Jan. 5, 1932. V. G. APPLE 1,839,858

ARMATURE AND METHOD OF MAKING IT

Filed May 16, 1929 3 Sheets-Sheet 1

Fig. 1.

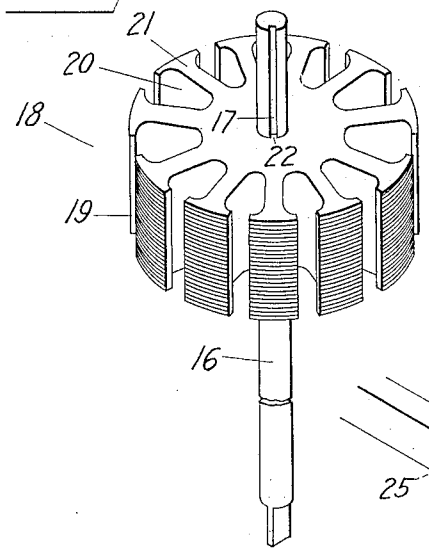
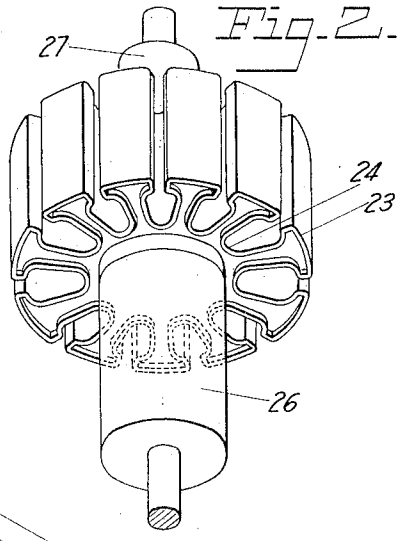


Fig. 2.



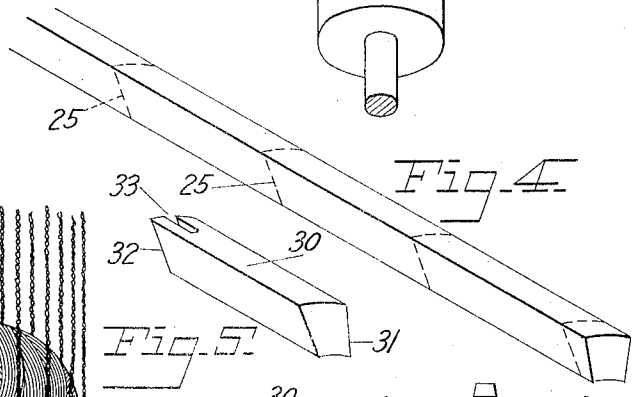


Fig. 4.

Fig. 5.

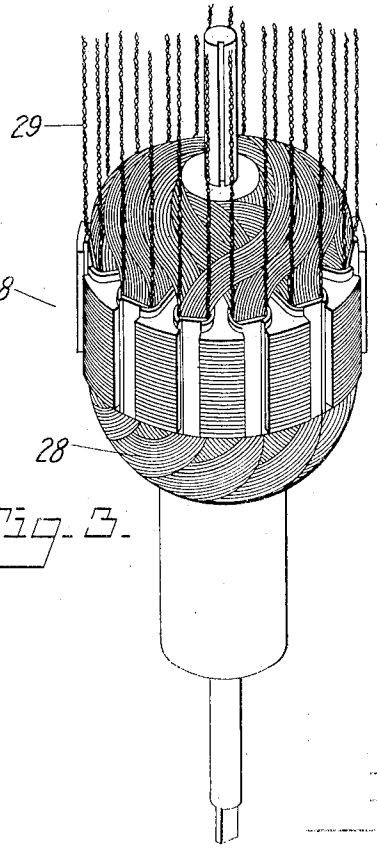


Fig. 3.

