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METHOD OF APPLYING SODIUM SILICATE
BINDERJohn M. Campbell, Cleveland, Ohio, assignor to
John M. Campbell and Philmore J. Haber as
trusteesNo Drawing. Application May 15, 1945,
Serial No. 593,963

4 Claims. (Cl. 106-84)

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My invention relates to binding agents in general, and in particular to binders for insulating materials.

An object of my invention is to provide a binder agent for materials having interstices therein which binder is evenly distributed throughout the mass.

Another object of my invention is to provide a binder agent for materials having interstices therein which binder can be mixed with the materials having interstices therein without packing the material and destroying the air pockets provided by the interstices.

Other objects and a fuller understanding of my invention may be had by referring to the following description and claims.

Granulated and fibrous insulating and acoustical sound-absorbing material, such for example, as expanded vermiculite, granulated cork, glass, wool, rock wool and similar materials, are employed for heat resisting, insulating and sound-absorbing boards by binding the loose material together with a suitable binder and either extruding or molding into final shape and form. However, heretofore known binders and methods of binding the loose insulating materials together into final form have been limited very much to specific uses. For example, many materials are highly inflammable, although having very excellent sound-absorbing and heat-insulating properties. These materials are often used in house insulating even though they add nothing to the fire-proof qualities of the house.

Clay is a well known and extensively used binder. However, a material bound together by clay is usually too heavy to float in water, and when wetted by an excess of water will allow the material to disintegrate and become useless. Further, clay will calcine under high temperatures and allow the insulating material to check and crack, and under extreme temperatures, to entirely disintegrate.

Water glass is another well known binding agent. However, water glass in its natural form is relatively viscous and syrupy. When water glass is mixed with one of the insulating materials referred to, there is a great tendency for one portion of the insulating materials to become over saturated with the water glass, while at the same time another portion becomes under

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wetted. The result is that one portion of the finished insulating material is exceedingly dense and hard whereas another portion is exceedingly light and fragile. The dense and hard portion will be found to have a higher coefficient of heat conduction than the light material, and therefore will act as a weak point insofar as the insulating properties are concerned. Again, water glass when used in sufficient quantities to serve as a binder will not normally produce an insulating material resistant to deterioration by moisture. Further, none of the known binders used today will increase the ability of the insulating material to withstand the effects of high temperature. That is, the finished insulating material will deteriorate and char at approximately the same temperature as would the original material.

My improved method of binding insulating material provides an evenly distributed binding action throughout the entire mass of the insulating material to bind the materials into a finished product of even density throughout, thereby preventing the described spotty condition of high density and low density areas. Further my improved method binder doesn't permit the insulating materials to calcine readily under relatively high temperature, and therefore holds the insulating material together under fire and intense heat. My binder also is so extremely light, that the density of the original insulating material will not be materially affected and therefore, the insulating materials may be fluffed to include enough air space to provide a finished product with a density less than one.

The basic conception of my invention is the peptizing or dispersing of an adhesive material in order that the adhesive action of the material might be reduced until after the adhesive material is entirely and thoroughly mixed with the insulating materials to be bound. After being well mixed and distributed, the peptized adhesive material is precipitated as a jelly by chemically shifting the pH value of the solution. The insulating materials are thus surrounded and enveloped by a precipitated jelly which is evenly distributed throughout the entire mass, and thus the adhesive is evenly distributed. One example of the use of this type of jelly distribution of an adhesive material is illustrated in my application entitled "Insulating and acoustical materials," bearing

*Sol. Solvent
+
water*

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Serial No. 593,964, and filed concurrently herewith. In that application, expanded vermiculite is impregnated with powdered aluminum hydrate and magnesium carbonate. As one example, the impregnated particles are then wetted with a solution of a slightly acidic hardening agent. Thereafter, a peptized solution of an adhesive material was slowly sprayed to the acidified mixture as the mixture was being constantly stirred. Thus, the adhesive material is evenly distributed throughout the material because it is in an entirely fluid condition upon entering into the mass, whereafter it is precipitated as a jelly to completely enclose and support the fragile expanded vermiculite particles. After drying, the adhesive material shrinks to a very small amount of material, and therefore does not materially increase the weight of the insulating board. Although the jelly is usually produced by precipitating the adhesive material by an acidic material, the principles involved include a precipitation of certain binders by a reverse procedure, that is, a precipitation by chemical manipulation to change the pH value to the basic side. The use of this improved jelly process of distributing an adhesive agent is not limited, however, to use with vermiculite and similar insulating materials. For example, glass wool and even saw dust has been shown to resist the action of heat to a considerably greater degree when bound into insulating board by my process, than with any other known process today.

