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(71) Applicant: **Knauf Insulation SPRL**
4600 Visé (BE)
(72) Inventor: **Dheur, Etienne**
1435 Mont Saint Guibert (BE)
(74) Representative: **Farmer, Guy Dominic et al**
ARC-IP sprl
Rue Emile Francqui, 4
1435 Mont-Saint-Guibert (BE)

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(54) **INSULATED BUILDING STRUCTURE**

(57) A tilting batten attachment portion of a hanger for an insulated, room side building frame secured to a building structure is used to facilitate alignment and installation of the battens of the building frame.

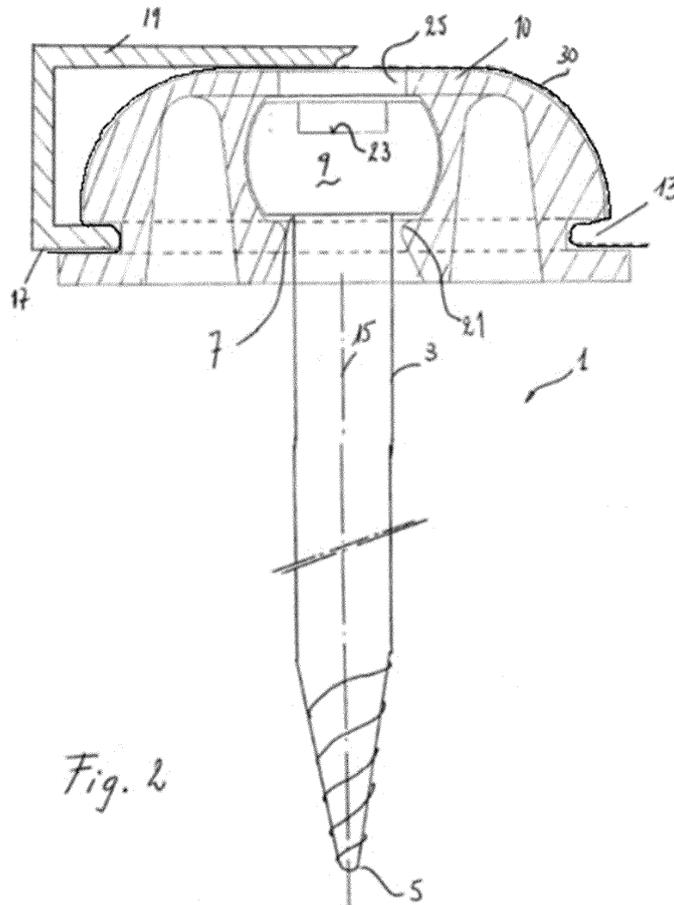


Fig. 2

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Description

[0001] This invention relates to an insulated building structure provided with a room side building frame and to a hanger for such a structure.

[0002] An example of a known hanger system for this type of insulated building structure is disclosed in EP3009582. One aim of the present invention is to provide an insulated building structure having a hanger system which facilitates installation in the real conditions encountered on a building site and/or which is quicker to install.

[0003] In accordance with one of its aspects, the present invention provides an insulated building structure as defined in claim 1. Additional aspects of the invention are defined in other independent claims. The dependent claims define preferred and/or alternative embodiments.

[0004] In some aspects, the invention provides an advantageous system for circumstances in which it is desired to provide thermal and/or acoustic insulation on the room side of a building structure such as a wall, roof or ceiling by using a hanger to retain a plasterboard or wood board surface spaced from the building structure and providing the intervening cavity with thermal insulation.

[0005] In accordance with further aspects, the present invention provides:

- a hanger for supporting a batten to form an insulated room side building frame for a building structure, the hanger comprising a rod provided with a building attachment at one of its ends and a batten attachment at its other end, the building attachment being adapted to be secured to the building structure, the rod being adapted to pass through a layer of room side insulation arranged at the building structure and the batten attachment being adapted to protrude from the room side of the layer of thermal insulation, in which the batten attachment is connected to its rod by a tiltable ball and socket connection;
- an insulated building structure incorporating a plurality of such hangers; and
- a method of providing a building structure with a room side building frame using a plurality of such hangers.

[0006] The building structure may comprise a roof, notably an inclined roof and in particular roof rafters. Alternatively, it may comprise a wall, for example an external wall, or a ceiling. The building structure may be part of a residential house. The insulated building structure may be provided during renovation of an existing building, for example to improve thermal insulation of the building or during replacement of part of the building structure. Alternatively, it may be provided when initially constructing the building.

[0007] The term "room side of the building structure" is used herein to indicate the inside side of the building as opposed to the outside of the building. For example, in the case of the building structure being an inclined roof

structure defining a loft of a building, the room side of the building structure is the loft side of the building structure as opposed to the side which will be outside the finished building.

[0008] The layer of thermal insulation maintained on the room side of the building structure may be mineral wool or rigid foam, for example polyurethane or polystyrene; it is preferably mineral wool insulation. It may have an uncompressed thickness which is $\geq 10\text{cm}$, $\geq 12\text{cm}$ or $\geq 15\text{cm}$ and/or $\leq 40\text{cm}$, $\leq 35\text{cm}$ or $\leq 30\text{cm}$. The length of the hanger, particularly the length of the hanger rod, may be selected according to the thickness of the thermal insulation; hangers of different length may be provided, notably for use with different thicknesses of thermal insulation. The thermal insulation may comprise glass mineral wool, notably having a density which is $\geq 10\text{ kg/m}^3$ or $\geq 15\text{ kg/m}^3$ and/or which is $\leq 50\text{ kg/m}^3$ or $\leq 45\text{ kg/m}^3$. It may comprise rock mineral wool, notably having a density which is $\geq 25\text{ kg/m}^3$ or $\geq 30\text{ kg/m}^3$ and/or which is $\leq 180\text{ kg/m}^3$ or $\leq 150\text{ kg/m}^3$. The layer of thermal insulation may have a thermal conductivity λ which is less than 40 mW/m.K and/or which is at least 20 mW/m.K . In some preferred embodiment, additional thermal insulation and/or layers of thermal insulation is provided, for example an addition layer of thermal insulation, notably mineral wool, provided between rafters of a building structure.

[0009] The hanger comprises a rod having a building attachment at one of its end and a batten attachment at its other end. The rod is preferably substantially straight and made to be substantially non-deformable under the loads it is intended to support. It may comprise a metal rod, notably a steel rod; it may be circular in cross and may have a diameter which is $\geq 5\text{mm}$ and/or $\leq 15\text{mm}$. The building attachment of the hanger which is intended to be secured to the building structure may be a continuation of the rod. It is preferably secured directly to the building structure, for example by being embedded in the building structure without any additional fixing. For example, where the building structure comprises a wooden frame or a wall, for example a brick or concrete wall, the building attachment may be configured to be embedded directly in the frame or wall. The building attachment may comprise a threaded portion adapted to be screwed directly in to the building structure, notably a self-tapping threaded section which does not require pre-drilling of the building structure. Such a threaded portion is preferably configured to avoid or minimise snagging when it passes through the desired insulation material. For example, when the threaded portion is adapted to pass through mineral wool, it is preferable that the thread is smooth to avoid snagging. The threaded portion may comprise a knurled shoulder adapted to provide a bore in the building support adapted to the diameter of the hanger rod; this ensures a desired fit, for example a slight compression fit, between the bore and the rod and may be used to improve stability of the hanger at the building support. The batten attachment is adapted to have a bat-

ten secured to it so that the hanger supports the batten and secures the batten at the building structure spaced from the building structure by the hanger rod. The batten attachment may comprise a plastics material; it may be injection moulded. The hanger may comprise a thermal break to avoid or reduce the hanger providing a thermal bridge; a plastics batten attachment may provide an advantageous thermal break in the hanger, particularly when the rod is metal.

[0010] The batten may be a metal batten, notably a steel or galvanised steel batten; it may comprise a planar batten face against which a sheet building material may be arranged and webs which project from opposite edges of its face to form a substantially U shaped cross section. Each web may further comprise an arm projecting inwards. In some preferred embodiments, the batten is a furring, for example a furring adapted to have sheet building material secured to it by screws. For example, the furring may be a F45, F47 or F60 type furring.

[0011] Preferably, the batten attachment is configured to facilitate attachment and securing of the intended batten. For example, where the batten is a furring having a generally U shaped section with additional inwardly projecting arms, the batten attachment may comprise a furring groove, notably an annular furring groove, adapted to receive and retain the inwardly projecting arms of the furring, for example in a sprung fit and/or clip fit arrangement. Such annular furring grooves may be intended to be arranged in a plane which is parallel to the planar face of the furring.

