Dec. 26, 1950 E. C. WAHLBERG 2,535,825

COMMUTATOR

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Fig. 1

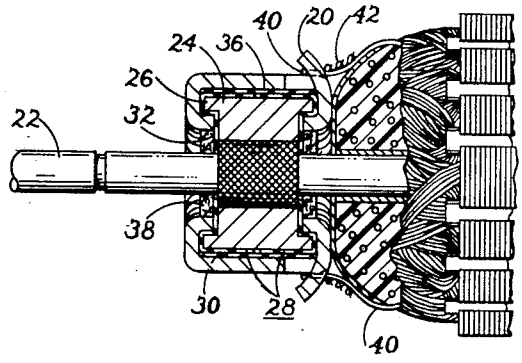



Fig. 2

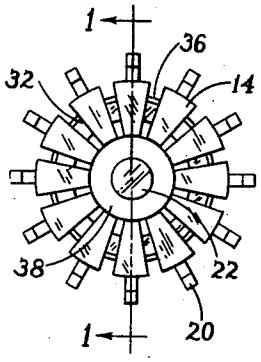



Fig. 3

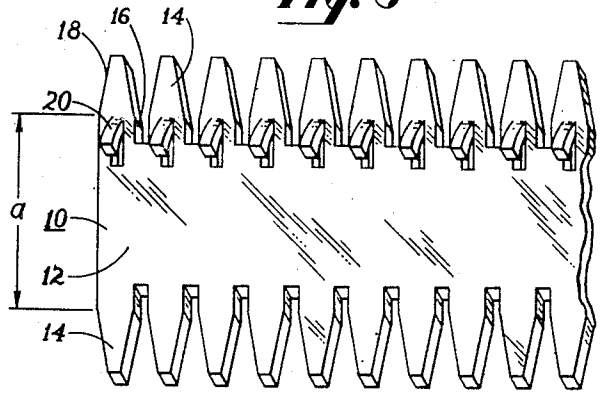
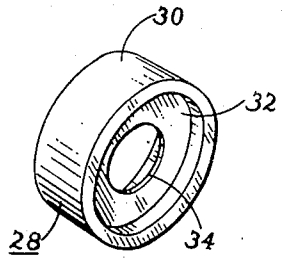



Fig. 4

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# UNITED STATES PATENT OFFICE

2,535,825

## COMMUTATOR

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9 Claims. (Cl. 171—321)

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My invention relates to commutators for electric motors, and more particularly to commutators of the type wherein a metal blank, which ultimately is to form the bars, is stamped from a flat sheet with anchoring tabs extending from opposite edges of the blank, the blank thereafter being wrapped around a hub structure, the tabs bent inwardly to anchoring position and the blank thereafter slotted to form the individual bars.

Heretofore, in the manufacture of commutators of this type, it has been customary to use a rigid insulating material, such as a phenolic resin condensation product, for the hub structure in order to insulate the bars from each other. However, while material of this nature may be suitable for motors which operate without substantial increase in commutator temperature, it has proved to be unsuitable for powerful high speed motors, due chiefly to the fact that ozone, which is produced as a result of commutator sparking, reacts chemically with the material at the high temperatures prevailing, which reaction reduces the originally rigid material to a granular state with an attendant loss of mechanical strength.

One of the objects of my invention is to provide a commutator of this type, which however is not subject to the above disadvantage, while still being relatively inexpensive. This I accomplish by providing a hub of metal which has ample mechanical strength and is not adversely affected by heat and ozone. This hub is insulated from the commutator bars by being encased in two cup-shaped members of insulating material, preferably made of moulded paper impregnated with an insulating compound. These cups are economical to manufacture and to apply to the metal hub.

In order to simplify the slotting operation after the blank has been secured to the hub structure, I form portions of the slots by the initial stamping operation. This not only reduces the length of cut necessary to complete the separation of the bars, but also assures that all of the metal which has to be cut is directly and firmly supported by the hub structure, which assures that it is cleanly and completely cut through and that no burs or bridges are left between the bars.

A further object of my invention is the provision of improved means for securing the armature leads to the commutator bars. To this end, a tongue is struck up from each of the anchor tabs on one side of the blank, this preferably being done as a part of the initial stamping operation. These tongues are so positioned with respect to the tabs that when the latter are bent inwardly to anchoring position, the tongues are automatically caused to extend outwardly at a suitable angle to the axis of commutator so that the leads may be wrapped around them. This eliminates the usual staking operation heretofore employed to secure the leads in short slots formed in the bars.

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Further objects and advantages of my invention will be apparent from the following description considered in connection with the accompanying drawings, which form a part of this specification and of which:

Fig. 1 is a cross-sectional view, taken on the line 1—1 of Fig. 2, of a portion of an armature of an electrical motor embodying a commutator in accordance with my invention;

Fig. 2 is an end view of the commutator shown in Fig. 1;

Fig. 3 is a perspective view on an enlarged scale of a metal blank which is employed in the construction of the commutator shown in the preceding figures; and

Fig. 4 is a perspective view of an insulating member.

