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(54) **Deadbolt socket assembly in a frame, having an increased break-in resistance**

(57) The invention relates to a deadbolt socket immersed in the frame, supported with a brace fixed in a recess, the brace and the deadbolt socket being preferably connected with one another after assembling in the frame, and having a common possibility of a limited ro-

tational movement around an axis away from the deadbolt and fixed in the frame, after exceeding a fixed limit moment of force acting in the direction of pulling the deadbolt socket out of the recess.

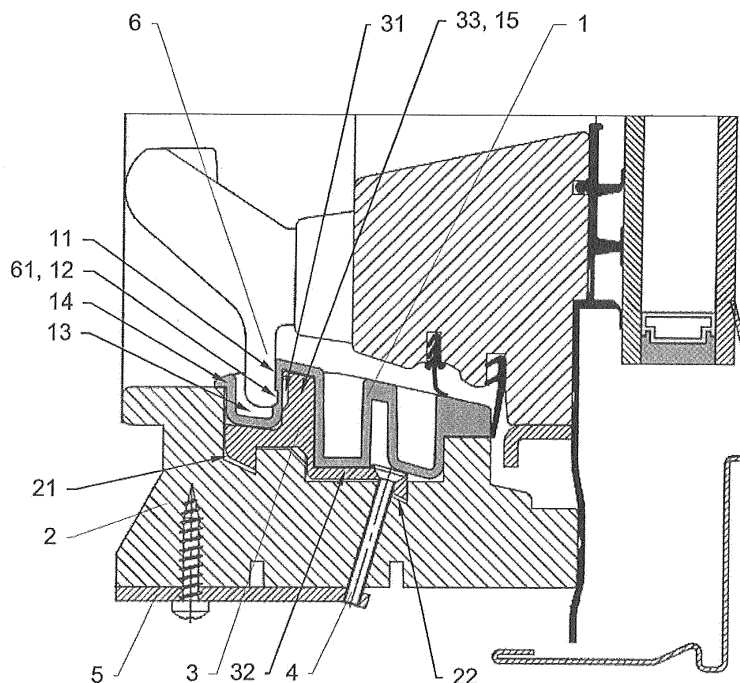


Fig. 2

Description

[0001] The invention relates to a deadbolt socket assembly in a frame, particularly in a roof window frame, the assembly having a reinforced structure and an increased resistance to a break-in from the outside. The assembly according to the invention is used mainly in roof windows with wooden or plastic frames, in which a handle with a deadbolt is being fixed to the sash frame in a position, in which its rotation axis is perpendicular to the surface of the sash. And the deadbolt socket is installed in a recess in the frame.

[0002] Plastic deadbolt sockets are commonly known, used particularly in roof windows, which are immersed in the frame. In a closed position, the deadbolt of the handle installed on the window sash, is placed in a deadbolt recess, thus blocking the possibility to open the sash. These sockets often have additional deadbolt recesses, for slightly ajar window sash position for ventilation. Known deadbolt sockets, made mainly of plastics for aesthetic reasons, are fixed in wooden frames using screws, and in plastic frames, additionally snap fasteners are used. Also, additional fixing and positioning elements are used in the form of a dovetail or a horn pressed into the socket in the frame. Solutions of such a type are simple and cheap, but they have a low resistance to break-in attempts because of low mechanical strength of plastics. In solution with an increased break-in resistance, additional elements reinforcing the deadbolt socket are used. Thus, for instance, patent description No. EP2331781B1 includes solutions used in windows containing wooden elements of the sash and frame, comprising, apart from the deadbolt socket made mainly of plastic, various solutions for metal brackets, reinforcing the working surface of the deadbolt recess. A reinforced deadbolt socket fulfils its function, hindering its breaking or mechanical damaging by force. However, it is not an effective protection from an attempt of breaking the sash with a deadbolt from the outside using a crowbar or a similar tool. A method for such break-in consists in bending the sash member with the handle by force and pulling the deadbolt out of the deadbolt socket.

[0003] A protection known from patent No. PL212637 B1 is much more effective, wherein the deadbolt socket made essentially of plastic is supported from the side immersed in the frame by a metal brace, fixed to the frame. The brace is an angular element, consisting of a fastening base for fixing the brace to the frame, and a brace arm, positioned at an acute angle, about $20^\circ \div 30^\circ$, towards the working surface of the deadbolt recess. Consequently, the pressure of the handle deadbolt, counterbalanced by the reactive force of the working surface of the deadbolt recess supported by the brace arm, generates a moment of force leading to a bending of the brace arm and overlapping of the deadbolt socket over the deadbolt of the handle. Such a solution significantly hardens the possibility to pull the handle deadbolt out of the deadbolt recess by force, in the result of a change in the

resultant direction of the force vector, increasing the value of the reactive force during pulling out. Effectiveness of this solution is high, however it loses its advantages in case of plastic bending of the angular element of the brace. In such case, a repeated attempt to pull the deadbolt out in the way described above does not encounter the resistance constituting the essence of the mentioned solution.

[0004] The aim of the proposed solution is a design of the deadbolt socket assembly in the window frame, particularly a wooden frame, the design enhancing the break-in protection properties of the window lock realised using a rotary handle with a deadbolt, installed in the sash, with the rotation axis perpendicular to the surface of the sash.

[0005] The essence of the invention is constituted by a deadbolt socket immersed in the frame, supported with a brace fixed in a recess, the brace and the deadbolt socket being preferably connected with one another after assembling in the frame, and having a common possibility of a limited rotational movement around an axis away from the deadbolt and fixed in the frame, after exceeding a fixed limit moment of force acting in the direction of pulling the deadbolt socket out of the recess. The moment of force is generated as a result of an attempt to pull the deadbolt out of the deadbolt socket, existence of a kinematic connection of the deadbolt socket with the deadbolt being a necessary condition. The connection is realised by a pressure of the deadbolt to the deadbolt-adjacent surface of the deadbolt socket exerted by a sufficiently high normal force in the closed position of the handle with the deadbolt. Another solution, effective particularly in case when the deadbolt of the handle has a slight pressure to the deadbolt-adjacent surface in the deadbolt socket, is using a quasi-rotary kinematic pair, e.g. in the form of a protrusion in the deadbolt, seated in the socket immersed in the deadbolt-adjacent surface. Thanks to this, during an attempt to force in the window sash from the outside, the deadbolt takes the deadbolt socket along with itself, rotating it around the fixing point of the brace. Such a mechanism protects the deadbolt from being pulled out of the deadbolt socket and thus keeps the window sash in a closed position even when bent significantly, or shifted in relation to the frame and the window sash, in which the mechanism of the handle is installed.

