

Description

FIELD OF APPLICATION

[0001] The present invention relates to a fire door.

BACKGROUND ART

[0002] A fire door is used as passive protection in case of fire, and therefore with safety functions for buildings. In general, the function thereof is to separate two rooms, one of which is subject to fire, by withstanding for a given time and at the same time ensuring there is no passage of flame and there is a limitation of the temperatures on the side not exposed to the fire.

[0003] Therefore, a fire door is designed to withstand a very high source of heat for a certain length of time.

[0004] It essentially consists of two folded sheets, which form the exoskeleton of the door, while the inside is filled with material, which withstands fire and has a very low thermal conductivity. Thereby, during the fire, the side exposed to the fire reaches very high temperatures (close to 1200°C), while the side not exposed to the fire is to heat up much more slowly. The thermal gradient inevitably generated between the two sides however induces a differentiated expansion between the two faces of the door, which causes an asymmetrical deformation. Consequently, the door itself tends to bend in the points not connected to the frame, i.e., in the portions furthest from the lock, sweeps, hinges. The deformation results in less contiguity between jamb and door, opening gaps which let the flame pass, and therefore reduce the duration of the door. In other words, the duration of the fire integrity of a door is determined by two factors: the thermal insulation and the deformation. The scale of the deformation is directly proportionate to the thermal gradient between the two faces; therefore, the more performing the insulation, the more important it is to control the deformation.

[0005] The general structure of a fire door is shown in Figures 1 and 2. A fire door 1 consists of the coupling of a first punched and folded plate 2 made of metal sheet (generally galvanized steel), which forms the base of the door, and of a second punched and folded sheet plate 3, which forms the bottom of the door. The two plates 2 and 3 are coupled around the perimeter so as to define a closed box-like structure which defines a cavity 4 in the door. There is insulating, fire-retardant material with low thermal conductivity in cavity 4. The more performing the insulation filler, the greater the thermal gradient between the two faces, thus inducing a greater warping of the door in the event of fire. In use, the fire door 1 is connected to a perimeter frame 5 by means of hinges 6. Frame 3 in turn is mounted at an opening made on a wall 8. Door 1 further comprises at least one lock 7 and possible blocking sweeps to close the door. The hinges, the lock and the possible sweeps are connection points with frame 5 and accordingly oppose the deformation due to the ther-

mal expansion.

[0006] In the following description, a fire door having an exoskeleton consisting of the coupling of two metal sheet plates defining a cavity therebetween, filled with one or more thermal insulation materials, is identified as "fire door with a standard structure".

[0007] Improving the performance of a fire door with a standard structure by introducing stiffening elements serving the purpose of counteracting the deformations induced by the thermal stress applied is also known in the background art.

[0008] Certain technical solutions provide inserting plasterboards to replace the fire-retardant material in the door cavity, at least in certain portions of the door itself.

[0009] Other technical solutions provide inserting an inner reinforcing frame in the cavity, which extends for the whole perimeter of the door itself.

[0010] Such an inner frame is fixed to the load-bearing structure of the door by means of mechanical connection elements such as, for example bolts or screws.

[0011] Although they allow reducing the deformations with respect to a fire door with a standard structure - thermal stress applied being equal (duration and value of the thermal gradient) - these technical solutions however have the limit of significantly increasing the weight thereof.

[0012] Therefore, the yet to be met need of making a fire door which - applied thermal stress being equal - is subject to fewer deformations with respect to a fire door with a standard structure, without however being significantly heavier, exists.

PRESENTATION OF THE INVENTION

[0013] It is the object of the present invention to provide a fire door, which, the applied thermal stress being equal, is subject to fewer deformations with respect to a fire door with a standard structure, without however being significantly heavier.

[0014] It is a further object of the present invention to provide a fire door, which, the applied thermal stress being equal, is subject to fewer deformations with respect to a fire door with a standard structure, without however being significantly heavier and which is also simple and affordable to make.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] The technical features of the invention according to the aforesaid objects may be clearly found in the contents of the claims hereinbelow and the advantages thereof will become more apparent from the following detailed description, given with reference to the accompanying drawings which show one or more embodiments merely given by way of non-limiting example, in which:

- Figure 1 shows a front orthogonal view of a fire door with a standard structure;

- Figure 2 shows a top sectional view of the door in Figure 1, according to a section plane II-II therein indicated;
- Figure 3 shows a photograph of a deformed fire door, after a failed fire-resistance test;
- Figure 4 shows a front orthogonal view of a fire door according to a first embodiment of the invention, partially shown in transparency to show certain inner stiffening elements;
- Figure 5 shows a top sectional view of the door in Figure 4, according to a section plane V-V therein indicated;
- Figure 6 shows a partial sectional perspective view of a fire door according to a particular embodiment, with certain components removed to better show others;
- Figures 7 a to h show detailed views of eight different variants of the detail shown in circle VII in Figure 5, concerning a reinforcing element in the door; and
- Figure 8 shows a detailed view of an embodiment variant of the reinforcing element depicted in the detail shown in circle VIII in Figure 4.

DETAILED DESCRIPTION

[0016] The present invention relates to a fire door.

[0017] The fire door according to the invention is indicated as a whole by 1 in the accompanying drawings.

[0018] Reference is made here and later in the description and in the claims, to the fire door 1 under condition of use, i.e., hinged to a fixed frame stably anchored to the opening of a wall, for example of a building. Any references to a lower or upper, or front or rear, or horizontal or vertical, position or side must therefore be understood in this sense.

[0019] As shown in Figures 4 and 5, the fire door 1 comprises a load-bearing structure 10, which is defined by two metal sheets 2 and 3, which are folded and coupled together around the perimeter, so as to delimit a closed cavity 4 therebetween and inside the load-bearing structure itself.

[0020] As shown in the accompanying drawings, the load-bearing structure 10 has the shape of a panel. The aforesaid two metal sheets 2, 3 defining the two opposite faces of the fire door 1 are an inner face and an outer face, respectively. The perimeter sides of the panel defined by the load-bearing structure 10 define the four perimeter sides of the door itself, of which, two vertical sides 10a and 10b and two horizontal sides 10c and 10d (upper and lower, respectively), which connect the two vertical sides to each other.

[0021] The fire door 1 comprises:

- two or more hinges 6 which are suitable to connect the fire door 1 to a fixed support frame 5 and are arranged at a first vertical perimeter side 10a of the load-bearing structure 10; and
- a lock 7 which is suitable to lock said fire door 1

closed to said fixed frame 5 and which is arranged at a second vertical perimeter side 10b of the load-bearing structure 10, opposite to the first vertical side 10a.

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[0022] Preferably, as shown in Figure 6, lock 7, which is at least partially accommodated in cavity 4, is protected by at least two plasterboards 70 arranged in the cavity itself between lock 7 and the two metal sheets 2 and 3.

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[0023] As shown in particular in Figure 6, the fire door 1 further comprises fire-retardant thermal insulation material 9, which is arranged as filler inside the closed cavity 4. The term "thermal insulation material" means a material marked by low thermal conductivity. "Fire-retardant material" generically means a non-flammable material or a material having features by virtue of which the combustion thereof is significantly reduced or is significantly delayed.

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[0024] The fire-retardant thermal insulation material may consist of a single material (for example, mineral fiber, rock wool) or of the combination of two or more materials (for example, mineral fiber, silicates, foam glass).

