April 7, 1931. V. G. APPLE 1,799,347

ARMATURE

Filed July 5, 1929 2 Sheets-Sheet 1

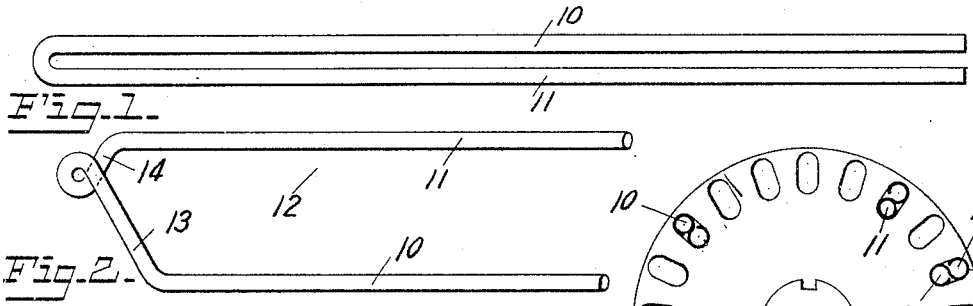

Fig. 1.

Fig. 2.

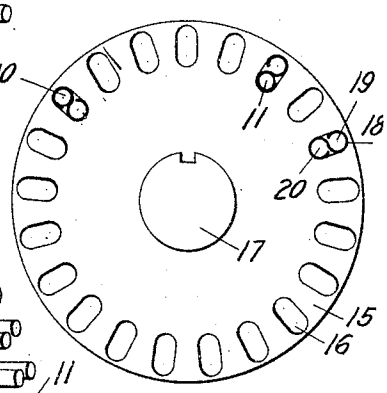

Fig. 3.

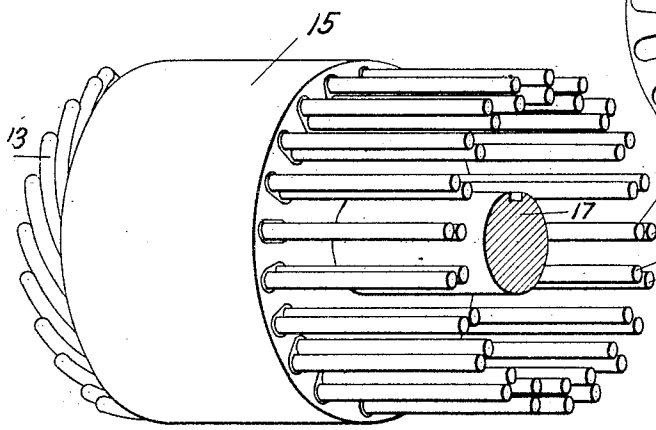

Fig. 4.

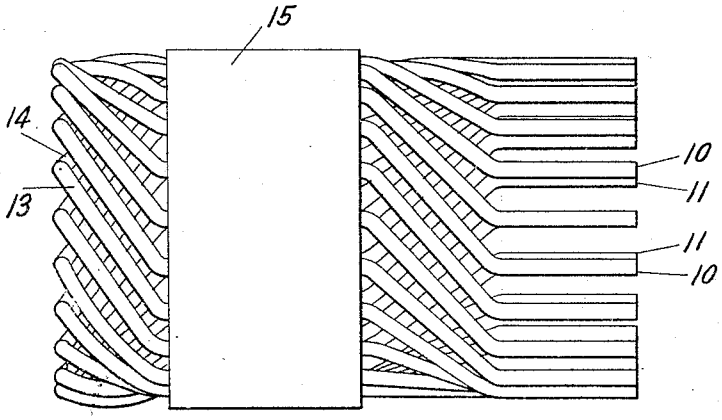

Fig. 5.

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ARMATURE

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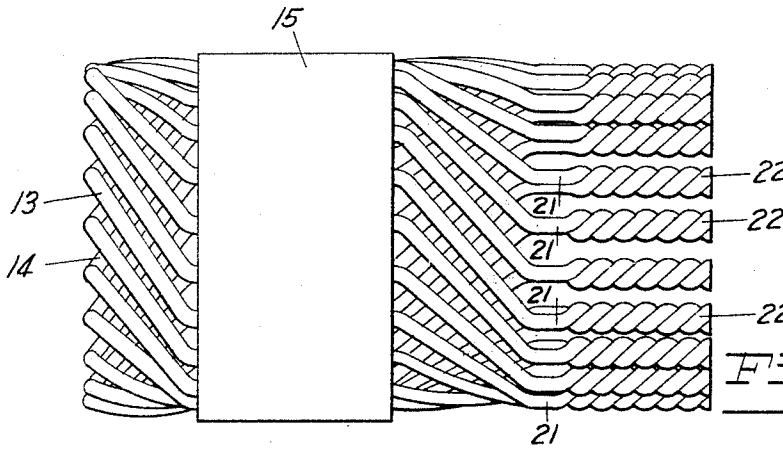

Fig. 6.

