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(54) Method for manufacturing a frame profile for a fire resistant door.

(57) A frame profile for a fire resistant door, said profile comprising:
a. a solid beam;
b. a groove extending longitudinally in said beam, an intumescent composition being provided in said groove;
characterized in that said groove has a depth/width ratio of 1,5 or more, preferably 2 or more.

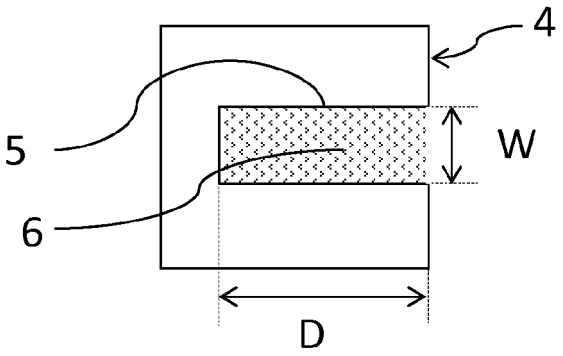

Fig. 2

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to a profile for the manufacturing of a frame of fire resistant doors.

BACKGROUND OF THE INVENTION

[0002] Fire prevention is facing more and more stringent requirements to be matched with increasing consumer demands in terms of design.

[0003] Both safety and require requirements are difficult to match and demand a continuous development effort from the industry. Fire retardant doors have been developed comprising a peripheral frame wherein a groove is provided accommodating a strip of an intumescent composition. US 6,115,976 A and BE 1,011,525 A3 both describe a frame profile for fire retardant doors comprising a groove accommodating a strip of an intumescent composition, wherein said strip is covered with a decorative strip of wood veneer or plastic.

[0004] An disadvantage of the door profiles according to US '976 and BE '525 is that the strip may prevent the intumescent composition of completely sealing the door upon expansion or may postpone expansion of the intumescent composition in case of fire, thereby compromising the safety obtainable by providing an intumescent material strip.

[0005] GB 1,377,059 discloses a frame profile for fire retardant doors manufactured by laminating fire-resistant plywood alternated with strips of intumescent composition. A disadvantage of such frame profile is that the intumescent composition can expand in several directions and not necessarily in the direction of the gap between the door and the outer (surrounding) door frame such that rather high volumes of intumescent composition are needed to ensure integrity of the smoke barrier obtained.

[0006] Given the above, there remains a need for a frame profile meeting both high safety and design standards that can be manufactured cost efficient.

SUMMARY OF THE INVENTION

[0007] The present invention addresses the above demands and provides a frame profile for a fire resistant door, said profile comprising:

(a) A solid beam;
(b) A groove extending longitudinally in said beam wherein an intumescent composition is provided;

wherein said groove has a depth/width ratio of 1,5 or more, preferably 2 or more.

[0008] The present invention also concerns a method for manufacturing a frame profile for a fire resistant door, said method comprising:

(a) Providing a solid beam;
(b) Providing at least one longitudinal groove in a side of said solid beam;
(c) Introducing an intumescent composition in said groove,

Wherein said groove as a depth/width ratio of 1,5 or more and preferably 2 or more.

[0009] Finally the present invention concerns a door comprising a frame profile as identified above, whereby the groove with the intumescent material provided therein is situated at the outer periphery of the door frame.

DESCRIPTION OF THE INVENTION

[0010] In a preferred method of the present invention the solid beam is manufactured out of a solid body, preferably of a composite comprising wood.

[0011] According to a preferred method of the invention, the groove provided in the solid beam has a depth/width ratio of 1 or more, preferably 1,5 or more, most preferably 2 or more. The width of the groove is preferably 7mm broad or less.

[0012] The frame profile of the present invention preferably lacks a decorative strip or masking strip covering the groove comprising the intumescent composition.

[0013] The intumescent composition is preferably introduced in said groove by an extrusion process.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014]

FIG 1: represents a door according to the present invention;
FIG 2: represents a cross section according to line II-II in figure 1;
FIGs 3-5: represent alternative cross sections of figure 2.

DETAILED DESCRIPTION OF THE INVENTION

[0015] Figure 1 represents a fire resistant door 1 comprising a frame 2 surrounding a core 3 fixed in said frame 2. The frame comprises vertical styles and horizontal beams further referred to as frame profiles 4.

[0016] As represented in figure 2, the frame profiles 4 are provided with a groove 5 at the outer periphery of the frame, which grooves 5 extend in the longitudinal direction of the frame profiles 4 and preferably over the entire length of each profile 4.