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[0025] As shown in the accompanying drawings, the fire door 1 further comprises one or more stiffening elements 11, 12 arranged inside the aforesaid cavity 4 to counteract thermal deformations induced on the load-bearing structure 10 by a thermal gradient between the inner face and the outer face of door 1.

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[0026] According to a first aspect of the invention, the aforesaid one or more stiffening elements 11, 12 consist of elongated bodies which each have a prevailing longitudinal direction of extension X1, X2 and are arranged along one or more perimeter sides 10b, 10c of the load-bearing structure 10.

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[0027] In particular, the aforesaid one or more stiffening elements 11, 12 are arranged so as to have the prevailing longitudinal direction of extension X1, X2 parallel to a perimeter side 10b, 10c.

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[0028] Therefore, stiffening elements having a very limited volume are involved because they are intended to occupy a very limited portion of cavity 4.

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[0029] According to another aspect of the invention, the aforesaid one or more stiffening elements 11, 12 are made of austenitic or austenitic-ferritic stainless steel.

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[0030] Austenitic and austenitic-ferritic stainless steel have an increased capacity of deformation and absorption of energy prior to breaking with respect to other types of steel such as, for example carbon steel or ferritic steel. Moreover, the mechanical properties in austenitic stainless steel and austenitic-ferritic stainless-steel decline in a less pronounced way at temperatures above 400 to 500°C.

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[0031] Thereby, the weight with respect to conventional reinforcements being equal, the aforesaid stiffening elements may be ensured to have superior mechanical properties, also at increased temperatures, and therefore a superior and more prolonged capacity of countering

the deformations.

[0032] Conversely, the mechanical performance being equal, making the stiffening elements in steel of austenitic type or of austenitic-ferritic type allows reducing the amount of material used, and therefore the weight added to the door by the stiffening elements.

[0033] It is also worth noting that given that the austenitic stainless steel and the austenitic-ferritic stainless steel are highly conductive, the whole stiffening element will have an almost uniform temperature in use, which results in a deformation due to the temperature, uniform in the whole element. This is to the benefit of a uniform behavior of the stiffening element.

[0034] Preferably, the stainless steel is an austenitic stainless steel, in particular AISI304 or AISI316.

[0035] According to a further aspect of the invention, the aforesaid stiffening elements 11, 12 are arranged only at the areas most subjected to deformations if a thermal load is applied to the fire door 1 on one of the two faces. Therefore, the stiffening elements 11, 12 are located only in the areas in which the stiffening is most useful and effective. Thereby, the counteracting effect of the deformations is maximized, while at the same time minimizing the increase in weight of door 1 associated with the insertion of the stiffening elements 11, 12.

[0036] It has been possible to verify that the critical points with the most deformation in a fire door with a standard structure are the upper side of the door and the upper part of the side on which there is the lock, i.e., the sides of the door with no coupling points to frame 5 (by means of hinges, locks and possible sweeps). The photograph in Figure 3 shows the results of a failed test carried out on a fire door with a standard structure. The critical points with the higher deformation are shown with L-shaped dashed lines and correspond to the upper horizontal side of the door and the upper part of the vertical side on which the lock is located.

[0037] According to the invention, the aforesaid one or more stiffening elements 11, 12 are therefore arranged along one or both the following perimeter sides of the load-bearing structure 10:

- the second vertical perimeter side 10b;
- the upper horizontal side 10c.

[0038] By virtue of the invention, a fire door which, applied thermal stress being equal, is subjected to fewer deformations with respect to a fire door with a standard structure, may be made without however being significantly heavier.

[0039] All the features of the invention indeed synergistically contribute to increasing the resistance to the deformation of the load-bearing structure of the door when subjected to heat, thus minimizing the increase of the weight.

[0040] In particular, the use of austenitic or austenitic-ferritic stainless steel allows the mechanical performance of the stiffening elements to be increased at high tem-

peratures, thus allowing the amount of material required in such stiffening elements to be reduced, performance being equal. Moreover, due to the fact that according to the invention, the aforesaid stiffening elements 11 and 12 consist of elongated bodies arranged along one or more perimeter sides 10b, 10c of the load-bearing structure 10 and only in the critical deformation areas of the door, the counteracting action of the deformations in the areas of maximum deformation of the structure is concentrated, thus at the same time minimizing the extension, and therefore the weight added to the structure by the aforesaid stiffening elements 11 and 12.

[0041] Preferably, the fire door 1 comprises only two stiffening elements 11, 12, of which a first element 11 is arranged along the second vertical perimeter side 10b and a second element 12 is arranged along the upper horizontal side 10c.

[0042] More in detail, as diagrammatically shown in Figure 4, such two stiffening elements 11, 12 may extend in length up to reaching the corner of the door, defined by the intersection between the second vertical perimeter side 10b and the upper horizontal side 10c. In this case, the two stiffening elements 11, 12 may be connected to each other and form a single body or they may be simply placed side-by-side without forming a single body.

[0043] Alternatively, as shown in Figure 6, such two stiffening elements 11, 12 might also not extend in length up to reaching the aforesaid corner.

[0044] In particular, as shown in Figure 6, the stiffening element 11 located along the second vertical perimeter side 10b may extend in a limited manner to the upper portion 10b' of such a side 10b, i.e., to the portion of the side which extends from lock 7 up to the upper side 10c.

[0045] In this case, the stiffening element 11 has an extension in length equivalent to at least 3/4 of the upper portion 10b' of the second vertical perimeter side 10b.

[0046] The stiffening element 11 located along the second vertical perimeter side 10b may also extend to the lower portion 10b" of such a side 10b, i.e., to the portion of the side which extends from lock 7 up to the lower side 10d. If door 1 is provided with plasterboards 70 to protect lock 7, the stiffening element 11 is divided into two sections separated by the protective plasterboards 70: an upper one and a lower one.

[0047] Preferably, each of said one or more stiffening elements 11, 12 has an extension in length equivalent to at least 3/4 of the length of side 10b, 10c of the load-bearing structure along which it is arranged. It has been possible to experimentally verify that such a longitudinal extension is sufficient to allow the individual stiffening element to carry out the function thereof, i.e., of counteracting the deformations of the load-bearing structure 10. Therefore, there is no need for each stiffening element 11, 12 to extend for the whole length of the side of the load-bearing structure 10 along which it is located.

[0048] Preferably, as shown in Figures 7 a to h, each of said one or more stiffening elements 11, 12 has a height H, measured transversely to the prevailing longi-

tudinal direction of extension X1, X2 and orthogonally to the inner and outer faces of said door 1, which is equivalent to at least 80% of thickness S1 of the load-bearing structure 10, measured orthogonally to the inner and outer faces of said door 1. It has been possible to experimentally verify that such an extension in terms of height H is sufficient to allow the individual stiffening element to carry out the function thereof, i.e., of counteracting the deformations of the load-bearing structure 10. Therefore, there is no need for each stiffening element 11, 12 to extend for the whole thickness S1 of the load-bearing structure 10.

[0049] Advantageously, the aforesaid one or more stiffening elements 11, 12 are kept in position inside cavity 4 only by the fire-retardant thermal insulation material 9, and possibly also by shape coupling with the load-bearing structure 10.

[0050] In particular, there is no need for the stiffening elements 11, 12 to be mechanically fixed to the load-bearing structure 10 by means of anchoring elements, such as screws or bolts. This significantly simplifies the production process of the fire door 1. Indeed, the stiffening elements 11, 12 may be simply resting inside the cavity and kept in position by the fire-retardant thermal insulation material.

