Dec. 9, 1969 TERUMOTO YAMAGUCHI 3,482,307

METHOD FOR PRODUCING COMMUTATORS FOR MINIATURE ELECTRIC MACHINES

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Fig. 2a

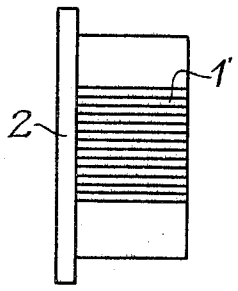


Fig. 2b

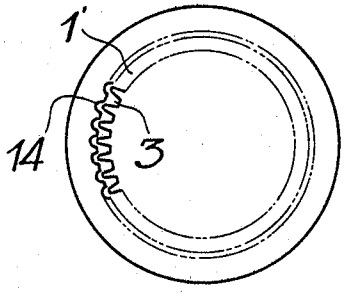


Fig. 1

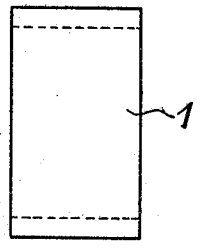


Fig. 3a

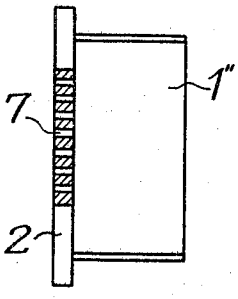


Fig. 3b

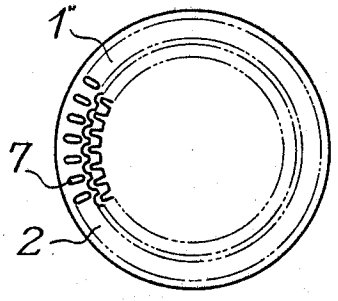


Fig. 5

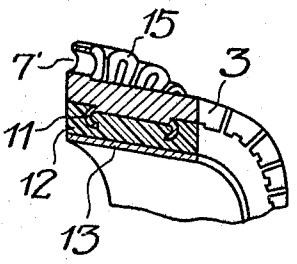


Fig. 4a

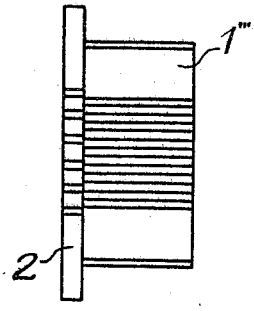
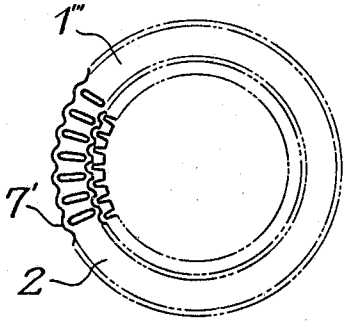


Fig. 4b



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Fig. 6

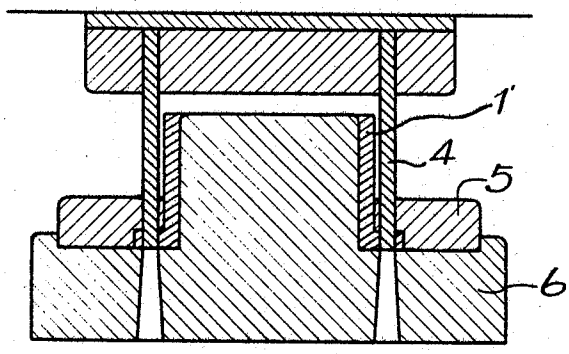
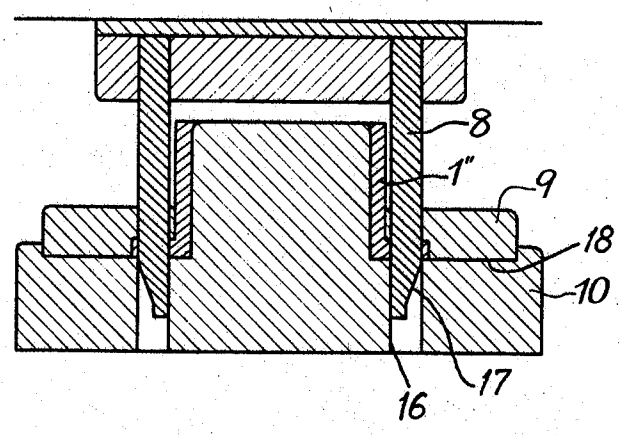