[0017] According to a preferred embodiment of the frame profiles according to the present invention, the groove 5 has a depth (D)/width (W) ratio of 1 or more, more preferably 1,5 or more and most preferably 2 or more. The width (W) of each groove 5 - measured at the outer peripheral surface of the frame profile- is preferably less than 7 mm broad. Clearly, each profile can be pro-

vided with a plurality of grooves 5 as represented in figures 3 to 5.

[0018] In the groove 5 an intumescent composition 6 is provided comprising an intumescent material.

[0019] In the context of the present invention, intumescent material is defined as one that undergoes a chemical change when exposed to heat or flames, becoming viscous then forming expanding bubbles that harden into a dense, heat insulating multicellular char.

[0020] The intumescent composition preferably comprises an intumescent material, an organic binder and a flame retardant.

[0021] The intumescent materials are water-insoluble mineral granules. The intumescent material may be a granular hydrated alkali metal silicate such as described in U. S. Pat. No. 4,273,879. The preferred alkali metal silicates described in the '879 patent are granulated sodium silicates having a moisture content of about 5 to about 30 weight percent, a silicon dioxide (Si02) to sodium oxide (Na20) ratio ranging from about 2.0: 1 to about 3.75: 1, and particle sizes ranging from about 0.2 mm to 2.0 mm (i. e. about 95% of the particles being greater than 0.2 mm).

[0022] A preferred water-insoluble mineral granule is a mixture of alkali metal silicate represented by the formula M20: xSi02 in which M is an alkali metal. The mixture also includes at least one oxy boron compound which may be selected from boric acid and borate salts of Group I and II elements and water. The weight ratio X ranges from about 1.5 to about 4, the molar ratio of boron to M is between about 0.2 and about 0.9, and the water comprises about 5 to 15 weight percent of the total composition.

[0023] There are many silicates which could be used. Examples cited in US Pat. No. 4,521,333 include sodium silicate, lithium silicate and potassium silicate.

[0024] There are many oxy boron compounds, which could be used. Examples cited in Graham et al.'333 of oxy boron compounds include metaborate, tetraborate, perborate, polyborate radicals, boric acid, colemanite, calcium metaborate, magnesium borate and zinc borate.

[0025] Other intumescent compounds may be used especially if admixed with the above silicates. These intumescent compounds include, for example, expandable graphite, vermiculite, perlite, NaBSi, glass particles, mica, inorganic and organic blowing agents and mixtures thereof. In particular expandable graphite may be admixed with the granulated hydrated alkali metal silicate intumescent composition mentioned above. The amount of intumescent material typically may range from about 10 to about 70 wt-%, preferably from about 25 to about 60 wt-%, based on a total weight of fire sealing composition.

[0026] The second component of the intumescent composition is a, preferably halogen-free, organic binder. This material is a thermoplastic or thermosetting binder.

[0027] Examples of thermoplastic materials include substantially linear polymers such as acrylate polymers, ethylene vinyl acetate copolymers, natural rubbers, styrene butadiene copolymers, butadiene acrylonitrile copolymers, polyisoprene, polybutadiene, polyvinyl acetate, polyethylene terephthalate, polyethylene, polypropylene, polystyrene, and combinations and mixtures of these polymers.

[0028] Examples of suitable thermoset materials include epoxies, phenolics, polyesters, silicones, polyurethanes, polyimides and the like. In addition, suitable thermoset materials include thermoplastic materials capable of being cross-linked with the addition of a crosslinking agent and/or exposure to an appropriate energy source such as an electron beam. The materials include, for example, natural rubber, styrene butadiene copolymers, butadiene acrylonitrile copolymers, and polybutadiene.

[0029] If the binder is in the form of a latex, the latex material is preferably dried prior to the high shear mixing to remove water and other volatiles, if present.

[0030] Preferred thermoplastic or thermosetting binders include synthetic or natural isoprene rubber, ethylene propylene rubber, EPDM rubber, and polybutadiene. The most preferred binder contains an ethylene vinyl acetate copolymer. Blends of these materials, e.g., ethylene vinyl acetate/synthetic isoprene rubber may also be employed.

[0031] The amount of binder may typically range from about 10 to about 50 wt-%, preferably from about 12 to about 40 wt-%, based on the total weight of the fire barrier material.

[0032] A third ingredient in the intumescent composition is a flame retardant. This flame retardant is preferably a phosphorous and/or nitrogen containing material which promotes the charring of organic binders by forming an acid when heated. Preferred phosphorous containing compounds include compounds containing ammonium polyphosphate (APP).

[0033] Typically flame retardant compounds, when present, are in an amount ranging from about 10 to about 50 wt-%, preferably about 15 to about 40 wt-%, based on the total weight of the fire sealing composition.

