May 21, 1946. C. E. MEYERHOEFER 2,400,590

METHOD OF MAKING COMMUTATORS

Filed May 18, 1944

Fig. 1

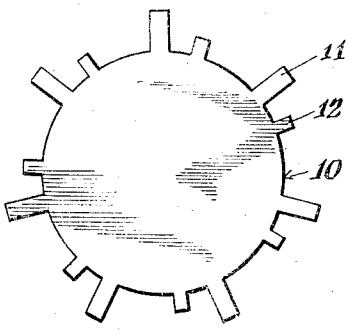


Fig. 2



Fig. 3

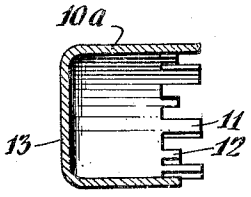


Fig. 4

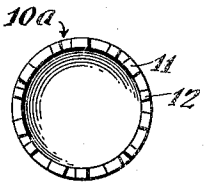


Fig. 5

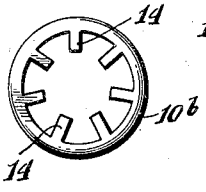


Fig. 6

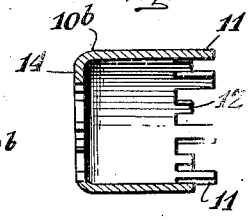


Fig. 7

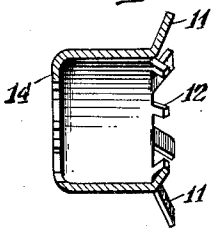


Fig. 8

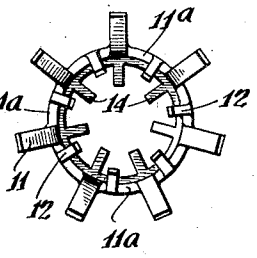


Fig. 9

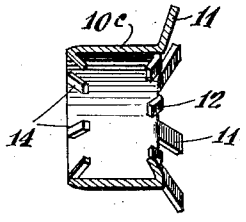


Fig. 10

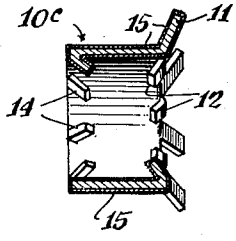


Fig. 11

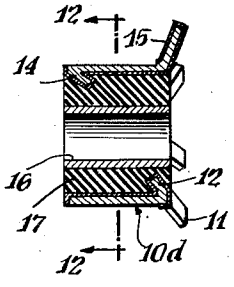
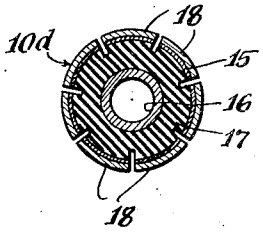


Fig. 12



INVENTOR.

Carl E. Meyerhoefer

BY

Duell, Kane & Smoak

ATTORNEYS

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METHOD OF MAKING COMMUTATORS

Carl E. Meyerhoefer, Brooklyn, N. Y., assignor to E. A. Laboratories, Inc., Brooklyn, N. Y., a corporation of New York

Application May 18, 1944, Serial No. 536,079

3 Claims. (Cl. 29—155.54)

This invention relates to improvements in the construction of commutators for electric motors and generators.

In particular, the invention relates to an improved commutator for use with relatively small, high speed motors, and affords means whereby a commutator having a high degree of perfection of finish and balance may be made by mass-production methods, with relatively unskilled labor.

It is an object of the invention to provide an improved means of manufacturing commutators for electric motors or generators.

It is an object of the invention to provide a method of manufacturing commutators, which will afford a low-cost, high quality product.

It is an object of the invention to provide a method of manufacturing commutators by the cold working of sheet copper, whereupon the finished product is work-hardened and therefore of increased durability.

Commutators for relatively small-size motors are presently made by placing within a tubular blank of copper having interiorly directed fingers or tabs, a mass of moldable insulation material, curing said material in situ and then slitting the cylinder according to the number of poles of the armature with which the commutator is to be used.

