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(54) **Fire-rated closure**

(57) A fire-rated closure comprising a frame (1) and a hatch (2), the frame further including a supporting frame (11) on one side of a space divider and an opposite frame (12), on the opposite side of the space divider, separated with thermal barriers (14, 14) made of fire-resistant material with low thermal conductivity. In the embodiment intended for mounting in the building slab, the closure comprises folding stairs (3) seated in the axis (34), joined with the supporting frame bearings (11), and the hatch (3) supported by the stairs. (12 claims)

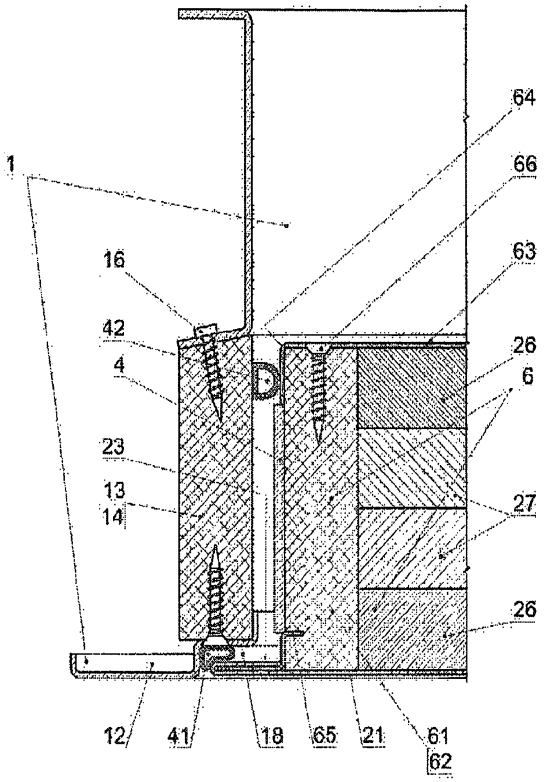

Fig. 5

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Description

[0001] This application relates to a fire-rated closure of an opening in a space divider in normal operation being an access through the space divider, and in case of fire being a closure preventing fire propagation and providing protection against high temperature. The closure of the type intended for mounting in the slab, i.e. as an attic access unit, also comprising folding stairs. The closure may also be of the type intended for mounting in the vertical wall, also comprising folding stairs.

[0002] **Prior art.** Fire-rated closures mounted in space dividers, i.e. fire-rated walls and slabs, in form of doors or hatches, usually made of metal are well known. The fire-rated closures are filled with fire-resistant and thermal insulating materials or lined with such materials. The frames are usually made of metal to provide fire resistance, although the metal is a good thermal conductor and does not prevent heat transmission. Also the closures with wooden frames are well known, providing better thermal insulation and lower fire rating.

[0003] **Disclosure.** A fire-rated closure in a space divider comprising a frame, at least partially made of metal, further including a supporting frame, located on one side of the space divider and an opposite frame, located on the other side of the space divider, where both frames are separated with thermal barriers made of fire-resistant material with low thermal conductivity. The thermal barriers may be made of silicate-cement panels. Thermal barriers on four sides of the frame form an insulating frame comprising of the thermal barriers installed with threaded fasteners to the frame.

[0004] The supporting frame and the opposite frame are made of bend metal sheet sections, and thermal barriers are fastened to both frames with threaded fasteners seated in thermal barriers. Preferably the supporting frame is made of channel sections with obtuse angle between the web and at least one of the flanges of the channel section. Thermal barriers have inclined surfaces adjacent to the inclined flanges of the channel sections of the supporting frame, and the screws seated in the thermal barriers are fastened through the holes in channel flanges. The inclination allows access to the screws with a suitable tool without the need to cut the second flange of the channel.

[0005] The fire-rated closure comprises a hatch movable in relation to the frame, closing the opening in the frame, where the hatch is lined with fire-resistant and thermal insulation materials. The surface of the hatch lateral in relation to its main surface, inside the frame is surrounded with an intumescent seal expanding at high temperature. The closure is mounted in the fire-rated space divider, to provide protection against fire and thermal energy between contiguous rooms. The closure comprises a lock maintaining closed position of the closure, where the tension of a spring holding the hatch in closed position is reduced at high temperature.

[0006] The hatch of the fire-rated closure is a box type structure comprising two metal sheets lined with fire-resistant and low thermal conductivity material. One of the metal sheets is shaped as a rebate, which in closed position adhere to a face of the frame in closed position under the spring tension, from the side of hatch movement during opening.

[0007] In the first hatch embodiment, both metal sheets are joined with insulating walls made of fire-resistant material with low thermal conductivity transverse to the metal sheets. The walls can be made of silicate-cement panels, identical to the thermal barriers of the frame.

