

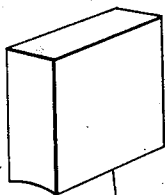
May 5, 1931.

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1,804 052

DYNAMO BRUSH

Filed Oct. 10, 1925



GRAPHITE
and
COKED HYDROCARBON

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DYNAMO BRUSH

Application filed October 10, 1925. Serial No. 61,842.

This invention relates to commutator brushes for dynamo electric machines and particularly to brushes composed of a sintered mixture of graphite, a carbonized binder and an abrasive.

It has been known to shape into briquettes, mixtures of graphite and synthetic resins and to heat the briquettes in a non-oxidizing atmosphere at a temperature sufficient to drive off the volatile matter from the binder so that the particles of graphite will be held together only by the coked residue of the binder.

One of the objects of the present invention is to produce economically, brushes composed of sintered mixtures of graphite and synthetic resins in order that the cost of manufacture of brushes of this type will be materially reduced by enabling the brushes to be manufactured in large quantities while maintaining a uniformly good product.

The single figure of the drawing shows a brush in accordance with my invention.

With these objects in view, the present invention provides for the use of ingredients having a high degree of uniformity as regards their chemical and physical properties. While artificial graphite has proved satisfactory, very good results can be obtained with certain grades of natural graphite. One such grade is known to the trade as Dixon's No. .0674 natural graphite. The graphite used should not contain more than 1% ash and should pass through a 200 mesh screen.

One species of synthetic resin which may be used as a binder is a phenol-formaldehyde resin, one form of which is known to the trade as bakelite, grade 2A.

One formula which has produced a satisfactory brush is 91% graphite and 9% bakelite. In order that the bakelite will be uniformly distributed throughout the graphite and that the granules of bakelite will be separated from each other throughout the mass, the bakelite content is first mixed with an equal amount of weight of graphite for 30 minutes in a pot mill mixer. This operation causes the granules of bakelite to be thoroughly coated with graphite. To this mixture is added the balance of the graphite

(82% in the example given) and then the entire mixture is mixed for one hour in a pot mill mixer. Previously computed quantities of this powdered mixture are pressed in a compound molding die having recesses for receiving a substantial quantity of briquettes, 40 to 50 for example. Before introducing the powder, the dies are previously preheated (preferably by steam) to 250° F. and then are cleaned off with a cloth saturated with a volatile acid, such as stearic acid; and the briquette punches and dies are lightly powdered with talcum.

Pressure is applied to the punch until it enters the die recess a predetermined distance which is determined by a suitable stop. Provided the closing distance of the punch with respect to the die is maintained uniform and uniform quantities of the powder are pressed in the die recess, the briquetting pressure will be uniform. This pressure should be approximately 3000 pounds per square inch. This temperature and pressure is maintained for six minutes, which is known as the curing time of the compound in the mold. The steam for heating the die is turned off and cool water between 60° and 70° Fahr. is turned into the die for three minutes while the briquetting pressure is still maintained. The step of cooling while maintaining pressure causes the set of the briquetted material to be more permanent and thus assists in eliminating blisters on the surface of the briquettes and hence renders the briquettes more uniform in density.

The briquettes are next packed with fine charcoal preferably in a nichrome carbonizing pot. The briquettes are packed in layers and the layers are separated by a thin layer of charcoal. A number of these pots are heated for ten hours in a suitable furnace at at least 900° F. or at a temperature for a time sufficient to convert substantially all of the bakelite into carbon, so that the graphite particles will be bound together with particles of coked bakelite. If this is not done the briquettes will not give satisfaction as a commutator brush. The presence of uncarbonized bakelite causes the brush to become soft in use and to wear away very rapidly. The

sintering time and temperature specified have proved satisfactory for brushes which are $\frac{3}{8}$ " thick. Obviously brushes having a greater bakelite content or brushes which are thicker require a longer time or greater temperature to carbonize all of the bakelite.

After the sintering step the carbonizing pots are removed from the furnace but the lids are left on and the contents are undisturbed until the contents are cooled to room temperature. One purpose of this step is to render brushes less likely to crack or to have surface checks which are believed to be caused by exposing the brushes while heated, directly to room temperature. By keeping them packed in the carbonizing pots they are allowed to cool off more gradually.

A modified and preferred form of the present invention results from substituting for certain part of the graphite an equal part of powdered coke. A very pure form of coke must be used for this purpose. A very satisfactory ingredient can be made by carbonizing pieces of phenolic condensation product which has been molded into an insoluble shape, namely, rejected insulating parts which have been molded from bakelite. The scrap bakelite must be absolutely free from metallic particles, grease and other foreign substances. The bakelite scrap is crushed into sizes which will permit the maximum amount to be pressed in a carbonizing pot. This scrap is heated in a non-oxidizing atmosphere from 6 to 7 hours at about 1700° F. which causes the bakelite material to be converted into carbon in the form of coke. This carbon is removed from the pot and ground so that it will all pass a 65 mesh screen.

For 10% of the 91% graphite used in the preceding example 10% of bakelite coke is substituted, so that the formula in this example becomes 81% graphite, 10% bakelite coke and 9% bakelite grade 2A. These ingredients are mixed in the following manner. As stated in the previous example, 9% of bakelite and 9% graphite are mixed in a pot mill mixer for 30 minutes in order that the granules of bakelite shall be thoroughly coated with graphite. To this mixture is added 72% graphite and 10% bakelite coke and the total mixture is mixed for one hour in a pot mill mixer. The succeeding steps of the process are carried out as stated in the first example. The presence of the bakelite coke particles uniformly distributed in the briquette apparently assist in the escape of volatile matter during the sintering operation. There is usually less distortion or other changing in shape when coke particles are used.