A second presently known method of manufacture resides in rolling a strip of copper, configurated to provide a plurality of fingers or soldering lugs, into cylindrical form, filling the cylinder with insulation material as aforesaid, and slitting the cylinder as aforesaid.

Disadvantages in the said methods reside in the necessity of using relatively soft copper stock to insure that the fingers and lugs do not break or fracture during the bending thereof; in manufacturing according to the rolled-strip method, it is difficult to attain an initial cylinder which is truly concentric, necessitating grinding or turning operations which result in portions which are relatively thinner than others. In high speed motors, in which 12,500 R. P. M. is not an unusual speed, an unbalanced condition, such as will result from non-uniform weight distribution, is detrimental to operative life.

Pursuant to the present invention, a flat blank of soft or semi-soft copper is drawn, in the cold, into cup shape, slightly oversize, and having a plurality of axial tabs at its open end. A light anneal slightly softens the metal to protect against breakage of the tabs upon the bending thereof; successive cold-working stages provide a commutator blank of work-hardened copper. The blank may subsequently be provided with a core of phenolic condensation material or the like, slotted to provide the requisite poles, and mounted on its armature shaft for polishing.

During the cupping and drawing operations, the blank is maintained as a substantially true cylinder, and the grinding and polishing of the completed commutator is achieved without sacrifice of balance.

With these and other objects in mind, reference is had to the attached sheet of drawings illustrating stages in the practice of the invention, and in which:

Fig. 1 is a plan view of a soft copper sheet, blanked to provide the terminal tabs and anchoring tabs of the completed commutator;

Fig. 2 is a side elevation of the same;

Fig. 3 is a side elevation, in section, of the first cupping stage of the copper sheet;

Fig. 4 is an end elevation of the same;

Fig. 5 is a front view of the commutator blank at a successive stage of manufacture;

Fig. 6 is a side elevation, in section, of the commutator blank of Fig. 5;

Fig. 7 is a side elevation, in section, of the commutator blank, showing the bending of the terminal and anchoring tabs;

Fig. 8 is a rear elevation of the commutator blank of Fig. 7;

Fig. 9 illustrates the next forming stage of the commutator blank;

Fig. 10 depicts the tinned commutator blank of Fig. 9, prior to the stage of the insertion of dielectric material therein;

Fig. 11 shows, in section, a commutator blank complete as respects the core of dielectric material therein; and

Fig. 12 is a section on lines 12—12 of Fig. 11, after the slitting operation.

Referring to the drawing, a blank 10 is stamped from copper sheet. Extensions 11, 12, ultimately provide soldering tabs and anchoring lugs, respectively.

The blank is placed in a conventional cupping or draw press and is drawn to produce a commutator shell 10a, in which the respective tabs 11, 12 are axially disposed. The drawing operation affords a symmetrical, closed-ended cylinder, preferably .005 inch oversize.

The closed end 13 of the shell 10a is blanked out to provide a plurality of anchoring lugs 14.

If desired, the commutator shell, now designated 10b, may be given a light anneal which conditions the copper so that the soldering tabs

11 and the anchoring lugs 12 may be angularly struck, see Fig. 7, without danger of fracture.

Subsequently, and preferably in a cold working drawing operation, the respective anchoring lugs 12 and 14 are directed inwardly of the shell, identified 10c, as shown in Fig. 9. At this stage, the initial oversize dimension 10a may be reduced as desired. The respective anchors 12 and 14 are equal in number and are substantially of equal weight. As shown in Fig. 8, the disposition of the anchors 12 and 14 is such as to provide clear areas 11a adjacent each soldering tab 11, along which the slitting saw may pass in a later stage.

The shell 10c is then plated with a thin coating 15 of tin. In a suitable molding press (not shown) the shell 10c is disposed concentrically about a bushing 16, the inside diameter of which is suitable to engage tightly the shaft of the armature with which the commutator is to be used, and the annular space about said shell is filled with a thermo-setting plastic material 17 such as "Bakelite" or the like, whereupon the plastic material is cured, bonding with the sleeve 17, and completely enveloping and engaging the anchors 12 and 14.