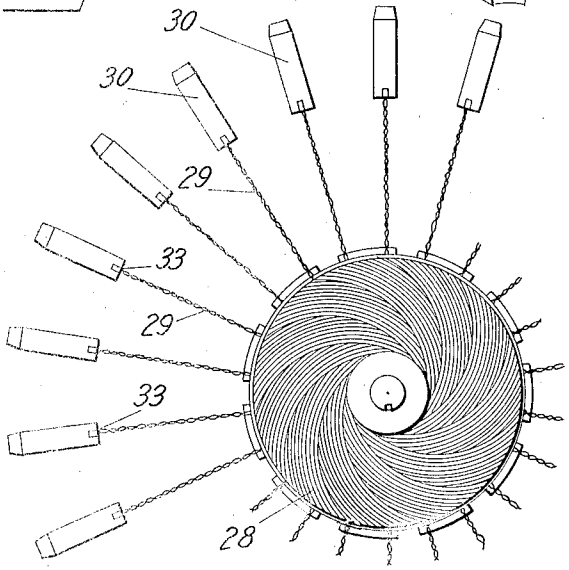


Fig. 6.

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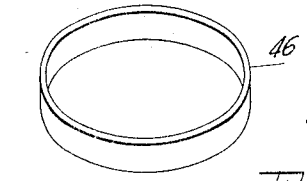

Fig. 9.

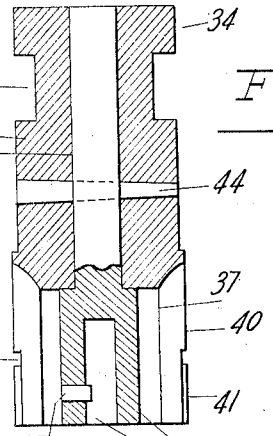

Fig. 7.

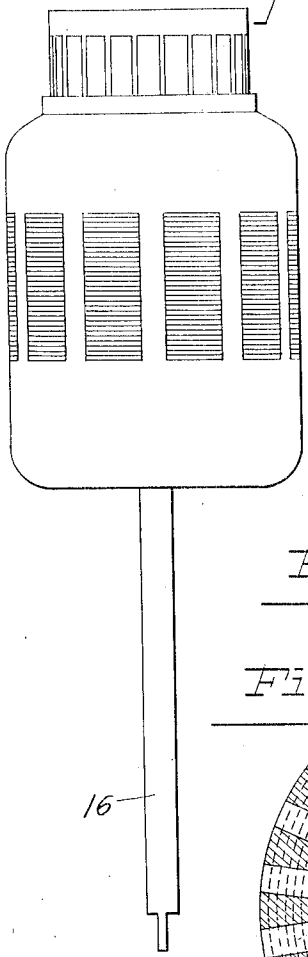

Fig. 15.

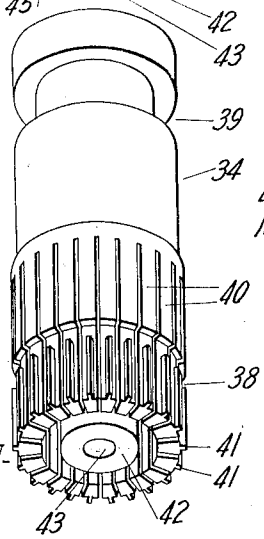

Fig. 8.

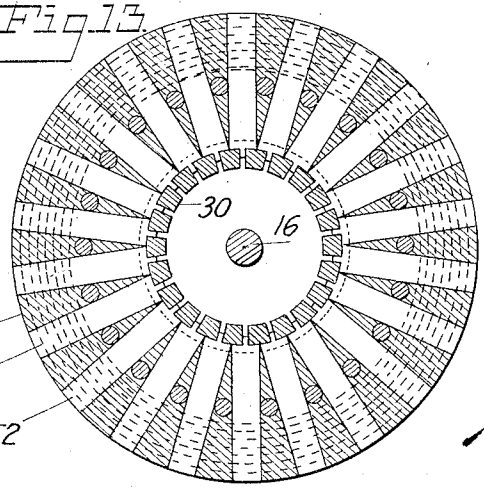

Fig. 13.

