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(54) **LAMELLA FOR FIREPROOF GATES AND A FIREPROOF GATE COMPRISING THESE LAMELLAS**

(57) The invention relates to a lamella (1) for lamellar fireproof gates (9), in particular for high-speed lamellar fireproof gates (9), which contains a core (2) made of a thermal insulating material based on mineral and/or inorganic fibers, which is arranged between cover layers (3) of a foamed fire resistant geopolymer composite or of light-weight alkali-activated aluminosilicate, whereby the outer surface of the lamella (1) is overlaid with a steel sheet (6). A conical ridge (4) made of a non-combustible thermal insulating material is arranged on the longer side of the circumference of the core (2) of the lamella (1) along at least a part of the length of the core (2) of the lamella (1), whereas a conical groove (5) is arranged in the opposite longer side of the circumference of the core (2) of the lamella (1) along at least a part of the length of the core (2) of the lamella (1), whereby the conical groove (5) corresponds to the conical ridge (4) by its location, shape and size and is intended to receive the conical ridge (4) of the adjacent lamella (1), whereby the side walls and the top of the conical ridge (4), as well as the side walls and the bottom of the conical groove, (5) are overlaid with the steel sheet (6). Cooling holes (7) are formed in the steel sheet (6) which overlaps the sides and/or the top of the conical ridge (4) and in the steel sheet (6) which overlaps the sides and/or the bottom of the conical groove (5).

In addition, the invention relates to a lamellar fireproof gate (9), particularly a high-speed lamellar fireproof gate, which contains these lamellas (1).

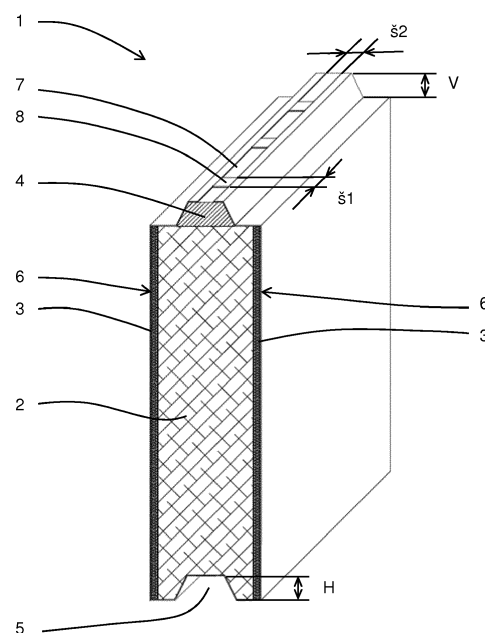


Fig. 1

Description

Technical field

[0001] The invention relates to a lamella for lamellar fireproof gates, particularly for high-speed lamellar fireproof gates.

[0002] In addition, the present invention also relates to lamellar fireproof gates, particularly high-speed lamellar fireproof gates, containing these lamellas.

Background art

[0003] Nowadays, a wide range of different designs of lamellar fireproof gates or partition walls are known which contain a group of mutually interconnected or mutually interconnectable lamellas. Their greatest drawback, however, is the existing design of the lamellas used which, when exposed to heating from a fire from one side, enable different deformations of the opposite surfaces of the lamella and consequently its bending in a vertical plane, which may result in opening a gap between the adjacent lamellas and in mechanical damage to the lamella, whereby the lamella or lamellas may even fall out of the guide of the fireproof gate or the frame of the fireproof partition wall, thereby leading to premature failure of the particular fire protection system.

[0004] A further disadvantage of the known designs of a lamella and lamellar fireproof gates is also the fact that the used types of shape locks which are mounted or formed on one side of the lamellas and the manners of mounting the lamellas in the frame of the lamellar gates limit the speed of the sliding movement of the lamellar fireproof gates which, therefore, does not exceed 0.5 m/s. In addition, the existing design of the lamellar fireproof gates suffers from inadequate sealing and allows excessive penetration of smoke. Therefore, the lamellar fireproof gates do not meet the requirements of applicable regulations and standards, such as EN 1634-3 Fire resistance tests for door and shutter assemblies.

[0005] The aim of the invention is to provide a lamella for lamellar fireproof gates which would ensure adequate fire resistance of the fireproof gates containing these lamellas, as well as adequate sealing and, optionally, would also enable to increase the sliding speed of these gates above 0.5 m/s.