[0008] In the second embodiment, the hatch walls transverse to the main surface, joining both metal sheets are made of perforated metal sheets. The perforation reduces the heat transmission area and prevents heat penetration to the other side of the closure.

[0009] Elastomeric seals (rubber) are fitted between the hatch and the frame of the fire-rated closure. The elastomeric seals, unlike intumescent seals are used for closing and opening the hatch in normal operation. The seals provide protection in initial stage of the fire, whereas the function is provided at high temperature by the intumescent seal, which expands and fills the space between the inner frame surface and the hatch walls.

[0010] Fire-rated closure is intended for mounting in the building slab, and comprises folding stairs, which open downwards to the room below the slab. For closures mounted in the slab, the supporting frame is located at the top, and the opposite frame is a bottom section, and the hatch is opened downwards, with the stairs. Fire-rated closure comprises a set of springs partially counterbalancing the weight of the stairs and the hatch.

[0011] In the first embodiment, the stairs comprise ladder sections, specifically made of metal with hinged joints. Preferably the folding stairs have three sections, where the hinge joining the top section with middle section are mounted on the top surfaces of the stringers, and hinges joining the middle section with bottom section are mounted on the bottom surfaces of the stringers. In closed position, the sections of folded stairs are positioned inside the frame, where the top section is at the bottom, i.e. close to the hatch and the bottom section is at the top.

[0012] The stairs are joined with the frame with an axis fixed to the top section of the stairs, mounted in the frame bearings. The hatch of fire-rated closure is supported by the top section of folding stairs, preferably joined with swivel joints providing automatic positioning of the hatch in relation to the frame, and proper adherence.

[0013] In the second embodiment, the folding stairs comprise scissor stairs with two parallel multiple pantographs joined with treads. To unfold, the stairs are extended, and the treads are positioned in usable distance, and in closed position the treads are pushed together to fit inside the frame. The hatch is joined with the supporting frame with a hinged mechanism, with two swivel joints on both sides of the hatch, providing a slidable rotation axis of the hatch, with scissor stairs mounted on the

hatch.

[0014] The two embodiments and joints with fire-rated closure hatch are not comprehensive. The hatch hinged joined with the supporting frame may comprise pull-down stairs instead of scissor stairs. The frame may comprise scissor stairs, which require use of intermediate frame, and the stairs or the intermediate frame may support the hatch.

[0015] The spring tension is selected to maintain closed position of the hatch with the stairs. The lock is an additional means of protection, maintaining closed position of the hatch, in case the spring tension is reduced at high temperature.

[0016] The presented closures with folding stairs are not the only embodiments of the invention. Fire-rated closure may also be a door in a vertical wall with or without folding stairs, or a closure in the slab without stairs.

[0017] Advantages of the invention. Fire-rated closure with thermal barriers, in the frame, between two metal frames is characterized by low thermal conductivity and the metal frame components are non-flammable. The inclination of channel flanges facilitates installation of thermal barriers. Additional thermal insulation properties result from the use of insulation walls in the hatch, and the hinge joints facilitate automatic hatch positioning in the frame.

[0018] Preferred embodiments of the invention. Fire-rated closure in a space divider of the present invention shown as embodiments in the following drawings, where the following figures shows:

Fig. 1 - Longitudinal section of the fire-rated closure with folding stairs and thermal barriers within the frame.

Fig. 2 - Frame and hatch of Fig. 1 - axonometric view.

Fig. 3 - Cross section of the frame and hatch of Fig. 1, in the plane of screws joining the metal frames with thermal barriers.

Fig. 4 - Cross section of the frame and hatch of Fig. 2, along the lines A-A, with the lock.

Fig. 5 - Cross section of the frame and hatch with insulation thermal barriers within the frame and the hatch.

[0019] The fire-rated closure is presented as the embodiments not shown in the figures, described by indication of common features and differences in relation to shown embodiments.

[0020] Embodiment 1. Fire-rated closure with a frame 1 and a hatch 2, fixed to the rotatably mounted folding stairs 3. The frame comprising a supporting frame 11, being the top frame and an opposite frame 12, being the bottom frame - separated with longitudinal thermal barriers 13, transverse thermal barriers 14 made of fire-resistant materials with low thermal conductivity, i.e. silicate-cement panels. The supporting frame 11 made of formed metal sheet channel sections, bevelled at 45° at the ends and welded at corners. Supporting frame channels 11 positioned with the webs to the inside of the frame, and inclined bottom flanges forming an obtuse angle between the flange and the web of the channel. The opposite frame 12 made of formed metal sheet sections, channels positioned with the web downwards, welded. Thermal barriers: longitudinal 13 and transverse 14 made of panels cut to the width of frame sides. Longitudinal thermal barriers 13 are longer than the frame clearance by a double panel thickness, and transverse thermal barriers 14 adhere with its face to the end sections of longitudinal thermal barriers outside the frame clearance 13. The thermal barriers are joined with screws 15, at the end sections of longitudinal thermal barriers 13, the screws are seated in the face of the transverse thermal barriers 14 - forming a complete insulation frame. Thermal barriers: longitudinal 13 and transverse 14, fastened to the supporting frame 11 with top screws 16, fastened to the opposite frame 12 with bottom screws 17, where all screws are seated in the thermal barrier 13, 14. The top surface of thermal barriers 13, 14 are inclined in relation to the inclination of the bottom flange of the supporting frame channel 11, and the top screws are inclined likewise 16 providing access for suitable tools without additional cut-outs in the supporting frame.