[0051] According to a particularly preferred embodiment, the aforesaid two metal sheets 2, 3 are made of carbon steel sheet, in particular cold forming steel, even more specifically galvanized steel.

[0052] Advantageously, the aforesaid one or more stiffening elements 11, 12 made of stainless steel may be externally covered by a layer of ceramic material. The ceramic material allows the metal reinforcement to be thermally insulated for a longer period of time so as to preserve the mechanical properties of the stainless steel which are greater at lower temperatures, for a longer period of time.

[0053] Advantageously, the elongated bodies forming the aforesaid one or more stiffening elements 11, 12 may have different shapes and cross-sections.

[0054] According to an embodiment shown in Figure 7a, each of said one or more stiffening elements 11, 12 may consist of a solid stainless-steel bar.

[0055] Preferably, the aforesaid solid bar has a thickness S2, measured transversely to the prevailing longitudinal direction of extension X1, X2 of the bar itself and parallel to said inner and outer faces of said door 1, which is between 4 and 8 times the thickness of one of the two metal sheets 2, 3. It has been possible to experimentally verify that a stiffening element 11, 12 made from a solid bar of such a thickness S2 is capable of effectively counteracting the deformations of the metal sheet 2 or 3, which defines the face of the door exposed to the heat, thus minimizing the weight added to the door itself.

[0056] Advantageously, the elongated elements forming the aforesaid stiffening elements 11 and 12 may have a cross section having such a shape that, the weight being equal, the rigidity thereof is increased along the pre-

vailing longitudinal direction of extension X1, X2 of the elongated element itself.

[0057] According to the embodiments shown in Figures 7b and 7c, each of said one or more stiffening elements 11, 12 may be a profile consisting of metal sheet folded at least once on itself along one or more folding lines parallel to the prevailing longitudinal direction of extension X1, X2 of the elongated body defining said stiffening element 11, 12. The folding lines define at least two parallel flat edges 13 of metal sheet on the profile, joined by a curved portion of metal sheet 14. The aforesaid at least two flat edges 13 lie on planes orthogonal to the two inner and outer faces of said door 1.

[0058] For example, there may be two flat edges 13, as shown in Figure 7b (metal sheet folded once on itself), or three, as shown in Figure 7c (metal sheet folded twice on itself). Overall, a stiffening element thus made is compact.

[0059] Preferably, the aforesaid profile (consisting of a metal sheet folded at least once on itself according to one or more folding lines parallel to the prevailing longitudinal direction of extension X1, X2) has a thickness S2, measured transversely to said prevailing longitudinal direction of extension X1, X2 and parallel to said inner and outer faces of said door 1, which is between 4 and 8 times the thickness of one of the two metal sheets (2, 3). It has been possible to experimentally verify that a stiffening element 11, 12 made from a profile having the aforesaid features and with such a thickness S2 is capable of effectively counteracting the deformations of the metal sheet 2 or 3 which defines the face of the door exposed to the heat, thus minimizing the weight added to the door itself.

[0060] According to alternative embodiments shown in Figures 7d, 7e and 7f, each of said one or more stiffening elements 11, 12 may be a profile consisting of metal sheet partially folded along one or more folding lines parallel to the prevailing longitudinal direction of extension X1, X2 of the elongated body defining said stiffening element 11, 12. More in detail, the folding lines define a main flat edge 15 on the profile, which main flat edge lies on a plane orthogonal to said inner and outer faces of said door 1, and one or two flat flaps 16, each of which extends from the main flat edge 15 and lies on a plane parallel to the inner and outer faces of said door 1. In particular, the aforesaid profile 11, 12 may have a "Z"-shaped cross-section (Figure 7d), a "C"-shaped cross-section (Figure 7e) or an "L"-shaped cross-section (Figure 7f).

[0061] Preferably, the aforesaid profile has a width W, measured transversely to the respective prevailing longitudinal direction of extension X1, X2 and parallel to the inner and outer faces of said door 1, which is between 12 and 24 times the thickness of one of the two metal sheets 2, 3. It has been possible to experimentally verify that a stiffening element 11, 12 made from a profile having the aforesaid features and with such a width W is capable of effectively counteracting the deformations of the metal sheet 2 or 3 which defines the face of the door exposed

to the heat, thus minimizing the weight added to the door itself.

[0062] According to a further alternative embodiment shown in Figure 7g, each of said one or more stiffening elements 11, 12 may be a profile consisting of metal sheet folded along one or more folding lines parallel to the prevailing longitudinal direction of extension X1, X2 of the elongated body so as to form a closed polygonal figure. Preferably, such a closed polygonal figure is quadrangular, even more preferably rectangular, so that two sides 17 of the profile may be arranged parallel to the faces of the door, and the other two sides 18 may be arranged orthogonally to the two faces of the door.

[0063] According to a further alternative embodiment shown in Figure 7h, each of said one or more stiffening elements 11, 12 may directly consist of a stainless-steel tubular body having polygonal section, preferably quadrangular, even more preferably rectangular.

[0064] Preferably, the aforesaid stiffening element (whether it is defined by a profile obtained by folding a metal sheet to form a closed polygonal figure, or it is defined by a tubular body) has a width W, measured transversely to the respective prevailing longitudinal direction of extension X1, X2 and parallel to the inner and outer faces of said door 1, which is between 12 and 24 times the thickness of one of the two metal sheets 2, 3. It has been possible to experimentally verify that a stiffening element 11, 12 thus made and with such a width W is capable of effectively counteracting the deformations of the metal sheet 2 or 3 which defines the face of the door exposed to the heat, thus minimizing the weight added to the door itself.

[0065] The invention allows several advantages to be obtained, some of which have already been pointed out previously.

[0066] The applied thermal stress being equal, the fire door 1 according to the invention is subjected to fewer deformations with respect to a fire door with a standard structure, without however being significantly heavier.

[0067] Indeed, the stiffening elements 11, 12 are made of materials (austenitic or austenitic-ferritic stainless steel) having high performance (at high temperatures, in particular) and are located only in the areas in which the stiffening is more useful and effective. Thereby, the counteracting effect of the deformations is maximized, while at the same time minimizing the increase in weight of door 1 associated with the insertion of the stiffening elements 11, 12. The maximization of the counteracting effect of the deformations is obtained also by virtue of the elongated shape of the stiffening elements arranged along the sides of the load-bearing structure most subjected to deformations.

[0068] Moreover, the fire door 1 is simple and affordable to make by virtue of the fact that the stiffening elements are located only in limited portions of the load-bearing structure and the fact that the stiffening elements are preferably not mechanically fixed to the load-bearing structure, rather are kept in position by the fire-retardant

thermal insulation material. This simplifies making the fire door, with benefits in terms of reducing the production costs.

[0069] Therefore, the invention, thus conceived, achieves the preset objects.

