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(54) **PORTAL FRAME STRUCTURE FOR FINISHING AND EQUIPPING AN OPENING OF AN OUTER
WALL OF A BUILDING**

(57) A portal frame structure for finishing and equip-
ping an opening of an outer wall of a building has a first
and a second lateral elongated element (9, 10) and trans-
verse elements (11; 12) integral with the first and the
second lateral elongated elements (9, 10), which are par-
allel and each comprise at least one mat (13) made of
an insulating and incombustible material such as, for ex-
ample, mineral wool or fibreglass; and at least one rein-
forcement panel (14), which is integral with the mat (13)
and extends along the greater part of a main face of the
mat (13).

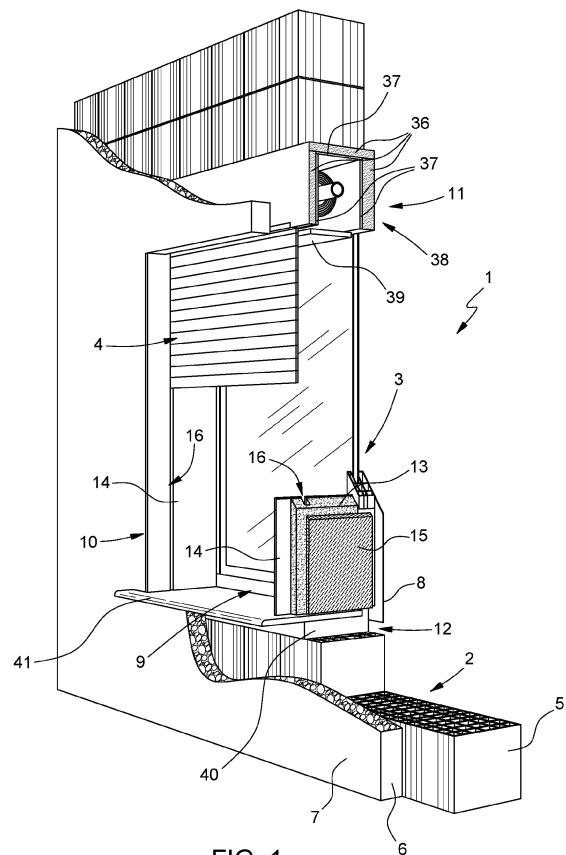


FIG. 1

Description

[0001] The present invention relates to a portal frame structure for finishing and equipping an opening of an outer wall of a building.

[0002] In particular, the present invention relates to a portal frame structure, which is inserted in the opening of the outer wall and fixed to the outer wall for the purpose of housing and supporting a respective fixture be it a window, a windowed door or a door. The portal frame structure defines a made-to-measure housing for the respective fixture, delimits the space having suitably finished surfaces, and thermally and acoustically insulates the fixture from the outer wall and prevents the formation of thermal bridges along the outer wall around the fixtures.

[0003] Generally, the portal frame structure is made in large part of high-density polystyrene, which has good compactness properties, mechanical resistance, workability, thermal and acoustic insulation.

[0004] However, this material is combustible and some countries have banned its use in the building sector and other countries are adopting analogous measures.

[0005] One object of the present invention is to provide a portal frame structure of the above-identified type which remedies the drawbacks of the prior art.

[0006] In accordance with the present invention, a portal frame structure for finishing and equipping an opening of an outer wall of a building is provided, the portal frame structure comprising at least a first and a second elongated element and transverse elements integral with the first and the second elongated elements, which are parallel and each comprise at least one mat made of an insulating and incombustible material such as, for example, mineral wool or fibreglass; and at least one reinforcement panel, which is integral with the mat.

[0007] This way, mats made of a thermally and acoustically insulating material such as, for example, mineral wool and fibreglass can be used, which are capable of meeting the most stringent fire prevention regulations but are not capable of fully carrying out a load-bearing function in the portal frame structure. Mineral wool and fibreglass allow classifying the portal frame structure in high classes of reaction to fire, in particular in the classes A1, A2 and B of the European classification EN 13501-1.

[0008] The reinforcement panel, which adheres, for example by gluing, to a main face of the mat has the function of defining the outer finishing surface of the space of the opening and, in combination with the mat, of making the first and the second elongated elements self-supporting. The reinforcement panel is generally thin and made of a high-density material such as, for example, fibre cement and, thus, subject to bending if subjected to a bending moment, while the mat is much thicker than the reinforcement panel but has a lower density and, thus, is more deformable. In practice, a mineral wool or fibreglass having a density comprised between 70 and 150 kg/mc is selected. The joining of the mat having a large thickness to the reinforcement panel having a reduced thickness

takes care of the reciprocal structural weaknesses of the mat and of the reinforcement panel and makes the first and the second elongated elements sufficiently self-supporting.

5 **[0009]** In addition, the proposed solution has the advantage of greatly reducing the use of materials derived from oil.