[0006] In addition, the aim of the invention is to provide a lamellar fireproof gate containing these lamellas - mutually interconnected and mounted in a respective guide.

Principle of the invention

[0007] The aim of the invention is achieved by a lamella for lamellar fireproof gates, particularly for high-speed lamellar fireproof gates, which contains a core of a thermal insulating material based on mineral and/or inorganic fibers, which is arranged between cover layers formed by a foamed fire-resistant geopolymer composite or by

light-weight alkali-activated aluminosilicate, the outer surface of the lamella being overlaid with a steel sheet. The principle of the lamella consists in that a conical ridge of a non-combustible thermal insulating material is provided on the longer side of the circumference of the lamella core along at least a part of the length of the lamella core, and a conical groove is provided in the opposite longer side of the circumference of the lamella core along at least a part of the length of the lamella core. The conical groove corresponds to the conical ridge by its location, shape and size and is intended to receive the conical ridge of the adjacent lamella. Furthermore, the conical ridge and the conical groove of the adjacent lamellas together form a shape lock which, upon closing the lamellar fireproof gate, ensures that the adjacent lamellas accurately abut each other and that the interspace between them is closed and sealed. Placing the shape locks in the middle of the lamellas or in vicinity of their middle, that is, inside the lamellar fireproof gate, increases the mechanical stiffness of the gate in the closed state, thereby increasing the ability of the gate to resist deformations caused by one-sided thermal loads. In addition, cooling holes are provided in the steel sheet which overlaps the sides and/or the top of the conical ridge and in the steel sheet which overlaps the sides and/or the bottom of the conical groove. These cooling holes reduce heat transfer between the opposite surfaces of the lamella and, in the case of the use of materials based on water-binding compound/compounds in the core or in the conical ridge, allow the water to cool the lamellas and especially their joints.

[0008] Preferably, the cooling holes occupy 40 to 95% of the area of the respective side wall or top of the conical ridge, or of the side wall or of the bottom of the conical groove.

[0009] The height of the conical ridge ranges from 10 to 35 mm, depending on the height of the entire lamella. The conical ridge may be formed by the same material as the lamella core, or it may also form a part of the lamella core. However, more preferably, it is made of a silicate-based material and/or of a water-binding compound/compounds.

[0010] In a preferred variant of embodiment, the cooling holes are formed by a gap between the two parts of the steel sheet arranged on the surface of the lamella which are interconnected by connecting bridges. The width of the connecting bridges is preferably in the range from 10 to 30 mm and they are arranged at a spacing of 100 to 400 mm.

[0011] In addition, the aim of the present invention is also achieved by a lamellar fireproof gate, particularly a high-speed lamellar fireproof gate, having a sliding speed higher than 0.5 m/s, whose principle consists in that it contains lamellas according to the invention. Adjacent lamellas are interconnected by means of hinges, whereby the hinges are at both ends of the lamellas connected to rollers which can rotate about their axes, the rollers being mounted in guide profiles arranged along the

height of the gate.

[0012] In a preferred embodiment, the rollers are mounted on an extended pin of the pivot hinges and rotate about the same axis as the hinges.

Description of drawings

[0013] In the enclosed drawings, Fig. 1 schematically shows a cross-sectional view of the lamella according to the invention, Fig. 2 a vertical cross-section of a pair of interconnected lamellas according to the invention, and Fig. 3 the fireproof gate according to the invention containing these lamellas.

Examples of embodiment

[0014] The principle of the lamella 1 for a lamellar fireproof gate according to the invention will be explained with reference to an embodiment of the lamella 1 intended for a rolling lamellar fireproof gate which is schematically represented in Fig. 1 and Fig. 2. However, as is clear, this is only an exemplary embodiment and an analogous lamella 1 can also be used in other types of lamellar fireproof gates. In addition, if appropriate, the material composition of the lamella 1 and/or the arrangement and/or the parameters and/or the number of its layers can be adjusted according to the specific requirements for the resulting fire resistance of the lamella or for any other parameter.

