



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
26.10.2016 Bulletin 2016/43

(51) Int Cl.:
E04B 9/20 (2006.01) **E04D 13/16 (2006.01)**
E04F 13/08 (2006.01) **E04G 21/18 (2006.01)**
E04B 9/18 (2006.01)

(21) Application number: **16166581.5**

(22) Date of filing: **22.04.2016**

(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:
MA MD

(71) Applicant: **Saint-Gobain Isover**
92400 Courbevoie (FR)

(72) Inventors:
• **Langkau, Michael**
68535 Edingen-Neckarhausen (DE)
• **Fabian, Felix**
68219 Mannheim (DE)

(30) Priority: **23.04.2015 DE 102015106286**
22.01.2016 DE 202016100284 U

(74) Representative: **Bockhorni & Kollegen**
Elsenheimerstraße 49
80687 München (DE)

(54) **SYSTEM FOR INTERNAL INSULATION OF BUILDINGS, IN PARTICULAR OF SLANTED ROOFS AND MOUNTING METHOD FOR THE INTERNAL INSULATION**

(57) In a system for internal insulation of buildings, in particular of slanted roofs with a wooden basic construction including rafters and/or beams and slats or profile strips arranged thereon at a distance attachment de-

vices are used which are configured in two components, namely a base element and an attachment element adjustable relative thereto, wherein the relative positioning of attachment element and base element is fixable.

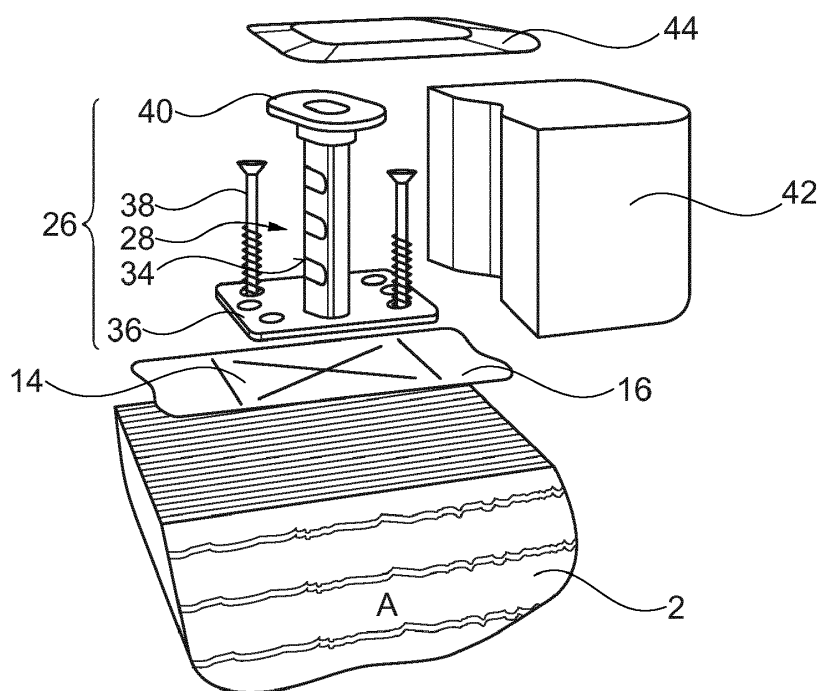


Fig. 5

Description

[0001] The invention relates to a system for the internal insulation of buildings, in particular of slanted roofs according to the preamble of patent claim 1. The invention furthermore relates to a respective mounting method for applying an internal insulation, advantageously in the field of slanted roofs and a particularly suitable fastener element.

[0002] In the field of building insulation so called on rafter insulation is known for slanted roofs wherein the insulation material is applied to rafters extending perpendicular to a ridge beam of a roof, wherein the rafters are arranged at a distance from one another and extend according to the slant of the roof. Thereafter a lower cover web forming a water repellent outer layer is placed on the insulation material, thereafter there is counter and support lattice work forming a support structure for the roof tiles. Optionally a vapor barrier foil or a similar suitable climate membrane can be provided in particular in a remodeling situation.

[0003] Additionally, also the portion between the rafters arranged at a distance from one another can be filled with insulation material. So called clamping felts are typically used for this purpose. Clamping felts are typically delivered on rolls and are provided with evenly spaced marking lines. For insulation purposes, sections are cut off by a knife or similar on site from the unwound clamping felt roll, wherein a length of the clamping felt rolls corresponds to a clear width between the rafters and a predetermined oversize. These clamping felt sections are accordingly inserted between the rafters under pressure which builds up a reset spring force within the clamping felt so that the clamping felt is firmly supported between the rafters. Due to a considerable thickness of the rafters a large amount of damping material can be arranged between the rafters due to a considerable thickness of the rafters when providing between rafters insulation which naturally increases the damping effect.

[0004] The subsequently described invention does not relate to external insulation of buildings but to an internal insulation of buildings wherein the insulation material is arranged from an inside under the inward oriented faces of the rafters (so called under rafter insulation). Also for under rafter insulation a support lattice structure is used which is formed by slats or metal profiles attached at the rafters at a distance from one another like in on rafter insulation. This support lattice structure/metal substructure is arranged from an inside on the respectively deployed insulation materials and attached at the rafters with fastener elements, as an alternative thereto, the support lattice structure is applied first and the insulation materials are introduced thereafter. The support lattice structure is used for receiving the inner covering for which typically sheet rock is used which is attached at the support lattice structure with screws. Insofar a force introduced through the support lattice structure has to be received overall by the fastener elements.

[0005] When there are walls made from a beam construction, either in the field of slanted roofs or when there are walls that extend over the entire height of a story and which have a wooden structure, the internal insulation is analogously applied to the rafter wherein also here an intermediary rafter insulation is typically, this means insulation material is arranged between the offset support rafters. Since this configuration differentiates on the one hand side between rafters for roof construction and on the other hand side beams for walls the term rafter element is subsequently uniformly used for beams and rafters like the term slat element typically includes slats made from wood and also optionally used profile strips made from plastic or sheet metal, in particular so called C or CD profile strips. Also the term under rafter insulation is uniformly used for the internal insulation placed in front of the rafter elements in a slanted roof and also in a vertical wall.

[0006] A system of this type for internal insulation of slanted roofs formed by rafters is known from WO 2009/103 911 A2. Thus insulation plates made from mineral wool for heat and/or sound insulation are placed onto the rafters from an inside and supported by anchor elements which are configured like bolts. These bolt type anchor elements are attached at the rafters by an integrally formed base portion and respectively include a head piece which is configured for receiving U-profile bars, wherein the head piece can be furthermore clipped onto an anchor element and which is furthermore also provided with clip in grooves for clipping on the profile bar. After arranging the insulation elements at the rafters the U-profile strips are clipped onto the head pieces of the anchor elements transversal to the longitudinal direction of the rafters, so that a support lattice structure is formed which is eventually used for receiving the cover elements, in particular sheet rock plates. These sheet rock plates are typically attached by self cutting bolts at the support lattice structure from an inside of the room wherein the support lattice structure is made from suitable profile strips.

[0007] The insulation material plates are thus arranged between the rafter and the head element of the anchoring elements, optionally with a vapor barrier or a similar climate membrane arranged there between. The anchoring elements are arranged at an inside of the rafters through the integrally formed base pieces through a bolted connection. An adaptation through thermal insulation plates with different thickness is either provided through a respective offset of the bolted connection of the anchor elements at the rafter through the base element or the base element is formed from plural sections arranged behind each other which are connected with one another through weak sections, so that respective sections are separable from the base element as a function of the thickness of the thermal insulation plate. This system however causes a certain assembly complexity, in particular with respect to adaptation to heat insulation plates with various thickness. Also during assembly the insula-

tion elements arranged at the rafters are not secured against falling off which makes insulating large surface roofs more difficult.

[0008] A system for internally insulating buildings is known from WO 2006 / 061 538 A1 for insulating walls formed from bricks or wall elements, wherein mineral wool insulation elements are arranged at an inside of the wall made from wall elements which is oriented towards the interior space of the building, wherein an inner covering is applied to the mineral wool insulation elements. Also here sheet rock plates are used in particular for the inner covering.

[0009] In this system horizontally extending profile strips are attached at the built up wall into which support elements are clipped at a uniform distance from one another wherein the support elements protrude from the profile bars to an interior of the room. Horizontally extending profile strips are also arranged at the upper and at the lower end of the built up wall. Eventually the insulation material elements are placed onto bolt shaped support elements. Thereafter respective locking elements are placed onto the protruding bolts of the support elements, wherein the locking elements are provided with head elements with clip in grooves into which in particular vertically oriented C profile strips are clipped. The bolt of the support element and also a respective inner borehole of each locking element are provided with opposite engagement profiles in the form of rib bands with free spaces in between in which a longitudinally extending rib shaped bar is configured. Depending on the rotational orientation of the locking elements, they can be moved together with the vertical C profile strips clipped thereto on the bolts of the support element in a direction towards the applied damper element. In the desired position the locking elements are then locked by rotating a lever arranged at the locking element, so that the vertical profile bars are fixated in the desired insertion position at a distance to the horizontal profile strip on the support elements. Thereafter the sheet rock plates are placed onto the vertical profile bars and threaded together with screws with self cutting thread with these profile strips in order to form the inner covering.

[0010] Various quick attachment elements are furthermore known from (EP 2 476 921 A1, EP 2 476 922 A1) through which profiles strips are connectable with each other with an adjustable distance, in particular for connecting thermal insulation and/or sound insulation elements for building walls. These quick connecting elements are provided with an anchor bolt provided with a head piece for connecting to a C-profile and an insertion bolt insertable therein, wherein both elements are provided with corresponding rib bands over a partial circumference. In one orientation the insertion bolt can be moved relative to the anchor bolt and can interlock in a desired plug in position or insertion position by a rotation by 90° similar to WO 2006 061 538 A1.

[0011] In particular in the field of slanted roofs increasingly an under rafter insulation is used, thus always in

combination with a between rafter insulation. This type of insulation is used for new construction and also for renovating buildings. Thus it is important that the support lattice structure is leveled as precisely as possible over the entire roof surface in order to receive the fairing elements so that the covering arranged on the support lattice structure is flat and level over the entire roof portion, in particular to provide an optically appealing surface configuration for the inner spaces provided under the roof portion. This leveling is very complex and time intensive, in particular due to the fact that the support lattice structure is attached at the rafters by a plurality of anchoring or attachment elements which overall have to be adjusted an set accordingly for leveling, e.g. by placing wood, veneer or plastic plates with different thickness behind the slats/profiles. Furthermore the inner insulation of slanted roofs is advantageously provided with insulation elements with different thickness which typically has the consequence that a plurality of different attachment elements has to be used for inner insulations of this type which are to be attached at the rafter in a suitable manner and respectively at a correct position for receiving the slats for the support lattice work and furthermore with a respective distance from the rafter in order to be able to receive the insulation elements arranged between support lattice work and rafters and vapor retarder foils or similar climate membranes. Thus the assembly of insulation elements for this type becomes very complex for an internal insulation of this type and based on errors during assembly difficulties occur thereafter when cover plates are applied in a separate process step because sufficient leveling of the support lattice work is missing. This requires additional complex measures, wherein damping can become time consuming and also expensive. Practical applications have shown that errors during such internal insulations are quite frequently caused by a deficient execution of the so that there is a need for a suitable mounting system for an internal insulation of this type, in particular in the slanted roof field.

[0012] Thus it is an object of the invention to provide a suitable system for an internal insulation of this type which can be used for mounting the insulation elements in a quick, simple and safe manner and in order to facilitate the execution of the insulation work and in order to prevent or avoid a deficient execution of the insulation caused by the mounting. It is another aspect of the invention to not only provide quick assembly but in particular also a precise assembly which in a simple manner facilitates an even leveling for subsequent layup of covering plates.

[0013] This object is achieved according to the invention by a system with the features of claim 1.

[0014] According to the invention the slat elements are arranged to form the lattice work for the fairing through attachment elements which are divided into a base element and an attachment element thus so that the attachment element that can be arranged on the base element is adjustable into a desired elevation position relative to

the base element and so that the attachment element is lockable in this position. Furthermore the attachment element includes a receiver element for the slat element of the support lattice arrangement thus a support for forming the under rafter insulation thus a support for the insulation elements is provided that are placed from below to the rafter elements for forming the under rafter insulation during the assembly by the base elements attached to the rafter elements, wherein in particular clamping felts are used for this purpose which when they are arranged between the connectors respectively provide support due to the built up reset forces. Thus support function for the insulation elements of the under rafter insulation is in particular important for the main application of insulating the slanted roof. Due to the attachment elements that are respectively placeable onto a base element a desired distance to the rafter can be adjusted which is advantageous because insulation elements with different thickness are used as required for the below rafter insulation. For clamping felts in a range of the below rafter insulation for example thickness dimensions in a range of 60 mm to 120 mm and above are typical. Simultaneously an individual leveling for the support lattice work is feasible so that a flat surface for the covering elements can be provided in a simple manner that are applied to the lattice structure. After the leveling has been performed only the slats have to be arranged in the receiver provided on the attachment element.

[0015] In particular receiver shoes with a U profile shaped receiver are suitable as receiver elements, wherein these receiver shoes are used in particular when slats made from wood are used. The receiver shoe is thus advantageously configured for the typical slat dimension of 60 x 40 mm, wherein for other slat dimensions thus 50 x 30 mm certainly also accordingly configured receiver shoes can be used. For improving support of the slats during assembly it is useful that knob or hook shaped protrusions are configured at least at one of the U-arms of the receiver shoe, so that a temporary support is provided as an assembly support already after the slat is inserted until the slat has been bolted to the receiver shoe. Depending on the application also profile strips made from sheet metal or plastic are used for forming a support slat, in particular C- profiles or CD profiles and similar. For this application the receiver element is provided as a head piece with laterally provided grooves for clip connecting profile strips of this type.

[0016] For mounting the attachment devices typically an assembly tool is used according to the invention wherein the assembly tool is configured band shaped and which includes positioning elements in a predetermined even distance, wherein a distance of the positioning elements from one another corresponds to the desired distance of the slat elements for forming the support lattice work. These assembly tools are attached along the rafter bottom side oriented into the interior of the space so that the positioning elements configured or provided thereon facilitate an exact and also quick arrange-

ment of the attachment devices at the rafters during assembly which is very advantageous for an exact orientation of the support lattice work that is to be subsequently attached and which also facilitates a quick fixation of the attachment device at the rafters without complex measuring steps.

[0017] For an assembly aid according to the invention an adhesive tape with a release foil is useful thus with a glue surface on one side which is covered by the release foil wherein the release foil can have graphic markers as positioning elements, for example a cross shaped marking, a circular marking and similar depending how the base element is configured in the attachment portion at the rafter, so that a simple and form fitting placement of the attachment devices at the rafter is facilitated.

[0018] When required also pedestal elements can be used as positioning elements wherein the pedestal elements are also attached on a band with a distance from each other and wherein the pedestal elements are already provided with a receiving mechanism which corresponds to the base element so that also without screw, nails or similar mechanical attachment devices an anchoring of the base element at the rafter can be provided merely by inserting the base element into the respective pedestal element. Advantageously clip connections in particular also a bayonet connection are used as a quick coupling connector. A quick coupling connector of this type has the advantage that assembly times can be reduced significantly since screwing the attachment elements to the rafter can be omitted, typically a multiple screw connection is respectively provided per attachment device. The band connecting the pedestal elements can be attached in a suitable manner, thus through adhesion, with mechanical attachment devices or similar at the rafter.

[0019] The base element advantageously includes a pedestal which is provided in an advantageous variant at its lower end with at least one side ways protruding attachment flange, in particular one attachment flange protruding from one side of the pedestal or in particular two attachment flanges protruding at opposite sides from the pedestal through which the attachment at the rafter is provided by a bolted connection, a nailed connection or similar. In another advantageous variant which facilitates omitting the screw connection process the base element is configured as complementary connector element relative to the pedestal element in order to facilitate a quick coupling of the base element at the rafter element in that the base element is configured as a clip element, or in particular as a bayonet closure element or similar.

[0020] Thus it is also advantageous according to the invention to combine plural different attachment options in the same base element wherein for example the lower portion of the base element can be configured as annular shoulder in case of a bayonet closure wherein the shoulder includes radial protrusions for forming the bayonet closure element, wherein the radial protrusions reach behind respective grooves in the pedestal element, wherein

however the annular shoulder is also additionally provided with openings for a pass through of screws or similar attachment devices, so that the attachment of the base element can be optionally performed with a bayonet closure or with a threaded connection or similar mechanical attachment devices.

[0021] It is advantageous to configure the base element as a simple sheet metal component or plastic component, in particular as an injection molded component which facilitates a cost effective production of these base elements. This is advantageous in particular because the attachment devices of this assembly system are mass produced components.

[0022] The attachment element that can be arranged at the base element however can also be advantageously configured as inserted element, wherein the base element is then accordingly configured for a respective receiver, in particular with a receiving bushing for receiving the inserted element. Thus the placement position of the inserted element in the base element is advantageously provided by form and/or friction locking, in particular by an interlocking fixation or a clamping process.

[0023] When using an attachment element configured as an insertion element the receiving bushing can be configured in a simple manner in a single wall socket so that the socket is provided with horizontal slots that are offset on top of one another so that bars are configured above one another between the slots on the socket. These bars when configured as a sheet metal component can be sequentially shaped in opposite direction from the pedestal outward in particular cambered in order to form the receiving bushing. This is advantageous because a receiving bushing can thus be configured in a simple manner for example from a simple single wall sheet metal component thus an L shaped sheet metal component configured as a base element wherein the sheet metal component is then used for receiving the insertion element. In an advantageous variant thus the insertion element can be provided with a suitable engagement profile like e.g. interlocking elements wave profiles rib strips teethings, threaded profiles and similar and the receiving bushing can be provided with a complementary engagement profile for mutual engagement. Thus an elevation adjustment and also a height adjustment and a fixation due to engagement are feasible. Teethings, waves and ribs are particularly suitable as engagement profiles which are advantageously arranged on top of one another like a band.

[0024] In an advantageous embodiment the insertion element includes two offset placement tongues which are used for engaging the receiving bushing of the base element wherein the placement tongues have a guide function and a support function. Between the two placement tongues the actual leveling element particularly in the form of a leveling screw can be provided which then interacts with a complementary threaded profile in the receiving bushing.

[0025] In an advantageous embodiment the leveling

screw does not have an engagement profile in its upper portion but rather has a smooth shaft and is supported in a bar connecting the two placement tongues in a clip connection axially fixated in the insertion element but freely rotatable. Thus it is advantageous to provide the bar with a receiving bushing in which slots are configured so that the bar is sufficiently flexible in the receiving portion of the leveling screw in order to facilitate clipping in the leveling screw. Leveling the insertion element relative to the base element is performed by threading the leveling screw in or out.

[0026] In a simple cost effective variant the insertion element can be directly formed merely by a leveling screw, at whose upper end only the receiver element for receiving a slat element is provided.

[0027] The leveling screw can be provided with a suitable thread profile or thread, wherein standard threads can certainly be used for cost reasons. The base element with which the leveling screw cooperates is thus provided with a complementary thread profile or thread as a receiving bushing. Calculations with maximum load through covering plates below the below spar insulation and in view of the weight of the insulation material have shown that the form locking due to interaction of the leveling screws with the respective receiving bushings of the base element suffices with multiple safety for the required load bearing. As required an additional friction locking clamping between leveling screw and base element can be provided through respective configuration of the receiving bushing, thus through subdividing into bars that are arranged on top of each other which are separated from one another through slots, wherein the friction locking clamping superimposes the form locking between the leveling screw and the base element and additionally contributes to a respective load bearing.

[0028] In an advantageous embodiment the pedestal at its upper end which is remote from the rafter is provided with a flange on a partial circumference of the pedestal which protrudes sideways, in particular with a flange that laterally protrudes beyond the pedestal which provides a contact surface for a placement of a vapor retarder foil or a similar climate membrane and also an advantageous support of the damping elements applied to the rafters for under rafter insulation during the mounting process, in particular during subsequent application of the elements for the support lattice work. This is particularly advantageous for the main application of a slanted roof. Thus it can be advantageous to provide a flange on a separate component in particular on a sleeve that can be placed onto the upper end of the base element that is remote from the rafter.

[0029] In another variant the insertion element is configured for forming a clamping mechanism for this purpose advantageously a clamping wedge received in the insertion element can be used wherein the clamping wedge interacts with a complementary wedge opposite surface at the insertion element. Through a movement of the clamping wedge relative to the insertion element

the clamping wedge can be adjusted from a mounting condition in which the insertion element is easily insertable into the base element and thus elevation adjustable relative thereto into a fixation position in which the insertion element is anchored in the base element.

[0030] For clamping the clamping wedge in this manner a turning bolt provided with a grip handle and an eccentric element is particularly suitable for adjusting the clamping wedge into the two positions, thus the mounting position and the fixation position advantageously the clamping wedge is attached through a suitable coupling at the interconnection at the insertion element. Thus it is advantageous that two grip handles are used namely one respective grip handle on one side of the insertion element. This embodiment has the advantage that a subsequent leveling can be performed in a simple manner also after applying the support lattice work in that only the grip handles are accordingly pivoted by 180° from the mounting position into the arresting position and vice versa.

[0031] In an advantageous embodiment the clamping wedge is provided with a wedge surface on its rear surface, wherein the wedge surface interacts with a complementary wedge surface of the wall element of the insertion element which receives the wedge, and in particular bridges two lateral insertion tongues. A movement of the clamping wedge relative to the wall element presses the clamping wedge outward so that a clamping of the clamping wedge mechanism within the receiving bushing of the base element is performed.

[0032] Advantageously the insertion element at its surface interacting with the receiving bushing, in particular the bars of the receiving bushing is provided with an engagement profile, in particular a groove profile and interacts with a complementary engagement profile in particular a groove profile in the receiving bushing or at the bars. A wave profile is particularly suited as a groove profile this engagement profile provides an advantageous support of the insertion element inserted into the receiving bushing for assembly already before clamping the insertion component in the receiving bushing so that the insertion elements placed so to speak overhead are already accordingly supported in the base elements or in the receiving bushing during the assembly process.

[0033] In combination with the clamping wedge mechanism according to the invention the wedge mechanism is not limited to the embodiment described supra, rather the wedge surfaces can also be formed differently or at another location. For example respective wedge surfaces can also be provided at the opposite placement tongues of the insertion element wherein the wedge surfaces cooperate with complementary wedge surfaces that are provided at an edge of the clamping wedge. Also this way a respective elevation adjustment of the clamping arrow can provide a fixation within a receiving bushing or within the base element. Certainly also other variations of the clamping wedge mechanism can be easily implemented.

[0034] In another embodiment it is useful to configure the attachment element not as an insertion element but rather as an attachment element which reaches over the base element during attachment or wherein the base element penetrates the attachment element.

[0035] In another variant the attachment element is configured by an arresting bolt which is configured with a respective engagement mechanism in particular a mechanism in which the arresting bolt is elevation adjustable relative to the receiving bushing of the pedestal when the arresting bolt is adjusted in rotation and fixated relative to the base element in another rotational orientation, in particular for a pivoting by 90°. In particular rib bands made from ribs arranged on top of one another, in particular bar shaped ribs are suitable as engagement mechanism wherein the ribs are arranged in particular at the arresting bolt opposite to one another, wherein a longitudinal bar is configured on each side of the arresting bolt in the space between the two rib bands. Also the receiving bushing is provided with a complementary profile. When the arresting bolt is aligned relative to the receiving bushing of the pedestal so that the two longitudinal bars correspond with both rib bands within the receiving bushing the arresting bolt can be adjusted relative to the pedestal. For a rotation by 90° opposite rib bands engage each other which then provides axial locking of the arresting bolt. This pivoting can be advantageously performed by a grip handle laterally protruding from the arresting bolt which facilitates in a simple manner a subsequent leveling also for when the lattice work has already been applied.

[0036] According to another advantageous variant the pedestal of the attachment device is configured with a plug in shoe which is used for receiving the insertion element on which the profile bar or slat is received. Advantageously the plug in shoe is suspended at the pedestal and supported floating with respect to pressure or spring elastic. The plug in shoe can be configured in one component or can be advantageously configured in two components and can be produced and arranged integrally in one piece with the pedestal or also separately from the pedestal. The pedestal is thus in particular configured by two flange shaped elements which are arranged opposite to each other thus with a distance from one another so that an intermediary space is formed for receiving the plug in shoe.

[0037] The plug in shoe is provided with an opening, in particular a bushing shaped opening for receiving the insertion element, in particular an insertion member arranged at this location which is configured with a threaded profile or an engagement profile, in particular a finely structured interlocking profile with interlocking distances of advantageously between 1 mm and 3mm, advantageously approximately 1.5 mm. The plug in shoe is thus configured so that inserting the plug in element thus advantageously a screw the opening is expanded thus advantageously against a suspension of the plug in shoe within the pedestal which eventually leads to a wedging

and clamping in a desired mounting position.

[0038] Advantageously the plug in shoe is arranged within the pedestal or between the flange elements by bar shaped lobes which are arranged on both sides of the plug in shoe and which extend between the plug in shoe and the flange elements and which are furthermore advantageously arranged in series respectively on top of one another at a distance from one another. In a mounting position of the pedestal the lobes extend from the flange elements in a direction towards the plug in shoe upward at a slant angle, thus advantageously at an angle of approximately 30° to 60°, further advantageously 35° to 55°, particularly advantageously 45°.

[0039] The plug in shoe advantageously includes a bushing shaped component which defines the opening for receiving the plug in screw. Thus it is particularly advantageous for an integral configuration of the shoe in one piece that the plug in shoe is slotted up to the receiving opening so that it can expand when inserting the plug in element or the screw while building up reset forces. In an advantageous manner the plug in shoe is configured in two components including a head expansion that may be arranged at one end and thus it is advantageous that the insertion shoe is integrally configured with the remaining pedestal element for an integral configuration of the plug in shoe and also for a multicomponent configuration in particular a two component configuration of the plug in shoe, wherein the connection of the pug in shoe with the flange elements is provided through the lobes that are arranged on top of one another and provided on both sides. The opening in the bushing shaped portion of the plug in shoe is thus configured with an interlocking profile or a thread profile complementary to the plug in element so that interlocked plug in positions can be taken when inserting the plug in element or the insertion element.

[0040] This configuration yields a very quick and simple assembly of the insertion elements. The insertion element only has to be pushed or inserted into the opening of the plug in shoe, thus until the insertion movement stops wherein the insertion element remains fixated at this location. Now when the covering thus the profile bars or slats and sheet rock plates are applied then as a matter of configuration the clamping force between the pedestal and the insertion element increases so that a safe positioning in the desired mounting position is facilitated. Thus also a simple adjustment is possible when a manual pressure is applied to the expanded head element of the plug in shoe since this pivots the lobes upward in mounting position so that the clamping is reduced or removed so that an easy adjustment of the insertion elements is possible through translatic insertion or movement of the insertion element within the pedestal. In an assumed desired interlocking position a fine adjustment is then possible in as far as rotating the screw facilitates an adjustment within the interlocking distance of the interlocking or thread profile. For easier turning for the purpose of adjustment the screw or the insertion element is advantageously provided with a square or hexagon or sim-

ilar for applying a suitable tool for turning the screw.

[0041] According to another advantageously embodiment the insertion element thus in particular the screw is provided with an expanded top at its end that is oriented away from the free end, wherein the plug in element can be snap locked into the head of the insertion element which is thus provided with downward protruding clamping or clip members. Thus the clamping is provided so that after clamping the insertion element or the screw the plug in element is still rotatable within the head of the insertion element in order to perform readjustments.

[0042] In an advantageous embodiment of the invention the insertion element is universally configured for receiving a profile bar and also a slat. Thus, it is advantageous to provide two laterally opposed grooves at the top element for snap locking the profile bar and a stop bar that is laterally arranged and downward extending in mounting position for laterally attaching the slat which can then be screwed together with the top element by regular screws. This configuration has the advantage that various individual elements do not have to be stocked.

[0043] With the attachment device according to the invention a quick and simple mounting of an inner insulation can be provided in particular at slanted roofs. Thus advantageously initially the positioning elements are arranged along each rafter thus through an adhesive tape or a threaded connection so that thereafter the base element can be applied one after another at exactly predetermined positions. Since the positions are predetermined by the positioning elements provided on the bands no complicated measuring steps are required for determining the individual attachment points which facilitates a quick and simple placement and attachment of the base elements at the rafters. Thereafter the under after insulation is quickly arranged wherein the insulation elements can be fixated between the base elements in particular by a flange provided at the base element against drop down during assembly. Thereafter optionally also a vapor retarder foil or another suitable climate membrane can be applied in particular on the flanges of the base element, thereafter the attachment elements are applied to the base elements and eventually the lattice elements are arranged thus through a threaded connection with the accordingly configured receiving shoes. Attaching the climate membrane foil can be provided through glue pads provided on the flanges wherein the glue pads can be provided with a release liner for activating the glue connection. Particularly advantageous are glue pads based on a self-adhesive and simultaneously sealing compound which provide an air tight sealing of the penetrations of the foil in addition to the fixation of the foil. Suitable compounds are known to a person skilled in the art and provided by various vendors.

[0044] As an alternative to factory mounting the glue pads at the flange surfaces they can be applied to the flanges with a dispenser when mounted on site as required. This takes care of the fact that in a significant number of cases the climate membrane is directly at-

tached to the rafters, so that the insulation according to the invention is arranged in front of the air tight layer on an interior side of the space and no foil layer is applied to the flanges wherein the factory attachment in many cases represents unnecessary complexity.

Alternatively the surfaces of the flanges can be provided with a hook and loop type surface structure for attaching the foil which cooperates with a respectively configured surface structure of the vapor retarder.

[0045] For the bands with the positioning elements it is advantageous to standardize them already for a particular length, thus with a predetermined distance of the positioning element relative to each other. The band length is influenced by process considerations and can be for example 10 meters. The distance of the positioning elements is determined by fire protection and static requirements and the size of the covering elements used, advantageously sheet rock plates typical distances are between approximately 40 cm and 62.5 cm, the graphic marking elements are thus advantageously adjusted to the attachment element of the base element, so that the base element is only placed and positioned against the graphic pattern and can then immediately be screwed down or attached by a suitable quick connector.

[0046] Subsequently advantageous embodiments of the invention are described to schematic drawing figures, wherein:

FIG. 1 illustrates a portion of a slanted roof with rafters from an interior;
 FIG. 2 illustrates a detail view of the slanted roof of FIG. 1 with an assembly aid with a graphic marker;
 FIG. 3 illustrates another embodiment of an assembly aid with pedestals arranged on a band;
 FIG. 4 illustrates a detail view of a portion of the slanted roof with the band that is provided with pedestals according to FIG. 3;
 FIG. 5 illustrates a first variant A of an attachment device in an exploded view;
 FIG. 6 illustrates a view of a pedestal or base element of the attachment device illustrated in FIG. 5;
 FIG. 7 illustrates the attachment device illustrated in FIG. 5 in a functional position before assembly;
 FIG. 8 illustrates the attachment device in an arrested position;
 FIG. 9 illustrates a side view of the attachment device;
 FIG. 10 illustrates a front view of the attachment device in assembled condition;
 FIG. 11 illustrates a top view of a screw supported in the attachment element;
 FIG. 12 illustrates a sectional view (horizontal sectional view) of FIG. 11;
 FIG. 13 illustrates another embodiment of the at-

FIG. 14

5 FIG. 15

FIG. 16

10 FIG. 17

FIG. 18

15 FIG. 19

FIG. 20

20 FIG. 21

FIG. 22

25 FIG. 23

FIG. 24

30 FIG. 24A

35

FIG. 24B

40 FIG. 25

FIG. 26

FIG. 27

45

FIG. 28

FIG. 29

50

FIG. 30

FIG. 31

55

FIG. 32

FIG. 33 - 38

tachment device in variant B in an exploded view;

illustrates a pedestal before assembly at a base element;

illustrates a pedestal according to FIG. 14 in mounted condition;

illustrates a pedestal with insertion component to be received therein and insulation elements arranged on the rafter; illustrates the previously illustrated attachment device in a lateral view;

illustrates the attachment device according to FIG. 17 in a front view with a profile bar snap locked on;

illustrates another alternative embodiment of variant C before the mounting position;

illustrates a variant C in insertion elements received in the pedestal;

illustrates a pedestal of variant C with insulation element mounted on a rafter;

illustrates a detail view of an insertion element for a clamping wedge mechanism;

illustrates a detail view of the insertion element in an arresting position of the clamping wedge;

illustrates a side view of variant C in mounted position;

illustrates a partial sectional view of a clamping wedge mechanism according to FIG. 24 in an inserted position when inserting an inserted component into a position representing a receiving bushing;

illustrates a respective partial sectional view analogous to Fig. 24A in a fixated position of the clamping wedge relative to the inserted component;

illustrates a front view of the variant C;

illustrates another embodiment of an attachment device according to variant D in an exploded view;

illustrates a view of a pedestal of an attachment device according to FIG. 26;

illustrates the attachment device of FIG. 26 before inserting the insertion element;

illustrates the attachment device illustrated in FIG. 28 with the fixated insertion element for receiving a wooden slat;

illustrates a side view of the variant D with a received sheet metal profile bar;

illustrates a front view of the embodiment according to variant D with a received sheet metal profile bar;

illustrates a multifunctional receiving element for an attachment device;

illustrate plural views of sequential steps

- of a mounting method using the system;
 FIG. 39 illustrates another embodiment of the fastener in an exploded view;
 FIG. 40 illustrates a perspective view of a fastener before inserting the insertion element;
 FIG. 41 illustrates a view according to FIG. 40 in which the insertion element is inserted;
 FIG. 42 illustrates a side view of the socket with a received screw;
 FIG. 43 illustrates three views of a socket of this embodiment in operating condition and with a screw of the insertion element;
 FIG. 44 illustrates a side view of the embodiment according to FIG. 39 illustrating the receiving head;
 FIG. 45 illustrates a side view of the fastener showing the slat attachment at the head;
 FIG. 46 illustrates the fastener according to FIG. 39 with the profile bar snap locked on;
 FIG. 47 illustrates a corresponding representation of the fastener with the wooden slat attached;
 FIG. 48 illustrates a perspective exploded view of another embodiment in an application for receiving a sheet metal profile or a wooden slat;
 FIG. 49 illustrates a perspective view with a sheet metal profile snap locked on;
 FIG. 50 illustrates detail namely the head piece of FIG. 49 in a blown up view;
 FIG. 51 illustrates a respective view with a screw for attaching a wooden slat;
 FIG. 52 illustrates a side view of the attachment device with the profile bar snap locked on, and;
 FIG. 53 illustrates a respective view with a wooden slat to be received.

