Title: BUILDING ELEMENT COMPRISING WOOD, SUCH AS A BEAM OR BOARD

Abstract: A building element comprising wood, such as a beam or board, wherein the building element is composed of at least two wood layers of wood and at least one fire prevention layer of a fire prevention material, wherein the at least one fire prevention layer is included between the at least two wood layers and wherein the first prevention material is a solid material which does not burn at a temperature that is lower than 850°C and which, in free condition, expands in volume by at least a factor 2, preferably by at least a factor 3 and more preferably by at least a factor 5 as a result of a temperature rise of the fire prevention material with a fire that has reached the fire prevention material.
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Title: Building element comprising wood, such as a beam or board.

The invention relates to a building element comprising wood, such as a beam or a board.

The invention also relates to the use of such a building element. The invention further relates to a door provided with a framework and two cover plates provided on opposite sides of the framework. The invention further relates to a casing for at least one door and/or at least one window. The invention further relates to a method for manufacturing a building element.

A building element comprising wood, such as a beam or board, is known per se. Such building elements are utilized, inter alia, in inner doors. Such a door is provided with a framework which is manufactured at least substantially from these wooden building elements.

Such a framework is known per se and is provided with, for instance, two vertical uprights, an upper horizontal member and a lower horizontal member. The two vertical uprights and the two horizontal members are manufactured from the wooden building element. On both sides of the framework, cover plates are provided.

If such known inner doors are to meet specific fire safety standards, such as, for instance, the standard of a 30 or 60 minute fire resistant door, use is made of wooden building elements whose framework is manufactured at least substantially from hardwood such as merbau or meranti. It is further known to provide a fire resistant material, such as perlite or a mineral fiberboard filling, between the cover plates. As the building elements consist of hardwood, the requirements set for a 30 minute or 60 minute fire resistant door can be met. This latter means that when there is a fire on one side of the door, it takes 30 or 60 minutes, respectively, before the fire reveals itself on the other side of the door. Therefore, the respective door can withstand fire for 30 or 60 minutes, respectively.
A drawback of the known doors and, hence, of the known building elements is that hardwood becomes ever scarcer and that the use of hardwood is relatively expensive. Furthermore, hardwood is generally appreciated as a visibly attractive sort of wood, from which aspect no profit is made when it is at the inside of the door. Furthermore, there are environmental objections to the use of, in particular, tropical hardwood.

The invention contemplates providing a solution to this problem.

Accordingly, a building element according to the invention is composed of at least two wood layers of wood and at least one fire prevention layer of a fire prevention material, wherein the at least one fire prevention layer is included between the at least two wood layers and wherein the fire prevention material is a solid material which does not burn at a temperature that is lower than 850°C and which, in free condition, expands in volume by at least a factor 2, preferably by at least a factor 3 and more preferably by at least a factor 5 as a result of the temperature rise of the fire prevention material with a fire that has reached the fire prevention material. What is meant by not burning at a temperature lower than 850°C is not burning at any random temperature lower than 850°C. The referred-to expansion in volume can be smaller when the fire prevention material is partly included in a rigid space as is the case in this example. As a result, pressure build-up can take place in the expanded material because then, it cannot fully expand.

Surprisingly, such a building element can be utilized in, for instance, doors, in a manner such that the doors can also meet the fire resistance standards without it being necessary that the framework comprises hardwood building elements. The at least two wood layers can be manufactured from a non-hardwood. For instance, the at least two wood layers may be manufactured from pine wood, maple and/or pitch pine. These are relatively inexpensive types of wood. The wood layers can also be manufactured from not only pure wood. For instance, the wood layers can be manufactured from, for
instance, MDF. Surprisingly, in use, the building element according to the invention can still meet the requirements for fire resistance.

In particular, the fire prevention material is a material which, in free condition, expands by the above-mentioned factor when the temperature of this fire prevention material rises above a temperature $T$, wherein $T$ is in the range of 100 - 180°C, more preferably in the range of 110 - 140°C.

