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BRUSH FOR ELECTRICAL MACHINES

171-325

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This invention relates to brushes for electric machines and the method of making such brushes.

One object of the invention is to provide a brush in which a more homogeneous and intimate mixture of the materials forming it is secured than heretofore whereby brushes of more uniform quality are obtained.

Another object of the invention is to provide a brush in which a lesser quantity of the binder is employed than has been heretofore used in brushes of the desired quality.

It is a further object of the invention to provide a brush containing a metallic constituent, having increased conductivity and containing metal in substantially pure metallic state.

It is another object of the invention to devise a method of making brushes having the properties above referred to which is simple and easy to carry out; is inexpensive and safe; and by means of which brushes having a metallic constituent can be formed without the formation of metallic oxide and which have greater conductivity than those made by methods heretofore used.

This application relates to a specific method for forming brushes for electrical machines and is an adaptation of a method for mixing granular materials which is described and claimed broadly in applicants' copending application Serial No. 458,591.

Heretofore, brushes for electric machines have been made primarily by one or the other of two methods. The materials which constitute the brush such as graphite and a binder of bakelite or some similar compound are mixed together dry in powdered form and are then formed into the desired shape in a briquetting press after which they are heated to cure the binder. If a binder such as pitch is employed, the binder is usually added in a liquid form and is mixed with the graphite until the whole becomes a stiff paste subsequent to which it is molded under pressure as above described. A relatively large amount of the binder must be used if the materials are mixed dry because it is difficult to secure a uniform mixture with a small amount of the binder, resulting in a part of the mixture having a greater proportion of binder than other parts and in the formation of a variable product. In order to secure a better mixture, another method has been employed in which the binder is dissolved in a volatile solvent such as alcohol or benzol which is mixed with the graphite. This solution of the binder is then added to the graphite, and the whole is mixed and the solvent is then evaporated. While this process has proved reasonably satisfactory, so far as the mixing operation is concerned, it is expensive due to the loss of the solvent and presents a dangerous fire hazard because of the use of large quantities of the solvent.

According to the present invention a method has been devised which is effective to secure an exceedingly homogeneous mixture of the materials employed and which is neither expensive nor dangerous. This method contemplates the mixture of the graphite in a wet condition with a solution of the binder in caustic alkali.

The amount of binder necessary to produce satisfactory brushes when the materials are mixed in this manner is variable within certain limits. Most excellent brushes have been made containing from fifteen parts bakelite and eighty-five parts graphite, to eight parts bakelite and ninety-two parts graphite, in fact, as little as four percent of bakelite has been employed with very satisfactory results. The graphite is mixed with water thoroughly in any suitable mixing device to make a relatively thin paste and to this is added a solution of bakelite in some alkali such as sodium hydroxide, potassium hydroxide, calcium hydroxide, sodium carbonate or sodium silicate, in fact, almost any alkali may be used with the exception of ammonium hydroxide which does not give entirely satisfactory results. A three to ten percent solution of the alkali may be used and a five percent solution has been found to give excellent results. The amount of alkali necessary to dissolve a given quantity of bakelite will vary somewhat, depending on the alkali used, but if sodium hydroxide is used, about one gram is employed for every five grams of bakelite.

The bakelite solution is thoroughly mixed

with the graphite in any desirable way and the mixture is then treated with sufficient acid such as hydrochloric or sulphuric, to neutralize the solution. The addition of the acid precipitates the bakelite from the solution in the form of a light and fluffy curd, which coats the graphite particles on all sides and adheres thereto, water and a salt in solution constituting the residue. The mixture obtained is then filtered and washed in any suitable manner to remove the salt and any other impurities which may be present. The mixture of graphite and bakelite is then dried in the air or in any suitable dryer where the temperature is not permitted to go above 200° F., and ground in a suitable mill to form a powder. The powder is then briquetted in a briquetting press and the briquettes cured under heat and pressure in a bakelite mold as is customary in the manufacture of brushes.