[0047] Subsequently the invention is described with reference to a slanted roof configuration with rafters, wherein this embodiment is also implementable for beam structures of vertical walls.

[0048] It is well known that slanted roofs in a simple embodiment are made from an upper bridge beam at which rafters are attached on both sides in uniform intervals, thus on a left and on a right side of the bridge beam. At a lower end the rafters are attached at so called base beams. In case of an under beam insulation slats are arranged at an inside of the rafters, thus on an inward oriented side of the rafters transversal to the rafters wherein the slats are attached at the rafters which in turn are arranged along the rafters at a distance from one another and which form the horizontal support lattice work for receiving the inner fairing. The slats of the support lattice work do not only have to be able to carry the load but also have to be leveled precisely. Between this support lattice work the under spar insulation is advantageously attached with a thickness that corresponds to

the slat depth wherein the so called inter slat insulation can be additionally arranged between the slats.

[0049] FIG. 1 schematically illustrates the configuration of one half of a slanted roof 1 with rafters 2 that are arranged at a distance to one another, a between rafters insulation 4 which is typically arranged flush with the rafters between the rafters 2, this means whose thickness corresponds to the height of the rafters and which completely fills the space between the rafters, a ridge beam 6 extending transversal to the rafters 2 and a bottom beam or threshold 8 and support lattice work arranged there between which is formed from slats 10 arranged at a distance from one another and extending transversal to the rafter.

[0050] In the embodiment illustrated in FIG. 1 eight slats 10 are provided in an exemplary manner between the ridge beam and the base beam 8 and wherein the slats 10 are attached at six rafters 2.

[0051] For a slanted roof half with a total of 6 rafters according to FIG. 1 this means that the slats have to be screwed down in a complex manner at 48 attachment points 12 and that they also have to be leveled. Thus FIG. 1 illustrates the slats 10 which extend horizontally and transversal to the rafters and which are not illustrated in a three dimensional manner but only has transversal bands for simplification purposes.

[0052] In case of the under rafter insulation described in an exemplary manner for description purposes the slats 6 have to be arranged at a distance to the rafters 2 so that respective insulation elements can be arranged in the space between the rafters and the rear side of the slats 6. Thus according to the invention special attachment devices are attached which on the one hand side support the slat 6 respectively at a respective distance to the rafters 2 attach them at the rafters and furthermore are also configured so that they receive the slat 6 or can alternatively also receive C-profile bars and can be leveled in elevation which then forms the lattice work for the fairing that is eventually to be applied and which is mostly made from sheet rock plates. Attachment devices of this type are subsequently illustrated and described in different advantageous embodiments.

[0053] It is self-evident that this assembly work is complex, namely FIG. 1 only shows a roof half with 6 rafters in an exemplary manner. However typically many more rafters are provided per roof half of a roof thus also more attachment points for anchoring the support lattice work at the rafters.

[0054] In order to precisely attach these attachment devices at the provided attachment positions 12 which can be provided by a screw connection assembly aids are advantageously provided. For this purpose an adhesive tape is particularly suited wherein the adhesive tape can be wound from a roll and can be used for an adhesive attachment along each rafter 2 and wherein the adhesive tape is marked with markings 14 at a visible side that is oriented away from the adhesive joint with the rafters wherein the markings are arranged at even distances

over the length of the adhesive tape 16 thus according to the nominal distance of the slats 10 of the support lattice work of the roof. A respective embodiment is illustrated based on FIG. 2 in which the respective adhesive tape 16 are already glued against the face of the rafters 2 oriented towards the interior of the room. The markings 14 which are provided on the visible side of the adhesive tape 16 and arranged at even distances from one another over the length of the adhesive tape are also clearly visible wherein the markers in this embodiment are formed in an exemplary manner by a cross marking. Other markings are also possible.

[0055] For an even orientation of all attachment points along the rafters of a roof half a thread 18 can be advantageously run horizontally on the rafters under tension so that all tapes for a roof half can be attached exactly in a line guided by the first markings and glued on the rafters on in another manner for example by staples. Alternatively this horizontal orientation axis is visualized by a construction laser. This yields an even pattern for all attachment points so that the attachment devices can be fixated exactly at the provided attachment points at the rafters.

[0056] A variant of a mounting aide of this type are illustrated in FIGs. 3 and 4 wherein the mounting aide is formed by a band 20 that is wound into a roller, in particular a band made from plastic material on which pedestal elements 22 are arranged, thus at uniform distances from one another wherein the distance corresponds to the provided distance between the slats 10 of the support lattice work. These pedestal elements 22 can be suitably attached on the band 20, thus through gluing, clip connection, inserted connection and similar. In the illustrated embodiment of FIG. 3 and 4 the pedestal elements 22 are centrally provided with an opening 24 through which the pedestal elements 22 can be attached at the rafters 2, in particular by screws, nails or similar.

[0057] In FIG. 4 in turn illustrates a thread 18 that is advantageously horizontally strong over the slats for precise alignment wherein the upper most pedestal elements 22 can be exactly applied to the thread so that a uniform orientation of all pedestal elements of the bands provided for the rafters can be provided in a simple manner.

[0058] As will be described infra in more detail the pedestal elements are provided with coupling members which facilitate a simple arrangement of the attachment devices at the pedestal elements, thus through a bayonet closure, clip interconnection or a similar quick connector. A connector of this type also facilitates dismounting at attachment devices of this type.

[0059] These assembly aids facilitate a correctly positioned fixation of the attachment elements for the desired support lattice work and thus of the support slats or alternatively C or CD profile strips and similar made from sheet metal or plastic material. As stated supra the support lattice work has to be attachable at a distance from the rafters in order to be able to arrange the insulation

that is provided between the rafters and the support lattice work. Furthermore the support lattice work also has to be precisely leveled in elevation which requires an exact orientation of the mounted slats at a level in order to provide an even surface for the fairing to be applied. Attachment devices suitable for this purpose are subsequently described in more detail.

[0060] The first embodiment of a respective attachment device is described with reference to FIGs. 5 - 10 wherein FIG. 5 illustrates an exploded view of all elements of the attachment device according to a first variant A.

[0061] As evident from FIG. 5 this attachment device is provided in particular for use together with a mounting aid according to the previously described adhesive tape 16 with markings 14, thus in a cross configuration, wherein the adhesive tape 16 is illustrated in FIG. 5 for better representation only as a partial section like the rafter 2. The attachment device designated as 26 is made from a base element 28 to be attached at the rafter 2 and an attachment element 30 configured as an insertion element 31, wherein FIG. 5 illustrates two embodiments of the insertion element 31, namely on a right side for receiving a slat 10 made from wood and on a left side for receiving a profile bar, namely a C- profile bar made from sheet metal which like the slat 10 is only illustrated in a portion. The profile strip is thus designated with the reference numeral 32 wherein for simplicity purposes this profile strip is also subsumed under the genus of a slat 10.

[0062] The base element 26 which is illustrated in this embodiment as a plastic element in order to reduce heat transfer however can also be made from sheet metal material as required and includes a pedestal 34 with an attachment flange 36 that is provided at a lower end and in particular integrally formed, wherein the attachment flange can be provided with openings so that the base element 28 can be attached at the rafter 2 with screws 38 in a suitable manner. A circumferentially extending flange 40 is arranged at an upper end of the pedestal and in particular integrally configured in one piece together with the plastic element. Furthermore FIG. 5 illustrates an insulation element 42 that is illustrated in sections for below rafter insulation, wherein commercially available insulation elements are used for under rafter insulation which can be configured as required for thermal and/or sound insulation and which are mostly made from mineral wool like e.g. glass wool or rock wool. In particular a so called under rafter felt is suitable as an insulation element wherein insulation elements with different thickness, thus 60 mm, 80mm, 100 mm and similar are used as required, wherein a height of the pedestal can be accordingly adjusted to this thickness of the insulation element 42, this means respective pedestals with a respective elevation can be used. The bead shaped recess that can be derived from FIG. 5 only represents the situation when the insulation element contacts the pedestal element and is not originally provided in the plate or roll shaped clamping felt.

[0063] It is certainly also possible to make the pedestal elevation adjustable in order to be able to use the same pedestal for insulation elements with different thickness. This can be provided for example by a two piece configuration of the pedestal with respective interlocking connection with elevation offset interlocking devices or through snapping on a respective insertion bushing.

[0064] Furthermore FIG. 5 discloses a membrane, in particular a climate membrane 44 or a vapor retarder foil which is arranged flat on the insulation element 42 and advantageously glued together therewith. Respective climate membranes can be vapor retarders or respective under membranes for gluing purposes glue pads or glue tapes can be provided on the flange.

[0065] The insertion element 31 configured for receiving a wooden slat 10 as evident from FIG. 7 includes two offset insertion tongues or insertion blades 36 which are connected with one another at its upper end through a central blade 48 above which eventually a receiving shoe 50 with a U-shaped cross section for receiving a wooden slat 10 can be provided.

[0066] As apparent in particular from FIG. 7 both arms 52 of the receiving shoe 50 can be provided with plural knobs or hooks 54 that their inner surface and respectively include an attachment 56 for a threaded connection with the wooden slat 10 which is not illustrated in FIGs. 5 - 10. For the attachment of the slats mostly screws are used. The knobs or hooks 54 provide that after inserting the slat into the receiving shoe 50 the slat is already supported for the subsequent screwing process through the two arms 52 of the receiving shoe 50. Thus it is appreciated that the illustration of FIGs. 5 - 10 is turned upside down for simplification purposes however the rafter 2 is respectively on top and the receiving shoe with its two receiving arms 52 is oriented downward.

[0067] The insertion element 31 illustrated in FIGs. 5 - 10 is advantageously integrated in one piece from plastic material thus by injection molding but it can also be made from other materials, thus it can be configured as a sheet metal component.

[0068] The central bar 48 is thus provided with slots 56, (c.f. FIG. 10) and thus configured as a slotted socket 58 which is used for receiving a leveling and attachment screw 60 which is received in the slotted socket 58 and which furthermore extends between the insertion tongues 46. The slotted socket 58 is thus centrally configured within the bar 48 which bridges the two insertion tongues 46.

[0069] Thus, reference is made in detail to the schematic representation of FIG. 12 which illustrate the reception of the screw 60 in the insertion element 30 in a sectional view and in a top view. Thereafter the screw 60 engages the slotted bushing 58 acting as a clip element with its lower head piece 62. The head piece 62 is configured cone shaped at its bottom and includes a circumferential contact shoulder 64 at its top wherein the contact shoulder reaches the slotted bushing or the central bar 48 so that the screw 60 is secured against falling out. At

the upper end of the screw 60 a larger head element 66 is provided which is configured cone shaped and which contacts a respective cone shaped shoulder 68 of the insertion element 30 so that the screw 16 is secured in this position by the slotted bushing 58 and the contact shoulders 64 and 68 and is flush with the surface for example of the receiving shoe.

[0070] FIG. 12 shows the slotted bushing 58 with the slots 56 and the central bar 48 which bridges the two insertion tongues 46 that are not illustrated in FIG. 12 and connects them with each other. The slots 56 in the slotted bushing 58 are not configured continuous but the slots 56 provide a sufficient elastic or spring characteristic which facilitates snapping the screw 60 and its support into the slotted bushing 58. Furthermore the screw 60 is provided in its lower portion with a thread 68 wherein the screw can be a self-cutting screw, drill screw, sheet metal screw or similar.

[0071] A respective opposite thread is provided in the pedestal and designated with the reference numeral 70 in FIG. 10.

[0072] The pedestal 34 in the illustrated embodiment has a cross section that is adapted to the outer circumference of the insertion element 31 and forms a receiving bushing 72 with an upper opening 74 for receiving the insertion element 30a with the two insertion tongues 46. The pedestal can also be produced integrally in one piece by injection molding from plastic material, but it can also be made from a sheet metal component. In the illustrated embodiment this is a sheet metal component wherein the threaded bushing 70 is formed by bars 76 due to horizontal slots introduced in the pedestal portion which are sequentially outward cambered towards one side and another side so that the bar 76 remaining between the slots define the receiving bushing for the screw 76 and also for the insertion tongues. The bars can also be provided with a thread that corresponds with the thread of the screw 60 at inner surfaces of the bars that are oriented towards each other. Thus turning the leveling screw 60 at the screw head 66 arranged in the portion of the receiving shoe 50 (c.f. FIG. 8) facilitates moving and positioning the insertion element 76 to the suitable insertion depth within the pedestal. Thus a leveling of the receiving shoe can be provided by the screw 60 due to the access to the screw head 66 so that the slat received in the receiving shoe can be elevation positioned relative to the pedestal or the rafter. The configuration of receiving bushing and leveling screw provides a form and friction locking which provides safe static load reaction without a risk of unintentional disengagement of the connection besides the option for leveling. For this purpose the form locking due to thread engagement between the bushing 70 and the leveling screw 60 is completely sufficient. The configuration of the threaded bushing 70 from the bars 7b arranged on top of one another and formed by horizontal slots additionally also yields a clamping between the screws 60 and the bars and thus also a friction locking engagement.

[0073] In case a in particular C-shaped profile bar from sheet metal or plastic material is used instead of the slat 10 made from wood according to the illustration on the right side in FIG. 5 the insertion element 31 includes a head 78 configured as clip on element instead of a receiving shoe 50. This head 78 is laterally provided with grooves 80, so that the profile bar 32 with its inward oriented C-bars 82 can be snapped locked into the grooves 80 and thus onto the head. Furthermore the insertion element 30 however is configured identically to the variant illustrated on the right in FIG. 5.

[0074] FIG. 6 clearly shows the pedestal 34 mounted onto the rafter 2 with the receiving bushing which is formed by horizontal slots in the pedestal and opposite outward bending of the bars thus formed. The opening 74 in the flange 40 at the upper end of the pedestal includes two opposite grooves 84 for support or the engagement of the insertion tongues 46. It is clearly evident that the insulation element 42 which can be a clamping felt is arranged and supported between the rafters and the flange 40 of the pedestal. Depending on the configuration a tensioning web 44 thus configured as a vapor retarder foil or similar climate membrane can be applied as a foil onto the insulation element 42 and can thus be advantageously glued as evident from FIG. 8. Eventually the insertion element in the illustration according to FIG. 8 is inserted from above, but in reality inserted in the roof portion from below into the pedestal and through the thread configuration at the lower end of the screw and in the receiving bushing a threading process can provide a respective leveling of the insertion element with respect to its depth or height relative to the pedestal 34 in order to align the slat 10 or the profile bar accordingly as evident from FIG. 7 and 8 for the variant of the insertion element with a receiving shoe 50 or in the FIG. 9 and 10 with respect to the variant with a clip element of the insertion element.

[0075] For mounting purposes as described supra the attachment points for placing the support slats or the profile strips are fixated as described supra using suitable mounting aides in particular adhesive tape 16 or tape 21 configured with pedestal elements. Thereafter in case of the described embodiment the pedestal element is placed correctly fitted onto the respective marking and the base element is threaded together with the rafter 2. Thereafter the under rafter insulation is applied thus by arranging clamping felts or similar and as required also the arrangement of a membrane foil or a respective tension web made from suitable material. Thus in particular a moisture adaptive vapor retarder foil is suitable. Eventually only the insertion element has to be inserted into the base element and has to be positioned to a respective insertion depth by rotating the screw which facilitates an exact leveling of the slats or profile strips in a simple manner wherein eventually the covering is attached to the slats or profile strips, wherein the covering is at least formed by sheet rock plates. The sheet rock plates are connected with sheet metal screws or self-tapping

screws in case of a sheet metal or plastic profile strip and with respective screws in case of wooden slats which provides an exact and flat covering in the roof portion but also in a wall portion of a building over the entire roof surface.

[0076] Variant B that will be described infra corresponds with respect to its basic configuration largely to variant A described supra so that identical or equivalent components of the attachment device are provided with identical reference numerals. Also his variant B has two alternative embodiment of the insertion element 31, namely on one side with a receiving shoe 50 for receiving a wooden slat 10 and a head element 70 for receiving a profile strip made from sheet metal or from plastic material. In so far the configuration of the insertion element is comparable. The only difference is in the leveling screw 60 that is being used which is configured as a self-tapping screw and which could furthermore also be used in variant A. For this purpose typical suitable standard screws can be used.

[0077] The main difference is the lower configuration of the pedestal 34 which is configured for engagement for the band 21 described supra with offset pedestal elements. Besides that however the configuration of the base element and of the insertion element is substantially analogous to the variant A.

[0078] As evident from FIGs. 14 and 15 the pedestal 34 is provided with a protruding annular shoulder 90 at its lower end wherein the annular shoulder in the present embodiment has two opposite tongue shaped radial protrusions 92 which are arranged opposite to one another. Accordingly each pedestal element 22 has recesses 94 that are complementary to the protrusions 92 which in turn are arranged opposite to one another and at which a respective annular shoulder 96 with a groove 98 that is open towards an interior of the pedestal element 22 adjoins and by which a bayonet type closure is formed. As evident from the sequence of FIGs. 14 and 15 pedestal 34 with a respective orientation of both protrusions 92 is inserted into the pedestal element 22 in a direction towards the recesses 94, rotated in a direction towards the annular shoulder 96 so that the protrusions 92 are respectively reached over by the respective annular shoulder 96 so that the pedestal in the pedestal element is fixated against a pull out in upward direction. When required the protrusions 92 and the grooves 98 can be provided with a tapering surface or a wedge surface like a bayonet closure in particular at their edges, so that they are clamped relative to one another in the end position so that a disengage able and safe arrangement of the pedestal in the pedestal element is provided.

[0079] This yields a simple attachment of the pedestal in the pedestal elements previously fixated on the rafters in that the pedestals with respective orientation are only inserted in to the pedestal elements and then depending on the length of the groove are rotated in the annular shoulder by a respective angle thus approximately 20° to 30° in the illustrated embodiment into the end position

under the annular shoulders so that the pedestals are then positioned accordingly in the pedestal elements. Thereafter the under rafter insulation can be arranged on the rafters and the insertion elements can be eventually applied, wherein as illustrated in FIGs. 16 the insertion element 31 with its lower end punctures a membrane foil with its lower end which is placed on the flanges 40 of the pedestal 34 and the insulation elements 42 and which eventually moves into the receiver of the pedestal 34 as illustrated with reference to FIGs. 17 and 18 for an insertion element with a head piece that is configured for a clip connection with a profile strip. This yields a quick connector relative to the threaded connection of the pedestal through the attachment flanges 36 provided in variant A.

[0080] The third variant C in analogy to the previously described variant B includes a base element with an annular shoulder 90 at the rafter side end and with two radial protrusions 92 for engagement in a pedestal element 92. Differently from the two previously described A and B the fixation of the insertion element in the socket is not provided any more by a leveling and fixation screw 60, but rather by a clamping wedge 100 which as illustrated in FIG. 19 is received between two respective insertion tongues 102 and which is pressed by a clamping lever 104 that is supported above the clamping wedge in the insertion element and provided with an eccentric element wherein the pressing is performed in downward direction relative to the two support or insertion tongues 102.

[0081] Thus, FIG. 19 illustrates the insertion element in a position for insertion into the respectively configured pedestal with bars 76 bent out in opposite direction into the approximately slot shaped opening 106 in the flange 40 as illustrated in FIG. 21. As soon as the insertion element 30 is placed to the desired insertion depth within the pedestal 34 the clamping lever 104 is moved or rotated by 180° so that the clamping wedge 100 is moved by an eccentric element 105 (FIG. 22) configured at the rotation bolt 103 of a clamping lever 104 relative to the two insertion tongues 102 so that the insertion element 30 is clamped relative to the pedestal due to the impact of two complementary wedge surfaces in the clamping wedge and in the insertion element in this position which is illustrated in FIG. 20.

[0082] In FIGs. 22 and 23 the insertion element is illustrated by itself in its two functional positions with the differently applied clamping lever. It is evident that the clamping lever that is provided on both sides of the handles 110 is received on both sides by lobes 112 at the head 78 which is provided with grooves 80 for snapping in C-profile bars. Thus the clamping element 100 which is not illustrated in the drawing is supported axially moveable by a suitable coupling mechanism at the clamping lever 104 so that it is moved in upward or downward direction depending on the pivot position of the clamping lever. When the clamping wedge is moved into the position that is evident from FIG. 23 the clamping wedge 100

is pulled in upward direction and runs against a wedge surface of the insertion element that is not evident from the figures wherein the wedge surface is formed behind the clamping wedge 104 so that in the position illustrated in FIG. 23 of the upward pulled clamping wedge the clamping is provided within the pedestal 34.

[0083] An embodiment of this type is illustrated in FIGs. 24a and 24b which illustrate two different functional positions of the clamping wedge 100 wherein the two figures illustrate a partial sectional view through FIG. 20.

[0084] The bars 76 between which the clamping wedge 100 penetrates and which are arranged on both sides of the clamping wedge 100 respectively above one another are clearly visible. Thus 107 designates a wall element which laterally connects both opposite insertion tongues 102 at which wall element the clamping wedge contacts flat. This wall 107 is provided with a wedge surface 109 whereas the clamping wedge 100 includes a complementary wedge surface 111 on an opposite side. In the position illustrated in FIG. 24a the insertion element 30 is inserted into the receiving bushing, this means between the bar 76. Flipping the clamping lever 104 not illustrated in FIGs. 24A and 24b moves the clamping lever upward as apparent from FIG. 24B as evident from the relative movement of both wedge surfaces. This pull along of the clamping wedge 100 is thus performed by a suitable coupling mechanism between the eccentric element 105 and the upper edge portion of the clamping wedge 100. Through this movement as evident from FIG. 24B a movement of the clamping wedge in outward direction towards the adjacent bars 76 is caused so that the clamping wedge is overall clamped with the receiving bushing which is illustrated herein by the opposite bars 76. This clamping can be performed in a suitable elevation position or insertion depth of the inserted element into the receiving bushing so that a suitable adjustment is feasible in a desired insertion depth. Simple flipping of the clamping lever back into its start position presses the wedge 100 back into the position according to FIG. 24A so that readjustment can be easily provided.

[0085] Advantageously a wave profile can be configured on the back side of the wall 107 wherein the wave profile extends horizontally and cooperates with a complementary wave profile at inner surfaces of the opposite bars 76. This wave profile is useful because it already provides a fixation of the insertion element relative to the base element when the base element is inserted which simplifies the overall mounting process.

[0086] FIG. 24 eventually illustrates the attachment device with a profile bar snap locked in at the head 78 in a clamped position within the pedestal 34, wherein FIG. 25 illustrates a side view of the front view in FIG. 24 from which the rotation bolt of the clamping lever 104 is more clearly visible, in particular with its suspension at lobes provided on both sides at the head 78. Thus the clamping lever 110 with turning bolt is advantageously supported by a snap in connection at the lobes.

[0087] It is an advantage of this clamping mechanism

that a leveling or depth adjustment between insertion element 31 and base element 28 is also feasible for an applied slat or profile due to the provided clamping lever 104. Certainly also in this variant C the insertion element 31 can be optionally configured with a receiving shoe according to the previous embodiments for receiving a slat 10 made from wood. In variant C the pedestal and the insertion element are advantageously made from plastic material, in particular by injection molding.

[0088] FIG. 32 illustrates an alternative embodiment for the receiving shoe 50 configured as a head 78 for snap locking a profile strip 32, thus by folding sheet metal sections from a flat sheet metal component 152 with four sheet metal lobes 158 grouped about a plastic plate 154 which can be folded in upward direction for either forming a receiving shoe 50 or forming the head element 78. The head element thus produced according to the center illustration is used for receiving a profile strip. The receiving shoe 50 illustrated on the bottom is used for receiving a wooden slat 10.

[0089] It is an advantage of this configuration that the same element can be used for both receiving variants for sheet metal profile or wooden profile and that it can be transported to a construction site as a flat component wherein folding up the respectively opposite attachment lobes can be performed in a simple manner about the centrally arranged plastic plate 154.

[0090] The subsequently described variant D of an attachment device operates with a leveling lever which facilitates a leveling also after applying the support lattice work which will be described infra.

[0091] According to FIG. 26 a pedestal 34 is used in this variant which substantially corresponds to the pedestal in the variants A and B which however is used in its base portion with an annular shoulder 90 and two opposite radial protrusions 92, wherein the base portion is also provided with openings 120 in the annular shoulder 90, in particular with four openings 120 according to FIG. 27 so that optionally when using a band 20 with pedestal element 22 (FIG. 3) also an attachment of the pedestal at the rafter 2 with mechanical fasteners, like screws 36 or nails is feasible in particular when using a glue tape 16 provided with markings. A respective glue tape 16 configured as an assembly aide is apparent from FIG. 26, wherein the glue tape before mounting the pedestals is glued together with the respective face of the rafter 2 after pulling off a release band which covers the glue surface. As evident from the representation according to FIG. 26 a marking 14 is used which is not configured as a cross marking like in FIG. 2 but which is rather substantially configured according to the circumference of the annular shoulders 90 so that a fitted and precise placement of the pedestal 34 that is to be attached at the rafter can be provided on the assembly aide. This yields increased variability when using an attachment device according to the embodiment according to variant D. Thus it is appreciated that the base elements described supra can also be configured with respective attachment

elements analogous to the embodiment according to variant D in order to facilitate variability of this type, thus attachment through screws or nails or advantageously through a clip connection or bayonet closure as illustrated with reference to FIG. 26. Due to the substantial structural identity of the pedestal 34 reference can be made to the description of the variants A and B.

[0092] Like for the preceding embodiments variant D also facilitates alternatively using a receiving shoe 50 and a head piece 78 for receiving a wooden slat 10 or a profile strip 32 (c.f. FIG. 26).

[0093] FIG. 37 illustrates the pedestal 34 after assembly through threaded connection on the rafter 2 with attachment of a receiving element, in particular clamping felt for below rafter damping which is illustrated like in the preceding illustrations only in sections and not as a complete plate or mat.

[0094] After arranging the insulation element 42 a vapor retarder or a climate membrane is placed onto the flanges 40 as required and thereafter the placement element 30 is applied which is described in more detail based on FIGs. 45 and 46. Both FIGs. illustrate a placement element 30 which is simultaneously configured as a receiving shoe 50, wherein the receiving shoe 50 with essential structural elements is already described in preceding variants. The placement element in this embodiment is advantageously configured from plastic material through injection molding and includes an arresting bolt 130 at a bottom side of the receiving shoe 50 wherein the arresting bolt is supported rotatable like a clip in a receiver of the receiving shoe 50.

[0095] The bar shaped arresting bolt 130 is respectively provided with a rib strip 132 at two opposite bar edge sides wherein the rib strip substantially extends over the entire length of the arresting bolt which can be provided with a tip 134 at its lower end in the illustrated embodiment. Instead of an engagement profile with ribs also teeth, waves and similar are feasible so that an arresting is feasible through respective engagement with a complementary profile.

[0096] On both opposite longitudinal sections of the bolt 130 that are arranged between the rib strips 132 a respective continuous longitudinal bar 136 is provided which extends into the area of the tip of the bolt 130. In top view of the rib strip 132 of the arresting bolt each of the two opposite bars 136 arranged opposite and between the rib strips 132 extends laterally beyond the longitudinal edges of the ribs strips 132.

[0097] Corresponding to this embodiment of the arresting bolt 130 the receiving bushing 72 of the pedestal 34 is configured, this means the pedestal includes two opposite complementary rib arrangements in its receiving bushing 72 provided for engagement with the arresting bolt 130 wherein the rib arrangements are complementary with the rib arrangement of the arresting bolt 130 as evident for example from FIG. 30. The width of this rib arrangement corresponds approximately to the width of the rib strips 132 wherein the width of the rib arrangement

can certainly be selected slightly larger than the width of the rib strips. It is essential that two backward recesses are provided between the two opposite rib arrangements wherein the width of the rib arrangements is advantageously slightly larger than the width of the rib strips 132. The width of the arresting bolt between the edges of the two opposite longitudinal bars 136 is slightly less than the width between the two opposite rib arrangements of the receiving bushing 72.

[0098] Due to this configuration the insertion element 30 with its arresting bolt 130. Due to this embodiment can be inserted without interlocking into the pedestal 34, this means into the receiving bushing 72 of the pedestal 34 so that the two longitudinal bars 136 are centered relative to the two rib arrangements in the receiving bushing and in the two opposite rib strips of the bolt 132 are aligned with the backward recesses of the receiving bushing. Thus, the attachment element 30 can be elevation positioned at will within the pedestal so that a respective leveling is feasible. For arresting purposes the attachment element 30 only has to be rotated by approximately 90° about its longitudinal axis whereby the two rib strips 132 come into engagement with the respective two rib arrangements in the receiving bushing in the set elevation position so that the arresting bolt is locked in longitudinal direction of the bolt within the receiving bushing and interlocked, this means fixated.

[0099] The unlocking is performed in a simple manner in reverse in that the arresting bolt is turned back by 90° so that the two rib strips 132, come out of engagement with the two opposite rib arrangements of the receiving bushing or the pedestal 34 which facilitates in turn a respective elevation positioning of the attachment element 30 of the pedestal.

[0100] For actuating the insertion element, this means for rotating about the longitudinal axis of the arresting bolt 130 as illustrated in FIGs. 28 and 29 a handle 138 can be provided which is configured in the illustrated embodiment integrally with the arresting bolt 130 and through which the arresting bolt in locking position and in unlocking position can be rotated by 90°. Thus a leveling is also possible when a respective wooden slat is received in the receiving shoe 50 which is very advantageous for mounting purposes. Advantageously the components are matched so that the arresting bolt 130 in the locking position contacts the receiving head or the receiving shoe and extends away from it in the unlocking position. Thus it can be determined in one glance whether all arresting bolts are in the locking position before the covering is applied or whether some locking steps still have to be performed.

[0101] FIGs. 30 and 31 illustrate the insertion element 30 alternatively with the receiving head 78 for receiving a profile strip 32. Even the handle 138 is clearly visible which is used for rotating the arresting bolt. Thus from FIG. 30 the opposite configuration of the in particular fine rib strips 132 and the central configuration of the longitudinal strip 136 between the two rib strips 132 is visible

as well as it is evident from FIG. 31 which illustrates the locking position that the two longitudinal strips 136 protrude slightly outward in top view of the rib strip 132. Certainly also a different design principle can be used for arresting and interlocking of this type, wherein mechanisms of this type are known in many configurations.

[0102] As a result this variant of an attachment device is reduced to two components for assembly, namely the attachment component 30 which can be produced in particular through injection molding from plastic material and the pedestal that is producible from sheet metal or plastic material which in case of being configured from plastic material can also be integrally produced as an injection molded component. As additional components only screws or nails are required for attachment at the rafter in case the bayonet closure is not used in case a band according to FIG. 3 provided with pedestal elements is used as an assembly aide. Also fine adjustment in elevation is very simple since the grip handle 138 only has to be rotated by 90° which then facilitates and elevation adjustment of the arresting bolt relative to the pedestal. This is also possible when a wooden slat or profile strip 32 is already received in the receiving shoe or in the receiving head 78.

[0103] Subsequently the complete assembly of a below rafter insulation using the attachment devices according to the invention is described with reference to FIGs 33-38. Thus starting from a roof half corresponding to FIG. 1 with 6 rafters and a between rafter insulation 4 introduced between the rafters 2 initially according to FIG. 49 a guide thread 18 is pulled taut over the rafters wherein optionally already a vapor retarder foil or a respective climate membrane was already mounted on the between rafter insulation as required.

[0104] In a second step using the taut guide thread 18 accordingly the adhesive tapes 16 are glued perpendicular to the taut guide thread 18 onto the rafters 2 after pulling a release foil from the adhesive tape, in case of an optionally mounted vapor retarder foil the tapes are glued onto the foil. Since the mounting process was illustrated for an attachment device according to variant A an adhesive tape with a cross marking 14 is used for this purpose accordingly.

[0105] Multiple assembly tests have shown that only a few minutes are required for pulling the guide thread 18 and for gluing the adhesive tapes onto the rafters or the vapor retarder foil.

[0106] Subsequently the assembly of the base elements 28 illustrated in FIG. 5 is performed using the attachment flange 36 and a screw connection at the rafters, wherein the time requirement for a total of 48 attachment points is minor. The attachment devices mounted on the roof in this step are evident from FIG. 35 where they are illustrated rectangular.