[0010] In particular, the transverse elements comprise a third upper elongated element, which rests on the first and the second elongated elements at their upper ends and is fixed to the first and to the second elongated elements and comprises a mat made of an insulating and incombustible material such as, for example, mineral wool or fibreglass; and at least one reinforcement panel, which is integral with the mat and extends along the greater part of a main face of the mat.

15 **[0011]** This way, also the upper element is capable of ensuring the thermal and acoustic insulation and of being incombustible.

20 **[0012]** In particular, the transverse elements comprise a fourth elongated element facing and parallel to the third elongated element and supporting the first and the second elongated elements; the fourth elongated element being fixed to the first and to the second elongated elements and comprising a mat made of an insulating and incombustible material such as, for example, mineral wool or fibreglass; and at least one reinforcement panel, which is integral with the mat and extends at least partially along a main face of the mat.

25 **[0013]** This way, the portal frame structure comprises a base and defines a square entirely acoustically and thermally insulated from the outer wall.

30 **[0014]** In particular, each of the first and the second lateral elongated elements comprises a further reinforcement panel integral with the mat.

35 **[0015]** This way, the further reinforcement panel allows further stiffening the first and the second elongated elements.

40 **[0016]** In particular, the reinforcement panel and the further reinforcement panel cover the greater part of the respective main faces of the mat.

[0017] This way, the reinforcement panel and the further reinforcement panel carry out the functions of containing and protecting the mat.

45 **[0018]** In particular, the further reinforcement panel has a protruding portion with respect to the mat for mounting an inner fixture along the protruding portion, in particular the further reinforcement panel partially extends along the main face opposite the face integral with the reinforcement panel.

50 **[0019]** This way, the further reinforcement panel also carries out the function of counter-frame.

[0020] In particular, each of the first and the second elongated elements comprises a plurality of containment elements extending between each reinforcement panel and the further reinforcement panel so as to enclose the mat between the reinforcement panel, the further reinforcement panel and the containment elements.

[0021] This configuration is necessary when the consistency of the mat is of a particularly low density.

[0022] In particular, the containment elements comprise strips, the opposite ends thereof are fixed to the reinforcement panel and to the further reinforcement panel, said strips being discretely distributed along the elongated element.

[0023] This way, it is possible to contain the weight of the first and of the second elongated elements.

[0024] In particular, the containment elements comprise a front panel arranged at right angles between the reinforcement panel and the further reinforcement panel.

[0025] This way, the mat is encased in a reinforcement structure.

[0026] In accordance with a variant of the present invention, the further reinforcement panel is embedded in the mat for the benefit of the structural simplicity of the first and of the second elongated elements.

[0027] In particular, each of the first and the second elongated elements comprises two mats and two respective reinforcement panels, one of which adheres to both incombustible insulating mats.

[0028] This way, it is possible to form different configurations depending on the depth of the mats such as, for example, to manufacture counter-frames.

[0029] In particular, the first and the second lateral elongated elements comprise respective recesses which extend in the mat; each recess housing a U-shaped guide, in particular the guide is made of a metal material.

[0030] This way, the first and the second elongated elements have the function of guiding the shutters.

[0031] In particular, the third elongated element comprises three insulating mats fixed to respective reinforcement panels, which are assembled so as to form a tunnel configured to house a shutter; the inner surface of the tunnel being defined by the free faces of the self-supporting panels.

[0032] This way, also the tunnel housing the shutter is incombustible.

[0033] In particular, the reinforcement panel is made of a material selected from fibre cement, magnesium oxide, calcium hydrosilicate; marble; sheet metal; resin; and ceramic.

[0034] The above-mentioned incombustible materials, besides ensuring a high level of surface finishing contribute to giving the portal frame structure an excellent class of reaction to fire according to the European classification EN 13501-1.

[0035] In particular, the further reinforcement panel is made of a material selected from metal, fibre cement, magnesium oxide, calcium hydrosilicate, resin, ceramic, and a wood-based material, in particular a wood-based material containing magnesium oxide and/or fibreglass and/or metal additives.

[0036] This way, also the use of a wood-based material normally used for manufacturing the counter-frame does not prejudice the high class of reaction to fire of the entire portal frame structure given the meagreness of the mass

of the wood-based material with respect to the entire portal frame structure.

[0037] A further object of the present invention is to provide a method for manufacturing a portal frame structure which is exempt from the drawbacks of the prior art.

[0038] In accordance with the present invention, a method for manufacturing a portal frame structure as described in the foregoing is provided, the method comprising:

- coupling a mat made of an insulating and incombustible material such as, for example, mineral wool or fibreglass, to a reinforcement panel in order to form a lateral elongated element; and
- assembling a first and a second lateral elongated element and transverse elements so as to manufacture a portal frame structure, wherein the first and the second lateral elongated elements face one another.

[0039] This way, the portal frame structure is structurally stable and ready to be inserted in an opening of the outer wall.

