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FIRE-PROOFING OF ELEMENTS PROVIDED WITH CAVITIES CONTAINING A POWDERED INFILL MATERIAL

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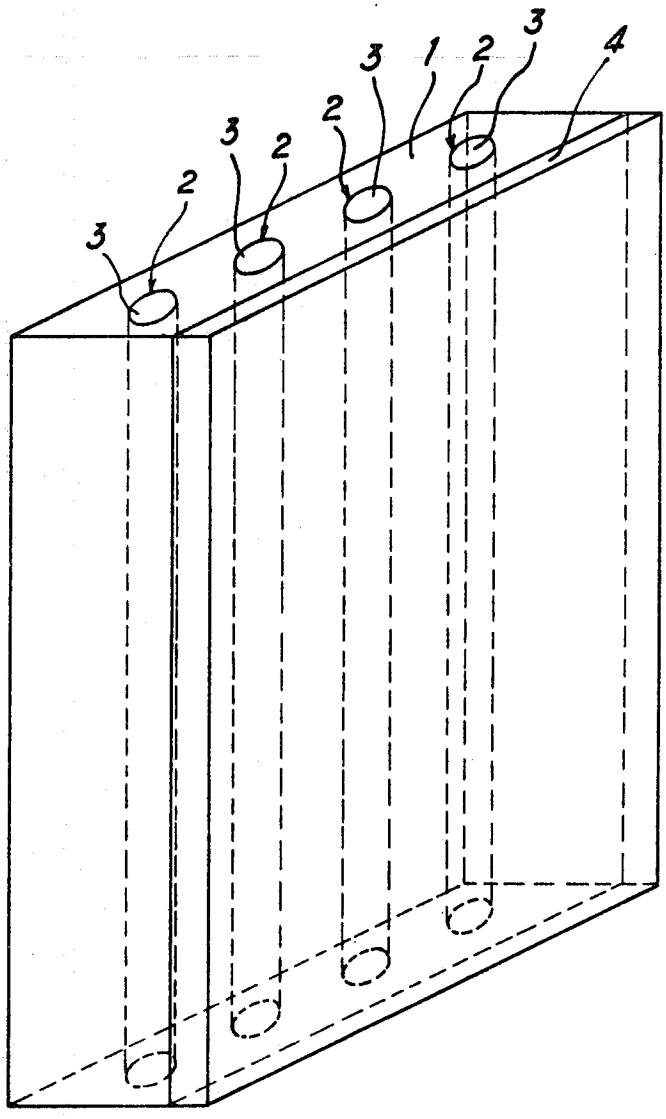


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# FIRE-PROOFING OF ELEMENTS PROVIDED WITH CAVITIES CONTAINING A POWDERED INFILL MATERIAL

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U.S. Cl. 161—139 9 Claims

## ABSTRACT OF THE DISCLOSURE

A prefabricated panel having fireproof characteristics, said panel having internal cavities filled with a pulverulent mixture comprising a small proportion of borax which agglutinates the mixture upon heating, thus preventing the flowing of the mixture outside the cavities when the panel is perforated up to the cavities under action of a flame. Preferably, less than 60 grams of finely powdered borax per liter of mixture is thoroughly dispersed in the remainder of the mixture, which is usually a granular sound insulating agent such as sand, asbestos, refractory earth, cement, etc. If desired, the mixture may be partially pre-agglutinated by moderate heating. In addition, a small proportion of borax may be added to any adhesives used in making the panel.

The present invention relates to improvements in prefabricated panels.

Prefabricated panels which have a core of organic materials agglomerated by sticking and pressing, for example panels consisting of agglomerated chips of wood or other vegetable materials, are limited in their use in the building industry because of the generally insufficient fire resistance of these panels.

The introduction into these panels of known and generally costly products selected because of their suitable resistance to fire (vermiculite, asbestos, etc.) does not sufficiently improve the fire resistance of the panels.

It has been found by the applicant that an unexpected and remarkable improvement in this fire resistance is obtained by a process which consists in introducing sodium borate into the panels.

The results obtained are better in proportion as the dispersion of the sodium borate in the panel is improved. One way of obtaining an excellent dispersion consists in mixing the sodium borate with the adhesive used for bonding together the materials which form the panel.

The quality of the results obtained increases with the finess of the sodium borate powder. If this sodium borate, because of a long storage period, forms pellets or other agglomerates, it must be screened, for example with a screen having a mesh size of the order of five tenths of a millimeter and preferably smaller than this size, before being mixed with the adhesive.