Claims

1. Fire door (1) comprising:

- a load-bearing structure (10) which is defined by two metal sheets (2,3), folded and coupled together around the perimeter, so as to delimit between them and inside said load-bearing structure a closed cavity (4), said two metal sheets (2, 3) defining respectively an inner face and an outer face of said fire door (1);

- fire-retardant thermal insulation material (9) placed as filler inside said closed cavity (4);

- one or more stiffening elements (11, 12) placed inside said cavity (4) to counteract thermal deformations induced on said load-bearing structure (10) by a thermal gradient between said inner face and said outer face,

- two or more hinges (6), suitable to connect said fire door (1) to a fixed support frame (5) and arranged at a first vertical perimeter side (10a) of said load-bearing structure (10),

- a lock (7) suitable to lock said fire door (1) closed to said fixed frame (5) and placed at a second vertical perimeter side (10b) of said load-bearing structure (10), opposite the first vertical side (10a),

characterised in that said one or more stiffening elements (11, 12) consist of elongated bodies having their own prevailing longitudinal direction of extension (X1, X2), arranged along one or more perimeter sides of said load-bearing structure (10), and are made of austenitic or austenitic-ferritic stainless steel,

and in that said stiffening elements (11, 12) are arranged along only one or both the following sides of the said load-bearing structure (10):

- said second vertical perimeter side (10b) opposite the first vertical perimeter side (10c);

- an upper horizontal side (10c), connecting said two vertical sides (10a; 10b).

2. Fire door (1) according to claim 1, wherein the stainless steel is austenitic, preferably AISI 304 or AISI 316.

3. Fire door (1) according to claim 1 or 2, wherein each of said one or more stiffening elements (11, 12) has an extension in length equivalent to at least 3/4 of

the length of the side (10b; 10c) of said load-bearing structure along which it is placed.

4. Fire door (1) according to any of the preceding claims, wherein one of said stiffening elements (11) has an extension in length equivalent to at least 3/4 of the upper portion (10b') or the lower portion (10b'') of the second vertical perimeter side (10b'') of said load-bearing structure, wherein said two upper (10b') and lower (10b'') portions are defined with respect to said lock (7).
5. Fire door (1) according to any of the preceding claims, wherein each of said one or more stiffening elements (11, 12) has a height (H), measured transversely to said prevailing longitudinal direction of extension (X1, X2) and orthogonally to said inner and outer faces of said door (1), equivalent to at least 80% of the thickness (S1) of said load-bearing structure (10), measured orthogonally to said inner and outer faces of said door (1).
6. Fire door (1) according to any of the preceding claims, wherein said two metal sheets (2,3) are made of carbon steel sheet, in particular cold forming steel.
7. Fire door (1) according to any of the preceding claims, wherein said one or more stiffening elements (11, 12) are coated on the outside with a layer of ceramic material.
8. Fire door (1) according to any of the preceding claims, wherein each of said one or more stiffening elements (11, 12) consists of a **solid bar**.
9. Fire door (1) according to claim 8, wherein said solid bar has a thickness (S2), measured transversely to said prevailing longitudinal direction of extension (X1, X2) and parallel to said inner and outer faces of said door (1), which is between 4 and 8 times the thickness of one of the two metal sheets (2, 3).
10. Fire door (1) according to any of the claims from 1 to 7, wherein each of said one or more stiffening elements (11, 12) is a profile consisting of a metal sheet folded at least once on itself along one or more folding lines parallel to the prevailing longitudinal direction of extension (X1, X2) of the elongated body which defines said stiffening element (11, 12), said folding defining on said profile at least two flat edges (13) of metal sheet parallel to each other and connected by a curved portion of metal sheet (14), said at least two flat edges (13) lying on planes orthogonal to said inner and outer faces of said door (1).
11. Fire door (1) according to claim 10, wherein said profile has a thickness (S2), measured transversely to said prevailing longitudinal direction of extension (X1, X2) and parallel to said inner and outer faces of said door (1), which is between 4 and 8 times the thickness of one of the two metal sheets (2, 3).
12. Fire door (1) according to any of the claims from 1 to 7, wherein each of said one or more stiffening elements (11, 12) is a profile consisting of a metal sheet partially folded along one or more folding lines parallel to the prevailing longitudinal direction of extension (X1, X2) of the elongated body defining said stiffening element (11), (12), said folding defining on said profile a main flat edge (15), which lies on a plane orthogonal to said inner and outer faces of said door (1), and one or two flat flaps (16), each of which extends from said main flat edge (15) and lies on a plane parallel to said inner and outer faces of said door (1).
13. Fire door (1) according to claim 12, wherein said profile (11, 12) has a 'Z', 'C' or 'L' cross-section.
14. Fire door (1) according to any of the claims from 1 to 7, wherein each of said one or more stiffening elements (11, 12) is a profile consisting of metal sheet folded along one or more folding lines parallel to the prevailing longitudinal direction of extension (X1, X2) of the elongated body defining said stiffening element (11, 12), said metal sheet being folded so as to form a closed polygonal figure, preferably quadrangular, even more preferably rectangular.
15. Fire door (1) according to any of the claims from 1 to 7, wherein each of said one or more stiffening elements (11, 12) consists of a stainless steel tubular body of polygonal section, preferably square, even more preferably rectangular.
16. Fire door (1) according to any of the claims from 12 to 15, wherein said profile has a width (W), measured transversely to said prevailing longitudinal direction of extension (X1, X2) and parallel to said inner and outer faces of said door (1), which is between 12 and 24 times the thickness of one of the two metal sheets (2, 3).
17. Fire door (1) according to any of the claims from 1 to 7, wherein each of said one or more stiffening elements (11, 12) is a profile consisting of a folded sheet, preferably in a regular manner, with folding lines orthogonal to said inner and outer faces of said door (1).
18. Fire door (1) according to claim 17, wherein said profile has a thickness (S2), measured transversely to said prevailing longitudinal direction of extension (X1, X2) and parallel to said inner and outer faces of said door (1), which is between 4 and 8 times the thickness of one of the two metal sheets (2, 3).

19. Fire door (1) according to any of the preceding claims, wherein said one or more stiffening elements (11, 12) are kept in position inside the cavity (4) only by said fire-retardant thermal insulation material (9), and possibly also by shape coupling with said load-bearing structure (10) inside said cavity (4). 5

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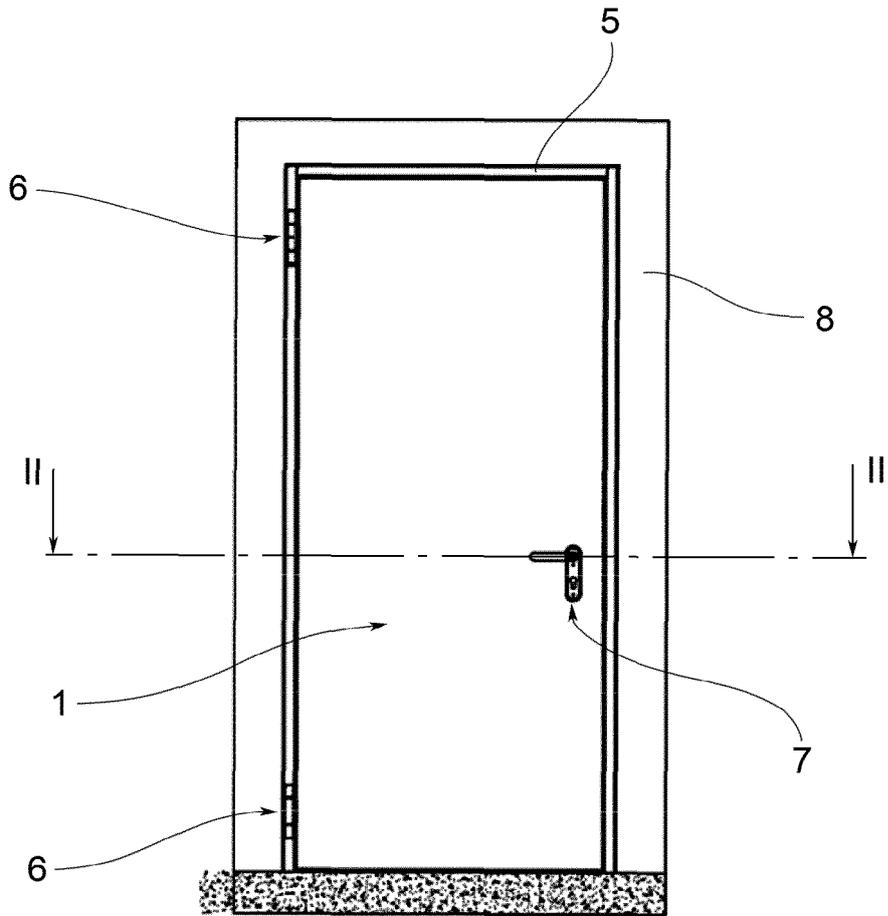


