(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 587 690 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
01.01.2020 Bulletin 2020/01

(51) Int Cl.:
E04B 5/12 *(2006.01)* ***E04F 15/024*** *(2006.01)*
E04G 23/02 *(2006.01)*

(21) Application number: **19180831.0**

(22) Date of filing: **18.06.2019**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(30) Priority: **25.06.2018 DK PA201870437**

(71) Applicant: **Bygherren ApS**
2100 København Ø (DK)

(72) Inventor: **Sauer, Silas Ohm**
2100 Copenhagen Ø (DK)

(74) Representative: **Holme Patent A/S**
Valbygårdsvej 33
2500 Valby (DK)

(54) AN ADJUSTING SCREW, AN ASSEMBLY AND A METHOD FOR LEVELLING AN OUT-OF-LEVEL FLOORING

(57) An adjusting screw (14;14') having a shank (22) with a screw tip (19) and an external threading (23) extending at least a distance from the screw tip (19) towards a levelling end part (18) with a levelling end (13) has a lengthwise extending blind hole (17) and a plug (16) accommodated inside the blind hole (17) for securing a first fastener (15). A plurality of adjusting screws (14;14') is utilised in an assembly and a method adapted for levelling an out-of-level flooring, which the assembly comprises a plurality of elongate levelling profiles (7;28;41) and bush mountings (34;34'). Once existing top- and/or sub-flooring (4) is removed and pugging (6) and floor joists (2) left in place. Adjusting screw mounting holes (10) are drilled in floor joists (2) and the plurality of adjusting screws (14;14') are screwed into the adjusting screw mounting holes (10) until their free levelling ends (13) are at level. Then the plurality of elongate levelling profiles (7;28) are arranged on top of the floor joists (2) with the first mounting holes (8) aligned with the openings of the blind holes (17), and first fasteners (15) screwed into the plugs to secure the elongate levelling profiles (7;28) to the floor joists (2). The new flooring is mounted crosswise the elongate levelling profiles (7;28) .

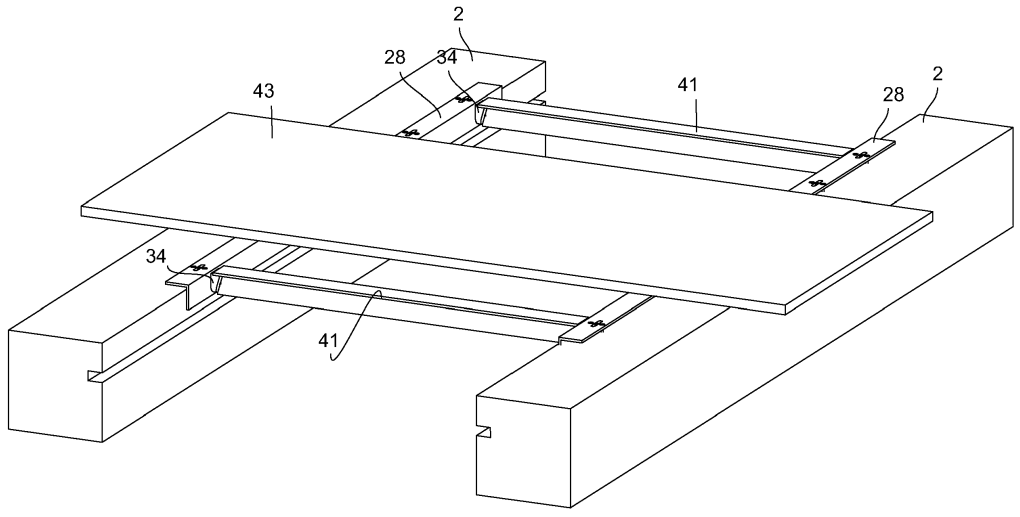

Fig. 20

EP 3 587 690 A1

Description

[0001] The present invention relates to means and a method to level a slanted or sloping floor. In particular the present invention relates to an adjusting screw having a shank with a screw tip and an external threading extending at least a distance from the screw tip towards a levelling end part with a levelling end.

[0002] The invention also relates to an assembly adapted for levelling an out-of-level floor and a method of levelling an out-of-level floor.

[0003] Floors that slope and slant are common in old houses. Over the course of the floor it can slope a lot. A deviation of e.g. 5-10 cm over an about 5 m wide floor is not uncommon. The floor itself might be flat though but many floors in old building also have sags or dips.

[0004] Floors not being levelled up are however a problem to most people, e.g. when placing furniture and walking on the floor. but conventional flooring restoration methods are often not easy to use in old buildings without removing pugging.

[0005] The flooring structure rest on floor joists and in the cavities between the floor joists a filler layer is provided. In old buildings this filler layer is typically remains from the construction process, - remains such as construction rubble, gravel, slag, brick fragments, mortar and clay.

[0006] It has been realized by the Department of Cultural heritage, Transformation and Restoration at The Royal Danish Academy of Fine Arts Schools of Architecture, Design and Conservation that filler layers, in particular filler layers including clay, - in the following description filling layers having clay content are in general denominated "pugging" -, in general should never be removed from the floor structure of old buildings. The pugging is laid on boards, - in the following denominated "pugging boards" -, between floor joists.

[0007] Pugging efficiently prevents access of moist to the adjacent attic joist floor and/or floor framework, thus prevents rot and contributes in controlling indoor climate. Further advantages of puggings are the excellent fire retardant and good sound absorbing qualities. Due to being construction remains the filling layers are also inexpensive, sustainable, reusable and have lasting quality and long useful life.

[0008] The presence of pugging and pugging boards is however a challenge when levelling of the floor needs to be undertaken. The clay filling takes up space needed for carrying out conventional levelling, such as installing new floor joists. So conventional levelling methods cannot be carried out, or only be carried out with difficulties and using expensive process and a lot of time without removing said pugging.

[0009] It is a main aspect of the present invention to provide an alternative way of levelling out-of-level floors.

[0010] It is yet an aspect of the present invention to provide an assembly and a method of the kind mentioned in the opening paragraph by means of which levelling out-of-level floors can be done without removing any of the pugging and the pugging boards.

[0011] It is yet an aspect of the present invention to provide an assembly and a method of the kind mentioned in the opening paragraph the use of which does not notable raise the plane of the final floor.

[0012] It is yet an aspect of the present invention to provide an assembly and a method of the kind mentioned in the opening paragraph which is faster and more convenient to use by the carpenter or other worker than existing means and methods.

[0013] It is yet an aspect of the present invention to provide a new adjusting screw adapted for use in levelling flooring, in particular flooring in old buildings.

[0014] The novel and unique whereby these and other aspects are achieved according to the present invention consist in that that the levelling end part of the adjusting screw has a lengthwise extending blind hole and a plug accommodated inside the blind hole for securing a first fastener inside the blind hole.

[0015] The novel adjusting screw has an external threading that advantageously serves to locate and secure the adjusting screw firmly into another object, e.g. a wooden object, such as a floor joist, in a desired arbitrary and appropriate depth selected to level up a flooring.

[0016] A levelling length of the adjusting screw, i.e. a part of the levelling end part, can easily be left to remain protruding from the other object. The levelling lengths of the plurality of adjusting screws are hereby adjusted appropriately and individually, simply by screwing the adjusting screws more or less into the other object, e.g. the wooden floor joists, so that the levelling end parts of the adjusted adjusting. The protruding free levelling ends of the levelling end parts opposite the screw tip are this way arranged in a common level plane whereby any slanting or sloping flooring can be made level again.

[0017] The protruding free levelling end of the adjusting screw may be flat for improved support of any object placed upon it. The tendency that other objects, that are placed on the protruding free levelling ends of the plurality of adjusting screws, rest unstable on the protruding free levelling ends can be substantially reduced by the free levelling ends of the adjusting screws being flat.

[0018] First fasteners can be screwed into a lengthwise extending blind hole having a plug, e.g. a plastic plug, accommodated inside said blind hole to subsequently mount another object on top of the protruding free levelling ends of the

adjusting screws respective. The plug may expand more or less when the first fastener is screwed into it to firmly anchor said first fastener, and thus the object placed at the flat free levelling end of the respective adjusting screw.

[0019] The adjusting screw may additionally be configured with one or more of the features selected from

- the adjusting screw is headless,
- the adjusting screw has the same largest exterior diameter at the free levelling end and at the threading,
- the blind hole has an enlargement at the free levelling end opposite the screw tip, which enlargement has a cross-sectional outline selected to engage a screw tool to screw the adjusting screw inside another object, such as a floor joist, and preferably the plug does not extend into the enlargement,
- the enlargement is a hex socket for use with a hex key,
- the plug is a plastic plug, preferably a nylon plug,
- the adjusting screw has a marking at or along a distance from the screw tip to indicate a minimum depth the adjusting screw must be screwed into the other object, such as into a floor joist,
- the adjusting screw has a length that is at least 5 times larger, preferably at least 8 times larger, and more preferred at least 8 times larger than its largest exterior diameter,
- the blind hole has a hole diameter that is about half the diameter of the levelling end part, and/or
- the depth of the blind hole is at least 20% of the length of the adjusting screw.

[0020] In a preferred embodiment an adjusting screw has no parts that protrudes radially beyond the crests of the external threading, nor parts that protrudes axially above the flat free levelling end, which axially protruding parts can be an obstacle when placing another component at the flat free levelling ends of the adjusting screws, as well as an obstacle that takes up space for additional fasteners in the vicinity of the perimeter of the flat free levelling end of the adjusting screw.

[0021] The plug may be loosely arranged in the blind hole or be fixed to the blind hold. The first fastener is screwed into the blind hole to secure another object on top of the adjusting screw after the height of the adjusting screw that is exposed from the floor joist has been established. So the carpenter may fit the adjusting screw with the plug or the plug may be reinserted. A nylon plug may provide a solid anchoring of first fastener to the plug and thus to the adjusting screw. The plug may be manufactured by other kinds of material. Preferred materials are materials that are resilient but compact to accept and firmly fasten the first fastener. Preferred material may at the best be durable, be resistant to fungi, mold, and rot and chemicals, be moist repellent and melt, not burn. The first fastener is preferably a self-cutting screw. The cross-section of the blind hole may be polygonal to prevent rotation of the plug when the first fastener is screwed into it. If the plug is fixed inside the plug, e.g. by gluing, any cross-section of the blind hole may be implemented, including circular. So the blind hole is the female part of the adjusting screw that receives the male plug adapted for screw driving the first fastener.

[0022] The adjusting screw may be rather long to serve to level large sloping and have a substantial diameter to be able to carry a load. As an example the largest exterior diameter measured across the crests of the external threading can be between 10 and 15 mm and the length of the adjusting screw from screw tip to free levelling end may be between 100 mm and 120 mm. For such an adjusting screw the blind hole may be about 20 - 30 mm deep. Plural smaller adjusting screws arranged at short distance from each other may replace a less number of larger adjusting screws arranged at larger distance, and vice versa.

[0023] The adjusting screw should normally be screwed into e.g. a floor joist at a certain minimum distance, as a precaution that the adjusting screw does not bend and/or break when subjected to loads from opposite the screw tip. To that aspect the adjusting screw may have e.g. one or more markings and/or one or more colour indications that indicate to the user how far inside the floor joist the adjusting screw is. If e.g. 50 mm of the adjusting screw starting from the screw tip is red the user knows that if he suddenly can see the red colour he has unscrewed the adjusting screw from the floor joust too must in his attempt to establish a level flooring plane, and that he needs to replace a too short adjusting screw with a longer, optionally stronger, adjusting screw. Several colour indications or length markings may be provided as a safety precaution to ensure that the adjusting screws according to the present invention at all times are screwed sufficiently far into the wood of the floor joists.

[0024] The enlargement of the blind hole serves to engage a screw tool for screwing the adjusting screws into the floor joists. The enlargement may preferably be a hex socket for use with a hex key, but other kinds of notches and screw tools are within the scope of the present invention.

[0025] The present invention also relates to an assembly adapted for levelling an out-of-level floor.