It will be understood that when employing the bakelite in an alkaline solution, the step of wetting the graphite may be omitted and the graphite used dry. However, as explained hereinafter, the mixture is not quite so good when dry graphite is used and a larger amount of bakelite must be used to secure the same binding effect.

According to another form of this invention copper powder may be incorporated in the brush. One example of the proportions of the materials employed which have been found to be satisfactory is 8% bakelite, 32% graphite and 60% copper. According to this form of the invention, the bakelite and graphite are mixed in the manner previously described and the mixture is dried and pulverized, dry copper powder being added to the dry powdered mixture of graphite and the binder. The copper and graphite-binder powder is thoroughly mixed in any suitable way, the mixture is molded in a briquetting press to the desired form and the forms cured in a bakelite mold in the conventional manner.

The addition of metallic copper powder to the brush gives it greater conductivity and moreover, when the copper is mixed with the other ingredients in the manner above described, the conductivity of the brush is greater than if the copper were mixed with the graphite before the binder is added. When the copper powder is added subsequent to the mixing of the graphite and bakelite, the small copper particles do not become surrounded by a film of the binder to as great an extent as when the binder is added to a mixture of copper and graphite. When the graphite and the binder are mixed according to the present method, the binder adheres so firmly to the graphite that very little of the binder is available to coat the copper particles and the latter are distributed throughout the brush very largely in metallic contact with each other, while according to the earlier process the binder is effective to coat the copper particles to substantially as great an extent as the graphite, with the result that very little increase in conductivity of the brush is secured unless more than 25% of the copper powder is added to the mixture. By adding the copper powder after the binder has been mixed with the graphite alone, the presence of as low as 15% copper powder showed a marked increase in conductivity of the formed brush.

Brushes formed according to this method not only need less copper to give the same degree of conductivity than do brushes made according to methods heretofore employed, but if the copper powder is added to the mixture of bakelite and graphite after the latter has been formed and dried, the formation of copper oxide is substantially prevented and the finished brush contains substantially pure metallic copper. If the copper were added to the graphite before mixture with the binder the subsequent wetting and heating would oxidize the copper.

Another form of this invention contemplates the method of mixing the graphite and the binder dissolved in a volatile solvent, while the graphite is in a wet condition. According to this form of the invention, the graphite is mixed with water thoroughly in quantities sufficient to form a relatively stiff paste, and the binder, such as rosin, pitch, or some artificial resin such as bakelite, is first dissolved in alcohol or benzol, or in a mixture of the two. If the mixture is employed, the proportions of the two solvents are 50% each. The graphite is mixed with the desired quantity of water in a suitable mixing device, and the dissolved binder is added in small amounts at a time, while the mixer is operated. The binder curdles when it comes in contact with the wet graphite and spreads over or coats the graphite particles. The operation is continued until the proper amount of the binder is added to and thoroughly mixed with the graphite, after which the mixture is dried either in air at normal room temperature or in a suitable dryer at a temperature of not to exceed 200° F., for about a day. The dry mass is then pulverized and passed through a screen of about No. 30 mesh after which the powder is molded into brushes in the usual manner in a suitable press under pressure of about twenty tons per square inch if no heat is applied during the molding operation. If heat is employed, the molding may be effected at a lesser pressure. The brushes are then cured and coked if desired in the manner previously described. When the materials are mixed in this way although a volatile solvent is employed, much less of the solvent is used to wet the materials and secure an intimate mixture because the graphite is first wet with water. Hence, the fire hazard is largely eliminated.

Another advantage of wetting the graphite

is due to the fact that the binder is not absorbed in the pores of the graphite particles when the materials are mixed in this manner. Owing to the fact that the pores are already filled with water, the binder does not enter these pores but remains on the outer surface where, of course, its binding action is greater than if some of the binder were absorbed. Therefore, a lesser quantity of the binder is necessary.