[0040] Other characteristics and advantages of the present invention will be apparent from the following description of non-limiting embodiment examples thereof, with reference to the accompanying figures, wherein:

- Figure 1 is a perspective view, with parts removed for the sake of clarity and parts in section, of a portal frame structure manufactured in accordance with the present invention and installed in an opening of an outer wall of a building;
- Figure 2 is a section view, with parts in section and on an enlarged scale, of a lateral elongated element of the portal frame structure;
- Figures 3, 4, 5 and 6 are section views, with parts removed for the sake of clarity, of respective variants of the lateral elongated element of Figure 2;
- Figures 7 and 8 are section views, with parts removed for the sake of clarity and on an enlarged scale, of respective upper and lower elongated elements of the portal frame structure of Figure 1;
- Figure 9 is a side elevation view, with details removed for the sake of clarity, of the elongated element of Figure 4; and
- Figures 10, 11 and 12 are schematic views, with parts removed for the sake of clarity and on a reduced scale, of respective three possible variants of the portal frame structure of Figure 1.

[0041] With reference to Figure 1, reference numeral 1 indicates, as a whole, a portal frame structure arranged in an opening of an outer wall 2 of a building. In general, the portal frame structure 1 carries out the functions of supporting an inner fixture 3 and an outer fixture or shutter; of insulating the fixtures 3 and 4 from the outer wall

2 and of finishing the free surfaces.

[0042] In the illustrated case, the outer fixture 4 is defined by a roller shutter and the load-bearing structure 1 also carries out the functions of guiding the roller shutter in the opening and closing movements and of housing the outer fixture 4.

[0043] In embodiments not illustrated in the accompanying figures, the inner and outer fixtures are of a different type and the portal frame structure has a configuration adapted to the configuration of the fixtures without however departing from the scope of protection of the present invention. In some cases, the outer fixture is absent.

[0044] The outer wall 2 comprises a load-bearing or infill wall 5; an outer insulating cladding 6; an outer finishing layer 7; and an inner finishing layer 8. The stratigraphy of the outer wall 2 illustrated in Figure 1 has a purely illustrative purpose and, in practice, can assume configurations different from the one illustrated.

[0045] The portal frame structure 1 illustrated in Figure 1 comprises four elongated elements 9, 10, 11 and 12 assembled with one another at the respective opposite ends: two lateral elongated elements 9 and 10, and two transverse elongated elements 11 and 12 of which a upper elongated element 11 and a lower elongated element 12. The portal frame structure 1 is fixed to the outer wall 2 by means of cramps, which are not illustrated in Figure 1 and are cemented in the outer wall.

[0046] The lateral elongated elements 9 and 10, are arranged at the sides of the opening and are parallel and face one another. The upper elongated element 11 rests on the elongated elements 9 and 10 at their upper ends and is fixed to the elongated elements 9 and 10. The lower elongated element 12 faces and is parallel to the upper elongated element 11 and directly supports the lateral elongated elements 9 and 10, and is fixed thereto.

[0047] Each of the elongated elements 9, 10, 11, and 12 comprises a mat 13, 36, 40; and a reinforcement panel 14, 37, 41 which is integral with the respective mat 13, 36, 40 and extends, at least partially, along a main face of the mat 13, 36, 40.

[0048] Each mat 13, 36, 40 has the shape of a parallelepiped and has insulating properties with regard both to the acoustic transmission and the heat transmission and is made of an incombustible material. In particular, each mat 13, 36, 40 is made of an insulating and incombustible material in particular selected from fibre glass and mineral wool. The definition incombustible refers to the European classification EN 13501-1. Even if both these materials have a high density, they are not capable of defining a portal frame structure with a stable shape. For this reason, each mat 13, 36, 40 is glued along a wide main face of the same to the respective reinforcement panel 14, 37, 41 so as to allow prefabricating the portal frame structure 1 prior to the installation of the portal frame structure 1 in the opening of the outer wall 2. In accordance with the tests performed, a satisfactory gluing has been obtained with a hygro-hardening polyurethane adhesive.

[0049] With reference to Figure 2, the elongated element 9, 10 comprises, besides the mat 13 and the reinforcement panel 14, a further reinforcement panel 15, which is integral with the mat 13, and has a protruding portion with respect to the mat 13 for mounting an inner fixture 3 along the protruding portion. In particular, the reinforcement panel 15 is glued to the mat 13 and partially extends along the main face opposite the main face integral with the reinforcement panel 14. The reinforcement panel 14 and the further reinforcement panel 15 cover the greater part of the respective main faces of the mat 13 hence the elongated element 9 and, analogously, the elongated element 10 have a sandwich configuration.

[0050] Each of the elongated elements 9 and 10 has a recess which extends in the mat 13 and a corresponding incision in the reinforcement panel 14 and comprises a U-shaped guide 16 housed in the recess and in the incision so as to guide the outer fixture 4 or shutter (Figure 1).

[0051] In the variant of Figure 3, the reinforcement panel 15 does not protrude with respect to the mat 13 and the lateral elongated element 9, 10 comprises a protruding metal plate 17, which is fixed to the reinforcement panel 15 and defines the counter-frame for housing the inner fixture.