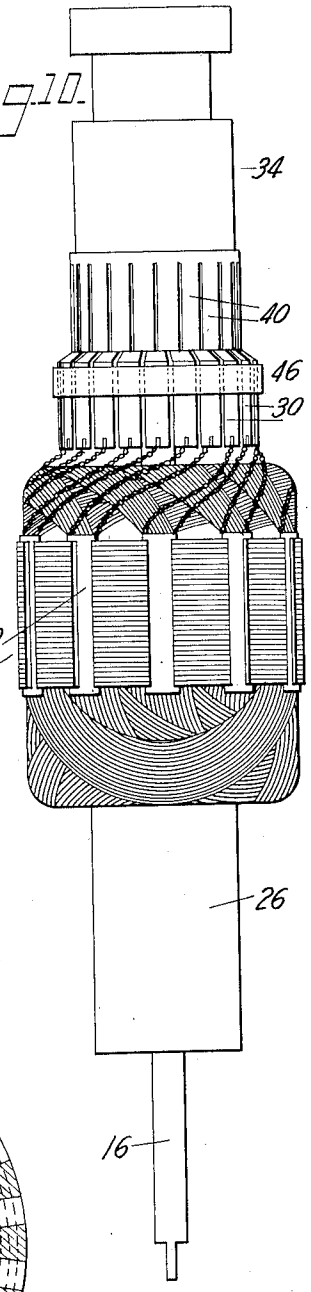

Fig. 10.

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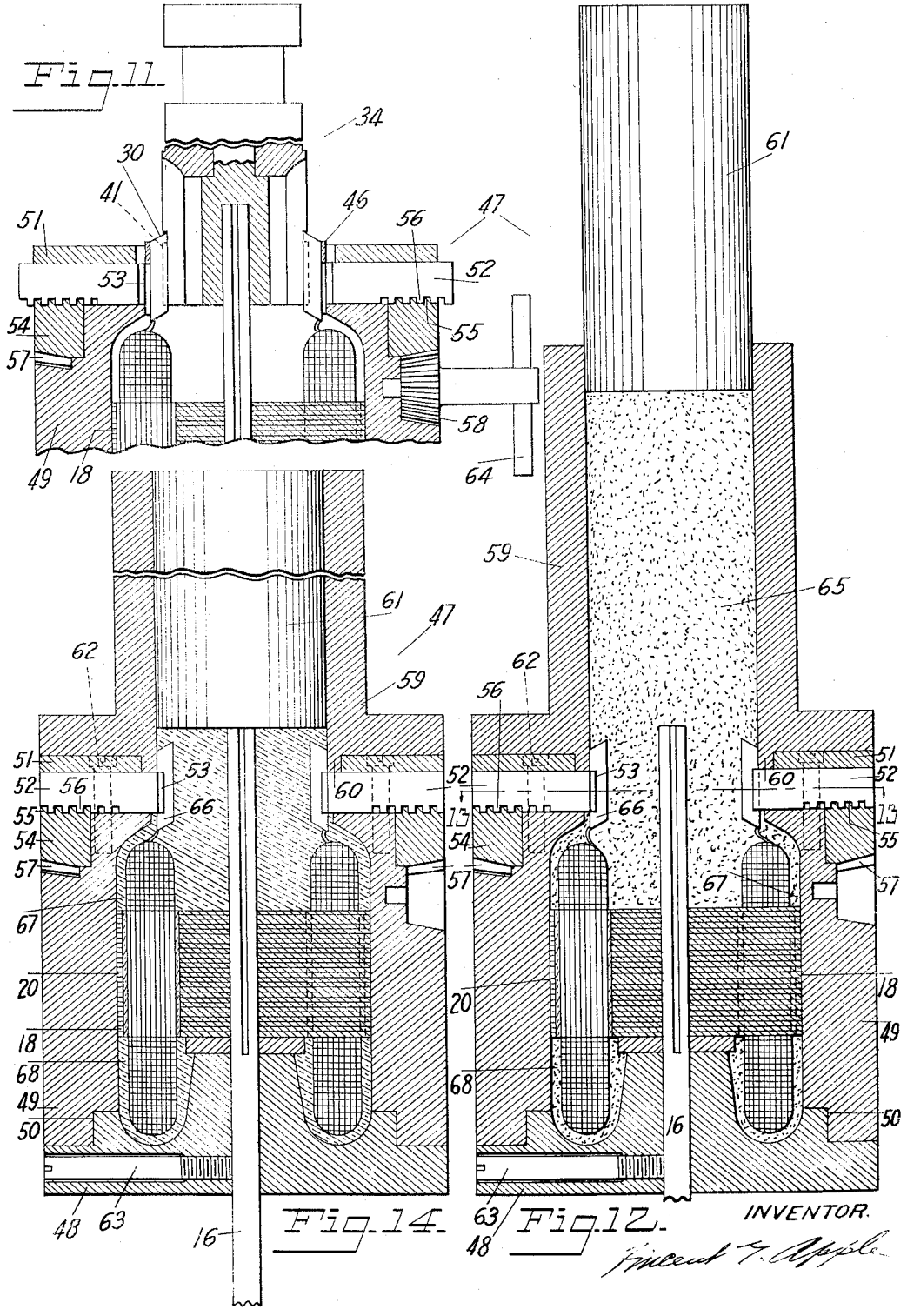