[0021] The hatch 2 is a box type structure comprising two metal sheets, bottom sheet 21 and top sheet 22 both made of metal sheets. The bottom sheet 21 edges are tucked in by 180°, forming a rebate 23 seated in the recess 18 of the frame, formed by the joint of the channel and the z-bar in the opposite frame 12. The top sheet 22 edges are folded 24 perpendicularly downwards and upwards to the inside. The top section of the side wall folded at 180° 25 is seated in the fold of the top sheet. The bottom section of the side wall 25 is folded perpendicularly to the outside and seated in the fold of the bottom sheet 21 forming a rebate 23.The side walls 25 of the hatch are made of perforated sheet to reduce the area of heat conduction. The box structure of the hatch 2 comprises the fire-resistant panels 26, a thermal insulation as an outer layer and thermal insulation 27 as an inner layer.

[0022] Folding stairs 3 comprise pull-down stairs made of three hinged joined sections: top 31, middle 32 and bottom 33. The section names are determined by the location in open position, whereas sections in closed position inside the frame are located in reverse positions, i.e. the top section 31 is at the bottom, with middle 32 and top section 33 above the top section. Folding stairs 3 are joined with a frame 1 with the axis 34, mounted in the bearings 19 of the supporting frame 11. Below the top section 31 of the folding stairs 3 are the swivel joints 35 supporting the hatch 2 of the fire-rated closure. Folding stairs 3 comprise the springs 36 counterbalancing the weight of the stairs and the hatch 2, which lift the hatch and the stairs during closing and absorb the descent during opening. Folding stairs further include the telescopic handrail 37 joining the top section 31 with the middle section 32, with a spring inside assisting lifting of the mid-

dle 32 and bottom 33 section during folding.

[0023] The hatch 2 comprises the intumescent seal 4 along the side walls 25 of the hatch. The seal expands at high temperature and fills the space between the frame and the hatch and prevents flame, hot air and smoke from entering adjacent rooms. Intumescent seal 4 is a disposable type, since its original dimensions are not restored after cooling and must be replaced. Apart from the intumescent seal 4, the fire-rated closure comprises two elastomeric seals for normal operation, fitted between the frame 1 and the hatch 2, on the whole perimeter, fixed to the frame. The elastomeric seals comprise the bottom seal 41, fitted in the recess 18 of the frame 1, and the top seal 42, in the fold 24 of the top sheet 22 of the hatch, where external surface of the fold cooperates with the top seal.

[0024] The lock 5 comprises the bolt 51 with the spring (not shown, inside the body) with inclined end of its top surface, to provide latching of the bolt51 in the recess of the thermal barrier 14 of the frame 1, when the hatch 2 is lifted. To move the hatch 2, the bolt 51 is retracted by the lug 52, which is also a handle for the hatch. The lock comprises the bolt support 53 fastened with screws 54 to the opposite frame 12 of the frame 1, although in closed position, the support is not used, since the spring 36 lifts the hatch 2 upwards, and between the bolt 51 and the support 53 there is a clearance. The bolt 51 rests on the support 53 in case of a fire, if the spring 36 tension is reduced at high temperature. The hatch 2 features through cut-outs in the fire-resistant panel 26 and the thermal insulation panel 27, both located from the bottom of the hatch to position the lock 5. Above the lock 5, the cut-out in the thermal insulation panel 27 is lined with an thermal barrier 55

[0025] Embodiment 2. Fire-rated closure comprising a frame 1 with a supporting frame 11, being the top frame in this embodiment and an opposite frame 12, being the bottom frame, identical to the first embodiment. Also thermal barriers: longitudinal 13 and transverse 14 and forming the insulating frame, as well as top screws 16 joints with inclined channel flange 11of the supporting frame and bottom screws 17 with the opposite frame 12 are identical to the first embodiment.

[0026] A hatch 6 comprising two sheets joined with longitudinal 61 and transverse 62 thermal barriers joined at corners, identical to the thermal barriers of the frame. A top sheet 63 of the hatch has a single, perpendicular bend 64 directed downwards. A bottom sheet 21, identical to the first embodiment has a 180° fold, forming a rebate 23corresponding to the recess 18 in the frame. The bottom sheet 21 is joined with the thermal barriers: longitudinal 61 and transverse 62 with z-bar 65, where a single wall is positioned in the fold forming the rebate 23, and the second parallel wall is positioned in the recess in the outer surfaces of the thermal barriers 61, 62. The top sheet 63 is joined with the thermal barriers 61, 62 with screws 66, seated in the thermal barriers.