FIG. 1

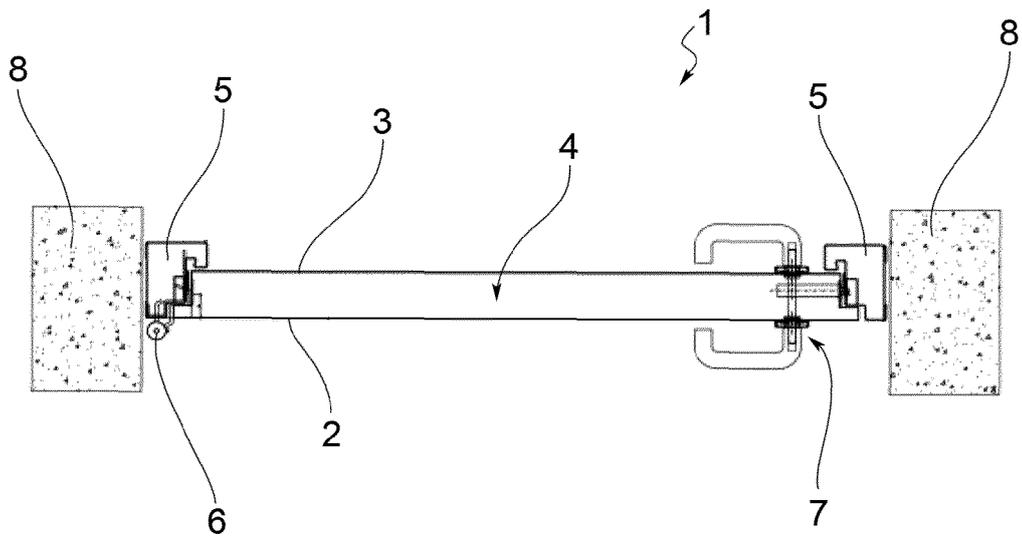


FIG. 2

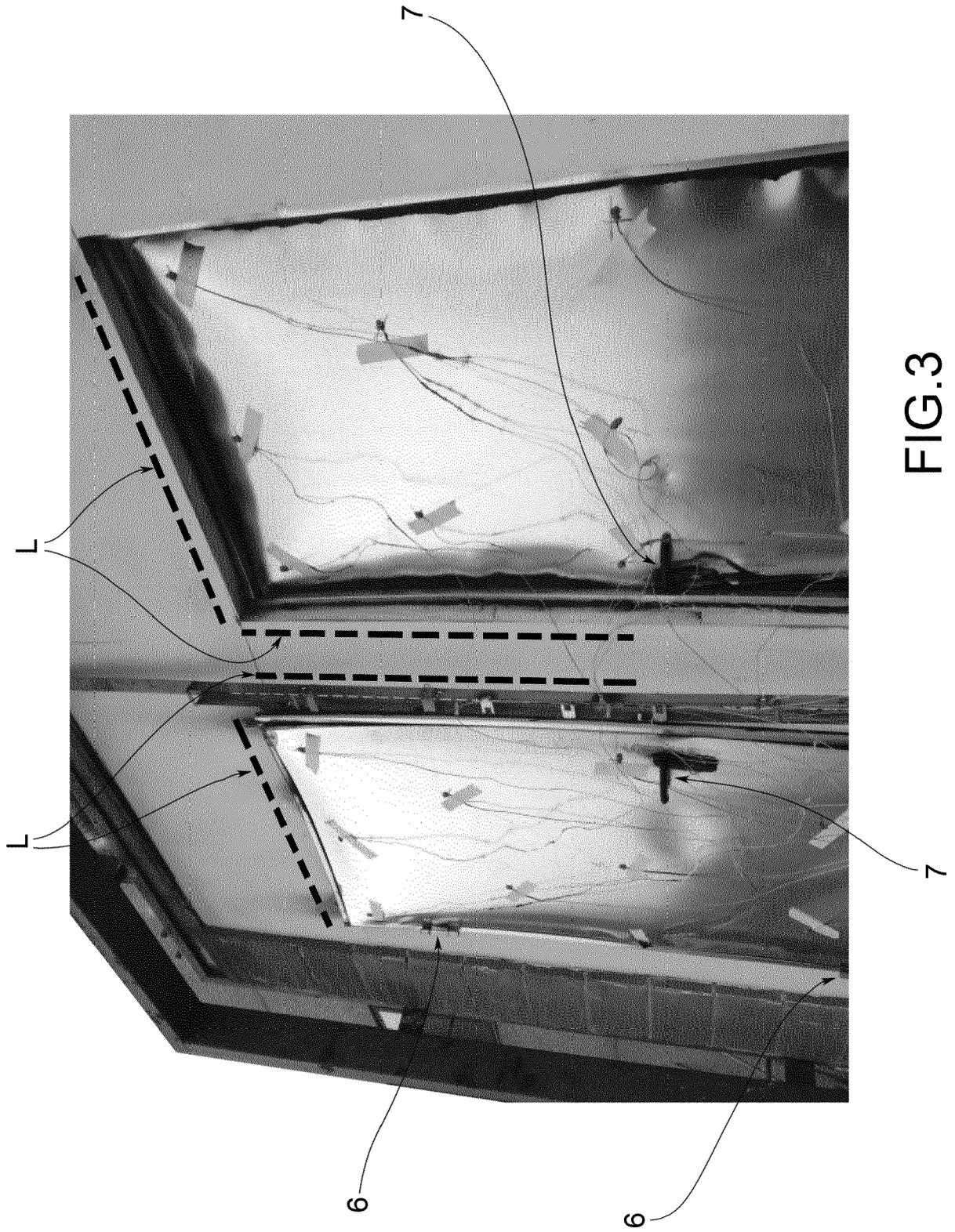


FIG. 3

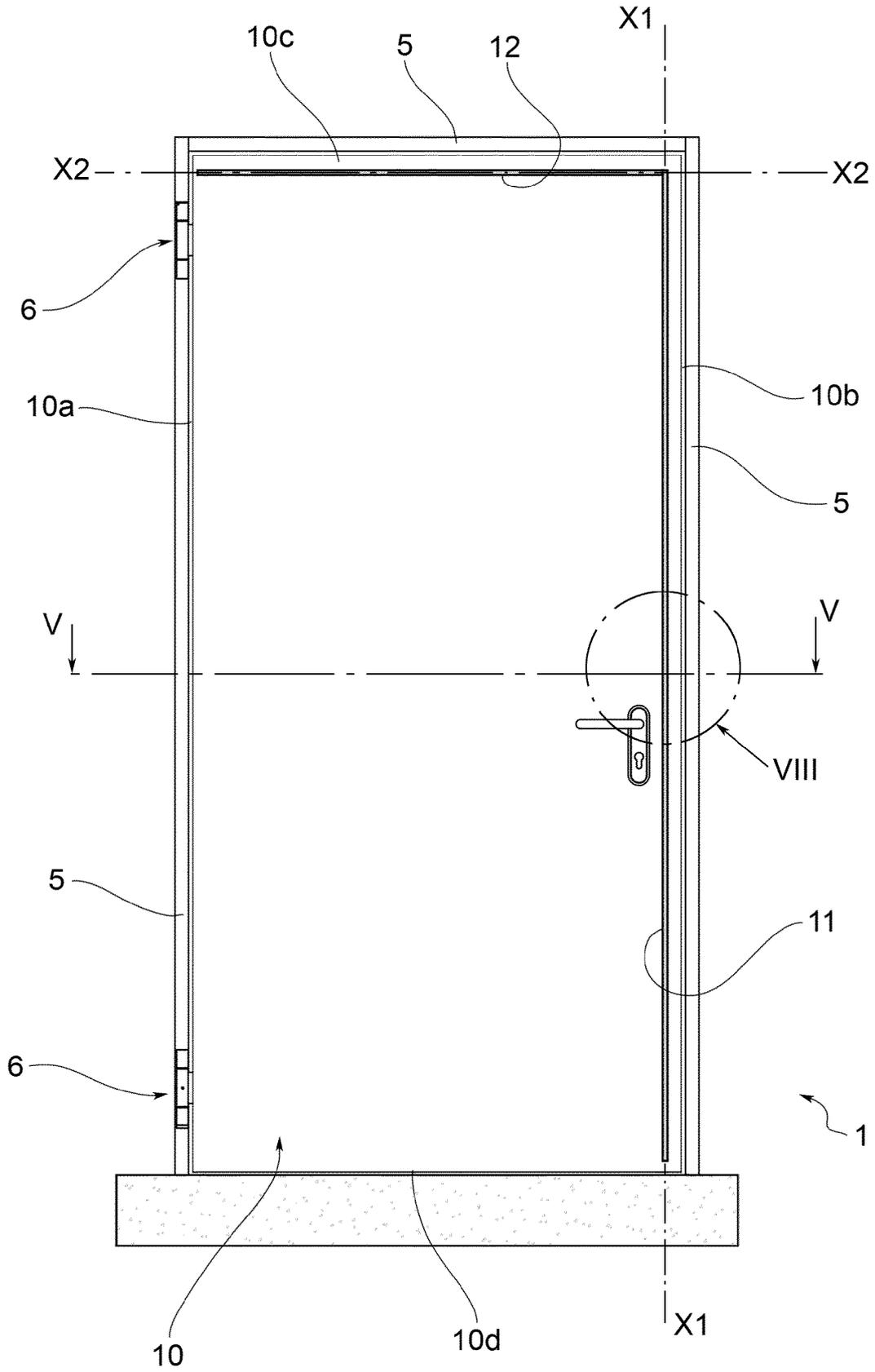