Referring more particularly to Fig. 3, reference character 10 designates generally a metal blank stamped from sheet copper or any other metal suitable for use as the bars of a commutator. This blank includes a continuous central portion 12 from the opposite side edges of which extend aligned projections 14. The root portions of these projections 14, which are adjacent to the continuous central portion 12, have straight sides, as is indicated at 16, whereas the tip portions have tapered sides as shown at 18. A tongue 20 is struck out of each of the projections 14 on one side of the central portion. The material forming the tongue is severed from the projection along two sides and one end of the tongue, the opposite end of the tongue remaining integral with the projection. This juncture between the tongue and the projection is substantially in alignment with the juncture between the straight and tapered portions of the projection.

Figs. 1 and 2 show a completed commutator in assembled relation on the armature shaft 22 of an electrical motor. The commutator includes a hub member 24 made preferably of steel or other suitable material which has a high mechanical strength and is not adversely affected by high temperatures and ozone. Hub 24 is formed with an annular flange 26 at each end thereof. The hub is encased within two cup-shaped members 28 made of insulating material. As is shown more particularly in Fig. 4, each of the members 28

includes a skirt portion 30, the inner diameter of which is substantially equal to the outer diameter of the hub 24, and an end portion 32 which has a configuration conforming to the end of the hub 24. The end portion 32 is formed with a central opening 34 through which extends the armature shaft 22. Preferably, the members 28 are made of moulded paper impregnated with a suitable insulating compound.

As above stated, two of the cup-shaped members 28 are employed to encase the metal hub 24, one being slipped on to the hub from each end and consequently the ends of the skirt portions 30 are in abutting relationship. The skirt portions serve to insulate the cylindrical outer surface of the metal hub 24, while the end portions 32 provide insulation at the ends of the hub. If desired, a strip 36 of mica or other suitable insulating material may be wrapped around the skirt portions 30 so as to bridge the joint between their abutting ends, while at the same time increasing the thickness of the insulation around the cylindrical portion of the hub.

The blank 10 is thereafter wrapped around the insulated hub 24 and the projections 14 are bent inwardly so as to engage around the flanges 26, thus securely anchoring the blank, the cup-shaped members 28 and the strip 36 to the hub. The parts are so dimensioned that the axial length of the hub 24, including the flanges 26 is substantially equal to the distance *a* as shown on Fig. 3. Consequently, before the projections are bent into clamping position, only the tapered end portions thereof extend axially beyond the hub and hence the bending begins at about the juncture of the straight and tapered portions. The end portions are made tapered so that, when bent inwardly around the flanges of the hub, there is sufficient clearance between adjacent projections so that they do not overlap or contact each other.

The bending of the projections in this manner automatically causes the tongues 20 to extend outwardly at a substantial angle with respect to the unbent portion of the blank, as is shown clearly in Fig. 1. This results from the fact that each tongue is joined to the projection in the region where the latter is bent and is separated from the unbent portion.

After blank 10 has been secured to the hub structure in a manner above described, it is slotted to form separate commutator bars by cutting through the central portion 12 between the inner ends of the straight sided slots. By forming these straight sided slots during the initial stamping operation the length of the cutting required to completely separate the bars is obviously reduced, thus speeding up this operation, and in addition all of the metal which has to be removed during the cutting operation is directly and firmly supported by the hub structure. This cutting operation is performed by a circular saw which, because of the soft nature of copper, would be apt to draw out the metal any place where it were not firmly supported, instead of cutting all the way through. If this were to occur there would remain an electrical connection between adjacent bars.

The purpose of the tongue 20 is to provide means for securing the armature leads 40 to the commutator bars. Heretofore, it has been the practice to bring out excessively long leads during the winding of the armature, which leads are subsequently secured to the bars, as by staking them into small slots formed in the bars and thereafter cutting off the excess length. With the tongues 20, on the other hand, it is unnecessary to bring out excessively long leads, inasmuch as the leads may be looped around the tongue which, as is shown in Fig. 1, extend at an angle and away from the armature winding. This not only saves a certain amount of material, but completely eliminates the separate staking operation. In order to obtain a good electrical connection between the leads and the tongues, solder may be applied where the leads are looped around the tongues, or the tongues may be bent down slightly after the leads have been looped therearound in order to clamp the leads between the tongues and the adjacent portions of the bars. Moreover, should a tongue accidentally be completely sheared from the bar, the lead may be staked in the conventional manner into the slot thus formed.



As is customary, a piece of tape 42 may be wound around the leads 40 in order to hold them securely in place to thus prevent them from bowing outwardly under the action of centrifugal force.