While the form of embodiment of the present invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. The method of forming a brush for electric machines which consists in forming a solution of a binder material in an alkali, mixing such solution with graphite, adding acid to precipitate the binder material from solution on the graphite, filtering, washing and drying the mixture thus formed, pulverizing the dried material, briquetting such material in the desired form, and curing the forms under heat and pressure.

2. The method of forming a brush for electric machines which consists in forming a solution of a binder material in an alkali, mixing such solution with graphite, adding acid to precipitate the binder material from solution on the graphite, filtering, washing and drying the mixture thus formed, pulverizing the dried material, briquetting such material in the desired form, curing and coking the forms.

3. The process of forming a brush for an electric machine comprising, graphite and a suitable binder which includes the steps of forming a solution of the binder in an alkali and subsequently mixing said binder with the graphite.

4. The process of forming a brush for an electric machine comprising, graphite and a suitable binder which includes the steps of wetting the graphite with water forming an alkaline solution of the binder and adding such solution to the wet graphite.

5. The process of forming a brush for an electric machine comprising, graphite and a suitable binder which includes the steps of wetting the graphite with water, dissolving the binder in a 3 to 10 per cent solution of an alkali, adding this solution to the graphite and mixing therewith.

6. The process of forming a brush for an electric machine comprising, graphite and a suitable binder which includes the steps of dissolving the binder in a 3 to 10 per cent solution of sodium hydroxide, using sufficient of the solution to contain one part by weight of the hydroxide to every 5 parts of the binder and mixing such solution with the graphite.

7. The process of forming a brush for an electric machine comprising, a binder material mixed with graphite which consists in wetting the graphite with water forming a solution of the binder material in a volatile solvent such as alcohol or benzol, mixing such solution with the wet graphite, drying the mixture to evaporate the volatile solvent, pulverizing the residue to obtain a powder which is a mixture of graphite and the binder, briquetting the powder in the desired form and curing the forms under heat and pressure.

8. The process of forming a brush for an electric machine comprising, a binder material mixed with graphite, which includes the steps of wetting the graphite and subsequently mixing therewith a solution of the binder material in a voltatile solvent.

9. The process of forming a brush for an electric machine comprising, a binder material mixed with graphite, which includes the steps of wetting the graphite and subsequently adding thereto a relatively concentrated solution of the binder material in a volatile solvent.

10. The process of forming a brush for an electric machine comprising, a binder material mixed with graphite, which includes the steps of wetting the graphite with sufficient water to form a relatively stiff paste and subsequently mixing therewith a solution of the binder material in a volatile solvent.

11. The process of forming a brush for an electric machine comprising, a binder material mixed with graphite, which includes the steps of wetting the graphite with sufficient water to form a relatively stiff paste and subsequently mixing therewith a concentrated solution of the binder material in a volatile solvent.

12. The process of forming a brush for an electric machine comprising, a binder material mixed with graphite, which includes the steps of wetting the graphite, subsequently mixing a solution of the binder material in a volatile solvent with the graphite and drying the mixture formed in a temperature not in excess of 200° F.

13. The process of forming a brush for an electric machine comprising, graphite, a binder, and metallic particles, which includes the steps of wetting the graphite, mixing the binder therewith, drying and pulverizing the mixture thus formed, and adding the metallic constituent of the brush subsequent to these operations.

14. The process of forming a brush for an electric machine comprising, graphite, a binder, and metallic particles, which includes the steps of wetting the graphite, adding to the wet graphite and mixing therewith a solution of the binder in an alkali, precipitating the binder from the solution by the addition of acid, drying and pulverizing the mixture thus formed and subsequently add-

ing the metallic constituent of the mixture thereto.

15. A brush for electric machines comprising, graphite and less than 5 per cent of a hydrocarbon binder, and in which the binder is uniformly distributed throughout the mass.

In testimony whereof we hereto affix our signatures.

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