When the building element according to the invention is utilized for manufacturing a door, according to the invention, it applies that the at least two wood layers and the at least one fire prevention layer each extend in planes which are substantially perpendicular to a plane of the door. For the door provided with a framework manufactured at least substantially from building elements according to the invention, it applies that the at least two wood layers and the at least one fire prevention layer of the building elements each extend in planes which are at least substantially perpendicular to the cover plates of the door. In other words, the at least two wood layers and the at least one fire prevention layer of the building elements are directed at least substantially perpendicularly to the plane of the door.

When a fire starts on one side of the door according to the invention, the wood of the building elements will start burning relatively rapidly. This will proceed relatively easily when the wood has not been manufactured from hardwood but from, for instance, pinewood. When wood burns, carbon is formed. However, as at the same time the fire prevention material will start to expand due to the increased heat, the carbon is retained and starts forming a carbon layer that protects against fire. The result is that a building element according to the invention can withstand fire much longer than a building element manufactured completely from non-hardwood. Here, the at least two wood layers and at least one fire prevention layer extend, in use, at least substantially in a direction in which the advance of the fire is to be prevented.

The building element according to the invention has as a property that during a fire, the at least one fire resistant layer will expand in all
directions. As a result, it is possible to counter all seams in, for instance, the framework or the casing manufactured from building elements according to the invention. Therefore, these seams will close during a fire. It is therefore possible to produce a framework of a door or a casing with great tolerances as to material dimensions. The same applies for window casings. The functionality of the fire resistant doors and window casings is therefore less dependent on accuracy used in production. Further, according to the invention, it is no longer necessary to afterwards provide a groove in a hardwood beam at the outside thereof and manually provide a fire resistant strip. Nor is there any longer any need to provide additional covering of a lock casing in a door. The function of cooling and insulating of such a lock casing is taken over, in the door, by the building elements according to the invention. Furthermore, it applies that the deformation during normal use and in a situation of a fire is considerably less than when non-layered construction wood is used.

In particular it applies that the building element is provided with at least three wood layers and at least two fire prevention layers.

It further applies in particular that each wood layer adjoins at least one of the fire prevention layers, more particularly that, with the exception of an outer wood layer, on both sides, each wood layer adjoins a fire prevention layer.

It also applies in particular that on both sides, the at least one fire prevention layer adjoins one of the wood layers, in particular that each fire prevention layer adjoins at least one of the wood layers, more particularly that on both sides, each fire prevention layer adjoins one of the wood layers.

It preferably applies that the at least one fire prevention layer and the at least two wood layers are at least substantially parallel to each other. Such building elements can be manufactured relatively simply.
It further applies in particular that each fire prevention layer is situated between two wood layers.

It preferably applies that the building element comprises a wooden beam or board, provided with at least one groove while in the at least one groove, a fire resistant layer is included. Such a building element can also be manufactured in a simple manner.

It preferably applies that the fire resistant material expands in volume by a factor in the range of 2 - 10, under the influence of a fire that reaches the building element.

It also preferably applies that the fire prevention material has a specific weight greater than 1000 kg/m.3.

It further applies in particular that the fire prevention material is a solid material that does not burn at a temperature that is lower than 1000 °C, and preferably does not burn at a temperature that is lower than 1200 °C.

Therefore, the fire prevention material does not burn in particular at any temperature lower than 1000 °C and preferably not at any temperature lower than 1200 °C.

The fire prevention material is for instance a salt, and comprises for instance substantially XSiO2, wherein X stands for Na, K or Ca.

It applies in particular that the fire prevention material comprises substantially silicates, such as sodium silicates, potassium silicates, sodium potassium silicates, sodium hydrogen silicates, potassium hydrogen silicates, magnesium silicates and/or calcium silicates.

It also applies in particular that the at least two wood layers each have a specific weight that is smaller than 900 kg/m3. A casing for, for instance, at least one window and/or at least one door is characterized according to the invention in that the casing is manufactured at least substantially from building elements according to the invention, wherein the at least two wood layers and the at least one fire prevention layer of the
building elements according to the invention each extend in planes that are at least substantially perpendicular to a plane of the casing.