[0052] Figures 4 and 9 illustrate a variant 19 of the elongated element 9 (Figure 1) and, analogously, a variant 20 of the elongated element 10 (Figure 1). In accordance with this variant, in Figure 4 the reinforcement panel 19, 20 comprises a mat 21 which is enclosed between a reinforcement panel 22, a reinforcement panel 23 and a plurality of containment elements, which comprise strips 24 the opposite ends thereof are fixed to the reinforcement panels 22 and 23 and a front panel 25 arranged at right angles between the reinforcement panels 22 and 23.

[0053] In the illustrated embodiment, the mat 21 has a recess while the reinforcement panel 22 comprises a corresponding recess housing a guide 26, which has a wall flush with a face of the mat 21.

[0054] The mat 21 has a further recess for partially housing the reinforcement panel 23, which has a face flush with a face of the insulating and incombustible mat 21. Each strip 24 is fixed to the reinforcement panel 23 and to the guide 26, which, in turn, is fixed to the reinforcement panel 22. The strips 24, instead, are preferably made of metal and fixed by means of screws.

[0055] In a variant not illustrated of Figure 4, the strips 24 are partially replaced by a panel which extends along the face opposite the face that adheres to the panel 22 and is directly connected to the reinforcement panel 23 and to the panel 22 by means of connecting strips. The panel 25 is replaced by connecting strips between the panel 22 and the panel 23.

[0056] Figure 5 illustrates a variant 29 of the elongated element 9 (Figure 1) and analogously a variant 30 of the elongated element 10 (Figure 1). Each of the first and the second lateral elongated elements 29, 30 comprises two mats 31 and 32 and two respective reinforcement

panels 33, 34, the first of which adheres to both mats 31 and 32. The mat 32 has a depth which is approximately half the depth of the mat 31 and is arranged in an overlapping manner so as to form a striker plate for a fixture (not illustrated) and approximately half the depth of the mat 31.

[0057] Each lateral elongated element 29, 30 comprises a further reinforcement panel 35 buried in the mat 31.

[0058] With reference to Figure 6, each mat 31, 32 has a respective reinforcement panel 33, 34 and a respective further reinforcement panel 35A, 35B glued to the main faces. The mat 32 houses a guide 26A.

[0059] In the variants described with reference to Figures 2, 3, 4, 5, the reinforcement panels 14, 22, 34 protrude with respect to the respective mats 13, 21, 32, it being understood that, in accordance with variants not illustrated, the reinforcement panels 14, 22, 34 are flush with the respective mats 13, 21, 32.

[0060] With reference to Figure 7, the upper elongated element 11 comprises three mats 36 integral with respective reinforcement panels 37, which are assembled with one another forming a tunnel 38 housing the outer fixture 4. The reinforcement panels 37 define the inner face of the tunnel 38.

[0061] With reference to Figure 1, the elongated element 11 comprises a further panel 39, which has the function of partially enclosing the tunnel 38 at the bottom leaving a slot for the passage of the shutter or the outer fixture 4.

[0062] In accordance with a variant not illustrated, the upper elongated element 11 comprises a single mat and a single reinforcement panel. This simplified solution is adopted when it is not necessary to house the outer fixture.

[0063] With reference to Figure 8, the elongated element 12 comprises the mat 40 and the reinforcement panel 41 arranged above the mat 40 and partially protruding with respect to the mat 40.

[0064] In general, the reinforcement panels 14, 22, 33, 34 having a finishing function are made of a material selected from fibre cement, magnesium oxide, calcium hydrosilicate; sheet metal; marble and ceramic.

[0065] The reinforcement panels 15, 23 are made of a material selected from metal, fibre cement, magnesium oxide, calcium hydrosilicate, resin, ceramic or of a wood-based material, in particular a wood-based material containing magnesium oxide and/or fibreglass and/or metal additives.

[0066] The reinforcement panels 35 are made of an incombustible material, preferably calcium hydrosilicate.

[0067] Finally, it is to be understood that variations can be made to the present invention with respect to the described embodiment without however departing from the scope of protection of the appended claims.

[0068] For example, Figure 10 shows a portal frame structure 42 comprising the lateral elongated elements 9 and 10 and two transverse stiffening bars 43 while the upper elongated element 11 and the lower elongated el-

ement 12 are omitted. Once the portal frame structure 42 has been installed, the transverse bars 43 are removed.

[0069] Figure 11 shows a portal frame structure 44, which comprises the lateral elongated elements 9 and 10, the upper elongated element 11 and two transverse stiffening bars 43 while the lower elongated element 12 is omitted.

[0070] Figure 12 shows a portal frame structure 45, which comprises the lateral elongated elements 9 and 10, the lower elongated element 12 and two transverse stiffening bars 43 while the upper elongated element 11 is omitted.

