

May 31, 1932.

V. G. APPLE

1,860,977

METHOD OF MAKING ARMATURE COILS

Filed Oct. 26, 1928

2 Sheets-Sheet 1

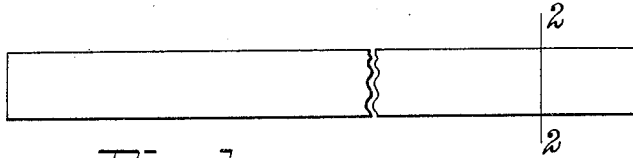


Fig. 2.

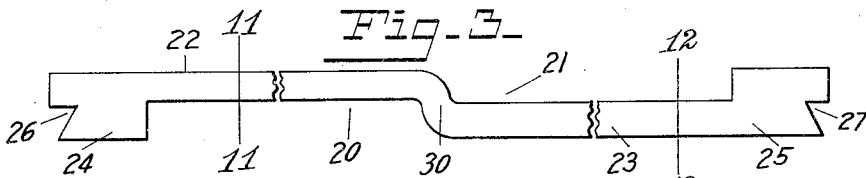


Fig. 11.

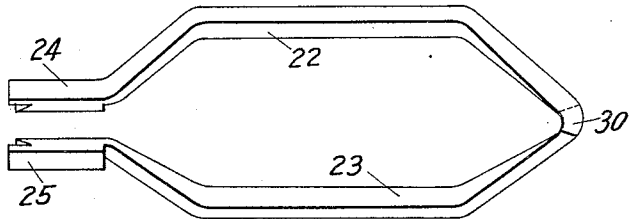
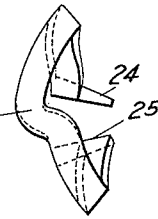
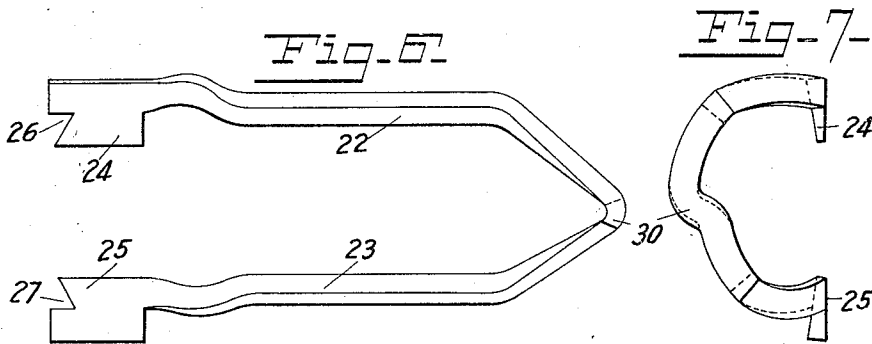
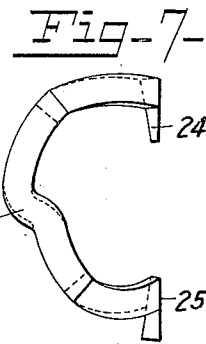
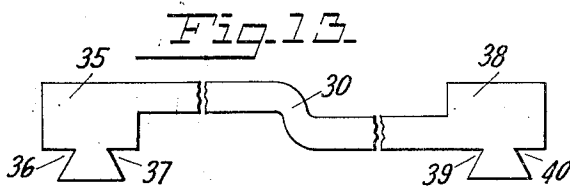


Fig. 12.



Fig. 4.

Fig. 5.