Presently, the invention will be further elucidated on the basis of the drawing. In the drawing:

Fig. 1 shows a first embodiment of a building element according to the invention;

Fig. 2a shows a framework of a door according to the invention;

Fig. 2b shows a cross section of the framework of Fig. 2a along the line 2b;

Fig. 2c shows a cross section of the framework of Fig. 2a along the line 2c;

Fig. 2d shows a cross section of the framework of Fig. 2a along the line 2d;

Fig. 2e shows a cross section of the framework of Fig. 2a along the line 2e;

Fig. 3 shows a side view of a door according to the invention in the direction of the arrow P of Fig. 2a;

Fig. 4 shows a second embodiment of a building element according to the invention;

Fig. 5a shows a second embodiment of a framework of a door according to the invention;

Fig. 5b shows a cross section of the framework of Fig. 5a along the line 5b;

Fig. 6 shows a third embodiment of a building element according to the invention; and

Fig. 7 shows a framework for a window or door, according to the invention.

In Fig. 1, with reference numeral 1, a building element according to the invention is indicated. A building element is in the form of a beam or a board and comprises wood. The building element 1 is composed of at least two
wood layers 2.1 and 2.2 and at least one fire prevention layer 4.1 which is included between the at least two wood layers 2.1 and 2.2. In this example, it applies that the building element is provided with four wood layers 2.1, 2.2, 2.3 and 2.4 and three fire prevention layers 4.1, 4.2 and 4.3. It applies that two of the wood layers 2.1 and 2.4 form an outer layer of the building element. It further applies in this example that, with the exception of an outer wood layer, on both sides, each wood layer adjoins one of the fire prevention layers.

It further applies that the fire prevention layer 4.1 is included between the wood layers 2.1 and 2.2 and that on both sides, the fire prevention layer adjoins the wood layers. The fire prevention layer 4.2 is included between the wood layers 2.2 and 2.3 and adjoins these layers. Finally, it applies for the fire prevention layer 4.3 that it is included between the wood layers 2.3 and 2.4 and adjoins these layers.

The fire prevention layers 4.1-4.3 are manufactured from a fire prevention material. The fire prevention material is a solid material that does not burn at a temperature that is lower than 850°C and preferably a material that does not burn at a temperature that is lower than 1000°C. It further applies for the fire prevention material that in free condition, it expands in volume by at least a factor 2, preferably by at least a factor 3 and more preferably by at least a factor 5 as a result of a temperature rise of the fire prevention material in case of a fire that has reached the fire prevention material. This expansion in volume can be smaller when the fire prevention material is partly included in a rigid space, as is the case in this example. As a result, pressure build-up in the expanded material can take place because then, it cannot fully expand. In case of a fire, the temperature of the material can rise to, for instance, 700°C, so that the fire prevention material starts to expand.

The volume increase is defined with respect to an initial volume at room temperature (21°C).
In this example, the building element comprises a wooden beam or board, provided with three grooves 6.1, 6.2 and 63, wherein in each groove, a fire prevention layer 4.1, 4.2 or 4.3, respectively, is included. It applies that the grooves are at least substantially parallel to each other. It also applies for at least one groove and, in this example, for each groove that it has a depth hi that is greater than 50% of a dimension h0 of the building element in the direction of the depth of the respective groove.

More particularly, it applies for at least one of the grooves, and in this example for each groove, that it has a depth hi that is greater than 80% of a dimension h0 of the building element in the direction of the depth of the respective groove. It also applies in this example for at least one fire prevention layer and even for each fire prevention layer that it extends over a distance hi within the building element that is greater than fifty percent and furthermore is greater than eighty percent of a dimension h0 of the building element in the direction of said distance.

