Oct. 29, 1935. V. G. APPLE 2,019,065

DYNAMO ELECTRIC MACHINE COMMUTATOR BRUSH WITH INTEGRAL SHUNT

Filed Jan. 31, 1934

Fig. 1

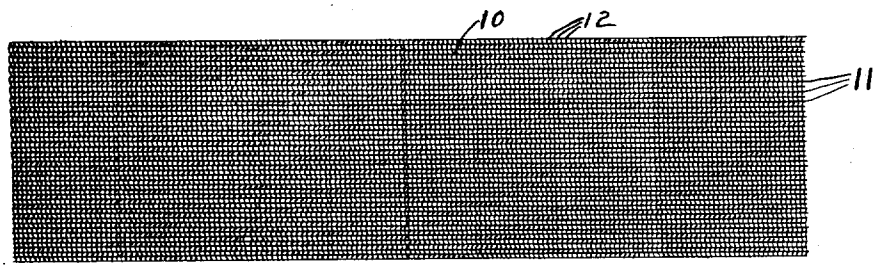


Fig. 2

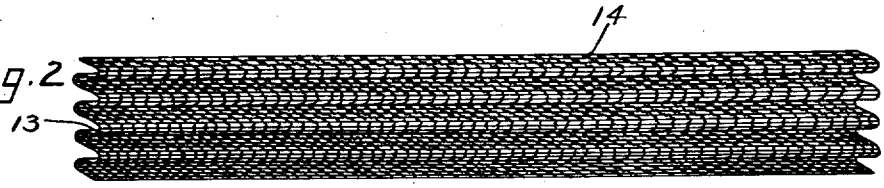


Fig. 3

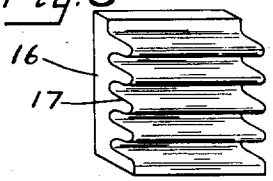


Fig. 4

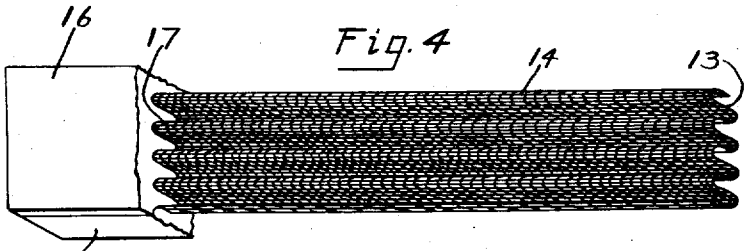


Fig. 5

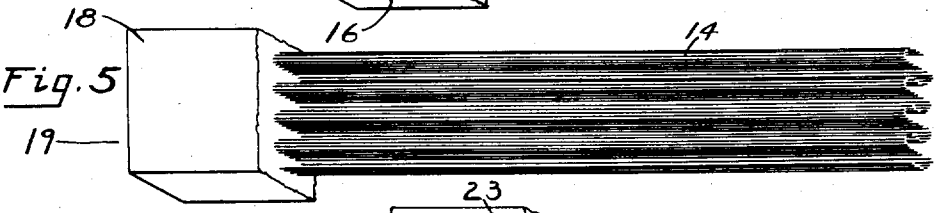


Fig. 6

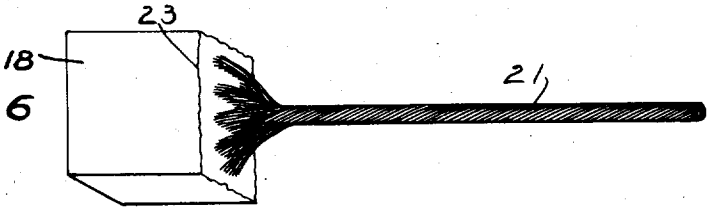


Fig. 7

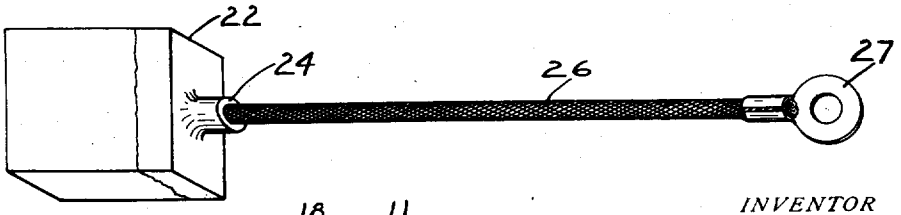
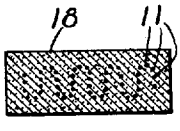


Fig. 8



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DYNAMO ELECTRIC MACHINE COMMUTATOR BRUSH WITH INTEGRAL SHUNT

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Application January 31, 1934, Serial No. 709,228

8 Claims. (Cl. 171—326)

This invention relates to dynamo electric machine commutator brushes and particularly to commutator brushes of low electrical resistance having flexible conductors commonly called "shunts" for carrying the current to or from the brushes.