[0012] The tilting connection between the batten attachment and its rod may be used to compensate for any imperfect alignment of the rod. Ideally, the batten attachments of each hanger arranged at a building structure should be coplanar. In practice, due to tolerances in the positioning of individual hangers and imperfections in the building structure itself which is rarely perfectly regular or perfectly planar, even when taking considerably care and time it is not easy to arrange each hanger to project at exactly the perfect angle from the building structure to achieve this. As used herein, the term imperfect alignment of the rod of the hanger means an alignment which is different from its nominal desired alignment or its nominal desired alignment with respect to the building structure, notably:

- an alignment of the rod at an angle which is $\geq 1^\circ$, or $\geq 3^\circ$, or $\geq 5^\circ$, or $\geq 10^\circ$ and/or $\leq 30^\circ$, or $\leq 25^\circ$, or $\leq 20^\circ$; or $\leq 15^\circ$ and/or
- an alignment which would result in an otherwise undesired displacement of the building attachment with respect to the attachment portion which is $\geq 2\text{mm}$, or $\geq 5\text{mm}$ and/or $\leq 10\text{mm}$.

As used herein, the tilting of the batten attachment in at least two directions with respect to its rod means that the batten attachment can tilt in at least:

- a first plane comprising the axis of the rod; and
- a second plane comprising the axis of the rod (the second plane being non co-planar with the first plane).

Thus tilting by a negative angle in a plane and tilting by a positive angle in the same plane are considered to be tilting in a single direction.

Preferably, the batten attachment can tilt in all directions with respect to its rod, that is to say in all planes comprising the axis of the rod, for example by means of a ball and socket connection. The amount by which the batten attachment may tilt in one or more of its tiltable directions with respect to an un-tilted or neutral position may be $\geq 5^\circ$, $\geq 10^\circ$ or $\geq 15^\circ$ and/or $\leq 30^\circ$ or $\leq 25^\circ$ or $\leq 20^\circ$; the batten attachment is preferably tiltable to such a degree in all of its tiltable directions. A tilt stop adapted to limit the amount of possible tilt may be provided, for example as part of the batten attachment and/or as part of the rod.

[0013] The hanger is preferable configured to support a weight of at least 50kg, preferably at least 70kg, more preferably at least 90kg. It may be configured such that it is not rated to carry a weight of greater than 200 kg.

[0014] The building sheet material adapted to be secured to the battens may comprise wall boards, ceiling boards, sheets of plaster board or wooden sheet material, for example sheets of chip board, fibre board, plywood or orientated strand board.

[0015] The vapour barrier membrane is preferably secured to the hangers without being pierced, for example by being clipped to the hangers, notably by being clamped against the head of the hangers by a batten which is secured to the hanger. The vapour barrier may be a plastics membrane notably comprising a sheet of polyethylene (PE), polyethylene terephthalate (PET), polypropylene (PP), polyester or combination thereof; it may comprise a metallised plastics sheet; for example having an aluminium coating. It may comprise a reinforcing scrim, grid of spunbound fabric, for example a glass fibre mesh. The membrane may have:

- a thickness of which is $\geq 80\mu\text{m}$ or $\geq 90\mu\text{m}$ and/or $\leq 200\mu\text{m}$; and/or
- water vapour diffusion of (Sd) of at least 2m, at least 10m or at least 20m and/or less than 120m, as determined by European standard EN1931.

[0016] The attachment between the rod and the batten attachment of the hanger is preferably positioned at or close to the batten attachment, for example at a distance which is $\leq 30\text{mm}$, notably $\leq 20\text{mm}$ or $\leq 10\text{mm}$ from the batten attachment. Tilting of the batten attachment preferably does not affect the orientation of the portion of the hanger between the building structure and attachment between the rod and the batten attachment. Preferably the attachment between the rod and the batten attachment is positioned at or close to the room side surface of the thermal insulation; in such a configuration, tilting

of the attachment portion causes little or no displacement of the rod with respect to the thermal insulation.

[0017] In one embodiment, attachment between the rod and the batten attachment of the hanger is provided by a ball and socket connection. The ball and socket may have interacting convex and concave contact surfaces which may be spherical or part spherical. In an alternative embodiment, attachment between the rod and the batten attachment is provided by a deformable connection; tilting of the deformable connection may comprise elastic deformation or plastic deformation. The connection may comprise a resilient connector, for example a spring; it may comprise an elastomer, for example of rubber or of elastomeric material.

[0018] Preferably, the rod is provided with a connector adapted to be used to rotate the rod about its axis, notably using a screwdriver or electric screwdriver, to secure the rod to the building structure. The connector is preferably accessible when the batten attachment is assembled with the rod. This allows attachment of the rod to the building structure when the batten attachment and the rod are already assembled together.

[0019] In accordance with one of its aspects, the insulated building structure comprises, notably in the following order, from the outside side of the building to the room side of the building structure:

- an external roofing material, for example comprising tiles, external roof boards or shingle;
- a roofing membrane, for example a wind and/or rain barrier sheet;
- optionally an external layer of insulating material;
- a roof structure which supports the external roofing material, for example rafters;
- optionally, a first layer of insulating material provided between portions of the roof structure, for example between rafters;
- room side insulation provided at the room side surface of the roof structure;
- a plurality of hangers passing through the room side insulation and secured to the roof structure, each hanger comprising a rod provided with a building attachment at one of its ends which is secured to the roof structure and, at its other end, a batten attachment which protrudes from the room side of the room side insulation, the batten attachment being connected to its rod by a tiltable connection;
- a vapour barrier membrane;
- a plurality of battens secured to the batten attachments of the hangers; and
- a building sheet material secured to the battens.

[0020] Embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawing of which:

Fig 1 is a perspective view of a prior art building structure provided with a room side building frame;

Fig 2 is a schematic cross section of a hanger;

Fig 3 and Fig 4 are schematic cross sections of alternative embodiments of hangers;

Fig 5 is a schematic cross section of three aligned hangers;

Fig 6 to Fig 12 show steps in the installation of a room side building frame.

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[0021] Fig 1 shows a prior art arrangement of a building structure, in this case spaced, inclined rafters 1001 of an inclined roof of a loft of a residential house. The room side of the structure is finished with sheets of plasterboard 1002 which are screwed to a room side building frame provided by a series of parallel, steel furring battens 1003. The structure is constructed by sequentially:

- attaching a plurality of hangers 1004 at pre-determined positions to each rafter so that these extend from the rafters towards the room side of the building;
- installing compression fit mineral wool insulation 1005 between rafter from the room side of the building;
- installing a further layer of mineral wool insulation 1006 on the room side of the rafters 1001 by pushing it on to the previously installed hangers 1004 so that the hangers pierce and pass through the mineral wool 1006;
- installing a vapour barrier membrane 1007 on the room side of the mineral wool insulation 1006;
- clipping the furring battens 1003 in to batten attachment portions of the hangers 1004; and
- attaching the plasterboards sheets 1002 to the room side building frame provided by the furring battens 1003, generally using self-tapping screws.

Even when significant care and time is taken, ensuring an exactly 90° orientation of each hanger with respect to its rafter is not always possible. Any misalignment of hangers makes it subsequently more difficult both to install the insulation layer 1006, particularly when relatively thick or relatively rigid insulation is used, and subsequently attach the furrings 1003 in their desired positions. Furthermore, prior to completing the system and at stages where exposed hangers project downwards from the rafters, care must be taken to avoid injury from the exposed and sometimes sharp ends of the hangers. These problems are exacerbated by the often cramped conditions in which the work is carried out. The second layer of mineral wool insulation 1006 is installed in a vertical direction from the ground to the roof of the loft; this often results in significant off-cuts having dimensions which prevent their use in the system. Furthermore, any slight misalignment of a hanger has a tendency to causes misplacement of the mineral wool layer 1006 as the mineral wool is pushed on to the hanger; this tends to create gaps in the mineral layer, for example between purlins and the mineral wool layer, which create thermal leaks.

[0022] The present invention provides an improved ar-

rangement for providing such room side building frames.