[0027] The box type structure of the hatch 6 lined with two fire-resistant panels 26, thermal insulation panels 27 and the intumescent seal 4 is identical to the first embodiment. Also the elastomeric seals are identical: bottom seal 41 and top seal 42, where the top seal 42 cooperates with the outer surface of the fold 64. The hatch 6 is supported by the section of stairs identical to the first embodiment with swivel joints; the stairs mounted in the bearings of the frame, springs and lock are also identical.

[0028] **Embodiment 3.** Fire-rated closure with a frame including a supporting frame and an opposite frame separated with thermal barriers, identical to the first embodiment. The closure does not comprise stairs, and the hatch is opened upwards, and cooperates with the supporting frame of the frame, without the springs. The hatch has the sheets and thermal barriers identical to the first embodiment, and is mounted in the frame.

[0029] **Embodiment 4**. Fire-rated closure with doors installed in a vertical wall at the height of approx. 1 meter over the floor. The closure comprises a supporting frame and an opposite frame separated with thermal barriers, identical to the first embodiment. A single section of folding stairs opened downwards in the direction of hatch opening is rotatably mounted in the supporting frame in the bottom section of the frame. In its closed position, the section is positioned vertically in the frame. The sheets and thermal barriers are identical to the first embodiment, and the hatch is mounted in the frame.

Claims

1. . The fire-rated closure of the opening in the space divider, specifically with folding stairs, intended for mounting in said space divider, specifically fire-rated, to provide protection against fire and thermal energy from transferring to adjacent rooms, comprising the frame, at least partially metal, mounted in said space divider, with movable hatch, said hatch lined with fire-resistant and thermal insulating materials, where the surface transverse to the main hatch surface, inside the frame is fitted with the intumescent seal expanding at high temperature, and the closure further includes the lock, said lock maintaining closed position of said hatch in case of a fire wherein the frame (1) comprises the supporting frame (11) on one side of said space divider and the opposite frame (12) on the opposite side of said space divider, separated with thermal barrier (13, 14), said thermal barriers made of fire-resistant material with low thermal conductivity.

2. . The fire-rated closure of claim 1 wherein the hatch (2) is a box type structure made of sheets with perforated transverse walls (25) and the inside lined with fire-resistant panel (26) and low thermal conductivity panel(27).

3. . The fire-rated closure of claim 1 wherein the hatch

(6) is a box type structure made of two sheets (21, 63), specifically metal sheets, joined with the insulating walls (61, 62) made of fire-resistant panel (27) and low thermal conductivity panel (27).

4. . The fire-rated closure of claim 1, 2 or 3 wherein the elastomeric seals (41, 42) are fitted between said hatch (2, 6) and said frame.

5. . The fire-rated closure of claim 1, 2, 3 or 4 for mounting in the slab with folding stairs wherein the supporting frame (11) of said frame (1) is positioned on the top, and the opposite frame (12) is positioned at the bottom, and said hatch (2) is opened downwards with said stairs (3), and comprises springs (36) partially counterbalancing the weight of said stairs and said hatch.

6. . The fire-rated closure of claim 5 wherein said stairs are pull-down type, made of hinged ladder sections (31, 32, and 33) positioned inside said frame (1) in **folded position.**

7. . The fire-rated closure of claim 5 wherein said stairs are scissor type, made of two parallel multiple pantographs with treads positioned inside said frame in folded position.

8. . The fire-rated closure of claim 6 or 7 wherein said stairs (3) are joined with said frame (1) with the axis (1) mounted in the bearings of the supporting frame, and said hatch (2) mounted on the top section (31) of said folding stairs (3), preferably joined with swivel joints (35).

9. . The fire-rated closure of claim 6 or 7 wherein said hatch is joined with said supporting frame with the hinged mechanism, and said folding stairs are mounted on said hatch.

10. . The fire-rated closure of claim 5, 6, 7, 8 or 9 wherein the spring tension counterbalancing (36) the weight of said stairs and said hatch maintains closed position of said hatch (2) with said stairs (3), and the lock (5) is an additional means of protection in case the tension of said spring is reduced at high temperature.

11. . The fire-rated closure of claim 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10 wherein the supporting frame (11) of said frame (1) is made of formed metal sheet sections, and said thermal barriers (13, 14) are joined with said supporting frame and said opposite frame with fasteners, preferably threaded (16, 17), said fasteners seated in the thermal barriers.

12. . The fire-rated closure of claim 11 wherein the supporting frame (11) of said frame is made of channel sections, where at least between one flange of said channel and the web thereof is an obtuse angle, and said thermal barriers (16, 17) are inclined at the surface adhering to the channel flanges, with screws (16) seated in said thermal barriers.