An object of the invention is to decrease the electrical resistance per unit of cross section of the brushes to the end that more current may be carried by a given size brush.

Another object is to provide a brush in which a metal and a conductive material of greater lubricity than the metal are combined in a novel manner to the end that the brush, though of large carrying capacity, will nevertheless be self-lubricating.

Another object is to so combine and arrange the metal and the lubricious material as to maintain uniformity in the distribution of the metal throughout the length of the brush, to the end that the brush will still be of substantially the same carrying capacity when partly worn away as when new.

Another object is to provide a new and improved method of uniting the shunt to the larger mass of the brush, to the end that the shunt may not become separated from the brush.

Another object is to provide greater continuity in the conductive path from the active surface of the brush to the source of armature current supply.

That these and other objects are attained will be obvious to one skilled in the art from a consideration of the following description which is supplemented by drawing wherein,

Fig. 1 shows a strip of woven fabric used in my improved brush, the warp of the strip being metal and the weft being of carbonizable material.

Fig. 2 shows the fabric strip Fig. 1 after it is corrugated lengthwise.

Fig. 3 shows a preformed shape of the lubricious material, two of the preforms being used to make the body of the brush.

Fig. 4 shows how two preforms Fig. 3 and a strip Fig. 2 are assembled preparatory to compacting them in a mold to unite the two preforms into a single brush body.

Fig. 5 shows the structure after the two preforms are united into a single brush body.

Fig. 6 shows the structure after the carbonized weft is shaken from the fabric, and the warp of the fabric then twisted to make the shunt.

Fig. 7 shows the structure Fig. 6 after a facing of insulating material has been molded thereto, the facing also surrounding the shunt where it emerges from the end of the brush.

Fig. 8 is a cross section through the brush showing the distribution of the metal wires in the brush.

Similar numerals refer to similar parts throughout the several views.

The fabric strip 10 Fig. 1 may either be woven in the form of a tape of the width shown or cut to the proper dimensions from a wider piece. In either event the warp 11 of the fabric preferably comprises a series of fine wires of copper or other good electrically conductive metal extending lengthwise through the strip while the weft 12 is composed of a plurality of cotton threads or threads of any other fibrous material which may be subsequently converted to carbon.

When a strip of the cotton-copper fabric of proper length and width such as is shown at 10 Fig. 1 has been provided, it is first corrugated lengthwise as shown at 13 in Fig. 2. This may be done by pressing it in a die or by pressing it lengthwise through corrugating rolls or by any other suitable means. But inasmuch as the weft of the fabric is of soft thread, it may be advisable to first saturate the strip in a suitable varnish or other liquid insulation and to partly dry it before corrugating it, so that the corrugations when once made will be more permanent. The corrugated strip may be referred to by the numeral 14.

For the body of the brush two preformed parts 16, Fig. 3 are provided. The material for these preforms preferably comprises a mixture of finely divided graphite and a binder which may subsequently be converted to carbon. A suitable binder may comprise a phenol aldehyde resin only, or, if desired, a commercial molding compound comprising a phenol aldehyde resin and an organic filler may be used. A mixture comprising about 85% of the powdered graphite and the remaining 15% of the commercial molding compound referred to has been found satisfactory. A volume of this mixture several times that of the preform 16 is compressed in a mold by heavy pressure to the dimensions shown. The mold may be slightly heated if desired. Corrugations 17 of the preforms are made to correspond to corrugations 13 of strip 14 and the corrugations are so placed on the preforms that two of the parts may be assembled with the corrugated faces toward each other and the corrugation of one part will fit into those of the other part and while ordinarily the two preforms composing the body will be composed of the same material cases may

arise where it is desirable that the leading side of the brush may be of higher resistance material than the other side, in which case the two preforms would be of a different material. The preforms although highly compressed are still susceptible of further reduction in dimensions by the application of heat and further pressure.

When a corrugated strip 14 and two preforms 16 have been provided they are assembled as shown in Fig. 4. When so assembled the body of the brush composed of the two preforms 16 is still somewhat thicker than its final dimensions. It is therefore placed in a mold and by means of heat and pressure the preforms are first softened, pressed through the mesh of the corrugated strip 14 where it lies between the two preforms, then by continued heat and pressure the preforms and the end of the strip are united into a single brush body 18.

When the structure is removed from the mold it will appear as at 19, Fig. 5. At this stage of the procedure the weft of the strip 14 is still intact since the heat which was applied in the mold, while sufficient to unite the two preforms 16 into a single body 18, was not sufficient to change the nature of the fibrous weft.

The structure Fig. 5 is accordingly placed in an oven and kept at a temperature of approximately 1750 degrees F. over a period of about 20 hours to coke the fibrous material comprising the weft of the fabric strip 14 as well as the binder which composed 15% of the mixture comprising the brush body. The coked weft and the coked binder within the brush body of course has now become satisfactory brush material by its conversion to carbon, but the coked weft in the exposed part of the strip 14 is no longer useful and may therefore be readily removed from the strip by shaking it or brushing it from between the metal warp.