In this example, it further applies that each wood layer 2.1, 2.2, 2.3 and 2.4 adjoins at least one of the fire prevention layers 4.1, 4.2 and 4.3. It also applies that each fire prevention layer adjoins at least one of the wood layers. In this example, it also applies that each fire prevention layer 4.1, 4.2 and 4.3 is located between two wood layers. In this example, the fire prevention layers and the wood layers are at least substantially parallel to each other.

The building element according to the invention has as an advantage that when fire approaches the building element in the direction of the arrow P or Q, the building element can offer relatively much resistance against fire. Here, the wood layers 2.1, 2.2, 2.3 and 2.4 can be formed from a non-hardwood type of wood such as pinewood, maple and/or pitch pine. In this example, the wood layers are manufactured from pinewood.

When the building element according to Fig. 1 comes into contact with fire from the direction arrow P, the wood of the wood layers will start to burn on the side 8 of the building element. As a result, carbon is formed.
However, as a result of the heat of the fire, the fire prevention layers 4.1, 4.2 and 4.3 will start to expand three-dimensionally. The result is that the fire prevention layers will also expand in the direction of the arrow X in Fig. 1. The result is that the carbon formed by the burning of the wood remains clamped in between the fire prevention layers 6.1, 6.2 and 6.3. Thus, a layer of carbon is formed that protects the parts that are not yet burned against fire. The result is that the building element will offer great resistance against fire when the fire is on the side 8 of the building element.

Also when there is a fire at the side 10 of the building element opposite side 8, it applies that the building element is highly fire-resistant. In this case too, the wood located at the side 10 will burn and carbon is formed. Once more, on the side 10, the fire prevention material of the fire prevention layers will start to expand so that the carbon formed is retained and thus forms a protecting layer against further burning of the building element.

In this example, it further applies that the fire prevention material is a solid material that does not burn at a temperature that is lower than 1000°C. This means that it does not burn at any random temperature that is lower than 1000°C. It further applies in this example, that the fire prevention material is a material which, in free condition, expands in volume by the factor mentioned when the temperature of this fire prevention material rises to above a temperature T, wherein T is in the range of 100 - 180°C, more preferably in the range of 110 - 140°C.

More in particular it applies in this example that the fire prevention material is a material which, in free condition, expands by the factor mentioned when the temperature of the fire prevention material rises to above a temperature of approximately 120°C.

It also applies in this example that the fire prevention material has a specific weight that is greater than 1000 kg/m³. It also applies in this example that the fire prevention material has a specific weight that is greater than 1200 kg/m³. In this example, it applies that the fire prevention material
comprises substantially silicates, such as sodium silicates, potassium silicates, sodium potassium silicates, sodium hydrogen silicates, potassium hydrogen silicates, magnesium silicates and/or calcium silicates. However, other materials are conceivable too. It is possible that, for instance, more in general, the fire prevention material is a salt which, upon heating, forms a glass-like substance. It may also apply that the fire prevention material comprises a water glass. In this example, it applies that the fire prevention material is at least provided with a sodium silicate, for instance sodium orthosilicate, sodium metasilicate, sodium polysilicate and/or sodium pyrosilicate. For this material, it applies that it does not burn at a temperature, i.e. any temperature, that is lower than 1000°C and that it expands by at least a factor 5 with respect to the initial volume at room temperature under influence of a fire that reaches the building element.

In this example, it further applies that the at least two wood layers each have a density that is smaller than 900 kg/m³. More particularly, it applies in this example that the fire prevention material has a specific weight that is smaller than 650 kg/m³.

In Fig. 2a, a possible use of the building element according to Fig. 1 is shown. The type of building element according to Fig. 1 is used for manufacturing a door, wherein the wood layers 2.1, 2.2, 2.3 and 2.4 and the fire prevention layers 4.1, 4.2 and 4.3 each extend at least substantially in planes that are perpendicular to a plane of the door. In this example, the plane of the door is the plane of the drawing.

In this example, the framework 12 of the door is provided with two vertical uprights 14, 16, an upper member 18 and a lower member 20. For both the upright 14 and the upright 16 it applies that it is manufactured from a building element as shown in Fig. 1. For the upper member 18 too it applies that it is manufactured from a building element according to Fig. 1. The lower member 20 is also manufactured from a building element according to Fig. 1.