[0023] The hanger 1 shown in Fig 2 comprises a rigid metal rod 3 having a screw threaded building attachment 5 at one end and a batten attachment comprising a head 10 at its other end. The screw threaded building attachment 5 is configured to allow it to be screwed through a layer of mineral wool thermal insulation without snagging directly into the building structure, notably in to a wooden rafter or beam. The head 10 of the batten attachment comprises an injection moulded plastics material; it is secured to the rod 3 by a ball and socket joint, the ball 9 being integral with and provided at one end rod 3 and the socket being provided as part of the head 10. An opening 25 in the head 10 allows access to a torx cross-headed connector 23 to rotate the rod about its axis, notably using an electric screwdriver, to screw the threaded attachment end 5 of the rod into the building structure. The head 10 also comprises an annular furring groove 13 in which the arms 17 of a furring batten 19 are receivable, to secure the furring 19 to the head 10 of the hanger 1, notably as a spring fit. Only a portion of the furring 19 is illustrated in Fig 2. Prior to attaching the furring 19 to the head 10, a vapour impermeable membrane 13 is generally arranged over the head 10 so that this is subsequently held in place against the head 10 by the furring 19.

[0024] The ball and socket attachment between the head 10 and the rod 3 of the hanger 1 allows the head to tilt in any direction with respect to the axis 15 of the hanger 1. This tilting of the batten attachment 10 of one of a series of hangers allows for compensation of any imperfect alignment of an individual hanger rod, for example due to the rod being screwed in to the building structure such its axis 15 is not perpendicular to the building structure or to the desired plane of the room side building frame to be formed by the battens 19. A protrusion 21 of the head 10 interacts with ball 9 to limit the permissible tilt of the head 10.

[0025] In the embodiment of Fig 3, a ball and socket connection between the head 10 and the rod 3 of the hanger is configured with a ball portion 123 provided as part of the head 10 and a plastics socket portion 109 secured to the rod 3, in this example being secure as a snap fit on the rod around a retaining ring 112. Interaction between a stop portion 121 of the socket portion 109 and the head 10 limits the amount of possible tilt of the head 10 with respect to the rod 3. A cross-headed connector (not shown) at the socket end of the rod 3 is accessible prior to attachment of the head 10 to screw the rod into the building structure.

[0026] In the embodiment of Fig 4, the head 10 is attached to the rod 3 through a deformable connector 220 which allows the head 10 to tilt with respect to the axis 15 of the rod 3. The deformable connector 220 in this example is a resilient connector provided by a spring.

[0027] The tilting of the batten attachment head 10 of one or more hangers 1 facilitates correct alignment and positioning of a furring. Possible misalignment of, notably, the angle of the rod of an individual hanger, for ex-

ample if the rod is not perfectly perpendicular with respect to its rafter, is compensated for by tilting of the hanger head 10 so that the furring grooves of an imperfectly angled hanger rod are aligned to be coplanar with those of the hangers in its row when its furring is attached. This increases the acceptable degree of tolerance when installing each hanger and thus facilitates construction of the system. This is illustrated in Fig 5 which shows three spaced hangers each secured to spaced rafters (the spacing is not shown to scale). The rod 3 of the middle hanger is imperfectly aligned as it is not perfectly perpendicular with respect to the rafter (the axis is not parallel with respect of the left and right hangers). The tilting of the batten attachment head 10 of the middle hanger compensates misalignment of the angle of the rod and allows correct alignment and positioning of a batten.

[0028] The sequential installation from Fig 6 to Fig 12 will now be described.

[0029] Fig 6 shows insulation material provided by batts of glass mineral wool 50 vertically assembled as a compression press fit between rafters 51 at the inside of an inclined roof. The rafters 41 provide a building structure to which a room side building frame will be attached. Fig 7 shows a laser source 52, for example attached to a tripod or to the building structure, arranged to project a horizontal laser beam indicating the desired position of the later installed batten attachment head of each hanger 1 of a horizontally extending row of hangers. The laser is also used to indicate the positions at which spaced markings 53 are provided on the two opposed lateral walls at the predetermined position and distance from the rafters 51. Alternatively, the position of the desired markings may determine by measuring from the building structure using a ruler.

[0030] Fig 8 shows the positioning of the first of a plurality of glass mineral wool batts or rolls which together form a layer of thermal insulation 60 positioned against the rafters 51 on the room side of the rafters. This can be considered as a second layer of thermal insulation which is installed, working horizontally in the Fig 8 example, over the first series of insulation batts 50. This second thermal insulation layer is installed starting from the bottom end of the inclined roof and working progressively towards the top end of inclined roof, each subsequent insulation batt being positioned against the rafters above the previously installed batt. Horizontal installation of the thermal insulation layer reduces the amount of non-useable offcuts. During installation, the batts of the second layer are held in place by retaining straps (61, 61', 61", 61''') which are stapled to the underlying rafter 51 and aligned with the left edge of the rafter 51. For example, prior to placing the insulation batt against the rafter 51, a retaining strap is stapled to a rafter at a position corresponding to the lower edge of the insulation batt; the lower edge of the insulation batt is then positioned so that it lies against the rafters; the retaining strap is then passed over the front surface of the insulating batt and used to help push the insulating batt into position against the raft-

ers; the retaining strap is held tight so that it partially compresses the insulation batt and is then stapled to the rafter 21 at a position corresponding to the top edge of the insulation batt. This retains the insulation batt in position against the rafters 51 with the insulation batt being slightly compressed by the strap which creates a convex curvature at the front, room side surface of the insulation batt. Alternatively, if the top or bottom edge of the insulation batt is adjacent to a purlin 62, 62', 62", the retaining strap may be fixed at the purlin, as illustrated in Fig 9. One retaining strap is used per rafter and the position of the retaining strap provides an indication of the position of the rafter underneath, in this example the left edge of the strap indicating the position of the left edge of the rafter. The straps temporarily hold the batts in place without their room side surfaces bulging below their desired position; this facilitates subsequent operations; notably, it allows subsequent positioning of the laser beam close to the room side surface of the batts without bulging of a batt cutting the laser beam. Use of the straps may not be required with all type of insulating materials; for example, some press-fit rock mineral wool slabs are sufficiently stiff to remain in place without the need for straps.

[0031] Fig 10 shows the completed layer of insulation material covering the underlying rafters and held in place by a series of straps. The compression of the insulation material is not illustrated.

[0032] As shown in Fig 11, a plurality of spaced hangers 1 are screwed into the rafters through the layers of thermal insulation 60 from the room side of the building structure. To facilitate this, the laser source 52 is again positioned so that the horizontal laser beam is aligned with the pre-set markings 53 and thus indicates the desired position of the batten attachment head of each hanger 1 of a horizontally extending row of hangers. The first hanger of a horizontal row of hangers is secured to a rafter of the building structure by being screwed through the layer of thermal insulation from inside the loft into an underlying rafter. The desired position is the intersection between i) the laser beam and ii) the position of the underlying rafter which is indicated by the strap. The hanger 1 is screwed into the underlying rafter to a depth at which the laser beam intersects a depth indicator, for example a depth indicator provided on the electric screw driver being used. When screwing the hanger into the underlying rafter, the laser beam intersects with the hanger, thus providing a visual indication that the hanger is suitably positioned. The remaining hangers of the row are then attached in a similar way. The laser beam is then repositioned to indicate the desired position of the next horizontally extending row of hangers, and so on.

[0033] The use of the laser beam to indicate the desired position of each hanger head 10 along the horizontal row of hangers and the desired distance of each hanger head 10 from its rafter facilitates co-linear horizontal alignment of each hanger head in a row and coplanar alignment of each hanger head 10 of the system.

[0034] Once the hangers have been installed the

straps are removed so that the thermal insulation is held in position against the rafters by the heads of the hangers. Gentle pulling on a strap is generally sufficient dislodge its staples and remove the strap which may subsequently be re-used. Removal of the straps releases the compression of the glass mineral wool batts which expand to provide a substantially planar front surface. Alternatively, the straps may be cut to release any compression but left in place.

[0035] As illustrated in Fig 12, horizontal furring battens 19 are then secured to each horizontally extending row of hanger heads with a vapour barrier membrane 30 positioned between the furring 19 and the glass wool batts. The furrings 19 comprise arms that snap-fit into the furring grooves of each hanger head 10 with the membrane 30 being clamped between the furring and the hanger head 10 without being pierced.

[0036] The edges of the vapour barrier membrane 30 are then sealed, for example by being taped to an adjacent portion of vapour barrier membrane or to an adjacent wall, purlin or other building structure. This provides a vapour barrier between the room side of the loft and the external roof. Similarly, any joints between adjacent pieces of the vapour barrier membrane are joined and sealed, for example use adhesive tape.

[0037] The furrings 19 provide a room side building frame attached to and spaced from the underlying rafters of the building structure with an intervening layer of thermal insulation. Sheets of plasterboard (not shown) are subsequently screwed to the building frame provided by the furrings. The space separating the sheets of plasterboard (or other building sheets) and the insulation may be used for the passage of, for example, electrical cables.