Patented Jan. 5, 1932 1,839,858

UNITED STATES PATENT OFFICE

VINCENT G. APPLE, OF DAYTON, OHIO

ARMATURE AND METHOD OF MAKING IT

Application filed May 16, 1929. Serial No. 363,702.

This invention relates to armatures of the class comprising a slotted core, a winding of insulation covered wire and a commutator.

An object of the invention is to generally improve the structure of an armature of this type.

A more specific object is to provide a structure wherein the core, the turns of wire composing the winding and the bars composing the commutator are all imbedded in the same substantially continuous mass of impervious insulating material whereby they are permanently held in spaced relation and protected against the harmful effect which results when oil, moisture, or other foreign matter is permitted to enter into the spaces between the conductive portions of the structure as in common practice.

A further object is to provide a novel procedure for carrying the first named objects into effect.

Other objects and meritorious features of the invention will become apparent to one skilled in the art as the invention is described in detail and reference is made to the drawings wherein,

Fig. 1 shows the core of the armature which I have selected to illustrate my invention.

Fig. 2 shows the core Fig. 1 with the slots lined with sheet insulation preparatory to placing the winding thereon and with collars at the ends of the core to keep the winding spaced apart from the shaft as it is being placed.

Fig. 3 shows the winding in place with extending leads formed of the ends of the wire composing the coils.

Fig. 4 shows a bar of stock from which the commutator segments are made.

Fig. 5 shows a single commutator segment.

Fig. 6 shows the wound structure Fig. 3 with a segment Fig. 5 electrically joined to each lead.

Fig. 7 is a vertical axial section through a tool used to arrange the segments of the structure Fig. 6 is proper spaced relation.

Fig. 8 shows the tool Fig. 7 in perspective.

Fig. 9 is a ring for holding the segments to the tool Fig. 8.

Fig. 10 shows the tool Fig. 8 and the ring Fig. 9 assembled on the armature to locate the commutator segments.

Fig. 11 is a fragmentary vertical section through a mold into which the armature is being placed.

Fig. 12 shows the armature in place ready to mold.

Fig. 13 is a transverse section taken at 13—13 of Fig. 12.

Fig. 14 shows the armature after the insulation has been molded about it.

Fig. 15 shows a completed armature after removal from the mold.

Similar numerals refer to similar parts throughout the several views.

In the drawings a shaft 16 having a longitudinally extending keyway 17 carries a core 18 composed of a plurality of core laminæ 19. Laminæ 19 have a series of winding slots 20 separated by teeth 21, and integral keys 22 extend inwardly into keyway 17 whereby slots 20 are held in definite relation to keyway 17.

Slots 20 are lined as in Figure 2 by placing a single strip of insulation 23 around the core and looping it downward into each slot as at 24. Collars 26 and 27 are placed over the shaft 10, but remain there only while the winding is being put on the core.

Fig. 3 shows the core 18 with the coils 28 wound in place. Leads 29 are formed by joining the end of one coil to the beginning of the next as in common practice.

In Fig. 5 I show one of the segments 30 which I use to compose a commutator. To make these segments I provide wire of trapeziform cross section (see Fig. 4) and cut it into lengths by cutting through the wire at an angle as at 25. Thus for each cut there is produced a segment 30 having one end beveled as at 31 and the other end as at 32. A lead slot 33 is then easily cut through the corner of each segment as shown.