The thus-formed shell 10d is disposed on a suitable slitting machine (not shown) and is subdivided into mutually insulated commutator segments 18, symmetrical and concentric with respect to the bushing 16, and each embodying a soldering tab 11 and anchor means 12 and 14. Each segment is therefore of substantially uniform weight and the dynamic balance of the commutator is preserved.

It will be understood that for smaller or lower speed motors, one of the anchoring tabs may be omitted from each segment, although there is little advantage gained from so doing.

It will be noted that at this stage, the tin plating 15 remains on the commutator.

The commutator is then placed on the previously trued armature shaft, for securement thereto, and the leads to the respective pole windings of the armature soldered to the soldering tabs 11. The tin coating on the tabs 11 simplifies the soldering step. The thus-mounted commutator is then ground to remove the surplus tin coating and to polish the surface of the respective segments. It will be apparent that with the commutator mounted upon the previously trued armature shaft, the symmetry of position of the segments with respect to the shafts is insured.

Whereas it is obvious that the several objects of the invention as specifically aforenoted are achieved, it is apparent that numerous changes in the manner of performing the steps of the method, and variations of the sequence of performance thereof might be resorted to without departing from the spirit of the invention as defined by the claims.

I claim:

1. A method of manufacturing commutators, which includes the steps of: drawing an initially circular blank having a plurality of pairs of radial extensions, into closed-ended cylindrical form having a diameter larger than the final commutator diameter, said cylindrical form having said extensions projecting axially thereof; blanking out the said closed end to provide thereat, a plurality of tabs equal in number to one half of the said pairs of extensions; cold working said cylinder to reduce the diameter thereof while bending one extension of each of said pairs of extensions angularly inwardly of the cylinder and bending the remaining extension angularly outwardly; bending the said tabs angularly inwardly of said cylinder; disposing within said cylinder a mass of insulation material in bonded relationship with said inwardly directed elements; slitting the cylinder longitudinally adjacent each of the said outwardly directed extensions to subivide the cylinder into a plurality of equal, electrically insulated segments of the said cylinder; and subsequently smoothing the surface of the said segments.

2. A method of manufacturing commutators which includes the steps of drawing a blank of metal having a plurality of pairs of radial extensions, into closed-ended cylinder form; blanking out the said closed end to provide a plurality of tabs equal in number to one half of the said pairs of extensions; annealing the said cylinder to soften the same; cold-working the cylinder to reduce the diameter thereof, while displacing one of each of said pairs of extensions angularly inwardly of the cylinder; displacing the tabs formed at the initially closed end of said cylinder angularly inwardly thereof; disposing within the said cylinder a sleeve of less diameter than the cylinder; disposing and curing within said cylinder and about said sleeve a mass of thermo-setting insulating material in bonded relationship with the inwardly projecting tabs and with the exterior wall of said sleeve; slitting said cylinder axially throughout its length at equi-distant locations without slitting the said tabs or extensions to subdivide the cylinder into a plurality of mutually insulated equi-angular segments; and smoothing the surface of the said segments.

3. The method of manufacturing commutators, which includes the steps of cold-working an initially flat blank of metal into a cylinder having a plurality of equi-angularly spaced tabs extending outwardly therefrom at one end thereof and a plurality of adjacent tabs extending angularly inwardly of said cylinder; tin plating the said cylinder and the outwardly extending tabs thereof; disposing within said cylinder a mass of insulation material; bonding the said mass of material to the inner wall of said cylinder and to the said inwardly directed tabs, and subdividing said cylinder into a plurality of individual segments of equal area and substantially equal weight and removing the tin plating from the surface of said segments by grinding the segments to produce a smooth surface thereon, while leaving the tin plating on the said tabs.

CARL E. MEYERHOEFER.