FIG.4

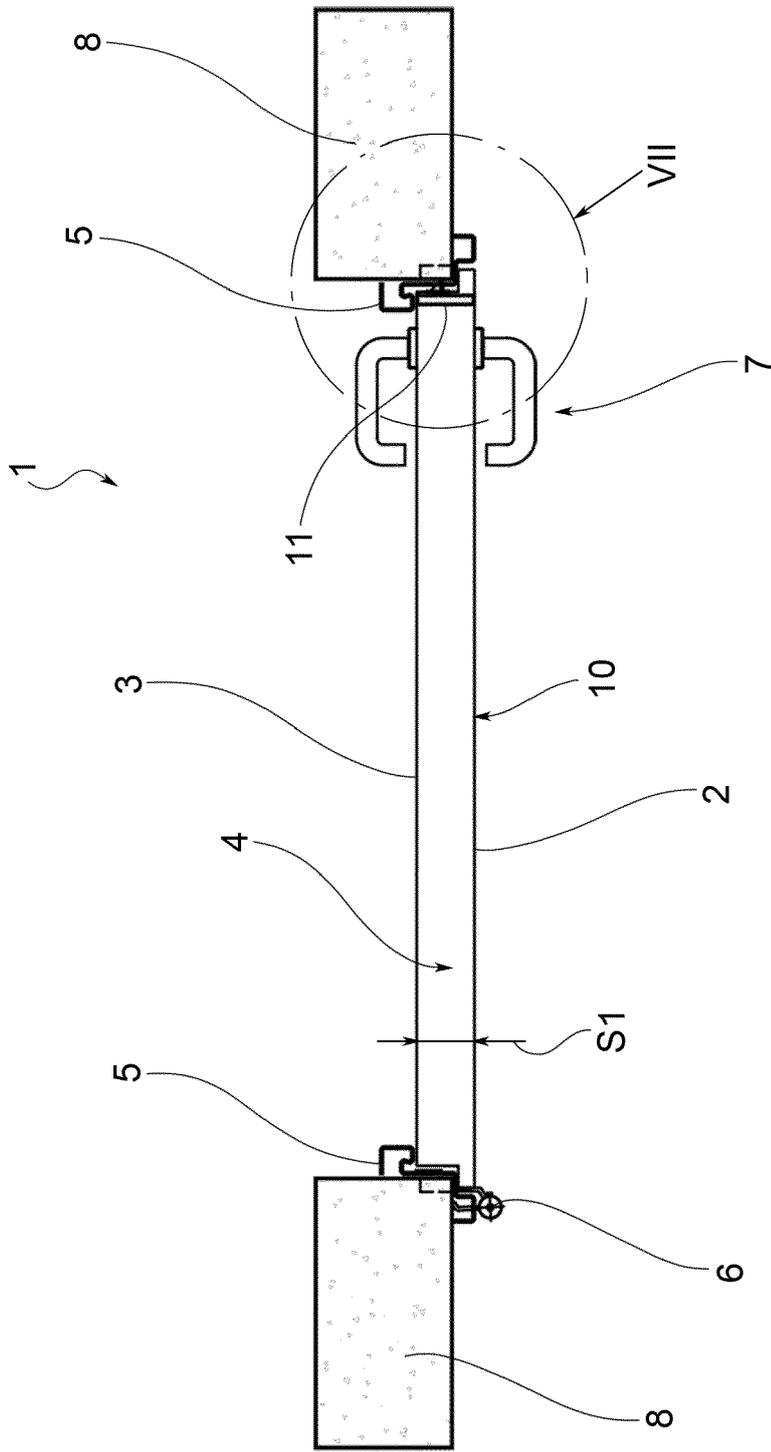


FIG.5

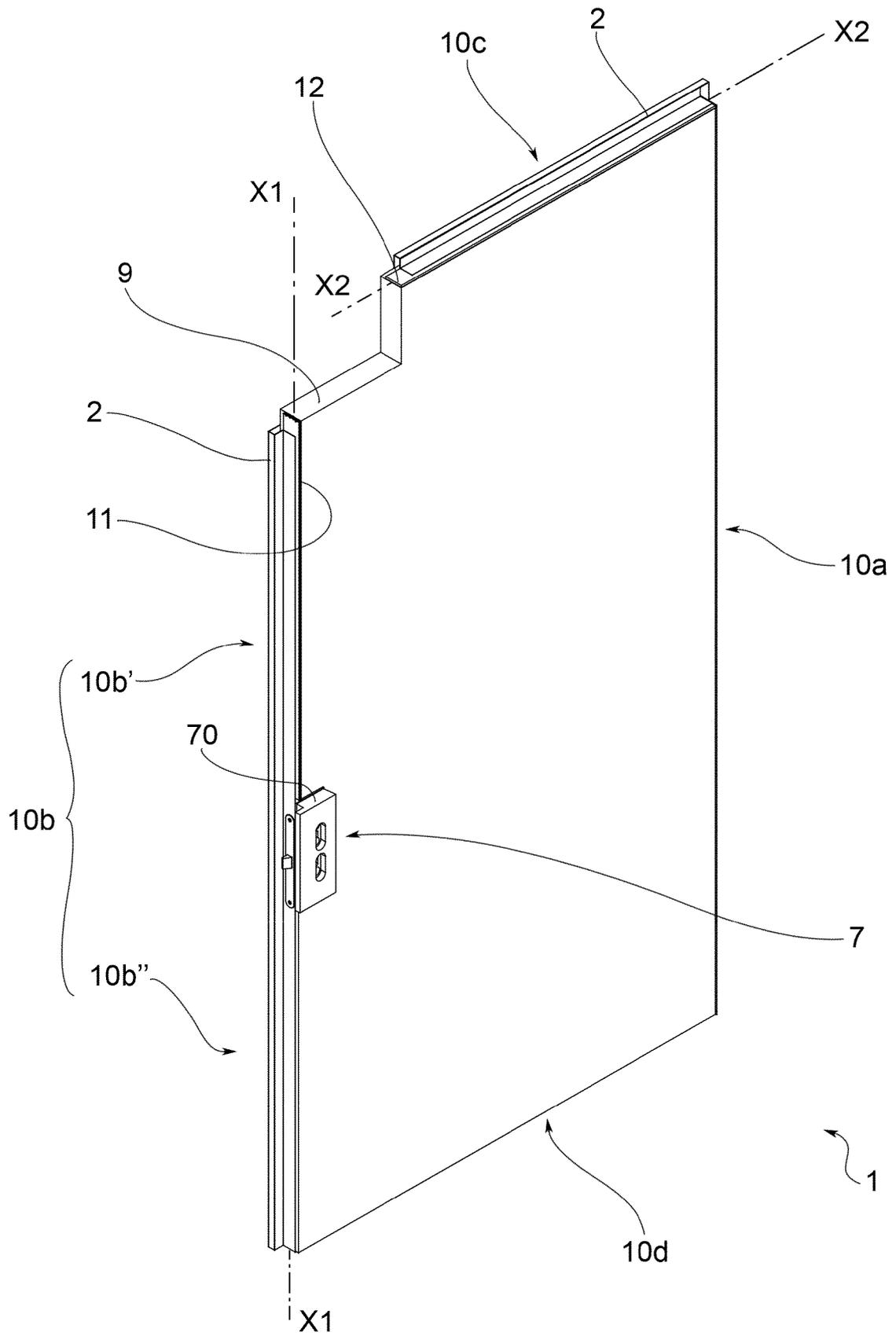


FIG.6

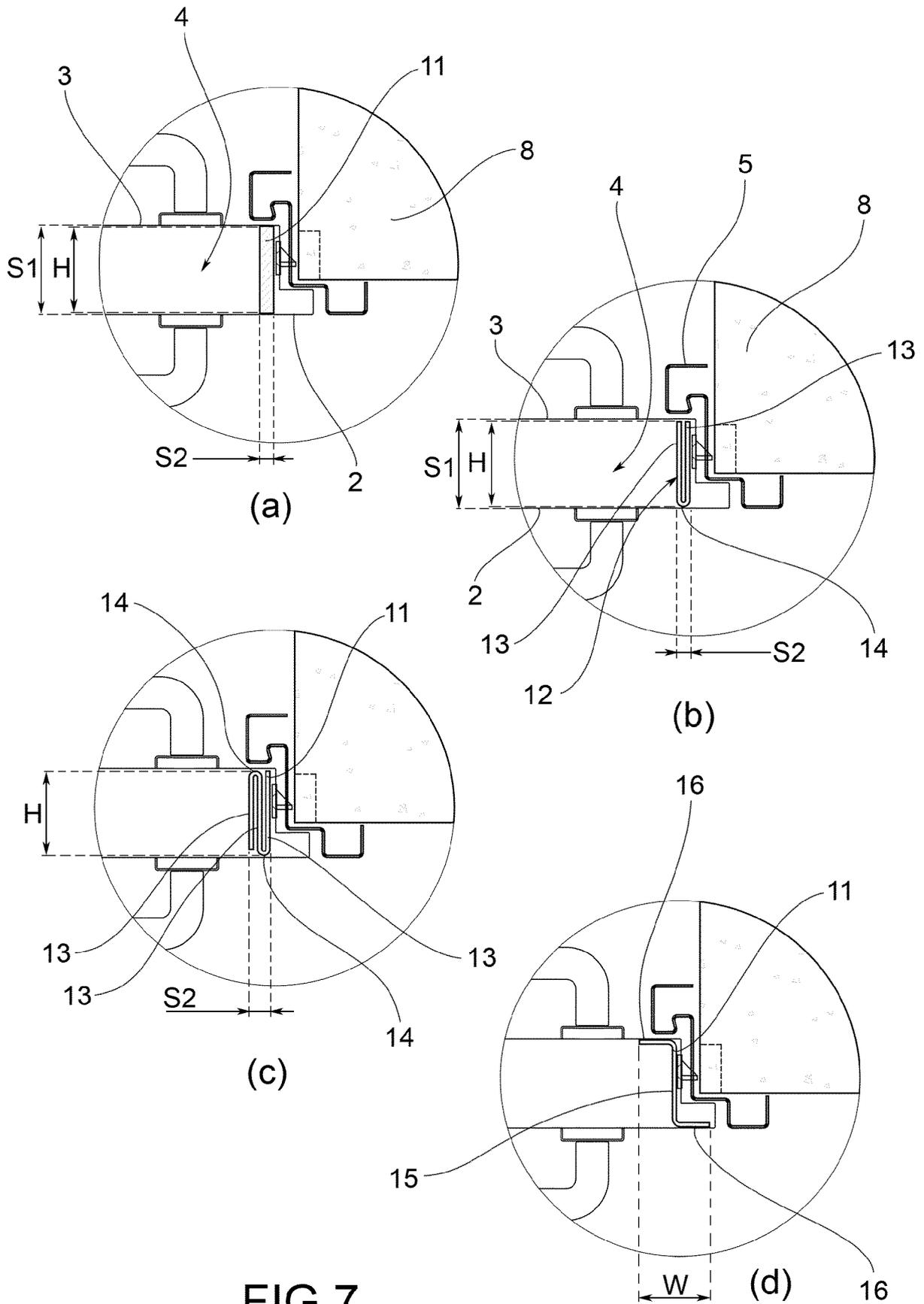


FIG. 7

