiveness of such securing means as the commutator is increased in length and other dimensions, decreases due to the difficulties in increasing the strength of attachment at the same rate as the weight, and hence centrifugal force of the segments is increased. However, with present high speed apparatus and correspondingly high values of centrifugal force on the one hand, and with the necessity for nice alignment of the outer surfaces of the segments on the other hand, the problem of an efficient mounting is of large imporance. The solution of this problem in a simple, efficient, and thoroughly practical manner, is among the dominant aims of this invention.

Referring now to Figure 1 of the drawings, there is shown at 10 a support which may be secured on the armature shaft. This support is preferably formed of steel, having a body portion of a general tubular or sleeve-like form, and having formed at spaced intervals throughout its length a number of rings or shoulders 12 substantially of the construction shown in the drawings. These shoulders preferably increase in thickness, that is in their longitudinal dimensions with respect to the commutator as they extend outwardly from the sleeve-like portion 11. This conformation results in an outer ring-like portion 13 connected with the sleeve portion 11 by means of a relatively narrow web-like portion 14.

In order that there may be no confusion of terms, it may be noted that the term "outward" will be used throughout to designate a direction away from the axis of rotation of the commutator, and that "inward" will have a contrary significance. Also, by "longitudinal" is meant a direction lengthwise of the commutator, that is, parallel to its axis, whereas "circumferential" is used to denote a direction extending about the commutator as a whole.

The commutator segments are preferably all alike and are all formed substantially like that shown in Figure 1 of the drawings. The segment is formed of copper or the like, having a body portion 15 with the usual contact surface 16, rounded to cylindrical form for contact with the brushes, and terminating in the so called pigtails by which connection is made to the armature winding.

Extending inwardly from the body of the segment are a number of projections 18 integral with the segment and having an inner broadened connected with the body part

15 by a neck 19. These inward projections, here shown as four in number, are intermeshed with the outwardly extending rings or shoulders 12. At the end of the commutator furthermore, there are formed end projections 20, each substantially like one-half of the projections 18 and interlocking with the outer surface of the adjacent shoulders 12 and providing, in the embodiment shown, a plane end surface 21. With the parts in their assembled relation, all parts of the copper segment are preferably spaced from the adjacent parts of the steel support with its shoulders by a substantially even distance.

This space is filled with an insulating compound which may be a condensation product of phenol and formaldehyde, or other molded insulating material. The material here shown as at 22 extends in such manner as to form an even thickness between all adjacent surfaces of the segment and the support, and also preferably extends outwardly in a radial sheet at the end of the segment as at 23. This sheet also may interlock with the ends of the segment if desired, although this is not usually necessary.

The insulating material furthermore, extends outwardly between adjacent segments as shown in Figure 3 at 24 and between the shoulders or rings of the steel support (in a longitudinal direction) it extends inwardly to space the projections 18 as shown at 25 in Figure 2.

The parts are assembled as above, preferably in the following manner. The segments are slipped over the shoulders 12, the maximum longitudinal thicknesses of which are such as to pass through the narrowest parts of the pockets in the segments in which they rest. The segments and steel support are held within a suitable mold in properly spaced position and the insulating material in fluid or plastic form is then forced into the commutator so as to fill all interstices, substantially as shown in the drawings. This may be accomplished under pressure if necessary. The entire device then within the mold is subjected to heat or other curing agency in such manner as to give to the insulating material its ultimate hardness and strength. The outer mold is then removed and the commutator is substantially complete although the outer or contact surface may be smoothed off if necessary.

The action of this device is substantially as follows. As against ordinary mechanical strains the commutator is rigidly anchored in position, all without the necessity of adjustment or the chance of its becoming forced even to a slight extent out of its desired alignment. As against short-circuiting, ample insulation is provided between contiguous segments in a circumferential direction; also the segment is fully insulated as shown in the drawings, from its support. As against centrifugal force, the anchoring of the segment is particularly effective. Whatever its length, the number of points of anchorage is increased in proportion. Also if it be made of greater depth, the inter-meshed parts of segment and support may be correspondingly increased, thus adding to the strength of attachment and reducing the weight of the segment, and consequently its centrifugal pull. The insulation is subjected merely to a crushing stress and as it is confined by metal and used in relatively thin layers only, it is well adapted to withstand such stress. Furthermore, the metal of the segment itself substantially interlocks with the metal of the support and both parts are accordingly tied together in a manner which will resist outward displacement substantially to the tensile strength of the metal. It is also to be noted that although ample conducting cross-section is given and an ample body is given to the segment to permit occasional turning down in order to true up its surface, nevertheless due to the displacement of a large part of its volume by steel and insulation, there is a considerable saving of copper.