[0015] The lamella 1 according to the invention shown in Fig. 1 and Fig. 2 contains a board-shaped core 2, the purpose of which is especially the thermal insulation of the opposite surfaces of the lamella 1. This core 2 is made of a suitable known thermal insulating material based on mineral and/or inorganic fibers, such as mineral wool, etc. The typical bulk density of the material of the core 2 of the lamella 1 is from 50 to 450 kg/m³, the typical thickness of the lamella core 2 is from 20 to 120 mm. However, any of these parameters, or both, may be, if desired, outside of said interval, e.g., for the purpose of achieving specific fire resistance, or for the use in non-standard conditions, etc.

[0016] The core 2 of the lamella 1 is disposed between two cover layers 3 which provide it protection against direct exposure to fire and, at the same time, improve the overall thermal insulating properties of the lamella 1. The cover layers 3 are made of a fire resistant and thermal insulating foamed geopolymer composite having a bulk density of 300 to 1200 kg/m³, preferably of 300 to 800 kg/m³, or of a light-weight alkali activated aluminosilicate having a bulk density of 300 to 800 kg/m³. The typical thickness of each of the cover layers 3 ranges from 3 to 25 mm. However, any of these parameters, or both, may be, if desired, outside of said interval, e.g., for the purpose of achieving specific fire resistance, or for the use in non-standard conditions, etc. The cover layers 3 on the opposite sides of the lamella 1 are usually identical, but may, if desired, differ from one another by, for example,

their thickness and/or material and/or their bulk density.

[0017] On the longer side of the circumference of the core 2 of the lamella 1, in the embodiment shown at the upper side, at least along a part of the length of the core 2 of the lamella 1 is arranged a conical ridge 4 formed by the material of the core 2 of the lamella 1 (whereby the conical ridge 4 may be directly part of the core 2 of the lamella 1) or, as is the case in the illustrated embodiment, formed by another non-flammable and thermal insulating material, preferably, for example, by a silicate-based material and/or a material based on water-binding compound/compounds, such as calcium silicate and/or calcium sulfate silicate, etc., see below. The typical bulk density of this material is in the range from 300 to 1200 kg/m³. This conical ridge 4 is arranged in the middle of the width of the core 2 of the lamella 1 or in vicinity of its middle. A conical groove 5 is provided in the opposite longer side of the circumference of the core 2 of the lamella 1, in the variant of embodiment shown in the lower side of the circumference of the core 2 of the lamella 1, whereby the conical groove corresponds by its location, shape and size to the conical ridge 4 and is intended to receive the conical ridge 4 of the adjacent lamella 1 - see Fig. 2.

[0018] In the embodiment shown in Figs. 1 and 2, the side walls of the conical ridge 4 and of the conical groove 5 are flat, if necessary, e.g., in order to increase the smoothness of the mutual movement of the lamellas 1, they may be rounded or bent. The same applies also to the top of the conical ridge 4 and the bottom of the conical groove 5.

[0019] The outer surface of the lamella 1, including the conical ridge 4 and the conical groove 5, is overlaid by a steel sheet 6 which reinforces both the cover layers 3, and the whole structure of the lamella 1 and at the same time provides protection to the layers 3 against mechanical damage and direct exposure to fire. Typically, the steel sheet 6 has a thickness of 0.75 to 1.5 mm, but, if desired, its thickness can be even greater. The height V of the conical ridge 4 including the steel sheet, is from 10 to 35 mm. The depth H of the conical groove 5 is the same as the height V of the conical ridge 4, or greater.

[0020] In addition, the lamella 1 according to the invention may contain also other layers - e.g. between the lamella core 2 and the cover layer/layers 3, a reflective layer (not shown) formed by, for example, a metal foil, usually stainless steel, aluminum or copper, may be arranged to reduce heat transfer by radiation, etc.

[0021] The conical ridge 4 and the conical groove 5 of the adjacent lamellas 1 together form a shape lock which upon closing the lamellar fireproof gate ensures that the adjacent lamellas 1 abut firmly each other and that the interspace between them is closed and sealed. This shape lock can be supplemented, if necessary, by a seal (not shown) and/or grooving on the respective part of the circumference of the lamella 1 and/or the surface of the conical ridge 4 and/or of the conical groove 5. The advantage of the embodiment when the conical ridge 4 is

made of a material based on water binding compound/compounds is the fact that these materials release water when heated, thereby cooling the joint of the adjacent lamellas 1 and reducing the heat transfer through the lamellas 1 and particularly through the interspaces between them, which results in increasing the fire resistance of the lamellar gate as a whole.