After the coked weft is removed the warp wires are twisted together to form a shunt as shown at 21, Fig. 6. For many purposes the structure here shown will be entirely satisfactory, but in some instances where a coil spring of light spring wire is made to bear against the rear end of a brush to maintain commutator contact, the light spring thus carries part of the current, and it often happens, upon overload, that the temper in the coil spring is drawn and the spring rendered ineffective. To overcome this difficulty the cover 22, Fig. 7, of some suitable non-conductive material is molded to the end of the brush body 18, whereby the brush tension spring is insulated from the brush.

The end of the brush body may be left rough as at 23, Fig. 6 so that the facing 22 will be more securely held thereto. The hub 24 of the facing is provided to center a brush spring. A flexible non-conductive sleeve 26 surrounds the shunt, and a terminal clip 27 is secured to the end as in common practice. The cross section Fig. 8 shows how the individual warp wires 11 comprising the shunt 21 are distributed through the brush body.

Metal has heretofore been variously combined with carbon or graphite to produce a low resistance self-lubricating brush, in some cases even by distributing metal wires through the graphite brush body, the wires extending lengthwise therethrough, and shunts have been variously attached to brushes, by riveting, bolting and soldering, but a brush of this character in which the same wires, which compose the shunt, extend also endwise through the brush body, thereby eliminating a joint, whereby the danger of a loose connection is obviated and a better conductive path provided, as well as the method of holding the individual wires of the shunt properly spaced while the brush body is molded about them is considered broadly new, and with this view of the scope of the invention, it is claimed:

1. The method of making a dynamo electric machine brush, which consists of cutting a strip of woven fabric longer than said brush, said fabric comprising a warp and a weft, the warp consisting of a plurality of small metal wires, molding a brush body through and about one end of said strip, then removing the weft from the portion of the strip which extends from said body.

2. The method of making a dynamo electric machine brush, which consists of cutting a strip of woven fabric longer and wider than the brush body, said fabric comprising a warp and a weft, the warp consisting of a plurality of small metal wires, corrugating said strip lengthwise to take up the excess width of the strip, molding a body of carbon through and about the one end of the corrugated strip, then removing the weft from the portion which extends beyond the brush body.

3. The method of making a dynamo electric machine brush, which consists in cutting a strip of woven fabric longer than said brush, said fabric comprising a warp of metal wires and a weft of carbonizable thread, molding a brush body through and about one end of the fabric strip, carbonizing the thread, then removing that part of the carbonized thread which is not imbedded in the brush body.

4. The method of making a dynamo electric machine brush, which consists of mixing powdered carbon and a carbonizable binder, molding a brush body of the mixture through and about one end of a fabric strip, said strip having a warp of metal wires and a weft of carbonizable thread, carbonizing the binder and the thread, then removing the carbonized thread from that part of the strip which extends from the brush body.

5. The method of making a dynamo electric machine brush, which consists of mixing powdered carbon and a carbonizable binder, molding the mixture into preforms each half the thickness required for the brush body, laying two of the preforms one on each side of a fabric strip at one end thereof, said fabric strip comprising a warp of metal wires and a weft of carbonizable threads, applying heat and pressure to said preforms to force them through and about the end of the fabric strip to mold them into the form of a brush body and to harden the binder, applying a higher heat to carbonize the binder and the weft of the fabric, then removing the weft from that part of the strip which extends from the body.

6. The method of making a dynamo electric machine brush which consists of mixing powdered carbon and a carbonizable binder, molding the mixture into preforms each half the thickness required for the brush body and corrugating one side of each preform lengthwise, impregnating a strip of woven fabric comprising a warp of metal wires and a weft of carbonizable threads with a varnish comprising a carbonizable material and a solvent, partly drying said solvent, corrugating the strip lengthwise to correspond to the corrugations in said preforms, laying two of the said preforms one on each side of said fabric strip at one end thereof with the corrugations of the preforms fitting into the corrugations of the fabric strip, applying heat and pressure to said preforms

to force them through and about the end of the fabric strip to mold them into the form of a brush body and to harden the binder, applying a higher heat to carbonize the binder, the weft in the fabric and the carbonizable varnish, then removing the carbonized weft and varnish from the part of the strip which extends from the body.

7. The method of making a dynamo electric machine brush, which consists of molding a brush body of carbon around one end of a fabric strip, said fabric having a warp of small metal wires, removing the weft from the strip where it extends from the end of the brush body, bringing together and twisting the extending warp wires to cable form and molding an insulating end to the end of the body through and about the wires to include the beginning of the twisted portion thereof.

8. The method of making a dynamo electric machine brush, which consists of molding a brush body of suitable brush material around one end of a fabric strip, said fabric having a warp of small metal wires, removing the weft from that portion of the strip not contained in the molded brush body, bringing together and twisting the extending warp wires to cable form except at the point where they emerge from the said brush body, and molding a brush end to the brush body to extend through and about the untwisted portion of the warp wires.

GOURLEY DARROCH,
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