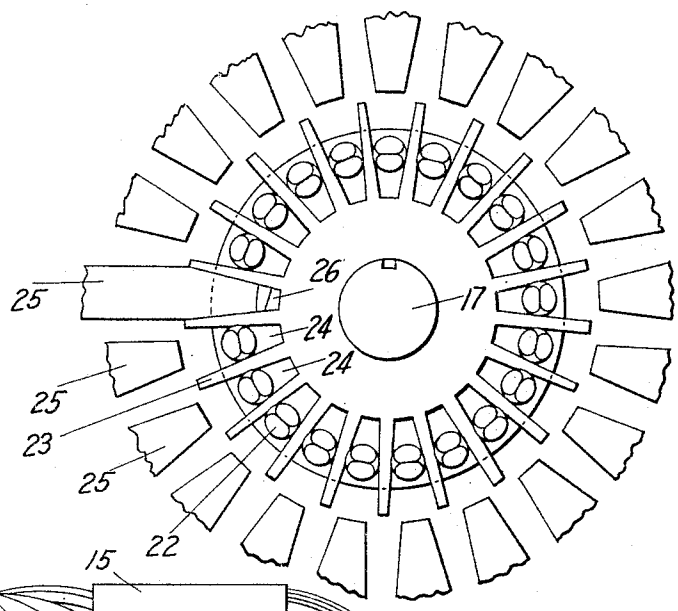

Fig. 7.

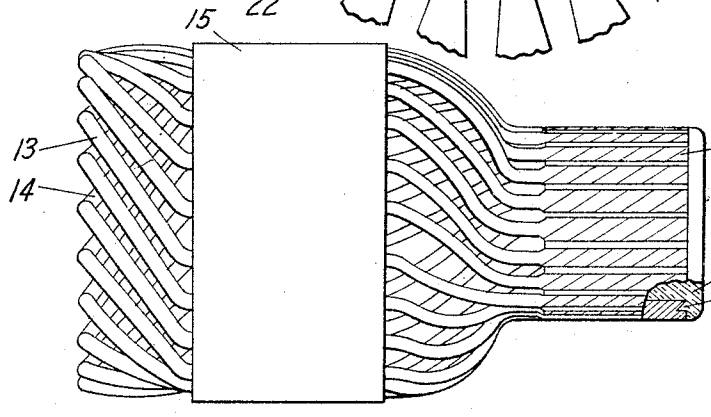

Fig. 8.

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UNITED STATES PATENT OFFICE

VINCENT G. APPLE, OF DAYTON, OHIO

ARMATURE

Application filed July 5, 1929. Serial No. 376,164.

This invention relates to armatures having bar windings and particularly to those wherein a commutator is made of integral ends of the bars of the winding.

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

Another object is to improve the intimacy of the electrical contact between pairs of bar ends composing segments.

Another object is to join the pairs of bar ends in such a manner as to compose a commutator segment of greater cross-sectional area than is ordinarily possible.

Other objects will be apparent to those skilled in the art as the invention is described in detail and reference is made to the drawings, wherein—

Fig. 1 shows a length of round wire of conductive material bent back upon itself in hairpin form.

Fig. 2 shows the legs of the hairpin Fig. 1 spaced apart to compose a winding loop.

Fig. 3 is an end view of a core into which loops Fig. 2 are assembled.

Fig. 4 is a perspective view of the core in Fig. 3 with a plurality of loops Fig. 2 assembled therein.

Fig. 5 shows the structure Fig. 4 after the bar ends have been circumferentially displaced to new positions and rearranged in new pairs.

Fig. 6 shows how the new pairs of bar ends are twisted together to more than double the cross-sectional area of a single wire and to make intimate electrical contact between the two bars of each pair.

Fig. 7 is an end view of a die into which the twisted ends are driven to compose smooth segments of trapeziform cross-section from the twisted pairs of ends.

Fig. 8 shows a completely wound core with the pairs of bar ends formed into commutator segments arranged in cylindrical formation and a commutator binding means applied thereto.