Fig. 7



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METHOD FOR PRODUCING COMMUTATORS FOR MINIATURE ELECTRIC MACHINES

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Claims priority, application Japan, Mar. 30, 1966, 41/20,180
Int. Cl. H01r 43/00
U.S. Cl. 29—597 1 Claim

ABSTRACT OF THE DISCLOSURE

This disclosure pertains to a method of manufacturing commutators wherein the risers are formed such that later operations on the commutator are made with less effort.

This invention relates to a method for producing commutators for miniature electric machines such as dynamos, starters and the like, for use in automobiles, and more particularly to a method of producing commutators having connecting segments.

In a typical conventional commutator of the prior art, a slot for inserting a connecting segment is punched in one end of each commutator segment for easy connection of the end of an armature winding of an electric machine; into this slot is inserted a connecting segment separately produced from a thin strip, which is then soldered firmly.

However, this method has the disadvantage in production that the connecting segments are manufactured separately and inserted and soldered later, accordingly demanding many steps and making the method very complicated. Besides, it takes hours for finishing each commutator having connecting segments. Furthermore, the use and soldering of a thin connecting segment are likely to cause defective joining, often resulting in insufficient strength of the connecting segments during use. In addition, the method as previously stated has a problem that it will become of necessity to employ a large commutator segment having a large circumferential width and a considerable diametrical thickness for the purpose of preventing decrease of strength likely to be induced by punching the slot, and also of obtaining a sufficient connecting segment holding strength.

In order to eliminate the above mentioned problems and disadvantages, the present invention has for its object to provide a method for producing a commutator, comprising the steps of: flanging and impact-extruding a tubular blank so as to form a flanged portion and a ring-like body of commutator segments or bars; punching preparatory rough connection holes in said flanged portion; forming said connection holes into the predetermined shape by means of a punch adapted to expand and finish said preparatory rough holes; and separating the commutator bars or segments into a separate bar or segment integral with the corresponding connection segment having the connection hole after injecting fluid insulating material capable of being hardened, whereby the production method can be simplified, the production time can be reduced, the strength of the connection segment in operation can be compensated, and the commutator bars or segments can be made compactly.

These and other features, objects and advantages of the present invention will become more obvious from the following description when taken in connection with the accompanying drawings illustrating one embodiment of the present invention, in which:

FIG. 1 is a front elevation showing an example of a tube blank to be used in the present invention;

FIGS. 2(*a*) and (*b*) are front and side elevations respectively, illustrating the primary workpiece of said tube blank after being flanged and impact-extruded;

FIGS. 3(*a*) and (*b*) are front and side elevations respectively, partly in section, showing the secondary workpiece whose preparatory rough holes have been punched;

FIGS. 4(*a*) and (*b*) are front and side elevations respectively illustrating the third work piece whose punched holes have been expanded and finished;

FIG. 5 is a perspective view partly in section showing the principal part of the finished commutator; and

FIGS. 6 and 7 are vertical sectional views illustrating the preparatory hole punching device and the hole expanding and finishing device used to accomplish the method of the present invention respectively.

Referring now to the drawings, and more particularly to FIGS. 1, 6 and 7, the reference number **1** designates a conductive tube blank, for example a copper tube. The preparatory hole punching device (FIGURE 6) is comprised of a punch **4**, a blankholder **5**, and a die **6**. The lower end **16** of the punch **8** (FIGURE 7) is of the same crosssectional form as that of the punch **4** (FIGURE 6), and has a slope portion **17** extending upwardly toward the outer periphery thereof. The reference number **9** (FIGURE 7) designates a retaining plate, and **10** a die. The groove **18** in the die **10** is finished equal to, or slightly larger than, the outside diameter of the punch **8** so that the maximum-diameter portion of the punch **8** may suitably fit into the groove. The punch **8**, the retaining plate **9**, and the die **10** constitute the hole expanding and finishing device.