Claims

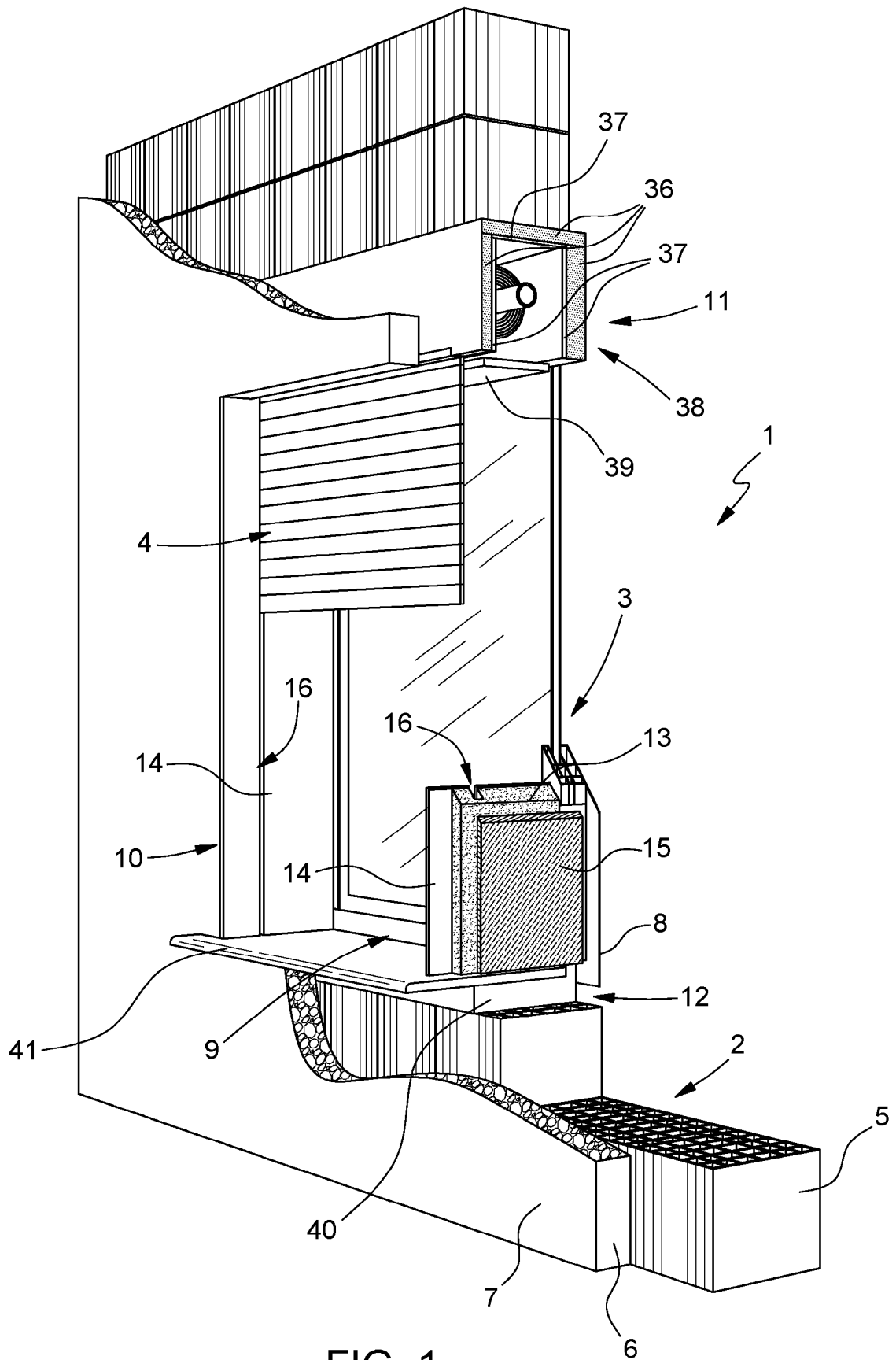
1. A portal frame structure for finishing and equipping an opening of an outer wall of a building, the portal frame structure (1; 42; 44; 45) comprising at least a first and a second lateral elongated element (9; 19; 29, 10; 20; 30) and transverse elements (11; 12; 43) integral with the first and the second lateral elongated elements (9; 19; 29, 10; 20; 30), which are parallel and each comprise at least one mat (13; 21; 31, 32) made of an insulating and incombustible material such as, for example, mineral wool or fibreglass; and at least one reinforcement panel (14; 22; 33, 34), which is integral with the mat (13; 21; 31, 32).
2. The portal frame structure as claimed in claim 1, wherein said transverse elements (11; 12; 43) comprise a third upper elongated element (11), which rests on the first and the second elongated elements (9; 19; 29, 10; 20; 30) at their upper ends and is fixed to the first and to the second elongated elements (9; 19; 29, 10; 20; 30) and comprises at least one mat (36) made of an insulating and incombustible material such as, for example, mineral wool or fibreglass; and at least one reinforcement panel (37), which is integral with the mat (36) and extends along the greater part of a main face of the mat (13).
3. The portal frame structure as claimed in claim 1 or 2, wherein said transverse elements (11; 12; 43) comprise a fourth lower elongated element (12), which is arranged under the first and the second lateral elongated elements (9; 19; 29, 10; 20; 30), is fixed to the first and to the second elongated elements (9; 19; 29, 10; 20; 30), and comprises a mat (40) made of an insulating and incombustible material such as, for example, mineral wool or fibreglass; and at least one reinforcement panel (41), which is integral with the mat (40) and extends at least along the greater part of a main face of the mat (40).
4. The portal frame structure as claimed in any of the preceding claims, wherein each of the first and the