[0006] The deadbolt socket, made preferably of plastic, is an element basically immersed in the frame and equipped with at least one deadbolt recess for mounting the handle deadbolt in a closed position of the sash. The body of the deadbolt socket has a flange resting on the window frame surface, for mounting of the deadbolt socket in the recess in the frame. At its immersed side, the body of the deadbolt socket has an inner recess, adjacent to the deadbolt recess and separated from it by a wall, on which the deadbolt of the handle rests when the window is closed. The other important element of the deadbolt socket assembly is a brace, preferably made of a

material with a significantly higher mechanical strength than the deadbolt socket, the brace consisting of a base and a protrusion. The brace is seated in a shaped recess, fixed via the base to the window frame preferably in one point. The brace is shaped preferably together with the deadbolt socket, and it adheres to the socket when folded, forming a kinematically uniform element of the assembly. Therefore, it is also possible to make one detail, which will comprise functions of the deadbolt socket and the brace, the detail being made of a material with the required strength. The deadbolt socket is seated in its basic part onto the brace, and in its circumference, it is seated onto the side walls of the window frame recess, and it adheres via the flange directly to the window frame surface. The fixing element for the brace is preferably, particularly in the case of a wooden frame, a bolt or screw, driven in via a hole in the base of the deadbolt socket into the window frame body. The protrusion is an element situated in an inner recess of the deadbolt socket and it adheres by its deadbolt-adjacent wall to the wall separating the deadbolt recess from the inner recess in the point where it adheres to the deadbolt of the handle at the opposite side of the wall. Locations of the deadbolt socket and the screw in relation to one another, as a rotation centre for the brace-deadbolt socket system, enables a limited rotary movement around an axis located in the resting point, towards the handle with the deadbolt. The contact point of the fixing element and the brace is at the same time, a rotational resting point for the brace. During normal operation, the deadbolt socket should remain motionless in the recess, therefore it is seated in the recess and onto the protrusion of the brace. In case of a window frame made of plastic profiles, supporting elements at the external circumference in the form of flexible catch pawls in window frame recesses corresponding to them are preferably used for keeping the deadbolt socket in the recess. The deadbolt socket may be additionally fixed by e.g. a screw in a way ensuring its rupture in case of a high force acting in the direction of pulling it out of the recess. The fixing with a screw is particularly important in case of a wooden frame, where the recesses for the catch pawls are hard to made because of properties of wood, moreover, they would not have a sufficient mechanical strength. On the other hand, under small forces occurring during normal operation, the brace is an immovable element maintained in a fixed position by the fixing means. It is only when a defined limit of the moment of force acting towards pulling the deadbolt socket out of the recess is exceeded, a rotational movement of the brace-deadbolt socket occurs, around an axis located in the resting point. The required rotation angle is small and it depends on the length of the rotation arm, or the distance between the deadbolt socket and the deadbolt, and the resting point and the potential deflection of the sash frame and the window frame in the point of the deadbolt during a break-off attempt. In case of solutions known till now, such a break-in attempt caused pulling the deadbolt out of the deadbolt

socket, and consequently, a free opening of the window sash. In case of the solution according to the invention, the deadbolt slipping out pulls the deadbolt socket with it, the socket performing an arc motion around the resting point of the brace. The deadbolt remains in the deadbolt socket even at a very high deflection of the window sash and the window frame, and the window remains closed.

[0007] Embodiments of the subject of the invention, in the form of a deadbolt socket assembly in a roof window with a wooden profile, are shown in the drawing, with the individual Figures showing:

Fig. 1 - A deadbolt socket assembly in the frame made of wood, and the elements of the window sash cooperating with it, drawn as separated, in a view;

Fig. 2 - A cross-sectional view of the deadbolt socket assembly, with the sash closed and the deadbolt in a closed position,

Fig. 3a - A cross-sectional view of the deadbolt socket assembly, with the sash closed and the deadbolt in a closed position; basic geometric dependencies of a rotary kinematic system.

Fig. 3b - A cross-sectional view of the deadbolt socket assembly, with the sash closed and the deadbolt in a closed position; position of the individual elements during an attempt to pull the deadbolt out by force by levering of the window sash.

Fig. 4 - A cross-section of the deadbolt socket assembly with catch pawls fixing the deadbolt socket in the frame of a plastic profile.

Fig. 5 - A cross-sectional view of the deadbolt socket assembly fixed to a wooden frame with an additional screw.

Fig. 6 - A cross-sectional view of the deadbolt socket assembly with a brace, as an external element of the deadbolt socket assembly and seated onto the deadbolt socket.

Fig. 7 - A cross-sectional view of the deadbolt socket assembly, where the deadbolt socket has a transverse catch pawl installed immovably in a hook recess, and the handle has a hook installed co-rotationally with the deadbolt.

[0008] In the first embodiment shown in Figures from Fig. 1 to Fig. 5, the deadbolt socket assembly in the frame consists of a deadbolt socket 1, immersed in the frame 2 made basically of wood, a brace 3 and a connecting element 4, preferably in the form of a screw or a bolt. The connecting element 4 serves the purpose of rotational fixing the brace 3 to the window frame 2. Considering the low mechanical strength of wood, in order to increase

the reliability of the solution, an anchor 5 may be used at the opposite side of the window frame 2, bonding the whole deadbolt socket assembly with the window frame 2 using a connecting element 4, e.g. a bolt. Depending on the size and shape of the anchor 5, it may require additional connecting elements fixing it to the window frame 2. An element of the deadbolt socket assembly which is fixed rotationally in the window sash consists of a handle with a deadbolt 6.

[0009] The brace 3 and the deadbolt socket 1 seated on the brace 3, preferably by pressing-in, have a possibility of a limited rotary movement around the fixing point located in the point of contact of the brace 3 and the connecting element 4 in the recess 21 of the window frame 2.

[0010] A solution for fixing the brace 3, 3', 3" in relation to the window frame 2 is also possible, in which brace 3, 3', 3" is seated rotationally in a docking socket 22 located in the recess 21 of the window frame 2. In such a case, the connecting element 4 is not absolutely necessary and it only serves the purpose of fixing the brace 3, 3', 3" to the window frame 2.