With the arrangement described above, the production steps of the present invention in which said devices are employed will be described hereinafter. First, the tube blank **1** (FIGURE 1) is flanged by means of, for example bending to provide a flange **2** on one end of the tube as shown in FIG. 2, and then there is impact-extruded the primary work piece **1'** whose commutator segments **3** are connected with one another by means of bridge pieces **14** protruding outwardly. Then the primary work piece **1'** is disposed between the retaining plate **5** and the die **6** of the hole punching device so that holes **7**, as shown in FIG. 3 are punched in the flange by pressing down the punch **4** (FIGURE 6). The shape of this hole is much the same in the circumferential width compared with the desired connecting hole but slightly less in the diametral length. The secondary work piece **1''** thus obtained is subsequently between the blankholder **9** (FIGURE 1) and the die **10** of the hole expanding and finishing device, whereby the holes **7** (FIGURE 3) are expanded successively by pressing the punch **4** downwardly. By this step, the required connecting hole **7'** (FIGURE 4) is finished as shown in FIG. 4, the external surface of the flange **2** becoming of a waved form. Next, hook-like lugs **11** (FIGURE 5) are provided by any suitable well known manner to the inner surface of the commutator bar or segment of the third work piece **1'''** (FIGURE 5) having finished connecting holes **7**. Then a fluid insulating plastic material capable of being hardened **12** is injected and the shaft fixing tube (**13**) (FIGURE 5) is inserted, and after the insulating compound has set, the outer periphery of the work piece is machined to remove the bridge pieces **14** and at the same time grooves are made between the connecting holes **7'** (FIGURE 4) so that the flange **2** may be separated into each commutator segment **3** having the connecting hole **7'**. Thus the commutator bar or segment **3** integral with its corresponding connecting segment **15** may be separated from one another and a finished commutator as shown in FIG. 5 may be obtained.

Thus according to the present invention such features are obtained that the complicated steps of producing securing in position said connecting segments can be eliminated so that the production steps may be simplified and the production time also may be reduced; that since the connection segment is formed integral with its corresponding commutator bar or segment, the thickness of the connecting segment can be made sufficiently thick and no trouble in connecting the connecting segment with the commutator bar or segment will occur so that sufficient strength can be obtained; further that since no groove for inserting the connecting segment is provided in the commutator bar or segment, the commutator bar or segment can be formed in such a manner that it may be made compact with the width thereof in the circumferential direction being narrower and the thickness in the radial direction being thinner; and further that the expanding and finishing step of the present invention can contribute to the improvement of yield of the material and to the simplification of the step to provide the grooves for separating each connecting segment.

While this invention has been described with particular reference to the construction shown in the drawing, it is to be understood that such is not to be construed as imparting limitations upon the invention, which is best defined by the appended claim.

Having thus described my invention, I claim:

1. A method for producing a commutator for a miniature electric machine, comprising the steps of: flanging and impact-extruding a tubular blank so as to form a flanged portion and a ring like body of commutator bars or segments; punching preparatory rough connecting holes in said flanged portion; simultaneously forming said connection holes into a predetermined shape and forming said flanged portion such that the area between holes is lessened and the formed connection holes and the area of the flange immediately around said holes which are subsequently risers, each associated respectively with said bars, take a definite shape by means of a punch adapted to expand and finish said rough holes, and after injecting into the body a fluid insulating material and hardening same, separating said commutator bars into separate bars and forming risers from the flanged portion by removing material from the areas between said holes such that each bar and its associated riser are electrically isolated.

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CARL E. HALL, Assistant Examiner

U.S. Cl. X.R.

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