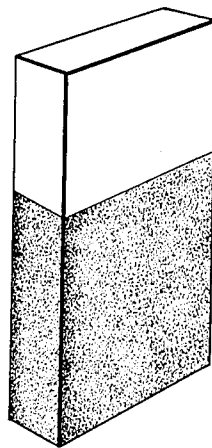


W. H. HARDMAN.
GRAPHITE BRUSH.
APPLICATION FILED MAY 31, 1912.

1,040,315.

Patented Oct. 8, 1912.



Graphite and Abrasive

WITNESSES:

J. Earl Ryan.
J. Ellis Eler.

INVENTOR:

WILLIAM H. HARDMAN,
BY Albert S. Davis
HIS ATTORNEY.

UNITED STATES PATENT OFFICE.

WILLIAM H. HARDMAN, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

GRAPHITE BRUSH.

1,040,315.

Specification of Letters Patent.

Patented Oct. 8, 1912.

Application filed May 31, 1912. Serial No. 700,596.

To all whom it may concern:

Be it known that I, WILLIAM H. HARDMAN, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Graphite Brushes, of which the following is a specification.

The present invention relates to current collectors and comprises a substantially all-graphite brush, suitable particularly for direct-current commutating machines.

Although graphite has a higher conductivity than other forms of carbonaceous material, it has not been suitable for all conditions of service because of its soft texture. Particularly when used on commutating machines it is found to be too soft to keep down the mica uniformly with the copper of the commutator, and consequently unless the mica is undecut the brush soon chatters, or vibrates up and down on the commutator, causing destructive sparking. Apparently the high mica is due both to unequal abrasion of the mica between the copper and to a mechanical working out of the mica between the copper bars by centrifugal action. It has been necessary to prevent chattering to add to the graphite other forms of carbon, such as lamp-black and coke, so as to increase the hardness of the brush. These additions represent a considerable part of the brush and necessarily materially lower its conductivity.

I have discovered that the advantage of the high conductivity of graphite can be secured, without incurring the difficulty of high mica, by adding a small amount of finely divided abrasive to the graphite.

The accompanying drawing shows a brush for dynamo electric machines made in accordance with my invention.

In carrying my invention into effect, a good quality of graphite, such as pure graphite produced at high temperature in the electric furnace, or a pure natural graphite, such as Ceylon graphite, is mixed with about one (1) to five (5) per cent. of a finely divided abrasive, such as carborundum, co-

rundum or the like. The percentage of abrasive will vary with the design and characteristics of the commutator. In most cases, about two (2) per cent. of abrasive is preferable. The mixture is compacted into desired form with a carbonizable binder, such as tar or pitch.

According to one process of manufacture, the pulverized graphite and abrasive, with about ten (10) per cent. of pitch binder, are ground together in benzol or other liquid solvent for the binder. This treatment thoroughly distributes the binder throughout the mass. The benzol is then evaporated and the caked mass is again pulverized. The brushes are made from this powder by compacting the same in a mold to a desired form, for example, as shown in the drawing.

The molded brushes are fired to carbonize and set the binder. Preferably the brushes are given a preliminary firing or baking treatment in an electrically heated muffle in which the temperature can be controlled with accuracy by means of a rheostat or other electrical means. The temperature is accordingly brought up to 440 degrees C. in about ninety hours, at which point the temperature is maintained for about ten hours. After this baking treatment, the brushes are fired in a porcelain kiln at a temperature of about 1200 to 1400 degrees C. The final firing temperature will depend somewhat upon the properties desired in the finished brush, but I prefer to operate the kiln as nearly as possible at a temperature of 1350 degrees.

I find that in spite of the presence of the abrasive my improved graphite brush exerts practically no greater abrading effect on the copper bars than a carbon brush. My invention, therefore, secures the combined advantage of the high conductivity of graphite and the effect on the mica of a harder brush.

What I claim as new, and desire to secure by Letters Patent of the United States, is:—

1. As an article of manufacture, a current collector consisting substantially of

pure graphite and a small amount of abrasive.

2. As an article of manufacture, a current collector consisting of about ninety-eight
5 per cent. (98%) graphite and about two
per cent. (2%) carborundum.

In witness whereof, I have hereunto set
my hand this 28th day of May, 1912.

WILLIAM H. HARDMAN.

Witnesses:

BENJAMIN B. HULL,
HELEN ORFORD.