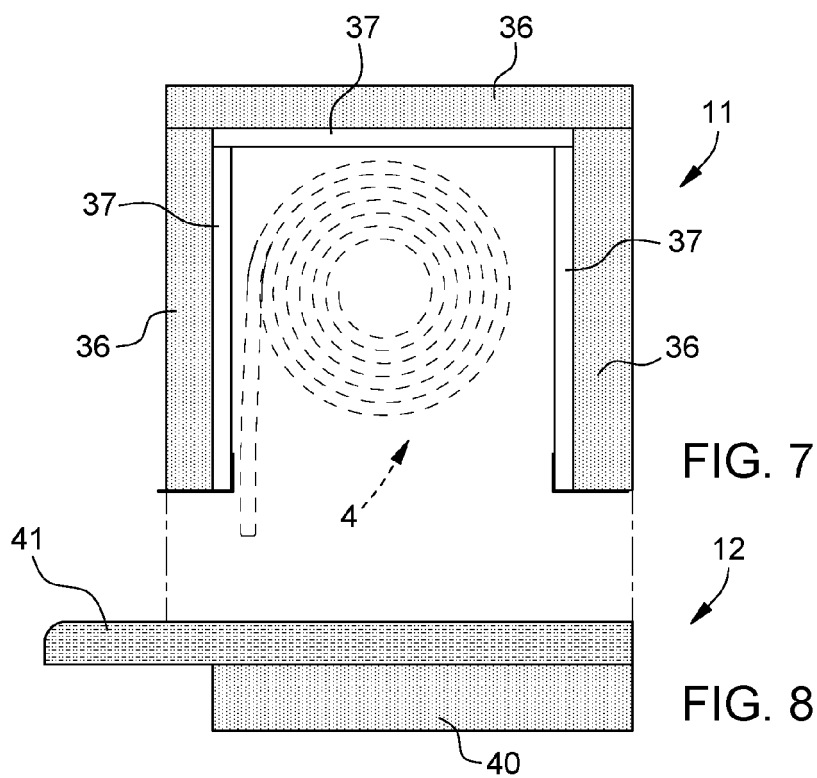
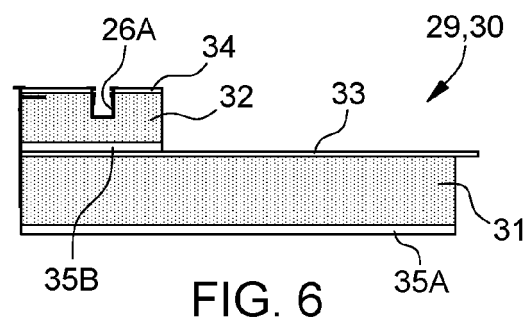
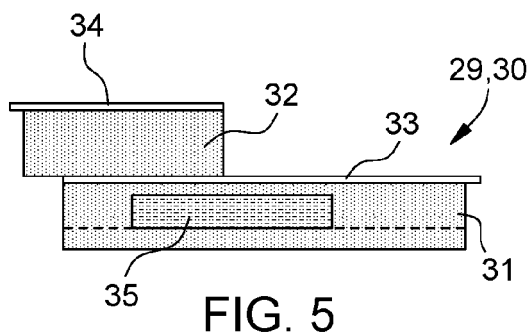
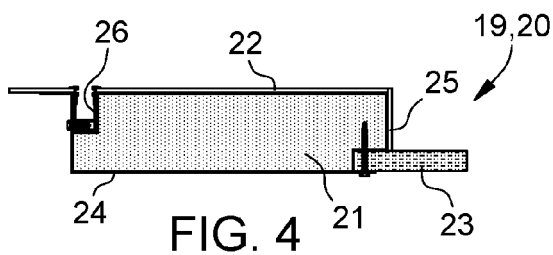
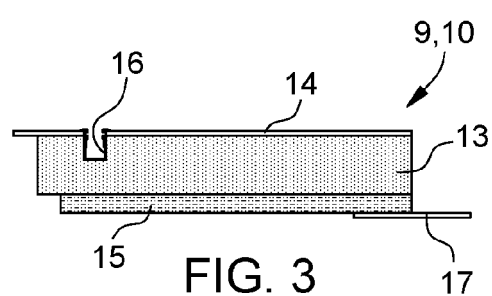
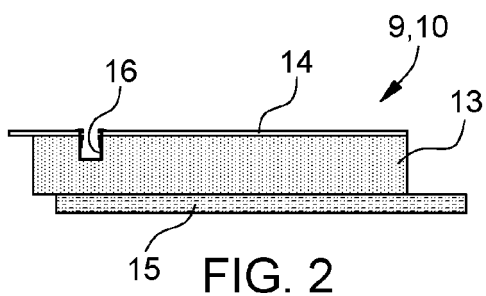
second lateral elongated elements (9; 19; 29, 10; 20; 30) comprises a further reinforcement panel (15; 23; 35; 35A; 35B) integral with the mat (13; 21; 31; 32).