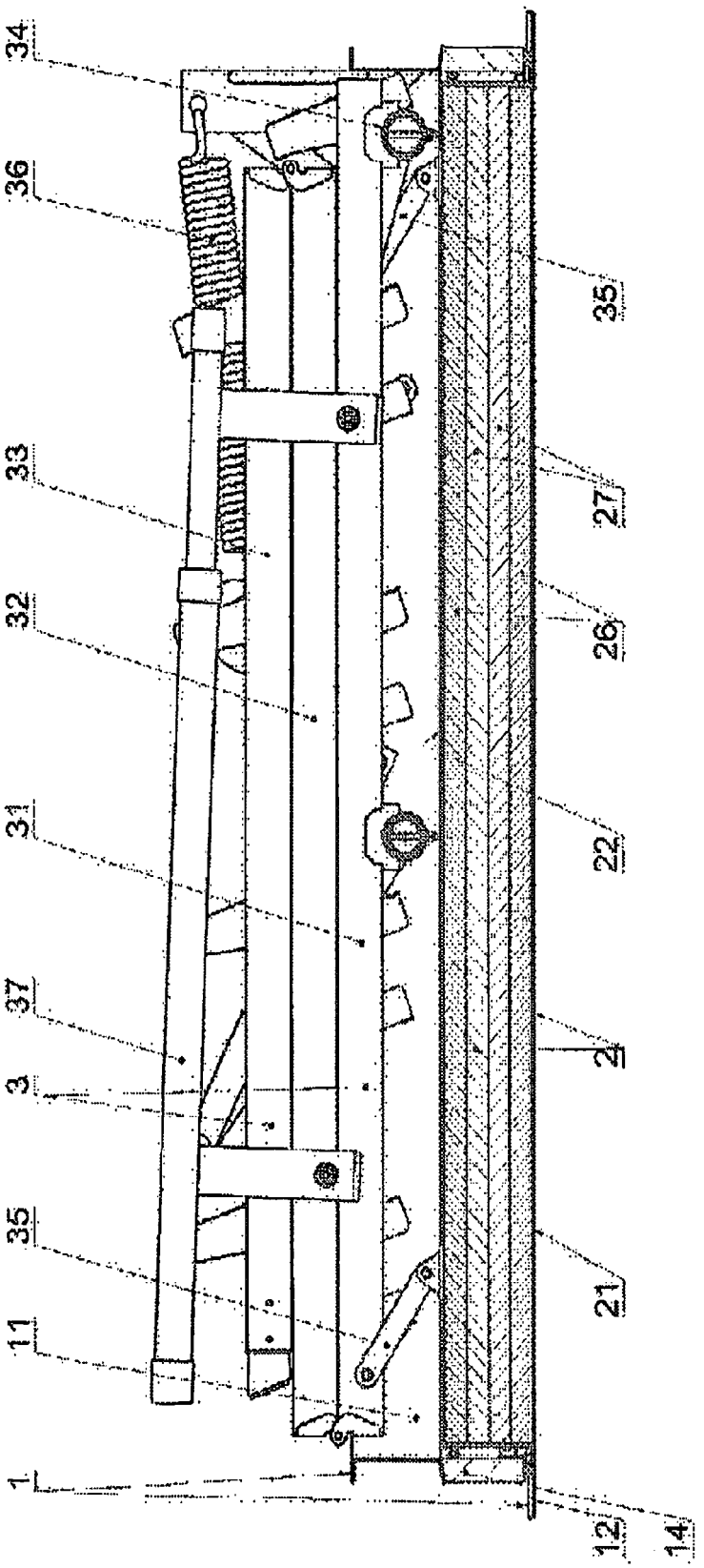

Fig. 1

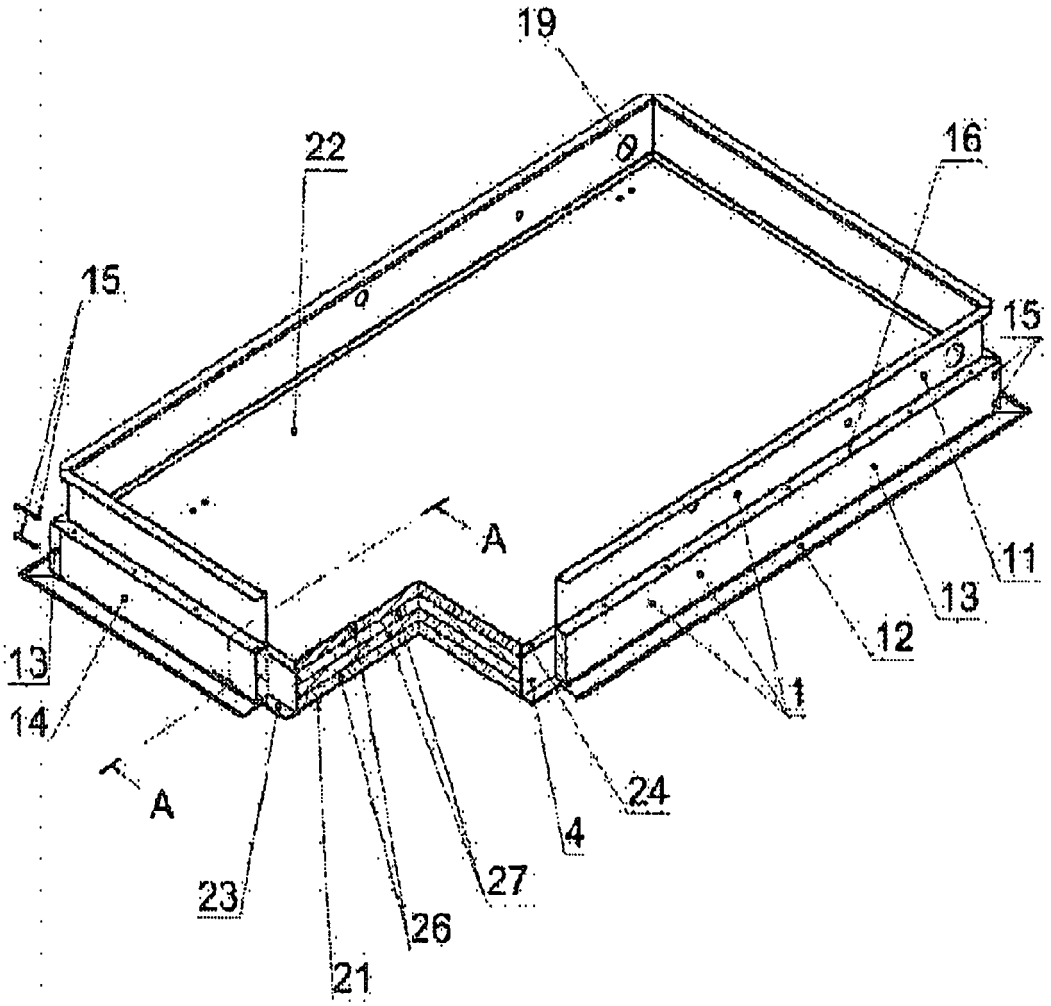

Fig. 2

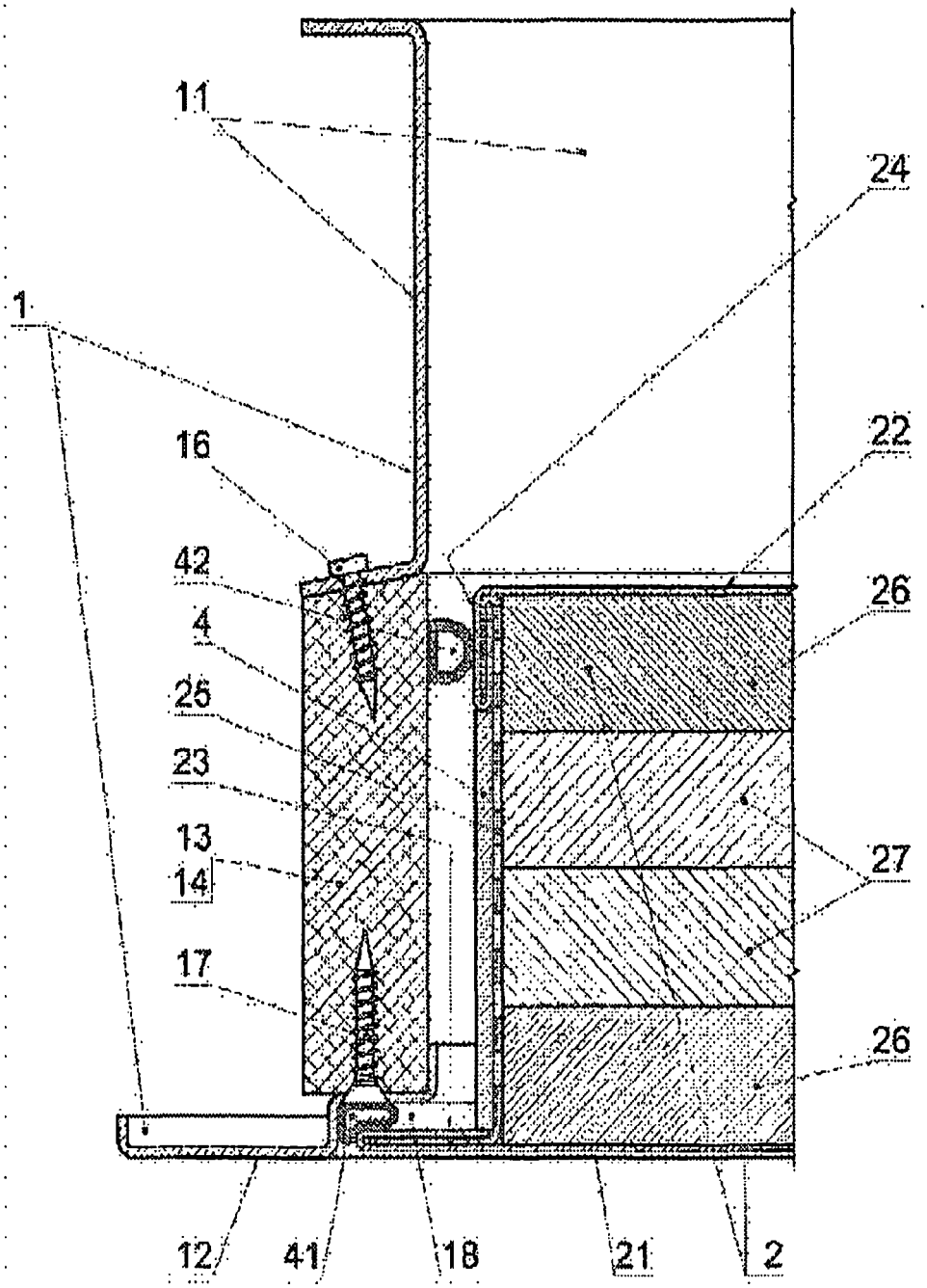

Fig. 3