[0011] Rotation of the brace 3 and the deadbolt socket 1 is possible in the direction of pulling the deadbolt socket 1 out of the recess 21. The moment of force originates as a result of an attempt to pull the deadbolt 6 out of the deadbolt socket 1 in the closed position of the handle, and the condition of existence of a kinematic connection of the deadbolt socket 1 with the deadbolt 6 is ensured by pressing of the deadbolt 6 to the deadbolt-adjacent surface 11 of the deadbolt socket 1. As a protection from sliding of the deadbolt 6 out of the deadbolt socket 1, a spline 61 in the deadbolt 6 was used, seated, in the closed position of the handle, in a recess 12 made in the deadbolt-adjacent surface 11. The recess 12 may be made during forming, it may be also formed as a result of pressure of the protrusion 61. The second alternative is possible, because the brace 3 has a niche 31 located directly behind the recess 12 in the deadbolt socket 1. Flexible slight deflection of the wall of the deadbolt-adjacent surface 11, together with the recess 12, caused by a pressure of the protrusion 61 of the deadbolt 6, does not meet the resistance of the brace 3 in the area of the niche 31, resulting in a deeper seating of the protrusion 61, and in consequence, in an increase in the reactive force of the deadbolt socket 1 against the force of the deadbolt 6 acting in the direction of its pulling out of the deadbolt socket 1. During a break-in attempt by pulling the deadbolt 6 out of the deadbolt socket 1 by force, in the proposed solution, the reactive force is big enough to cause a turning moment around the fixing point of the brace 3, leading to a pulling the deadbolt socket 1 out of the recess 21 in the frame 2, while the deadbolt 6 remains in the deadbolt socket 1. Such an operation of the mechanism of the deadbolt socket assembly leads to state, in which, in spite of significant displacement of the window sash with a handle with the deadbolt 6 installed in relation to the window frame 2, the deadbolt 6 remains in the dead-

bolt socket 1 and the sash cannot be open.

[0012] The deadbolt socket 1 is made preferably of plastic and it is an element equipped with at least one deadbolt recess 13 for mounting the deadbolt 6 of the handle in a closed position of the sash.

[0013] The deadbolt socket 1 has a flange 14 resting on the window frame surface 2, for mounting of the deadbolt socket 1 in the recess 21 in the frame 2. At its immersed side, the deadbolt socket 1 has an inner recess 15, adjacent to the deadbolt recess 13 and separated from it by a wall, on which the deadbolt 6 of the handle rests.

[0014] The brace 3 is made of a material with a significantly higher mechanical strength than that of the deadbolt socket, e.g. Zamak, and has two basic elements: a base 32 and a protrusion 33, in which the aforementioned niche 31 is located. The brace 3 is seated in the recess 21 and fixed via the base 32 to the window frame 2. The brace 3, together with the deadbolt socket 1, form a kinematically uniform element of the assembly.

[0015] The deadbolt socket 1 is seated in the recess 21 basically on the brace 3, while at its external circumference, it adheres via the flange 14 directly to the window frame surface 2.

[0016] In case of the window frame 2 made of plastic profiles, shown in Fig. 4, flexible catch pawls 16 at the external circumference along the flange 14, are used for maintaining the deadbolt socket 1 in the recess 21, the catch pawls being seated in the voids of the window frame 2 profile, at the edges of the profile walls.

[0017] In case of the window frame 2 made of wood, shown in Fig. 5, the deadbolt socket 1 is fixed with an additional screw 7 or other connecting element, driven in via a hole in the base of the deadbolt socket 1 and in the base 32 of the brace 3, to the window frame 2 in the recess 21 in a way ensuring rupture of this fixing in case of a high force acting in the direction of pulling the deadbolt socket 1 out of the recess 21. In justified cases, fixing with a screw 7 may be also used when the deadbolt socket 1 is seated in the frame 2 made of extruded plastic profiles.

[0018] Exceeding of a defined limit of the moment of force, acting in the direction of pulling the deadbolt socket 1 out of the recess 21, causes a rotational movement of the brace 3 - deadbolt socket 1 assembly around an axis located in the mounting point of the brace 3 using a connecting element 4. The mounting point of the brace 3, determining its axis of rotation, is shifted in relation to deadbolt-adjacent surface 11, in the outward direction in relation to the sash and basically in the direction of opening of the window in relation to the window frame 2, and their position towards one another is defined by angle α in relation to the plane of the sash and arm length l of the so-defined rotary system (Fig. 3a). The required rotation angle α is small and it depends on the length of the rotation arm l , or the distance between the contact point of the deadbolt socket 1 and the deadbolt 6 from the mounting point, and the maximum possible deflection

of the window sash and the window frame 2 in the location of the deadbolt 6 (Fig. 3b).

[0019] In the second embodiment shown in Fig. 6, the deadbolt socket assembly in the frame is characterised by the fact that the brace 3' is an external element of the deadbolt socket assembly and it is seated on the external surface of the deadbolt socket 1'. Functioning of the kinematic system shown in the first embodiment, composed of the protrusion 61 in the deadbolt 6 and the recess 12 in the deadbolt-adjacent surface 11, is realised here by the transverse protrusion 33' partially overlapping the hole of the deadbolt recess 13' at the side of the deadbolt-adjacent surface 11' for a distance preferably equal to the height of the protrusion 61' in the deadbolt 6' of the handle.

[0020] In the third embodiment shown in Fig. 7, the deadbolt socket assembly in the frame has a transverse catch pawl 17'' installed immovably in a hook recess 18'' of the deadbolt socket 1'', and the handle has a hook 8'' fixed co-rotationally with the deadbolt 6'', preferably positioned in parallel to it, hooking the transverse catch pawl 17'' in the closed position of the handle. These elements ensure functioning of the kinematic system similar to that shown in the first embodiment, the system being composed of the protrusion 61 in the deadbolt 6 and the recess 12 in the deadbolt-adjacent surface 11. The brace 3'' has preferably a shape and dimensions of the brace 3 shown in the first embodiment. The hook recess 18'' may have a size, which allows for using it as an additional deadbolt recess for positioning the sash in a slightly ajar position for ventilation purposes.