[0022] In the steel sheet 6 overlapping the top of the conical ridge 4, cooling holes 7 are formed which provide access to the material of the conical ridge 4 and permit the release of water therefrom while reducing the heat transfer between the opposite surfaces of the lamellas 1. The cooling holes 7 are preferably created at the top of the conical ridge 4, as in the embodiment shown in Fig. 1, but may be created also/only on the sides of the ridge 4. In a preferred variant of embodiment, the cooling holes 7 are formed by a gap which is deliberately left or created between two parts of the steel sheet 4, which are mutually interconnected by connecting bridges 8. In such a case, it is advantageous if the width s1 of each such bridge 8 is in the range from 10 to 30 mm and the spacing between the adjacent connecting bridges 8 is from 100 to 400 mm. The width s2 of the gap is 5 to 25 mm. Analogous cooling holes 7 are also formed in the bottom and/or on the sides of the conical groove 5.

[0023] In general, it is advantageous if the cooling holes 7 occupy 40 to 95 % of the area of the respective side wall and/or of the top of the conical ridge 4, or, optionally, of the side wall and/or of the bottom of the conical groove 5.

[0024] This design of the lamellas 1 and of their shape locks increases the fire resistance of the lamellar fireproof gate, since placing the shape locks in the middle of these lamellas 1 or in its vicinity and thus inside the lamellar fireproof gate increase together with their design the mechanical stiffness of the lamellar fireproof gate in a closed state, i.e., when the lamellas 1 abut each other, and thereby increase their ability to resist deformations caused by one-sided heat loads, reduce the heat transfer through the lamellas 1 and through the interspaces between them, and, at the same time, seal the interspaces tightly. The cooling holes 7 then reduce heat transfer between the opposite surfaces of the lamella 1 and, in the case of the use of materials based on water binding compound/compounds, allow the water to cool the lamellas 1 and especially their joints.

[0025] The lamellas 1 according to the invention are designed for the construction of lamellar fireproof gates of any known design or principle, which contain a group of mutually interconnected or interconnectable lamellas 1.

[0026] In the lamellar fireproof gate 9 according to the invention, which is in the exemplary embodiment shown in Fig. 3, each two adjacent lamellas 1 are pivotally connected by hinges 10 arranged on their outer surfaces, whereby these hinges allow mutual turning of the lamellas 1 during the rolling of the lamellar fireproof gate 9, as shown in Fig. 2. At the ends of the lamellas 1 from the

outer side, steel rollers 11 are connected to the outer hinges 10 with an option to rotate about their axis, which is preferably, but not necessarily, identical with the axis of rotation of the hinges 10. The roller 9 may be connected to the hinge 10 pin 12 extending outside the hinge 10 housing. In the case of the completed lamellar fireproof gate 9 the rollers 11 are mounted displaceably in the respective guide profiles 13, or rails.

[0027] The combination of the design of the lamellas 1 and their guidance by means of the rollers 11 then allow to increase the sliding speed of the lamellar fireproof gate 9 up to 1 m/s to create a high-speed lamellar fireproof gate 9, while maintaining the required fire resistance up to EI 120. Another advantage of the lamellar fireproof gate 9 according to the invention is the fact that the design of the lamellas 1 and their guidance by means of the rollers 11 prevents the adjacent lamellas 1 from coming into mutual contact during opening and closing the fireproof gate 9, which eliminates the risk of damaging their surfaces with negative impact on their fire resistant properties.

Example 1

[0028] The lamellar fireproof gate 9 contained solely the lamellas 1 according to the invention. Each of these lamellas 1 had a height of 315 mm (including the conical ridge 4 having a height V of 20 mm), its core 2 had a thickness of 80 mm and was formed by mineral wool having a bulk density of 150 kg/m³. Both cover layers 3 of each lamella 1 had a thickness of 6 mm and were formed by a foamed geopolymer composite with a bulk density of 400 kg/m³. The outer surface of each lamella 1 was overlaid with a steel sheet 6 having a thickness of 0.8 mm. At the top of the conical ridge 4 between the two parts of the steel sheet 6 was formed a gap having a width s2 of 5 mm, which was along its length divided by connecting bridges 8 having a width s1 of 15 mm arranged at a spacing of 330 mm. The spaces between the adjacent connecting bridges 8 thus formed the cooling holes 7. At its widest point, the conical ridge 4 had a width of 48.5 mm, at its narrowest point a width of 29.5 mm and was made of calcium silicate with a bulk density of 800 kg/m³. A silicone seal (not shown) was mounted at its top.