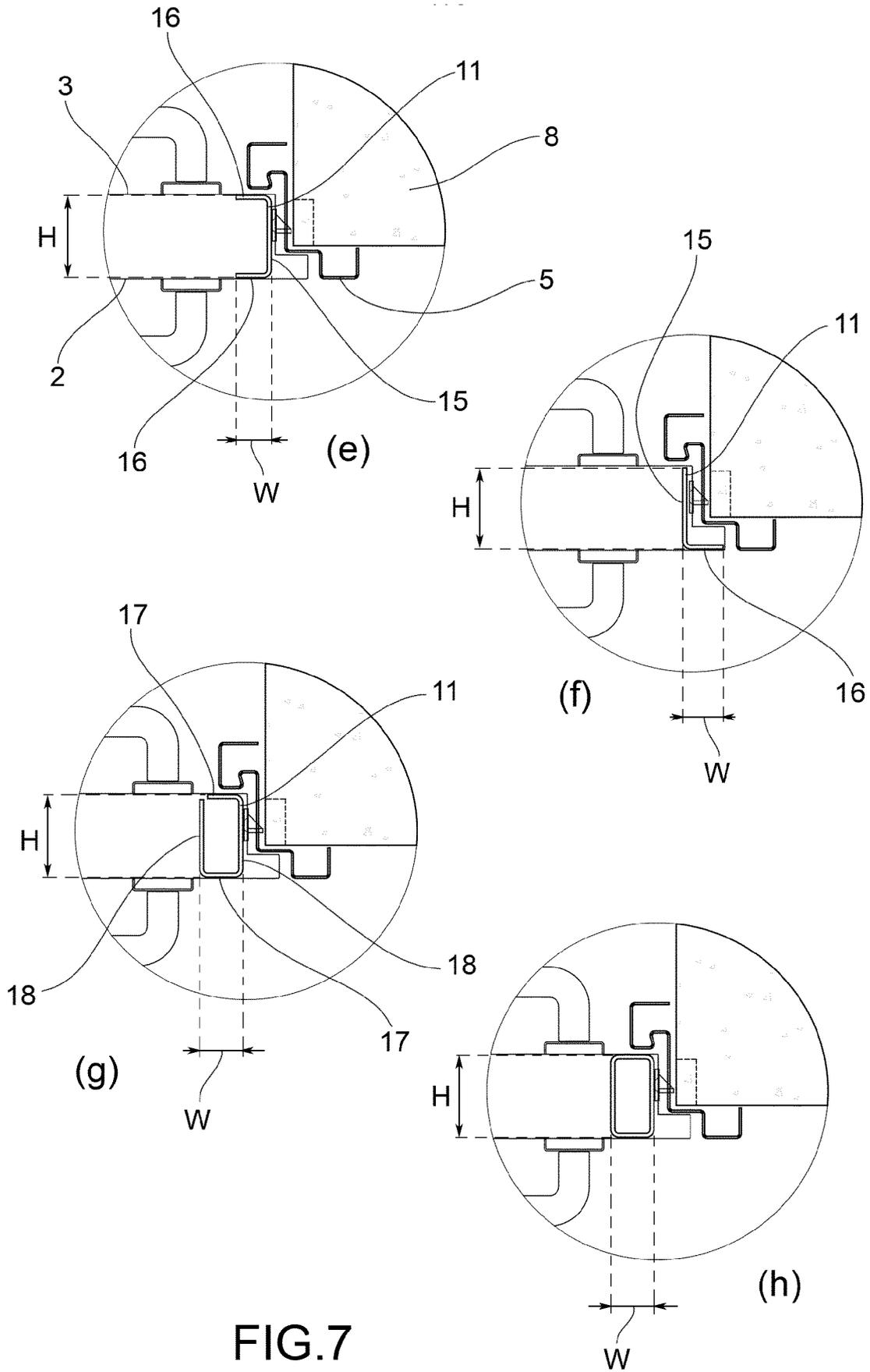


FIG. 7

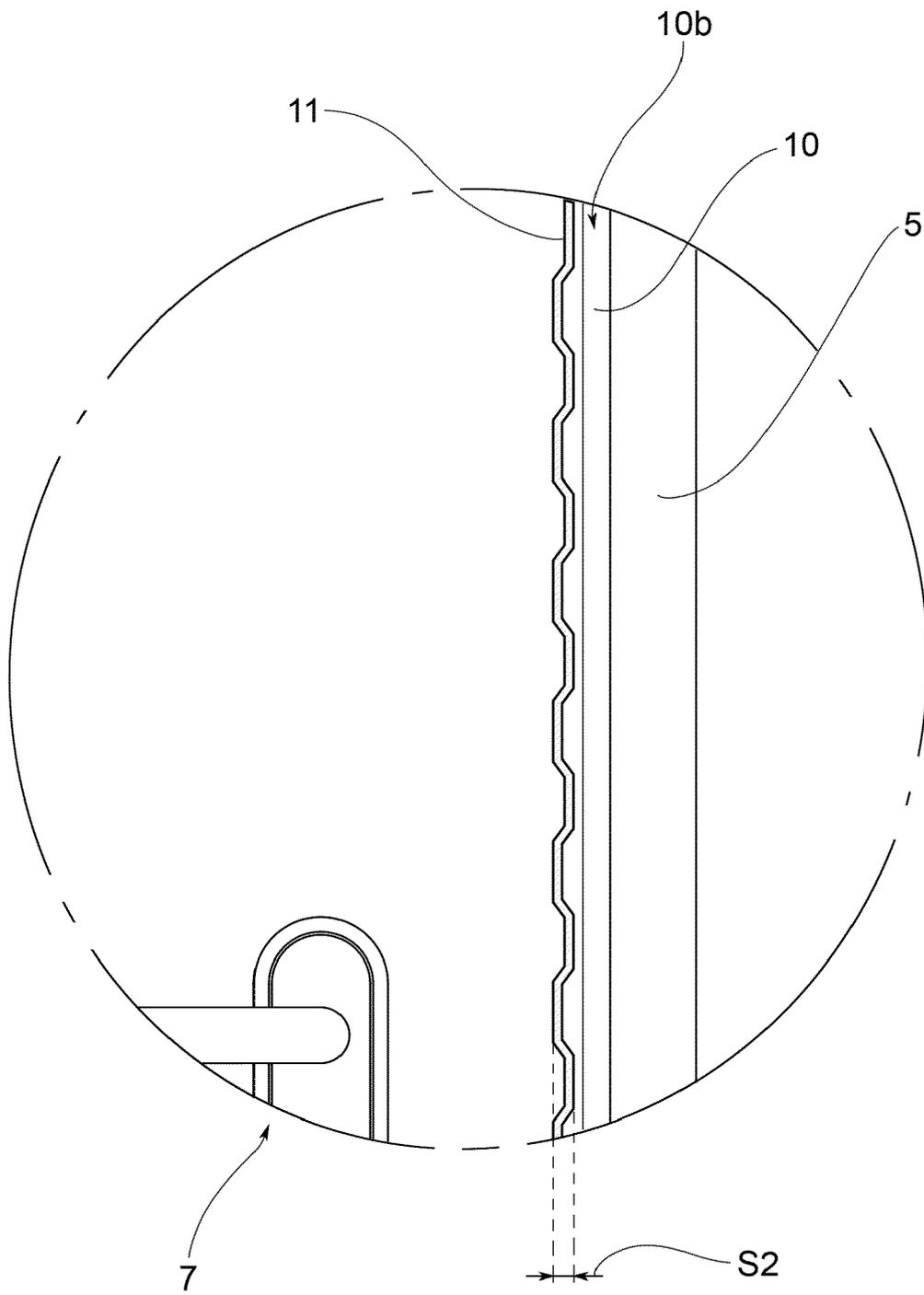


FIG.8



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Place of search The Hague		Date of completion of the search 26 March 2021	Examiner Cobusneanu, D
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