[0107] Thereafter the under rafter insulation is introduced thus by clamping felts or similar with a width of for example 400 mm as illustrated in FIG. 36. In this assembly condition the clamping felts 150 used as insulations

elements are secured by circumferentially protruding pedestal flanges 40 against falling down. Also this step is performed rather quickly. Thereafter also a vapor retarder foil or a suitable climate membrane can be applied to the under rafter insulation. For this purpose the flanges 40 are used for support. For this purpose the flanges 40 can be provided with respective glue pads from which only the release foil has to be pulled off so that the vapor retarder can be fixated easily on the flange 40 of the attachment devices.

[0108] Starting from the assembly condition in FIG. 35, thus applying the clamping felts 150 between the base elements the attachment elements 30 are then applied according to FIG. 37 with the receiving shoes 50 which can be performed with a cordless drill, wherein the surface can be leveled with a guide thread in order to provide a flat surface for the covering to be provided thereafter. Leveling is provided by the adjustment screws 60 visible from FIG. 10 which are received in the receiving head 78. Since a total of 48 attachment points is provided in the illustrated roof half and the assembly of the attachment element per attachment point is performed quickly little time is required for the assembly process according to FIG. 37 for 48 attachment points.

[0109] Thereafter the opposite attachment flanges that are illustrated in FIG. 32 only have to be bent up by hand wherein depending on the lattice work thus whether wooden slats or profile strips are used the respective opposite attachment lobes are bent up as evident for example from the illustration according to FIG. 32 bottom. This process only takes a few minutes, wherein after for example C, D profiles can be clicked into these supports. This final assembly condition is illustrated in FIG. 38. Overall the time up to this final assembly illustrated in FIG. 38 for a roof half with a surface of 8.6 meters² is only 1.5 hours so that this system provides very quick assembly for precise alignment and precise and simple leveling of the profile strips or alternatively of wooden slats for the support lattice work. Thereafter respective covering elements like e.g. sheet rock plates can be applied which are connected with typical quick construction screws with the CD profiles or the wood lattice work.

[0110] Thus this is an integrated mounting system which facilitates exact positioning of the attachment elements in a quick and simple manner, a secure mounting of the below rafter insulation between the attachment elements and which provides a flat mounting surface for the subsequent covering for a simple and quick leveling by attaching the lattice work on the receiving shoes or receiving heads.

[0111] Through the attachment elements with integrated support elements arranged with uniform row spacing and used as mounting aides for temporary fixation of the insulation elements or by the previously attached support lattice work the insulation material can be advantageously mounted in roll off direction for a predetermined width without the insulation material falling out of the intermediary space during assembly. This installation is not pos-

sible with known types of below rafter insulation due to the lacking clamping effect transversal to the direction of production. It is appreciated that this generates substantial time savings when installing insulation material.

[0112] FIGs. 29 - 55 describe another advantageous embodiment of the invention. This partially represents a mix of the previously described embodiments so that identical reference numerals are used for identical components in order to improve clarity. This embodiment however is characterized in particular through a modified design principle in a portion of the pedestal for receiving the insertion element. Furthermore the top element of the insertion element is configured universal so that it is useable for receiving a profile as well as a wooden slat and similar so that separate alternative insertion elements do not have to be stocked.

[0113] FIG. 39 illustrates an exploded view of this embodiment of a retainer or an attachment device. The base element 28 includes a specially configured pedestal 34 which is subsequently described in more detail. This pedestal 34 includes an attachment device at its lower end for attachment at a rafter element 2 which can be configured according to the embodiment of FIGs. 13 -15. At a lower end of the pedestal 34 there is an accordingly configured annular shoulder 90 with radially protruding tongue shaped protrusions 92 which is configured for an engagement in a type of bayonet closure into the pedestal element 22 according to FIGs. 3 and 4. The pedestal element according to FIGs. 3 and 4 is provided with an annular shoulder 96 with recesses 94 that are complementary to the protrusions 92 and with accordingly undercut grooves 98 for forming the bayonet closure. Through a screw 24 the pedestal element 22 is attached in particular using a positioning band 21 at the pedestal element 22 so that a very quick and very precise positioning of the attachment devices is facilitated for assembly purposes.

[0114] The pedestal 34 is rotated at an upper end according to FIG. 39, this means during installation the illustrated attachment device is rotated by 180° relative to the drawing and provided with a circular plate shaped flange 40 which is used for receiving a climate membrane or a respective vapor retarder foil, wherein in the illustrated embodiment a circular intermediary plate 180 can be provided between the membrane 44 and the flange 40.

[0115] In FIG. 39 on top there is the insertion element 31 with a screw 60 and an especially configured head 78 which is configured for alternative reception of a sheet metal profile 32 or a wooden slat 10 or similar.

[0116] It is appreciated that instead of the illustrated bayonet shaped attachment of the pedestal 34 at the rafter element also any other suitable attachment device can be used, in particular the alternative attachment devices which have been described based on the preceding embodiments.

[0117] FIG. 40 illustrates the base element 28 in an attached position at the rafter element 2 with an attached damper plate 42 of which in turn only a portion is illus-

trated for reasons of clarity and a climate membrane 44 applied thereto which can be glued together with the base element 28, this means the flange 40, wherein in particular suitable gluing pads are provided on the flange 40 or the intermediary plate 180.

[0118] Thus in particular during assembly the base element 28 is attached at the rafter element 22 first in the previously described manner and thereafter the clamping felt is arranged, wherein the pedestal shape prevents the clamping felt from dropping out during assembly (FIG. 29 illustrates the position that is rotated by 180° for illustration purposes).

[0119] In this position the insert element 31 is applied with the top element 78, wherein the screw 60 provided at the insert element 31 penetrates the climate membrane and is insertable into the pedestal 34 through an opening that is provided centrally in the intermediary plate or the flange 40 wherein this insertion is evident from FIG. 30.

[0120] FIG. 42 illustrates a modified configuration of the pedestal 34 which significantly defines the embodiment.

[0121] Accordingly the pedestal 34 includes two flange elements 182 and 184 that are arranged opposite to each other on the annular shoulder 90 provided in this embodiment wherein the flange elements are arranged with a distance from each other. In the illustrated embodiment connectors are provided for stabilizing in a lower portion thus in a lower third wherein the connectors are provided herein in the form of an intermediary bar 186 with ribs. Besides the fact that this connector can be provided in any shape this connector is not necessarily provided. However the connector is useful for stabilization in particular for a light weight and material saving configuration of the pedestal.

[0122] Furthermore the pedestal 34 includes a plug in shoe 188 which is provided at its top end with a plate for forming the flange 40. This plug in shoe is used for receiving the screw 60 of the insertion element as evident from FIG. 42 in which the insertion element is only illustrated with the screw. The plug in shoe 188 can be configured separately from the pedestal 34 thus as individual component but the plug in shoe is advantageously integrally provided in one piece with the pedestal 34 with the flange elements 182, 184 in the illustrated embodiment.

[0123] In interconnection between the plug in shoe 188 and the flange elements is advantageously connected with the flange elements by slanted bar shaped lobes 190. Thus the lobes 190 are configured in the upper portion of the pedestal 34, thus above the non mandatory connection bar 186 thus advantageously with an identical distance from each other thus on both sides of the plug in shoe 188 which is thus arranged at a slant angle for the integral embodiment by the lateral lobes 190 which are arranged at a slant angle from top to bottom (in installed position from the bottom up viewed from the flange element). These lobes that are arranged on a left side and on a right side of the plug in shoe at the flange ele-

ments 182, 184 form spring elastic clamping tongues that will be described infra. Advantageously the lobes are slanted at an angle between 30° and 60°, advantageously in a range of 45°, so that the plug in shoe 188 is so to speak supported in a floating or spring elastic manner relative to the two flange elements 182, 184, thus using the lobes 190 that are provided on both sides.

[0124] The plug in shoe 188 can be provided in two components in an advantageous embodiment, thus it is made from two plug in shoe halves wherein each half is respectively received by a lobe row of lobes 190 arranged above one another at an opposite and corresponding flange element 182 or 184. Alternatively the plug in shoe 188 can also be formed integrally by itself thus not from two halves thus as a bushing below the head plate 188 forming the flange 40, wherein however advantageously at least one or plural slots are provided, thus in the illustrated embodiment one slot 192 which can advantageously extend over a length of the bushing and which is optionally also arranged in the flange 40 so that the plug in shoe 188 is configured in particular for receiving the insertion element, in particular the screw 60 with a spring elastic character.

[0125] The plug in shoe 188 which is provided with a central opening into which the slot 192 reaches in a radial direction is provided with an inner profile which is complementary to the profile of the screw 60 of the insertion element. The profile can be configured as an interlocking or screw profile or similar.

[0126] Based on this embodiment the insertion element 31 with its screw 60 can be inserted in a simple manner into the pedestal, this means into the plug in shoe 188, thus far enough as required by the mounting position for receiving the slats or sheet metal profiles. Due to the insertion of the screw 60 into the plug in shoe 188 the receiving bushing 198 of the plug in shoe 188 expands and thus also pivots the lobes 190 which are then pressed downward in the illustration according to FIG. 31. In a hanging position thus with the holder turned upside down the clamping force between the insertion element 31 or the screw 60 and the plug in shoe 188 or the pedestal 34 is increased, in particular under a load of the covering arranged at the attachment devices. In case a fine adjustment of the insertion element 30 inserted into the plug in tongues 188 or the pedestal 34 is required a fine adjustment can be provided by the screw 60.

[0127] In order to facilitate fine adjustment of the screw 60 a square or hexagonal profile is arranged above the thread of the screw 60, thus a hexagonal profile in the illustrated embodiment in particular integrally formed so that the screw is easily rotatable by a suitable tool, in particular a wrench.

[0128] For assembly purposes only the insertion element 30 is inserted with its screw 60 into the plug in shoe 188 far enough so that the insertion element 30 is in the desired position, wherein the bushing expands accordingly or in case of a two piece plug in shoe 188 the two plug in shoe element are pressed outward so that a re-

spective clamping force is built up between the plug in shoe and the screw.

[0129] The interlocking of the interlocking or thread profile at the screw 60 or at the bushing shaped component 198 which come into engagement during insertion have an interlocking or a pitch in an advantageous range of 1 - 3 mm, in particular 1.2 - 18 mm, advantageously 1.5 mm. This means the distance profile to profile of the thread profile in the advantageous embodiment is 1.5mm. When the bolt 60, this means the insertion element 31 is inserted into the pedestal then an interlocking support is provided at the profiles at the screw and at the plug in shoe, wherein in case the interlocking dimension is 1.5mm which however can be advantageously selected at will but if this is not sufficient for the end position yet or not sufficiently precise then the desired end position can be reached precisely through fine adjustment of the screw.

[0130] Thus in a simple manner through manual pressure on the upper (in mounting position) plate 188 of the pedestal 34 the clamping can be removed and the insertion element can be adjusted as required in pull direction. It is a particular advantage of this embodiment that in principle the attachment device is adjustable without tools in that the insertion element 31 is only manually inserted into the respective end position and only when required a fine adjustment with a wrench or similar can be performed. This type of attachment is similar in a way to an attachment with a ground anchor.

[0131] Based on FIG. 43 the insertion movement is illustrated in various positions wherein the pedestal is in a starting position on a left side, in a center the pedestal is illustrated with a screw arranged above and on a right side the pedestal is illustrated in a partially inserted position of the screw 60.

[0132] The insertion element 31 that is subsequently described with reference to FIGs. 44 and 45 and the head piece 78 is certainly also useable for the previously described embodiments.

[0133] The insertion element includes a head piece 78 which is advantageously made from a plastic material like the pedestal 34 and the elements of the bayonet closure and made in particular through injection molding. The head piece 78 includes a base plate 200 from whose bottom side engagement members 202 protrude in downward direction according to the illustration in FIG. 44 wherein the engagement members form a free space between each other and the screw 60 can be snap locked with a head plate formed at its top side wherein the head plate however is freely rotating so that a fine adjustment during assembly is possible through the hexagonal or square element 196 with a suitable tool. Thus however also each suitable other attachment type between screw and head 78 is possible and included. Above the base plate 200 there is a block shaped head piece 206 which is advantageously configured with hollow spaces 208 in order to provide material savings. Grooves 80 are advantageously provided on both sides and opposite to the

head piece 206 wherein the grooves facilitate snap locking a profile bar 32 through the advantageously inward curved ends of the profile bar 32. A lateral support can also be provided by the support and stop bar 210 which protrudes in upward direction on one side, herein the left side according to FIG. 44. Thus the head 78 is configured accordingly for simple snap locking of typical profile bars 32.

[0134] As evident from FIG. 45 the same head 78 can also be optionally used for attaching a wood slat 10. Thus the stop bar 210 of the head piece 206 is used as a stop bar and the slat contacts a top side of the head piece 206 and is attached at the head piece by screws.

[0135] It is evident from FIGs. 46 and 47 that the same attachment device is used with the head 78 for receiving a profile bar 32 by snap locking or a slat 10 through screw attachment. The screw 60 that can be snap locked into the head piece 78 has the advantage that it can be snap locked in on site or also in a manufacturing plant. It is advantageous to arrange the snap lockable screw in the head piece 78 in the manufacturing plant since this also facilitates using stronger hooks. Overall this embodiment has the advantage that an easy manual insertion of the insertion element 31 and thus a quick adjustment is possible and also a subsequent fine adjustment of the screw when required.

[0136] The embodiment according to FIGs. 49 - 53 relates in particular to the embodiment of the head piece 78 for alternate reception either of a sheet metal profile bar 32 or a wooden slat 10 and in particular supporting or fixating the head piece 78 with reference to the adjustment screw 60, wherein the description of FIGs. 48 seqq. only has an exemplary character and these measures can certainly also be used accordingly in other embodiments.

[0137] Accordingly components in FIG. 48 which are more or less identical or functionally equivalent to components in other embodiments are provided with the same reference numerals. It starts with the rafter element 2 on which for example a pedestal element 22 is attached which certainly can also alternatively be configured according to the other embodiments which also applied for the pedestal 34 and the base member 28 and other components. It is evident in the embodiment according to FIG. 48 that the head piece 78 is offset relative to the preceding embodiments relative to the insert 31, thus in the form of a screw 60 similar to the embodiment according to FIG. 11 or 40 as evident in particular from FIGs. 50 and 51. By the same token the head piece 78 is configured as a universal receiving element, this means it can alternatively receive a sheet metal profile bar 32 according to the illustrations of FIGs. 49 and 52 or for the same component alternatively also a wooden slat 10 as evident from FIG. 48, right illustration top and FIG. 53.

[0138] Thus, it is possible after applying either the sheet metal profile bar 32 or the wooden slat 10 to actuate the screw 60 without having any impediment from the snap locked sheet metal profile 32 or the wooden slat

10. This naturally facilitates assembly and also possible readjustments, in particular during assembly. Furthermore the embodiment according to FIG. 48 - 53 is very similar to the embodiment according to FIG. 39 and 40 which however is only exemplary since certainly the redesign according to the embodiment of FIG. 48 seqq. is also applicable analogously to the other embodiments.

[0139] This applies also to the alternative receiving shoe for separate reception of a wooden slat as described in conjunction with the preceding figures. This is also the reason why the general configuration of the embodiment according to FIG. 48 seqq. is not described in detail since this embodiment can also be replaced by the preceding alternative embodiments.

[0140] It is evident from FIG. 50 that the head piece 78 includes a stop element on a right side which stop element is configured as plural upward protruding stop bars 220 with an engagement groove 80 arranged behind them. On the opposite side horizontally protruding engagement members 222 are provided which protrude in outward direction beyond the block shaped configuration of the head piece 78 as evident from FIG. 52 and which facilitate snap locking the sheet metal profile bar 32. It is evident that the sheet metal profile bar 32 with its two lateral C- arms reaches over the engagement members 222 and the stop members 220 and reaches behind them with their inward protruding extensions or arms 82 so that the bar 32 can be snap locked in a simple manner onto the head piece 78. The stop members 220 and/or the engagement members 222 respectively can also be configured as a continuous bar when required.

[0141] The same head bar 78 can also be used for receiving a wooden slat 10 as evident from FIG. 48, top right illustration and FIG. 53. Thus it is advantageous to provide plural recesses or openings 224 (FIG. 50) on a top portion of the head piece 78, which facilitates a screw attachment of the wooden bar 10 with typical wood screws 51, wherein in this embodiment two attachment screws 51 can be provided in an exemplary manner. The recesses 224 can be evenly distributed in the illustrated embodiment, in particular in rows that are oriented perpendicular to each other and furthermore respectively parallel to each other so that a plurality of recesses 224 is provided and a quick and simple assembly of the wooden slats 10 can be performed with the screws 51. The stop members 220 are thus used as stop elements for a simple application of the wooden bar.

[0142] From FIGs. 50 and 51 a support of the screw 60 is evident that is offset in outward direction relative to the head piece 78. This support is advantageously similar to the embodiment according to FIGs. 11 and 40 due to an annular bead 228 that is arranged from the upper screw head 226 offset in downward direction and thus axially fixable relative to the head piece 78 but rotatable. This in turn facilitates the assembly since the screw that is inserted overhead through snap locking cannot be lost anymore but can be rotated for adjusting the head piece 78 also for a received profile bar 32 or slat 10 rel-

ative to the pedestal 34. For this offset support an outward protruding lug 32 is advantageously provided at the head piece 78 in which the screw 60 is received. Also this only serves as an example, certainly also a bar shaped protrusion or similar can be used or configured. Last not least the head piece 78 as evident from FIGs. 50 and 51 can be provided on one side, thus advantageously the side opposite to the lug 128 or the screw 160 with a protrusion, thus in particular configured as a protruding bar 230 which facilitates manual handling of the head piece during assembly. Certainly this bar 230 is only provided when required, but advantageous in the context of the invention. This also applies for the configuration of a total of four stop members 220 for the support bar or for outward protruding horizontal bar shaped engagement members 222. Where required these engagement members can be configured as a bar or with more or fewer separate engagement members. Advantageously the head piece 78 is also configured as a plastic component, in particular provided as an injection molded component.

[0143] The subsequent steps 21 and 23 relate to mounting the attachment device at the rafter or similar:

Step 21: a method for mounting an interior insulation of buildings using a system according to one of the preceding steps, characterized in that bands that are provided with positioning elements are attached along the rafters, base elements (28) are placed onto the positioning elements and fixated at the rafters (2), subsequently attachment elements are placed onto the base elements and adjusted and eventually slat elements are attached at the attachment elements in order to form the support lattice work of the roof, wherein the insulation elements (42) for under rafter insulation are placed accordingly and that a guide thread is advantageously horizontally pulled against the rafters, at which guide thread the bands including the positioning elements are aligned for an even arrangement of the positioning elements along the rafters (2) and thereafter the bands are attached at the rafters (2).

Step 22: The method according to step 21, characterized in that after attaching the base elements at the rafters (2) and after arranging the insulation elements between the base elements a vapor retarder foil or similar climatic membrane is applied and fixated relative to the attachment elements.

Step 23: An assembly method according to step 21 or 22, characterized in that after applying the slat elements to the attachment devices, a leveling is performed by relative adjustment of the attachment element relative to the base element and subsequent arresting of the attachment element.

Claims

1. A system for internally insulating buildings in particular slanted roofs, the system comprising: a particularly wooden base structure including rafters (2) or beams (subsequently designated rafter elements), slats (10) and/or profile strips (32) (subsequently designated slat elements) which are transversally arranged at the rafter elements (2) and at a distance from the rafter elements and at a distance from each other, insulation elements (42) arranged from an interior of a room at the rafter elements (2) and between the rafter elements and the slat elements (10, 32) for thermal and/or sound insulation, in particular made from mineral wool forming an inner insulation placed in front of the rafter elements, (subsequently designated under rafter insulation), and attachment devices for supporting the insulation elements (42) and for attaching the slat elements (10, 32) at the rafter elements (2) offset therefrom for forming a support lattice structure at which a covering towards an interior of the room that is in particular made from sheet rock plates is attachable,

characterized in that

the attachment devices are respectively formed from a base element (28) that is attachable at the rafter element (2) and an attachment element (30) that is adjustable relative to the base element and interlockable at the rafter element (2) in a predetermined adjustment position and **in that** a receiving element (50, 78) for receiving the slat element (10, 32) is arranged at the end of the attachment element (30) that is remote from the rafter.

2. The system according to claim 1,

characterized in that

a band shaped mounting aide is provided for attaching the base element (28) at the rafter element (2), wherein the mounting aid is provided along the rafter element (2) attachable thereto and with positioning elements (14, 22) for a predetermined positioned arrangement of the base elements at the rafter element (2), wherein the base elements are respectively provided at a distance from one another at the mounting aide, wherein the distance corresponds to a distance between the slat elements (10, 32) of the support lattice structure, wherein the positioning elements (14, 22) are advantageously respectively formed by a graphic marking (14) on a mounting aide that is formed as an adhesive tape (16) for a glue connection along the rafter and/or which are respectively formed by pedestal elements (22) which are arranged at a band that is attachable at a rafter element (2), advantageously by screws, nails and similar and which are respectively configured for a quick coupling connection with a base element (28), which are in particular configured as a bayonet closure or clip element.

3. The system according to one of the preceding claims,

characterized in that

the base element (28) includes a pedestal (34) which is provided at one end with at least one attachment flange (36) angled away from the pedestal (34), advantageously two opposite attachment flanges (36) for attachment at the rafter element (2) and/or with an interconnection element that is complementary with the pedestal element (22) for a quick connection of the base element (28) at the rafter element (2) through the pedestal element (22), wherein the composite element arranged at the pedestal element proximal to the rafter is configured in particular for forming a clip connection or a bayonet closure with the pedestal element (22), **in that** advantageously the pedestal (34) for forming the bayonet closure is provided at its lower end with an annular shoulder (90) and advantageously two opposite radial protrusions (92) for engagement in complementary recesses (94) for reaching behind an annular shoulder (96) of the pedestal element (22) after a respective rotation of the pedestal (34) relative to the pedestal element (22) and that in particular an end of the pedestal (34) proximal to the rafter is configured as quick connector, in particular as bayonet closure element and simultaneously provided with openings for optional attachment via screws and similar mechanical attachment devices at the rafter element (2).

4. The system according to one of the preceding claims,

characterized in that

the pedestal (34) includes a receiving sleeve (72) for an elevation adjustable reception of the attachment element (30) and that the attachment element (30) is configured as an insertion element (31) that is insertable into the receiving bushing (72), in particular pluggable, which insertion element is clampable or fixable in a predetermined insertion position of the insertion element in the sleeve (72) through form and/or friction locking, whereas advantageously the pedestal (34) is configured with a single wall and subdivided into bars (76) arranged on top of one another by introducing slots that extend in particular perpendicular to the pedestal (34), wherein the bars are formed at both pedestal sides in outward direction, in particular cambered for forming a receiver in particular in a form of a receiving bushing (72), in particular sequential and in opposite directions, and that the receiving bushing (72) is advantageously adapted with its inner cross section to the outer circumference of the insertion element, wherein in particular the receiving bushing (72) is configured due to slot formation or similar spring elastic for clamping on the insertion element (30a).

5. The system according to claim 4, **characterized in**

that the insertion element (30) and the base element (28) are provided with complementary engagement profiles for fixating an adjustable relative position of both components relative to one another, wherein the engagement profile is an interlocking profile, a teething, a thread or a similar fixation mechanism.

6. The system according to claim 4 or 5, **characterized in that** the insertion element (31) which is provided with an engagement profile, in particular configured as a thread that is advantageously configured for a clamping with the receiving bushing (72), which thread engages for elevation adjustment of the insertion element (31) relative to the pedestal (34) with a complementary engagement profile in the pedestal (34), in particular in the receiving bushing (72) configured therein wherein the insertion component (30a) is advantageously formed by a leveling screw (60) on which the receiving element for the slat element (10, 32) is arranged, wherein the screw (60) is threadable into the receiving bushing (72) of the pedestal (34) which is in particular configured as a single wall sheet metal component for leveling the receiving element or includes two offset insertion tongues (46) between which a leveling screw (60) is received and advantageously the leveling screw (60) at its end remote from the rafter is received in a bar (48) connecting the two insertion tongues (46) wherein the bar (48) is thus advantageously provided with a slotted bushing (58) into which the screw with its interlocking shoulders (62, 66) is snap lockable with its shaft without engagement profile for a freely rotatable support but axial fixation of the screw shaft.
7. The system according to one of the preceding claims, **characterized in that** the flange (40) laterally protruding from the pedestal (34) is configured directly integrally at the pedestal end oriented away from the rafter or in an insertion sleeve that is placeable onto the pedestal end that is remote from the rafter and in particular made from plastic material, wherein the flange (40) is in particular configured so that it is suitable as a support for flat tightening a foil and so that it is used as an assembly aide which prevents a dropout of the insulations elements (42) arranged between the attachment devices during the assembly wherein advantageously the flange (40) laterally protrudes from the pedestal (34) at least over part of its circumference advantageously over its full circumference and forms a flat contact surface for applying a vapor retarder foil or a similar climate membrane and in particular for mounting and supporting the insulation elements (42) arranged in the attachment devices.
8. The system according to claim 4, **characterized in that** the insertion element (31) is provided with a clamping wedge mechanism for position fixation of

the insertion element relative to the pedestal (34).

9. The system according to claim 8, **characterized in that** the clamping wedge mechanism is formed by a clamping wedge (100) provided with a slanted surface wherein the clamping wedge is moveable along a complementary opposite slanted surface at the insertion element (31) and moveably guided and supported in the insertion element (31).
10. The system according to claim 8 or 9, **characterized in that** the clamping wedge (100) is actuatable by an eccentric element which is received at a rotation bolt (108) which is rotatably supported in the insertion element (30) in particular in protruding support lobes (12) and which is actuate able by at least one grip lever (110) for engaging and disengaging the clamping wedge (100), thus in particular by pivoting the grip lever by 180°.
11. The system according to claim 4, **characterized in that** the insertion element (30) is formed by an arresting bolt (10) which includes at its circumferential surface two opposite strip shaped engagement profiles, in particular rib strips (132), tooth strips or similar between which advantageously a respective longitudinal bar (136) is arranged and wherein the two opposite arranged complementary engagement profiles, in particular rib strips (132), are arranged in the receiving bushing (72) between which a backward recess is provided so that in a rotation position of the arresting bolt (130) in which the two longitudinal strips (136) are aligned with the two ribs strips of the receiving bushing (72), the insertion element (30) is elevation adjustable relative to the base element (28) or the pedestal (34) and in a rotation position in which the rib strips of receiving bushing (72) and arresting bolt (130) are arranged opposite to one another, this means in an engagement position, the insertion component is fixated relative to the pedestal (34) due to the engagement position of the rib strips (132) and that at least one grip lever (138) is advantageously arranged at the insertion element (30a) for rotating the arresting bolt (130).
12. The system according to claim 10, **characterized in that** a receiving element (50, 78) for receiving a slat element (10) is arranged at an upper end of the insertion element (30) that is remote from the rafter and wherein advantageously the insertion element (30) with the arresting bolt (130), the grip handle (138) and the receiving element (50, 78) are made from plastic material, in particular by injection molding.
13. The system according to one of the preceding claims, **characterized in that** the attachment element (30) is configured as a component that is plug-

gable onto the pedestal (34) which includes at its end portion remote from the rafters a flange (40) protruding in outward direction at least at two opposite sides from the attachment element (30) for securing the insulation material elements (42) in particular during assembly wherein the flange includes a flat contact surface for arranging a vapor retarder foil or a similar climate membrane (44).

14. The system according to one of the preceding claims, **characterized in that** the receiving element (50, 78) arranged at the end of the attachment element (30) is shaped as a U-shaped receiving shoe (50) for receiving a slat element or as a head (78) with lateral grooves (80) for snapping in a profile strip (32) and that the receiving component (50, 78) is advantageously integrally configured in one piece at the attachment element (30), in particular produced through injection molding from plastic material or pluggable onto the end of the attachment element (30) remote from the rafter and that is interlockable, in particular by a snap lock connection.
15. The system according to one of the preceding claims, **characterized in that** the receiving component (50, 78) is formed from a sheet metal component which includes four laterally protruding attachment flanges (158) that are arranged offset from one another by 90°, wherein two respectively opposite arranged attachment flanges are foldable in upward direction for forming a U-shaped receiving shoe (50) and the two other opposite attachment flanges (158) are foldable in upward direction for forming the head piece (78) with the lateral groove (80) so that the sheet metal component can be optionally configured as a receiving shoe (50) for receiving a slat (10) made from wood or a head piece (78) for receiving a profile strip.
16. The system according to one of the preceding claims, **characterized in that** the base element (28) configured at the pedestal (34) includes a plug in shoe (188) that is supported at the pedestal in a floating or spring elastic manner wherein the plug in shoe is provided with an advantageously elongated receiving opening for receiving the insertion element (31), in particular a plug in element provided at this location, wherein the plug in shoe is expandable by inserting the insertion element which generates a clamping reset force.
17. The system according to claim 16, **characterized in that** the plug in shoe (188) includes a bushing (198) including the insertion opening, wherein the bushing is at least provided with a longitudinal slot (192) extending to the receiving opening and that the plug in

shoe is advantageously provided integrally in one piece or in plural pieces, in particular in two pieces.

18. The system according to claim 16 or 17, **characterized in that** the pedestal (34) advantageously includes two flange elements (182, 184) arranged opposite to each other, wherein the plug in shoe (188) is arranged between the flange elements and that the plug in shoe (188) is supported in a spring elastic manner on both sides by advantageously slanted lobes (190) at the flange elements (182, 184) so that inserting the insertion element into the receiving opening presses the lobes in outward direction by expanding the receiving shoe and that the plug in shoe (188) is advantageously configured integrally in one piece with the pedestal (34).
19. The system according to one of the preceding claims, **characterized in that** the insertion element (31) includes a plug in element with an interlocking or threaded profile, in particular a screw (60) through which the insertion element (31) is insertable into the plug in shoe (188) for forming the attachment device, wherein the plug in shoe in a portion of its receiving opening is provided with a complementary profile for engagement with the plug in element and that advantageously the screw or the plug in element is configured at its end oriented away from the free end with a tool engagement element, in particular with a hexagon (196) or with a square.
20. The system according to one of the preceding claims, **characterized in that** the insertion element (30) includes a universal head (78) which in order to receive a profile bar (32) with two opposite grooves (80) advantageously includes a lateral stop bar (210) and openings for attaching a slat (10) in particular through screw attachment.
21. The system according to one of the preceding claims, **characterized in that** the head piece (78) is formed with a stop bar that is advantageously divided into individual receiving members (220) and which stop bar or which receiving members protrude in upward direction, and/or that at least one laterally protruding engagement member (222) is provided at the head piece for reaching behind a sheet metal profile bar (32) that is snap lockable, and/or at least one laterally protruding handling bar (230) is provided, so that the head piece is universally provided for receiving slats or profile bars.
22. The system according to one of the preceding

claims,

characterized in that

the insertion element (31), in particular the screw (60) is arranged at the receiving element or at the head piece (78) for the sheet metal profile bar (32) and/or the wooden slat (10) is laterally offset relative to the receiving element or the head piece (78), so that after mounting the sheet metal profile bar or the slat (32, 10) a direct access to the insertion element (31), in particular to the screw (60) is possible for adjustment.

23. A head piece for a system according to one of the preceding claims,
characterized in that
 the head piece (28) is configured as a universal head with features of one of the preceding claims, in particular the claims 20 - 22.
24. An attachment device for use in a system according to one of the claims 1 - 22, **characterized by**
 a base element and an attachment element respectively configured with features of at least one of the claims 1 - 22.
25. Method for mounting an interior insulation of buildings using a system according to one of the preceding claims 1 to 22,
characterized in that
 bands that are provided with positioning elements are attached along the rafters, base elements (28) are placed onto the positioning elements and fixated at the rafters (2), subsequently attachment elements are placed onto the base elements and adjusted and eventually slat elements are attached at the attachment elements in order to form the support lattice work of the roof, wherein the insulation elements (42) for under rafter insulation are placed accordingly and that a guide thread is advantageously horizontally pulled against the rafters, at which guide thread the bands including the positioning elements are aligned for an even arrangement of the positioning elements along the rafters (2) and thereafter the bands are attached at the rafters (2) and that preferably, after applying the slat elements to the attachment devices, a leveling is performed by relative adjustment of the attachment element relative to the base element and subsequent arresting of the attachment element.