Fig. 6 shows the structure after a segment 30 has been joined to each of the leads 29. The leads are pressed into the lead slots 33 whereupon they may be arc welded, brazed, soldered or otherwise electrically joined to the segments.

After all of the segments are joined to the

leads, a method of composing a commutator from the segments is provided. This consists briefly of holding the segments in the exact spaced relation which they occupy in the finished commutator and molding insulation within, between and about them while so held, hardening the insulation, then removing the holding means, and, since it is one of the objects of the invention to have the same substantially continuous mass of impervious insulation bind the segments together and extend round about the windings to enclose them, the tools are made to accomplish this object in the one molding operation.

Fig. 7 is a vertical axial section through the tool 34 into which the segments 30 are temporarily assembled in order that they may be more easily entered into the mold. The tool consists of a cylindrical body 35 bored at 36 and counterbored at 37, with annular grooves 38 and 39 extending around it. The counterbored portion 37 is divided by a series of longitudinal cuts into prongs 40 and each prong is further milled at its outer diameter from the free end to groove 38 to provide an integral key 41 extending outwardly therefrom. A plug 42, bored at 43 is fitted into opening 36 and secured by pin 44. Another pin 45 extends inwardly into opening 43. Tool 34 is also shown in perspective in Figure 8.

When an armature has been wound, and has its commutator segments 30 connected to the leads 29 as shown in Fig. 6, the collar 27 is removed and the tool 34 is placed over shaft 16 with pin 45 in keyway 17 of the shaft. The segments 30 are then laid around the tool with keys 41 of the tool extending outwardly between the segments (see Figs. 10 and 11). By this means the segments are held spaced apart and in correct relation to the winding slots 20 of core 18. Ring 46, Fig. 9 is now forced over the outside of segments 30, the prongs 40 springing slightly inward to permit the ring to go over, and the structure appears as in Fig. 10 and after removal of collar 26 is ready to be placed in the mold.

The mold 47 shown at three stages of its operation in Figs. 11, 12 and 14 comprises a base 48 bored to fit shaft 16, a body 49 bored to fit core 18 and to fit over annular rib 50 of base 48, a chuck jaw spacing plate 51 slotted in its lower surface to receive a number of chuck jaws 52 (see Fig. 13), each jaw being provided with a spacing tang 53 extending from its inner end, a chuck scroll ring 54 having scroll threads 55 in its upper surface engaging corresponding threads 56 in the lower edges of the jaws and bevel gear teeth 57 in the lower surface of the ring adapted to be engaged by the teeth of bevel pinion 58, a stock ring 59 bored to the diameter of the finished commutator and having an annular rib 60 extending downward into body 49 to maintain concentric location therebetween, and a plunger 61 snugly fitted into the bore of stock ring 59. The chuck jaw spacing plate 51 is secured to body 49 by screws 62 thereby retaining chuck jaws 52 and scroll ring 54 therebetween. A locating screw 63 is adapted to engage the shaft of the armature to prevent its turning in base 48.

In operation an armature which has been brought to the stage shown in Fig. 10 is placed on the base 48. The body 49 with chucking mechanism attached is brought down over the core as in Fig. 11. The chuck jaws 52 are at this time withdrawn from the opening through which the commutator extends, and the ring 46 which holds the segments against the tool 34 is brought as near as possible to the upper ends of the segments.

After locating the armature, having the tool 34 and ring 46 in place, in the mold 47 as shown, the bevel pinion 58 is rotated by handle 64 to bring the jaws 52 radially inward until the tangs 53 enter the spaces between the segments 30, after which the screw 63 is tightened, the tool 34 and ring 46 are withdrawn and the stock ring 59 is put into place.

The mold and its contents are now brought to a relatively high temperature, depending somewhat on the nature of the insulation to be molded, and a measured quantity of the unmolded thermo plastic insulation 65 is placed in the heated stock ring 59 and the plunger 61 slightly entered at the top as shown in Fig. 12.

