106. COMPOSITIONS, COATING OR PLASTIC

Cross Reference

Examiner

84

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INSULATING MATERIAL

175-21

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My invention relates to insulating materials or mediums and it has special relation to insulating coatings adapted for insulating the coreplates of transformers, dynamo-electric machines and the like.

Hitherto an organic insulating material, such as varnish or enamel, has been used for separating the sheet iron or steel plates used in making transformers, generators and motors. The insulating film or coating utilized for this work does not necessarily require a high value of specific resistance or a high breakdown value, but it is desirable that the insulating coating limit the contact area of the sheets of iron so as to cut down eddy-current losses. A varnish coating, however, is not altogether satisfactory for this purpose because it does not readily resist the effects of corona and is not effective in preventing the magnetic sheets from rusting when they are exposed to moisture or salt-water solutions. Such coatings are soft and easily abraded, and when pressure is applied to the sides of a plurality of assembled sheets which are insulated from each other in such manner, the varnish is often extruded from between the layers. Furthermore, the organic varnishes which have previously been utilized are inflammable, and explosive mixtures are sometimes formed during their manufacture. It is, therefore, necessary to provide expensive safety appliances to prevent injury to workmen, which increase the cost of manufacture.

Therefore, an object of my invention is to provide a material for insulating coreplates and the like, which has better mechanical properties, such as increased specific resistance and lower point contact, which does not flow readily after application, which resists abrasion, rusting of the sheets, and the effects of corona, and which is less expensive and less dangerous to make and use.

The improved insulating material need not have a high specific resistance and high dielectric breakdown value but such properties are desirable. The material must adhere strongly to the surface of the sheet iron, must cover the surface well and must resist abrasive action, thereby limiting the contact area. In addition to this property, it is desirable that the insulation should, in some types of electrical machinery, resist the action of corona discharge. Further, the material must be such as to prevent side slipping of the dies used in punching the sheets, thus preventing excessive wear of the dies. The material must be low in cost and easy to prepare and apply.

After considerable investigation and testing, I have discovered that a water solution of sodium silicate is very desirable as a coreplate insulating medium. I prefer to utilize a solution of specific gravity between 1.15 and 1.3.

Such coreplate insulating material, however, may be greatly improved by the addition of certain carbohydrate compounds and filler materials, singly or in combination.

Any of the carbohydrate compounds, such as sugar, starch or dextrin may be used individually or in combination as an addition to the sodium silicate. These materials aid greatly in preventing side slipping of the dies utilized in shearing the plates, and the insulating compound so formed does not flow readily and is not easily abraded. I prefer to use sugar because of its low cost.

Some steel plates, such as high-grade electrical sheet steel, are customarily annealed after application of the insulating medium. Since the annealing temperature is above the melting point of sodium silicate, the steel sheets would adhere to one another after removal from the baking ovens, if sodium silicate alone was used. By using a compound comprising sodium silicate and a carbohydrate, such adhering of the plates after annealing is avoided. These carbohydrate compounds, on heating, break down into carbon, water and a very small percentage of hydrocarbons, which materials have very little effect in increasing the carbon content of the steel plates at annealing temperature.

Although various proportions of sodium silicate, water and sugar may be used, I have found that a composition comprising substantially 60 parts of water, 45 parts of sodium silicate and 10 parts of sugar is very satisfactory.

I may add insulating or filler materials,

such as talc, silica, clays, mica, magnesia mica and insulating oxides such as aluminum oxide, iron oxide and magnesium oxide to improve the electrical and mechanical characteristics and produce a film that will not flow under pressure. A suitable dye may also be added to improve the color. The sheet steel may be sprayed, painted or dipped in the sodium silicate solution or the sodium silicate may be applied by the same special machines known to the art which are used in applying varnish.

The usual process of baking is to place the sheets on a moving platform or conveyor which carries them through a baking oven. The baking process takes about twenty five seconds. The source of heat is at the back of the oven so that a uniform raising of the temperature of the sheets to between 120 to 150° C. is secured, and it is found that this heat treatment results in the best product.

The sodium-silicate coating may be made slightly thinner than the varnish coating or film secured in the same manner, and the specific resistance of the sodium silicate will be found to be greater than that of the varnish film. The sodium-silicate film has been found to resist the action of salt spray for a longer period of time than a varnish film. A corona discharge for 60 hours had no appreciable effect on the sodium silicate film.

Although I have described a specific coating material and a specific use for the material, it is apparent that modifications and other uses may occur to those skilled in the art, and such modifications and uses are intended to be included within the spirit and scope of my invention, as defined in the appended claims.

I claim as my invention:

1. An article of manufacture comprising magnetic sheet material provided with a thin, adherent, electrical insulating and heat resisting coating, said coating containing sodium silicate and a substantial proportion of finely divided mica.

2. A magnetic core for electrical devices comprising a plurality of laminations of magnetic material, the laminations being provided with thin films of adherent insulating material comprising sodium silicate, said insulating material containing a finely divided mineral insulation, and being capable of withstanding pressure.

3. An article of manufacture comprising magnetic sheet material coated with an insulating film comprising a soluble silicate.

4. An article of manufacture comprising magnetic sheet material coated with an insulating film comprising a soluble silicate and a filler.

5. An article of manufacture comprising magnetic sheet material coated with an insulating film comprising sodium silicate.

6. An article of manufacture comprising magnetic sheet material coated with an insulating film composed essentially of sodium silicate and mica.

7. A magnetic core for electric devices comprising a plurality of laminations of magnetic material, each of said laminations being coated with an adherent insulating film comprising sodium silicate.

8. A magnetic core for electric devices comprising a plurality of laminations of magnetic material, each of said laminations being coated with an adherent insulating film comprising sodium silicate and an insulating filler.

9. The method of producing an insulating film upon a layer of sheet material which comprise coating the sheet material with a composition of matter comprising an aqueous solution of sodium silicate and heating the coated sheet to evaporate the water.

10. The method of producing an insulating film upon a layer of sheet material which comprises coating the sheet material with a composition of matter comprising an aqueous of sodium silicate and heating the coated sheets at a temperature between 120 and 150° C. to eliminate the water and bake the film.

11. The method of producing an insulating film upon a layer of sheet material which comprises coating the sheet material with a composition of matter comprising an aqueous solution of sodium silicate and an inorganic filler, and heating the coated sheets at an elevated temperature to eliminate the water and bake the film.

12. The method of producing an insulating film upon a plurality of annealed sheets of magnetic material which comprises coating the individual sheets with a composition of matter comprising water, sodium silicate and a carbohydrate, baking the film on each sheet to eliminate the water, assembling a plurality of such sheets and annealing them at a sufficiently high temperature to decompose the carbohydrate, said carbohydrate being added to the composition to prevent the sheets from adhering together during the annealing operation.

13. The method of producing an insulating film upon a plurality of annealed sheets of magnetic material which comprises coating the individual sheets with a composition of matter comprising water, sodium silicate and sugar, baking the film on each sheet to eliminate the water, assembling a plurality of such sheets and annealing them at a sufficiently high temperature to decompose the sugar, said sugar being added to the composition to prevent the sheets from adhering together during the annealing operation.

In testimony whereof, I have hereunto subscribed my name this 16th day of November, 1927.

JOSEPH E. GROSS.