It will thus be seen that there is provided a device of an essentially simple nature which may be manufactured rapidly at low cost. It will also be seen that this device presents various characteristics by reason of which it achieves the objects of this invention and is well suited to meet severe conditions of use.

As various possible embodiments might be made of the above invention and as various changes might be made in the embodiment above set forth, it is to be understood that all matter herein set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

I claim as my invention:

1. In commutator construction, in combination, a commutator segment provided with a recess extending outwardly thereinto and increasing in longitudinal width in an outward direction, rigid means of a maximum longitudinal width equal to or less than the minimium longitudinal width of said recess whereby said means may enter said recess, and insulating means for interlocking said rigid means with the walls of said recess.

2. In commutator construction, in combination, a supporting member provided with an outwardly directed part intermediate the ends of the commutator, a plurality of segments fitted about said supporting member and fitted over said part, and insulating means interposed between said seg-

ments and said supporting member acting to interlock the same together.

3. In commutator construction, in combination, a supporting member, an annular outwardly directed part formed on said supporting member and increasing in longitudinal width in an outward direction, a plurality of segments having recesses into which said part fits and shaped to decrease in longitudinal width in an inward direction, and insulating means interposed between said outwardly directed part and the walls of said recess.

4. In commutator construction, in combination, a supporting member provided with a plurality of annular projections between the ends of the commutator, a plurality of segments fitting over said projections, and insulating means interposed between said segments and said projections to interlock them together.

5. In commutator construction, in combination, a supporting member provided with a plurality of annular projections between the ends of the commutator, a plurality of segments fitting over said projections, and insulating means interposed between said segments and said projections to interlock them together, said projections increasing in longitudinal width in an outward direction.

6. In commutator construction, in combination, a metallic supporting member having a substantially cylindrical portion provided with a plurality of annular projections between the ends of the commutator and each projection increasing in longitudinal width in an outward direction, a plurality of commutator segments each of which is provided with a plurality of recesses corresponding to said segments and decreasing in longitudinal width in an inward direction, said recesses being fitted over said projections, and insulating material interposed between the projections and said segments to lock said projections within said segments.

7. In commutator construction, in combination, a commutator segment having an outwardly extending recess, a supporting member having an outward projection extending within said recess and shaped to be normally removable therefrom in a radial direction, and insulating means interposed between said projection and the walls of said recess, said projection and said recess being adapted by their shape to be locked by said interposed insulating means against radial separation.

8. In commutator construction, in combination, a commutator segment provided with a recess extending outwardly thereinto and increasing in longitudinal width in an outward direction, a hub member adapted to support said commutator segment, means associated with said hub member, said means having a maximum longitudinal width equal to or less than the minimum longitudinal width of said recess whereby said means may enter said recess, and insulating means for interlocking said means with the walls of said recess.

9. In commutator construction, in combination, a plurality of commutator segments each segment being provided with a plurality of transverse openings spaced throughout its length and intermediate its ends, a hub member for supporting said segments, and a plurality of securing members extending entirely around said hub and integral therewith, one of said securing members extending transversely through each of said openings.

10. In commutator construction, in combination, a plurality of commutator segments, each segment being provided with a plurality of transverse openings spaced throughout its length and intermediate its ends, a hub member for supporting said segments, and securing means integral with said hub member extending transversely through said openings, said openings in one segment registering substantially with those in the neighboring segments and said securing means extending entirely about the commutator.

In testimony whereof, I have signed my name to this specification this 26th day of February, 1920.

THOMAS W. VARLEY.