[0026] The assembly comprises a plurality of adjusting screws, e.g. the above mentioned adjusting screws, and a plurality of elongate levelling profiles having spaced apart first mounting holes for receiving first fasteners adapted for securing objects in form of the plurality of elongate levelling profiles to the adjusting screws via the first mounting holes.

[0027] The levelling profiles are simply placed on top of the adjusting screws at their flat ends after their heights have been adjusted by screwing said adjusting screws more or less into the floor joists to arrange their free levelling ends in

a level plane to level the subsequent installed flooring to remedy slanting etc. The plurality of elongate levelling profile may be selected from the group of elongate levelling profile comprising L-profiles, T-profiles, and flat profiles, and combinations thereof. The L-profile can e.g. be angle iron, the flat profile be flat iron, and the T-profile be T-iron.

[0028] The joist span, which is the distance between adjacent floor joists, is typically decided by the thickness of the flooring to be placed on top of the floor joists to finish the flooring, as well as by the expected load on the flooring. Some guidelines for joist spans are indicated in the below Table:

Point load	**2kN**	**2.5 kN**
Thickness of solid floor boards in mm	**Joist span for different thickness of floor boards in mm**	
20	520	
22	600	530
25	720	640
28	850	760
30	860	850
Thickness in mm of laminated parquet boards veneer at the lower face		
22 mm laminated parquet having 3 mm veneer at the lower face	500	450
22 mm laminated parquet having 2 mm veneer at the lower face	460	320

[0029] A flat profile may be employed if the joist span is short, such as up to 600 mm. Joist spans above 600 mm require further bracing structure so here a combination of a framework of L-profiles and T profiles are recommended. L-profiles may be provided along the exterior corners of opposite facing floor joists and T-profiles be used to span the gap between adjacent floor joists to obtain a framework to enforce the levelling structure. Subsequently wood-chip boards or other subflooring, or even the final flooring, can be mounted directly on top of the elongate levelling profiles crosswise the floor joists by means of self-cutting screws through said elongate levelling profiles.

[0030] The plurality of elongate levelling profiles may have one or more level correction holes provided in the vicinity of the first mounting holes for mounting second fasteners if the elongate levelling profiles cannot be secured steady and plane enough to the floor joists by means of the first fasteners.

[0031] The flat profiles and the L-profiles are used along the length of the floor joints and the T-profiles used to connect adjacent floor joints to create the framework. If pugging fills the joist span to an extent that does not allow space for arranging the stem of the T-profile below the levelling surface provided by the assembly of L-profiles and adjusting screws a furrow is simply cut in the pugging and the stem seated in said furrow without any need to remove pugging.

[0032] A plurality of bush mountings may be used to secure T-profiles to the longsides of opposite floor joists to further enforce the framework and bracing the structure of floor joists and L-profiles.

[0033] The present invention also relates to a method of levelling an out-of-level floor.

[0034] The method comprises the steps of

a) removing existing top- and/or sub-flooring and leaving pugging and floor joists in place,
b) providing a plurality of elongate levelling profiles,
c) providing a plurality of adjusting screws, preferably the adjusting screws according to any of the preceding claims 1 - 3,
d) drilling adjusting screw mounting holes in floor joists from the top of the floor joists at positions corresponding to the spaced apart first mounting holes of elongate levelling profiles,
e) screwing the plurality of adjusting screws into the adjusting screw mounting holes until their free levelling ends are at same level,
f) arranging the plurality of elongate levelling profiles on top of the floor joists with the first mounting holes aligned with the openings of the blind holes, and
g) screwing first fasteners into the plugs inside the blind holes of the adjusting screws via the first mounting holes to secure the elongate levelling profiles to the floor joists, optionally screwing second fasteners into the floor joists via level correction holes in the elongate levelling profiles.

[0035] The elongate levelling profiles may advantageously be cut to suitable lengths from longer profiles, and the longer profiles have the first mounting holes pre-made and distributed spaced apart along the length of the longer profile. Optionally level correction holes are located on opposite sides on the first mounting holes, when taken crosswise the elongate profile. The elongate levelling profiles may also be provided in shorter standards lengths, have markings that indicate their length and/or be colored.

[0036] If the elongate levelling profiles are L-profiles, a first web or leg may have the first mounting holes and a second web or leg, that extends at a substantially right angle from the first web or leg, be provided with second mounting holes. The legs or webs of an L-profile, such as an angle iron, may have same or different lengths.

[0037] When the joist span is larger than 600 mm L-profiles are used as elongate levelling profiles, but the joist span may need an enforcing bracing or framework between adjacent floor joists to carry a load. To that aspect the method may further comprises the steps of

h) providing a plurality of elongate T-profiles having lengths corresponding substantially to the distance between the adjacent floor joists,
i) providing a plurality of bush mountings,
j) securing the plurality of bush mountings to the L-profile by means of third fasteners, e.g. screws, pins or plugs or combinations thereof, inserted via the second mounting hole(s), and
k) suspending the T-profiles to the bush mountings of opposite L-profiles to span the joist span of the corresponding floor joists.

[0038] The head and the stem of the T-profile, such as a T-iron, may have same or different lengths.

[0039] When a level plane has been created by means of the adjusting screws, the assembly and the method of the present invention the flooring is secured on top of the plurality of elongate levelling profiles on top of the floor joists by means of fasteners screwed into a part of a floor joist not covered by an elongate levelling profile.

[0040] The bush mounting may be constructed of a durable, resilient material, preferably a material that is able to absorb the forces applied to them without undergoing a permanent deformation. As examples of suitable materials can be mentioned silicone rubber, which is generally non-reactive, stable, and resistant to extreme environments and temperatures from -55°C to +300°C while still maintaining its useful properties. Other examples include Ethylene Propylene Diene (EPDM), Nitrile Rubber (NBR), Styrene Butadiene Rubber (SBR), and Polybutadiene. This list is however not exhaustive.

[0041] The invention will be explained in greater details below with reference to the drawing, which illustrates exemplary embodiments to disclose further advantageous and technical features and effects of the present invention.

Fig. 1 is a principle sketch of a fragment of a slanting flooring with pugging,

Fig. 2 shows in perspective step b) of providing a flat profile on top of a floor joist,

Fig. 3 shows a sectional view taken along line III-III of the flat profile seen in fig. 1,

Fig. 4 shows step d) of the method of the present invention when using a flat profile,

Fig. 5 shows step e) of the method of the present invention when using a flat profile,

Fig. 6 is an enlarged scale longitudinal sectional view of an adjusting screw with a plug in the blind hole,

Fig. 7a is an exploded perspective view of the same with a first fastener,

Fig. 7b is an exploded perspective view of a modification of the adjusting screw seen in fig. 7a,

Fig. 8 shows step f) and g) of the method of the present invention when using a flat profile,

Fig. 9 shows step g') of the method of the present invention when using a flat profile,

Fig. 10 shows a fragment of an L-profile secured to a floor joist,

Fig. 11 shows in perspective step b) of providing L-profiles on opposite facing exterior corners of adjacent floor joists,

Fig. 12 shows step d) of the method of the present invention when using L-profiles,

Fig. 13 shows step f) of the method of the present invention when using L-profiles,

Fig. 14 shows step g) of the method of the present invention when using L-profiles,

Figs. 15 and 16 show step i) and j) of the method of the present invention when using L-profiles together with a first embodiment of a bush mounting,

Figs. 17 and 18 show step k) and j) of the method of the present invention when using L-profiles and T-profiles,

Fig. 19 shows in perspective a second embodiment of a bush mounting,

Fig. 20 shows step k') of the method of the present invention when using L-profiles and T profiles,

Fig. 21 is a cross-sectional enlarged scale view of the T-profile seen in figs. 17, 18 and 20.

Fig. 22 shows in perspective and from profile-securing face a third embodiment of a bush mounting,

Fig. 23 shows the same from an abutment face,

Fig. 24 shows in perspective the third embodiment of a bush mounting on an L-profile,

Fig. 25 shows in perspective the third embodiment of a bush mounting in an assembly of an L-profile, a T-profile and a plurality of adjusting screws, also illustrating a flat profile adjacent the L-profile, and

Fig. 26 shows in perspective the third embodiment of a bush mounting in an assembly of an L-profile and a T profile coupled in an angle of less than 90°.

[0042] In the following figs. 1 - 9 a first embodiment of the method and assembly of the present invention is described. The first embodiment is mostly used for plank flooring without sub-flooring, although sub-flooring can be used if preferred, e.g. if under-floor heating is installed.

[0043] Fig. 1 is a principle side view of a floor structure 1 composed of floor joists 2 extending from pugging boards 3 to a flooring 4. The joist spans 5 are filled with pugging 6. Due to age and time the flooring 4 slants and needs levelling.

[0044] To make a flooring having a joist span 5 of e.g. below level 600 mm level again a first embodiment of the invention provides a plurality of elongate levelling profiles in form of flat profiles 7 that has first mounting holes 8, that in the present embodiment of a flat profile is oblong to provide some tolerances in mutual spacing but can have any outline, and level correction holes 9 crosswise a flat profile 7 on opposite sides of the first mounting holes 8. A short length of floor joist 2 with a flat profile 7 is seen in fig. 2. The first mounting holes 8 and level correction holes 9 are seen more clearly in fig. 3 which is a sectional view along line III-III of fig. 2.

[0045] Fig. 4 shows step d) wherein the position of the adjusting screw mounting holes 10 are marked via the first mounting holes 8, using the flat profile 7 as template, so that the adjusting screw mounting holes 10 can be drilled, as indicated by dotted lines in relation to the first mounting holes 8, in the floor joist 2 from the top 11 of the floor joist 2.

[0046] As shown in fig. 5 of step e) a plurality of adjusting screws 14 are then screwed into the adjusting screw mounting holes 10 until their free levelling ends 13 are at same level at a levelling plane, preferably a horizontal levelling plane, as indicated by dotted line LP.

[0047] Fig. 6 is a longitudinal 1 sectional view of an adjusting screw 14. Fig. 7a shows the adjusting screw 14 shown in fig. 6a in a perspective exploded view. The adjusting screw 14 may be fastened to e.g. a floor joist by means of a first fastener 15, e.g. a self-cutting screw, inserted into a plug 16 accommodated in a blind hole 17 provided at a levelling end part 18 opposite the screw tip 19. The blind hole 17 opens into an enlargement 20 at a flat, free levelling end 13. The enlargement 20 serves to engage a tool (not shown) for screwing the adjusting screw 14 into the pre-drilled adjusting screw mounting holes 10 made in the floor joists 2, as seen in figs. 8 of step g).

[0048] The shank 22 of the adjusting screw 14 has an external threading 23 that extends at least the majority of the distance from the screw tip 19 to the flat, free levelling end 13. The levelling end part 18 with the flat, free levelling end 13 accommodates at least a part of the lengthwise extending blind hole 17. The pitch of the threading 23 may be coarse, such as few threads per cm, or fine, such as many threads pr cm. The pitch of the threading 23 may e.g. correspond to the pitch of a conventional wood screw. The plug may have a narrow through hole 16a that facilitates securing of the first fastener 15.

[0049] The second embodiment of an adjusting screw 14' seen in fig. 7b corresponds substantially to the adjusting screw seen in fig. 7a and for like parts same reference numerals are used. A difference between the adjusting screw

14 seen in fig. 7a and the adjusting screw 14' seen in fig. 7b is that the adjusting screw 14 has a slightly conical head 21 opposite the screw tip 19, whereby the diameter of the threaded shank 22 at the crests 23' of the threading 23 of the adjusting screw 14 seen in fig. 7a are the same as the diameter at the flat, free levelling end 13. The diameter of the threaded shank 22 at the crests 23' of the threading 23 of the adjusting screw 14' seen in fig. 7b are slightly larger than the diameter at the flat, free levelling end 13, due to the shank body having no constrictions due to the conical enlargement opposite the screw tip 19 of the adjusting screw 14.

[0050] Fig. 9 shows step g') of the first embodiment of the method and assembly of the present invention wherein several floor boards 24 have been placed on top of the flat profile (s) 7 crosswise the floor joists 2 for being secured to the elongate levelling profile 7 using self-cutting screws, of which just one is shown in fig. 9.