[0038] The tilting of the batten attachment head 10 of one or more hangers 1 facilitates correct alignment and positioning of a furring. Possible misalignment of, notably, the angle of the rod of an individual hanger, for example if the rod is not perfectly perpendicular with respect to its rafter, is compensated for by tilting of the hanger head 10 so that the furring groove of an imperfectly angled hanger rod is aligned to be coplanar with those of the hangers in its row when its furring is attached. This increases the acceptable degree of tolerance when installing each hanger and thus facilitates construction of the system.

Claims

1. An insulated building structure, comprising:

a layer of thermal insulation maintained on the room side of the building structure;

a plurality of hangers, each hanger comprising a rod provided with a building attachment at one of its ends and a batten attachment at its other end, each hanger being arranged such that its building attachment is secured to the building

- structure, its rod passes through the layer of thermal insulation material and its batten attachment protrudes from the room side of the layer of thermal insulation; and
 a plurality of battens secured to batten attachments of the plurality of hangers so as to be secured to and spaced from the building structure by the hangers;
characterised in that the batten attachment of each hanger is connected to its rod by a tilting connection which allows the batten attachment to tilt in at least two directions with respect to its rod.
2. An insulated building structure in accordance with claim 1, in which
 the building structure comprises a plurality of spaced, inclined rafters which support an external roofing of the building, the space between the rafters being provided with thermal insulation;
 the layer of thermal insulation is provided on the room side of the rafters;
 the building attachment of each hanger is secured directly in a respective one of the rafters;
 the batten attachment of each hanger comprises a furring groove adapted to receive and retain arms of a furring; and
 the batten is a furring which is secured to the batten attachments by its arms being retained in the furring groove of respective batten attachments.
 3. An insulated building structure in accordance with claim 1 or claim 2, in which the battens provide a room side building frame to which a building sheet material, notably a plurality of sheets of plasterboard, is secured to form a room side building sheet secured to and spaced from the building structure by the plurality of hangers.
 4. An insulated building structure in accordance with any preceding claim, further comprising a vapour barrier membrane arranged between the layer of thermal insulation and the battens.
 5. An insulated building structure in accordance with claim 4, as dependent from claim 2, in which the vapour barrier membrane is retained without piercing by being clamped against respective batten attachments by the furring.
 6. An insulated building structure in accordance with any preceding claim in which at least one of the hangers is secured to the building structure such that its rod is imperfectly aligned and in which tilting of the batten attachment with respect to the rod compensates for this imperfect alignment.
 7. A method of providing a building structure with a room side building frame using a hanger comprising a rod provided with a building attachment at one of its ends and a batten attachment at its other end comprising:
 - arranging a layer of thermal insulation adjacent to the building structure on the room side of the building structure;
 - subsequently securing a plurality of hangers to the building structure by passing the building attachment portion of the rod from the room side through the layer of thermal insulation and securing the building attachment to the building structure such that rod of the hanger passes through the layer of thermal insulation and the batten support of the hanger protrudes from the room side of the layer of thermal insulation;
 - securing a first batten to a first plurality of linearly aligned batten supports and securing a second batten to a second plurality of linearly aligned batten supports so the that the first and second battens provide the room side building frame.
 8. A method in accordance with claim 7, further comprising arranging a vapour barrier membrane on the room side of the layer of insulation material after the securing of the plurality of hangers to the building structure and before the securing of the first and second battens to their batten supports.
 9. A method in accordance with claim 8, further comprising clamping the vapour barrier without piercing to the hangers using the battens.
 10. A method in accordance with any of claims 7 to 9, in which arranging the layer of thermal insulation adjacent to the building structure on the room side of the building structure comprises securing the layer of thermal insulation adjacent to the building structure on the room side of the building structure, notably using straps.
 11. A method in accordance with any of claims 7 to 10, in which at least one of the hangers is secured to the building structure such that its rod is imperfectly aligned and comprising tilting the batten attachment with respect to the rod to compensate for this imperfect alignment.
 12. A hanger for supporting a batten to form an insulated room side building frame for a building structure, the hanger comprising a rod provided with a building attachment at one of its ends and a batten attachment at its other end, the building attachment being adapted to be secured to the building structure, the rod being adapted to pass through a layer of room side insulation arranged at the building structure and the batten attachment being adapted to protrude from

the room side of the layer of thermal insulation,
characterised in that the batten attachment is connected to its rod by a tilting connection which allows the batten attachment to tilt in at least two directions with respect to its rod.

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13. A hanger in accordance with claim 12 in which the batten attachment comprises a furring groove adapted to receive and retain arms of a furring.

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14. A hanger in accordance with claim 12 or claim 13, in which the batten attachment can tilt to an angle of at least 5°, preferably to an angle of at least 25°.

15. A hanger in accordance with any of claims 12 to 14, in which the batten attachment can tilt in in all directions with respect to a principal axis of the rod, notably in which the batten attachment is connected to its rod via a ball and socket type joint.