Claims

1. A deadbolt socket assembly in the roof window frame, comprising a deadbolt socket, made essentially of plastic, immersed in the frame, the socket having at least one deadbolt recess formed from the inner side, in which a deadbolt of a handle fixed rotationally in the window sash, is located, in a closed position, the deadbolt socket being reinforced with a brace seated and fixed in the recess made in the frame, and the deadbolt socket is seated immovably in relation to the brace, the assembly **characterised in that** the brace (3, 3', 3'') is an element connected immovably with the deadbolt socket (1, 1', 1'') and mounted rotationally in a surface basically perpendicular to the profile of the window sash of the window frame (2).
2. The deadbolt socket assembly in the frame according to claim 1, **characterised in that** the brace (3, 3') and the deadbolt socket (1, 1', 1'') form an assembly of elements having a possibility of forced common rotation in relation to the window frame (2) in the direction of pulling out of the recess (21), after applying a defined force or a moment of force.

3. The deadbolt socket assembly in the frame according to claim 2, **characterised in that** the brace (3, 3', 3'') is fixed rotationally using at least one mounting point located in the axis of rotation passing through the mounting point of the brace (3, 3', 3').
4. The deadbolt socket assembly in the frame according to claim 3, **characterised in that** the mounting point is located at the contact point of the base (32) of the brace (3) and the connecting element (4) in the recess (21) of the window frame (2).
5. The deadbolt socket assembly in the frame according to claim 2, **characterised in that** the brace (3, 3', 3'') is seated rotationally in the socket 22 located in the recess (21) of the window frame (2).
6. The deadbolt socket assembly in the frame according to any of the preceding claims, **characterised in that** the deadbolt socket (1, 1', 1'') has an inner recess (15) at the side immersed in the frame (2), adjacent to the deadbolt recess (13, 13') and separated from it by a wall having a deadbolt-adjacent surface (11, 11'), on which the deadbolt (6, 6', 6'') rests in the closed position of the handle, and the brace (3, 3'') has a base (32) and a protrusion (33), entering into the inner recess (15) of the deadbolt socket (1, 1', 1'').
7. The deadbolt socket assembly in the frame according to claim 2, **characterised in that** the point determining the rotation axis of the brace (3, 3', 3'') in relation to the window frame (2) is shifted in relation to the deadbolt-adjacent surface (11, 11') or the transverse catch pawl (17'') in the outward direction in relation to the sash and basically in the direction of opening of the window in relation to the window frame (2), and their position towards one another is defined by angle α in relation to the plane of the sash and the arm length / of the so-defined rotary system.
8. The deadbolt socket assembly in the frame according to claim 7, **characterised in that** angle α is greater than or equal to zero.
9. The deadbolt socket assembly in the frame according to any of the preceding claims, **characterised in that** the rotation plane of the brace (3, 3', 3'') run basically through the deadbolt (6, 6', 6'') of the handle in a closed position and through the mounting point of the brace (3, 3', 3'').
10. The deadbolt socket assembly in the frame according to any of the claims from 1 to 9, **characterised in that** the assembly of elements consisting of the brace (3, 3', 3'') and the deadbolt socket (1, 1', 1'') has catch pawls (16) seated in the recess (21) in the frame (2), allowing for pulling the deadbolt socket (1,

1', 1") out of the recess (21) after applying a defined force or a moment of force.

11. The deadbolt socket assembly in the frame according to any of the claims from 1 to 9, **characterised in that** the assembly of elements consisting of the brace (3, 3', 3") and of the deadbolt socket (1, 1', 1") is fixed in the recess (21) in the frame (2) using a screw (7) which enables to break the fixing after applying a defined force or a moment of force. 5 10
12. The deadbolt socket assembly in the frame according to any of the preceding claims, **characterised in that** the deadbolt (6, 6') of the handle has a spline (61, 61') and the deadbolt socket (1, 1') has a recess (12), serving the purpose of flexible seating of the protrusion (61, 61') in the closed position of the handle. 15
13. The deadbolt socket assembly in the frame according to claim 12, **characterised in that** the brace (3) has a niche (31) located directly behind the recess (12) in the deadbolt socket (1). 20
14. The deadbolt socket assembly in the frame according to claims 2 and 12, **characterised in that** the brace (3') is an external element of the deadbolt socket assembly and it is seated at the exterior of the deadbolt socket (1'), and it has a transverse protrusion (33') partially overlapping the hole of the deadbolt recess (13') at the side of the deadbolt-adjacent surface (11') for a distance preferably equal to the height of the protrusion (61') in the deadbolt (6') of the handle. 25 30 35
15. The deadbolt socket assembly in the frame according to claims 1 do 9, **characterised in that** it has a transverse catch pawl (17") installed immovably in a hook recess (18") of the deadbolt socket (1"), and the handle has a hook (8") fixed co-rotationally with the deadbolt (6"), hooking the transverse catch pawl (17") in the closed position of the handle. 40 45 50 55