50

55

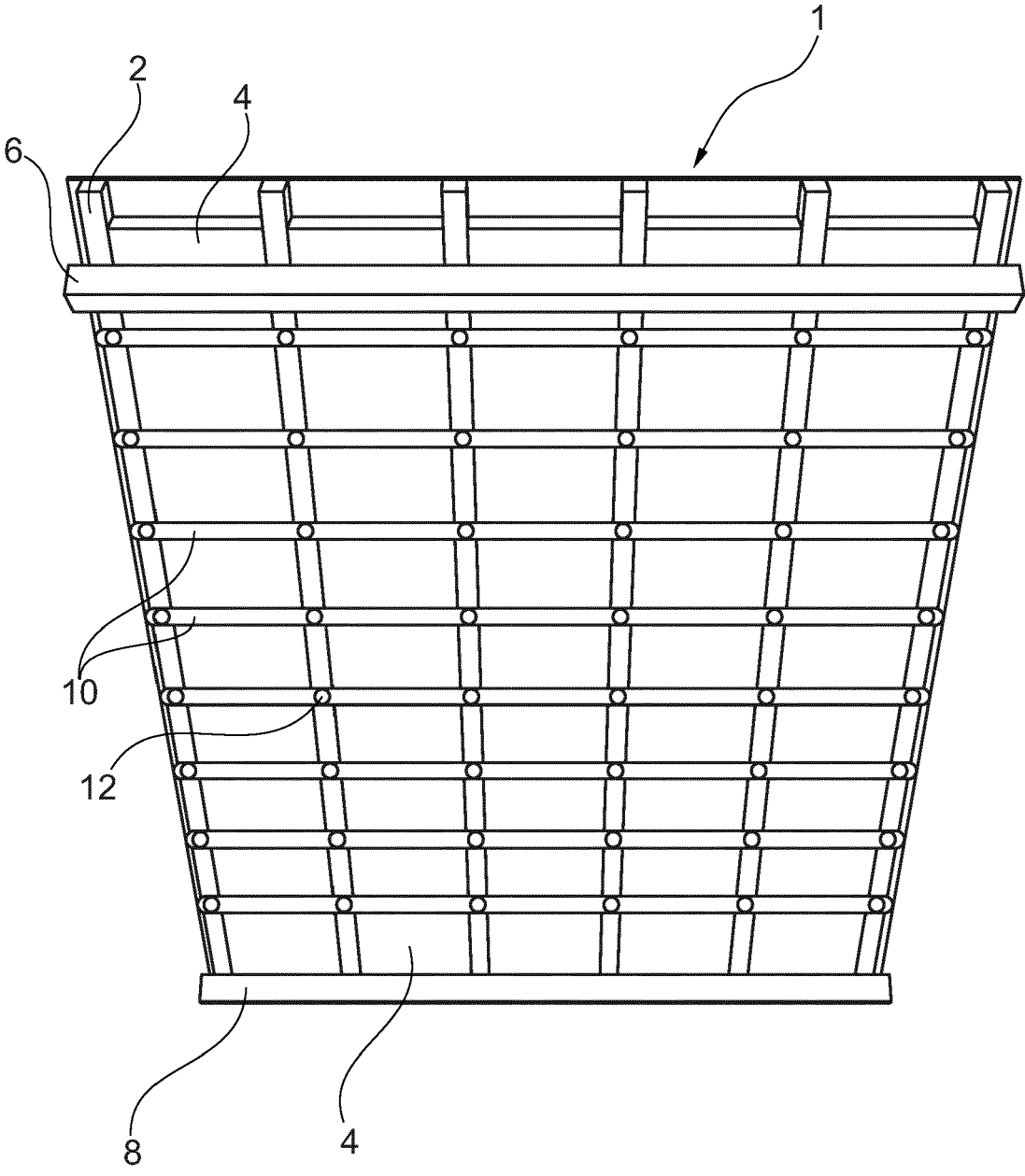


Fig. 1

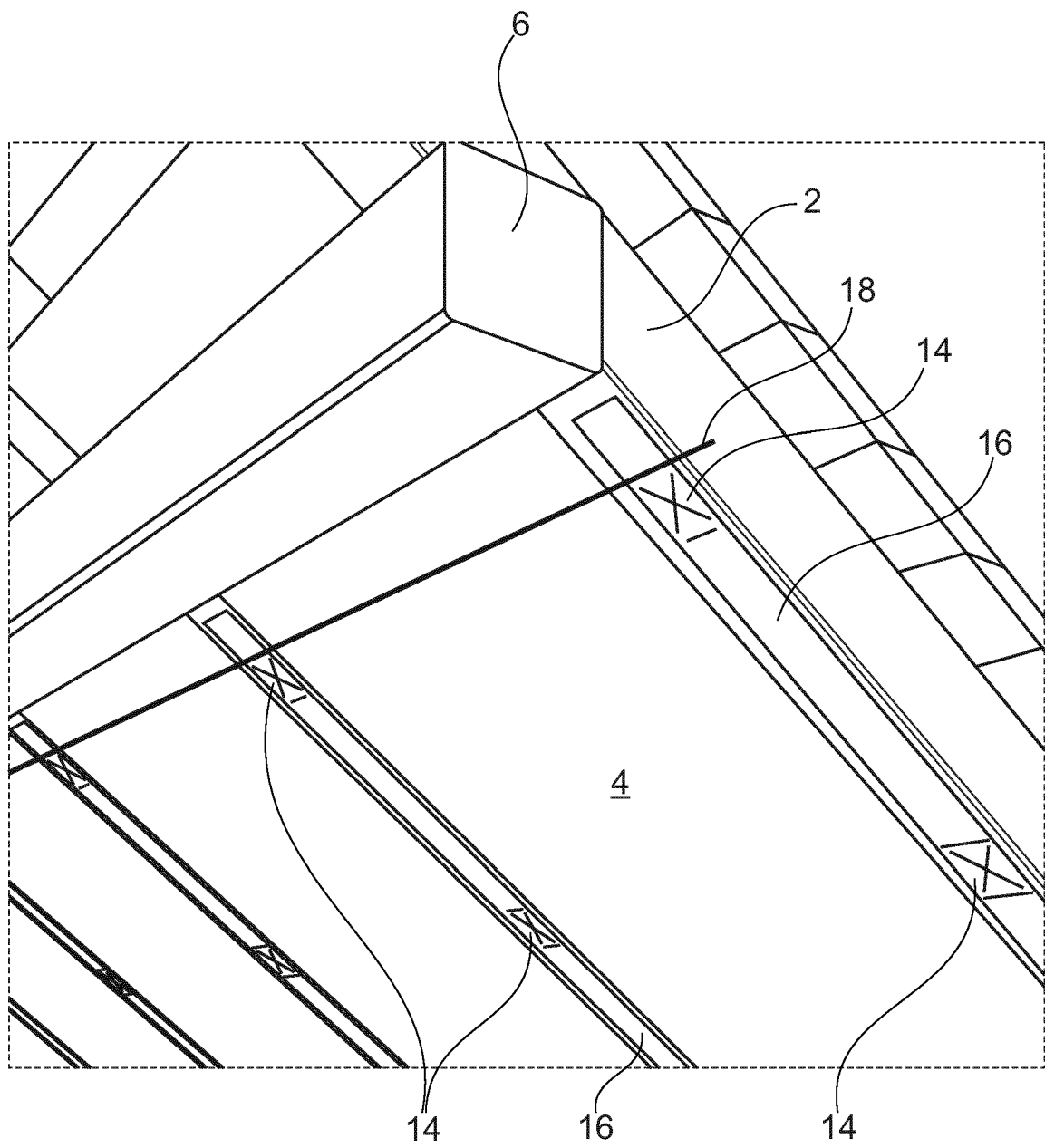


Fig. 2

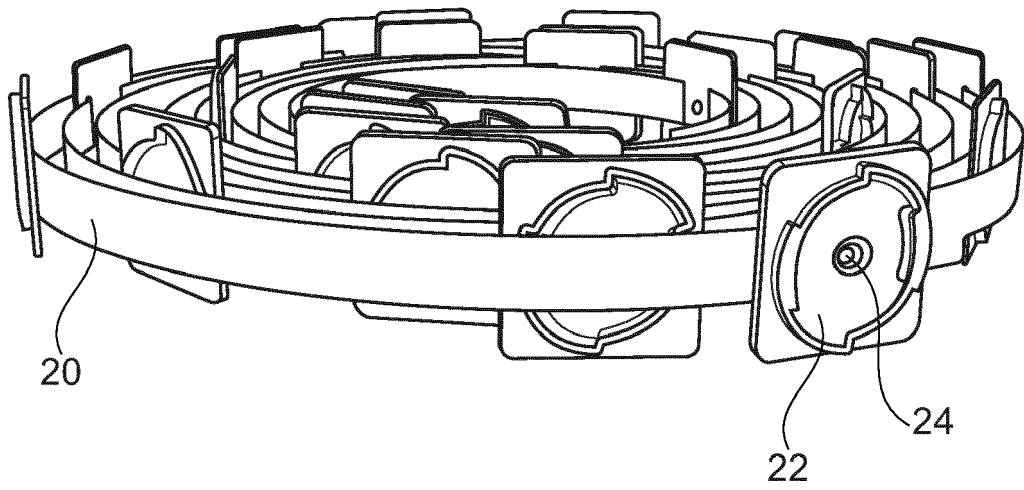


Fig. 3

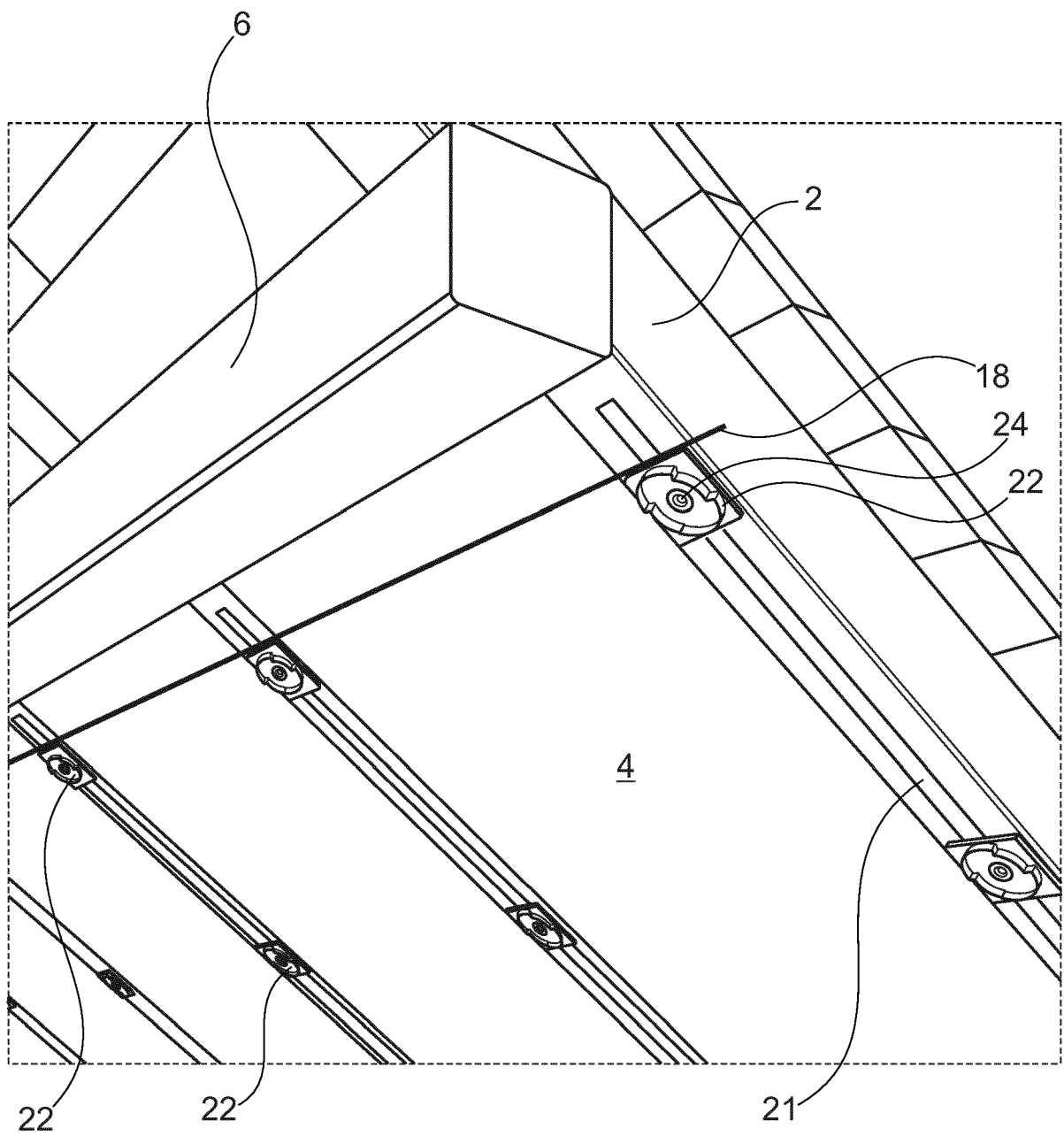


Fig. 4

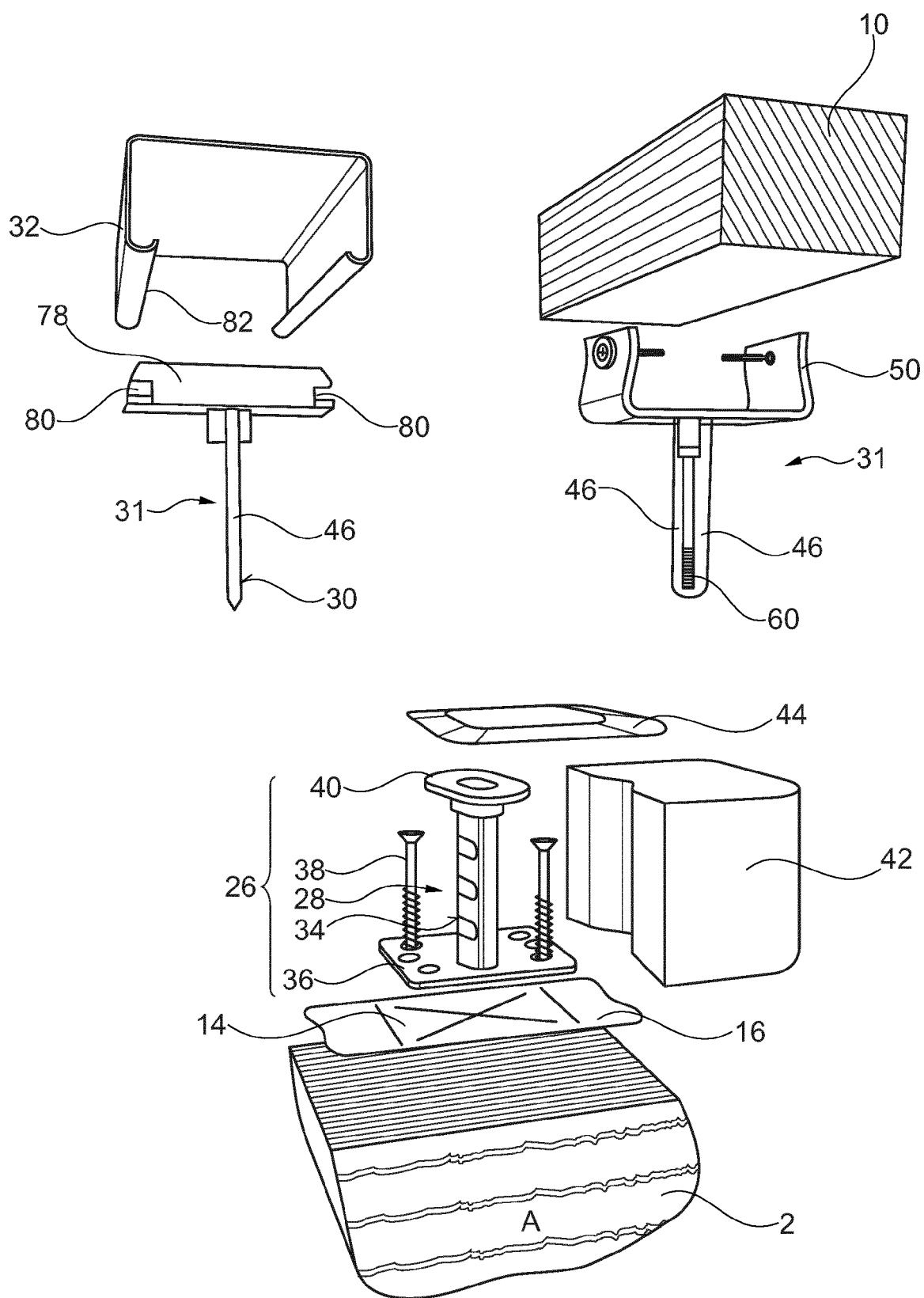


Fig. 5

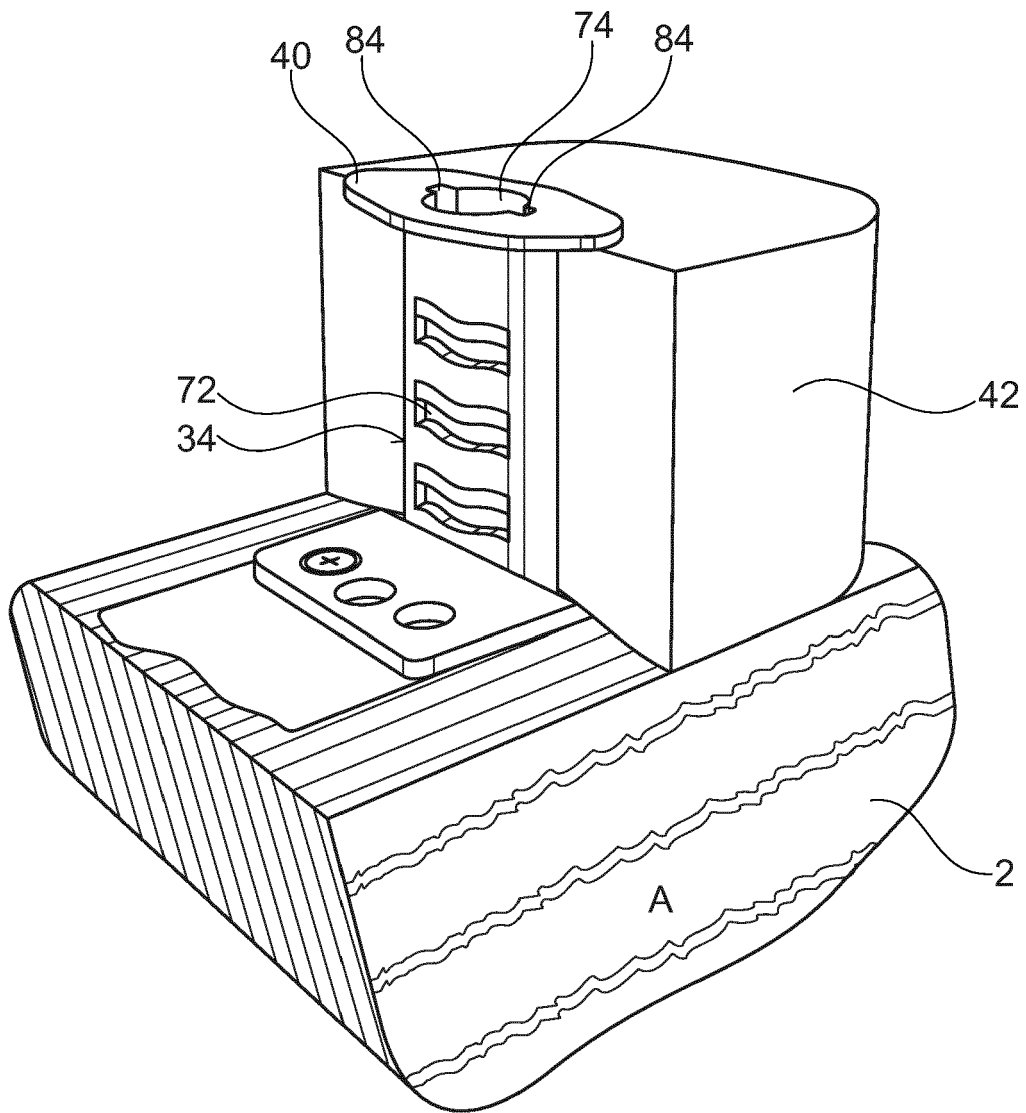


Fig. 6

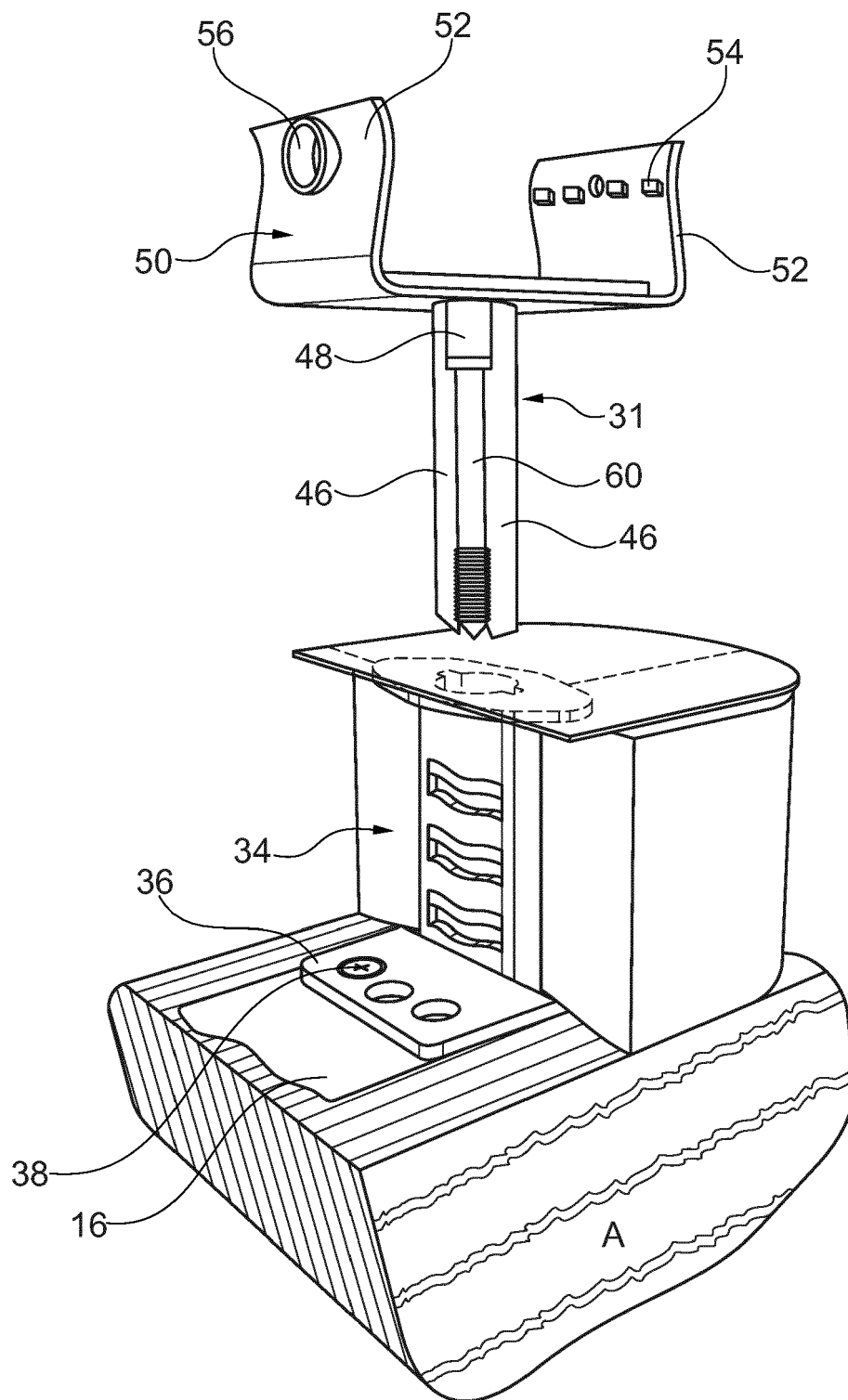


Fig. 7

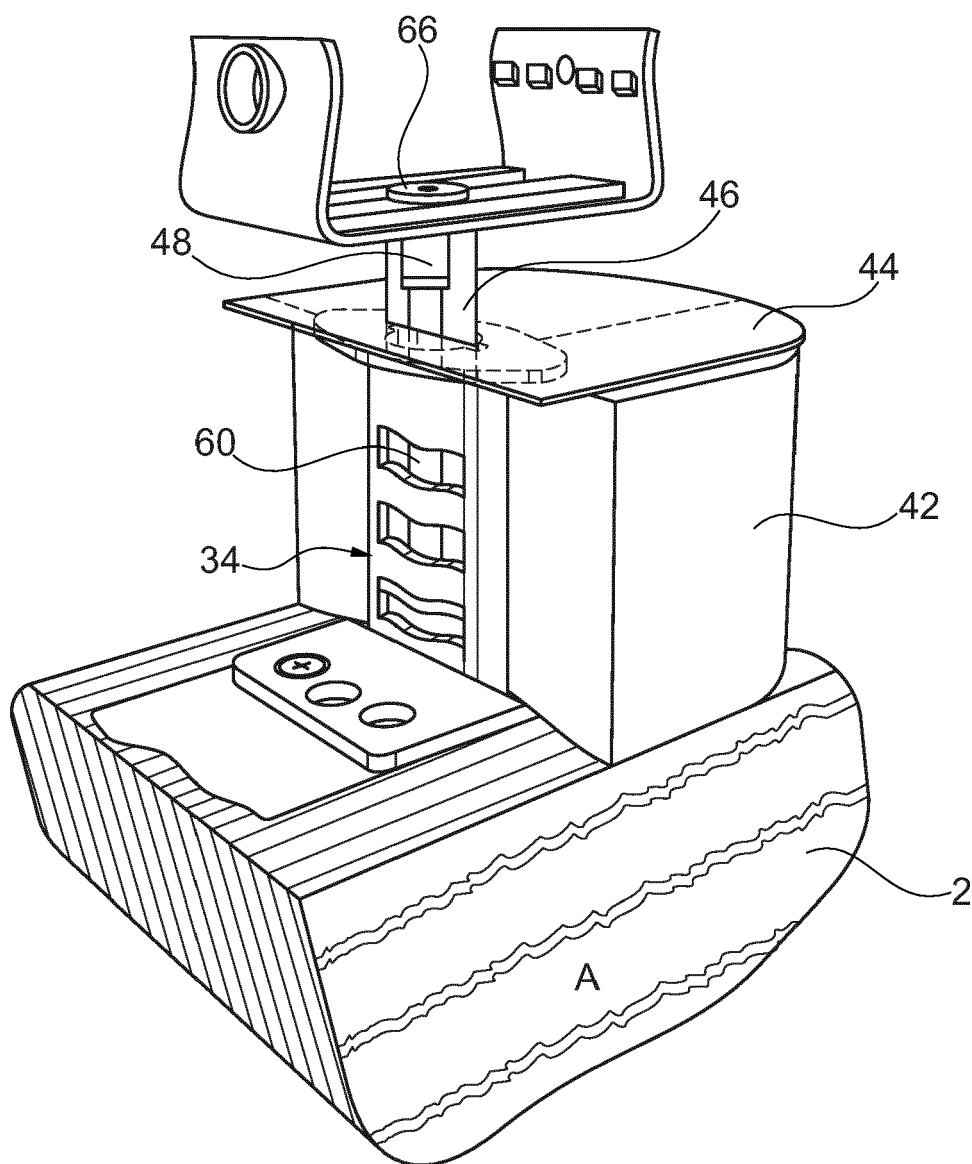


Fig. 8

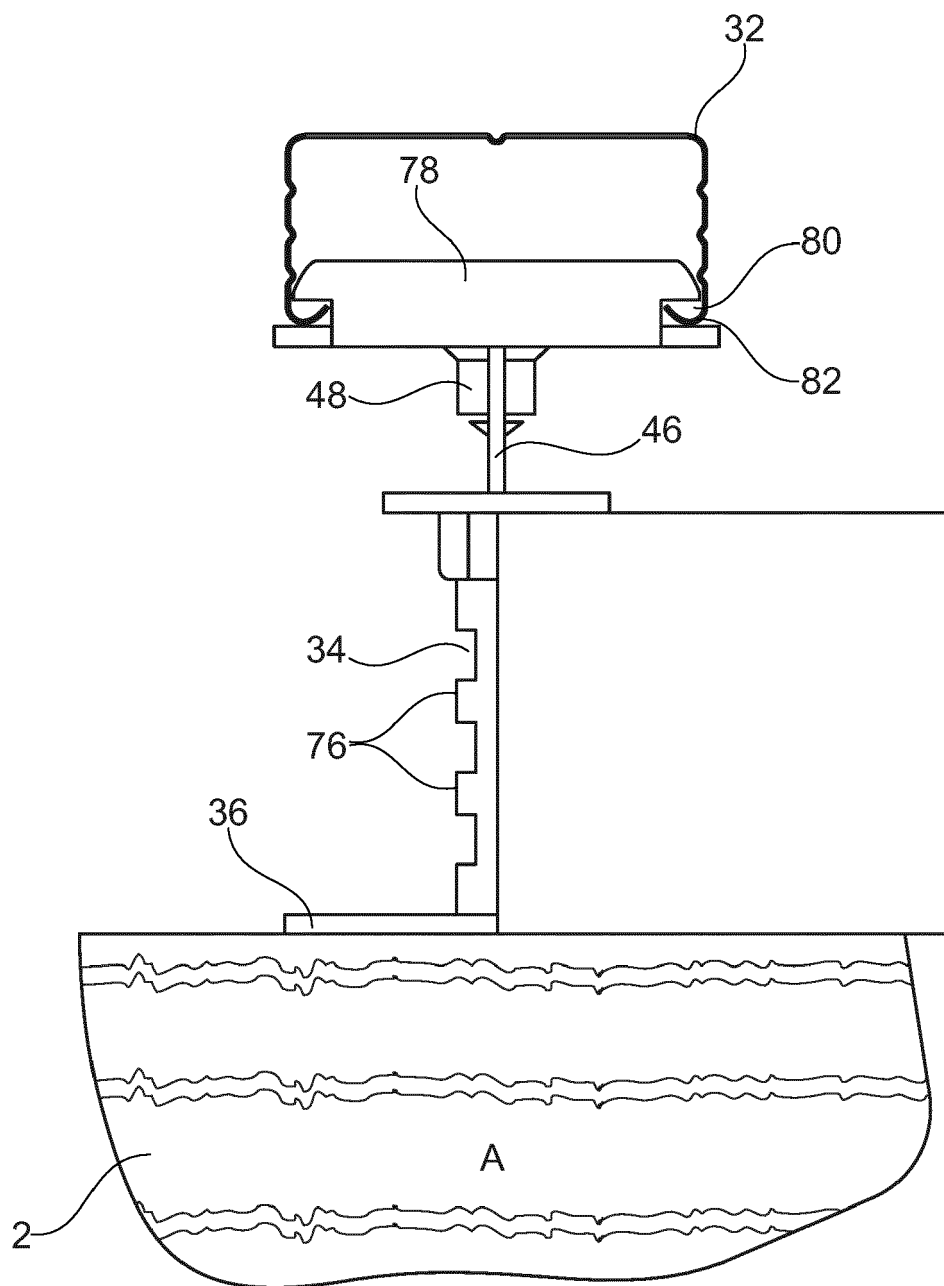


Fig. 9

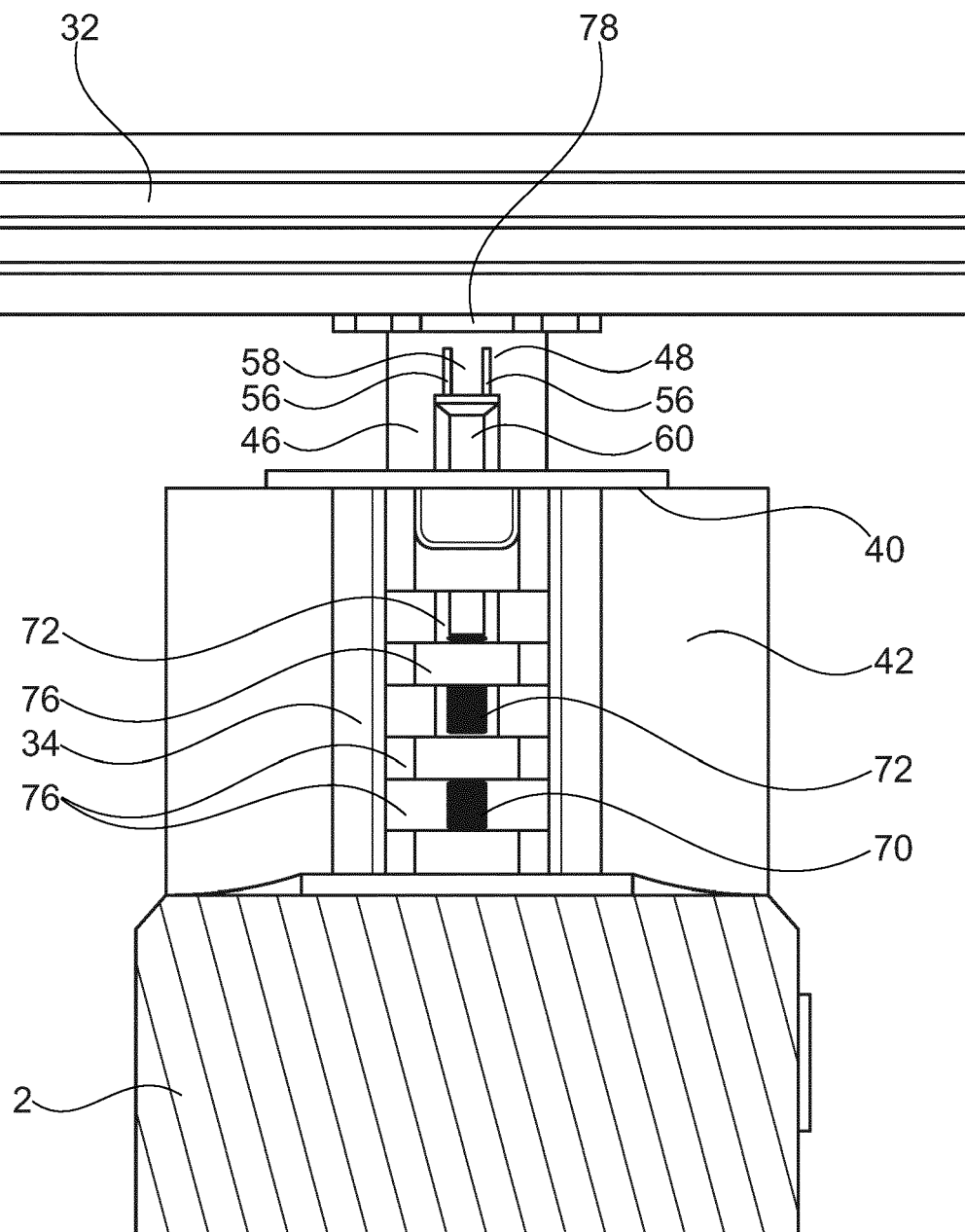


Fig. 10

Fig. 11

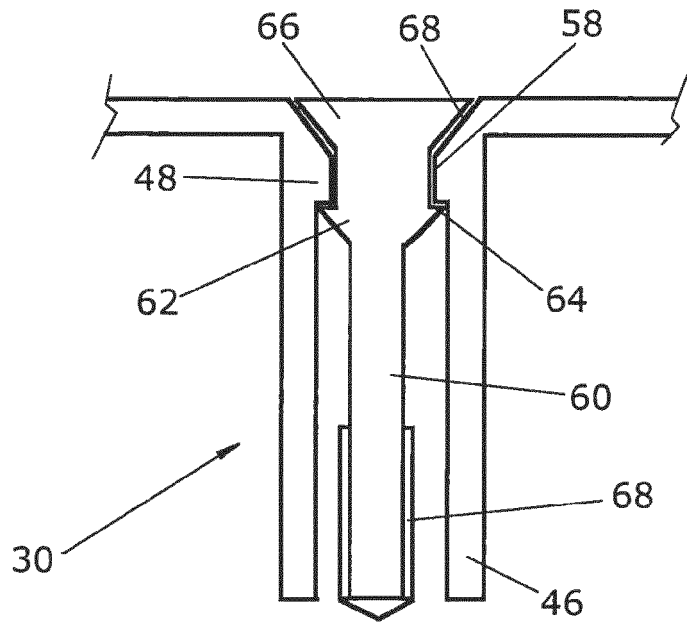
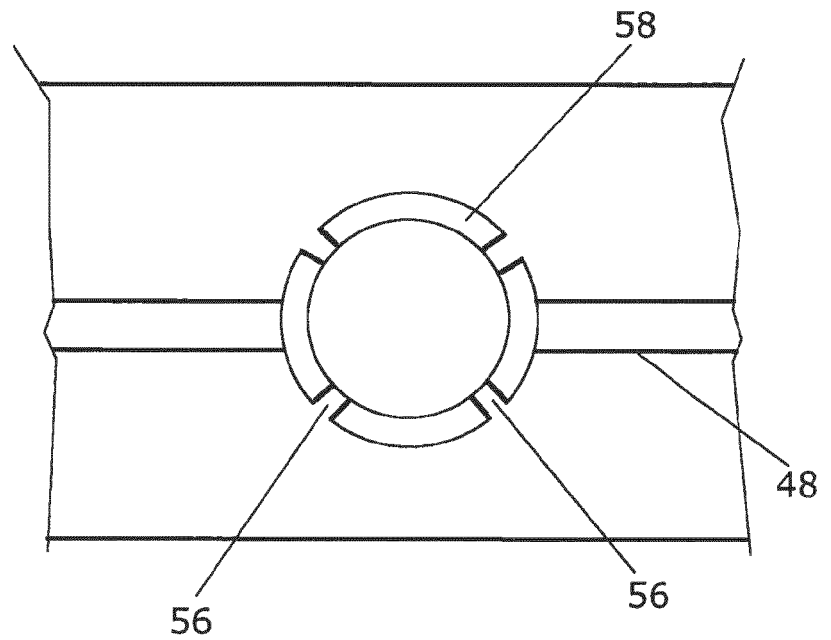