[0051] Although just one floor joist 2 and one flat profile 7 are shown in figs. 2, 4 - 8, and 9, it should be understood that within the scope of the present invention a plurality of elongate levelling profiles 7 are arranged on top 11 of spaced apart floor joists 2 to obtain a level plane. The length of one elongate levelling profile 7 may correspond to the entire length of the floor joist 2 or shorter lengths of elongate levelling profile be cut from longer elongate levelling profiles and be assembled end-to-end to end or with a predetermined distance between shorter lengths of elongate levelling profile.

[0052] The width of an elongate levelling profile 7 is conveniently shorter than the width of the associated floor joist 2 but sufficiently wide for screwing screws (not shown) into the floor joists 2 when mounting the floor boards 24 across the floor joists 2, as seen in fig. 9.

[0053] Fig. 10 is a principle sketch that shows an L-profile 28 mounted on an exterior corner floor joist 2. The L-profile 28 has a first web or leg 28a and a second leg or web 28b at right angle from the first web or leg 28a. The first web or leg 28a is configured just as the flat profile 7, with the difference that the flat profile 7 is secured on top 11 of a floor joist 2, so for like part same reference numerals are used. Accordingly securing of a flat profile 7 and securing of an L-profile 28 can be described in common with reference to fig. 10.

[0054] The first web or leg 28a is secured on top 11 of an exterior corner of a floor joist 2. The adjusting screw 14, which is shown in principle and with the floor joist being transparent, has been screwed into the floor joist 2 to an appropriate levelling length, and the first web or leg 28a is secured to the adjusting screws 14 by means of the first fasteners 15 via the first mounting holes 8 of the first web or leg 28a. The first fastener 15 is screwed into the corresponding plugs 16. Level correction holes 9 serve to allow second fasteners 25a,25b, in form of screws, to be screwed inside the floor joists 2 adjacent the first mounting holes 8 and the adjusting screw 14 so that the first web or leg 28a, or a flat profile 7, is fully level before the flooring is placed, e.g. as seen in fig. 9 in case of a flat profile 7 and in fig. 20 in case of an L-profile 28.

[0055] The flat profile 7 or first web or leg 28a rests on top of flat free levelling ends 21 of the adjusting screws 14, and the heads 26 of the first fasteners 15 can expediently be screwed inside the plug 16, to have its head 26 level with or slightly below the top face 27 of the flat profile 7 or of the first web or leg 28a. Two second fasteners 25a,25b are screwed into the floor joist 2 through level correction holes 9, which are provided next to the first mounting holes 8. The first web or leg 28a or the flat profile 7 now "floats" with a gap G above the floor joist 2 due to the extra height provided by the part of the adjusting screw 14 being upright of the floor joist 2, as seen in figs. 5 and 12.

[0056] In the following figs. 11 - 20 a second embodiment of the method and assembly of the present invention is described, in which method the L-profile 28 illustrated in fig. 10 is used. The second embodiment is typically used for flooring requiring sub-flooring, typically where joist spans are above 600 mm.

[0057] Fig. 11 shows in perspective step b) of providing two L-profiles 28 on top of adjacent floor joists 2 to mark up the positions of the adjusting screw mounting holes 10 through the first mounting holes 8, as indicated by dotted lines and as described in fig. 4. The L-profile 28 is placed on an exterior corner 29 of a floor joist 2 so that a first web or leg 28a with the first mounting holes 8 and level correction holes 9 is on top of the floor joist 2, and the second web or leg 28b extends at right angle from the first web or leg 28a down in abutment with the longside 30 of the floor joist 2. The position of the first mounting holes 8 are marked and drilled as described for the first embodiment in relation to fig. 4.

[0058] As illustrated in fig. 12 of step g) the adjusting screws 14 are screwed into the pre-drilled adjusting screw mounting holes 10 made in the floor joists 2, in a manner similar to the manner described in relation to fig. 5 to obtain a levelling plane, as indicated by dotted line LP, and the first web or leg 28a of the L-profile 28 are placed resting on top of flat free levelling ends 21 of the adjusting screws 14 along the exterior corner of the floor joist 2, as described in relation to fig. 10.

[0059] As illustrated in figs. 13 and 14 first fasteners 15 are then screwed via the first mounting holes 8 of the first webs 28a down into the plugs 16 inside the blind holes 17 of the adjusting screws 14 mounted into the floor joists 2 in adjusting screw mounting holes 10. As seen best in fig. 14 second fasteners 25, such as self-cutting screws, are screwed via level correction holes 9 inside the floor joists 2 adjacent the first mounting holes 10 to further secure the first web or leg 28a to the top 11 of said floor joist 2, and ensure that the first web or leg 28a of the L-profile 28, thus the horizontal web or leg 28a of the L-profile 28, rests fully level on top of the flat free levelling ends 21 of the adjusting screws 14. The horizontal web or leg 28a of the L-profile 28 now "floats" with a gap G above the floor joist 2 due to the extra height provided by the part of the adjusting screw 14 being upright of the floor joist 2.

[0060] The second web or leg 28a, which is the vertical web or leg of the L-profile 28, extends the longside 30 of said floor joist 2. The second web or leg 28a has second mounting holes 33 for fastening a plurality of spaced apart sets of opposite bush mountings 34, e.g. in accordance with a first embodiment of bush mountings, on opposite facing longsides 30 of neighbour floor joists 2, as shown in figs. 15 and 16, by means of one or more third fasteners 35.

[0061] The bush mountings are seen best in figs. 15 and 19. The first embodiment of a bush mounting 34 seen in figs. 15 - 18 has an abutment face 36 that is placed against the second web or leg 28b of the L-profile 28 and an opposite free profile-securing face 37. A slot 38 extends from top 39 to bottom 40 of the bush mounting 34 at the free profile-securing face 37, and third fasteners 35 are used to secure the bush mounting 34 to the second web or leg 28b of the L-profile 28 via one or more second mounting holes 33 in said second web or leg 28b. The third fasteners 35 may be wood screws, such as self-cutting screws.

[0062] Similarly the second embodiment of a bush mounting 34' has a profile-securing face 37' and an abutment face 36'.

[0063] Any of the bush mountings 34,34' may have a tenon 33' to be plugged into one of the second mounting holes 33 of the second web or leg 28b, so that the bush mountings 34,34' stay in place when a third fastener 35 is screwed into the other second mounting hole 33 of the second leg or web 28a via a fourth mounting hole 48 in the slot 38, optionally also into the floor joist 2.

[0064] In the first embodiment of a bush mounting 34 seen in e.g. fig. 15, said bush mounting 34 tapers from top 39 to bottom 40. The alternative second embodiment of a bush mounting 34' seen in fig. 19 does not taper.

[0065] Fig. 22 shows in perspective and from a profile-securing face 37" a third embodiment of a bush mounting 34", and fig. 23 shows the same from an abutment face 36". Fig. 24 shows in perspective the third embodiment of a bush mounting 34" on an L-profile 28.

[0066] As the first embodiment of a bush mounting 34 the third embodiment 34'' tapers towards its bottom 40. A tenon 33'' protrudes form the abutment face 36'' above a fourth mounting hole 48' in the slot 38' and serves to attach the bush mounting 34'' temporarily to the vertical web or leg 28b of the L-profile 28 before screws 35 are screwed via the fourth mounting hole 48' into the vertical web or leg 28b, optionally also into the floor joist (not shown). The support face 47'' has a depression 49 for receiving a head 45 of a T-profile 41 that, as shown in figs. 25 has its stem 44 inserted into the slot 38''. The depression 49 advantageously accommodates the head 45 of the T profile 41 to bring said head 45 in level with the horizontal leg or web 28a of the L-profile 28 so that the T-profile 41 can carry a load across the joist span as well, optionally be used for fastening flooring.

[0067] Fig. 25 shows in perspective the third embodiment of a bush mounting 34'' in an assembly of an L-profile 28, a T-profile 41 and a plurality of adjusting screws 14, also illustrating a flat profile 7 of the assembly adjacent the L-profile 28'.

[0068] Fig. 26 shows in perspective the third embodiment of a bush mounting 34'' in an assembly of an L-profile 28 and a T profile 41 coupled in an angle of about 30°. This options and versatility allows the assembly and method of the present invention to be used and carried out in rooms with e.g. odd corner angles.

[0069] Irrespective of embodiment of bush mountings 34;34';34'' its top 39 provides a support face 47,47',47'' for a head 45 of a T-profile 41 that, as shown in figs. 17 and 18, which T profile has its stem 44 inserted into the slot 38,38". The T-profile 41 spans the joist span 42 to make a reinforcing framework to support sub-flooring boards 43 as shown in fig. 20. The head surface 46 of the T-profile 41 can also support flooring, e.g. the floor boards 24 and/or the sub-flooring boards 43. Self-cutting screws can be used to secure the floor boards 24 and/or the sub-flooring boards 43 to any of the elongate levelling profiles 28,41 as desired. The bush mounting 34;34';34'' may advantageously be mounted prior to the L-profile 28 is placed on the exterior corner of the floor joist 2.

[0070] In the situation wherein any of the first mounting holes and/or the second mounting holes are missing or cut away due to suitable downsizing of the length of a longer elongate levelling profile, first mounting holes, the second mounting holes and the level correction holes can be drilled in the elongate levelling profile where needed using a metal drill, an optionally a template to mark up the drilling position of the various holes in relation to each other, whereby adjusting screws, second fasteners and bush mountings can be mounted at an end of an elongate levelling profile as well. In the same manner holes can be made where appropriate.

[0071] The present invention makes it possible, easily and conveniently, to set the floor joist to a level plane without having to remove pugging boards and deposits, such as pugging between floor joists, and without raising the floor construction noticeable. It also makes it possible to mount wood-chip board or any other flooring that requires a maximum joist span of 600 mm.

[0072] The many advantages of the assembly and the method of the present invention further include, but is not limited to, there is no need to reinforcements of existing truss beams and floor joints and no need to make trimming works to reduce the beam and/or joist distance for plate flooring. The assembly and the method save time-consuming and heavy work for disposal of pugging boards, pugging, and deposits between floor joists, and dispense with the subsequent fire protection with 2 layers of plaster and mineral wool which is required as replacement fire protection.

Claims

1. An adjusting screw (14;14') having a shank (22) with a screw tip (19) and an external threading (23) extending at least a distance from the screw tip (19) towards a levelling end part (18) with a levelling end (13), **characterized in that** the levelling end part (18) of the adjusting screw (14;14') has a lengthwise extending blind hole (17) and a plug (16) accommodated inside the blind hole (17) for securing a first fastener (15).

2. An adjusting screw (14;14') according to claim 1, **characterized in that** the adjusting screw (14;14') has a flat levelling end (13) opposite the screw tip (19.

3. An adjusting screw (14;14') according to claims 1 or 2, **characterized in that** the adjusting screw (14;14') is configured with one or more of the features selected from

   - the adjusting screw (14;14') is headless,
   - the adjusting screw (14;14') has the same largest exterior diameter at the free levelling end (13) and at the threading (23),
   - the blind hole (17) has an enlargement (20) at the free levelling end (13) opposite the screw tip (19), which enlargement (20) has a cross-sectional outline selected to engage a screw tool to screw the adjusting screw (14;14') inside another object, such as a floor joist (2), and preferably the plug (16) does not extend into the enlargement (20),
   - the enlargement is a hex socket for use with a hex key,
   - the plug (16) is a plastic plug, preferably a nylon plug,
   - the adjusting screw (14;14') has a marking at or along a distance from the screw tip to indicate a minimum depth the adjusting screw (14;14') must be screwed into the other object, such as into a floor joist (2),
   - the adjusting screw (14;14') has a length that is at least 5 times larger, preferably at least 8 times larger, and more preferred at least 8 times larger than its exterior diameter,
   - the blind hole (17) has a hole diameter that is about half the diameter of the levelling end part, and/or
   - the depth of the blind hole (17) is at least 20% of the length of the adjusting screw (14;14').