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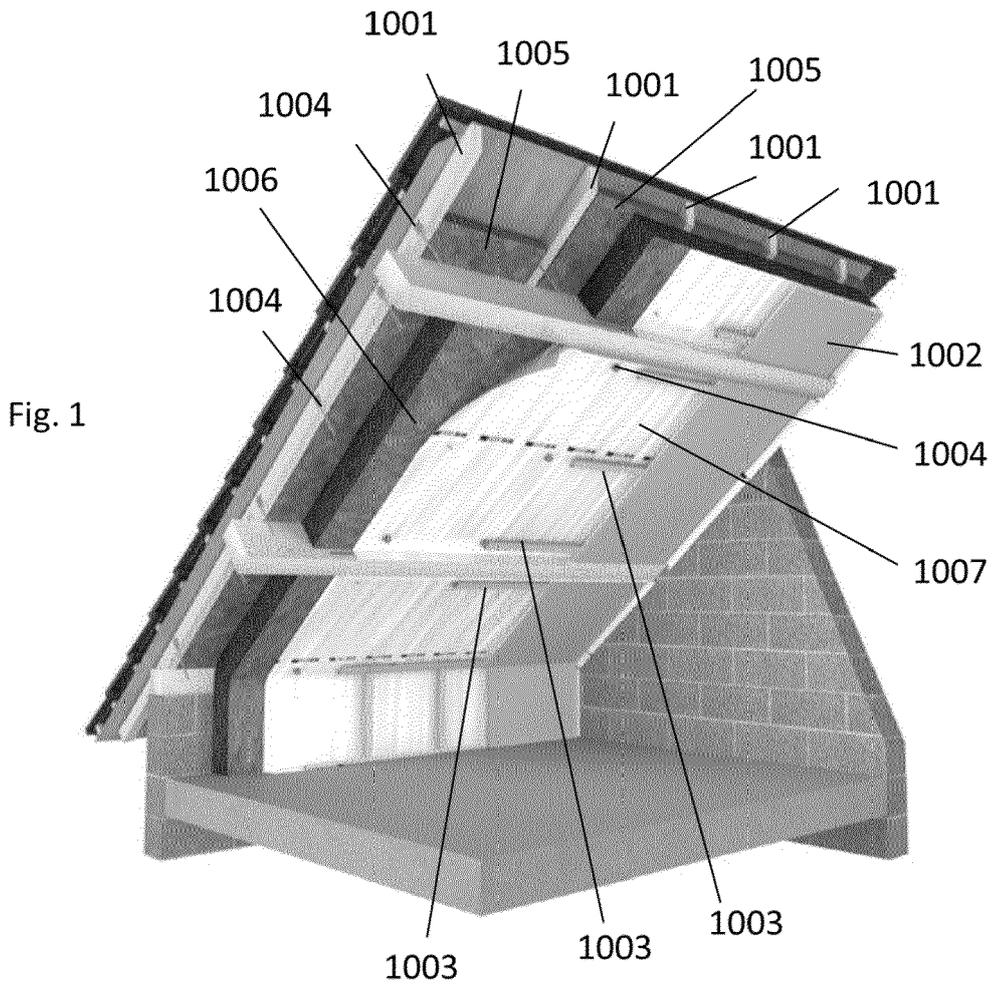
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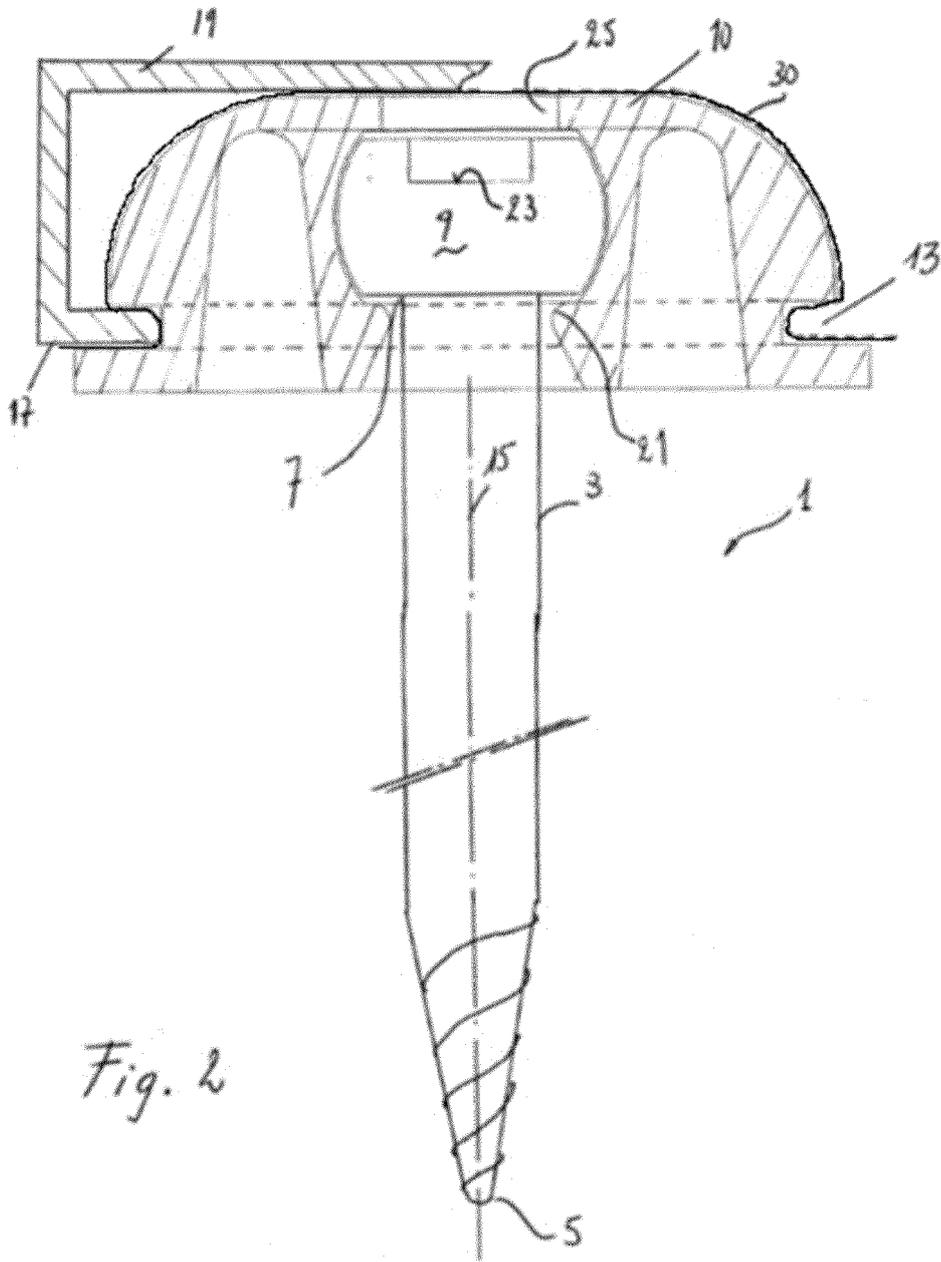