[0034] Further optional ingredients may also be present to add or enhance the properties of the fire sealing composition and may include fillers, pigments, and processing aids. In addition, since thermosetting materials may be employed as a binder, curative or crosslinking agents may be present such as, for example, organic peroxides such as dicumyl peroxide.

[0035] Plasticizers, preferably a flame retardant plasticizer, most preferably an organic phosphate plasticizer.

[0036] The amount of plasticizer should be limited to avoid the composition becoming too soft or putty-like.

[0037] According to the present invention the above ingredients are combined through a high shear mixing operation and directly extruded into a groove 5 of a frame profile 4 at a pressure of 200 bar or higher.

[0038] Typically, the composition is made by high shear mixing of the various ingredients using for exam-

ple, a 2-roll mill, Banbury mixer, or, preferably, a twin-screw extruder equipped with heating/cooling capabilities to control the processing temperature.

[0039] The term "a substantially volatile-free state" means that the high shear mixing takes place in a chamber where the components of the composition are free of volatile organic solvents and the binder is also essentially free of water (i. e., containing less than 0.25% by weight). This water being other than bound water, wherein bound water is water that does not evaporate until the material is heated to at least 100 C (preferably, at least 150 C, more preferably at least 250 C).

[0040] The binder is either pre-dried, e. g. in an oven, or, if dry, directly added to the mixing chamber and mixed until thoroughly blended. Any fillers, processing aids, char forming resins, waxes, colorants, flame retardants, antioxidants, antiozonants, curatives, and plasticizers are then added while the mixing operation continues. The last ingredient added is usually the intumescent material. The composition is typically mixed until homogeneous and smooth (i. e., not lumpy).

[0041] The composition can also be prepared by adding the ingredients to a heated zone of a twin screw extruder where volatiles, if present, are removed prior to entering a mixing zone. Following mixing, the composition is extruded directly into the groove 5 of a frame profile at elevated pressures of 200 bar or higher.

1	Door
2	Frame
3	Core
4	Frame profiles
5	Groove
6	Intumescent material
D	Groove depth
W	Groove width

Claims

1. A frame profile for a fire resistant door, said profile comprising:

   a. a solid beam;
   b. a groove extending longitudinally in said beam, an intumescent composition being provided in said groove;
   characterized in that said groove has a depth/width ratio of 1,5 or more, preferably 2 or more.

2. The frame profile according to claim 1, wherein said solid beam is manufactured out of a solid body, preferably of a composite comprising wood.

3. The frame profile according to claim 1, wherein said groove has a width of 7 mm or less.

4. The frame profile according to claim 1, wherein said intumescent composition contains graphite.

5. The frame profile according to claim 1, wherein no adhesive or mechanical connection means are provided between the intumescent composition and the inner surface of the groove.

6. A method of manufacturing a frame profile for a fire resistant door, said method comprising:

   a. providing a solid beam;
   b. providing at least one longitudinal groove in a side of said solid beam;
   c. introducing an intumescent composition in said groove;
   characterized in that said groove has a depth/width ratio of 1,5 or more, preferably 2 or more.

7. The method according to claim 6, wherein said intumescent composition is introduced in said groove be an extrusion process.

8. The method according to claim 7, wherein said intumescent composition is extruded directly in said groove at a pressure of 200 bar or more.

9. A door comprising a frame profile as identified in any of claims 1 to 5, whereby the groove with the intumescent composition provided therein is situated at the outer periphery of the door frame.

10. the door according to claim 9, wherein said groove comprising the intumescent composition is not covered by a decorative strip or masking strip.