4. An assembly adapted for levelling an out-of-level flooring, **characterized in that** the assembly comprises

   - a plurality of adjusting screws (14;14'), and
   - a plurality of elongate levelling profiles (7;28;41) having spaced apart first mounting holes (8) for receiving first fasteners (15) adapted for securing the plurality of elongate levelling profiles (7;28;41) to the adjusting screws (14;14') via the first mounting holes (8).

5. An assembly according to claim 4, **characterized in that** the plurality of elongate levelling profiles (7;28;41) is selected from the group of elongate levelling profiles (7;28;41) comprising L-profiles (28), T-profiles (41), and flat profiles (7), and combinations thereof, preferably the adjusting screw (14;14') is the adjusting screws (14;14') according to any of the preceding claims 1 - 3.

6. An assembly according to claims 4 or 5, **characterized in that** the plurality of elongate levelling profiles (7;28;41) has one or more level correction holes (9) provided in the vicinity of the first mounting holes (8).

7. An assembly according to any of the preceding claims 4, 5 or 6 **characterized in** further comprising a plurality of bush mountings (34;34').

8. A method of levelling an out-of-level flooring **characterized in that** the method comprises the steps of

   a) removing existing top- and/or sub-flooring (4) and leaving pugging (6), and floor joists (2) in place,
   b) providing a plurality of elongate levelling profiles (7;28;41),
   c) providing a plurality of adjusting screws (14;14'),
   d) drilling adjusting screw mounting holes (10) in floor joists (2) from the top of the floor joists (2) at positions corresponding to the first mounting holes (8) of elongate levelling profiles (7;28;41),
   e) screwing the plurality of adjusting screws (14;14') into the spaced apart adjusting screw mounting holes (10) until their free levelling ends (13) are at level,
   f) arranging the plurality of elongate levelling profiles (7;28) on top of the floor joists (2) with the first mounting holes (8) aligned with the openings of the blind holes (17), and

g) screwing first fasteners (15) into the plugs (16) inside the blind holes (17) of the adjusting screws (14;14') via the first mounting holes (8) to secure the elongate levelling profiles (7;28)to the floor joists (2), optionally screwing second fasteners (25) into the floor joists (2) via level correction holes (9) in the elongate levelling profiles (7;28).

9. A method according to claim 8, **characterized in that** the adjusting screw (14;14') is the adjusting screw (14;14') according to any of the preceding claims 1 - 3.

10. A method according to claims 8 or 9, **characterized in that in that** the elongate levelling profiles are L-profiles (28), wherein an L-profile (28) has a first web or leg (28a) having the first mounting holes (8) and a second web or leg (28b) provided with second mounting holes (28b), and the method further comprises the steps

h) providing a plurality of elongate T-profiles (41) having lengths corresponding substantially to the distance between the floor joist (2),
i) providing a plurality of bush mountings (34;34';34"),
j) securing the plurality of bush mountings (34;34';34") to the L-profile (28) by means of third fasteners (35), e.g. screws, pins or plugs or combinations thereof, inserted via the second mounting hole(s) (33), and
k) suspending the T-profiles (41) to the bush mountings (34;34';34") of opposite L-profiles (28) to span the joist span (5) of the corresponding floor joists (2).

11. A method according to claims 8, 9 or 10, **characterized in that** the method comprises step g') after step g) or k') after step k), wherein step g') and k') comprises mounting a flooring (4;24;43) on top of the elongate levelling profiles (7;28;41).