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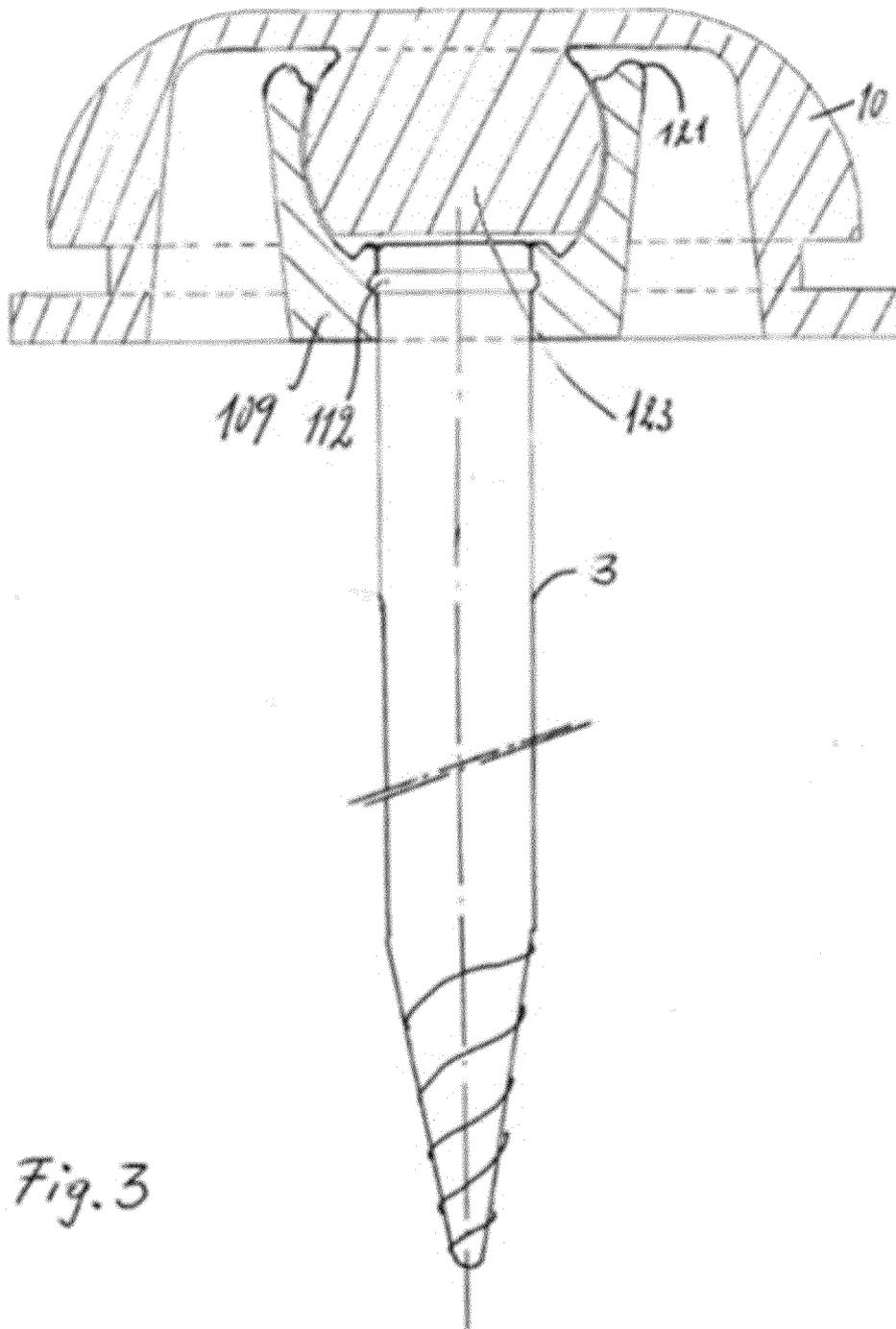
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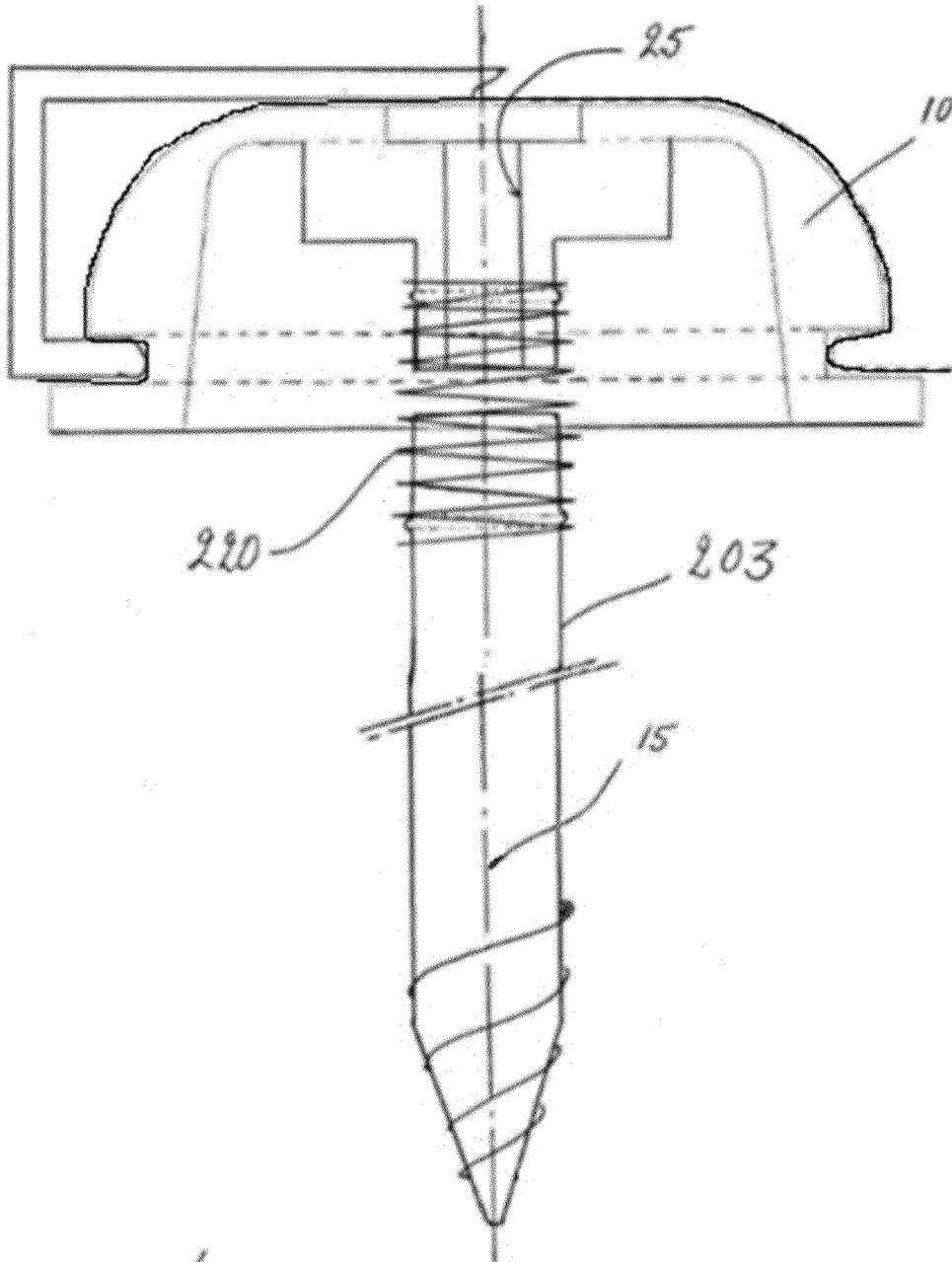