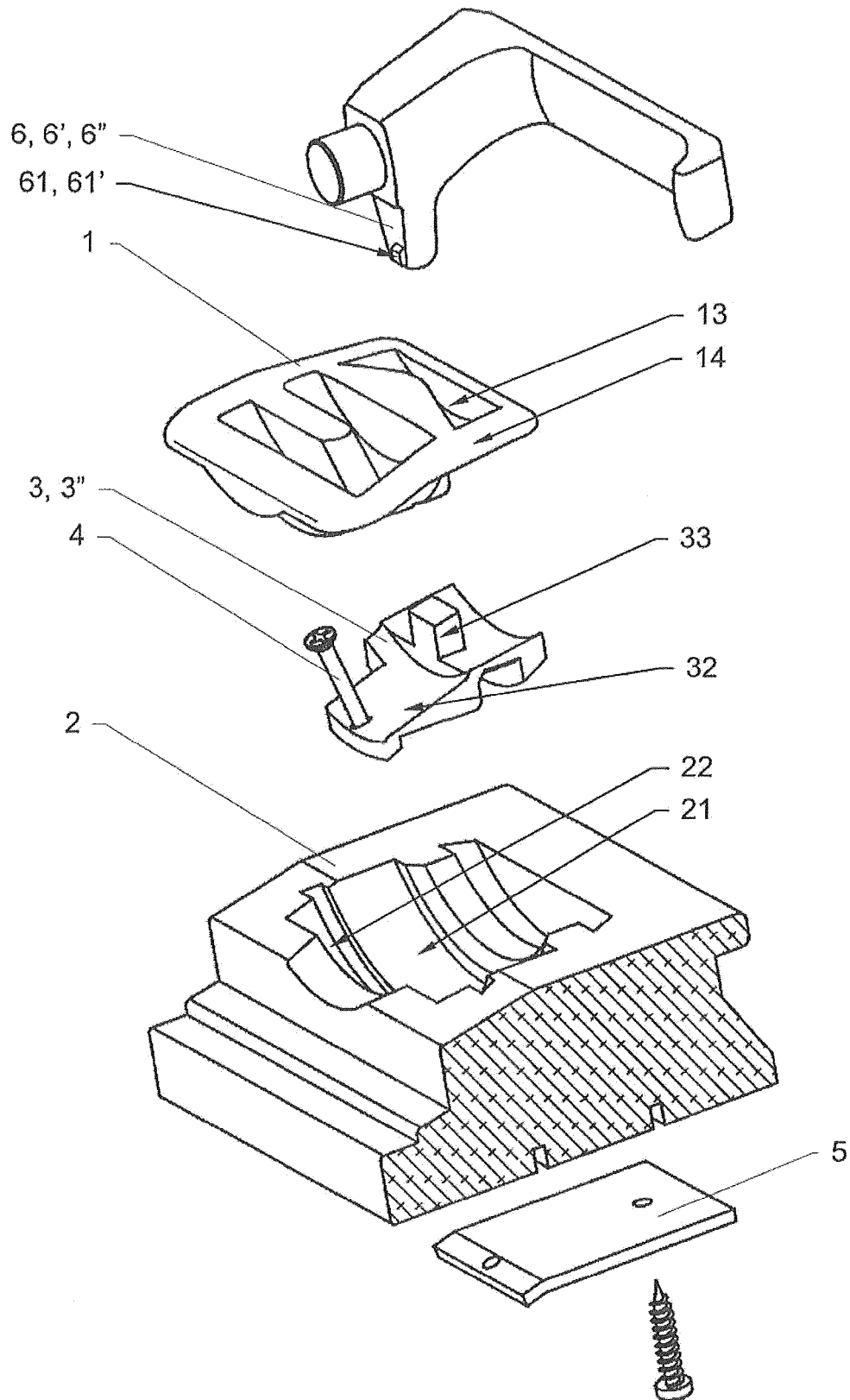


Fig. 1

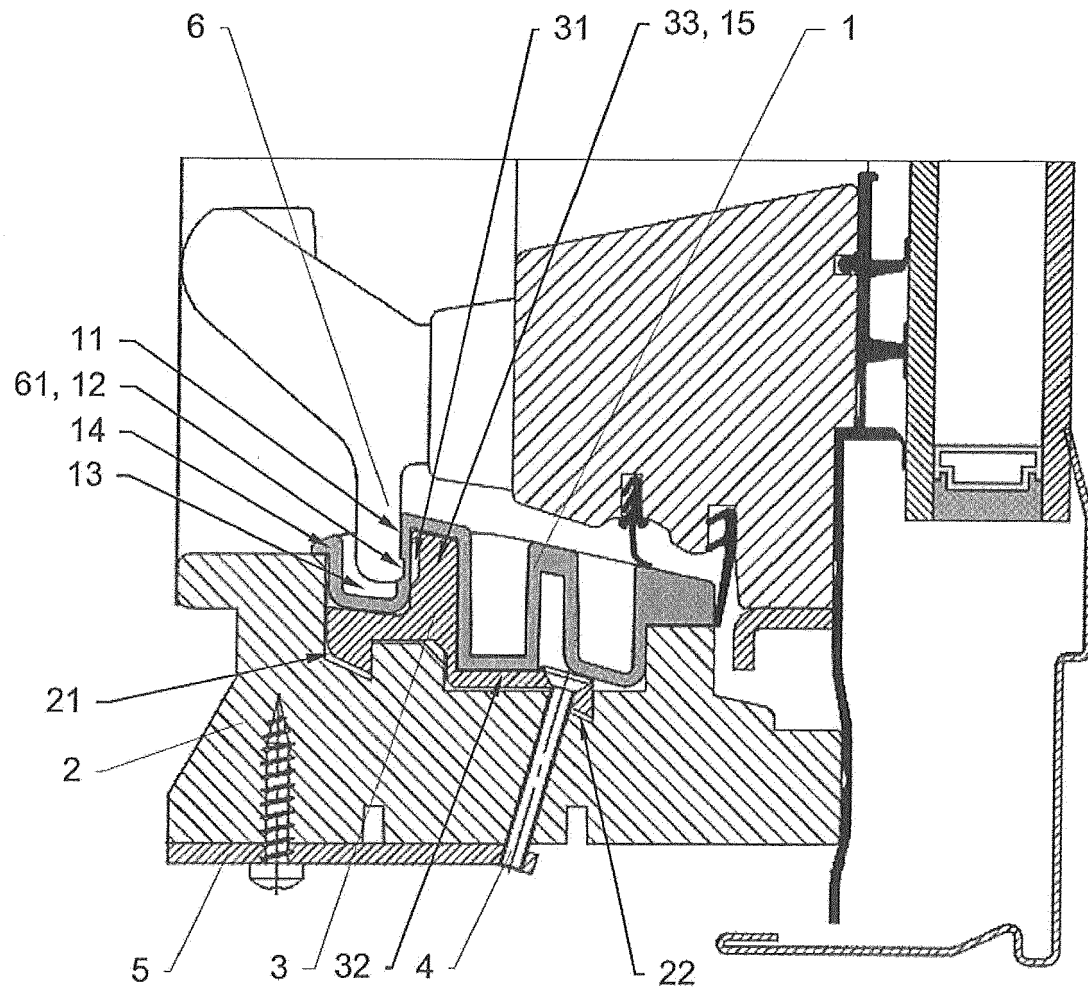


Fig. 2