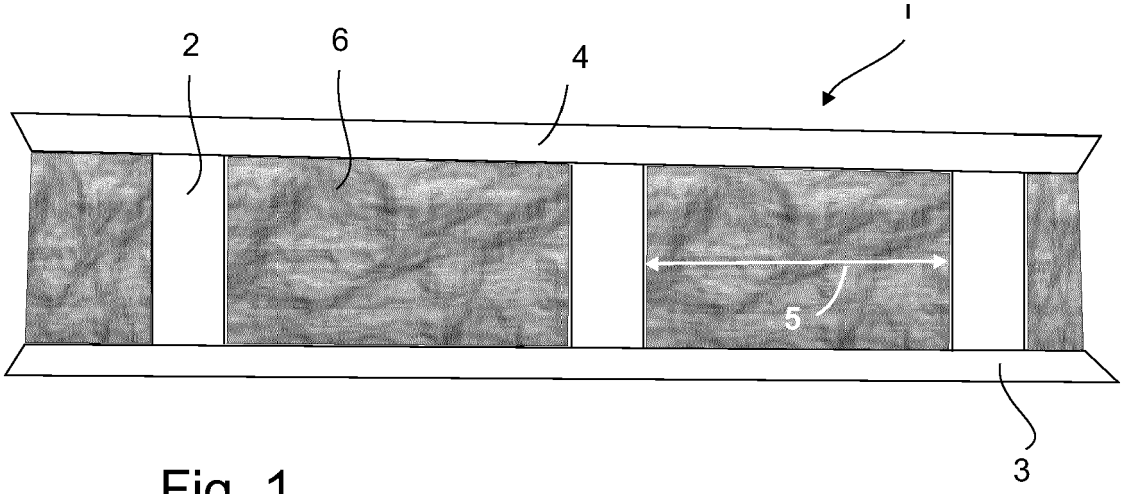

Fig. 1

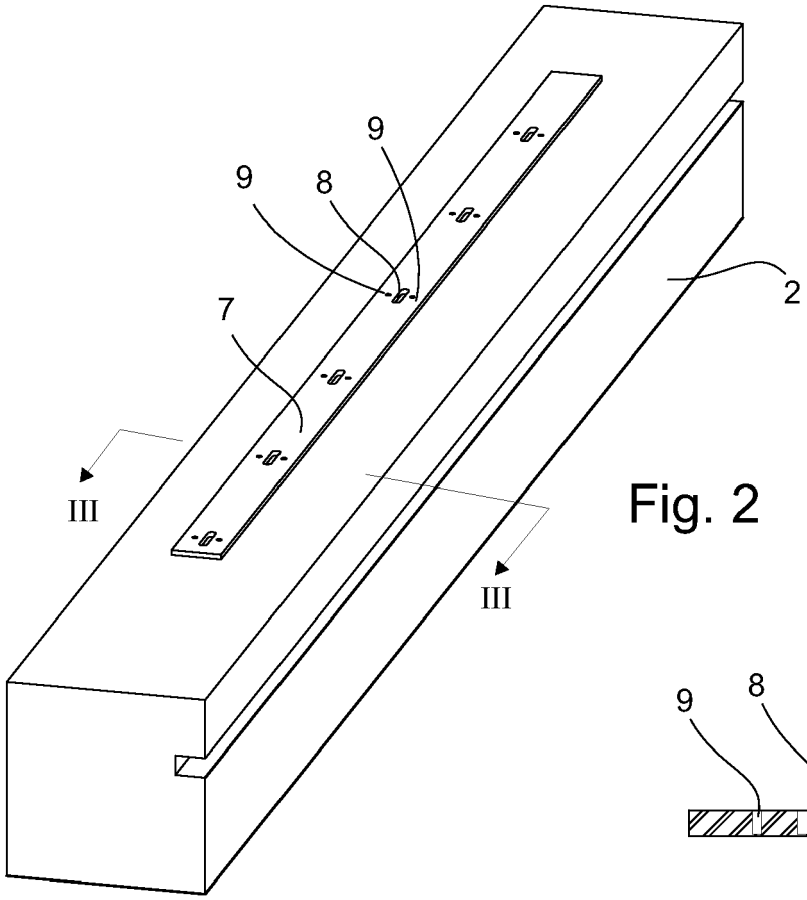

Fig. 2

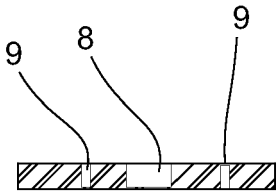

Fig. 3

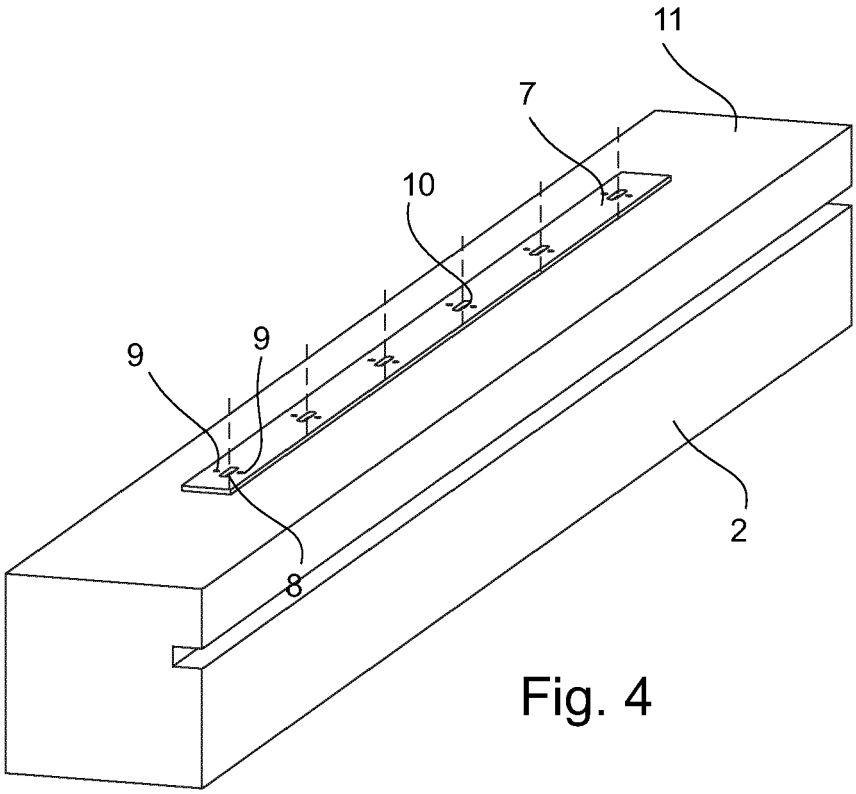

Fig. 4

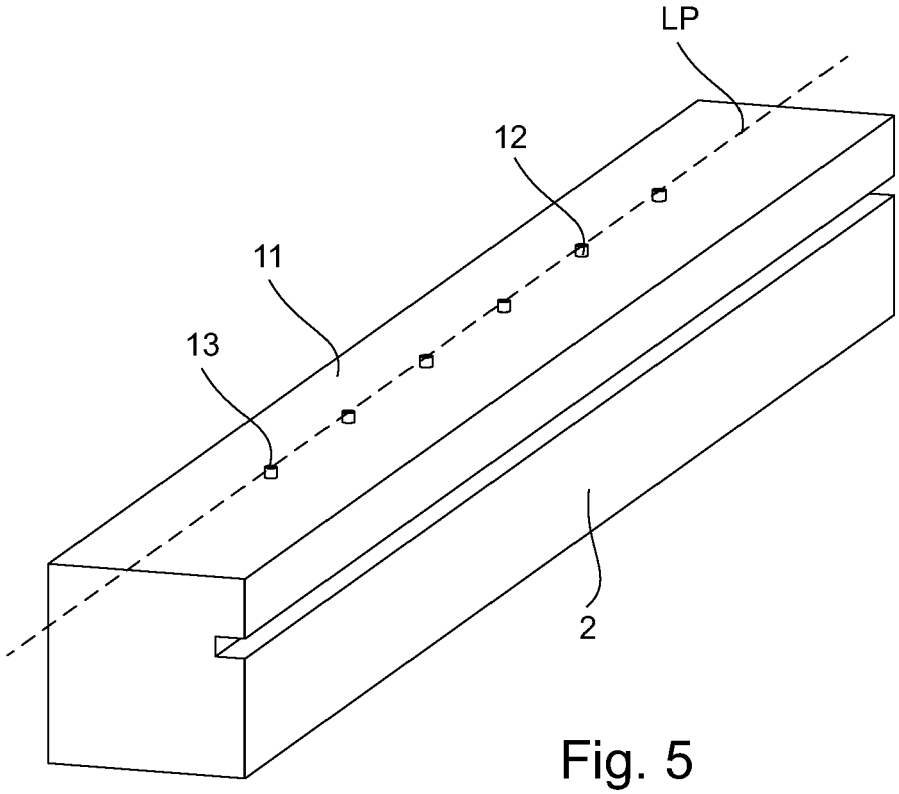

Fig. 5

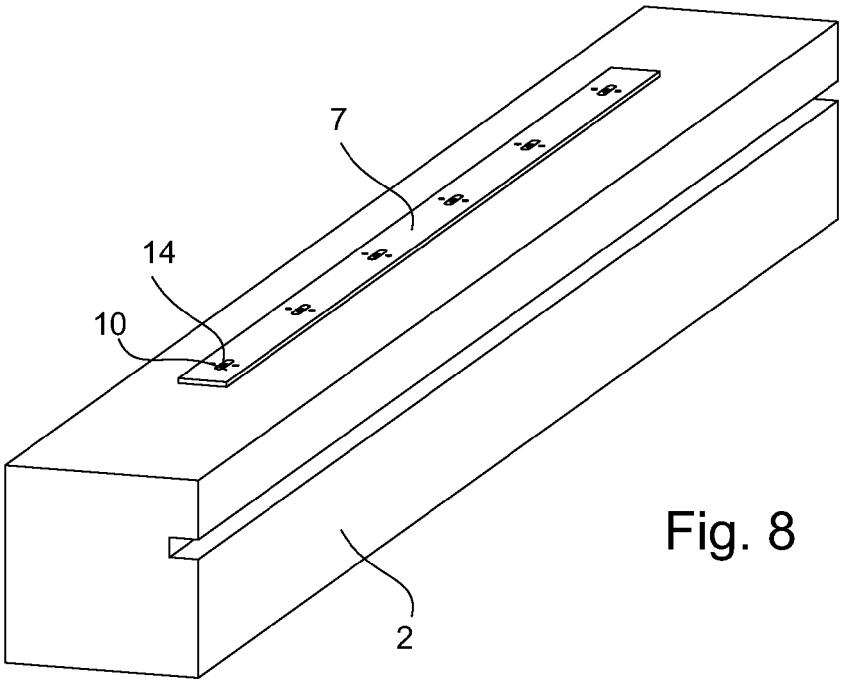

Fig. 8

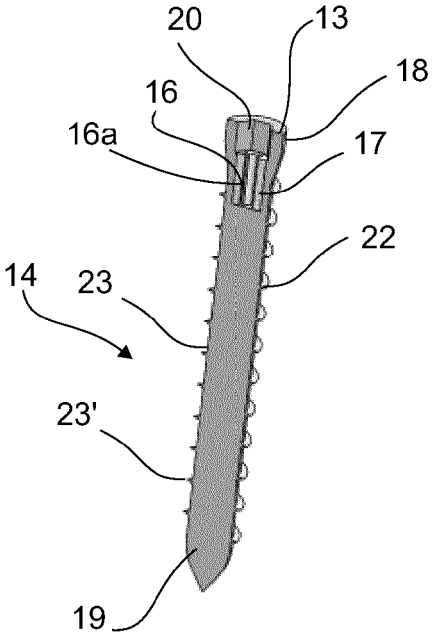

Fig. 6

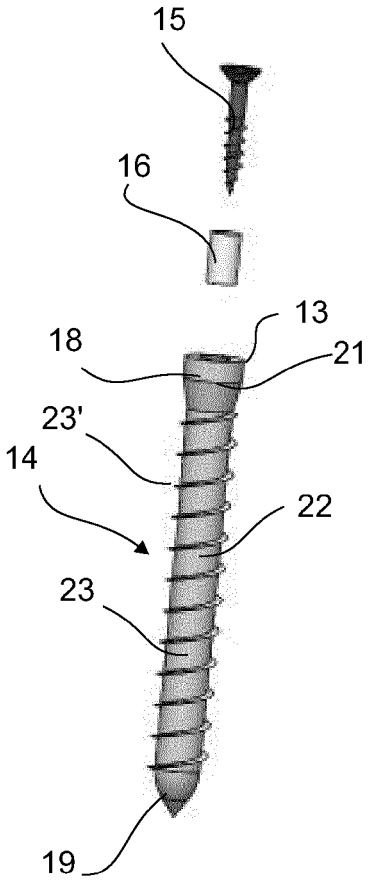

Fig. 7a