For the upright 14, also, with reference numerals, the wood layers 2.1, - 2.4
and the fire prevention layers 4.1 - 4.3 of the building element are indicated. The side of the building element 14 that is in sight is indicated with reference numeral 22. A cross-section of the building element 14 is shown in Fig. 2c where, also, the side 22 is indicated. The side of the building element 16 that is in sight is indicated with reference numeral 24, the side of the building element 18 that is in sight is indicated with reference numeral 26 and the side of the building element 20 that is in sight is indicated with reference numeral 28. These sides are also indicated in the Figs. 2b, 2d and 2e. Within the space enclosed by the framework, a further fire resistant material is included in the form of perlite 30. Instead thereof, also a mineral fiberboard filling 30 could have been included. For manufacturing a door, further, two cover plates 32, 34 are provided, on both sides of the framework. All this is shown in Fig. 3, viewed from a direction of the arrow P of Fig. 2a. Thus, a door is obtained which, in this example, is resistant to fire for at least a 60 minutes.

When, for instance, a fire breaks out on a side 36 of the door (see Fig. 3), the door can withstand the fire for at least 60 minutes. This means that it takes at least 60 minutes before the fire has penetrated to the side 38 of the door (see Fig. 3). In case of a fire on the side 36 of the door, the cover plate 32, which is manufactured from, for instance, MDF, plywood, hardboard and the like, will start to burn relatively rapidly. The result is that also, the wood layers 2.1, 2.2, 2.3 and 2.4 of the vertical uprights 14, 16 and the members 18, 20 located on the side 36 of the door, will rapidly start to burn. These wood layers will burn while forming carbon. However, at the same time, the fire prevention layers 4.1, 4.2 and 4.3 of the uprights 14, 16 and of the members 18, 20 will start to expand as a result of the heat. Also, the fire prevention layers will not burn. The result is that the carbon formed will be retained and will thus form a carbon layer that offers resistance to fire and protects the parts of the building elements 14, 16, 18 and 20 that are not burnt yet against the relatively rapid further burning. The result is that the building
element 14, 16, 18 and 20 will withstand the fire for at least 60 minutes as indicated hereinabove.

In case of fire, it further applies that the entire framework of Fig. 2a will start to expand three-dimensionally. This means that during a fire, the framework will also start to expand in the direction of the arrow X (see Fig. 2a) so that the door will clamp itself in a casing which is important for the fire prevention. Also, the door will expand in the direction of the arrow Y (see Fig. 2a) so that the door will also clamp between a threshold and an upper beam of a casing in which the door is present. This is also beneficial to the fire prevention.

The invention is not limited in any manner to the embodiment outlined hereinabove. For instance, the cover plates of the door can also be manufactured from other materials, such as plasterboard. The door can further also be provided in a known manner with a glass opening. In the glass opening, for instance pyrodur glass can be included.

In the examples it applies that the door involved is an inside door.

In Fig. 4, a possible second embodiment of a building element according to the invention is indicated with reference numeral 40. In this example, it applies that, once more, the building element is provided with four wood layers 2.1, 2.2, 2.3 and 2.4 and three fire prevention layers 4.1, 4.2 and 4.3. Here, a difference to the embodiment according to Fig. 1 is that the height h0 of the building element and hence the height h0 of the wood layers 2.1–2.4 is equal to the height hlof the fire prevention layers 4.1–4.3.