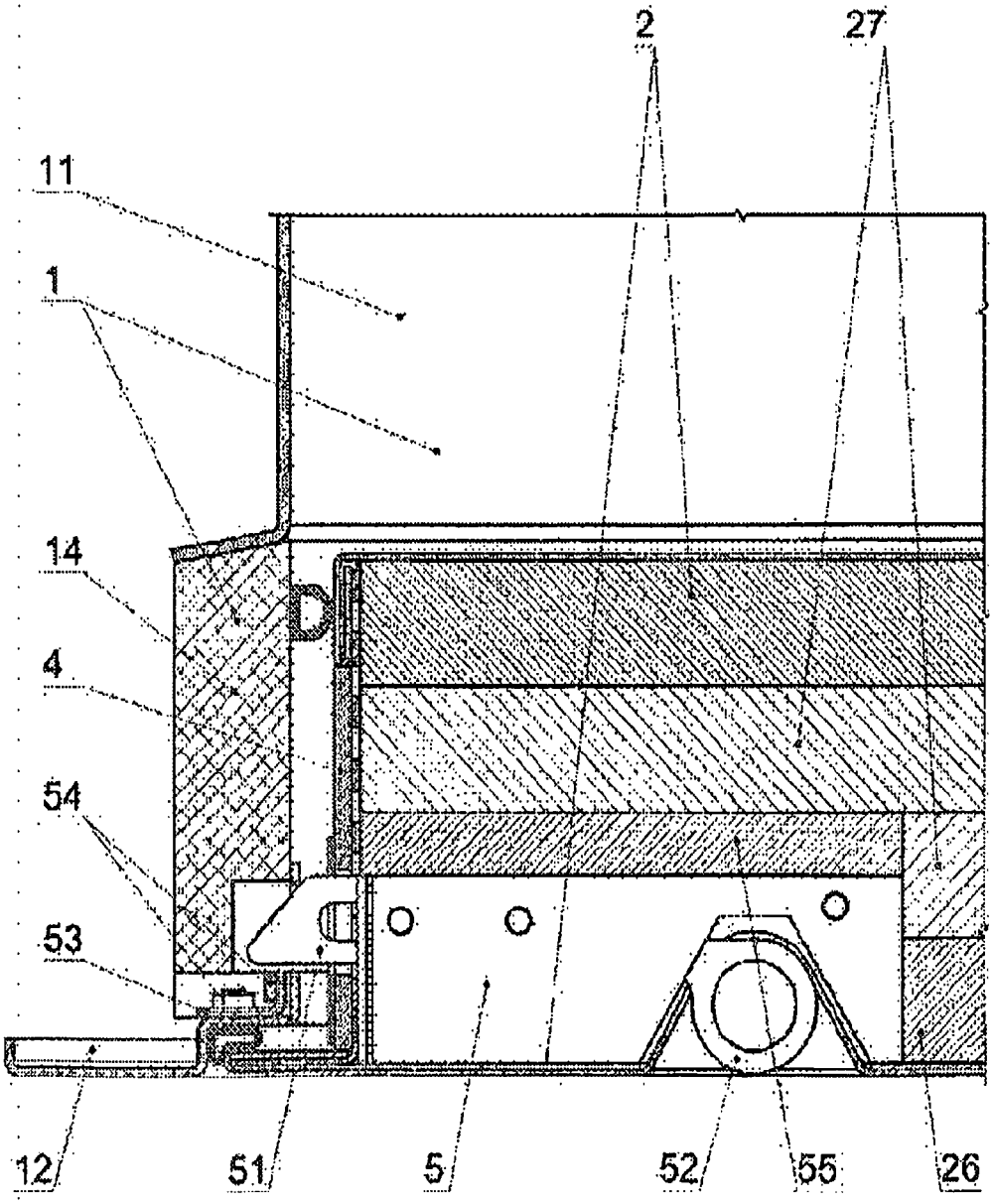

Fig. 4

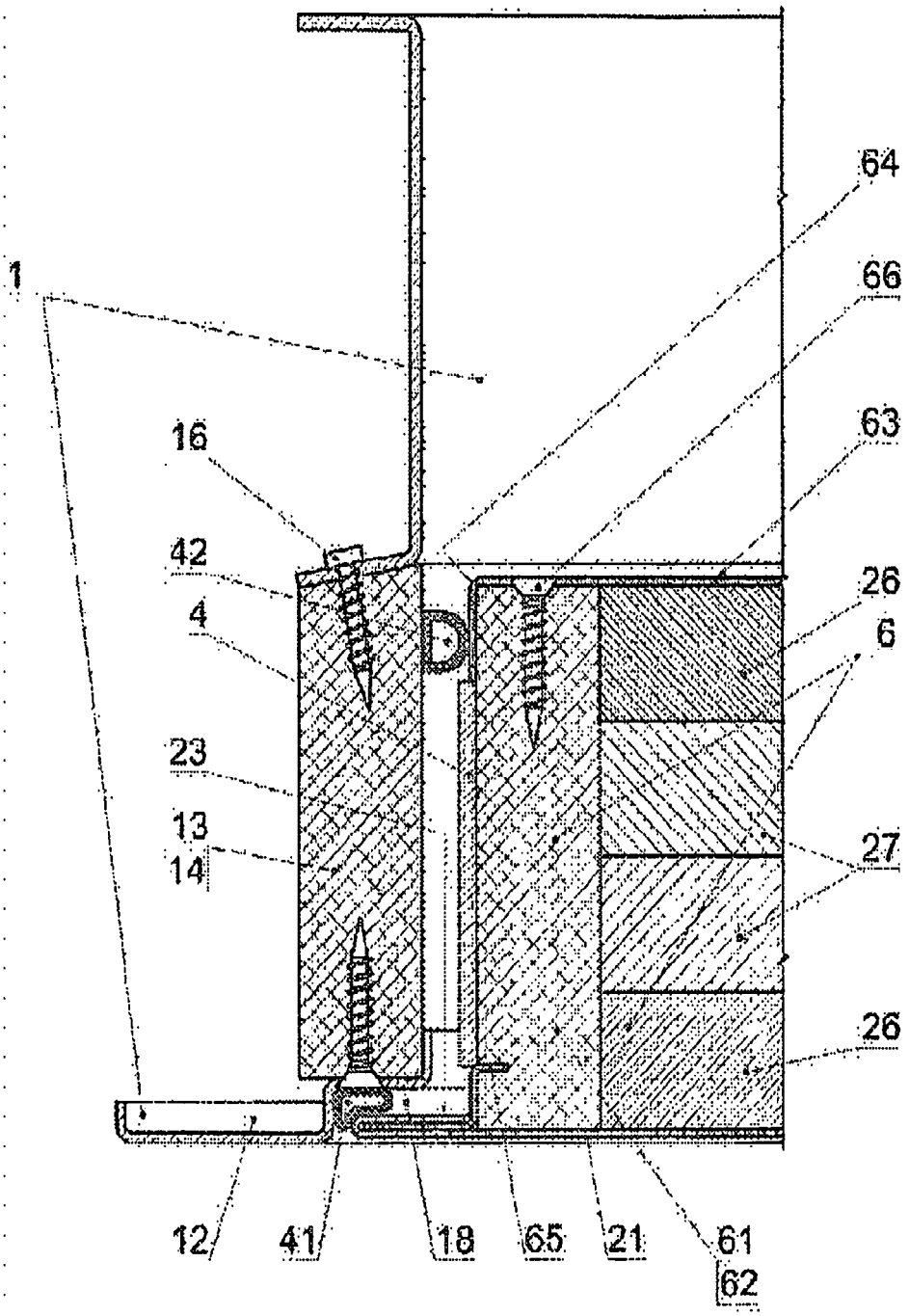

Fig. 5

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EUROPEAN SEARCH REPORT

Application Number
EP 12 00 0044

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TECHNICAL FIELDS SEARCHED (IPC)

E04F
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E06B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	4 April 2012	Fournier, Thomas

CATEGORY OF CITED DOCUMENTS

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