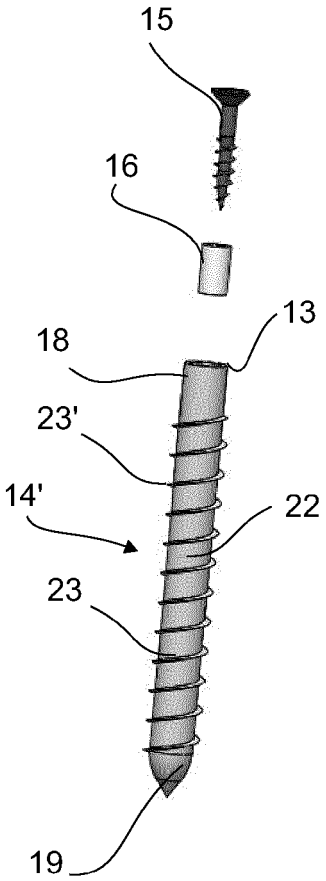

Fig. 7b

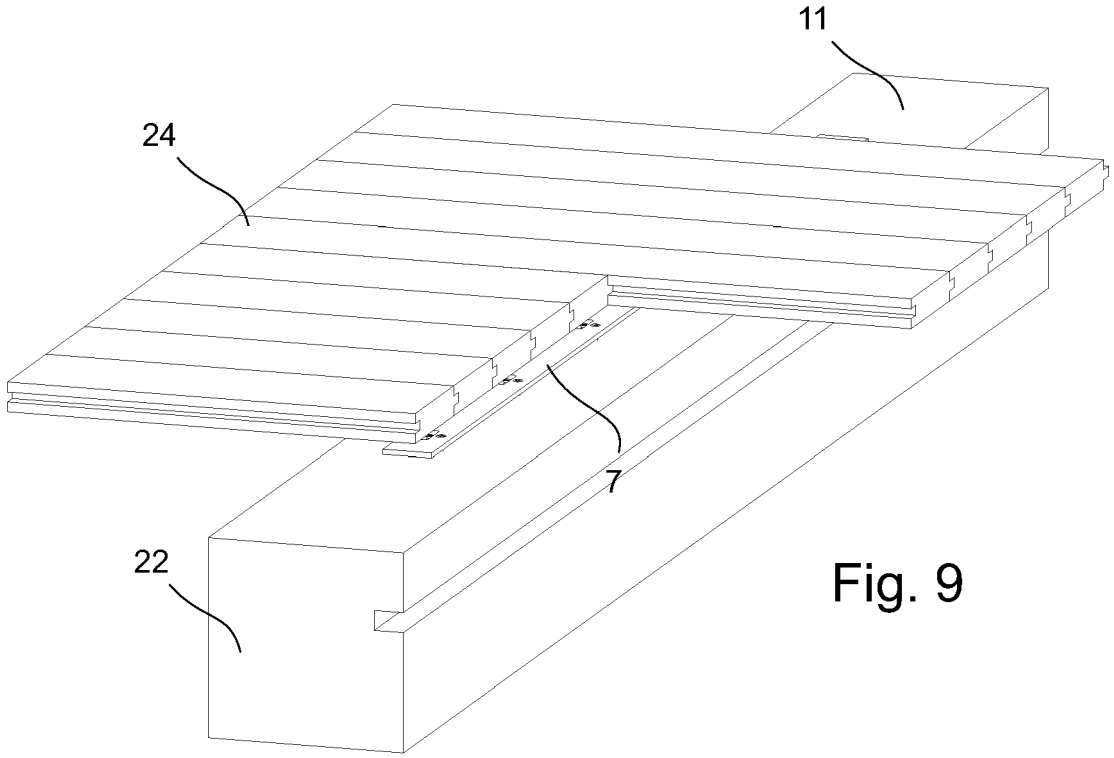

Fig. 9

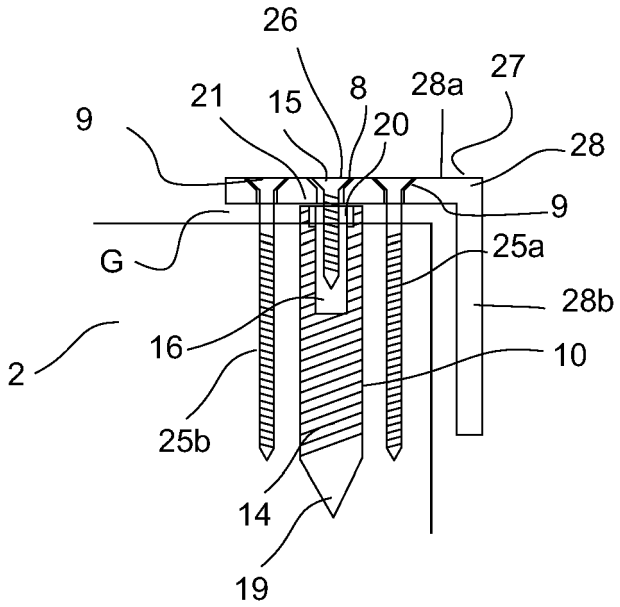

Fig. 10

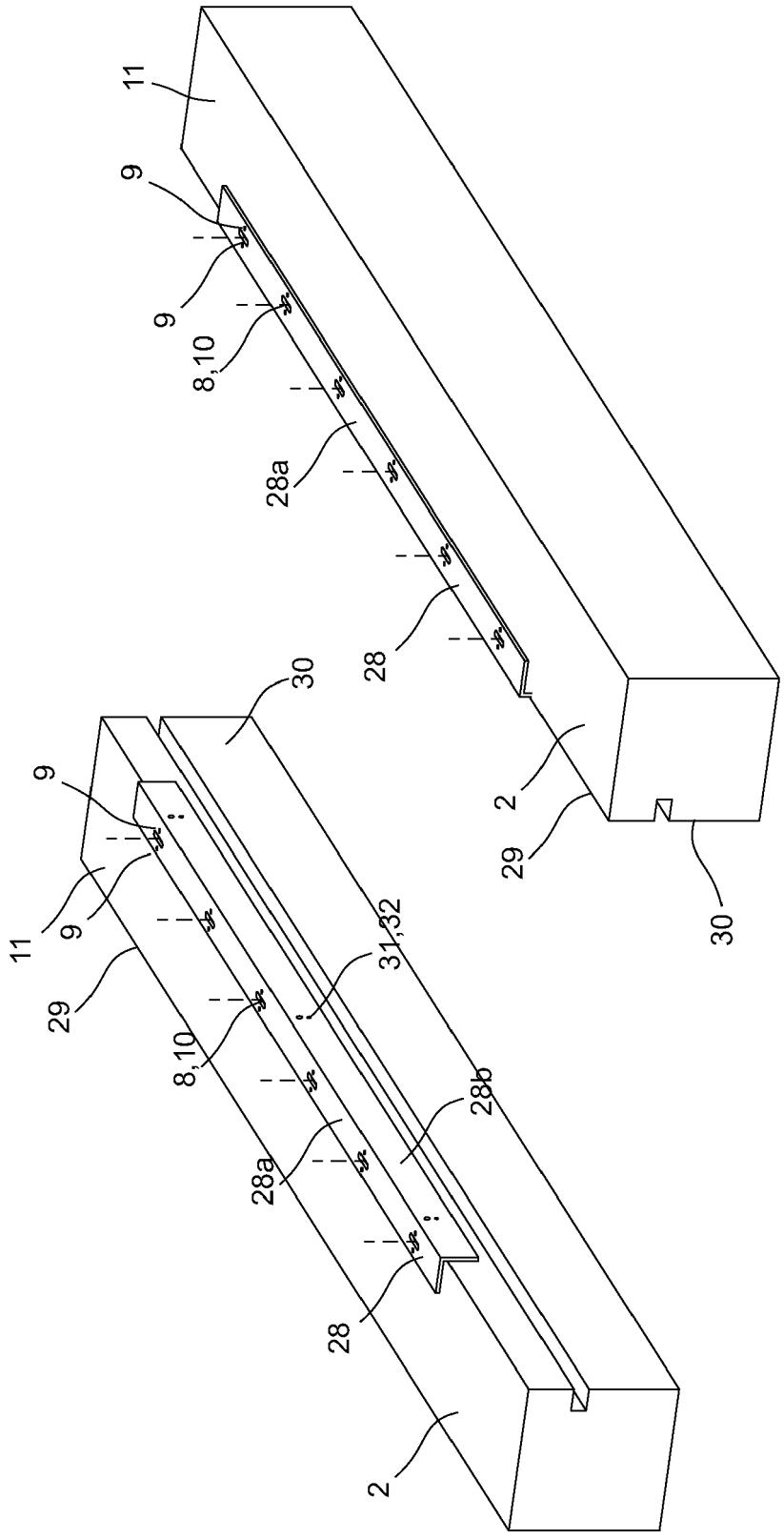

Fig. 11

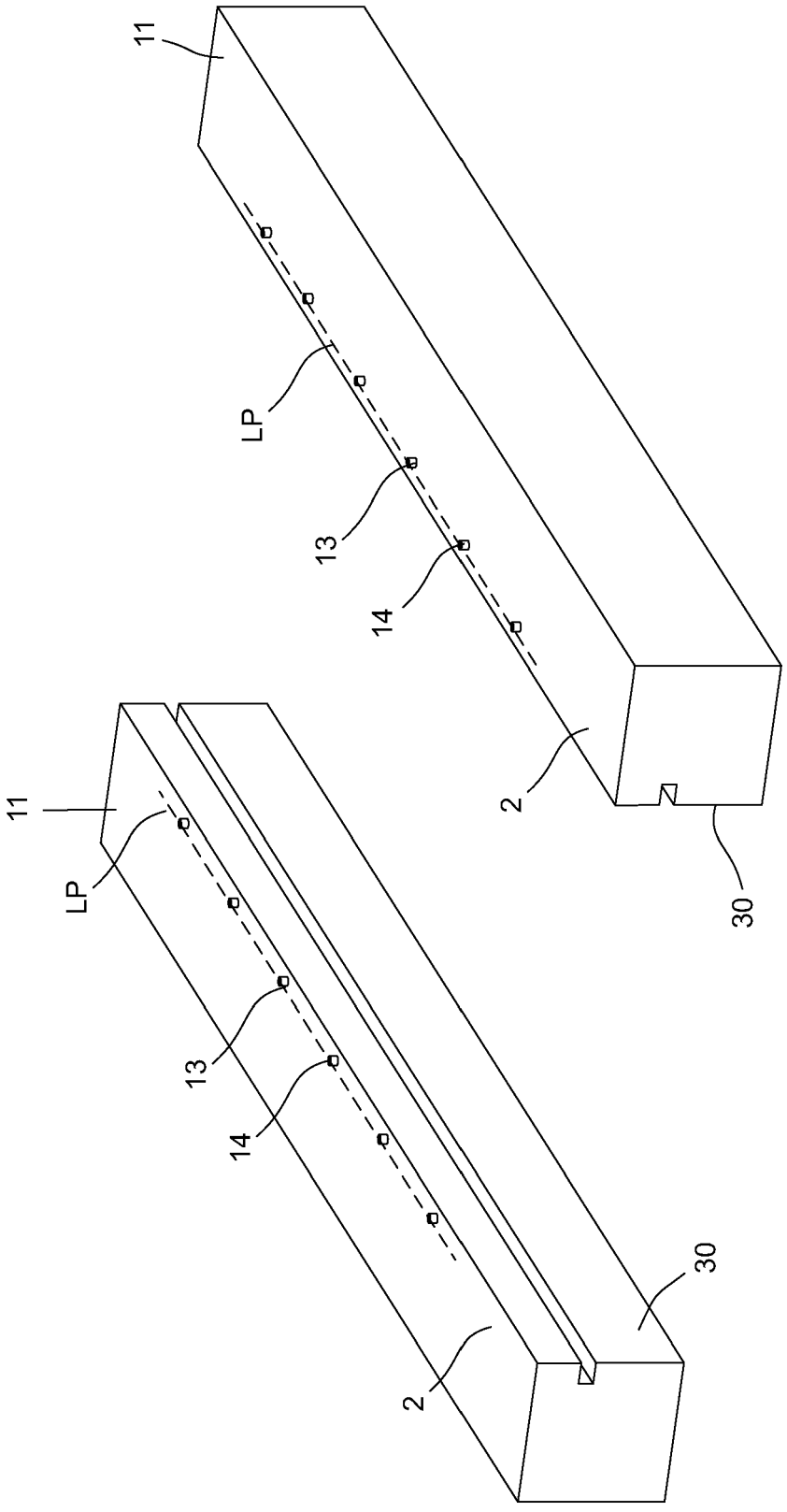

Fig. 12

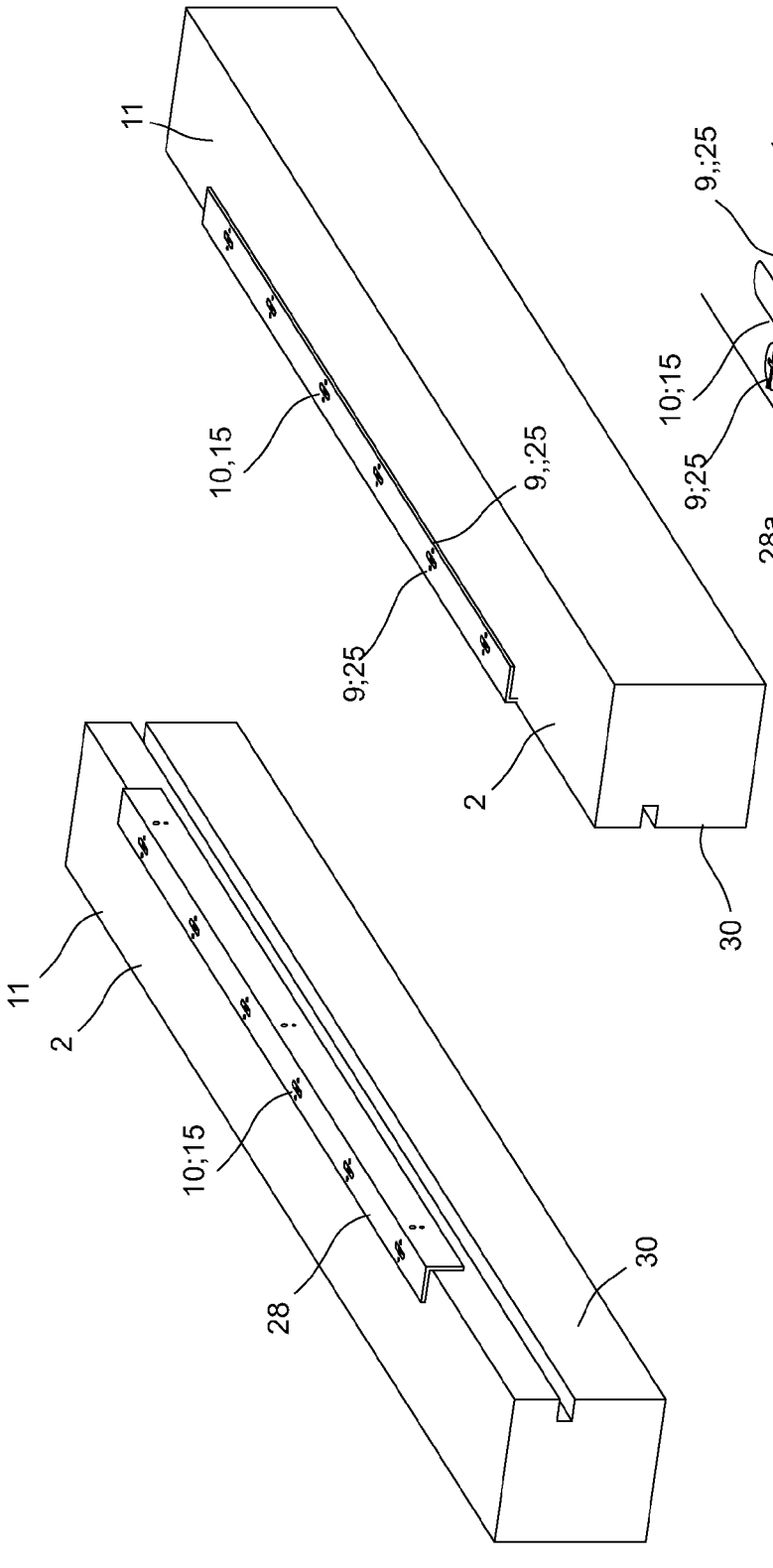

Fig. 13

Fig. 14

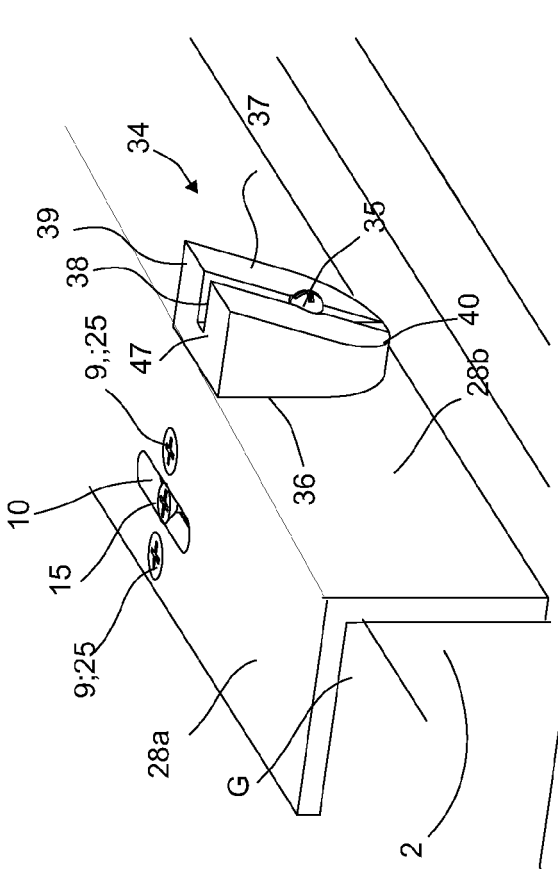
34
37
39
38
35
9;25
47
40
28b
10
36
15
9;25
28a
G
2