Fig. 4

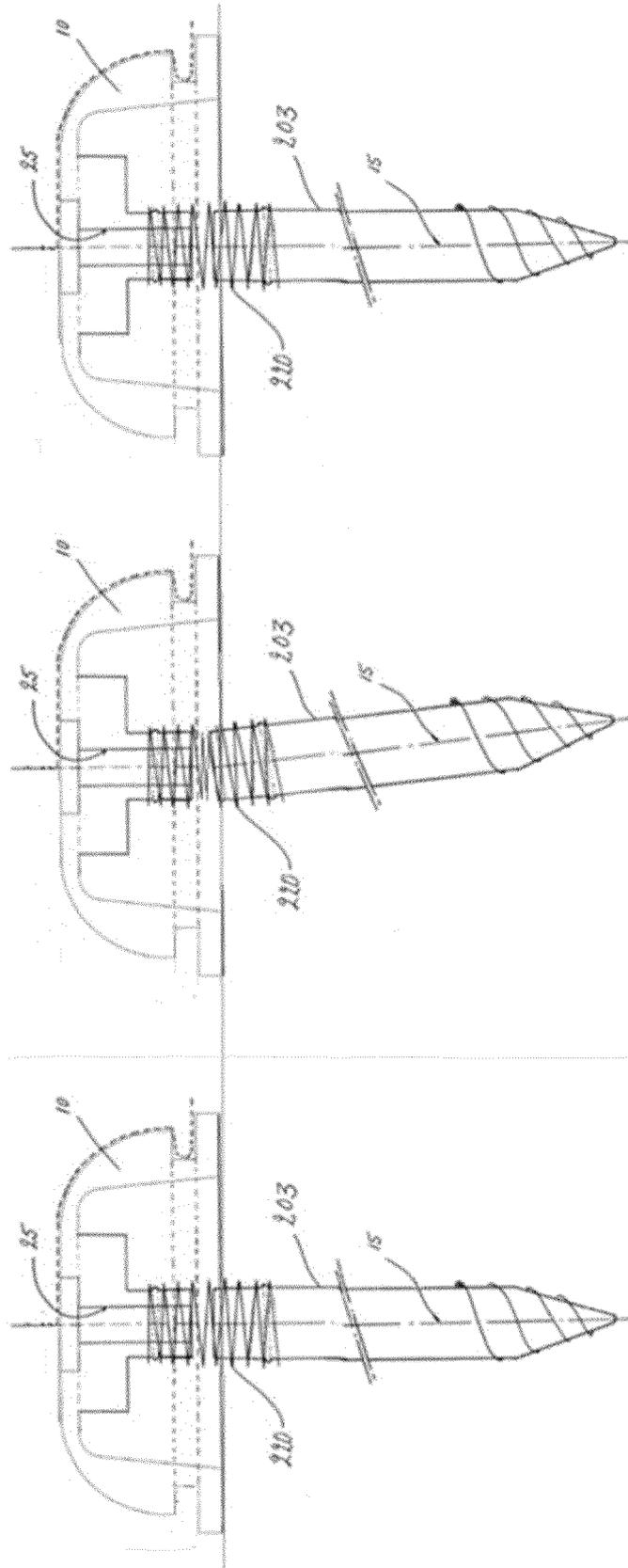


Fig. 5

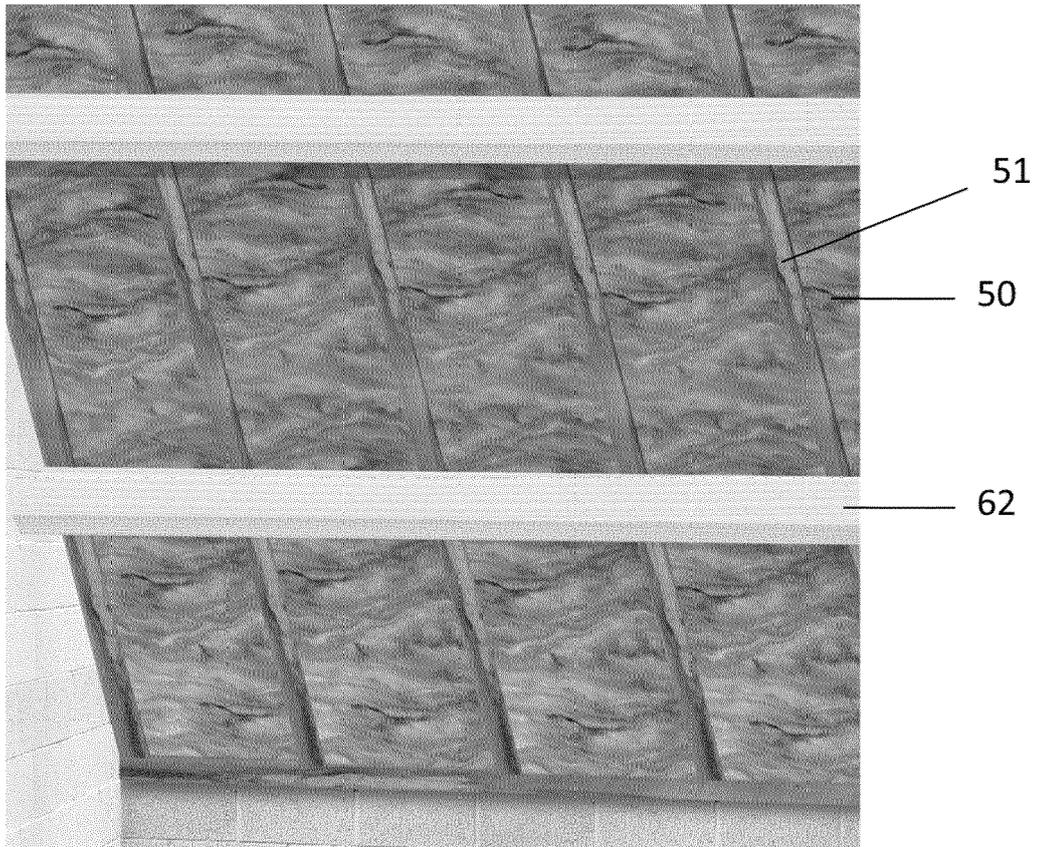


Fig. 6



Fig. 7

Fig. 8

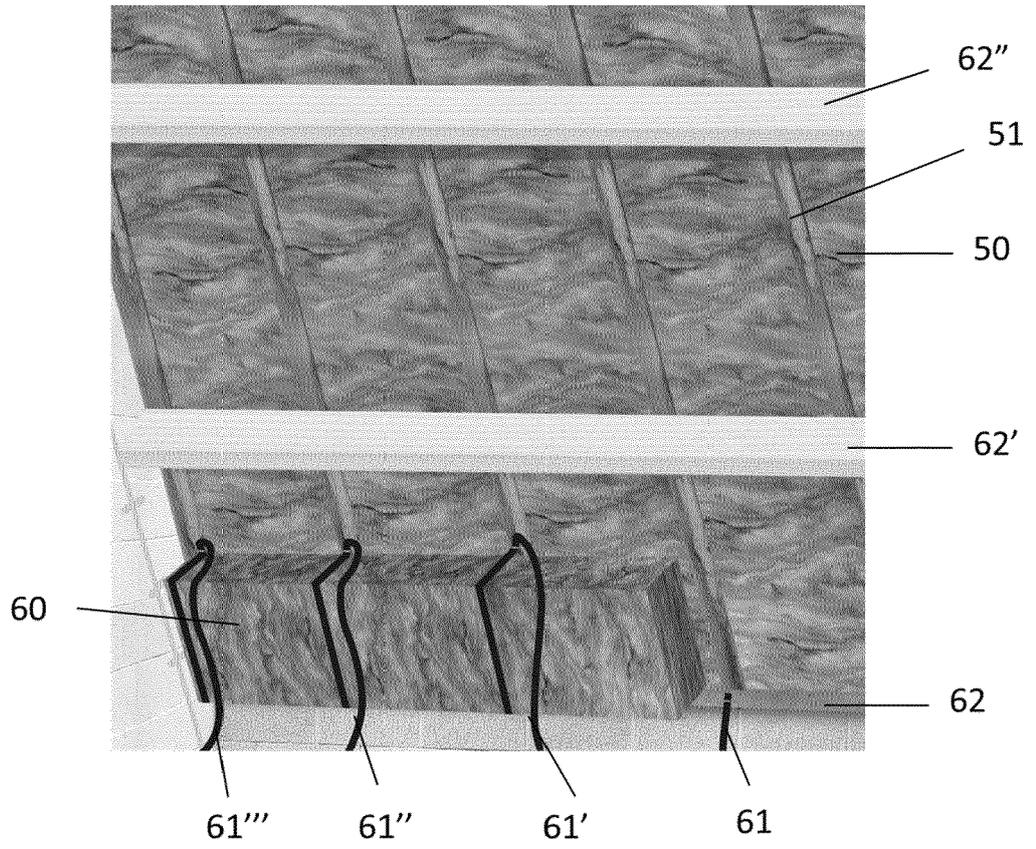
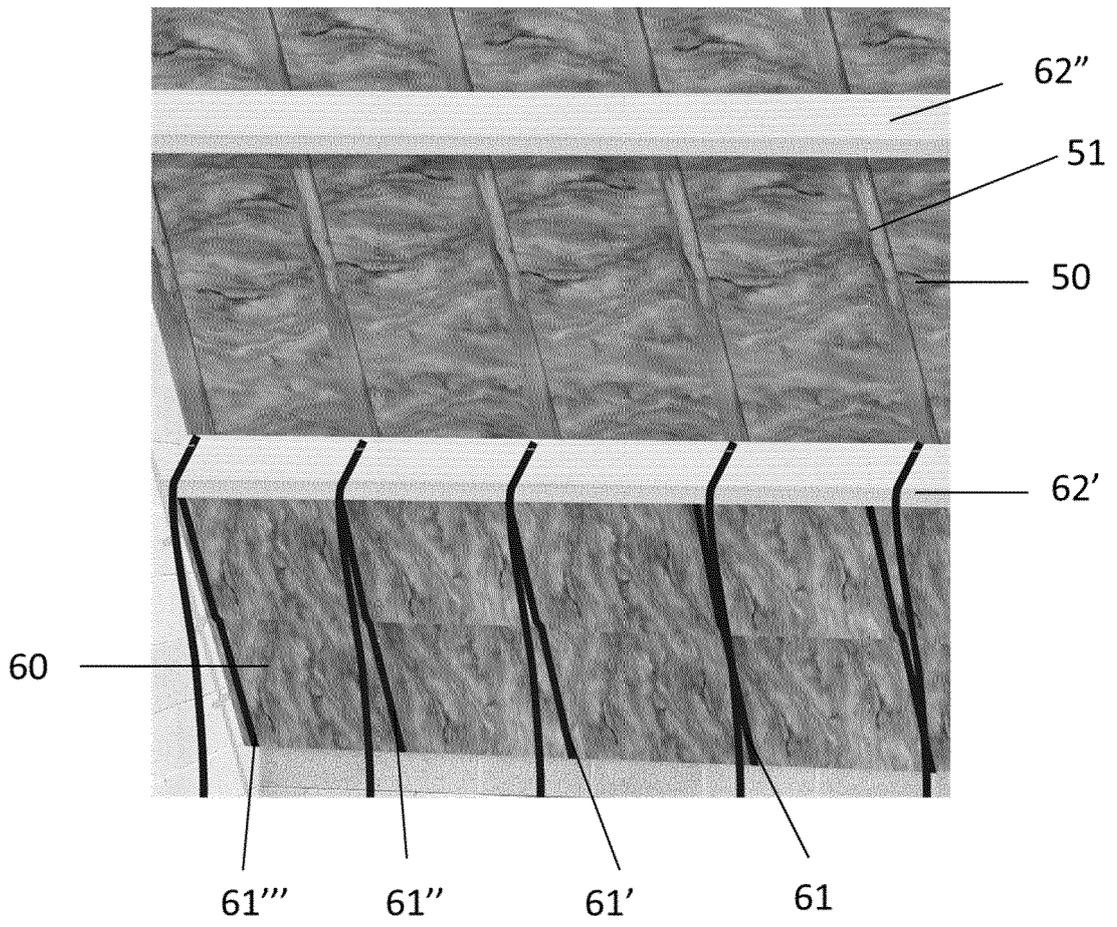