[0029] This lamellar fireproof gate 9 has been tested in an accredited test facility according to EN 1634-1 Fire resistance and smoke control tests for door and shutter assemblies, openable windows and elements of building hardware - Part 1: Fire resistance test for door and shutter assemblies and openable windows. In the first test, when the gate 9 was installed in a test furnace, fire resistance EI 60 was achieved, in the second test, when the gate 9 was installed from the outer side of the furnace, fire resistance EI 90 was achieved.

[0030] Furthermore, two samples of this lamellar fireproof gate 9 have been tested also according to the standard EN 1634-3 Fire resistance tests for door and

shutter assemblies - Part 3: Smoke control doors and shutters. The values of smoke penetration are shown in Table 1 and meet the requirements of given standard.

Table 1

		Penetration of smoke Q (m ³ /h) at pressure difference		
1 st sample		10 Pa	25 Pa	50 Pa
	Sa	1.20	2.90	5.30
	Sm	5.60	6.80	9.40
2 nd sample		10 Pa	25 Pa	50 Pa
	Sa	3.00	6.40	9.40
	Sm	2.80	4.00	7.60

List of references

[0031]

- 1 lamella
- 2 lamella core
- 3 cover layer
- 4 conical ridge
- 5 conical groove
- 6 steel sheet
- 7 cooling hole
- 8 connecting bridge
- 9 lamellar fireproof gate
- 10 hinge
- 11 roller
- 12 pin of the hinge
- 13 guide profile
- V height of the conical ridge
- H depth of the conical groove
- s1 width of the connecting bridge
- s2 width of the gap

Claims

1. A lamella (1) for lamellar fireproof gates (9), in particular for high-speed lamellar fireproof gates (9), which contains a core (2) made of a thermal insulating material based on mineral and/or inorganic fibers, which is arranged between cover layers (3) made of a foamed fire resistant geopolymer composite or of light-weight alkali-activated aluminosilicate, whereby the outer surface of the lamella (1) is overlaid with a steel sheet (6), **characterized in that** a conical ridge (4) formed by a non-combustible thermal insulating material is arranged on the longer side of the circumference of the core (2) of the lamella (1) along at least a part of the length of the core (2) of the lamella (1), whereas a conical groove (5) is arranged in the opposite longer side of the circumfer-

ence of the core (2) of the lamella (1) along at least a part of the length of of the core (2) of the lamella (1), whereby the conical groove (5) corresponds to the conical ridge (4) by its location, shape and size and is intended to receive the conical ridge (4) of the adjacent lamella (1), whereby the side walls and the top of the conical ridge (4) as well as the side walls and the bottom of the conical groove (5), are overlaid with the steel sheet (6) and cooling holes (7) are formed in the steel sheet (6) which overlaps the sides and/or the top of the conical ridge (4) and in the steel sheet (6) which overlaps the sides and/or the bottom of the conical groove (5).

2. The lamella (1) according to claim 1, **characterized in that** the cooling holes (7) occupy 40 to 95 % of the area of the respective side wall and/or of the top of the conical ridge (4).
3. The lamella (1) according to claim 1, **characterized in that** the cooling holes (7) occupy 40 to 95 % of the area of the respective side wall and/or of the bottom of the conical groove (5).
4. The lamella (1) according to claim 1, **characterized in that** the height (V) of the conical ridge (4) is from 10 to 35 mm.
5. The lamella (1) according to claim 1, **characterized in that** the conical ridge (4) is made up of the same material as the core (2) of the lamella (1).
6. The lamella (1) according to claim 1, **characterized in that** the conical ridge (4) is formed by a silicate-based material and/or a water-binding compound/compounds.
7. The lamella (1) according to claim 1, **characterized in that** the cooling holes (7) are formed by a gap between two parts of the steel sheet (6), which are mutually joined by connecting bridges (8).
8. The lamella (1) according to claim 7, **characterized in that** the width (s1) of the connecting bridges (8) is in the range from 10 to 30 mm, and these connecting bridges (8) are arranged at a spacing of 100 to 400 mm.
9. A lamellar fireproof gate (9), particularly a high-speed lamellar fireproof gate (9), **characterized in that** it contains lamellas (1) according to any of the preceding claims, whereby the adjacent lamellas (1) are mutually interconnected by hinges (10), whereby at both ends of the lamellas (1) rollers (11) are connected to the hinges (10) with an option to rotate about their axes, the rollers (11) being mounted in the guide profiles (13) arranged along the height of the gate (9).