Fig. 15

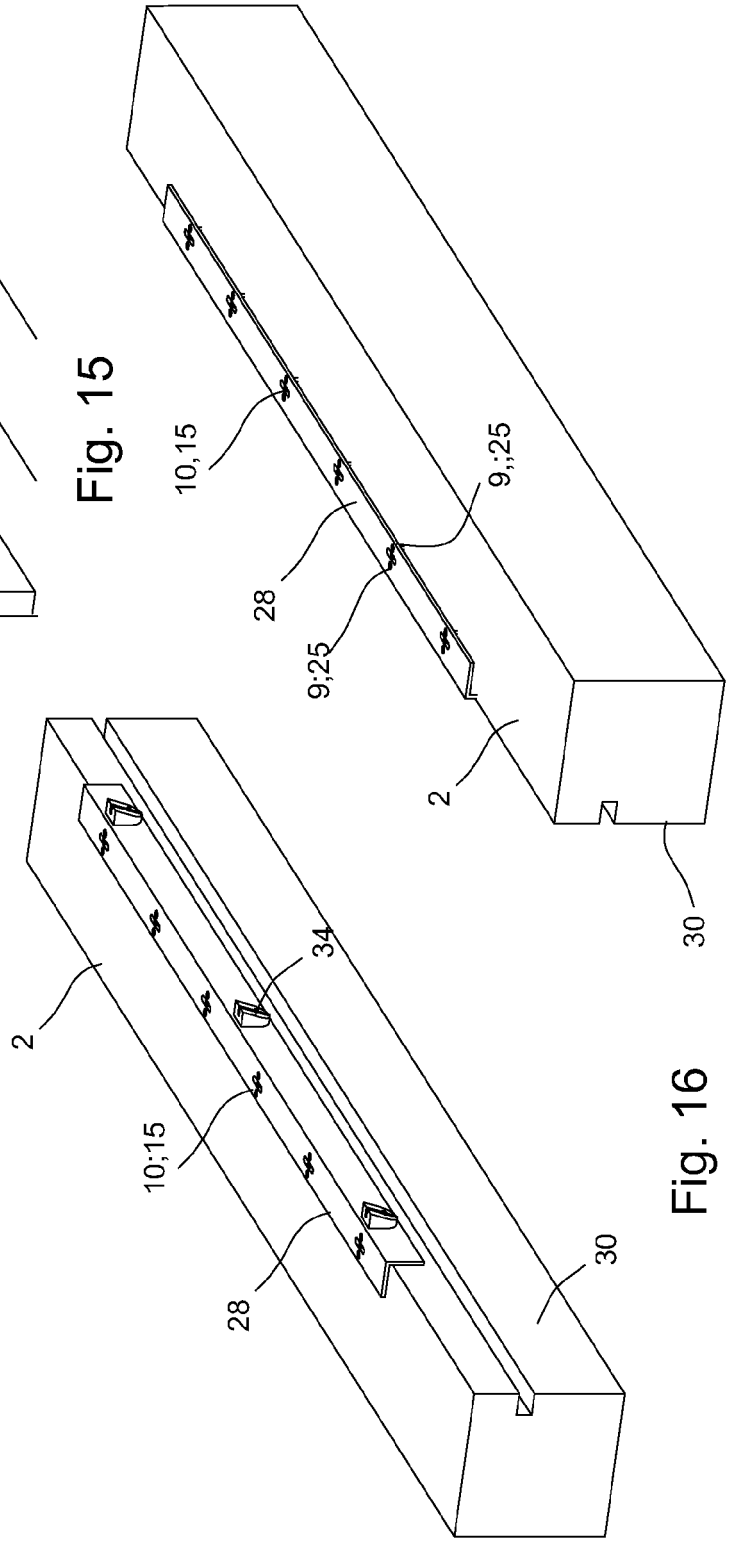
10,15
9;,25
28
9;25
2
30
2
34
10;15
28
30