Fig. 12



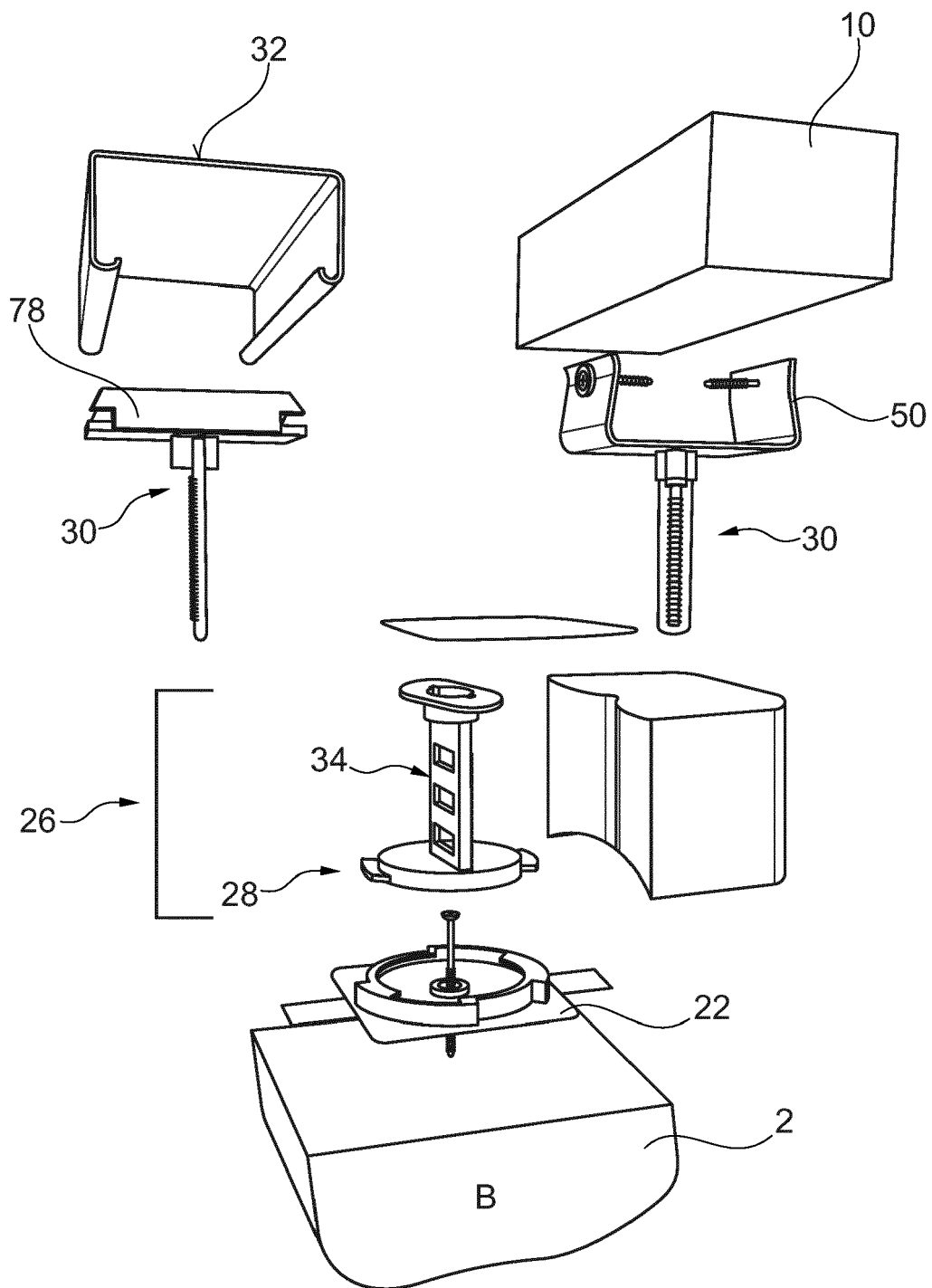


Fig. 13

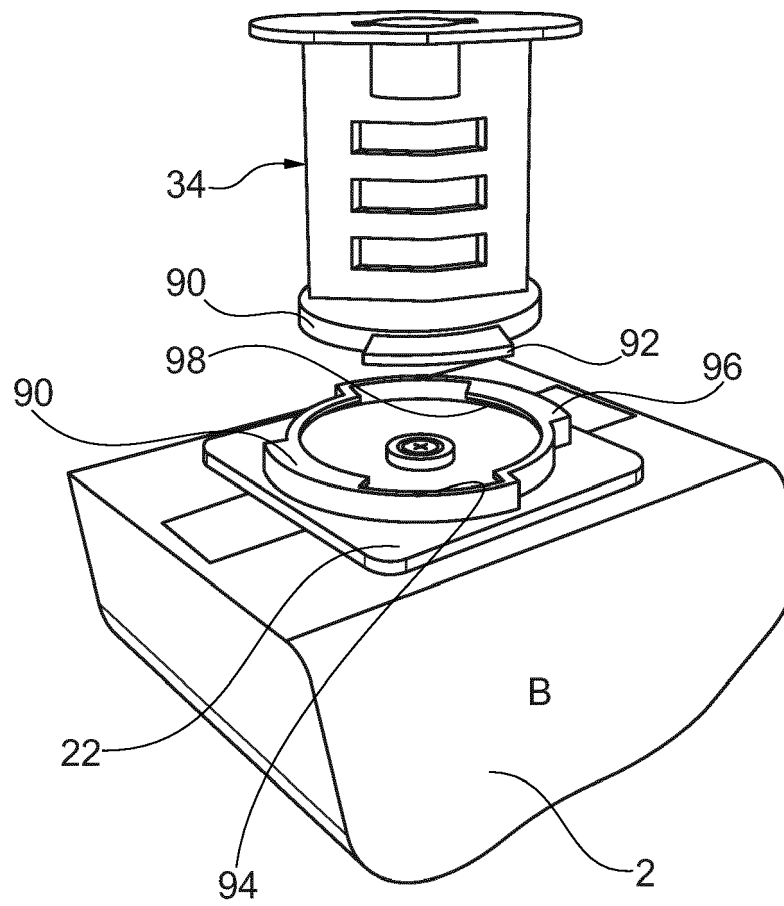


Fig. 14

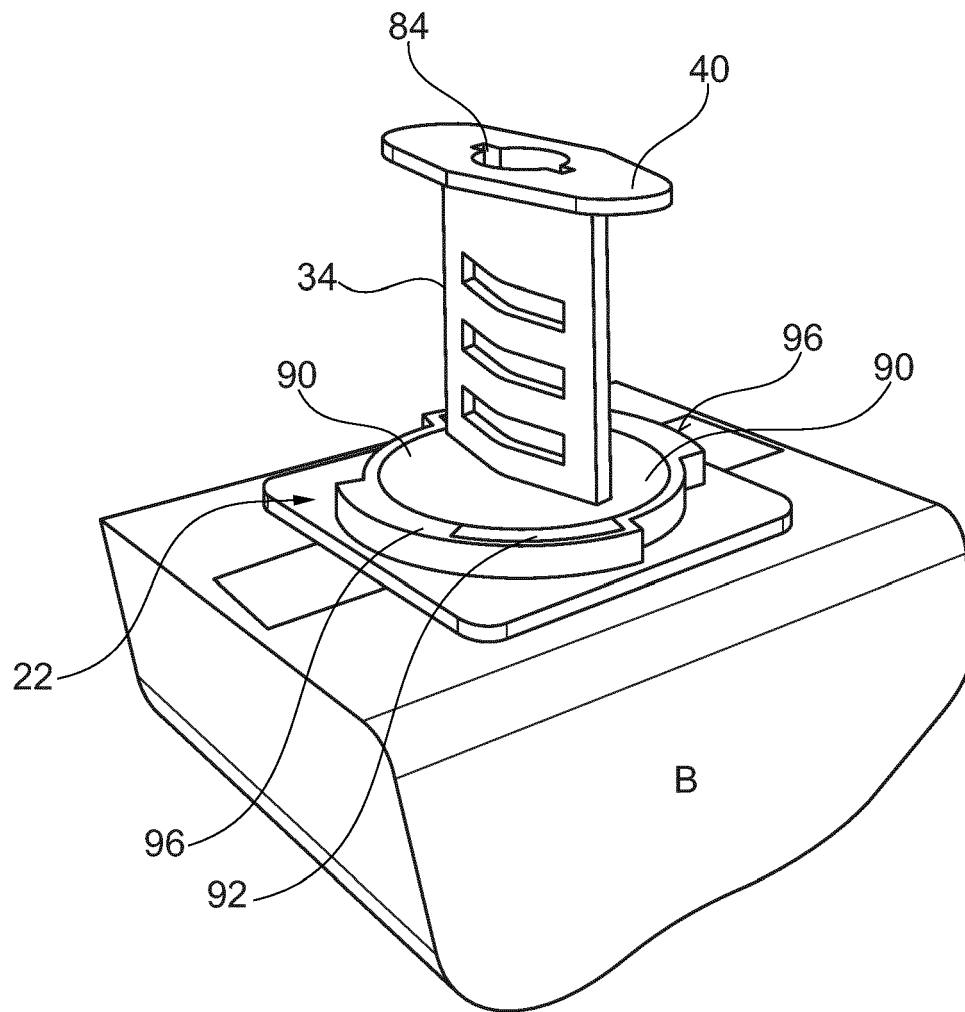


Fig. 15

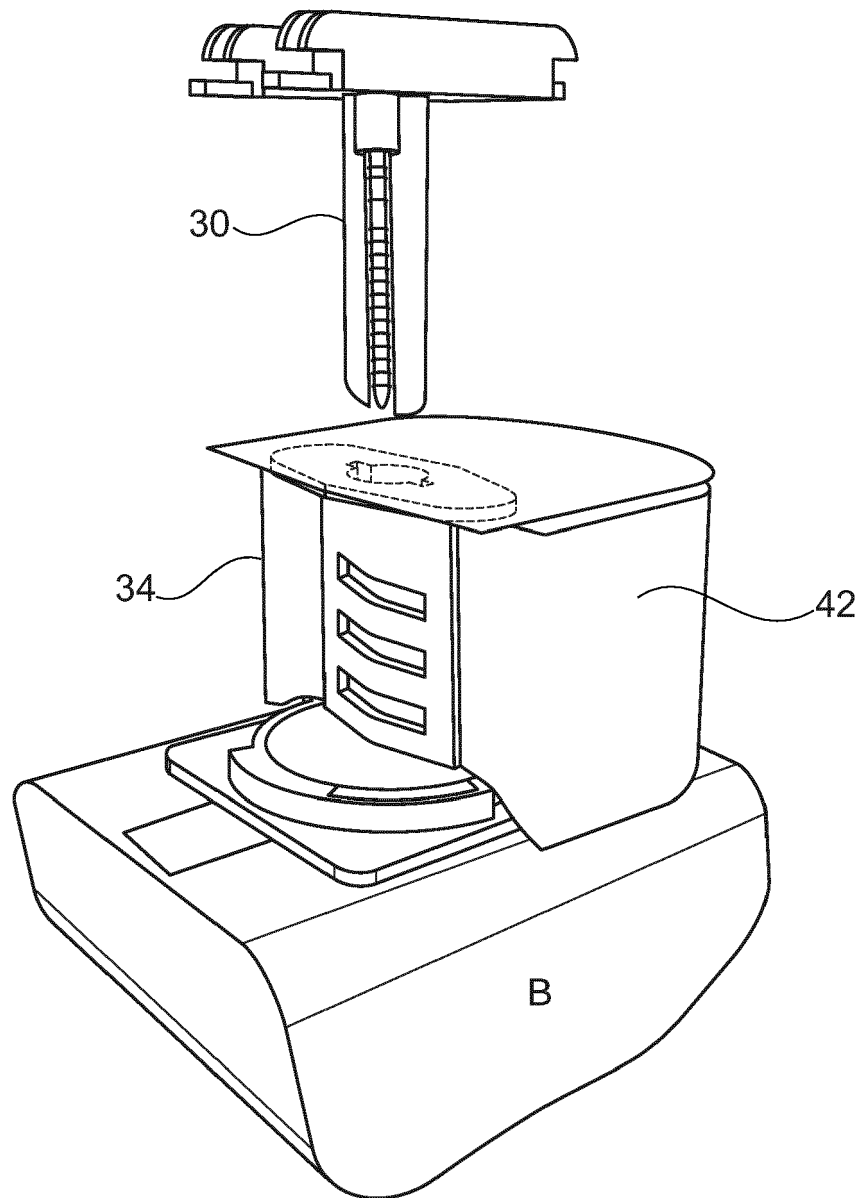


Fig. 16

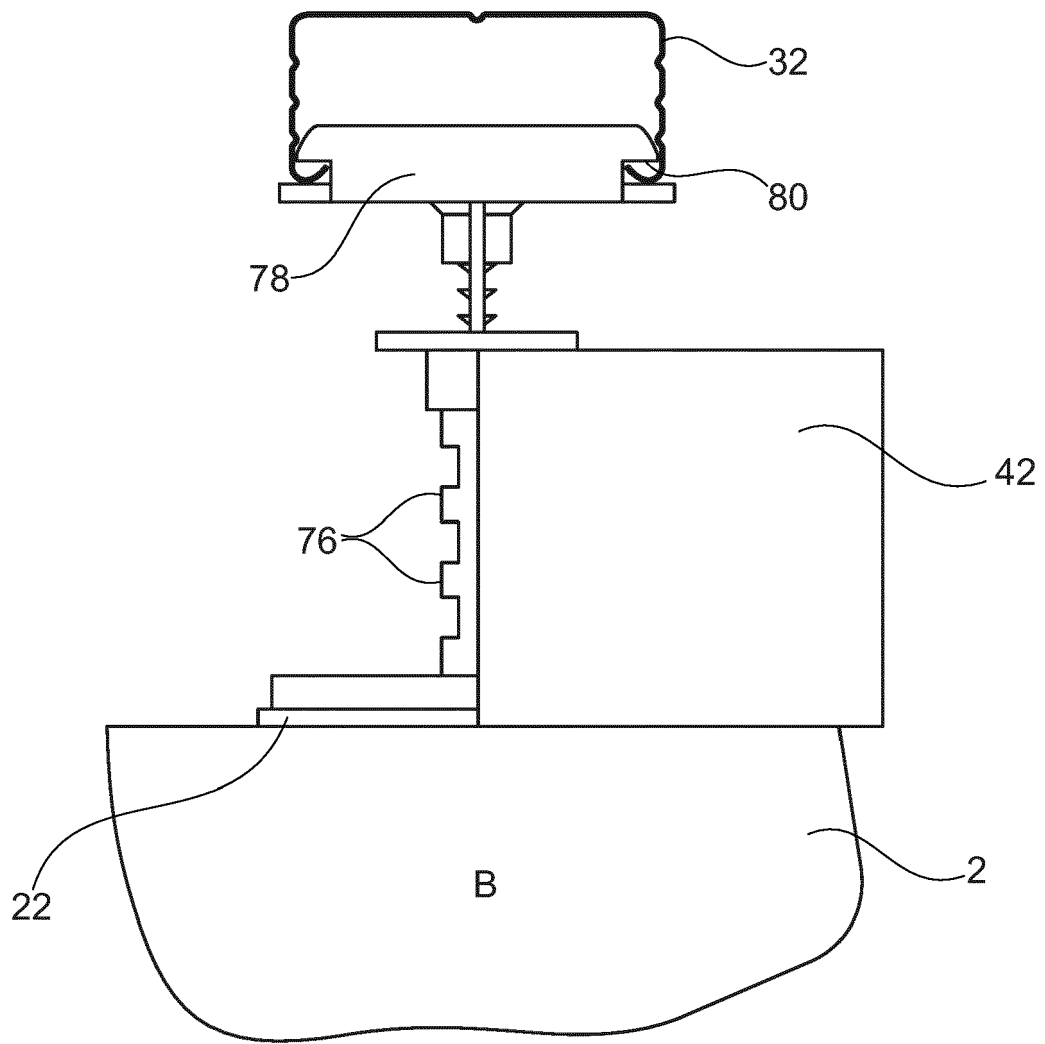


Fig. 17

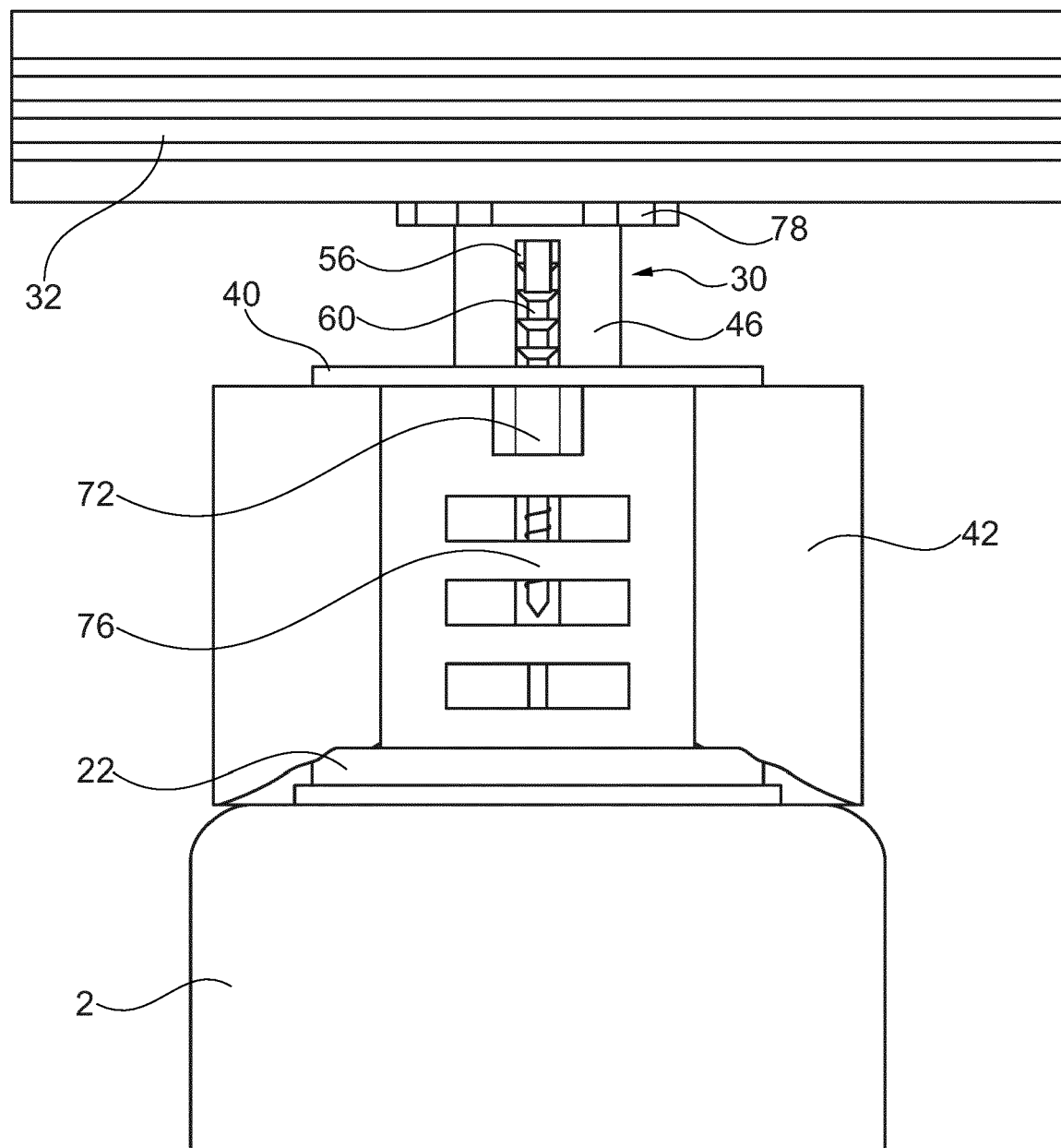


Fig. 18

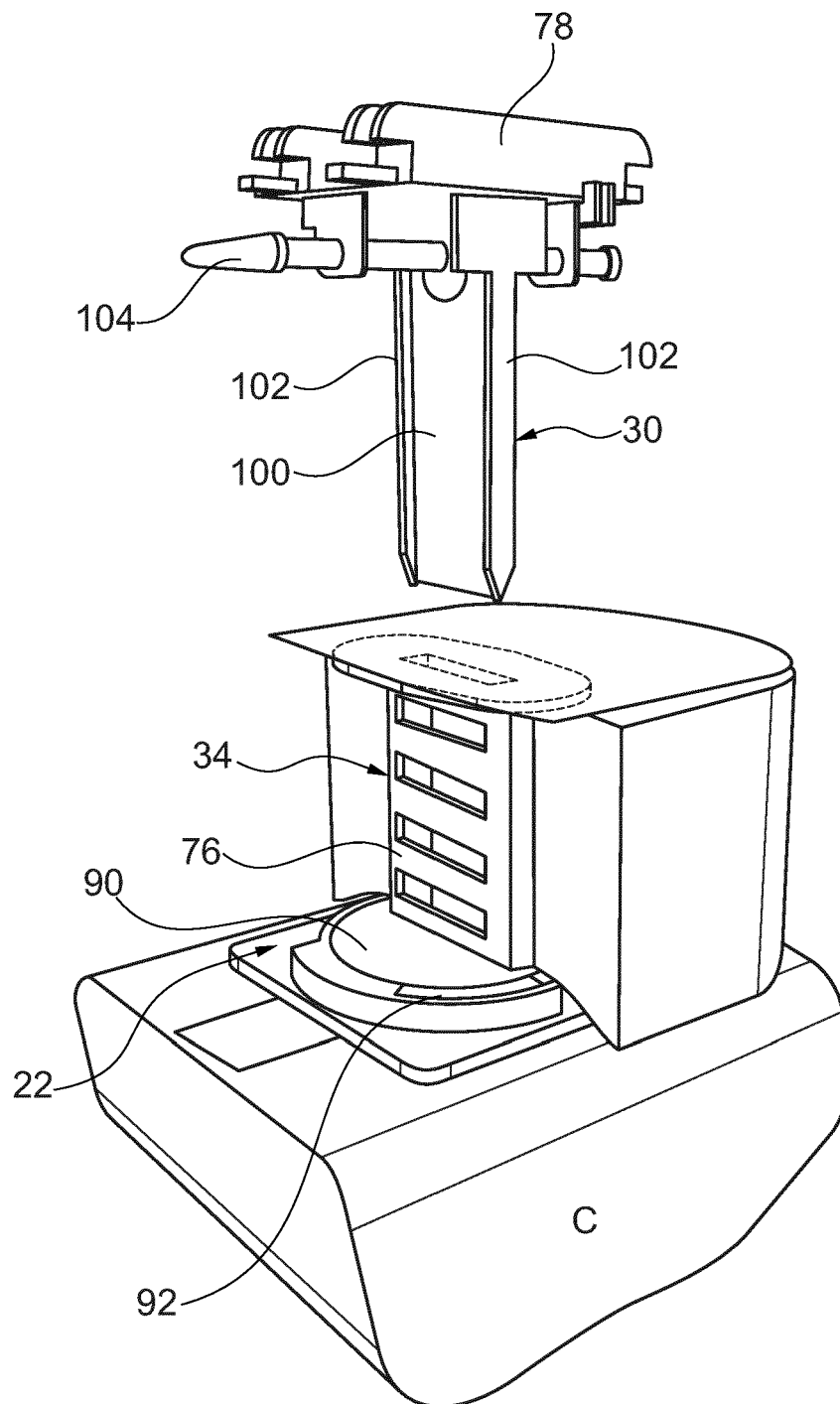


Fig. 19

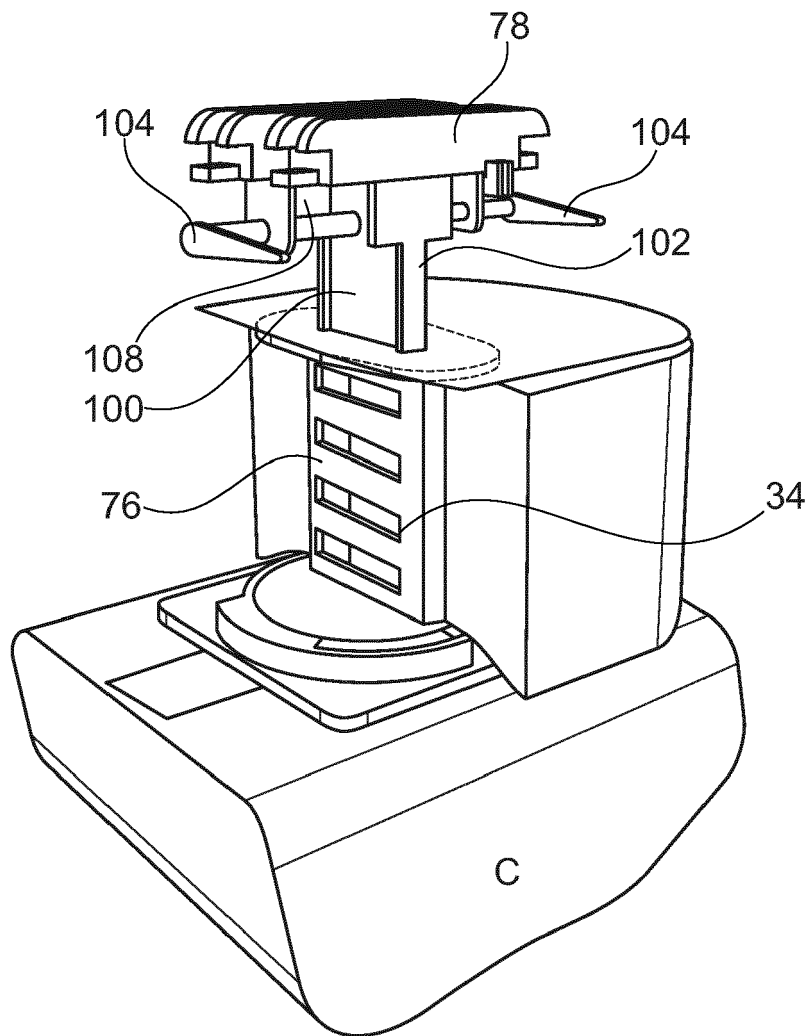


Fig. 20

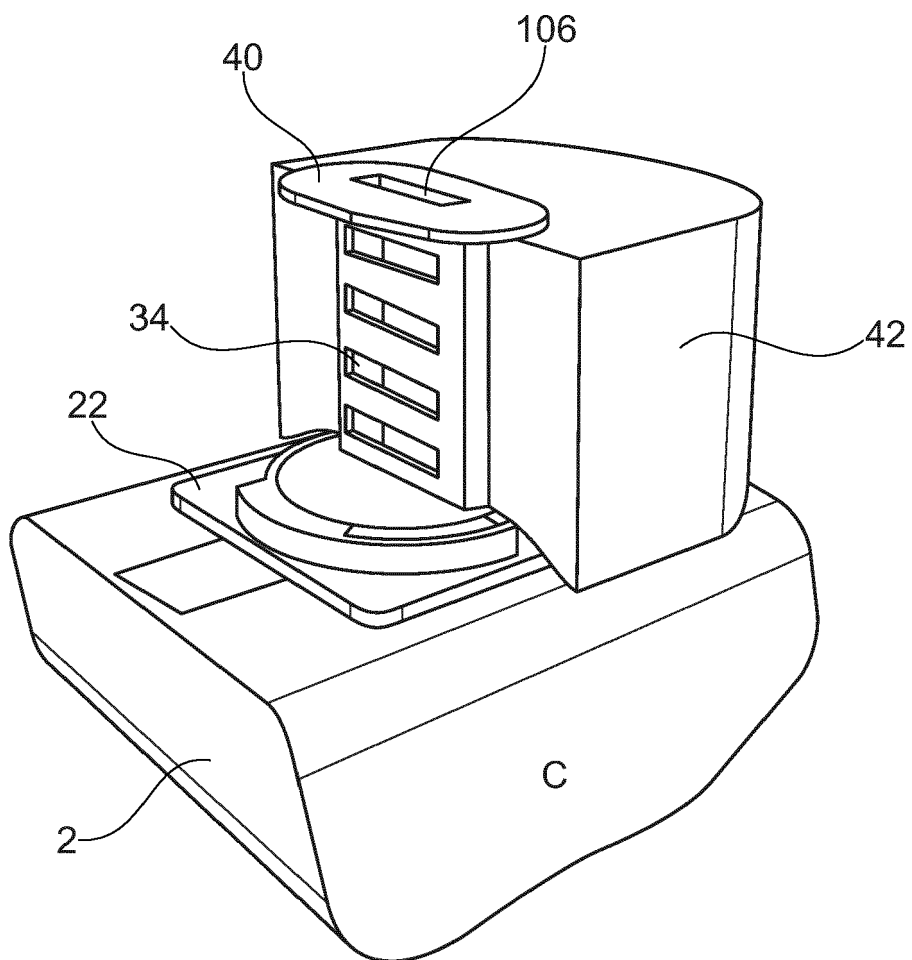


Fig. 21

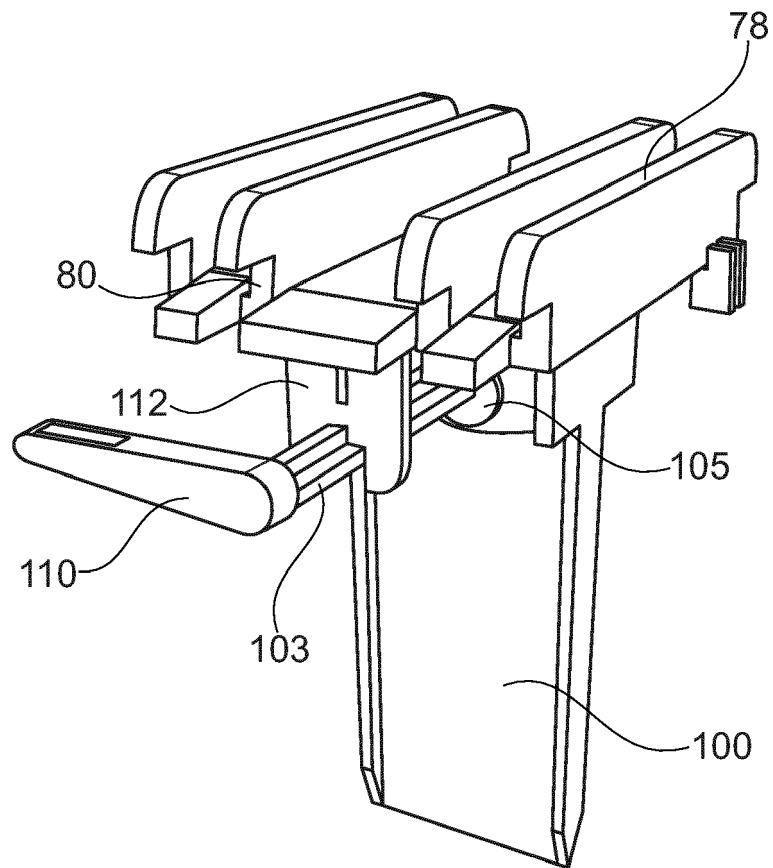


Fig. 22

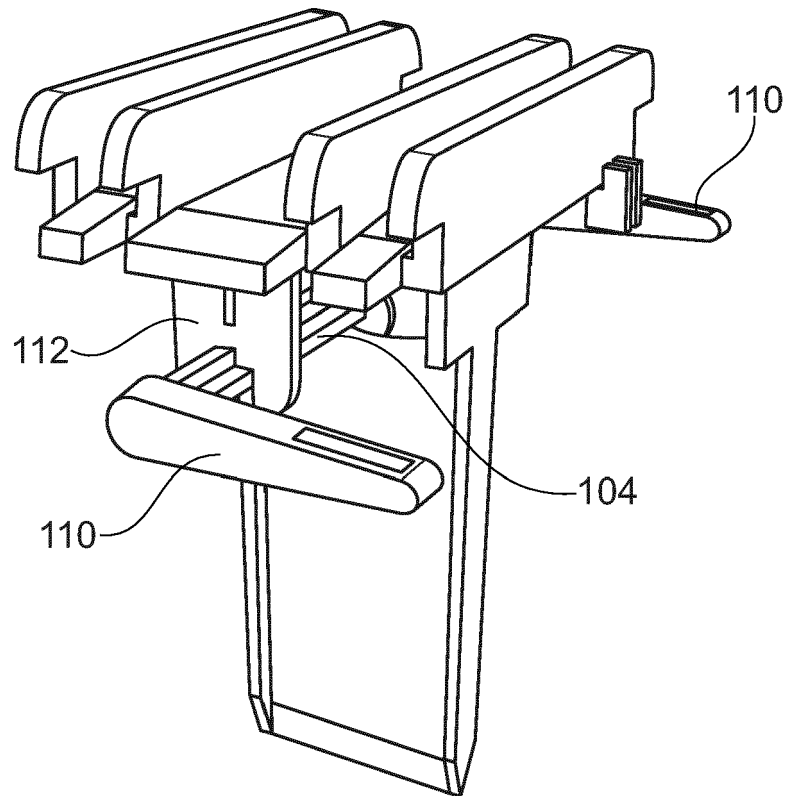


Fig. 23