5. The portal frame structure as claimed in claim 4, wherein the reinforcement panel (14; 22; 33, 34) and the further reinforcement panel (15; 35A; 35B) cover the greater part of the respective main faces of the mat (13; 31; 32). 5
6. The portal frame structure as claimed in claim 4 or 5, wherein the further reinforcement panel (15; 23) has a protruding portion with respect to the mat (13; 21) for mounting an inner fixture (3) along the protruding portion, in particular the further reinforcement panel (15; 23) extends in part along the main face opposite the face integral with the reinforcement panel (14; 22). 10
7. The portal frame structure as claimed in claim 6, wherein each of the first and the second elongated elements (19, 20) comprises a plurality of containment elements (24, 25) extending between each reinforcement panel and the further reinforcement panel (23) so as to enclose the mat (21) between the reinforcement panel (22), the further reinforcement panel (23) and the containment elements (24, 25). 20
8. The portal frame structure as claimed in claim 7, wherein the containment elements (24, 25) comprise strips (24), the opposite ends thereof are fixed to the reinforcement panel (22) and to the further reinforcement panel (23), said strips (24) being discretely distributed along the elongated element (19, 20). 25
9. The portal frame structure as claimed in claims 7 or 8, wherein the containment elements (24, 25) comprise a front panel (25) arranged at right angles between the reinforcement panel (22) and the further reinforcement panel (23). 30
10. The portal frame structure as claimed in claim 4, wherein the further reinforcement panel (35) is embedded in the mat (31). 35
11. The portal frame structure as claimed in any of claims 4 to 10, wherein each of the first and the second elongated elements (9, 10) comprises two mats (31, 32) and two respective reinforcement panels (33, 34), the two mats (31, 32) being connected to one another so as to form a shoulder. 40
12. The portal frame structure as claimed in any of the preceding claims, wherein the first and the second lateral elongated elements (9; 19, 10; 20) comprise respective recesses which extend in the mat (13; 21); each recess housing a U-shaped guide (16; 26), 45

in particular the guide (16; 26) is made of a metal material.

13. The portal frame structure as claimed in any of claims 2 to 12, wherein the third elongated element (11) comprises three mats (36) fixed to respective reinforcement panels (37), which are assembled to form a tunnel (38) configured to house an outer fixture (4), in particular the inner surface of the tunnel (38) being defined by the free faces of the reinforcement panels (37). 50
14. The portal frame structure as claimed in any of the preceding claims, wherein the reinforcement panel (14; 22; 33, 34) is made of a material selected from fibre cement, magnesium oxide, calcium hydrosilicate; marble; sheet metal; resin; and ceramic. 55
15. The portal frame structure as claimed in any of claims 4 to 14, wherein the further reinforcement panel (15; 23; 35) is made of a material selected from metal, fibre cement, magnesium oxide, calcium hydrosilicate, resin, ceramic, a wood-based material, in particular a wood-based material containing magnesium oxide and/or fibreglass and/or metal additives.
16. The portal frame structure as claimed in any of the preceding claims, wherein the mat (13; 21; 31, 32) has the shape of a parallelepiped and has insulating properties with regard both to the acoustic transmission and the heat transmission.
17. A method for manufacturing a portal frame structure as claimed in any of the preceding claims, the method comprising:
 - coupling a mat (13; 21; 31, 32) made of an insulating and incombustible material, for example of mineral wool or fibreglass, to a reinforcement panel (14; 22; 33, 34) so as to form a lateral elongated element (9; 19; 29, 10; 20; 30);
 - assembling a first and a second lateral elongated element (9; 19; 29, 10; 20; 30) and transverse elements (11; 12; 43) so as to manufacture a portal frame structure (1; 42; 43; 44), wherein the first and the second lateral elongated elements (9; 19; 29, 10; 20; 30) face one another.