Fig. 5a shows a framework 12' of an inside door which is provided in this example with two vertical uprights 14', 16', which are each manufactured from a building element according to Fig. 4, and an upper member 18' and a lower member 20' which are each manufactured from a building element according to Fig. 4. Once more, it applies that the wood layers and the fire prevention layers each extend in planes that are perpendicular to the plane of the door, i.e. perpendicular to the cover plates of the door.
When, in Fig. 1 or in Fig. 4, the fire prevention layers 4.2 and 4.3 and the wood layers 2.3 and 2.4 are omitted, a building element remains that is provided with one fire prevention layer 4.1 having on both sides a wood layer, 2.1 and 2.2. These too are embodiments of a building element according to the invention. With the building element according to Fig. 1, the wood layers 2.3 and 2.4 and the fire prevention layer 4.3 can also be omitted so that a building element according to the invention is the result. It therefore also applies that in particular the building element is provided with at least three wood layers and at least two fire prevention layers. Another variant is shown in Fig. 6, where the building element 1 is provided with five wood layers 2.1 - 2.5 and four fire prevention layers 4.1 - 4.4. For each of the building elements according to Fig. 1, 4 and 6 it furthermore applies that for instance an outer wood layer 2.1 can be omitted.

A building element according to the invention can for instance be manufactured by providing grooves in a beam or board of the wood mentioned, wherein, in the respective grooves, the fire prevention material can be provided. Thus, the building elements according to the Figures 1 and 6 can be obtained. It may be so that the fire prevention material is introduced into the grooves in liquid form whereupon the fire prevention material will harden. It is, however, also possible that the fire prevention material is introduced into the respective grooves in the form of a strip. Each groove can then be provided with one or more strips. Here, the strips can be provided in the respective grooves by clamping or with glue.

For manufacturing a building element according to Fig. 4, four separate wood layers 2.1 — 2.4 and three separate fire prevention layers 4.1 — 4.3 can be the starting point, which are attached to each other by means of gluing. Here, use is made of a suitable glue such as PVAC glue. The wood layers may have been manufactured from MDF or pure wood.

In addition to a framework of a door, with the aid of the building elements, for instance also a casing for at least one window and/or at least one
door can be manufactured. Such a casing is for instance shown in Fig. 7. The casing is provided with two vertical uprights 14” and 16”, and a horizontal member 18”. The wood layers and the fire prevention layers of the building elements 14”, 16” and 18” are each at least substantially in planes that are perpendicular to a plane of the casing. This plane of the casing is, once more, located in the plane of the drawing. Such a casing is fire resistant for the same reason as discussed with reference to the framework of Fig. 2a. Here, once more, fire resistance in a direction perpendicular to the plane of the drawing as discussed with reference to Fig. 2a is involved.

In addition to a casing of a door, also a casing of a window can be formed. Such a casing for a window may further be provided with a lower member 20” as represented in dotted lines in Fig. 7. With a casing for a door, this lower member can be omitted.

It is also possible to use other types of wood, among which, if desired, hardwood. Wood layers of wood are also understood to include layers that are manufactured not only from pure wood, such as plates of MDF. It is also possible to use other fire prevention materials than discussed, which have the properties mentioned. Such variants are each understood to fall within the framework of the invention.
Claims

1. A building element comprising wood, such as a beam or board, wherein the building element is composed of at least two wood layers of wood and at least one fire prevention layer of a fire prevention material, wherein the at least one fire prevention layer is included between the at least two wood layers and wherein the first prevention material is a solid material which does not burn at a temperature that is lower than 850 °C and which, in free condition, expands in volume by at least a factor 2, preferably by at least a factor 3 and more preferably by at least a factor 5 as a result of a temperature rise of the fire prevention material with a fire that has reached the fire prevention material.

2. A building element according to claim 1, characterized in that the building element is provided with at least three wood layers and at least two fire prevention layers.

3. A building element according to claim 1 or 2, characterized in that two of the wood layers form an outer layer of the building element.

4. A bunding element according to any one of the preceding claims, characterized in that each wood layer adjoins at least one of the fire prevention layers, more particularly in that, with the exception of an outer wood layer, on both sides, each wood layer adjoins a fire prevention layer.

5. A building element according to any one of the preceding claims, characterized in that on both sides, the at least one fire prevention layer adjoins one of the wood layers, in particular that each fire prevention layers adjoins at least one of the wood layers, more particularly that on both sides, each fire prevention layer adjoins one of the wood layers.