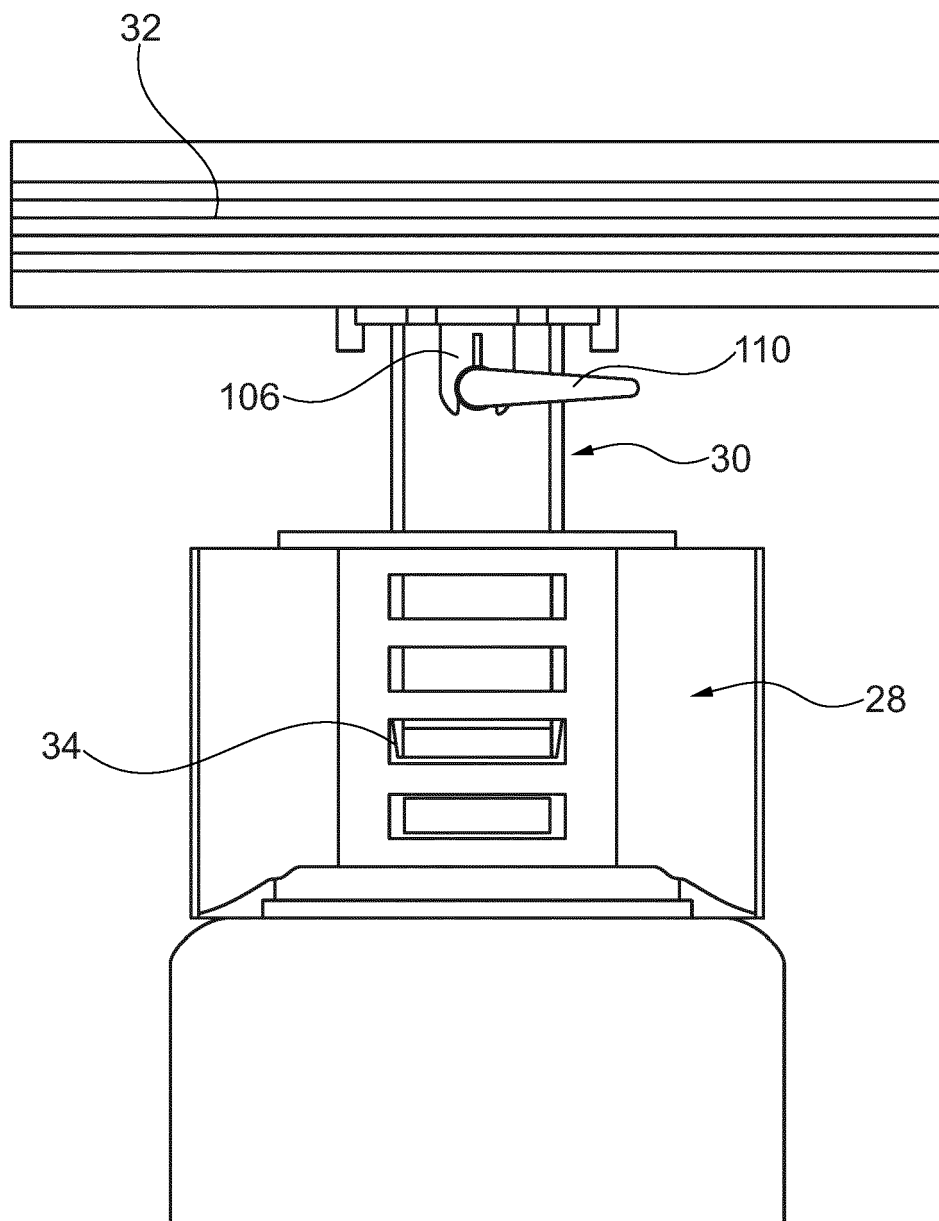


Fig. 24

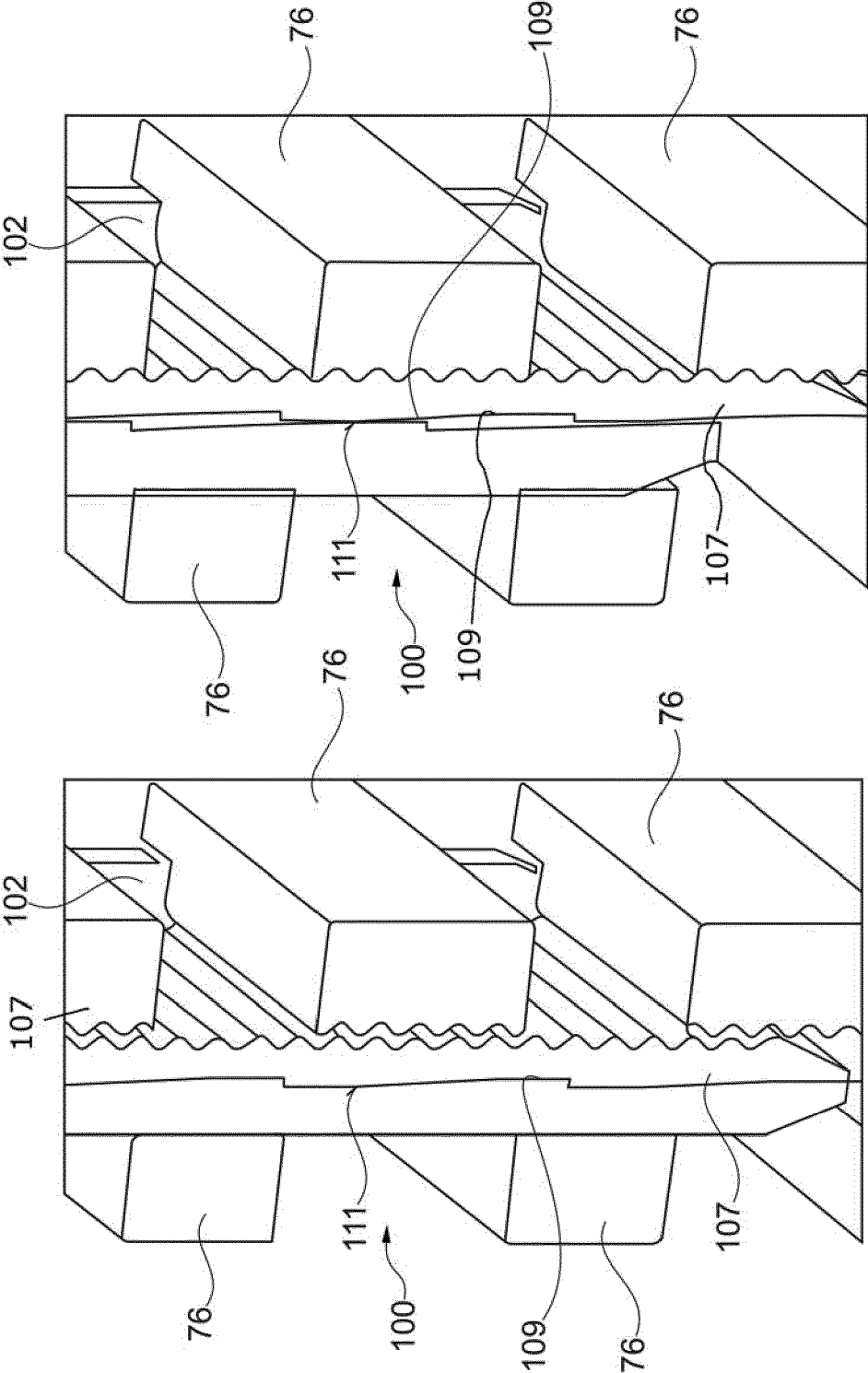


Fig. 24B

Fig. 24A

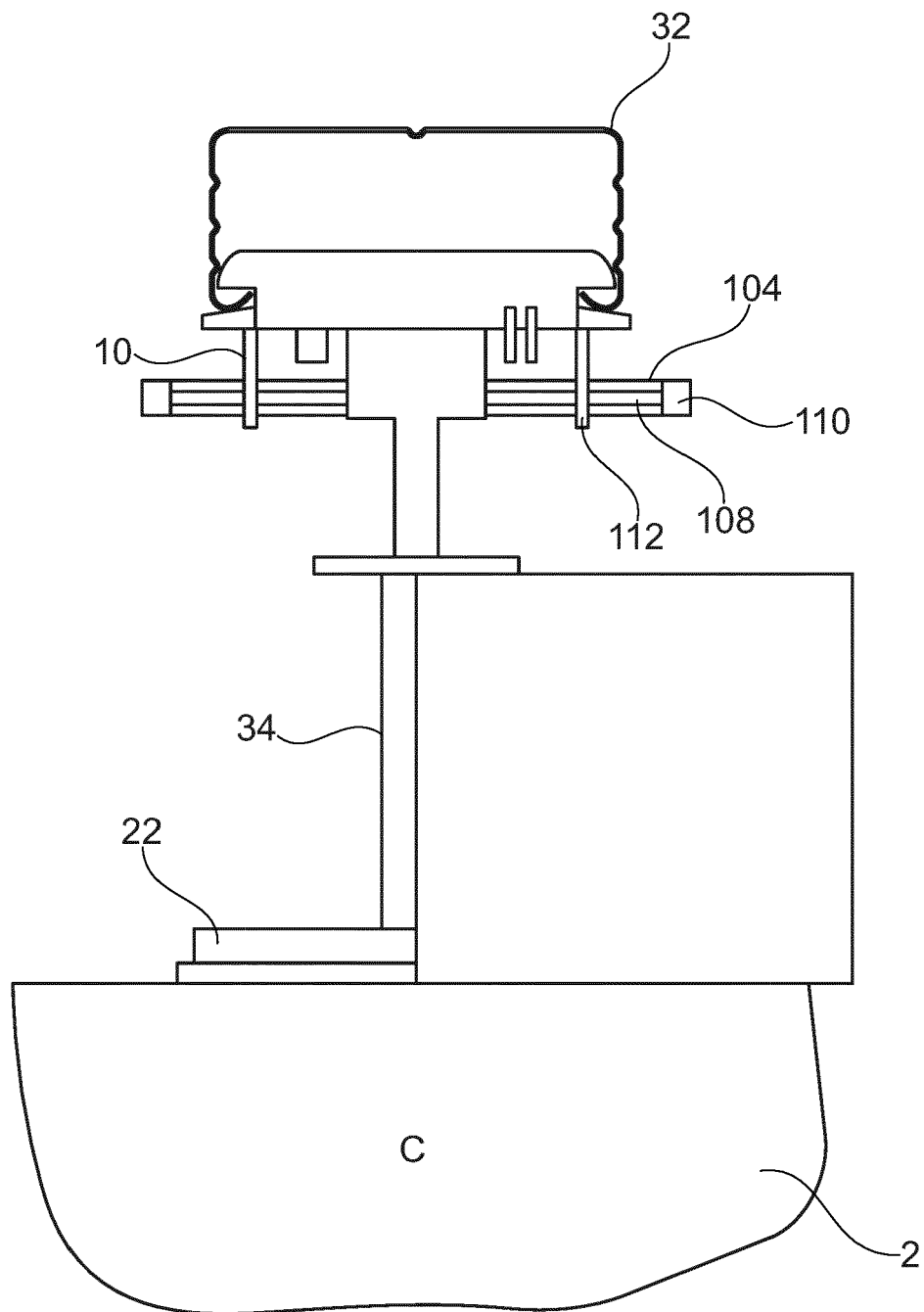


Fig. 25

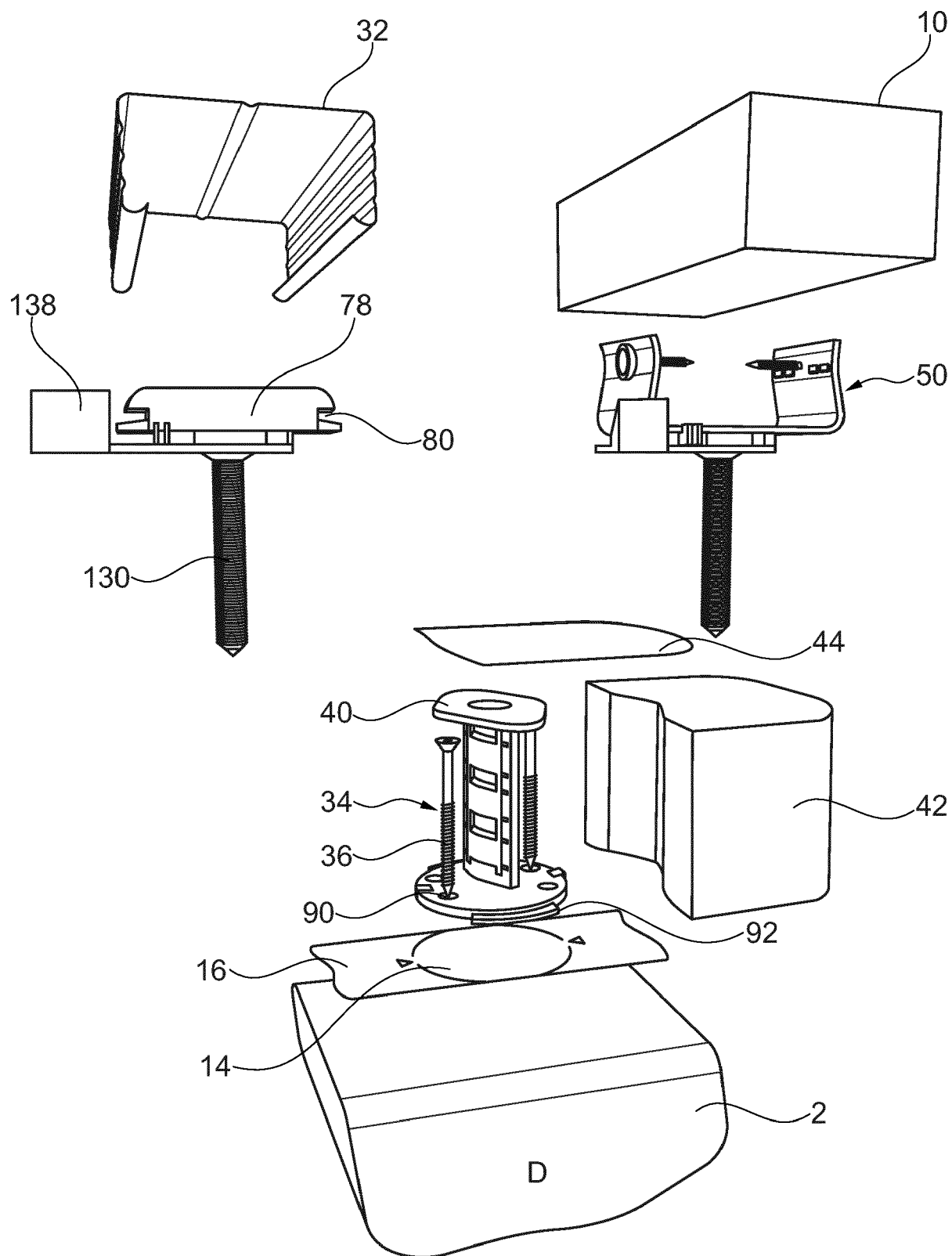


Fig. 26

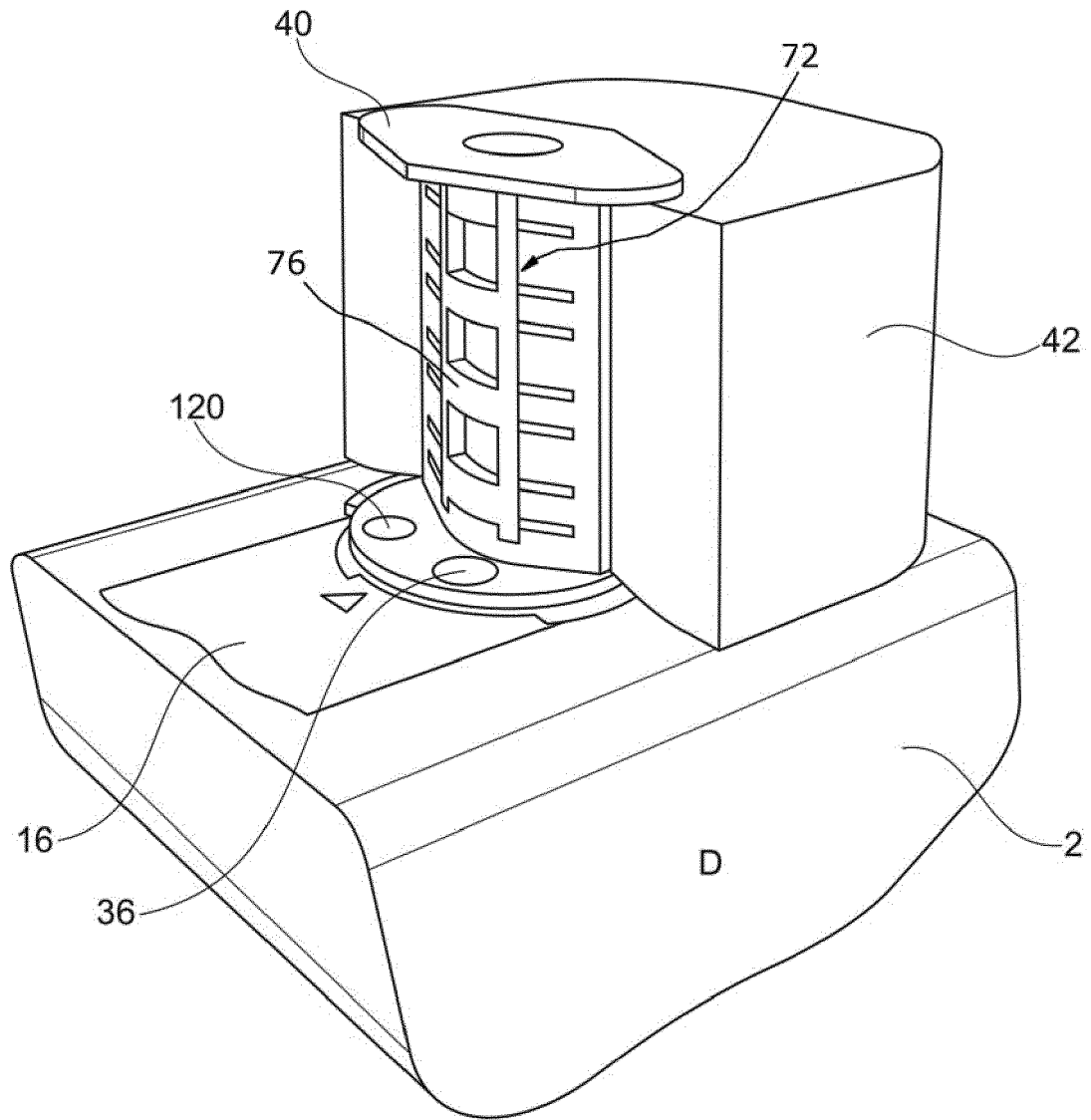


Fig. 27

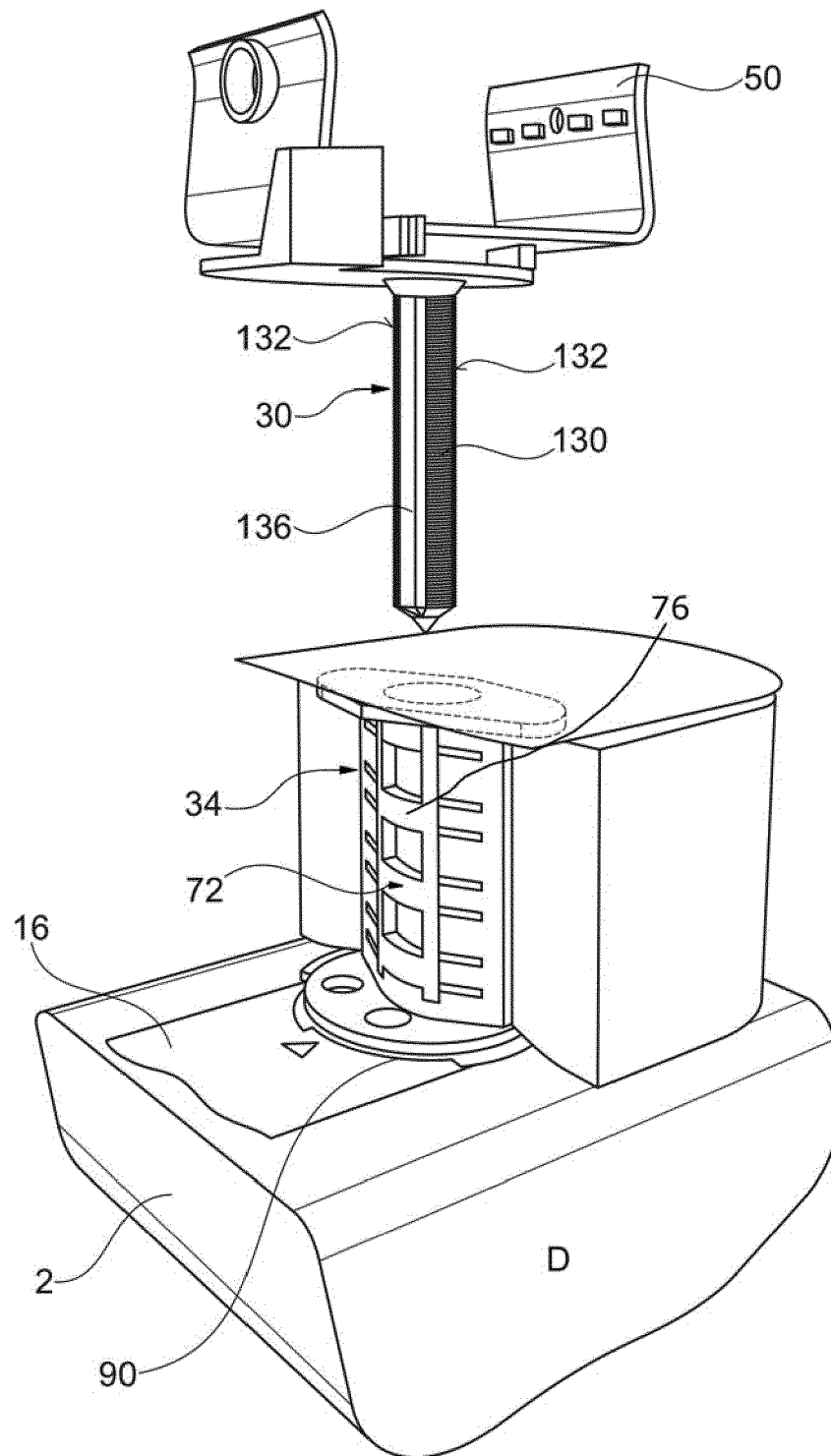


Fig. 28

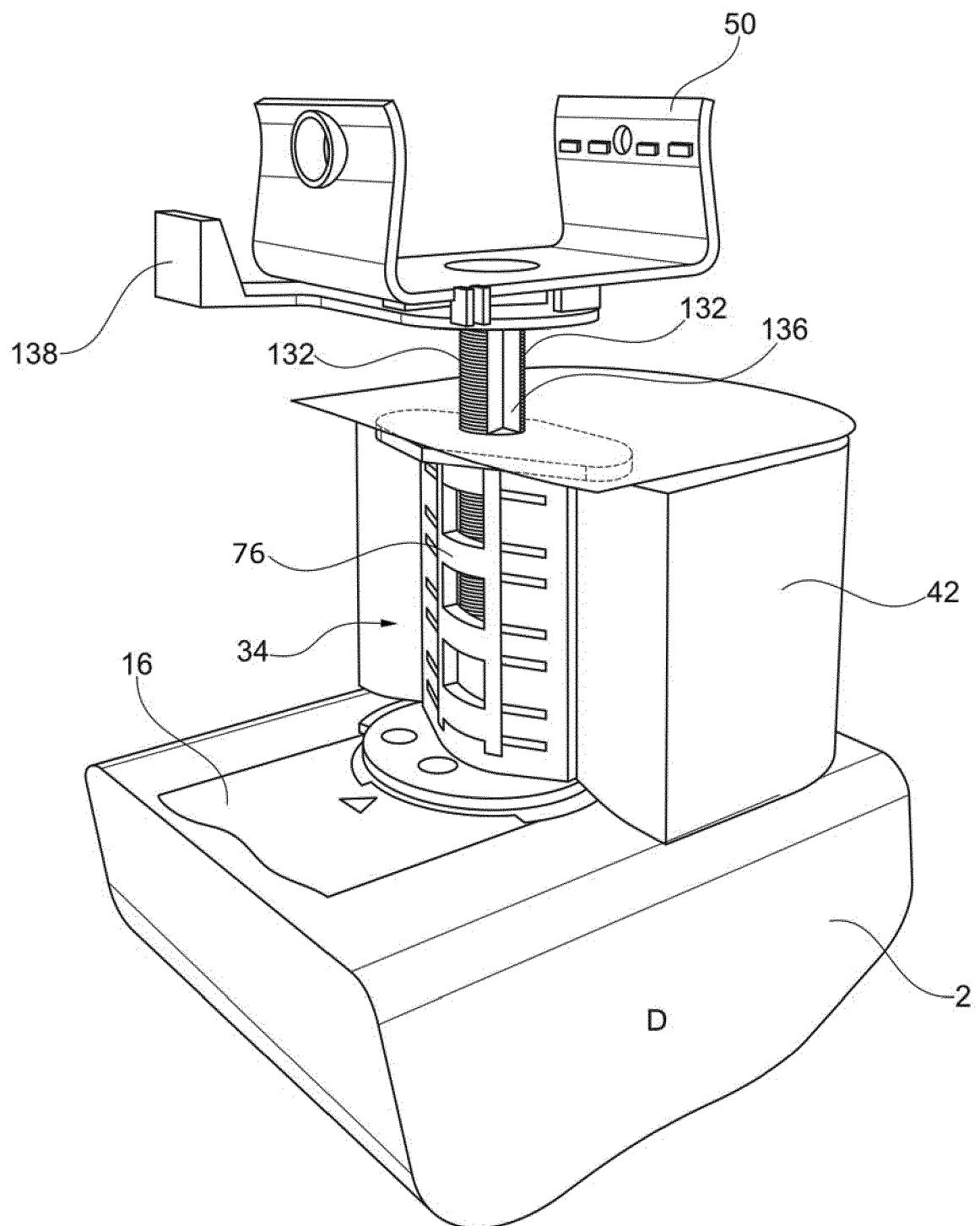


Fig. 29

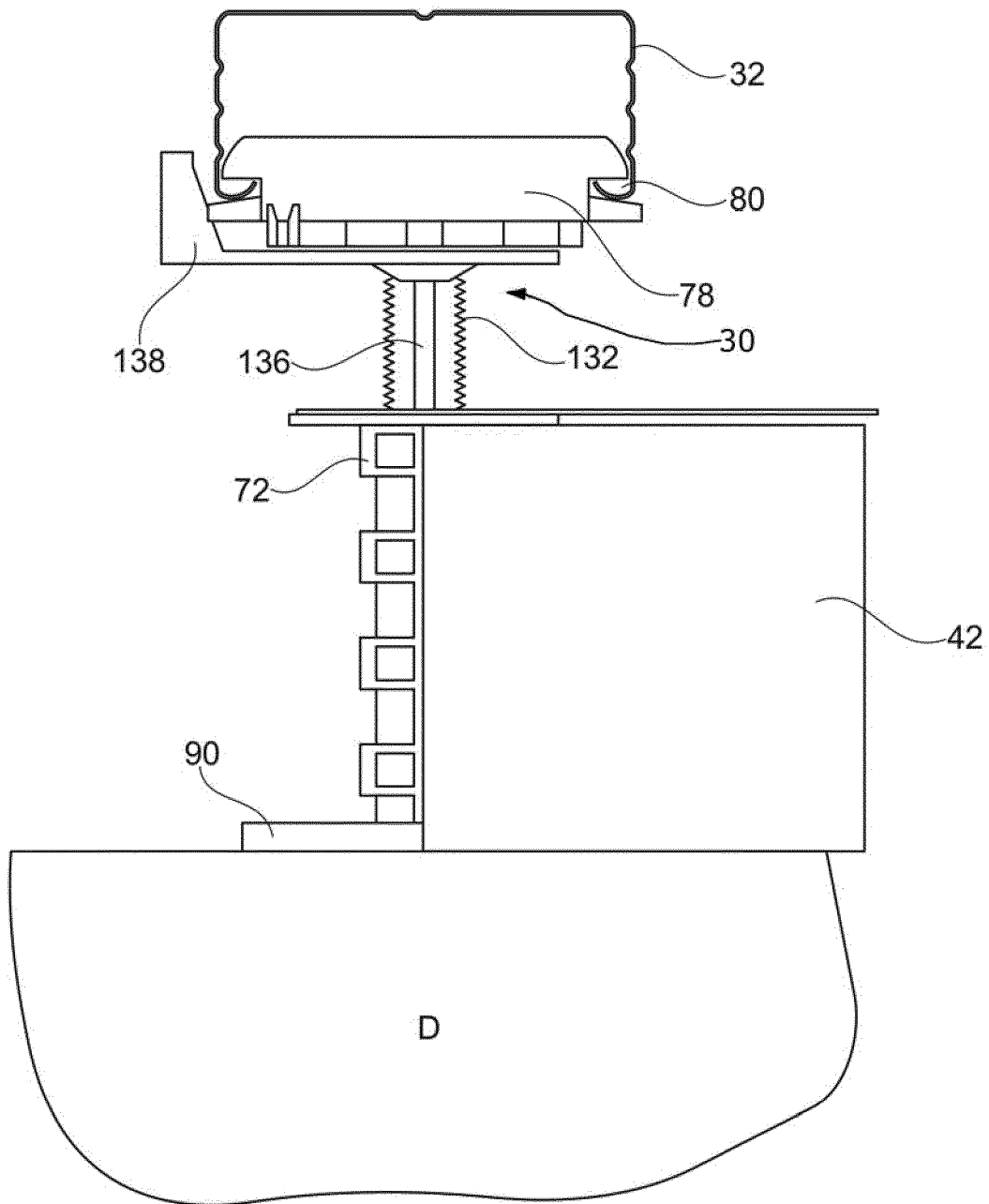


Fig. 30

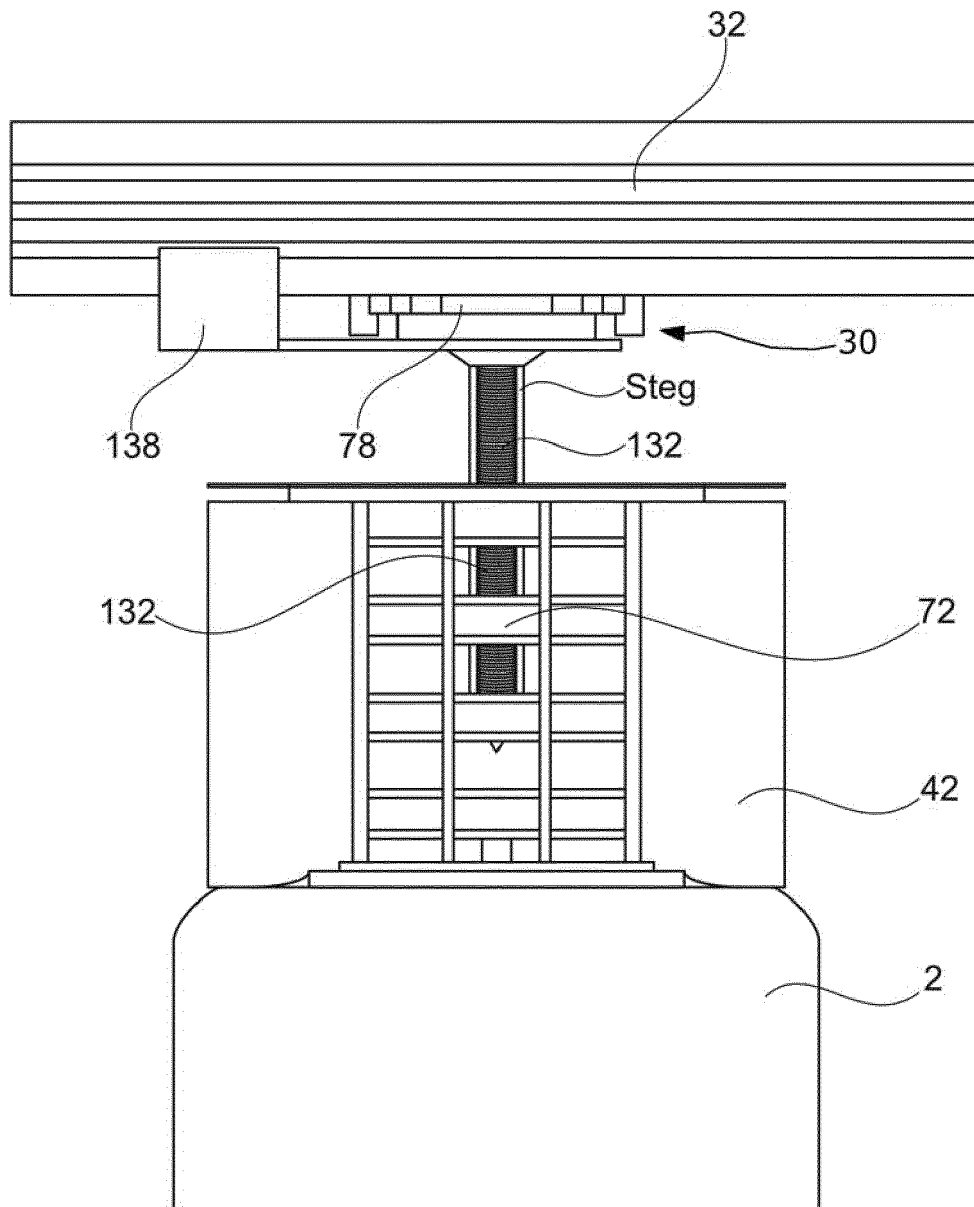


Fig. 31

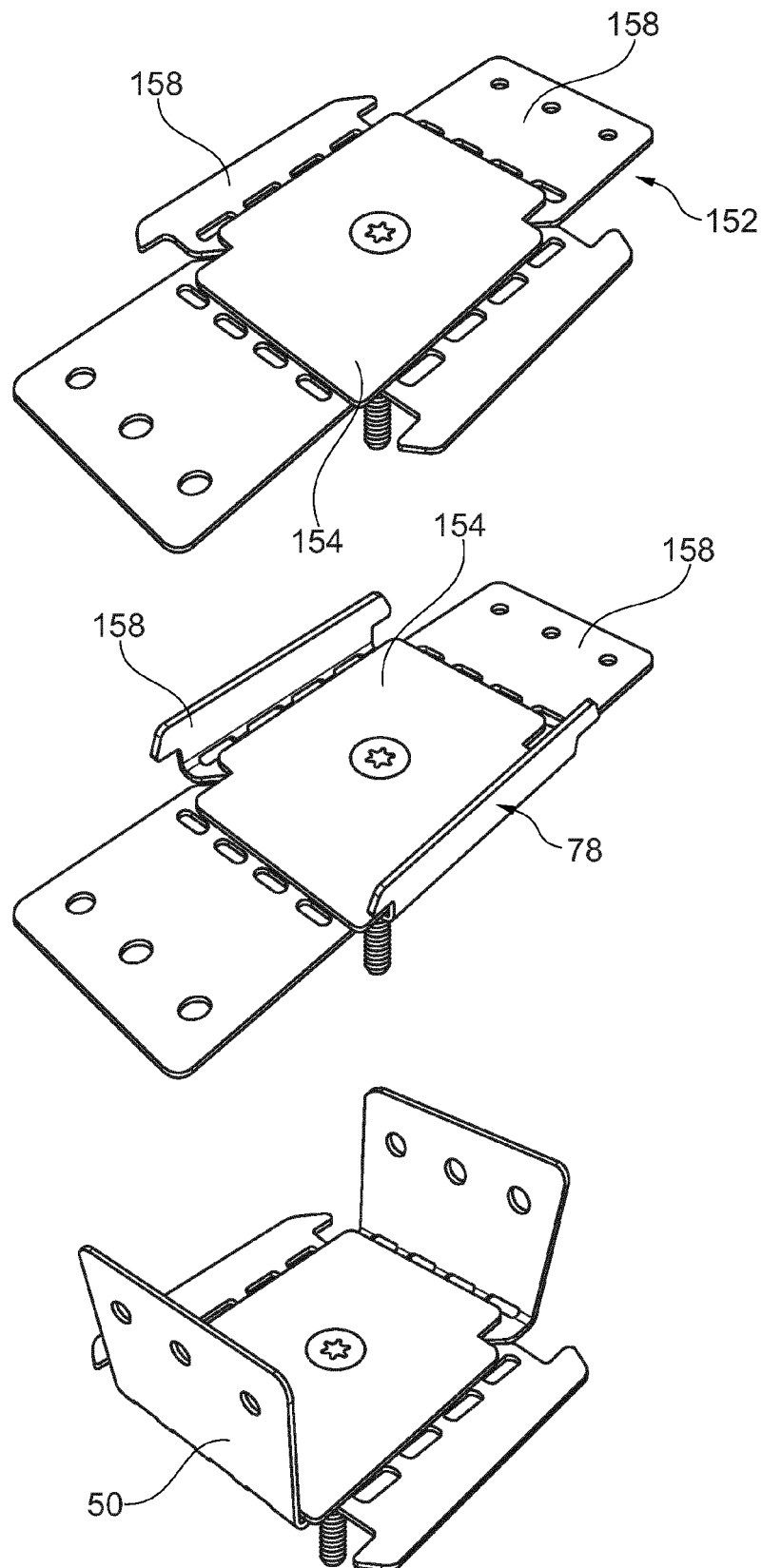


Fig. 32

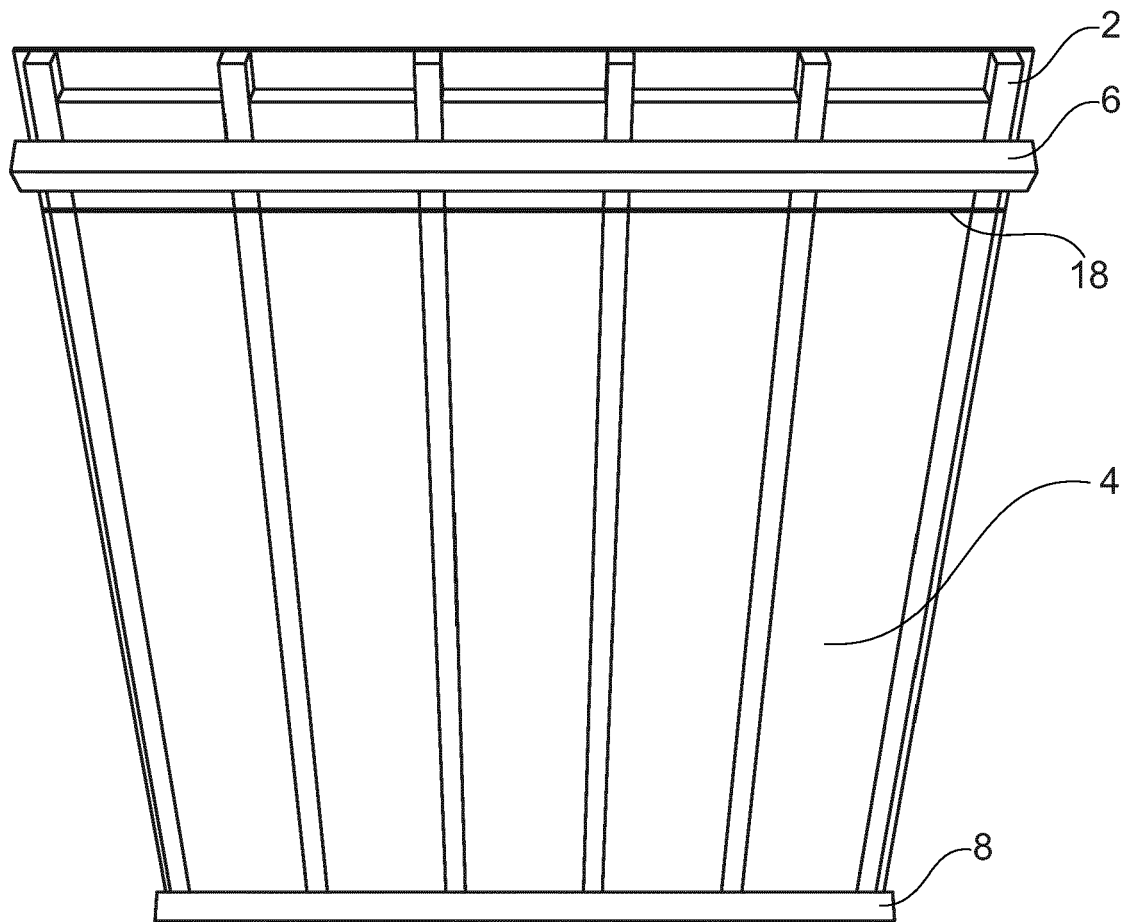


Fig. 33