10. The lamellar fireproof gate (9) according to claim 9,
characterized in that the rollers (11) are mounted
on an extended pin (12) of the pivot hinges (10).

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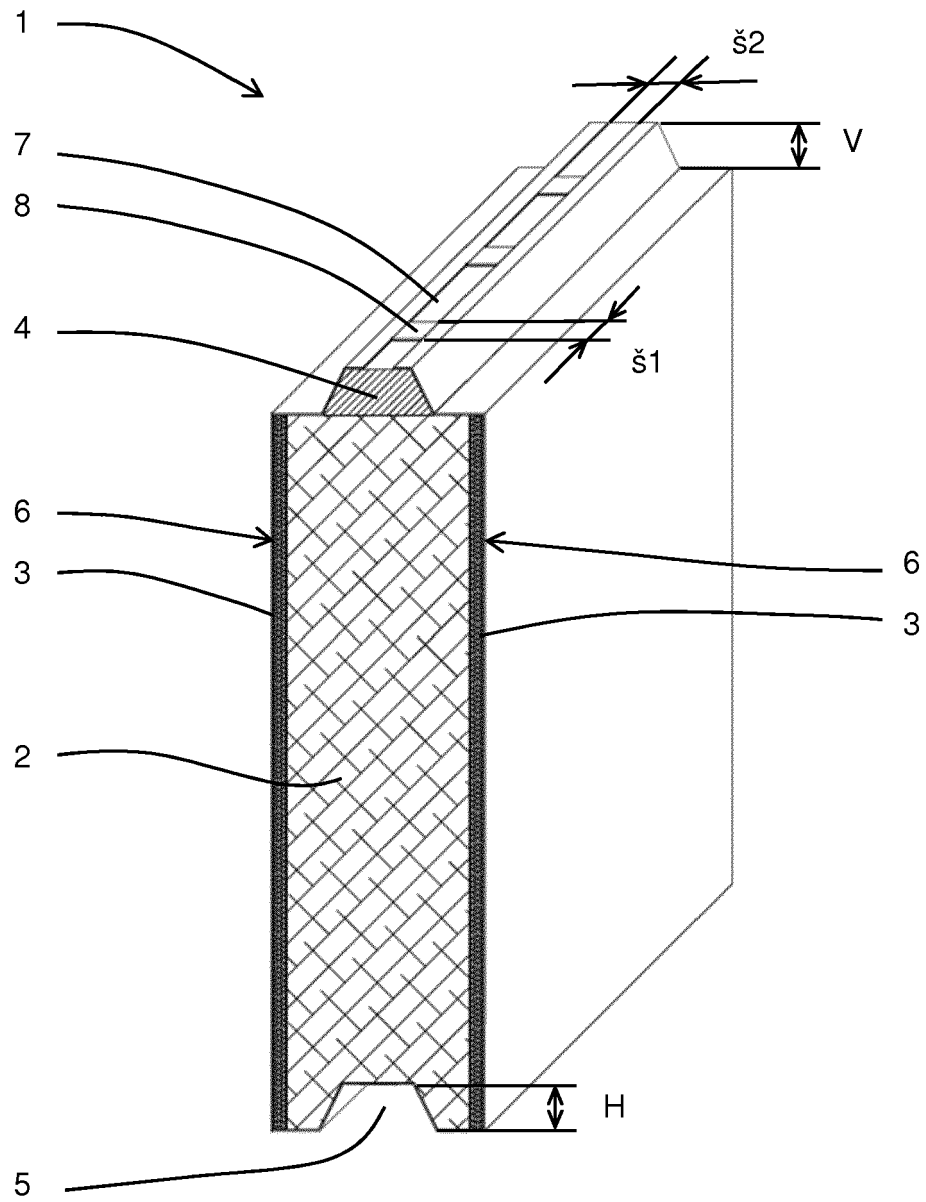