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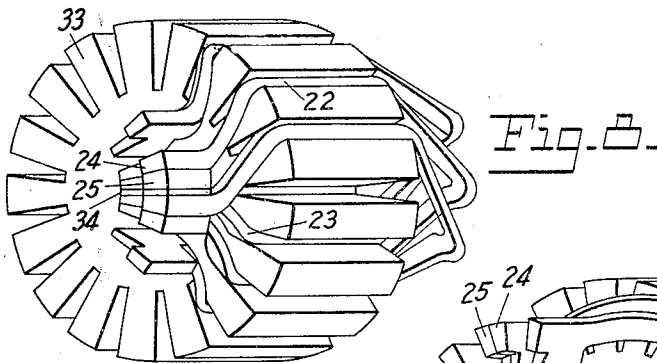
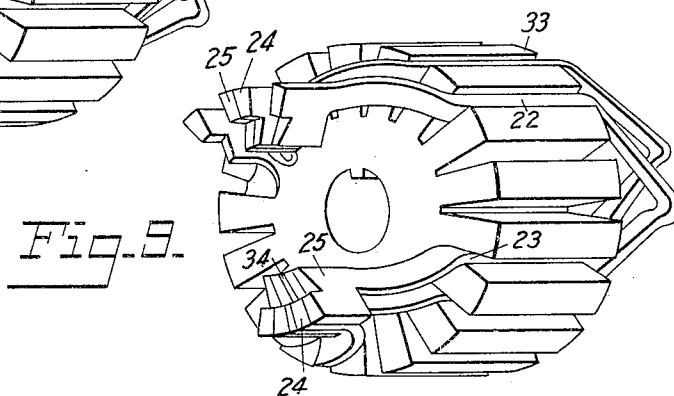
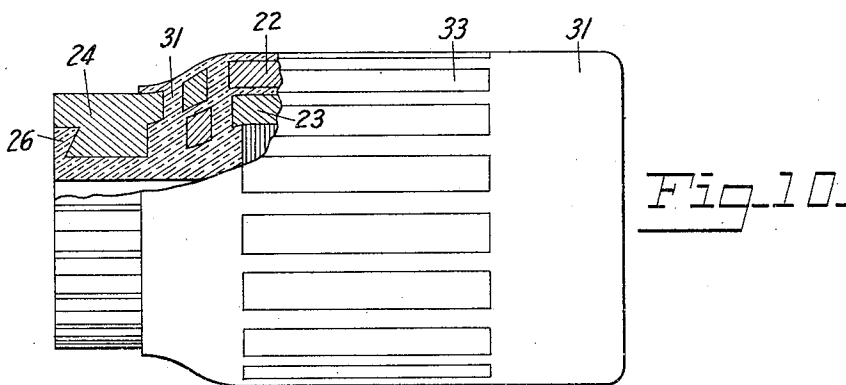
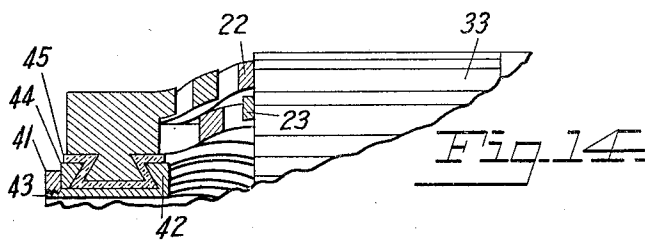
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METHOD OF MAKING ARMATURE COILS

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2 Sheets-Sheet 2



INVENTOR.

V. G. Apple

# UNITED STATES PATENT OFFICE

VINCENT G. APPLE, OF DAYTON, OHIO

## METHOD OF MAKING ARMATURE COILS

Application filed October 26, 1928. Serial No. 315,338.

This invention is shown, tho not claimed, in my co-pending application, Serial Number 234,158, filed Nov. 18, 1927, and relates to bar wound armature coils suitable for radial entry into open core slots, the open ends of said loops being somewhat prolonged and specially formed so that the commutator segments are composed of pairs thereof.

An object of my invention is to reduce the cost of an armature by eliminating the separately made commutator, thereby reducing the number of parts and the amount of labor and material required.

Another object is to improve the electric circuit thru an armature by eliminating the soldered, brazed or welded joints commonly made to connect the bars of the winding to the commutator segments.

Further objects will be apparent from a consideration of the following description, reference being had to the drawings wherein—

Fig. 1 shows a length of wedge shaped bar stock.

Fig. 2 is a cross section taken at 2—2 Fig. 1.

Fig. 3 shows the bar Fig. 1 with portions cut away.

Fig. 4 shows a bar Fig. 3 after it has been bent to form one loop of a lap winding.

Fig. 5 is an end view of Fig. 4.

Fig. 6 shows a bar Fig. 3 after it has been bent to form one loop of a wave winding.

Fig. 7 is an end view of Fig. 6.

Fig. 8 shows several loops of a lap winding assembled in a core.

Fig. 9 shows several loops of a wave winding assembled in a core.

Fig. 10 shows a completed armature, partly in section.

Fig. 11 is a cross section taken at 11—11 Fig. 2.

Fig. 12 is a cross section taken at 12—12 Fig. 2.

Fig. 13 shows how commutator lugs are formed when a conventional commutator binding means is employed.

Fig. 14 shows a conventional commutator binding means applied to loops made according to my invention.

Similar numerals refer to similar parts thruout the several views.

Heretofore bar wound armatures of the open slot type have usually been made by providing loops of bar stock or wire and radially entering these loops into the open core slots, then providing a separate commutator and joining the open ends of the loops to bars of the commutator by soldering. The volume of current carried by these bar windings is usually large and frequently the solder is melted and the usefulness of the armature destroyed. This, together with the fact that the cost of separately producing a conventional commutator is considerable, and the labor incident to joining the loop ends to the commutator bars is costly, makes the hereinafter described method of great value both as to cost and dependability.

A segment of a commutator is preferably wedge shaped, and since the present invention contemplates forming a commutator segment and a turn of the winding integral, a simple way to put the invention to practice is to use a core having wedge shaped winding slots. In this way stock of suitable cross section to fit a winding slot may be suitable also for a commutator segment. As one means to thus carry out my invention I provide lengths of bar stock Fig. 1 of a cross section Fig. 2, then cut away portions 20 and 21 and cut notches 26 and 27 Fig. 3, leaving a conductor bar 22 adapted to occupy a position in the outer layer of the winding, a conductor bar 23 adapted to occupy a position in the inner layer of the winding connected as at 30, and two lugs 24 and 25 each suitable to compose half the thickness of a commutator segment.