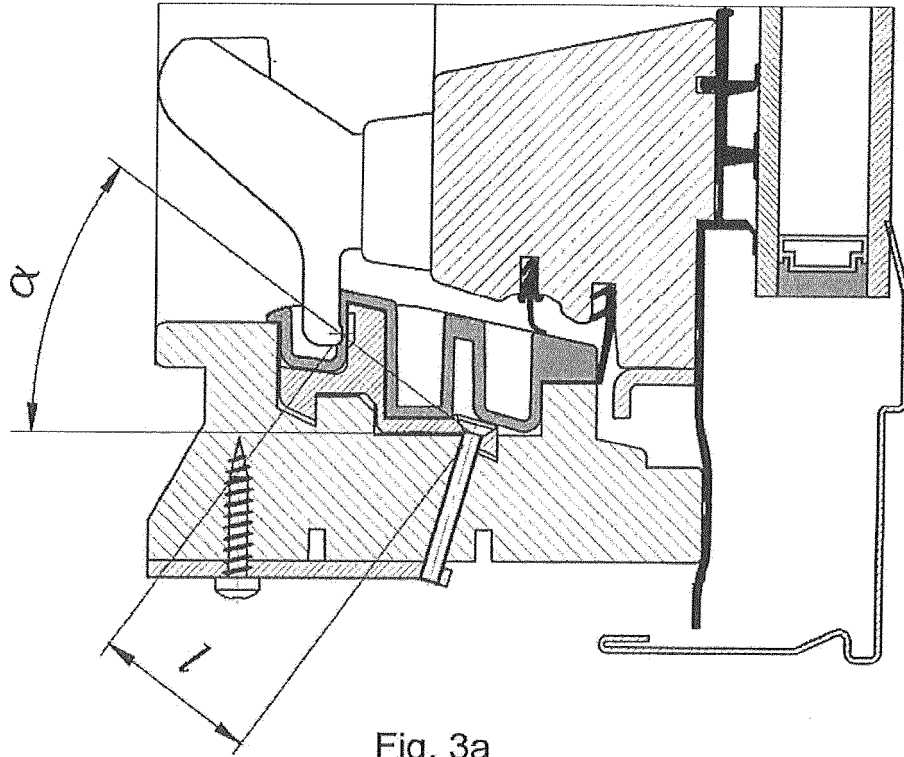


Fig. 3a

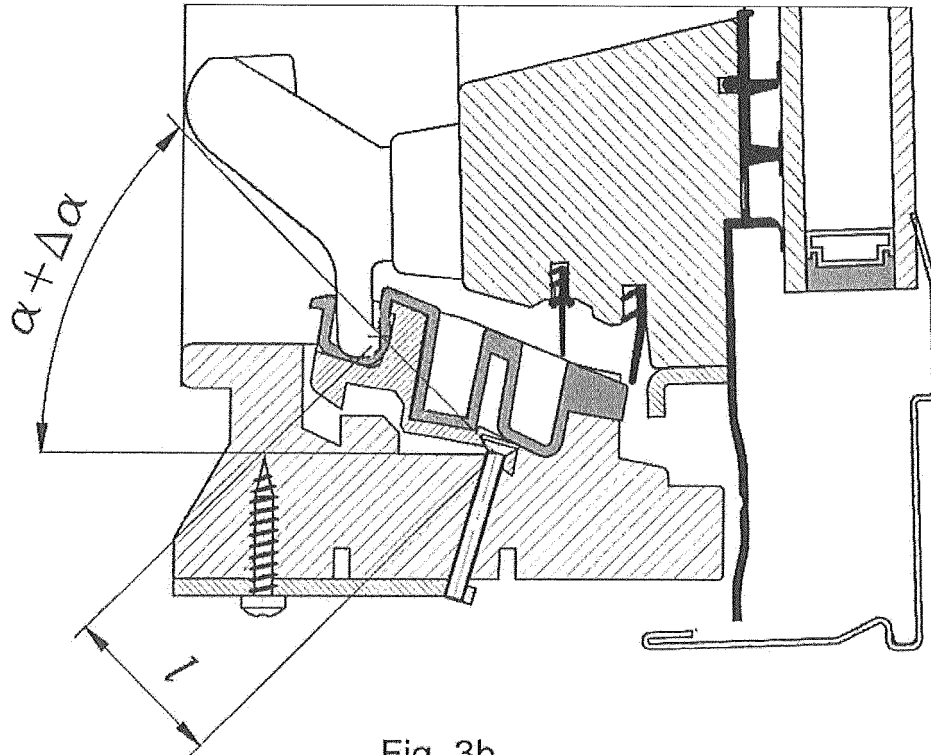


Fig. 3b

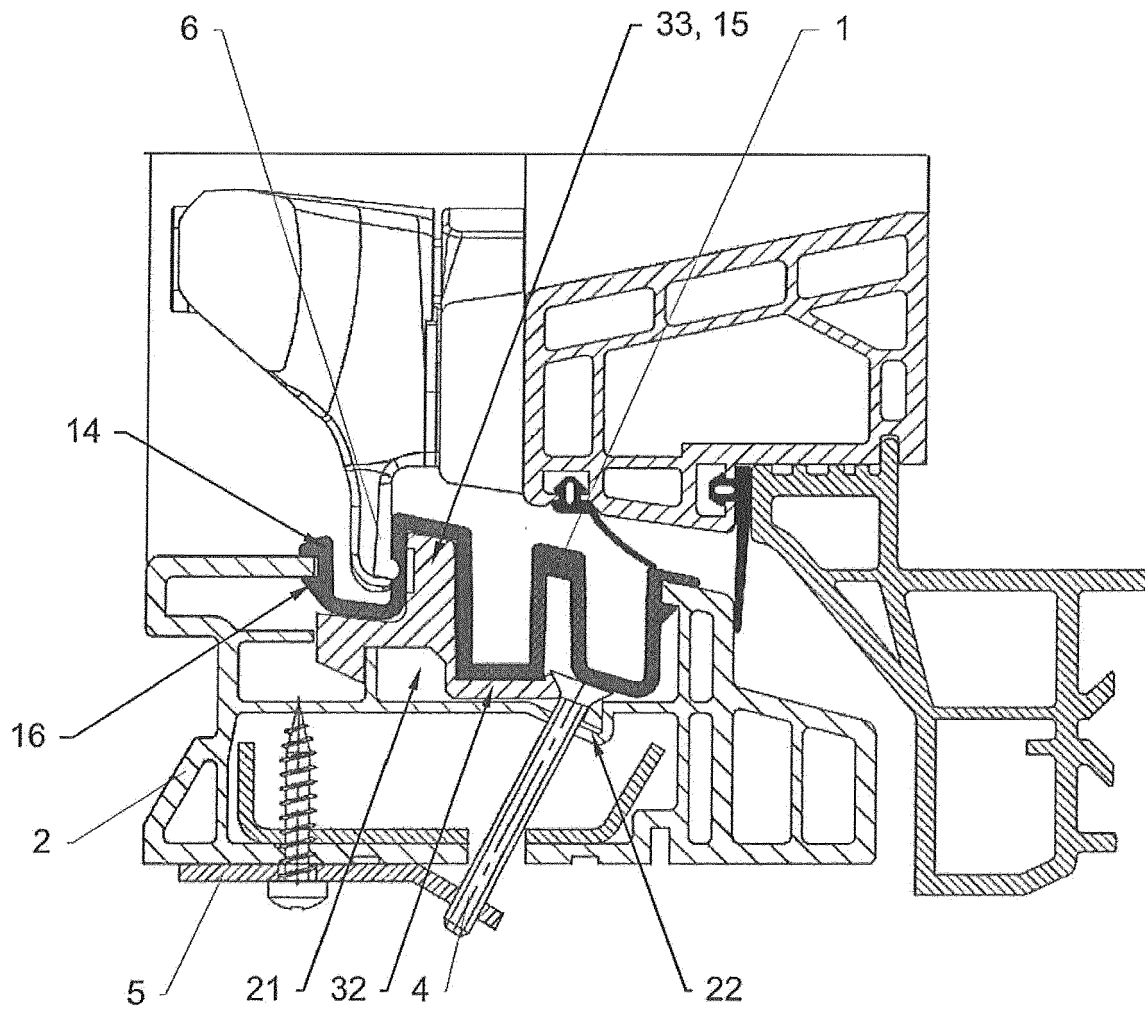