Fig. 9



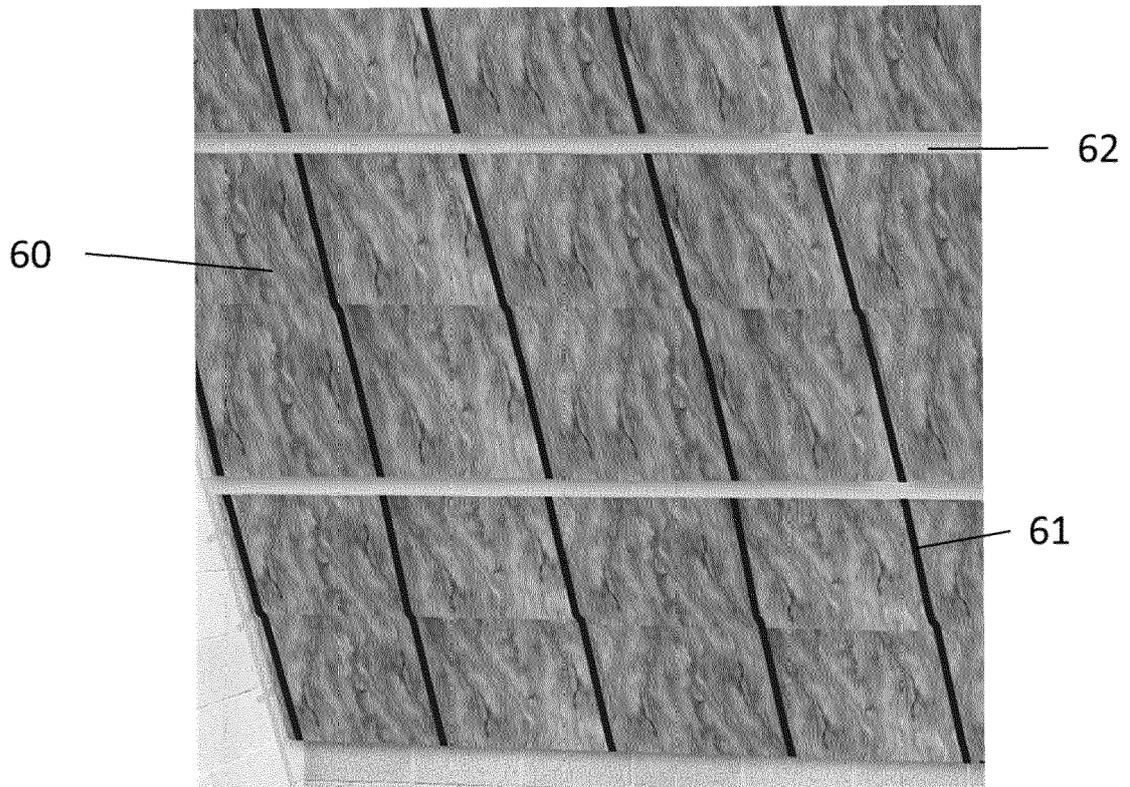


Fig. 10

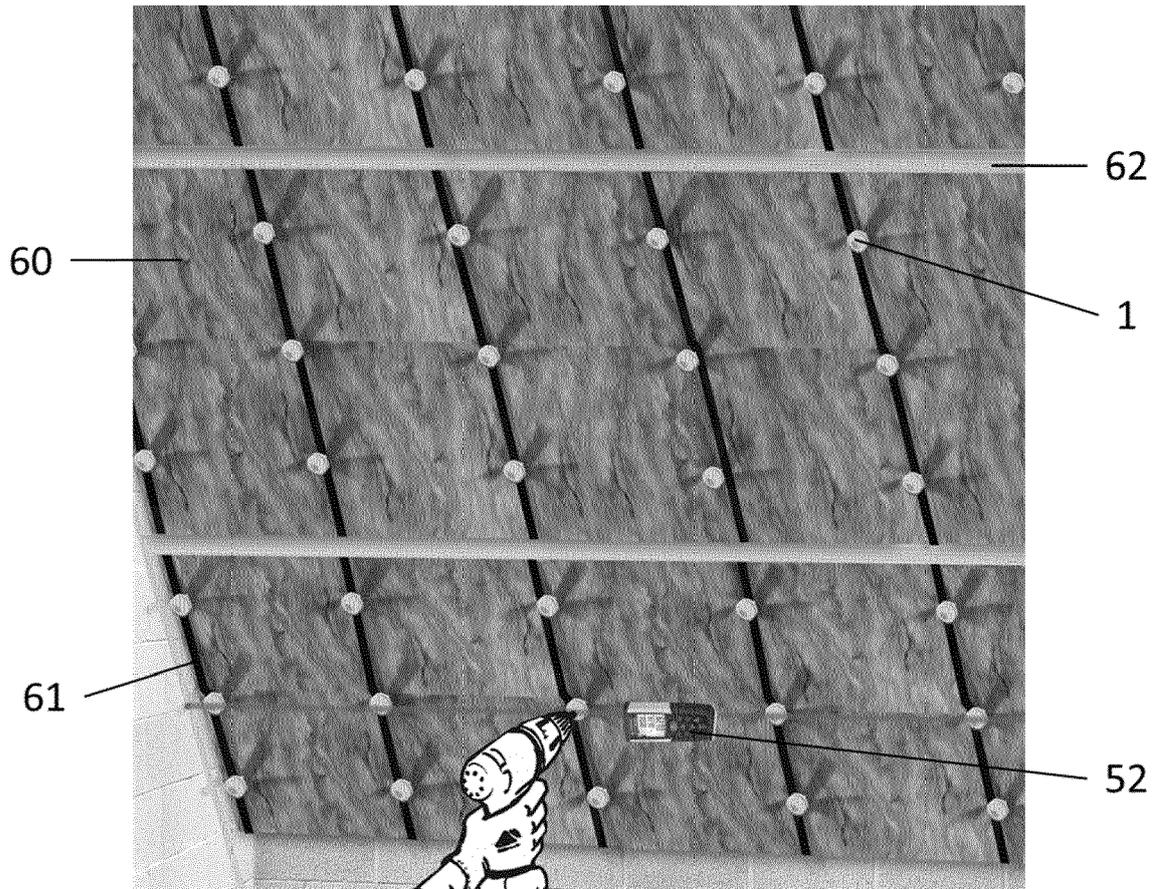


Fig. 11

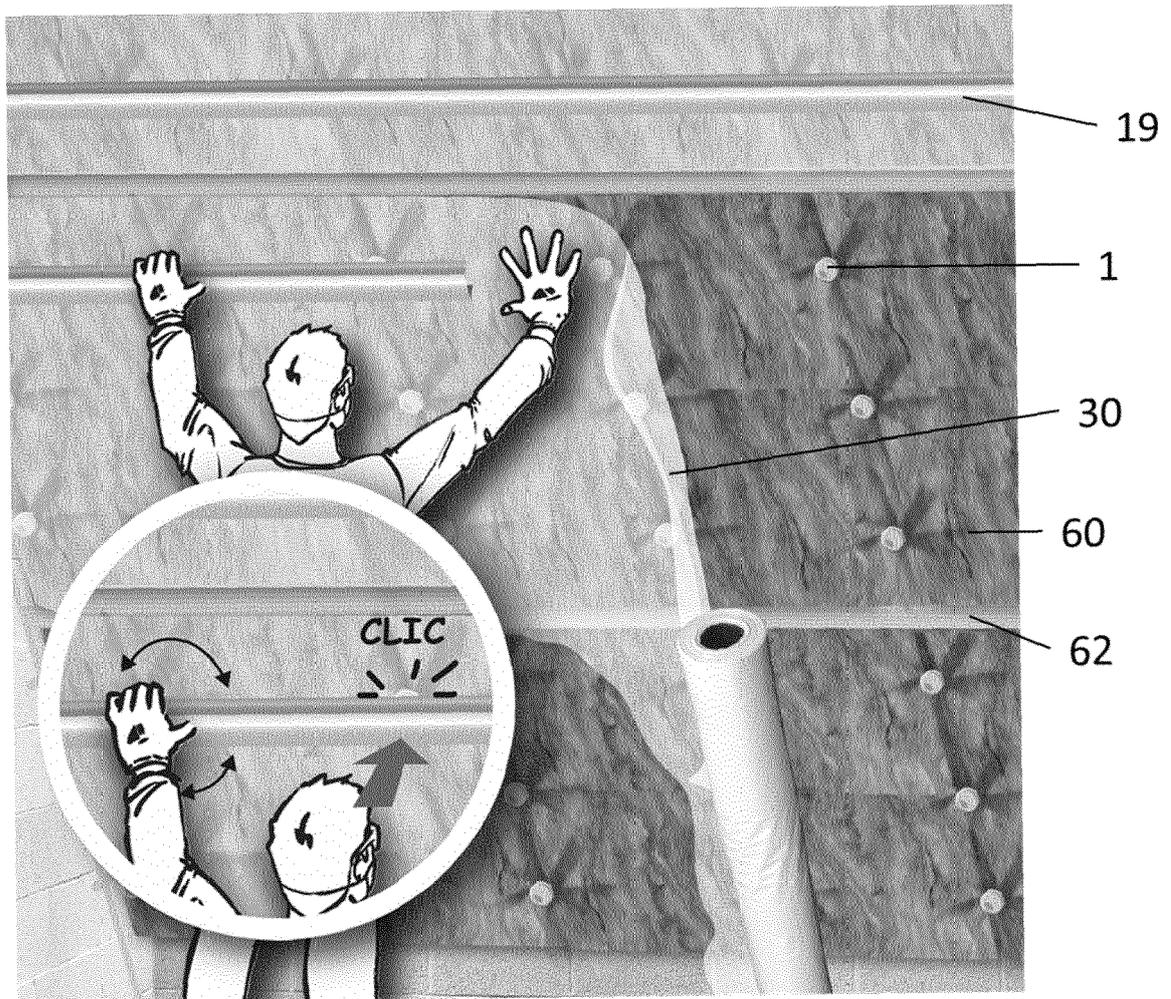


Fig. 12



EUROPEAN SEARCH REPORT

Application Number
EP 17 15 9199

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A		1-6, 12-15	
			TECHNICAL FIELDS SEARCHED (IPC)
			E04B E04F
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 5 July 2017	Examiner Delzor, François
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