The incorporation of sodium borate into the panel produces the remarkable result that this inexpensive product,



which in itself is not an agent noted for its fire resistance, reacts in the panel under the action of heat to form successive films which act to prevent the destruction of the panel. Due to the presence of sodium borate in the adhesive, the panel exposed to the direct action of a flame does not show the fissures which can be seen in a conventional panel, and the result of this is a remarkable increase in the fire resistance of the panel.

Numerous tests have shown that it is sufficient to incorporate into the adhesive from 1 to 10% by weight of sodium borate, related to the weight of adhesive ready for use, in order to obtain excellent results, and in practice an incorporation of 2 to 5% is generally sufficient.

The effect of these small quantities is that it is easy to achieve an intimate mixture of adhesive and sodium borate by using the known mixers, and also that the addition of sodium borate to the adhesive does not impair the true action of the adhesive and as a result makes it unnecessary to increase the quantity of adhesive for agglomerating the materials of the panel.

Furthermore, this introduction of sodium borate into the panel does not involve any modification of the material normally employed for the manufacture of panels.

According to another feature of the invention, in the most usual case where the panel has to have a facing on one of its two large surfaces or on both, it is recommended that this facing should be stuck to the core of the panel with an adhesive containing sodium borate, preferably reduced to the state of very fine powder, it being possible for the proportions of sodium borate and adhesive to be similar to the proportions indicated above for the adhesive of the panel. Under these conditions, the sodium borate does in fact penetrate with the adhesive into the pores of the facing and produces therein its effect on resisting propagation of flame when this facing is exposed to the action of a flame.

When the panel is of the type known as a "tubular" panel (the panel comprising internal tubular compartments containing a sound-insulating agent in powder or granular form and/or a fire-resisting agent), it is also easy and very advantageous to mix sodium borate with this agent. A simple addition of about 20 g. of sodium borate per litre of powdered agent is sufficient to provide excellent results, and an addition which is between 20 g. and 60 g. per litre is suitable in practically every case. The powdered or granular agent can be for example sand, refractory earth, cement, lime, crushed porcelain, pumice, vermiculite, asbestos, plaster, wood flour, etc., and mixtures thereof, the best results being obtained with the material which are as fine as possible.

When this insulating agent does not have sodium borate added thereto, which is the case in known panels, the agent is able to escape from the compartment containing it when the panel is penetrated as far as the compartment by the action of a flame, and the compartment which is thus emptied serves as a chimney for the fire, thereby accelerating the destruction of the panel.

Sodium borate has the unexpected property of solidifying the agent in powder form when the mixture of this powdered agent and sodium borate is touched by a flame: the result of this is that the mixture is agglutinated under

the action of heat and forms a block which is retained in the compartment and which resists the fire.

In addition, sodium borate releases, under the action of heat, gases which contribute to preventing the propagation of the flame in the panel.

The prefabricated panel containing compartments filled with a pulverulent mixture of sound-insulating agent and sodium borate can if desired be subjected to a moderate heating (for example of about 60 to 180° C.), this having the effect of hardening at least the periphery of the aforesaid mixture and of stabilising it, so that there is no longer any danger of the mixture running out of the panel if the latter is perforated by a pointed object extending through the panel as far as a compartment.

The invention thus makes it possible to supply prefabricated panels of agglomerated materials containing a sound-insulating agent which is stabilised against flow and having a considerably improved fire resistance.

By way of example, a panel according to the invention will be described with reference to the single figure of the accompanying drawing, which is a perspective view of a parallelepipedic panel.

The panel there shown has a core **1** consisting of organic materials agglomerated by sticking and pressing, this core being formed with tubular compartments **2** containing silica as a sound-insulating agent **3**. A facing **4** is stuck to the core of the panel on one of its large surfaces. The panel is made of agglomerated wood chips and has a thickness of 50 mm., while the compartments contain a mixture of borax (usual commercial form of sodium borate) and dry fine sand at the rate of 3 to 5% by weight of borax. Borax powder is marketed by Messrs. Prolabo under the name LP 654. The panel just described has a remarkable behaviour with respect to fire, the mixture of silica and sodium borate being homogenised and hardened under the action of heat, forming white and rigid cylindrical rods which contain the fire for a long time.