As soon as the insulation absorbs sufficient heat from the walls of the stock chamber to become plastic; the plunger 61 is pressed downward, and the insulation is forced first outwardly between the ends of the segments 30 as at 66, and between the coils where they are held apart by the teeth 21 adjacent the end of the core 19 into the space 67, downward through the outer unoccupied portions of the winding slots 20 into the space 68 around the coils, thus forming a core of insulation for the commutator and a complete cover for all parts of the winding, even for that portion which extends through the core slots.

The mold is held completely closed as in Fig. 14 until the stored heat of the mold hardens the covering of insulating material whereupon the armature is pressed out complete except for a very slight trueing up of the outer diameter of the commutator.

A completed armature after removal from the mold is shown as in Fig. 15.

Having described my invention, I claim—

1. The method of making an armature, which consists of winding conducting wire into the slots of the core leaving connecting leads at suitable intervals, attaching a commutator segment to each lead, arranging the segments in cylindrical formation and mold-

ing insulation within, between and about them to compose a commutator.

2. The method of making an armature which consists of winding coils of insulated conducting wire into the core slots leaving connecting leads extending from the coils, electrically joining a commutator segment to each lead, arranging the segments in cylindrical formation, placing the structure in a mold, and molding insulation within, between and about the segments to compose a commutator.

3. The method of making an armature, which consists of winding coils of insulated conducting wire into the core slots, leaving connecting leads extending from the coils, electrically joining a commutator segment to each lead, arranging the segments in cylindrical formation, placing the structure in a mold, holding the segments at their outer edges to maintain their cylindrical formation, then molding insulation to extend within, between and about the segments to compose a commutator.

4. The method of making an armature, which consists of winding coils of insulated conducting wire into the core slots, leaving connecting leads extending from the coils, electrically joining a commutator segment to each lead, arranging the segments in spaced apart relation around a cylindrical core, placing the structure in a mold, holding the segments at their outer edges to maintain their spaced apart relation, removing the cylindrical core, then molding insulation to extend within, between and about the segments to compose a commutator therefrom.

5. The method of making an armature, which consists of winding coils of insulated conducting wire into the core slots leaving conducting leads extending from the coils, joining a commutator segment to each lead, keeping the segments in spaced apart relation and in cylindrical formation by means which holds them at their inner edges, placing the structure in a mold, holding the segments at their outer edges, removing the means which holds them at their inner edges and replacing said inner edge holding means with a mass of insulation molded in situ.

6. The method of making an armature, which consists of winding coils of insulated conducting wire into the core slots leaving connecting leads extending from the coils, electrically joining a commutator segment to each lead, arranging the segments in spaced apart relation around a cylindrical core, placing the structure in a mold, holding the segments at their outer edges to keep them in their cylindrical arrangement and spaced apart positions, removing the cylindrical core, then molding a substantially continuous mass of insulation through, between and about the segments and over the entire winding.

7. The method of making an armature, which consists of winding coils of insulated conducting wire into the core slots leaving connecting leads extending from the coils, electrically joining a commutator segment to each lead, arranging the segments in spaced apart relation around a cylindrical core, placing the structure in a mold, holding the segments at their outer edges to keep them in cylindrical arrangement and in spaced apart relation, removing the cylindrical core, placing a measured quantity of unmolded insulation at the end of the ring of commutator segments, heating said insulation and forcing it into and through said ring and through the coils to cover the coils at the one end of the core, through the core slots and about the coils at the other end of the core, to form one substantially continuous mass of insulation comprising a core for the commutator and a cover for the entire winding.

8. An armature comprising a core, coils composed of a plurality of turns of insulated wire on said core, connecting leads extending from said coils, a commutator segment electrically joined to each connecting lead, and an integral mass of impervious insulation extending within, between and about said segments and said coils forming a commutator of said segments and a covering for said coils.

9. An armature such as is described in claim 8 having the insulation excluded from between the segments of the commutator at the brush track.

10. An armature comprising a slotted core, coils composed of a plurality of turns of insulated wire in the slots of said core and extending beyond the core at each end, connecting leads extending from said coils, commutator segments connected to the leads, and an integral mass of molded insulation extending within, between and about the said segments, through and about the extending ends of said coils and filling the upper portion of the core slots not occupied by said coils.

In testimony whereof, I hereunto set my hand.

VINCENT G. APPLE.