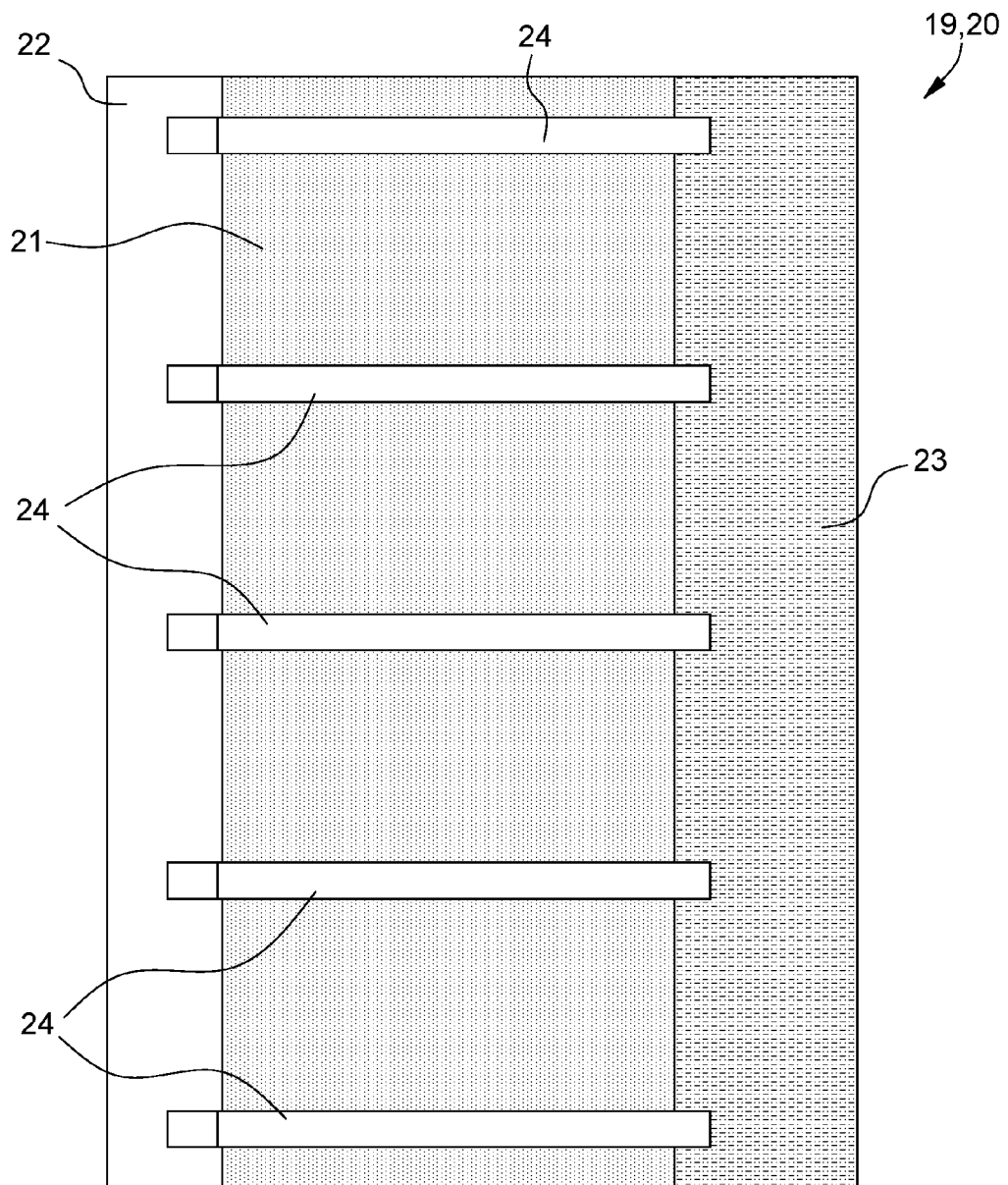


FIG. 9

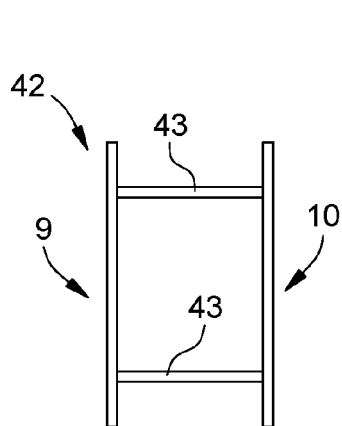


FIG. 10

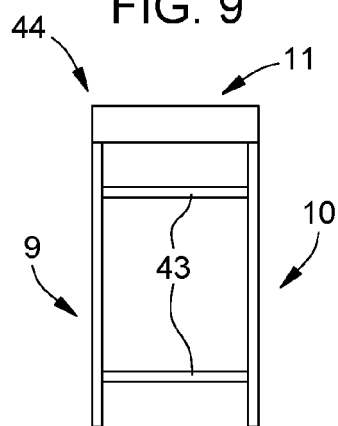


FIG. 11

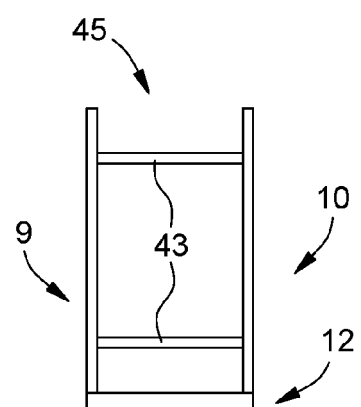


FIG. 12