Fig. 1

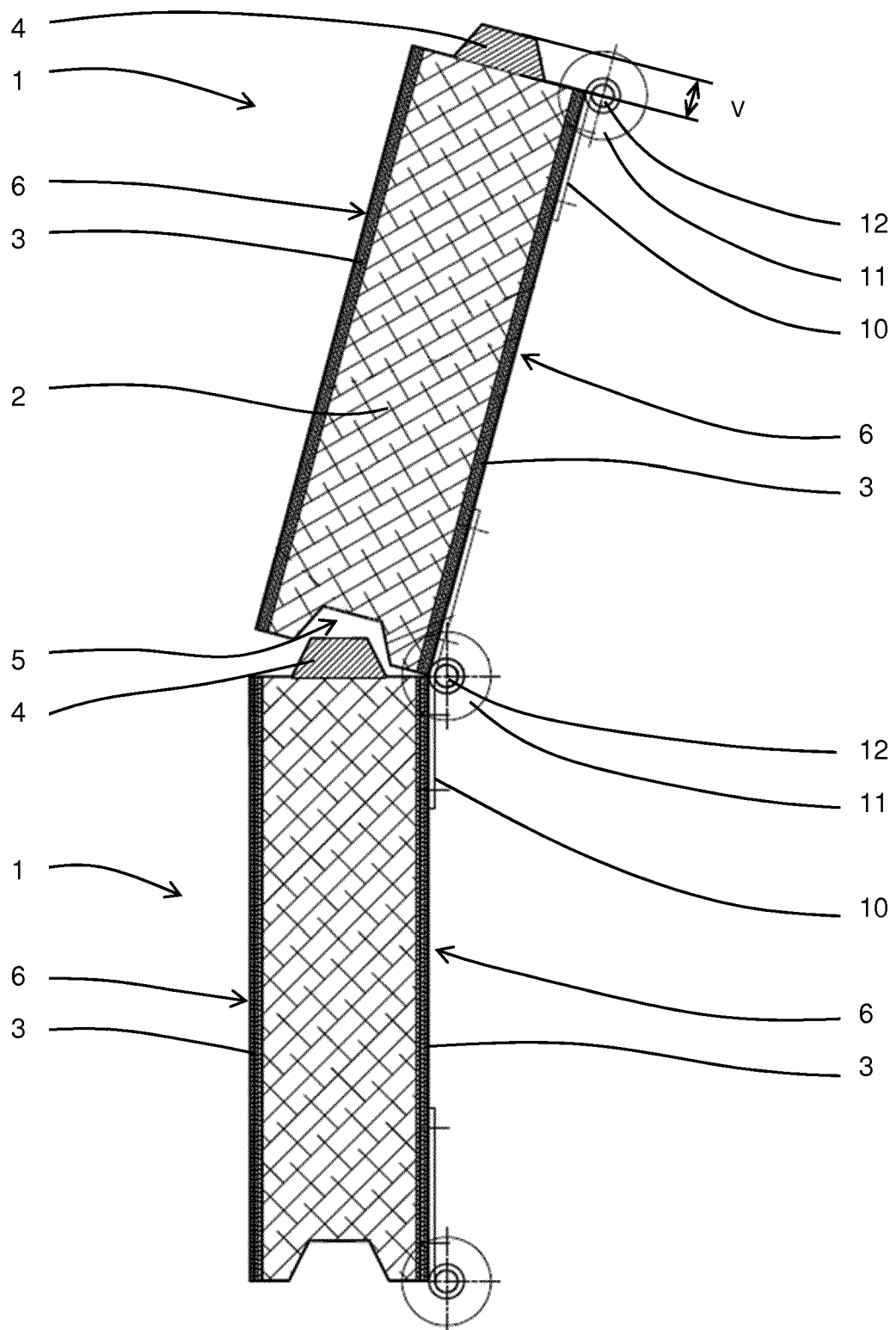


Fig. 2

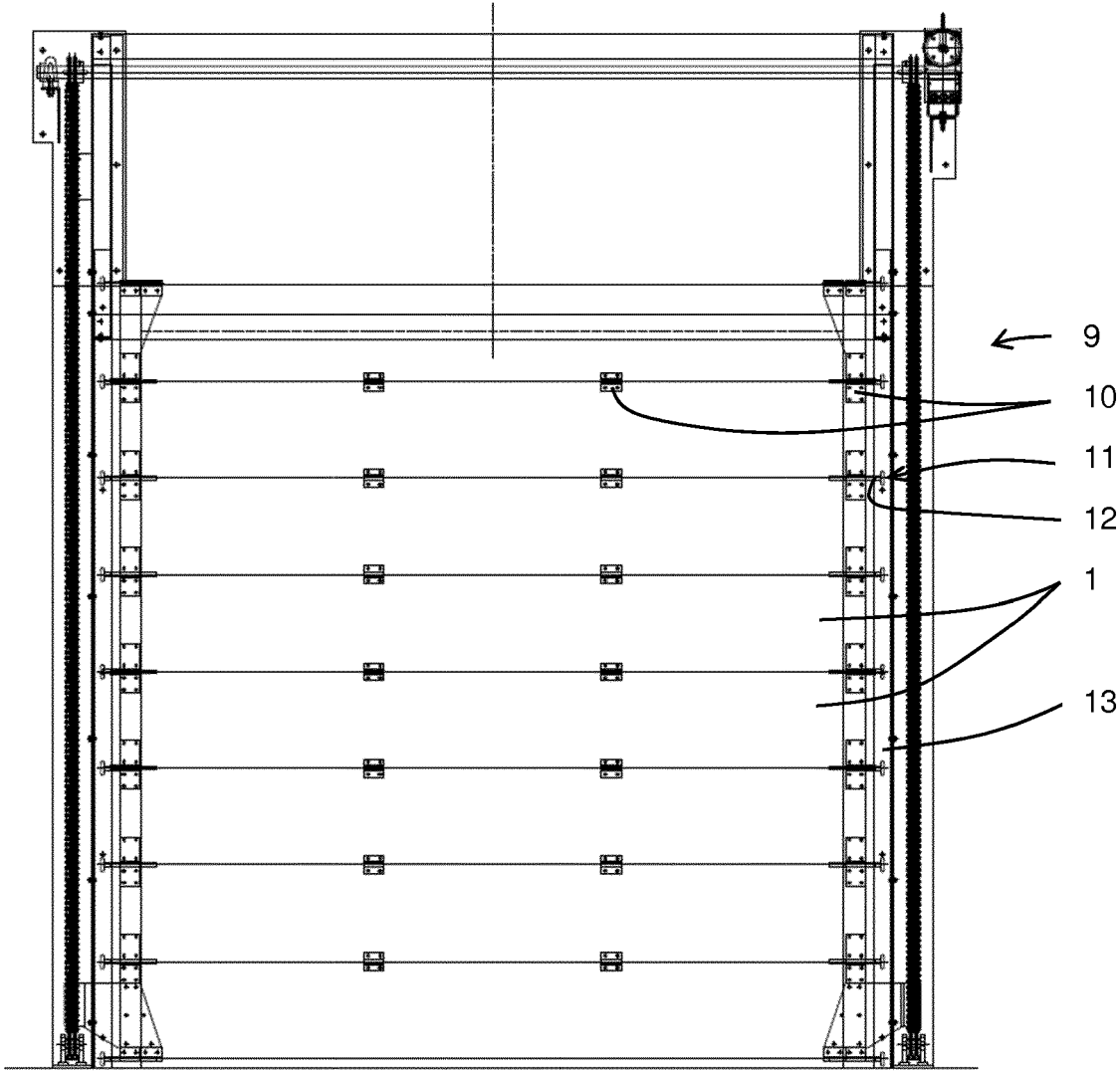


Fig. 3



EUROPEAN SEARCH REPORT

Application Number
EP 19 15 1135

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EPO FORM 1503 03.82 (P04C01)

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			E06B
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 6 May 2019	Examiner Merz, Wolfgang
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 19 15 1135

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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