Segments of conventional commutators are frequently composed of several circumferentially adjacent layers, so also in the present invention a lug 24 and a lug 25 are placed circumferentially adjacent in electrical contact and held by a commutator segment binding means which impinges on notches 26 and 27. A cross section thru outer conductor bar 22 is shown at 28 Fig. 11 and a cross section thru inner conductor bar 23 is shown at 29 Fig. 12. The cross sectional

areas of Fig. 11 and Fig. 12 are substantially equal.

After lengths of stock have been cut away and notched as shown in Fig. 3 they are bent to compose loops. If a lap winding is desired they are bent as in Fig. 4 and end view Fig. 5, while if a wave winding is desired they are bent as in Fig. 6 and end view Fig. 7.

Fig. 8 shows several loops of a lap winding in place in a core 33 while Fig. 9 shows several loops of a wave winding in place in another core 33. The purpose of these figures is to show how a continuous circuit may be provided by placing a commutator lug 24 circumferentially adjacent to a commutator lug 25, two such lugs in electrical contact joining adjacent loops of the circuit and together composing one commutator segment. Other requirements of common practice must be met, such as having the core slots lined with insulating material, keeping the outer and inner layers of the winding electrically separated, etc.

When a number of loops equal to the number of slots have been assembled in a core, pairs of commutator lugs must be held in intimate electrical contact, one member of a pair with the other, to compose commutator segments, and the segments must be mechanically bound together, tho electrically separated from each other, to compose a commutator.

Spacers 34 of insulating material may be inserted to separate the several segments but must not be placed between two lugs which together compose a segment. Spacers 34 may, however, be eliminated when molded insulation is used to bind the segments together by holding the segments spaced apart to permit the insulating material to extend between them while molding is being effected.

Such a binding means is shown in Fig. 10 where molded insulating material 31 surrounds the conductor bars and impinges on the notches 26 and 27 to bind the commutator segments together. Any suitable insulating material may be used, as may any suitable mold, a requirement being that the commutator lugs be subjected to inward radial pressure, or that they be otherwise held to keep them in intimate contact while molding is taking place, and while the drawing shows the entire winding covered with insulating material, an economy may be effected by so arranging the mold as to permit insulating material to surround the commutator end of the armature only, and when the armature is to run at relatively low speed such modification may be justifiable.

Instead of using molded insulation as a binding means, the conventional commutator binding means may be employed. By cutting and notching a length of stock as in Fig. 13, instead of as in Fig. 3, a conven-

tional commutator binding means shown in Fig. 14 may be used. In Fig. 13 the lug 35 is notched as at 36 and 37 and the lug 38 is notched as at 39 and 40. In Fig. 14 a nut 41 draws together the beveled head 42 of sleeve 43 and the beveled washer 44 against insulation 45, after the manner practiced in building ordinary commutators.

Having described my invention, I claim—

1. The method of making an integral winding loop for a bar wound armature which consists of providing a bar of relatively thin and wide wedge shaped cross section, cutting away the thinner half of the bar from a point somewhat removed from one end to near the middle of the bar, cutting away the thicker half of the bar from a point somewhat removed from the other end to near the middle of the bar, then bending the bar flatwise at its middle to provide two parallel spaced apart bar conductors and near its ends to provide two parallel differently spaced apart commutator segments.

2. The method of making an integral winding loop for a bar wound armature from a straight bar of relatively thin and wide wedge shaped cross section, which consists of cutting away the thinner half of the bar from a point near the middle to a point somewhat removed from one end, cutting away the thicker half of the bar from a point near the middle to a point somewhat removed from the other end, notching the ends to provide places where a commutator binding means may bear, and bending the bar flatwise at its middle to provide two parallel spaced apart bar conductors and near its ends to provide two parallel differently spaced apart commutator segments.

3. A method of making an armature winding unit comprising a turn of the winding and two commutator sections from a single continuous bar of uniform relatively thin and wide cross section throughout its length, which consists of cutting away the one half of the cross section of the bar from a point near the middle to a point somewhat removed from the one end, and the other half of the cross section of the bar from a point near the middle to a point somewhat removed from the other end, and bending the bar flatwise at its middle to provide two parallel spaced apart bar conductors and both flatwise and edgewise near the ends to provide two parallel differently spaced apart commutator sections.

4. A method of making an armature winding loop having two commutator sections formed at the open ends, which consists of cutting a length of bar stock of uniform relatively thin and wide cross section, cutting a notch in each end of the bar, cutting away portions at opposite edges of the bar, said portions extending substantially half-way through the bar, the one extending

lengthwise from near the middle to a point somewhat removed from one end and the other from near the middle to a point somewhat removed from the other end, and folding the bar flatwise at its middle to provide  
5 two parallel spaced apart bar conductors and both flatwise and edgewise near its ends to provide two parallel differently spaced apart commutator sections.

10 In testimony whereof, I hereunto set my hand.

VINCENT G. APPLE.

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