Fig. 4

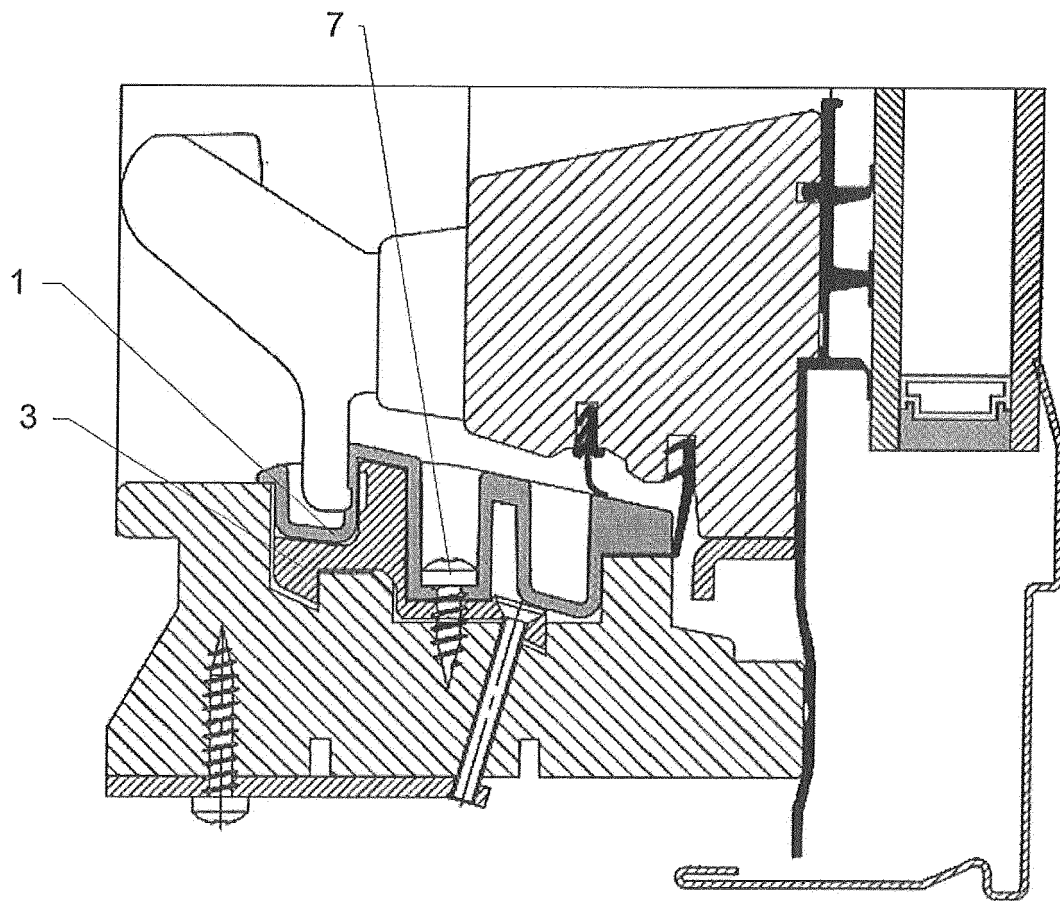
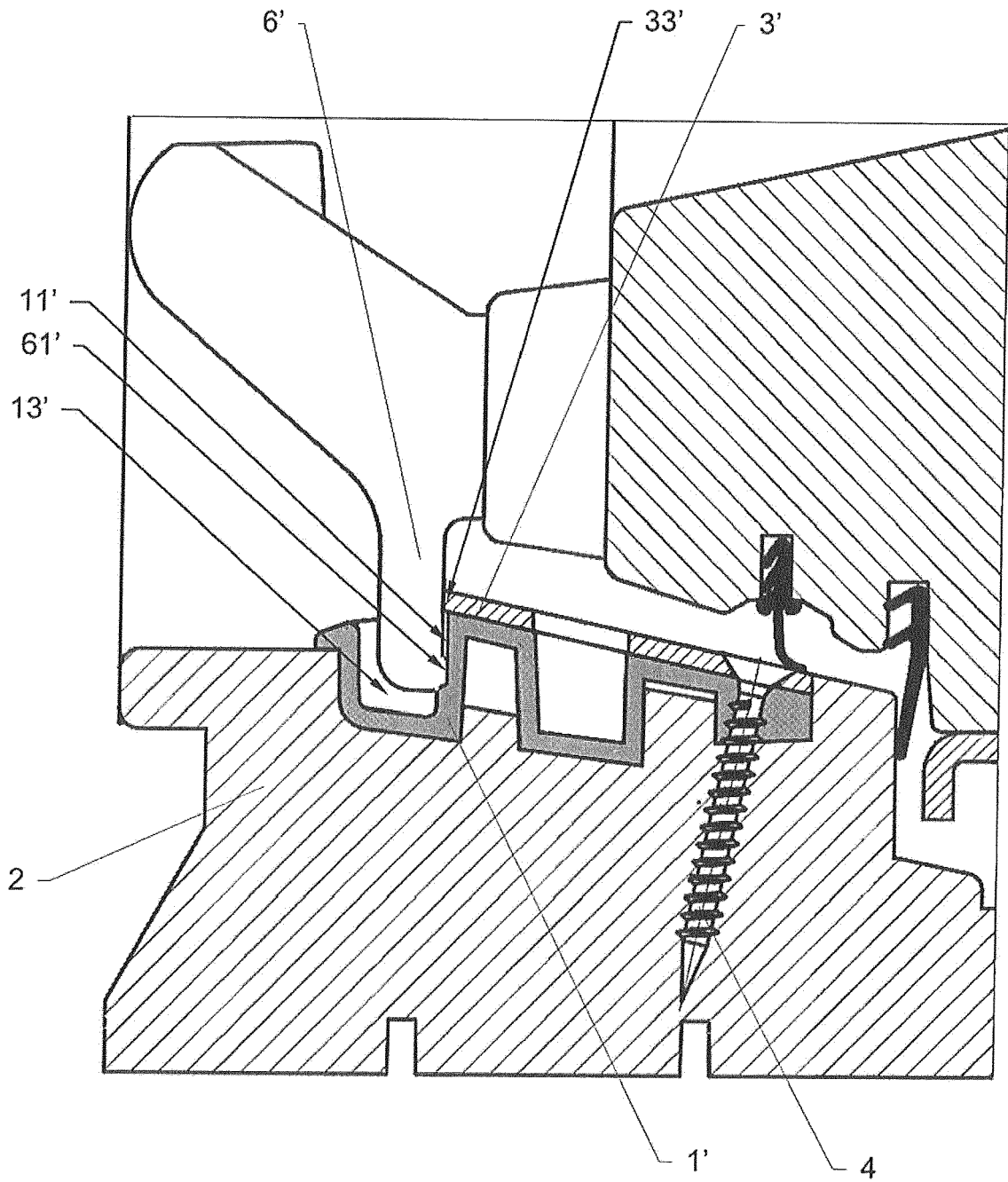