The present invention is not limited to the use of natural graphite having the desired uniformity of physical and chemical characteristics. A uniform grade of artificial graphite may be used, but when this is done it is necessary to add a small quantity of fine-

ly divided abrasive such as levigated alumina. In order that the alumina will be uniformly distributed throughout the mass, the alumina should be mixed with substantially an equal portion of graphite in a pot mill mixer for at least an hour in order that the granules of alumina will be thoroughly coated with graphite. The granules of bakelite are thoroughly coated with graphite by mixing bakelite with an equal amount of graphite as already specified. Then these two mixtures are thoroughly mixed together with bakelite coke and with the balance of the graphite, and the briquetting and sintering operations are carried out as previously stated.

In all of the examples given it has been specified that the granules of bakelite should be thoroughly coated with graphite before the bakelite is mixed with the balance of the graphite required by the formulae.

What is claimed is as follows:

1. A dynamo brush in which the different ingredients contained in said brush are uniformly distributed therethrough and comprising a sintered mixture of graphite, particles of previously coked phenolic-condensation product and a hydrocarbon binder.

2. A dynamo brush in which the different ingredients contained in said brush are uniformly distributed therethrough and comprising a sintered mixture of graphite, particles of previously coked phenolic-condensation product and a binder of phenolic-condensation product.

3. The method of making a dynamo brush composed of a sintered mixture of graphite and a hydrocarbon binder which consists first in mixing the binder with a portion only of the graphite used in order to coat the particles of the binder with the graphite, then thoroughly mixing this mixture with the balance of the graphite, in shaping the mixture, and in heating in a non-oxidizing atmosphere.

4. The method of making a dynamo brush which includes briquetting a mixture of graphite and a binder under heat and pressure, cooling the briquette while maintaining the briquetting pressure, and heating the briquette in a non-oxidizing atmosphere.

5. The method of making a dynamo brush which includes briquetting in a heated mold a mixture of graphite and a binder, in cooling the mold and briquette while the briquetting pressure is maintained, and in heating the briquette in a non-oxidizing atmosphere.

6. The method of making a dynamo brush which includes briquetting a mixture of graphite and a binder of synthetic resin in a mold heated to at least 250° Fahr., in cooling the briquette in the mold to at least 100° F. while the briquetting pressure is maintained, and in heating the briquette in a non-oxidizing atmosphere.

7. The method of making a dynamo brush

which includes briquetting a mixture of graphite and a phenolic-condensation product in a mold heated to between 250° and 300° Fahr., in cooling the briquette in the mold to at least 100° Fahr., and in heating the briquette in a non-oxidizing atmosphere.

8. The method of making a dynamo brush which includes briquetting a mixture of graphite and phenolic-condensation product in a mold heated to between 250° and 300° Fahr., the briquetting pressure being about 3000 lbs. per square inch and the heat being maintained for about 6 minutes, in cooling the mold to at least 100° Fahr. while maintaining the briquetting pressure, and in heating the briquette in a non-oxidizing atmosphere.

9. The method of making a dynamo brush which includes briquetting a mixture of graphite and phenolic-condensation product in a mold heated to between 250° and 300° Fahr., the briquetting pressure being about 3000 lbs. per square inch and the heat being maintained for about 6 minutes, and in cooling the mold by subjecting it for about 3 minutes to cool running water while maintaining the briquetting pressure, and in heating the briquette in a non-oxidizing atmosphere.

10. The method of making a dynamo brush comprising graphite and a hydro-carbon binder, which consists in coking a part of the binder, mixing graphite with the uncoked portion of the binder, then mixing the coked portion of said binder with the mixture thus formed, shaping the mixture into the desired form and heating said mixture in a non-oxidizing atmosphere.

11. The method of making a dynamo brush comprising graphite and a hydro-carbon binder, which consists in coking a part of the binder, mixing a part of the graphite with the uncoked portion of the binder, then mixing the coked portion of the binder and remainder of the graphite with the mixture thus formed, shaping the mixture into the desired form and heating said mixture in a non-oxidizing atmosphere.

12. The method of making a dynamo brush comprising graphite and a hydro-carbon binder which consists in coking substantially half of the binder, mixing the uncoked half of the binder with a substantially equal quantity of graphite, then mixing the remainder of the graphite and the coked portion of the binder with the mixture thus formed, shaping the mixture into the desired form and heating said mixture in a non-oxidizing atmosphere.

13. The method of making a dynamo brush comprising approximately 81% graphite and 19% hydro-carbon binder, which consists in coking approximately one-half the binder mixing substantially one-ninth of the graphite with the uncoked portion of the binder, mixing the remainder of the graphite and

the coked portion of the binder with the mixture thus formed, shaping the mixture into the desired form and heating said mixture in a non-oxidizing atmosphere.

14. A dynamo brush comprising a sintered mixture of graphite, carbon in the form of a previously coked hydrocarbon binder, and a hydrocarbon binder which has not been previously coked.

15. A dynamo brush comprising a sintered mixture of graphite, carbon in the form of a previously coked hydrocarbon binder, and a synthetic resinous binder which has not been previously coked.

16. A dynamo brush comprising a sintered mixture of graphite, previously coked bakelite and a binder of uncoked bakelite.

17. A dynamo brush comprising a sintered mixture of approximately 9 parts carbon including graphite and previously coked hydrocarbon binder and 1 part uncoked hydrocarbon binder.

18. A dynamo brush comprising a sintered mixture of approximately 8 parts graphite, 1 part previously coked hydrocarbon binder, and 1 part uncoked binder.

19. A dynamo brush comprising a sintered mixture of 81% graphite, 10% previously coked bakelite, and 9% uncoked bakelite.

In testimony whereof I hereto affix my signature.

NELSON ROBERT HAAS.

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