6. A building element according to any one of the preceding claims, characterized in that the at least one fire prevention layer and the at least two wood layers are at least substantially parallel to each other.
7. A building element according to claim 2, characterized in that the wood layers and the fire prevention layers are at least substantially parallel to each other.

8. A building element according to any one of the preceding claims, characterized in that each fire prevention layer is between two wood layers.

9. A building element according to any one of the preceding claims, characterized in that the building element comprises a wooden beam or board provided with at least one groove while in the at least one groove, a fire prevention layer is included.

10. A building element according to claims 2 and 9, characterized in that the wooden beam or board is provided with at least two spaced apart grooves while in each groove, a fire prevention layer is included.

11. A building element according to claim 10, characterized in that the grooves are at least substantially parallel to each other.

12. A building element according to claim 10 or 11, characterized in that for at least one of the grooves it applies that it has a depth that is greater than fifty percent of a diameter of the building element according to a cross section through the respective groove.

13. A building element according to claim 12, characterized in that for at least one of the grooves it applies that it has a depth that is greater than eighty percent of a diameter of the building element according to a cross section through the respective groove.

14. A building element according to claim 12 or 13, characterized in that for each groove it applies that it has a depth that is greater than fifty percent and is preferably greater than eighty percent of a diameter of the building element in the direction of the depth of the respective groove.

15. A building element according to any one of the preceding claims, characterized in that the fire prevention material is a solid material that does not burn at a temperature that is lower than 1000°C and preferably does not burn at a temperature that is lower than 1200°C.
16. A building element according to any one of the preceding claims, characterized in that the fire prevention material expands in volume by a factor in the range of 2—40 under the influence of a fire that reaches the building element.

17. A building element according to any one of the preceding claims, characterized in that the fire prevention material is a material which, in free condition, expands in volume by said factor when the temperature of this fire prevention material rises to above a temperature $T$, wherein $T$ is in the range of 100 - 180°C, more preferably in the range of 110 - 140°C.

18. A building element according to claim 17, characterized in that the fire prevention material is a material which, in free condition, expands by said factor when the temperature of the fire prevention material rises to above a temperature of approximately 120°C.

19. A building element according to any one of the preceding claims, characterized in that the fire prevention material has a specific weight that is greater than 1000 kg/m³.

20. A building element according to claim 19, characterized in that the fire prevention material has a specific weight that is greater than 1200 kg/m³ and preferably greater than 1300 kg/m³.

21. A building element according to any one of the preceding claims, characterized in that the fire prevention material is a salt which, upon heating, forms a glass-like substance.

22. A building element according to any one of the preceding claims, characterized in that the fire prevention material comprises substantially silicates, such as sodium silicates, potassium silicates, sodium potassium silicates, sodium hydrogen silicates, potassium hydrogen silicates, magnesium silicates and/or calcium silicates.

23. A building element according to any one of the preceding claims, characterized in that the fire prevention material comprises a water glass.
24. A building element according to any one of the preceding claims, characterized in that the fire prevention material is at least provided with a sodium silicate, for instance sodium orthosilicate, sodium metasilicate, sodium polysilicate and/or sodium pyrosilicate.

25. A building element according to any one of the preceding claims, characterized in that the at least two wood layers are manufactured from a non-hardwood.

26. A building element according to any one of the preceding claims, characterized in that the at least two wood layers each have a specific weight that is smaller than 900 kg/m³.

27. A building element according to claim 26, characterized in that the at least two wood layers each have a specific weight that is smaller than 650 kg/m³.

28. A building element according to any one of the preceding claims, characterized in that the at least two wood layers are manufactured from pinewood, maple and/or pitch pine.

29. A building element according to any one of the preceding claims, characterized in that for at least one fire prevention layer and more specifically for each fire prevention layer it applies that this extends over a distance within the building element that is greater than fifty percent and is preferably greater than eighty percent of a dimension of the building element in the direction of said distance.