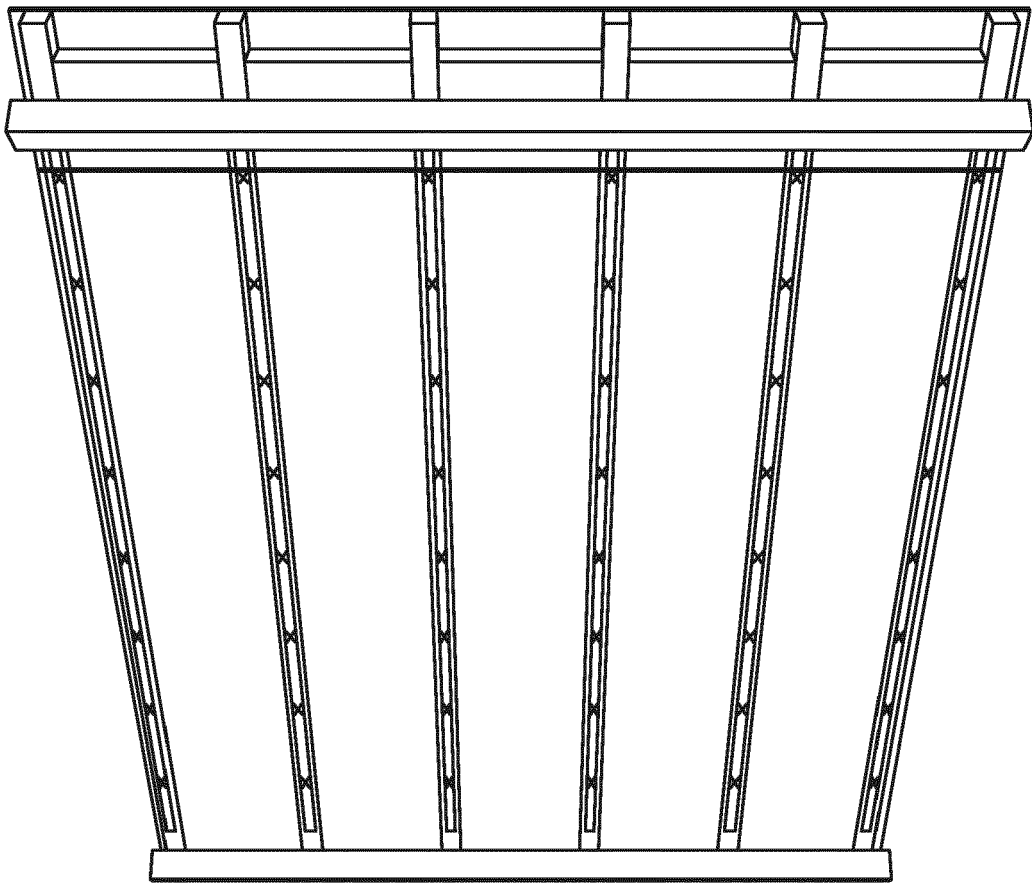


Fig. 34

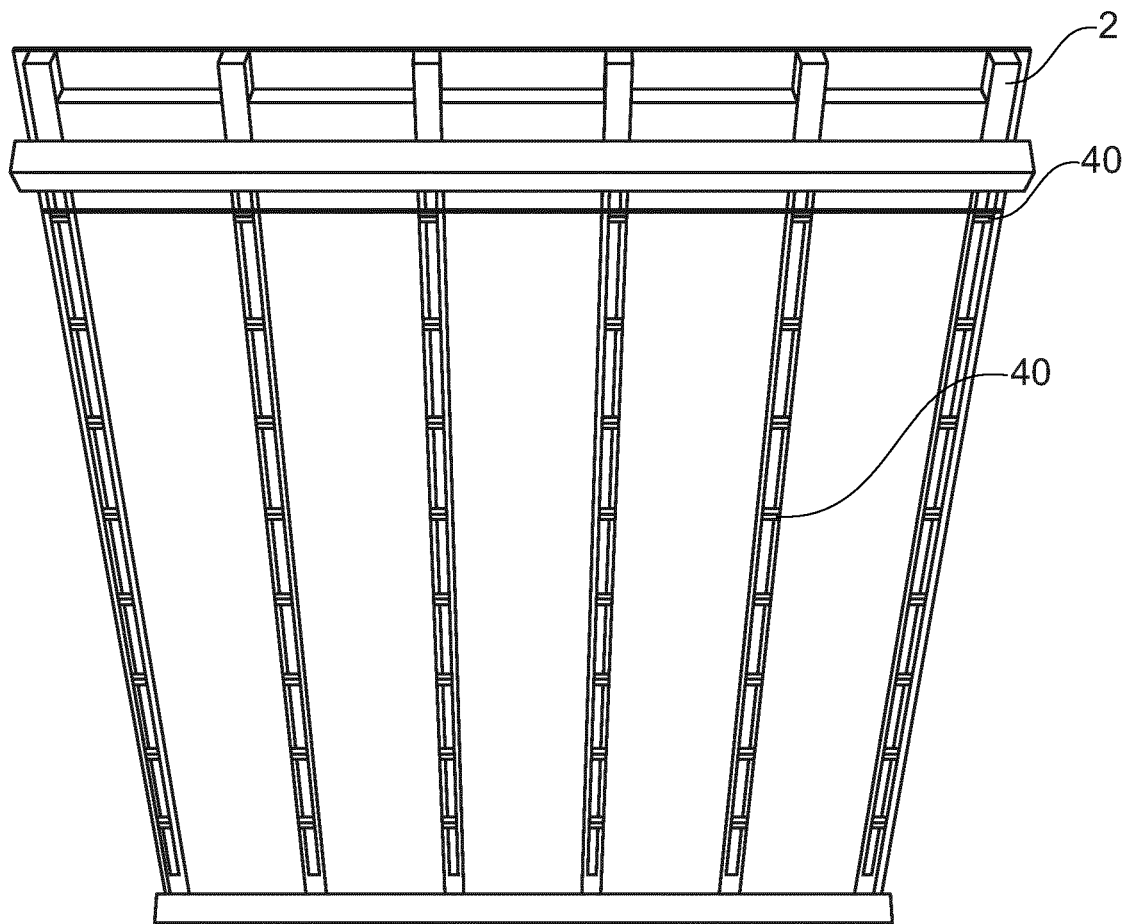


Fig. 35

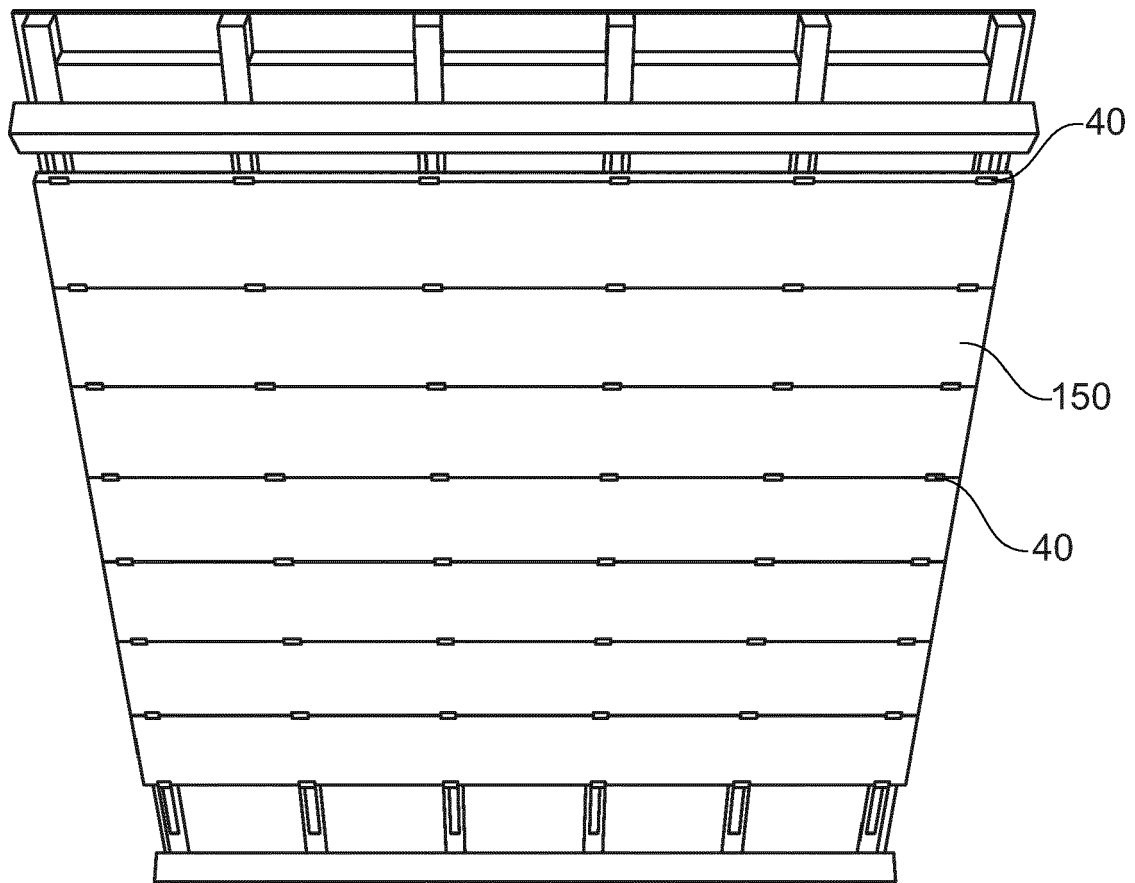


Fig. 36

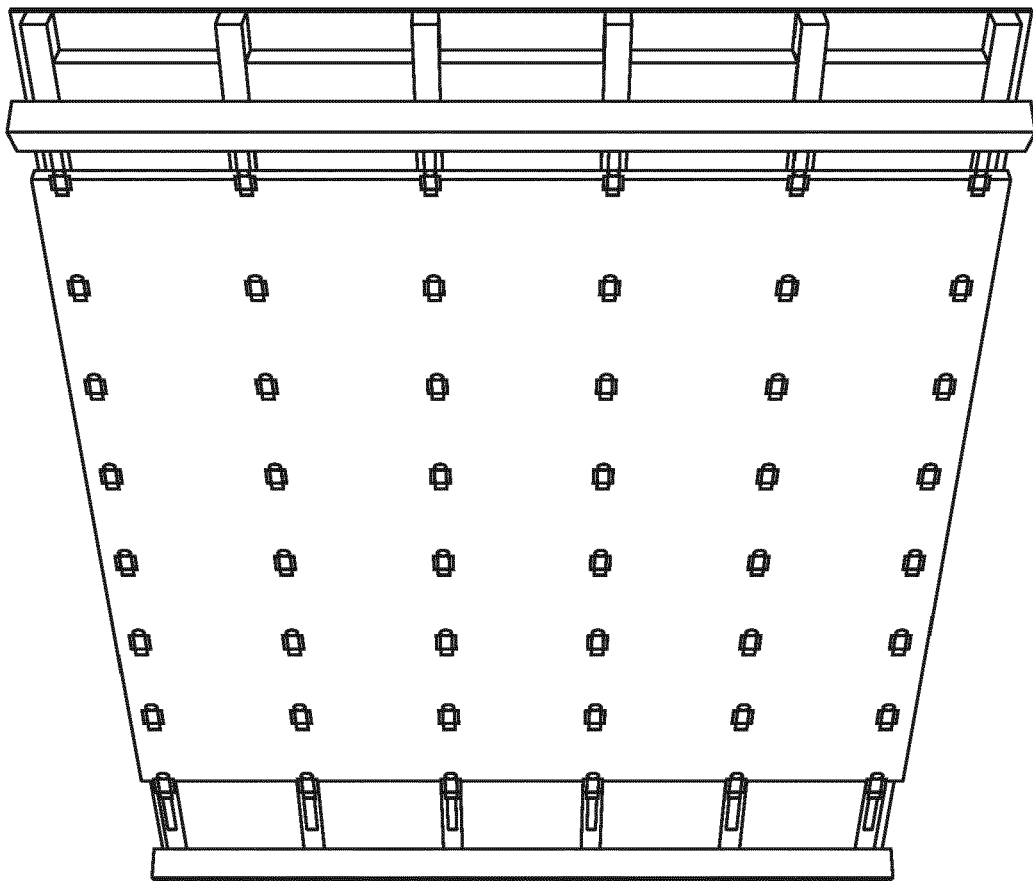


Fig. 37

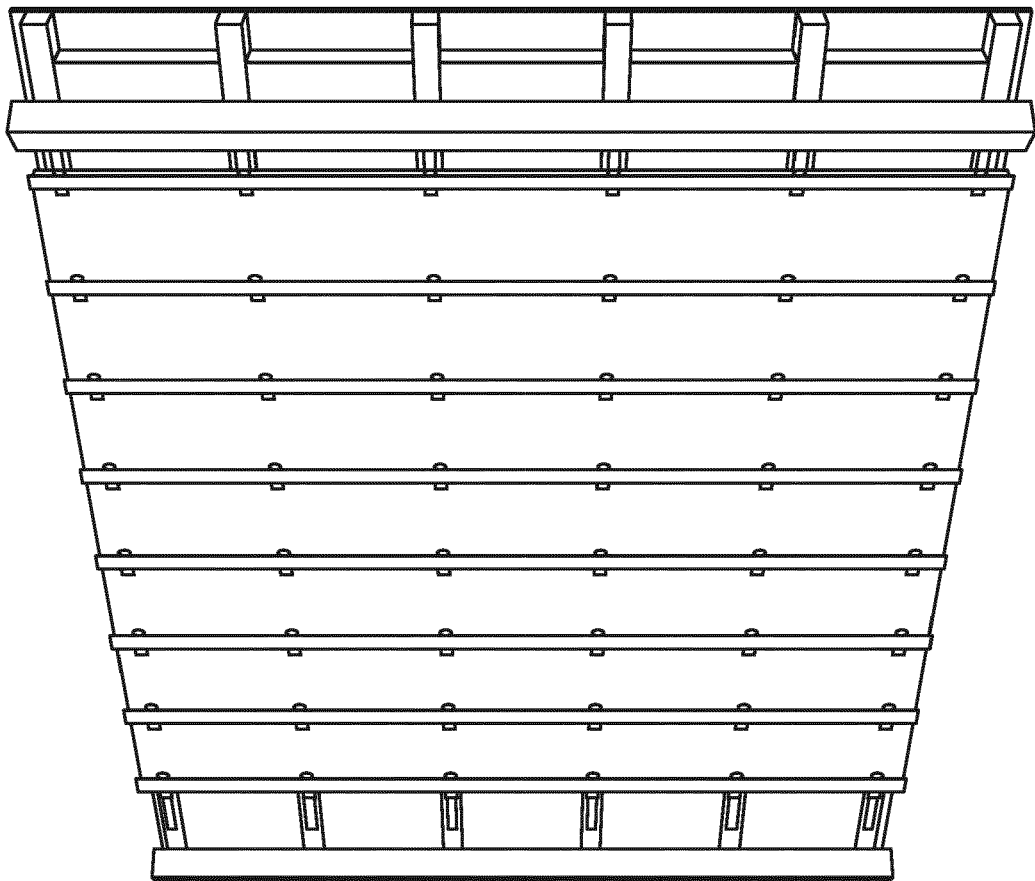


Fig. 38

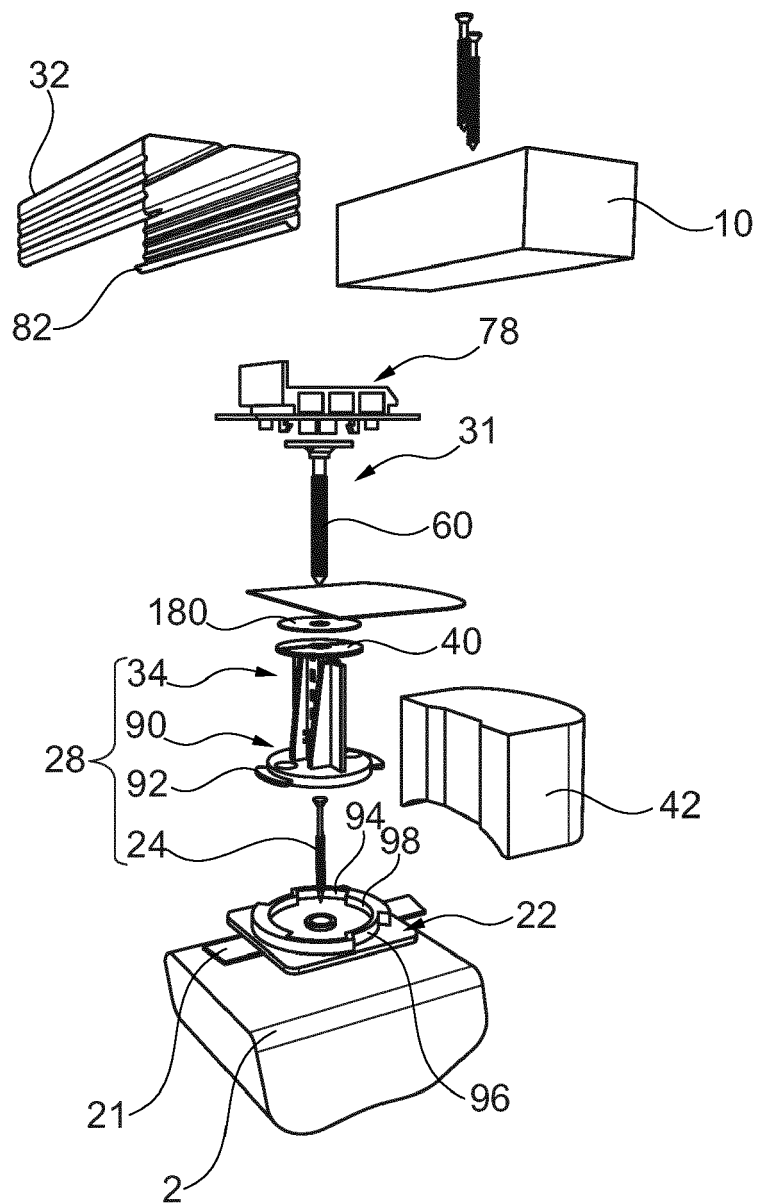


Fig. 39

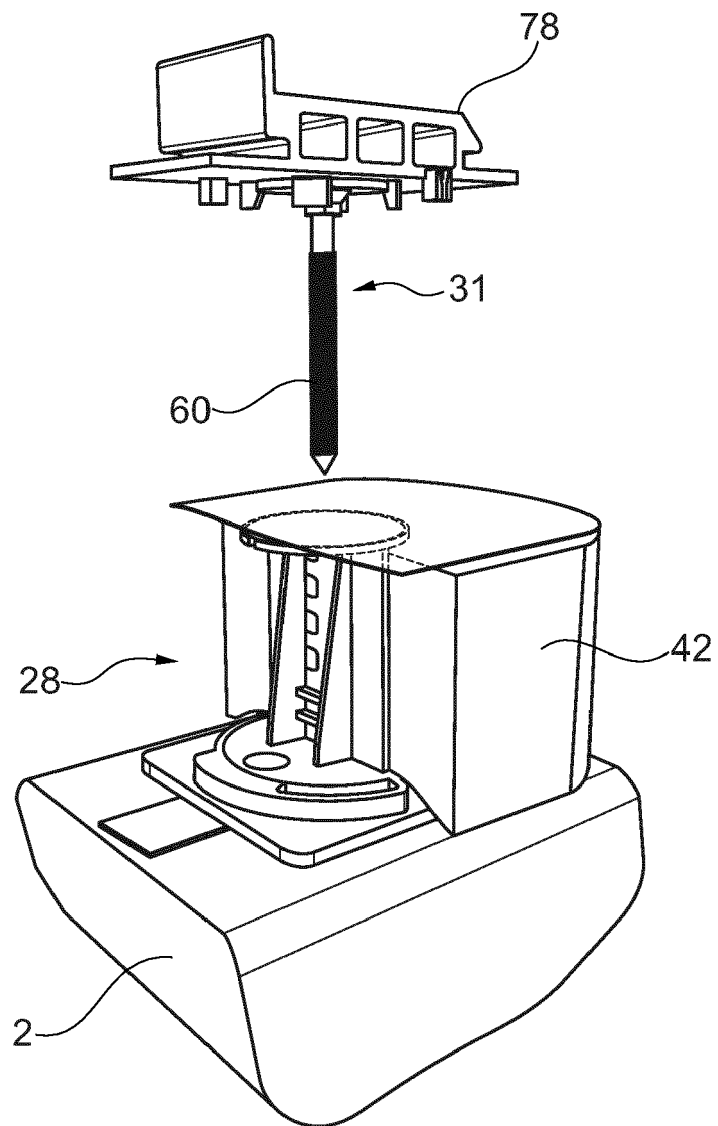


Fig. 40

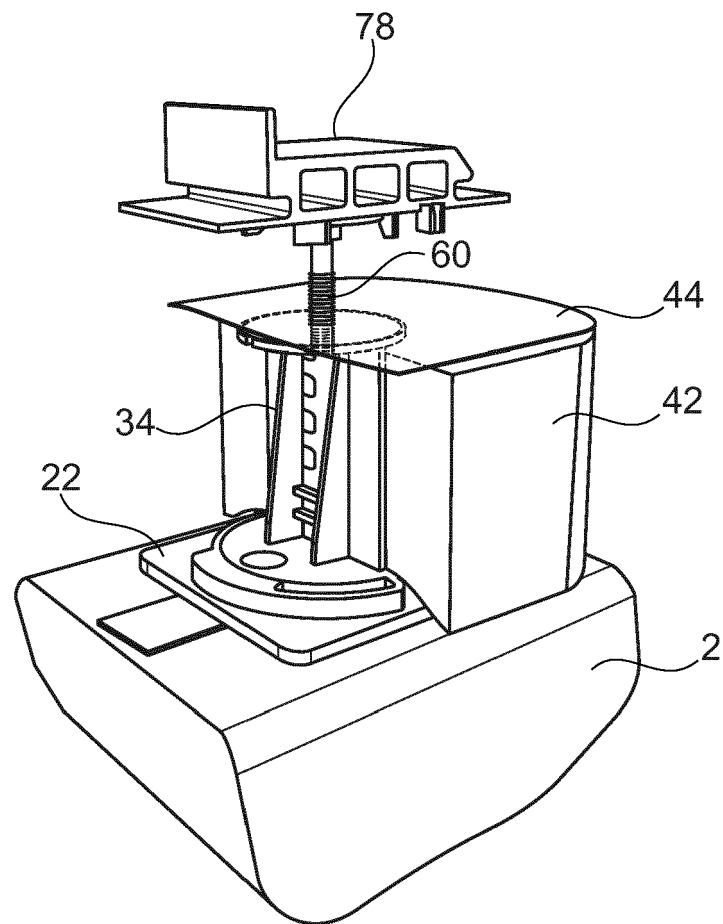


Fig. 41

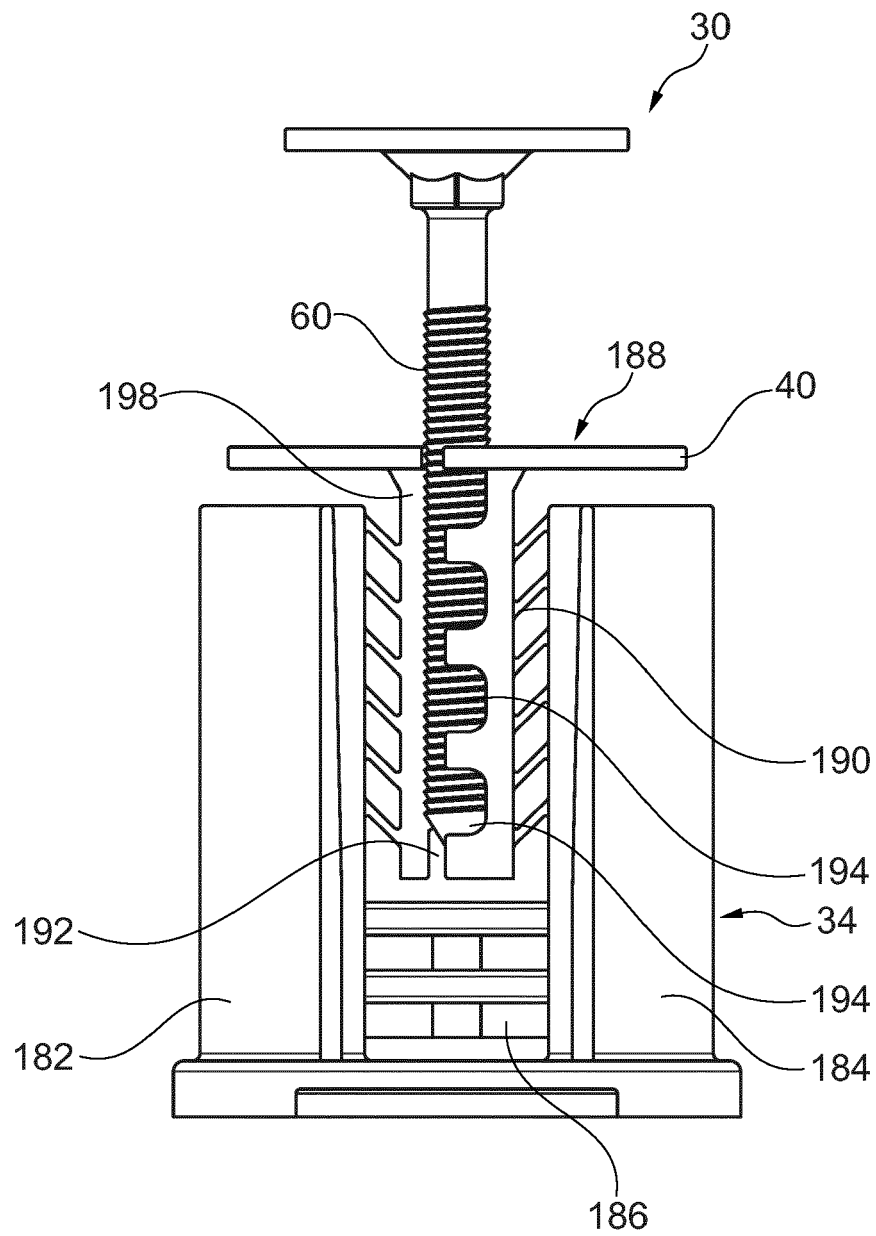


Fig. 42

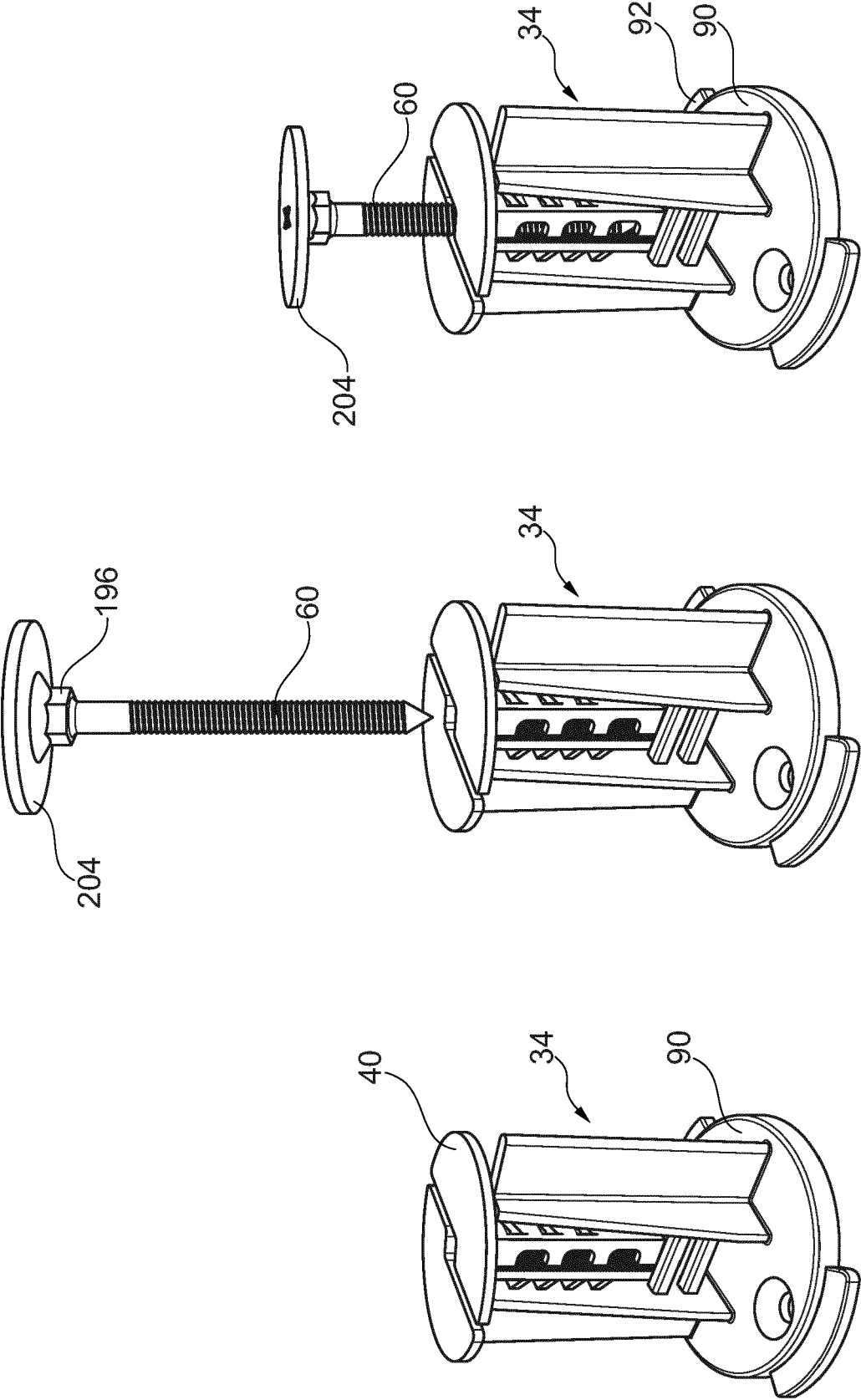


Fig. 43

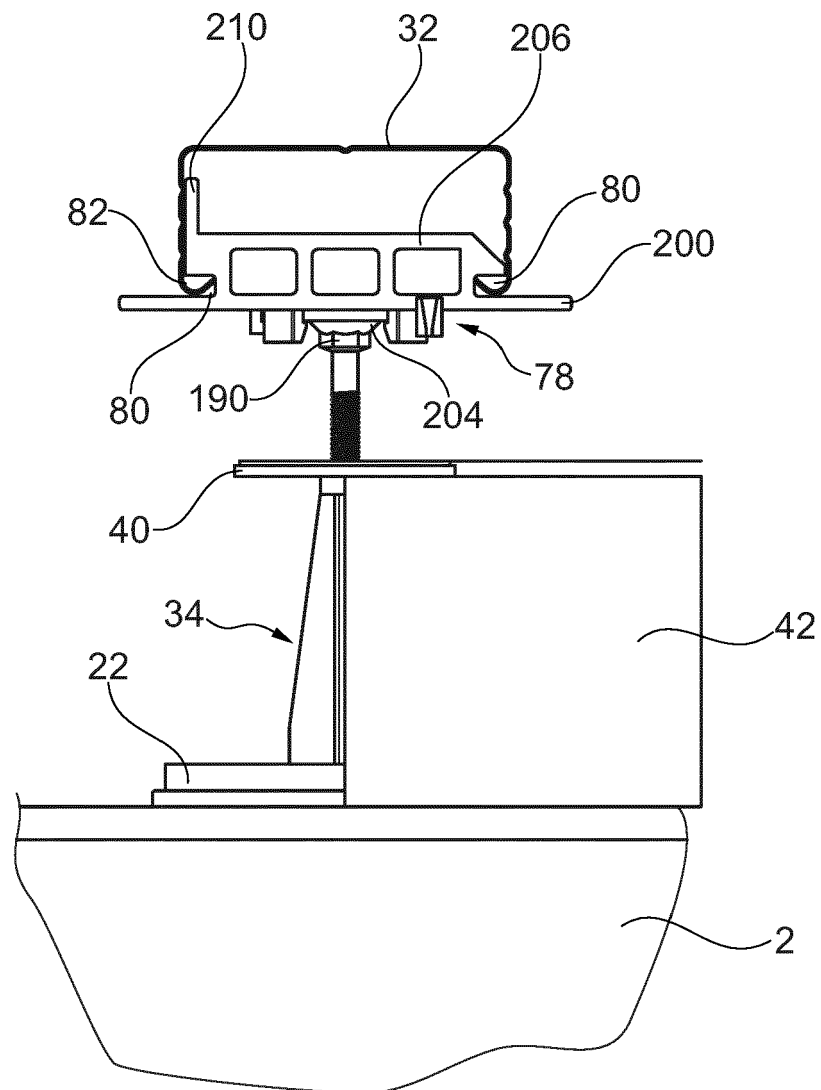


Fig. 44

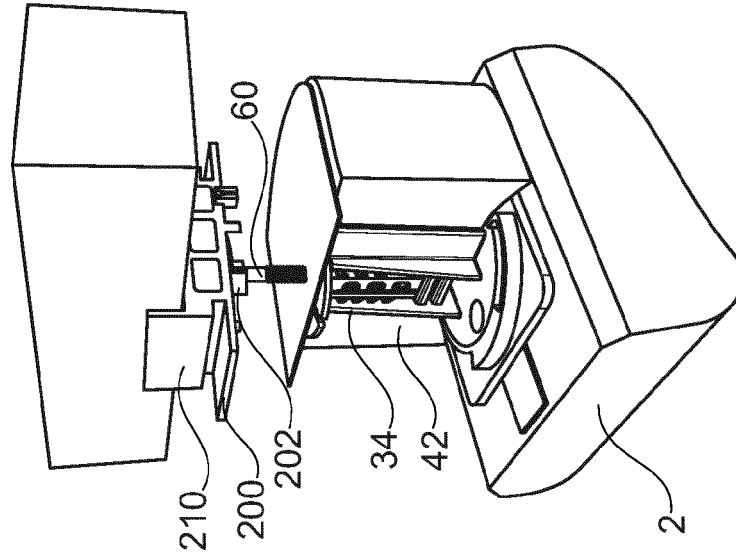


