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METHOD OF FORMING INSULATING MATERIAL

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The present invention relates to composite materials and has particular reference to improvements in insulating materials of the type composed of fibres of rock wool and the like bonded together by an adhesive.

Rock wool products have been employed extensively in the formation of insulating materials. Customarily, the raw material from which the products are produced is heated until molten and then blown into a suitable receptacle where the molten slag hardens into fibre-like structures. The fibres are formed into a mass of the desired shape for insulation purposes. In order to maintain the fibres in the desired shape it is customary to incorporate with the rock wool fibres a suitable binder. Many adhesive substances have been suggested for this purpose, including various starch products. While such adhesives are easily applied to the rock wool, the resulting product has the fault of being destructible at relatively high temperatures by reason of the smoking or burning of the starch product.

A principal object of the present invention is the provision of materials of the type described which will withstand relatively high temperatures.

An additional object is the provision of an insulating material composed of insulating fibres or particles held together by a binder composed of a readily applicable organic adhesive combined with a fusible inorganic adhesive.

A further object is to provide an improved method for forming insulating materials from fibrous structures, such as rock wool.

A still further object is the provision of a method for incorporating into a body of rock wool an inorganic fused adhesive.

These and other objects will be made apparent upon a consideration of the following description of a preferred embodiment of the invention.

Rock wool may be formed by blowing the molten material from a suitable cupola into a chamber where it may be allowed to felt on a traveling belt, forming a structure of the nature of cotton batting. Under such conditions the material will be loosely felted and will not stand severe handling. Additionally, the loosely felted material will not properly retain its form and will tend to settle when the material is used as in a vertical wall for house installation. To bind the material in more shape-retaining mass, it is customary to incorporate an organic adhesive, such as asphalt, tars and starch products with the rock wool fibres. One method of incorporating the binders with the fibres is to spray the former into the chamber wherein the molten rock wool is blown.

Although the adhesively bonded fibres of rock wool satisfactorily retain their integral structure under ordinary conditions, high temperatures have the effect of breaking down the organic binder. For this reason, use of rock wool as an insulating material for such purposes as in the insulation of cooking stoves and the like where the oven temperature is of the order of 550° F. has not been as favorable as might be desired. At the temperature involved, the organic binders tend to burn off, thereby leaving the molten product without a binding agent to maintain it in the proper form. Starch products will withstand temperatures of the order of 350° F. or less when used as a binder for rock wool, but if the temperature is raised to the order of 370° F. the binding agent will start to burn off.

In spite of this tendency to decompose at elevated temperatures, the organic binding agents have the desirable property of being easily applied to the rock wool during the process of manufacturing the latter. In accordance with the present invention, there is combined with the rock wool a binder which will withstand the elevated temperatures at which organic binders are decomposed. I have found that certain inorganic compounds are particularly desirable for this purpose, in that such compounds fuse at elevated temperatures to act as adhesives for maintaining the fibres of rock wool in united condition. Boron compounds have been found particularly desirable in this respect. For example, boric acid and borax are preferred inorganic compounds for bonding the fibres of rock wool together. When heated, borax has the property of fusing with a loss of water crystallization, and swells up into a white porous mass. Continued heating causes the borax to melt to the form of a clear glass. Other intumescent compounds, such as the metaphosphates, behave similarly.

To apply the heat-resisting bonding agent, a suitable quantity of borax may be combined with an easily applied organic adhesive, such as starch products. More particularly, the borax may be suspended in aqueous medium containing a starch adhesive and the resulting mixture can be applied to the rock wool in any suitable manner. The mixture may be cooked and added to a water suspension of the fibres, which then may be formed into slabs by conventional methods. In other cases it will be found desirable to spray

the mixed bonding agent into the wool, either as the fibres are felted or after felting.

Another convenient method of applying the dual acting bonding agent is to form an uncooked aqueous mixture of starch, borax and boric acid. The mixture is incorporated with the fibres of rock wool and dried at a temperature sufficiently high to gelatinize the starch, thereby furnishing the desired preliminary adhesive properties. A mixture of boric acid and borax forms a particularly useful bonding agent of the type described and when this mixture or its components is properly combined with the starch product the adhesive properties of the latter are not detrimentally diminished. It appears that the organic adhesive maintains the inorganic adhesive in well distributed form which facilitates the later formation of a heat-resisting adhesive. These inorganic substances do not have pronounced adhesive characteristics under ordinary conditions. For example, a slurry of borax or boric acid would not produce a binding effect upon the rock wool fibres to an equivalent extent to the effect produced by the ordinary organic adhesives.

The insulating material bonded together by mixture of an organic adhesive and borax may be employed as produced in high temperature zones. In such cases the organic adhesive will be decomposed or burned and the borax will fuse to produce an effective bond between the fibres. That is, the fused borax will replace the organic compound as an adhesive and loss of form of the rock wool fibres is prevented. In some cases it will be found desirable to produce this formation of the borax adhesive in situ before the insulating material is used.

By way of example of the invention, a satisfactory formula for combining the fibres of rock wool in the manner described consists of a mixture containing 75 per cent of starch or a starch product, 11.25 per cent of boric acid, and 13.75 per cent of borax. These materials may be mixed together and used in fabrication of the rock wool in a manner customary in the application of organic adhesives. Although the boron compounds will have little adhesive value as applied, the secondary treatment to which the insulating material is subjected acts to change the compounds into a tenacious bonding agent. Backing members may be employed to enclose the unitary mass of fibres, and fireproof material is best suited.

It will be seen that the ingredients of the dual active bonding agent cooperate to produce a mass of fibrous materials which are stable in form under various conditions. While particular reference has been made to rock wool, it will be recognized that the invention will be applicable to other fibrous materials.

Various changes and modifications of the procedure of the product described herein are possible without departing from the scope of the invention, and such changes and modifications are intended to be included in the appended claims.

I claim:

1. The method of forming an insulating material, which comprises mixing an inorganic compound having substantially no adhesive properties but being fusible at elevated temperatures to form a heat-resisting adhesive, with an organic easily applied adhesive, incorporating said mixture with rock wool fibres to bind the latter together, and subjecting said fibres to a temperature sufficiently high to fuse said inorganic compound and to burn said organic compound.

2. The method of forming an insulating material, which comprises forming an adhesive by mixing a boron compound with a starch product, incorporating said adhesive with rock wool fibres to bind the fibres into a loosely felted unitary mass, and heating said mass to a temperature sufficiently high to decompose the starch product and to fuse the boron compound.

3. A method of forming an insulating material, which comprises forming an adhesive by mixing starch with an intumescent substance, incorporating said adhesive with rock wool fibres to bind the fibres into a loosely felted unitary mass, and heating said mass to a temperature sufficiently high to decompose the starch product and to fuse the intumescent compound.

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