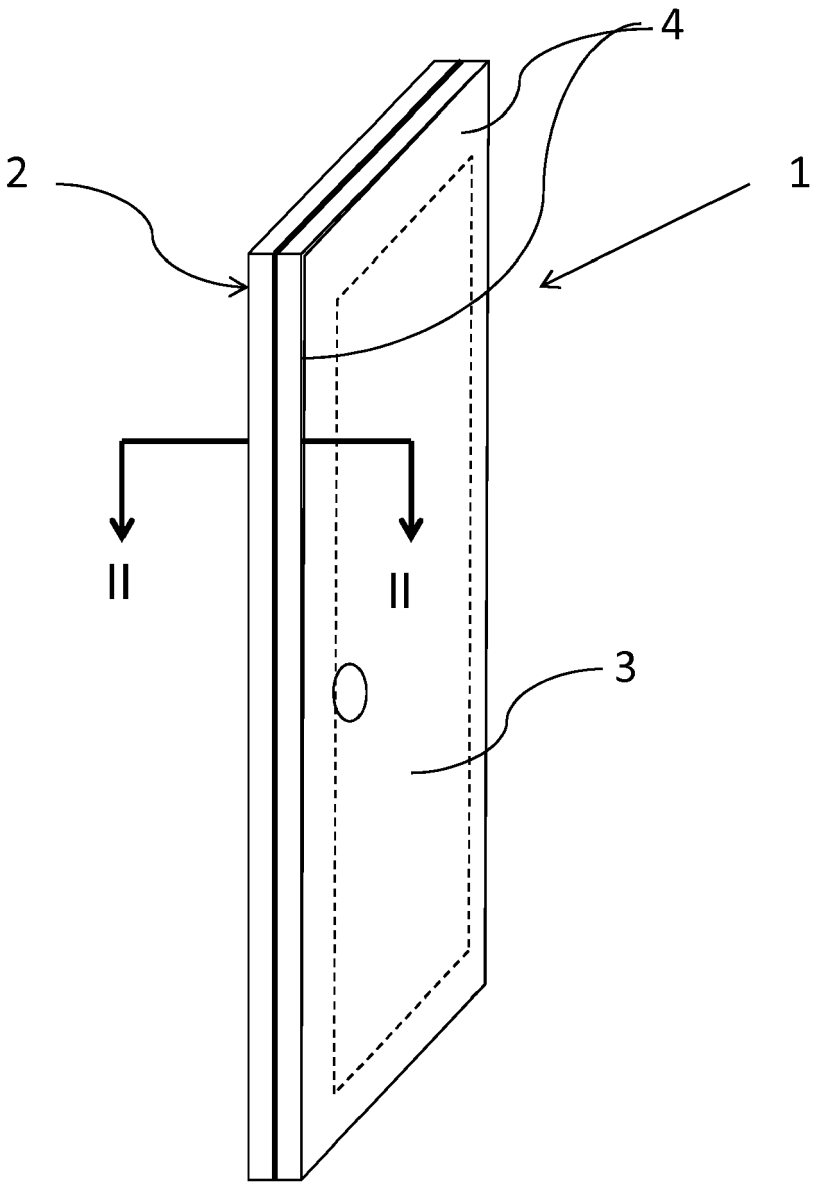

Fig. 1

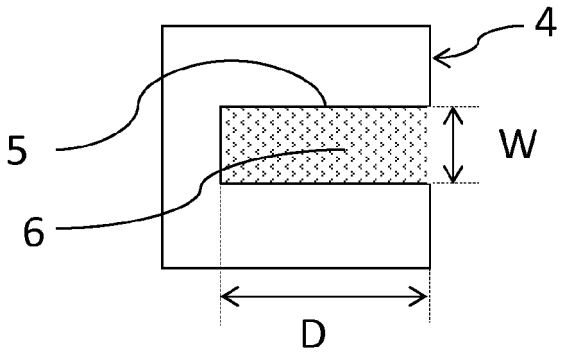

Fig. 2

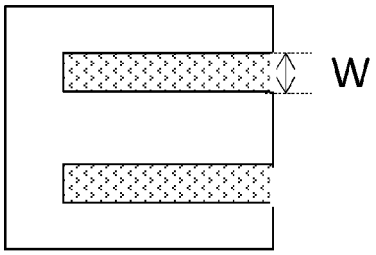

Fig. 3

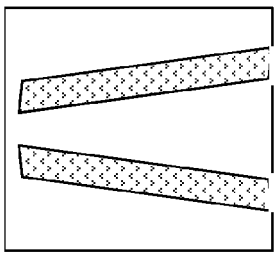

Fig. 4

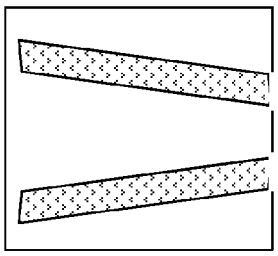

Fig. 5

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EUROPEAN SEARCH REPORT

Application Number
EP 13 15 0807

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 2008/030087 A1 (WIJNVELD B V [NL]; WIJNVELD HENDRIK JAN [NL]) 13 March 2008 (2008-03-13)	1-3,5,6, 8-10	INV. E06B5/16
Y	* the whole document *	4,7	

Y	US 2011/314755 A1 (LANGILLE KEVIN B [CA] ET AL) 29 December 2011 (2011-12-29) * figures 1-12 *	4,7	

TECHNICAL FIELDS SEARCHED (IPC)
E06B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	3 July 2013	Merz, Wolfgang

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 13 15 0807

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03-07-2013

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REFERENCES CITED IN THE DESCRIPTION

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- BE 1011525 A3 **[0003]**
- GB 1377059 A **[0005]**
- US 4273879 A **[0021]**
- US 4521333 A **[0023]**