Fig. 47

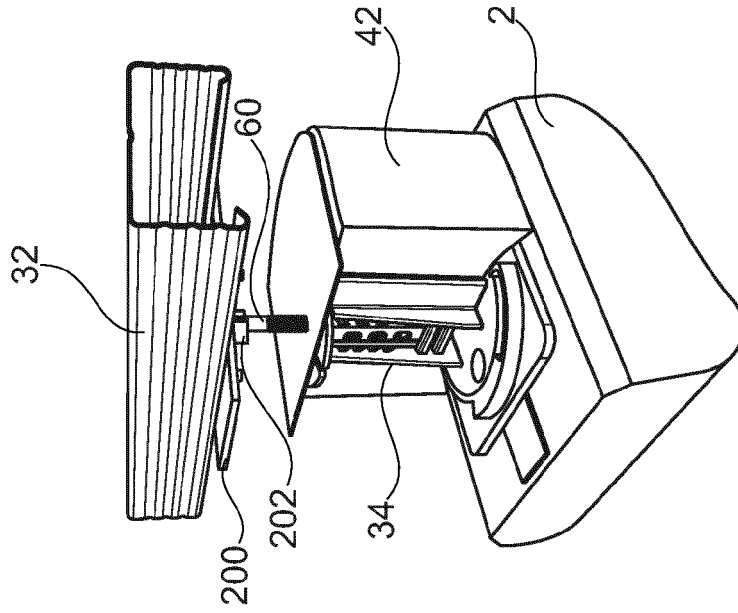


Fig. 46

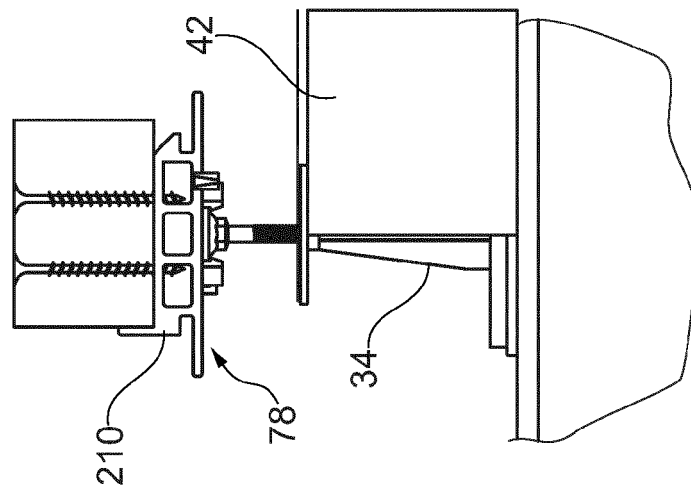


Fig. 45

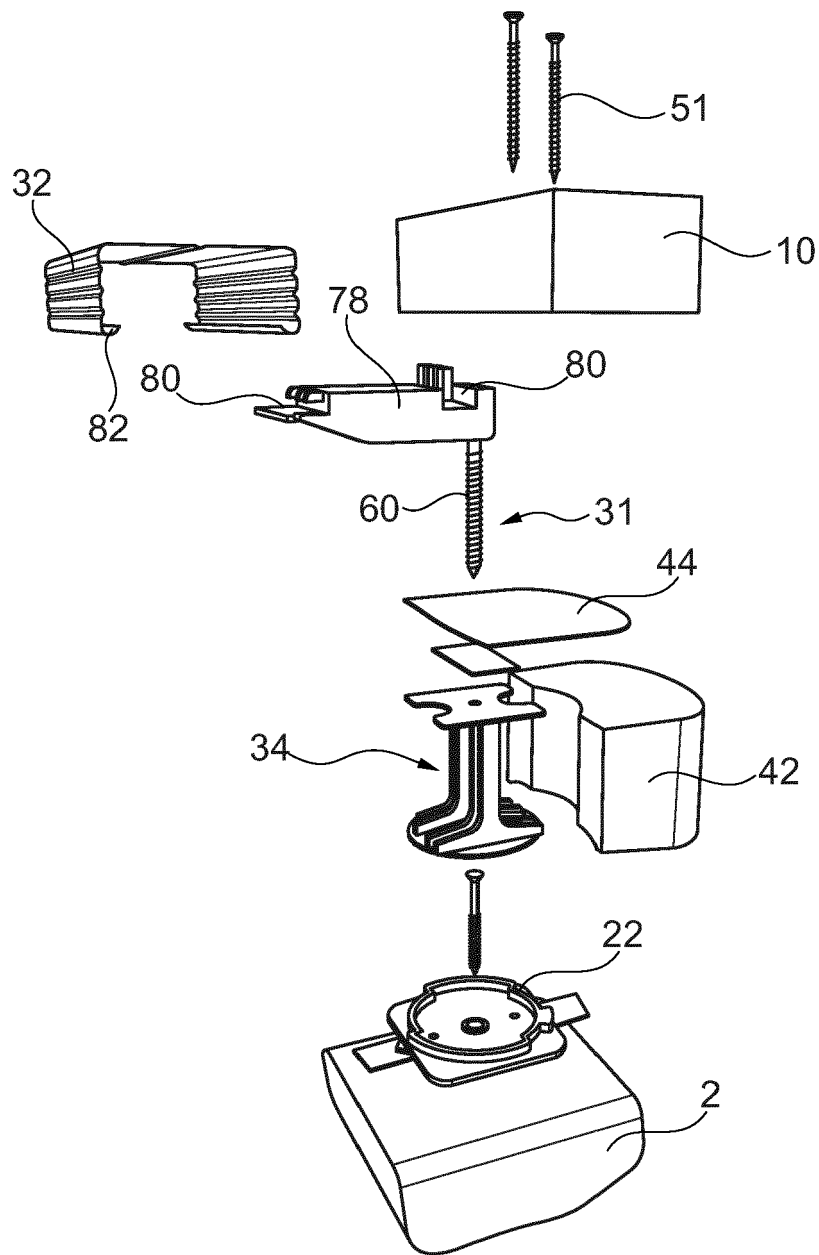


Fig. 48

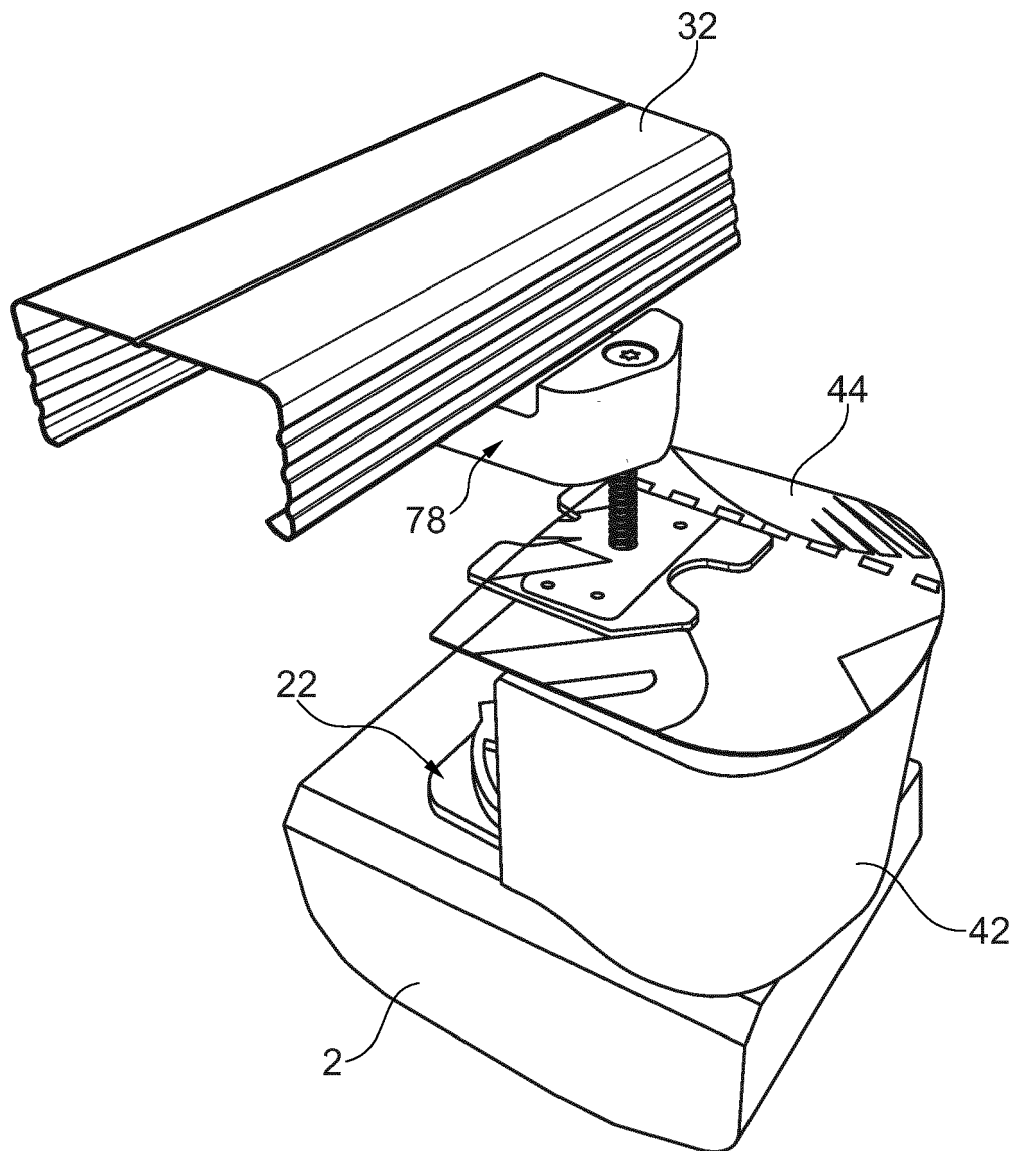


Fig. 49

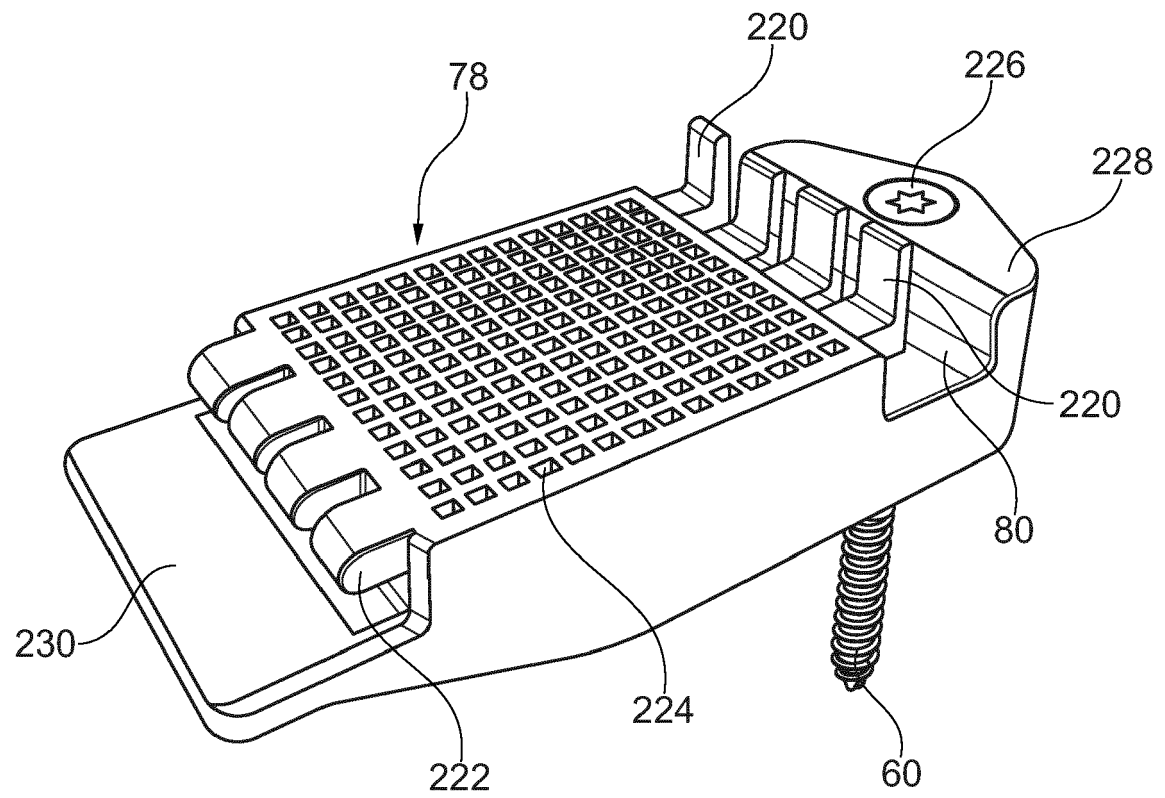


Fig. 50

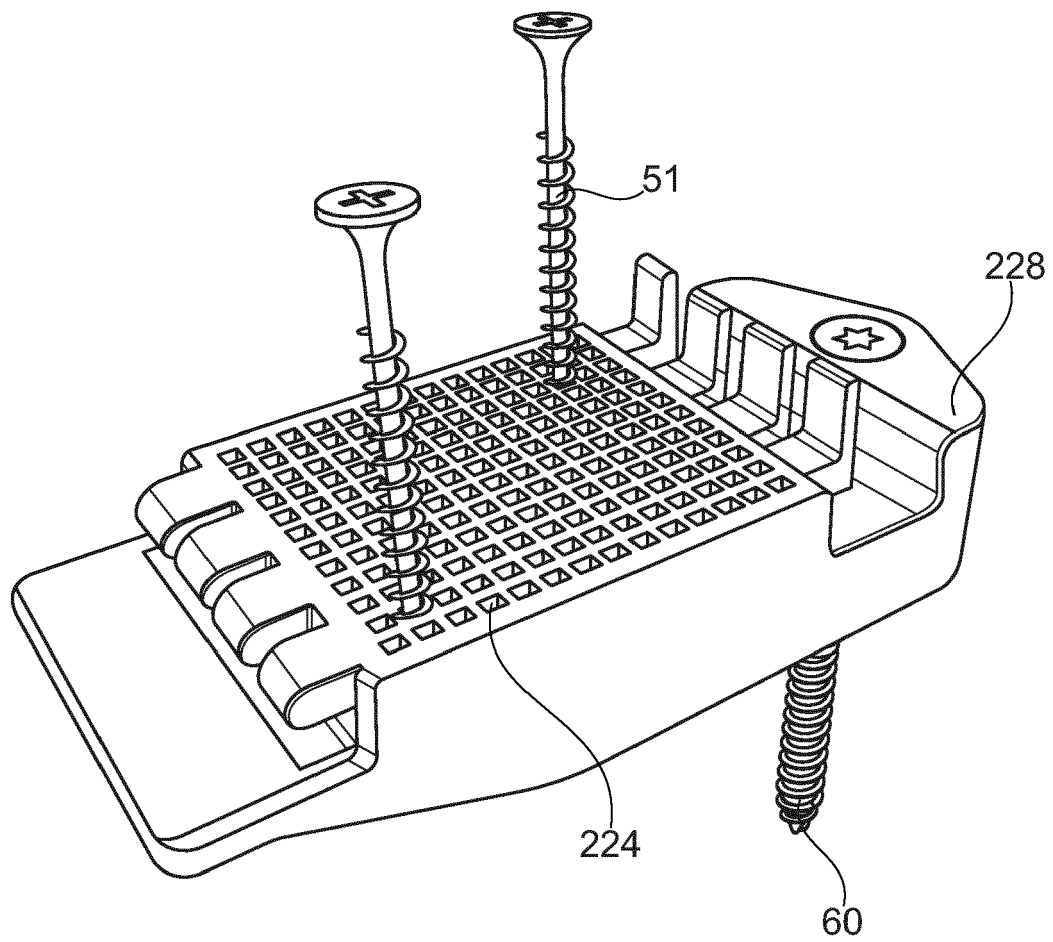


Fig. 51

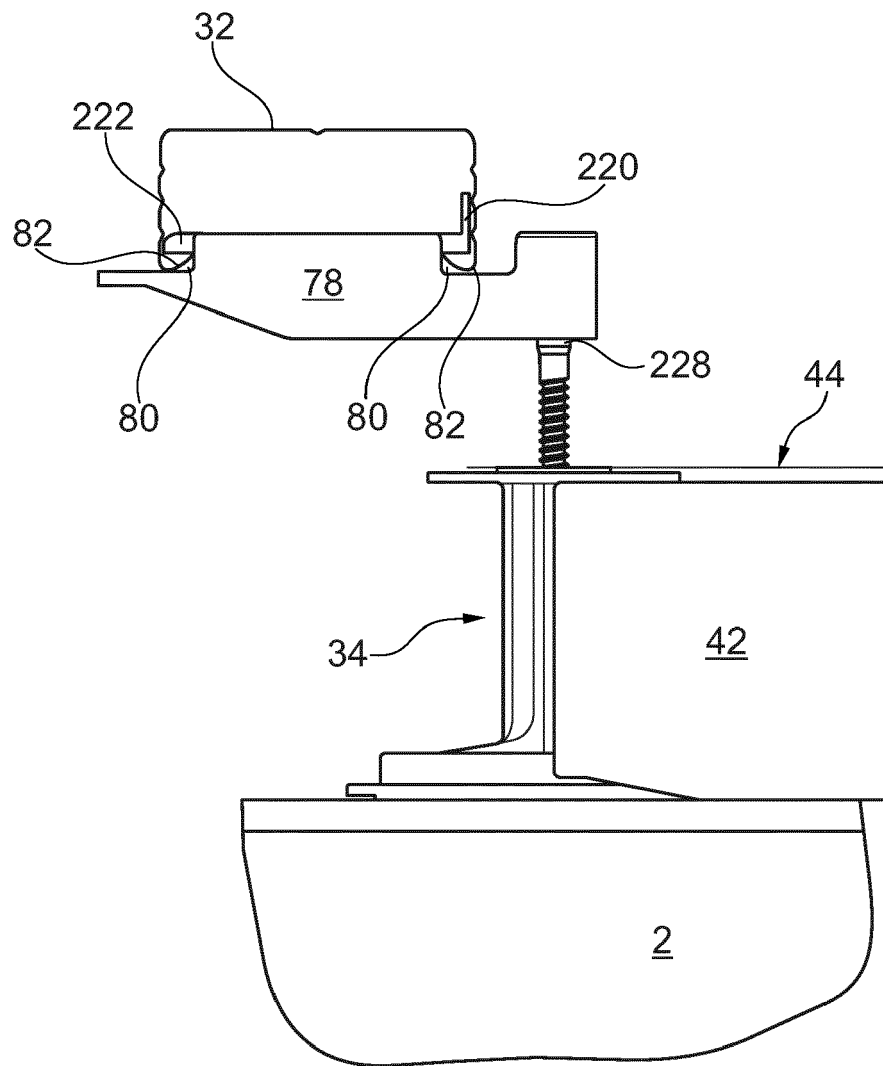


Fig. 52

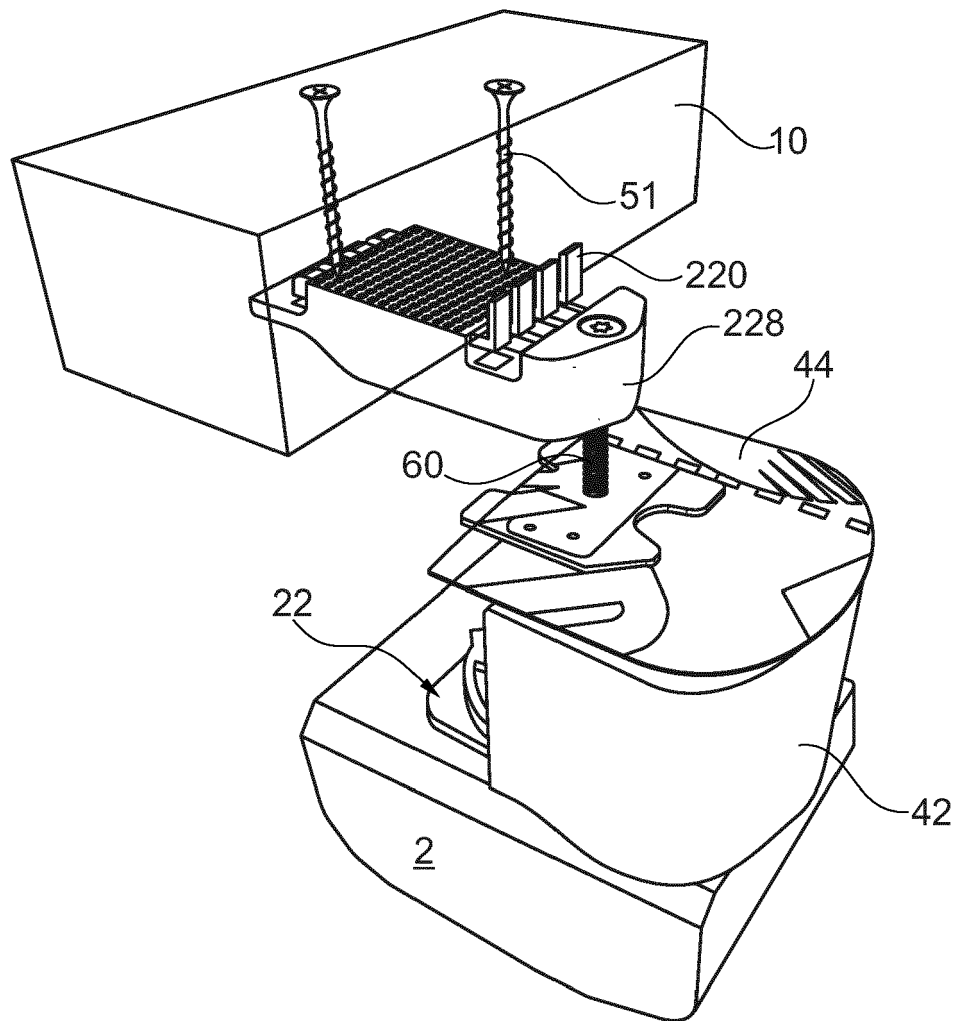


Fig. 53

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- WO 2009103911 A2 [0006]
- WO 2006061538 A1 [0008] [0010]
- EP 2476921 A1 [0010]
- EP 2476922 A1 [0010]