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ADDITIVE FOR COPPER GRAPHITE BRUSH

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This invention relates to brushes for the supply of electric current, and more particularly concerns long wearing commutator brushes.

Metal graphite brushes such as the conventional copper-graphite brushes containing about 30 percent to 75 percent copper, and 25 percent to 70 percent graphite have several desirable properties. At low current densities and rubbing speeds, that is, about 60 amperes per square inch and 2500 feet per minute, respectively, the copper graphite brush generally operates satisfactorily with a low contact voltage drop and a low temperature. When used under these conditions, the copper-graphite brush is free from dusting and can render service for a relatively long time. But when more stringent conditions are imposed on the brush, the operating life is considerably impaired. Increasing either the current density or the rubbing speed can cause a rapid increase in brush wear. For example, at a rubbing speed of approximately 5000 feet per minute and current density of 120 amperes per square inch, the performance of the conventional brush is hampered by the effects of ring wear, high coefficient of friction and dusting. The brush is also sensitive to commutator or ring eccentricity. Often the combination of these factors will intensify sparking, burn portions of the ring surface, and even cause the release of small streamers at the trailing edges.

It is, therefore, an important object of the present invention to provide an improved metal graphite brush composition which is long wearing and suitable for heavy duty purposes.

According to the present invention it has been found that the life of a conventional metal graphite sliding contacting brush can be greatly lengthened and contact conditions materially improved if the brush composition is made from certain materials.

A brush embodying the principles of my invention may be readily formed by introducing as additive material into a conventional metal graphite brush composition of approximately 30 percent to 75 percent copper and 25 percent to 70 percent graphite, small quantities of lead and boron nitride. These combined additives may be present in the brush composition in amounts between 1.1 percent and 15 percent by weight of the copper graphite mixture.

Highly satisfactory results have been obtained in the practice of the invention when the percentage composition of the above additives are within the composition range listed below in Table I.

TABLE I

Additive	Composition, Percent	
	Broad Range, percent	Preferred Range, percent
Lead	1.0 to 10	4 to 6
Boron Nitride	0.1 to 5	0.5 to 1.5

An example of the practice of the invention is as follows:

EXAMPLE I

The composition of a copper graphite mixture containing approximately 50 percent copper, 50 percent grahite and suitable binder material was modified by adding to it about 5 percent lead powder and 1 percent boron nitride powder. The said ingredients were then well mixed and molded at a pressure of 15 tons per square inch to a block of suitable size for making a commutator brush. The block was then baked at 900° C. by suitable heating means for a period sufficient to impart known and inherent brush characteristics.

Table II sets forth the conditions and results of a number of typical tests wherein the brush was tested at sea level conditions. In this table the brushes were subjected to current densities of 60 amperes per square inch and 120 amperes per square inch. The procedure used for testing the brushes consisted in applying the brush to a machine having an operating speed of about 6500 revolutions per minute, giving a rubbing speed of 5100 feet per minute. A brush spring pressure between 7.1 p. s. i. and 7.3 p. s. i. was used. The current flow through the brush was adjusted to between 20 and 40 amperes at a current density between 60 amperes per square inch and 120 amperes per square inch. Tests were conducted in room air for a total of 20 hours or more. During that time readings were taken of contact drop voltage, brush temperature, and coefficient of friction. At the end of the tests brush length was measured and brush life in hours per inch of wear was calculated.

TABLE II

Brush composition

A=Copper, 50 parts
Graphite, 50 parts
B=Copper, 50 parts
Graphite, 50 parts
Lead, 5 percent
Boron nitride, 1 percent

Brush	Current Density, Amps. per Sq. In.	Operating Properties			
		Contact Drop, Volts	Brush Temp., ° C.	Brush Life, Hrs./In.	Coef. of Sliding Friction Against Copper
A	60	0.20	108	226	0.42
	120	0.90	Dusted	162	
B	60	1.01	100	6,000	0.09
	120	1.29	117	2,860	

From the data in Table II it will be seen that for

brushes of the copper graphite type, better performance can be obtained if the brushes contain boron nitride and lead within the aforesaid composition range.

The improved performance manifests itself in longer brush life, smaller ring wear, low coefficient of friction, low operating temperatures, and greater current load capacity.

It will be understood that modifications and variations may be effected without departing from the novel concents and scope of the present invention.

What is claimed is:

1. An electrical contact brush consisting of about 30% to 75% copper, 25% to 70% graphite, 0.1% to 5% boron nitride and 1% to 10% lead, said boron nitride and lead rendering said brush substantially resistant to dusting conditions and imparting longer wear life thereto.

2. An electrical contact brush consisting of about 30% to 75% copper, 25% to 70% graphite, 0.5% to 1.5% boron nitride and 4% to 6% lead, said boron nitride and lead rendering said brush substantially resistant to dusting conditions and imparting longer wear life thereto.

References Cited in the file of this patent

UNITED STATES PATENTS

1,121,960	Whitney	Dec. 22, 1914
2,156,803	Cooper	May 2, 1939

FOREIGN PATENTS

712,188	Great Britain	July 21, 1954