Similar numerals refer to similar parts throughout the several views.

Referring to the drawing a round wire is bent double as in Fig. 1, forming two parallel slightly spaced apart legs 10 and 11, which are then spread apart to compose a winding loop 12 as shown in Fig. 2, in which the leg 10 is positioned to form a part of the outer layer of the winding and the leg 11 is positioned to form a part of the inner layer of the winding, the two legs remaining joined together by integral back leads 13 and 14.

A core 15, Fig. 3, having oval winding apertures 16 is mounted on a shaft 17 extending lengthwise therethrough. Apertures 16 are lined with strips of sheet insulation 18 formed so as to provide two openings 19 and 20 through each aperture 16, said openings being insulated one from the other and both from the core. The leg 10 of a loop is shown in an opening 19 and the leg 11 in a spaced apart opening 20. The entire set of loops 12 composing a winding occupy similar positions in other lined apertures of the core.

Fig. 4 shows an entire set of loops 12 assembled in a core whereby two concentric rows, one composed of ends of legs 10, and the other composed of ends of legs 11, are formed. The ends are then circumferentially displaced one layer in one direction and the other layer in the other direction as in Fig. 5, whereby a leg of one layer emanating from a certain aperture is paired with a leg of the other layer coming from a widely spaced apart aperture.

The rearranged pairs of ends of bars 10 and 11 as shown in Figs. 5 are now held one radially above the other at 21, 21 etc. and twisted together as at 22, Fig. 6. The twisted part thus becomes shorter than the lengths of wire composing it. This not only increases the cross-sectional area over and above that of a pair of parallel bars, but it forms a highly effective electrical joint between the two.

A forging die 23 having a plurality of tapered slots 24 is placed over shaft 17 and a plurality of plungers 25, one for each slot, operated by means not shown, force the twisted ends 22 to the bottom of the slots 24 forming wedge shaped segments 26 of the twisted ends. One only of the plungers 25 and its formed segment 26 are shown in the operated position, but it is readily conceiv-

able that all of the plungers may be simultaneously operated if desired.

Fig. 8 shows the armature with the forging die 23 removed, and all of the twisted ends 22 formed into commutator segments 26, a V shaped notch 27 cut in the end of each segment, and a core of insulation 28 binding the segments together to form a commutator thereof.

Having shown and described one embodiment of my invention whereby the objects set forth are attained, I claim,

1. In an armature winding, commutator segments composed of twisted together pairs of the armature conductor ends.

2. In an armature winding, a plurality of spaced apart conductor bars and commutator segments formed of the twisted together ends of said bars.

3. An armature winding comprising a plurality of winding loops with the open ends of succeeding loops of the circuit twisted together in pairs, and wedge shaped commutator segments formed of compressed pairs of the said twisted together ends.

4. In a bar wound armature, two concentric rows of conductor bars in a core, and a single row of wedge shaped commutator segments formed of compressed pairs of twisted together bar ends, the cross sectional area of each segment being larger than the combined area of the untwisted portion of the pair of bars.

5. In a bar wound armature, a plurality of spaced apart conductor bars arranged in cylindrical formation, and a plurality of wedge shaped commutator segments formed of compressed pairs of twisted together ends of said bars, said ends in the untwisted state being longer than said segments.

6. Steps in the method of making an armature, which consists of twisting together the ends of conductor bars of the winding in pairs, and striking each twisted together pair in a wedge shaped die.

7. Steps in the method of making an armature, which consists of bringing together the ends of widely separated conductor bars of the winding, twisting them together, and striking them in a die to bring them to a wedge shape.

8. Steps in the method of making an armature, which consist of bringing bars of the winding together in pairs, twisting the two members of each pair together, striking them into the pockets of a die to bring the twisted portions to a substantially smooth wedge shape and in a circular row closer to the armature axis than the winding, and binding the circular row of segments together to compose a commutator.

9. The method of making an armature, which consists of arranging the conductor bars around the periphery of the core in two concentric layers, circumferentially displacing the bars of one layer relative to the bars of the other layer to bring the ends of bars of one layer radially over the ends of widely spaced apart bars of the other layer in pairs, twisting together the two members of each pair, placing the twisted ends in a die having a circular row of wedge shaped slots, forcing said twisted ends radially inward to the bottoms of said slots, removing the die, and molding a core of insulation about said ends to compose a commutator.

In testimony whereof I affix my signature.

VINCENT G. APPLE.