If desired, washers 38 may be placed at each end of the hub and within the inturned ends of the projections 14. I have found it suitable to use felt washers which, when saturated with impregnating compound during the regular impregnating of the completed armature, become rigid and serve to prevent the inturned ends of the projections from moving inwardly away from the flanges 26. Hence, the washers aid in locking the projections in anchoring position.

Instead of completing the slotting of the commutator immediately after the blank has been secured to the hub and before the latter is mounted on the armature shaft, this step may be performed after the armature has been wound and impregnated. This has the advantage that the impregnating compound cannot get in the central portions of the slots and the compound which does get in the preformed end portions, is removed during the cutting step, thus eliminating the necessity of a separate operation for removing the compound from the slots. Furthermore, the preformed end portions of the slots are ordinarily outside of the brush track, and hence it is immaterial if compound remains in these portions.

While I have shown and described one more or less specific embodiment of my invention it is to be understood that this has been done for illustrations only and the scope of my invention is not to be limited thereby but is to be determined by the appended claims.

What I claim is:

1. In a commutator, a cylindrical metal hub, a pair of insulating members each having a cylindrical skirt portion and an end wall formed with a central aperture, said insulating members enclosing said hub to insulate the cylindrical and end surfaces thereof, a plurality of commutator bars circumferentially disposed around the insulated hub, and anchor tabs extending radially inwardly from said bars for securing the latter, said members and said hub in assembled relationship, the end walls of said members insulating said tabs from the end surfaces of the hub.

2. In a commutator, a cylindrical metal hub having an axially extending peripheral flange at each end thereof, a pair of insulating members each having a cylindrical skirt portion and

an end wall conforming to the flanged end of said hub, said insulating members enclosing said hub to insulate the cylindrical and end surfaces thereof, a plurality of commutator bars circumferentially disposed around the insulated hub, and an anchor tab extending from each end of each bar, said tabs being bent inwardly around said flanges to secure said bars, said insulating members and said hub in assembled relationship.

3. In a commutator, a cylindrical metal hub, a pair of insulating members each having a cylindrical skirt portion and an end wall formed with a central aperture, said insulating members enclosing said hub with the ends of the skirt portions adjacent to each other to insulate the cylindrical and end surfaces of the hub, a band of insulating material surrounding both skirt portions and bridging the joint between the adjacent ends thereof to increase the thickness of the insulation on the cylindrical surface of the hub, a plurality of commutator bars circumferentially disposed around the insulated hub, and anchor tabs extending radially inwardly from said bars for securing the latter, said members, said band and said hub in assembled relationship, the end walls of said members insulating said tabs from the end surfaces of the hub.

4. In a commutator, a cylindrical metal hub, means for insulating the cylindrical and end surfaces of said hub, a plurality of commutator bars circumferentially disposed around the insulated hub, anchor tabs extending from the ends of said bars and being bent inwardly around the end of said hub for securing the bars to the hub, and a tongue struck out from each of the tabs at one end of the commutator, the tongues being secured to the tabs in the bent portions of the latter and free from unbent portions of the bars, whereby the tongues extend at an angle to said unbent portions.

5. In an armature, a shaft, a winding on said shaft, a commutator mounted on said shaft comprising a cylindrical metal hub, means for insulating the cylindrical and end surfaces of said hub, a plurality of commutator bars circumferentially disposed around the insulated hub, anchor tabs extending from the ends of said bars and being bent inwardly around the end of said hub for securing the bars to the hub and a tongue projecting outwardly from each bar and extending at an angle away from said winding, and leads from said winding looped around said tongues and clamped between the tongues and adjacent portions of said commutator bars.

6. In a commutator, a cylindrical metal hub having an axially extending peripheral flange at each end thereof, a pair of insulating members each having a cylindrical skirt portion and an end wall conforming to the flanged end of said hub, said insulating members enclosing said hub to insulate the cylindrical and end surfaces thereof, a plurality of commutator bars circumferentially disposed around the insulated hub, an anchor tab extending from each end of each bar, said tabs being bent inwardly around said flanges to secure said bars, said insulating members and said hub in assembled relationship, and a tongue struck out from a bent portion of each of the tabs at one end of the commutator.



7. A metal commutator blank comprising a continuous center portion and a plurality of projections extending laterally from opposite side edges thereof, each projection having a root portion with substantially parallel side edges and a tip portion tapering outwardly from the root portion whereby the center portion will be firmly supported during a subsequent cutting operation.

8. A metal commutator blank comprising a continuous central portion and a plurality of projections extending laterally from opposite side edges thereof, and a tongue struck out from each of the projections on one side of said central portion.

9. A metal commutator blank comprising a continuous central portion and a plurality of projections extending laterally from opposite side edges thereof, each projection having a straight sided root portion and a tapered tip portion, and a tongue struck out from each of the projections on one side of said central portion, said tongues being joined to the projections at a distance from said central portion substantially equal to the lateral extent of said root portions and extending inwardly towards said central portion.

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