Fig. 16

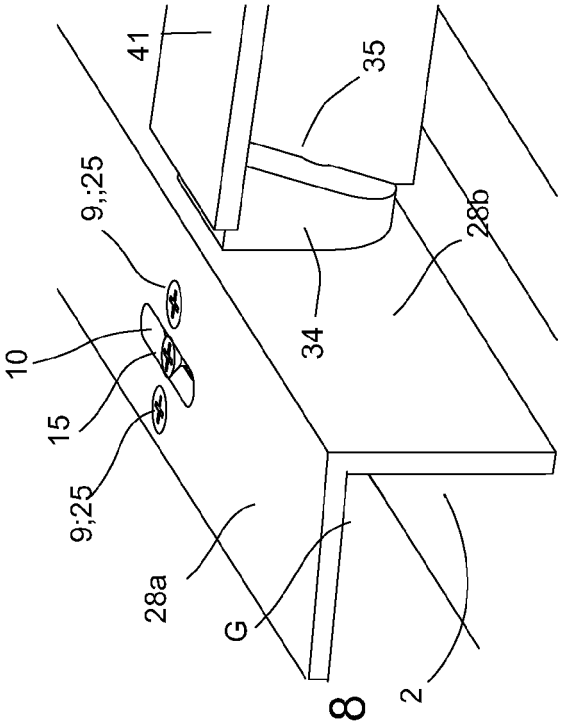

Fig. 18

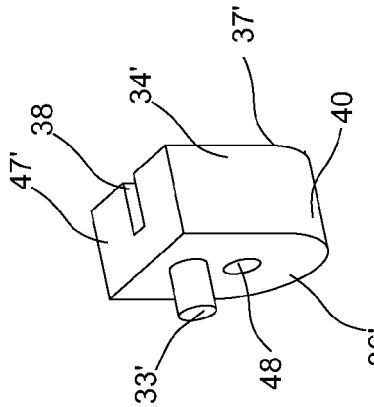

Fig. 19

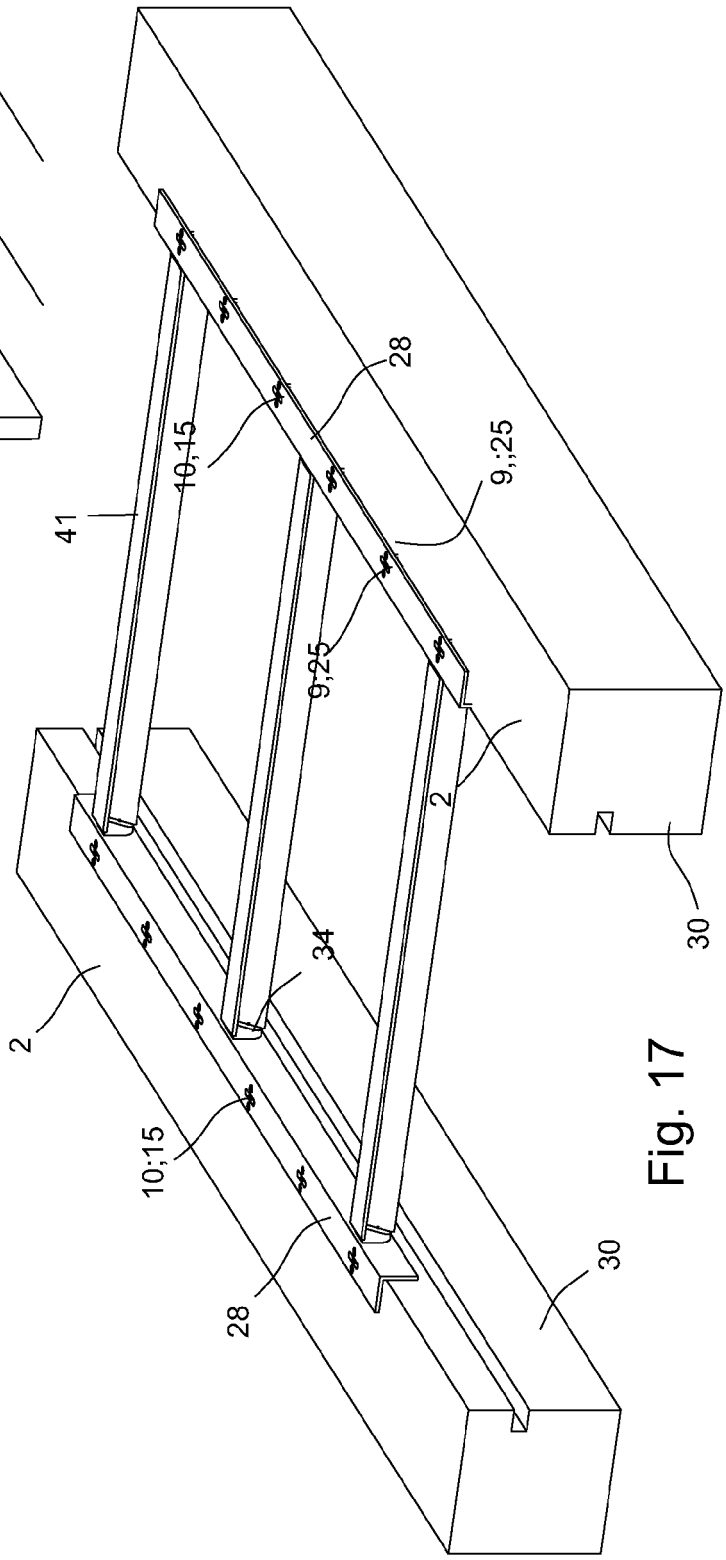

Fig. 17

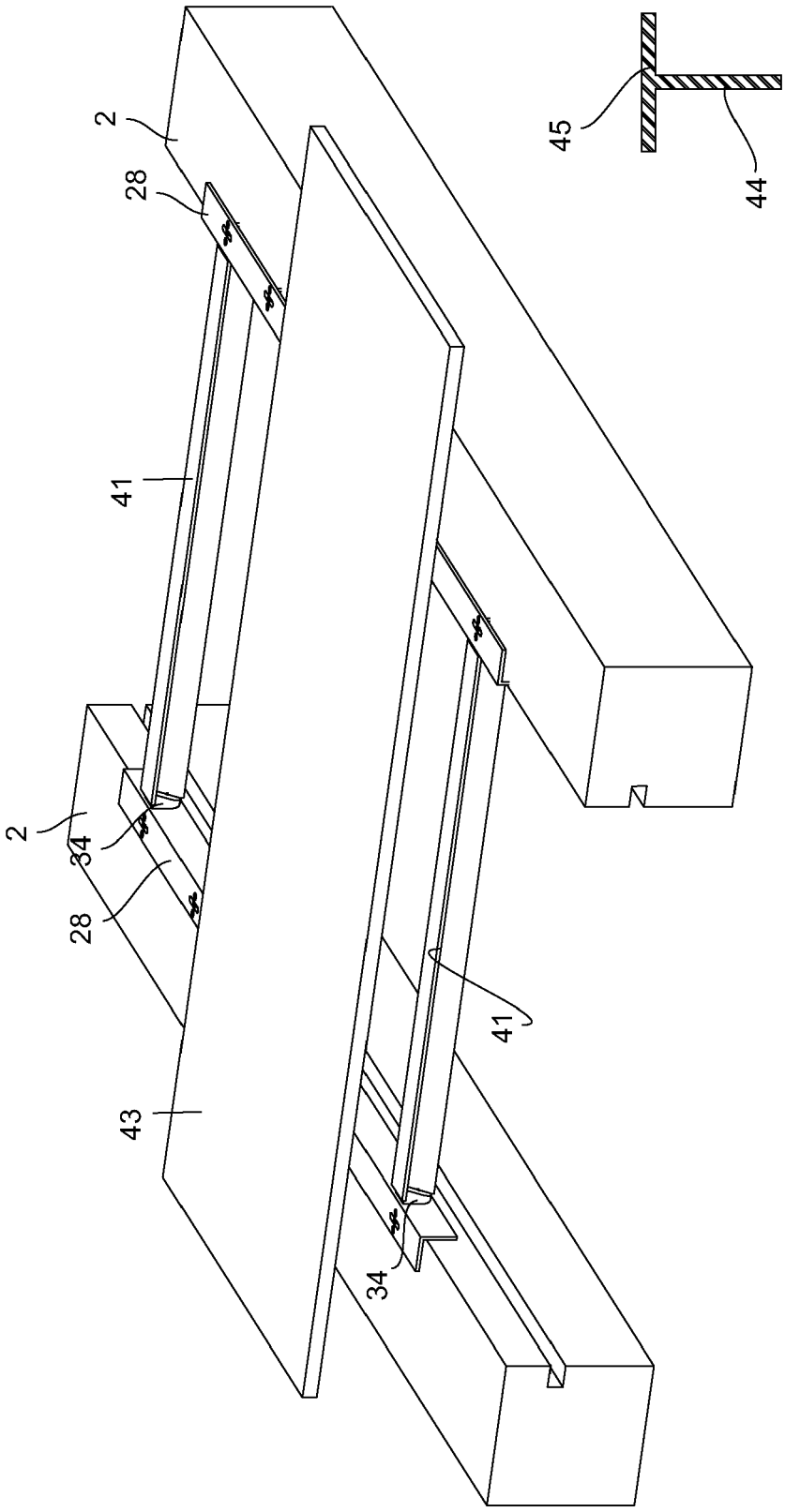

Fig. 20

Fig. 21

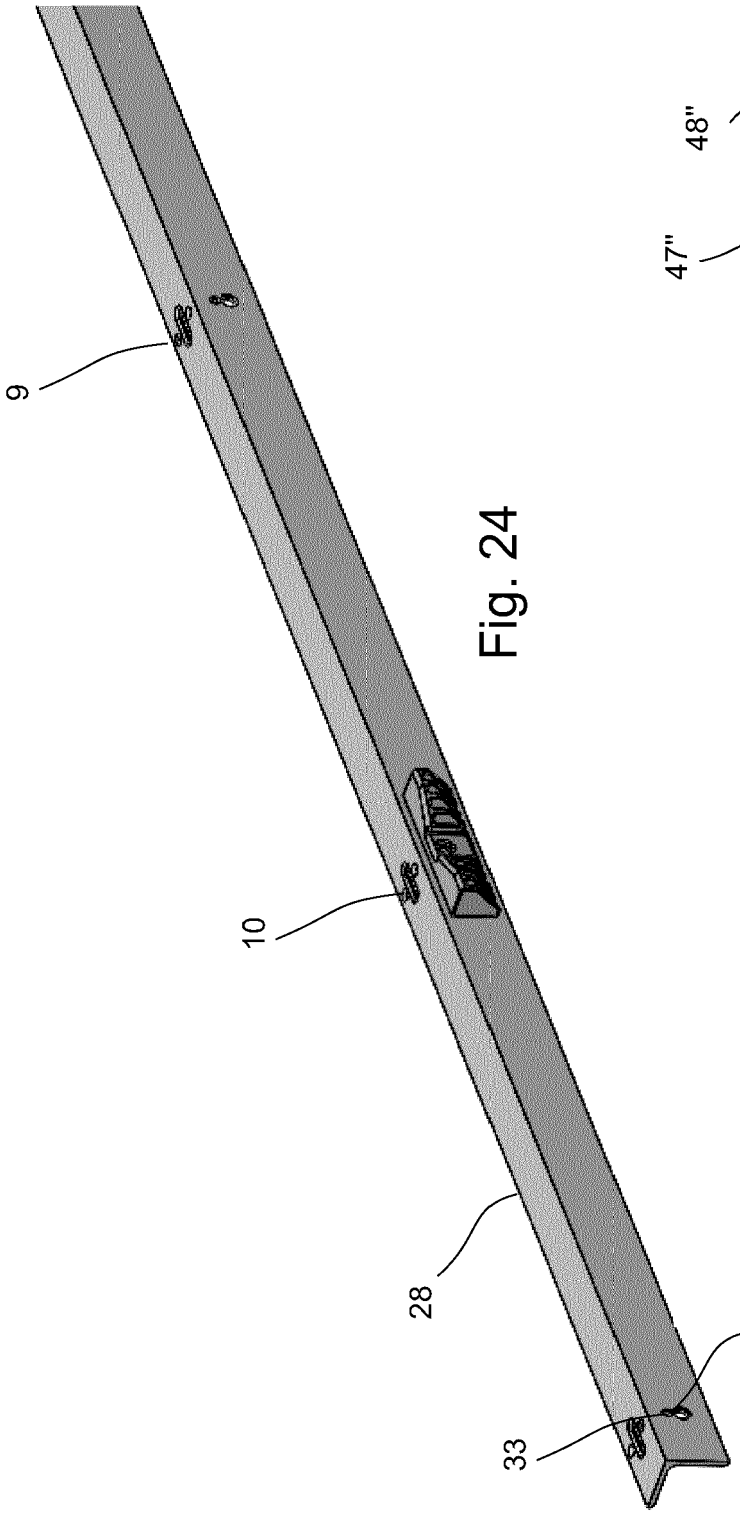

Fig. 24

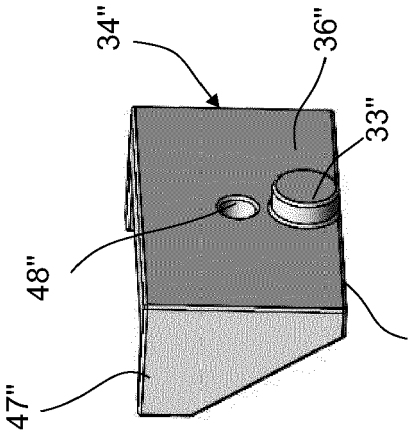

Fig. 23

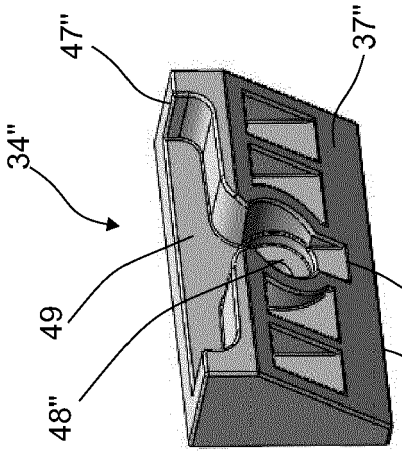

Fig. 22

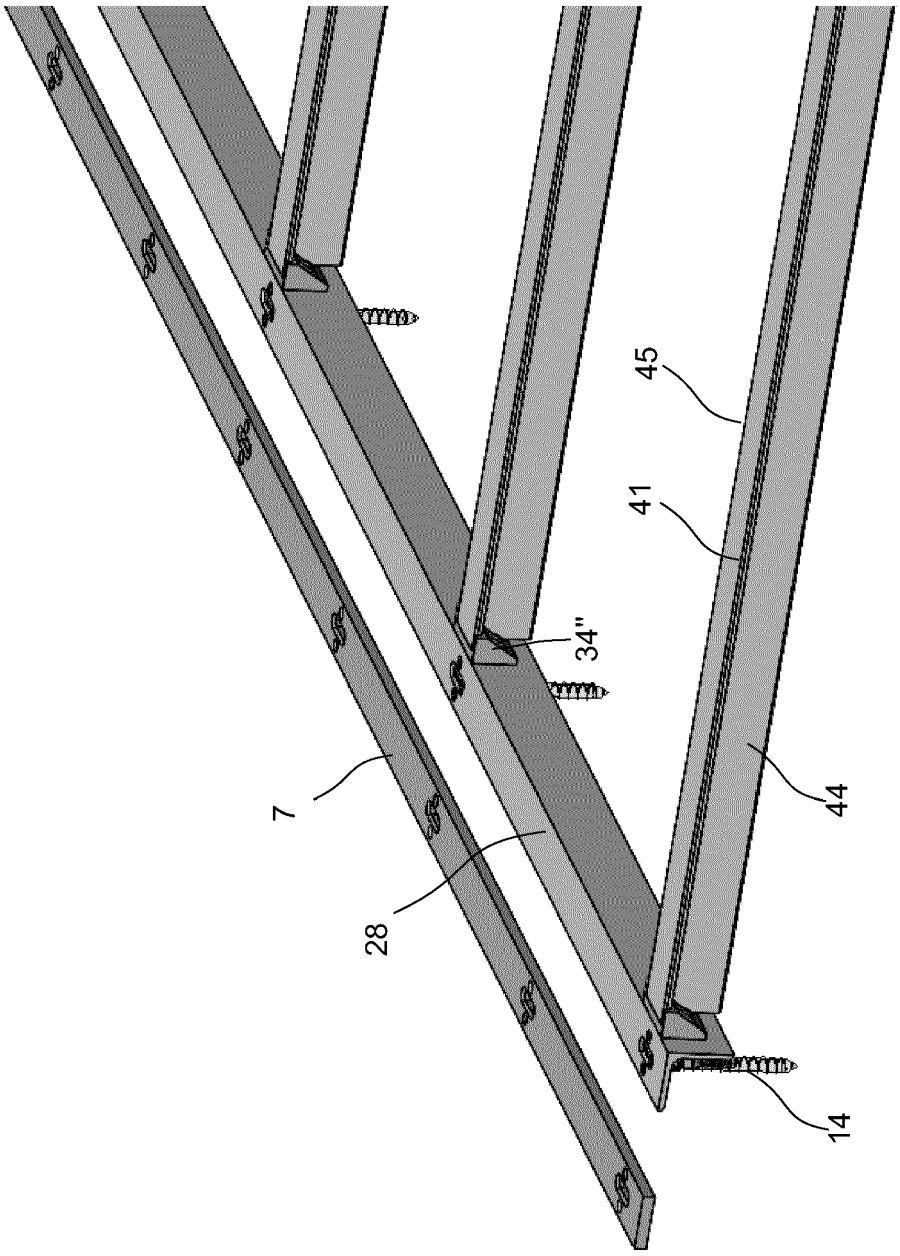

Fig. 25

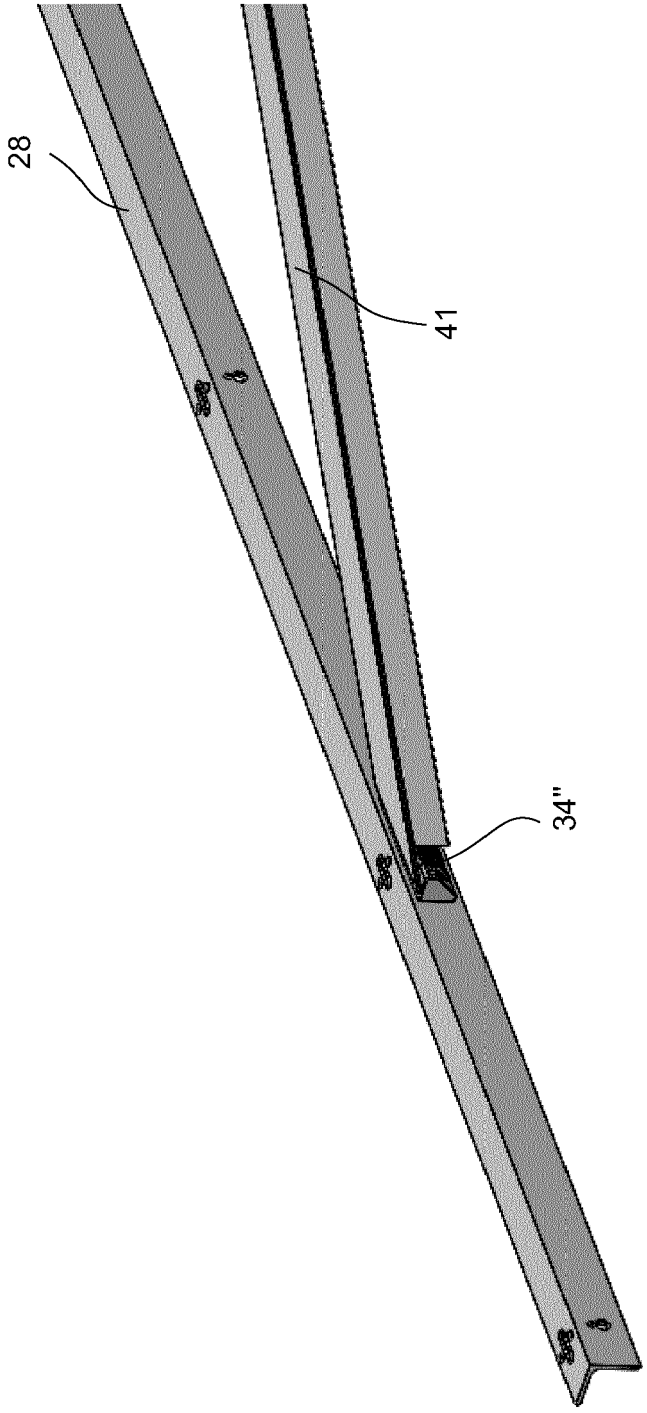

Fig. 26

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 19 18 0831

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	DE 43 17 303 A1 (HH INNOVATION OY [FI]) 1 December 1994 (1994-12-01) * figures 1-6 * * column 1, line 5 * -----	1-9	INV. E04B5/12 E04F15/024 E04G23/02
A	JP H08 49394 A (MIYAGI KATSUNORI) 20 February 1996 (1996-02-20) * figures 1-4 * -----	1-11	
A	RU 2 369 702 C2 (KARDASHEV SERGEJ NIKOLAEVICH [RU]) 10 October 2009 (2009-10-10) * figures 1-4 * -----	1-11	

TECHNICAL FIELDS SEARCHED (IPC)

E04B
E04F
E04G

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	14 October 2019	Petrinja, Etiel

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 19 18 0831

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

14-10-2019

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 4317303 A1	01-12-1994	NONE	
JP H0849394 A	20-02-1996	NONE	
RU 2369702 C2	10-10-2009	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82