Sodium borate is introduced into the panel itself by being mixed with the adhesive used for agglomerating the chips or other constituents of the panel and/or by mixing it with the adhesive used for fixing a facing to the panel and/or by mixing with an agent in powder form introduced into the internal compartments of the panel. The sodium borate can alternatively have other fillers added thereto. The invention provides in particular for the addition thereto of asbestos, which is not in fibre form, but in the form of a powder which is as fine as possible, the fineness of the asbestos powder being preferably comparable with that of flour or talcum.

It has been established that an addition of 1 to 10% by weight and preferably 5 to 10% by weight of powdered asbestos, with respect to the weight of adhesive, can advantageously be made to this adhesive when this action is accompanied by an addition of sodium borate. On the contrary the powdered asbestos, if it were used by itself in the adhesive, would have to be incorporated in a much larger quantity which could reach 50% of the weight of adhesive, and this would furthermore make it necessary in practice to increase the quantity of adhesive in order to obtain a sufficient sticking effect.

It has been established that in addition the presence of this powdered asbestos improves in a surprising manner the water resistance of the panel, of which the tendency to swell is found to be greatly reduced.

It is possible that the powdered asbestos forms substantially around each chip a sheath which is constituted by a cloud of particles which are close to one another and are held by the adhesive, insulating the chip and in intimate contact with it, simultaneously preventing it from swelling due to absorption of water and from being distilled by contact with a flame.

These properties can also be due to interactions between the adhesive and the incorporated agent.



By way of example, it can be indicated that a panel with a thickness of 60 mm. and consisting of agglomerated wood chips containing borax mixed with the adhesive which has served for the agglomeration of the chips, which panel is exposed to the action of a large petrol-operated welding torch, is not penetrated by the flame after being exposed thereto for seven hours.

In a typical composition according to the invention, for 100 kg. of wood chips and about 30 kg. of resin-based adhesive ready for use, the proportion of borax powder to be added is from 0.3 to 3 kg., preferably 0.6 to 1.5 kg., and the proportion of asbestos powder which can be usefully added is from 0.3 to 3 kg. and preferably 1.5 to 3 kg.

The teaching of the invention, namely, the incorporation into tubular or non-tubular panels of sodium borate, preferably accompanied by very fine asbestos powder, is applicable to the various materials which are used for forming panels and particularly to agglomerates of vegetable materials (chips of wood, flax, straw, etc.). The invention is also applicable to the various adhesives used in these panels, preferably adhesives of the urea-formaldehyde type, and to melamine-based adhesives, and for example to the adhesive sold commercially under the name Kaurit, although the invention is not limited to a particular type of agglomerated material or adhesive.

The teachings of the invention are applicable in general fashion to all construction elements comprising cavities which can be filled with a pulverulent mixture containing sodium borate to modify the fire-resistance qualities of the elements. This sodium borate is mixed for example with sand, and/or with ground pumic stone and/or other known insulation product. These mixtures can in particular be contained between two metallic walls, for making a fire-proof door for example, or in a casing for protecting a part surrounded by the casing for example a post or pole or a pipe, conduit or flue. The double wall containing the mixture can be made of organic materials, for example wood, plastics materials, etc.

I claim:

**1.** A prefabricated panel having internal cavities filled with a pulverulent mixture comprising powdered borax, said borax being thoroughly dispersed within said mixture and the proportion of the borax in the mixture being less than about 60 grams of borax per litre of mixture, the remainder of the mixture being a powder agglutinatable by said borax upon heating thus preventing the flowing of the mixture outside the cavities when the panel is perforated up to said cavities under the action of flame, thereby improving the fire-resistance of the panel.

**2.** A prefabricated panel according ot claim **1** wherein said mixture contains at least one agent selected from the group consisting essentially of asbestos, sand, refractory earth, cement, lime, crushed porcelain, pumice, vermiculite, and plaster.

**3.** A prefabricated panel according to claim **2** wherein said borax is so sized that it passes through a screen having mesh openings which are smaller than about 0.5 mm.

**4.** A prefabricated panel according to claim **2** wherein at least the periphery of said mixture has been pre-agglutinated.

**5.** A prefabricated panel according to claim **2** wherein said internal cavities are tubular compartments.

**6.** A prefabricated panel according to claim **2** wherein said internal cavities are formed between metallic walls.

**7.** A prefabricated panel according to claim **2** wherein said panel has a core of organic materials agglomerated.

**8.** A prefabricated panel according to claim **7** wherein the agglomerated materials are of vegetable nature in chip form.

**9.** A prefabricated panel according to claim **8** wherein the agglomerated materials are selected from the group consisting essentially of wood, flax and straw.

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