30. Use of at least one building element according to any one of the preceding claims for manufacturing a door wherein the at least two wood layers and the at least one fire prevention layer each extend at least substantially in planes that are perpendicular to a plane of the door and/or for manufacturing a casing for, for instance, at least one door and/or at least one window wherein the at least two wood layers and the at least one fire prevention layer each extend in planes that are at least substantially perpendicular to a plane of the casing.
31. Use according to claim 30, characterized in that the at least one building element is used for manufacturing at least a part of a framework of a door that is covered by two cover plates which extend parallel to the plane of the door.

32. Use according to claim 30 or 31, characterized in that the at least one building element is used for manufacturing uprights and members of the door.

33. Use according to any one of the preceding claims 30—32, characterized in that the door is an inside door.

34. A door provided with a framework which is at least substantially manufactured from building elements according to any one of claims 1-29 and two cover plates which are provided on either side of the framework while the at least two wood layers and the at least one fire prevention layer each extend in planes which are at least substantially perpendicular to the cover plates of the door.

35. A door according to claim 34, characterized in that the framework is provided with two vertical uprights, an upper horizontal member and a lower horizontal member.

36. A door according to claim 34 or 35, characterized in that between the cover plates, perlite and/or a mineral fiberboard filling is included.

37. A door according to any one of claims 34—36, characterized in that the at least one upright of the door is provided, on a side located at an outside of the door, with a strip manufactured from a foaming material.

38. A door according to any one of claims 34—37, characterized in that the cover plates are manufactured from MDF, plywood, hardboard, plasterboard and/or comparable materials.

39. A door according to any one of claims 34—38, characterized in that the door is further provided with a glass opening.

40. A door according to claim 39, characterized in that in the glass opening, pyrodur glass is included.
41. A door according to any one of claims 34 - 40, characterized in that
the door involves an inside door.

42. A method for manufacturing a building element according to any one
of claims 9 - 14, characterized in that in a beam or board of said wood, the at
least one groove is provided whereupon in the at least one groove, the fire
prevention material is provided.

43. A method according to claim 42, characterized in that the fire
prevention material is introduced in liquid form in the at least one groove
whereupon the fire prevention material will harden.

44. A method according to claim 42, characterized in that the fire
prevention material is introduced into the at least one groove in the form of a
strip.

45. A method according to claim 44, characterized in that the strip is
attached by clamping or with glue in the at least one groove to the beam or
board.

46. A method for manufacturing a building element according to any one
of the preceding claims 1 - 29, characterized in that on both sides of the at
least one layer of the fire prevention material a wood layer is attached.

47. A method according to claim 46, characterized in that the wood
layers and the at least one layer of fire prevention material are attached to
each other through gluing.

48. A casing for, for instance, at least one door and/or at least one
window, characterized in that the casing is at least substantially
manufactured from building elements according to any one of the preceding
claims 1 - 29, wherein the at least two wood layers and the at least one fire
prevention layer each extend in planes that are at least substantially
perpendicular to a plane of the casing.
Fig. 2a
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION(S) SUBJECT MATTER

INVENTION:

E06B/3/16
E04C.3/14

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

E04C E06B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
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<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
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<tbody>
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<td>X</td>
<td>US 6 745 526 B1 (AUTOVINO ENRICO [US]) 8 June 2004 (2004-06-08) column 6, line 22 - line 51; figure 3</td>
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+Further documents are listed in the continuation of Box C.+

\[\text{[X]}\] See patent family annex.

- Special categories of cited documents:
  - "A" document denoting the general state of the art which is not considered to be of particular relevance
  - "E" earlier document but published on or after the international filing date
  - "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
  - "O" document referring to an oral disclosure, use, exhibition or other means
  - "P" document published prior to the international filing date but later than the priority date claimed

\[\text{[X]}\] Prior document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

\[\text{[X]}\] Document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

\[\text{[X]}\] Document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

\[\text{[X]}\] Document member of the same patent family

Date of the actual completion of the international search: 18 March 2008

Date of mailing of the International search report: 27/03/2008

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Authorized officer

Verdonck, Benoit
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<td>Patent family member(s)</td>
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