Fig. 5



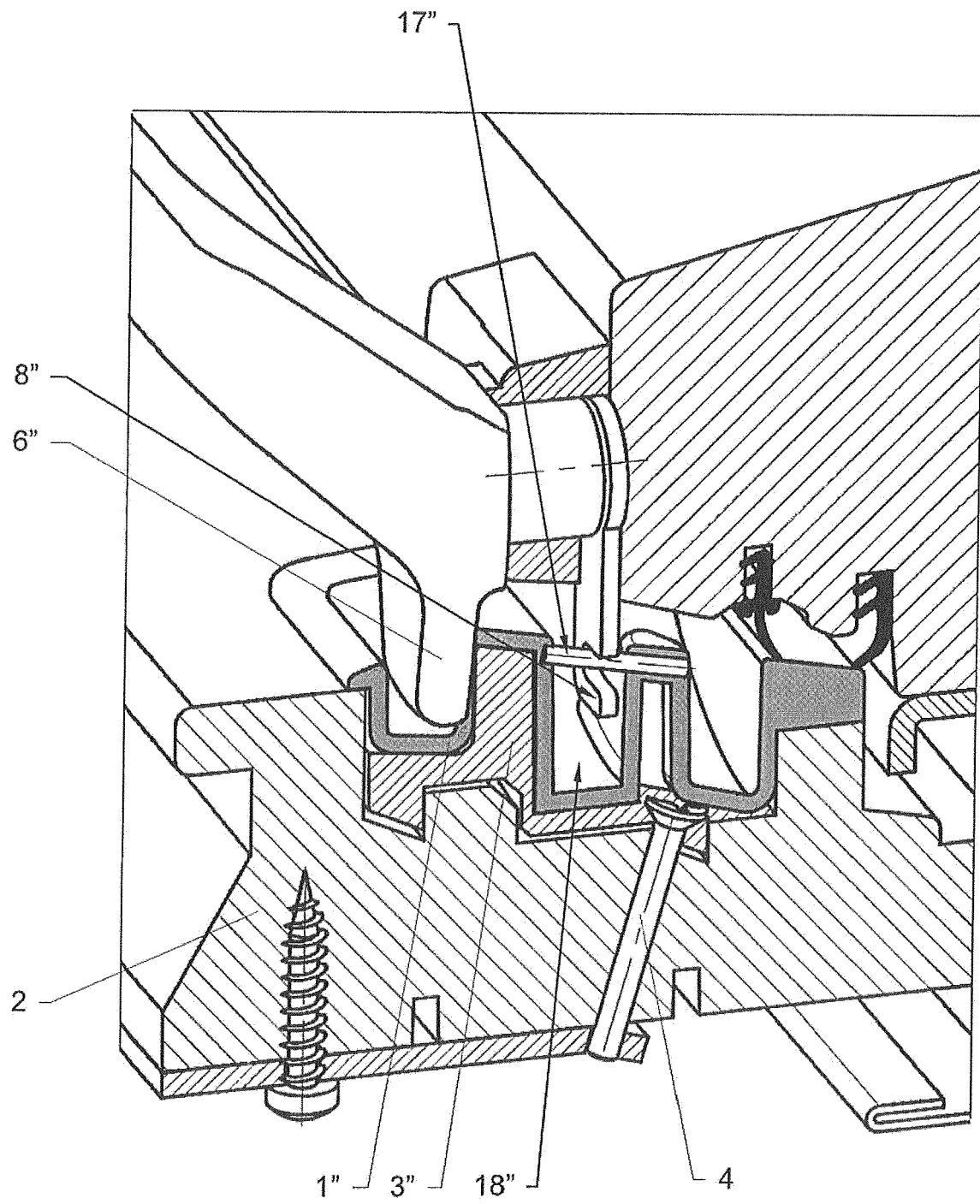


Fig. 7

REFERENCES CITED IN THE DESCRIPTION

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