In actual operation, my improved binder jelly may be used advantageously with any material having interstices therein. The binder agent such as water glass, resin, silica resin, etc., may be peptized by any well known peptizing agent such as urea, for example, and then be evenly dispersed throughout the mass of insulating material. Thereafter, a slightly acidic solution may be added to the moistened mass to precipitate the adhesive in the form of a jelly throughout the material. On the other hand, if the insulating material used in the type having the body thereof made of individual laminated exfoliated cells, such as vermiculite, the mass may be first moistened with the acidic material to prevent the peptized insulating material from running into the interstices of the individual cell. That is, after the material has been wetted with the acidic mixture the peptized adhesive material will jelly shortly after being added to the mass, and therefore will not penetrate into the small openings of the material. Further, the peptized binder will remain fluid until the pH value thereof is shifted to the acidic side. Therefore, once the acidic property of the acidic materials is neutralized in one spot, the peptized fluid binder will pass over and be precipitated in another spot. Thus, an over concentration of binder is prevented in any one spot. Thus, in the case of materials of this kind such as vermiculite or granulated cork, the adhesive material is withheld from the interior of the individual cell particles, and an insulating material is thus produced having a large amount of entrapped air pockets and an appreciably lighter specific gravity. The acidic solution added to cause the peptized adhesive material to jelly, may preferably be in the form of a hardening agent which will hydrolize to give the desired acidic properties. For example, I have found that magnesium fluosilicate will serve to precipitate the adhesive binder as a jelly, and at the same time serve to harden the adhesive material to better withstand the actions of high tempera-

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tures and mechanical forces. This hardening effect is particularly noticeable when using water glass as the binding agent.

Although the precipitated binder is somewhat of a lubricating material, I have found that it is advantageous to add a small amount of clay or talc or similar material of the same class to increase the lubricating action of the resultant jelled mass in order that the mass may be extruded from an extruding machine into shape. It is well known that extruded insulating materials are considerably cheaper to manufacture than those formed by molding. In addition to the clay or talc as a plasticizer or lubricant to help in extruding water-proofing agents to increase the resistance to water, color, fillers and other materials may be added to the mass either before the wetting action or after. These materials are entirely auxiliary to the basic conception of jelly distribution of the adhesive agent, and may be varied within suitable limits for specific purposes.

After forming into suitable shapes, the material may be air dried or oven dried as desired. In either case, the material will be found to have shrunk only a fraction of one per cent of its original volume and will not be checked or cracked. The finished product may be sawed or nailed and may be used as a fire-proof filler between two walls. The jelled mass, before drying, or after being rewetted, is also an excellent plaster material being held tenaciously in place by the evenly distributed adhesive.

Although I have described my invention with a certain degree of particularity, it is understood that the present disclosure has been made only by way of example and that numerous changes in the details of construction and the combination and arrangement of parts may be resorted to without departing from the spirit and the scope of the invention as hereinafter claimed.

I claim as my invention:

1. An improved method of applying adhesive sodium silicate binder to material having interstices therein, said method comprising the steps of peptizing the said sodium silicate with urea to form a peptized solution within the said material to be bound with the peptized sodium silicate solution and thereafter precipitating the sodium silicate in jelly form by shifting the pH value of the peptized sodium silicate solution, the pH value being shifted by the addition of a solution of sodium fluosilicate.

2. An improved method of applying sodium silicate binder to particles of material to be bound together, said method comprising the steps of mixing the particles with an acidic solution in quantities sufficient to moisten the surfaces of the individual particles, separately preparing a binder of peptized aqueous dispersion of sodium silicate and urea, and thereafter mixing the binder with the filled particles while the filled particles are still moist with the acid solution, whereby the peptized dispersion is precipitated as an adhesive jelly, and thereafter shaping into forms and drying.

3. An improved method of applying an adhesive of sodium silicate to material having interstices therein, said method comprising the steps of peptizing an aqueous solution of the said adhesive with urea, mixing the sodium silicate and urea solution with the said material to be bound, and thereafter precipitating the adhesive jelly form by shifting the pH value of the peptized adhesive to a more acid degree, the pH value being shifted

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by contacting the peptized adhesive with an acid material within the said material to be bound.

4. An improved method of applying sodium silicate binder to particles of material to be bound together, said method comprising the steps of separately preparing a binder of peptized aqueous dispersion of sodium silicate and urea, and thereafter mixing the binder with the particles and precipitating the sodium silicate in jelly form by contacting the said binder with acidic material to shift the pH value of the peptized sodium silicate and urea solution.

JOHN M. CAMPBELL.

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