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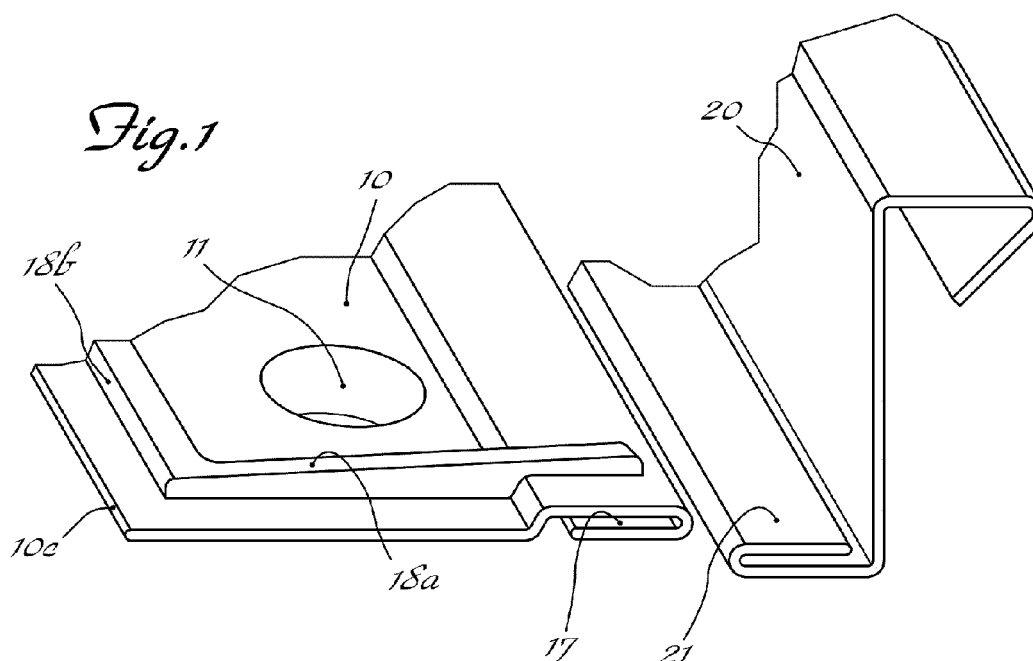
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(54) **Clamp for securing metal sheets to beams of roofing systems, roofs and the like with joint for joining together base surface and bearing surface freely slidable in the longitudinal direction**

(57) Clamp for securing metal sheets (2) to roofing beams (3), comprising a horizontal base surface (10) in which at least two through-holes (11) are formed, a bearing surface (20), substantially perpendicular to the base surface (10), the base surface (10) being provided with raised transverse ribs (18a) and at least one raised longitudinal rib (18b), wherein fastening together of the base

surface (10) and the bearing surface (20) is performed by means of a joint (16,21a,21b) between a horizontal edge (15) of the base surface and a horizontal foot (21) of the vertical surface (20) which provides at least one degree of freedom for relative sliding of the base surface (10) and bearing surface (20) in the longitudinal direction (X-X)



Description

[0001] The present invention relates to a clamp for securing metal sheets to beams of roofing systems, roofs and the like.

[0002] In the technical sector of roofing for buildings it is known to construct roofs using metal sheets which are arranged on top of the wooden roof beams to which they are fixed by means of positioning brackets, being then seamed together longitudinally in order to create a fastening in the transverse and vertical direction - for preventing for example a wind suction effect - from the roof ridge to the free edge or guttering of the roof.

[0003] Also known are special L-shaped clips or clamps designed to allow fixing, by means of nailing, of the metal sheets both to an associated support beam (rafters arranged along the slope of the roof hip) and to a corresponding stringer connected to the rafters, where fixing of the metal sheet is performed; once fixed in position, the sheets are then definitively seamed together.

[0004] US 2009/044477 A1 and WO 98/59130 A2 describe securing clamps according to the preamble of Claim 1.

[0005] Although performing their function, the clips or clamps of the known type have a number of drawbacks arising from the fact securing thereof to the beams and the stringers is performed using nail guns which do not allow correct positioning of the clamp which remains fixed in a manner not perfectly at right angles to and aligned with the beams and/or stringers, resulting in the roof making a bothersome noise when temperature variations during the summer and winter cause expansion and contraction of the metal sheet.

[0006] In addition, fixing of the two parts to stationary structures does not allow compensation of the expansion of the metal sheets due to the temperature variations and with time said expansion causes damage to the roofing resulting in noisiness and leaks.

[0007] The technical problem which is posed therefore is that of providing a clamp for securing metal sheets for roofing, able to allow improved centring, relative alignment and perpendicular arrangement with respect to the support beams during positioning and fixing of the clamp and at the same time able to compensate for the relative movements of the metal sheets due to the thermal expansion thereof, in order to prevent noisiness of the roof and damage thereto resulting from the movements of the metal sheet in the longitudinal and transverse direction.

[0008] In connection with this problem it is also required that the clamp should allow fixing by means of screws at a speed which is equivalent to that of nailing and which is easy and inexpensive to produce and assemble.

[0009] These results are achieved according to the present invention by a clamp for securing metal sheets to beams of roofing systems, roofs and the like according to the characteristic features of Claim 1.

[0010] Such a securing clamp according to the inven-

tion comprises a horizontal base surface in which at least two through-holes are formed, and a vertical bearing surface, substantially perpendicular to the base surface, with raised transverse ribs and at least one longitudinal raised rib being formed in the base surface; fastening together of the base surface and the bearing surface is performed by means of a joint, between a horizontal edge of the base surface and a horizontal foot of the vertical surface, which ensures at least one degree of freedom for the relative sliding movement of the base surface and bearing surface in the longitudinal direction, and the two respective bottom sides of the base surface and foot of the bearing surface, which are intended to come into contact with the stringer of the roof, are coplanar with each other once joining has been performed. Preferably, joining together between the base surface and the bearing surface is performed between folded edges thereof lying in planes substantially parallel to the base surface.

[0011] In a preferred embodiment, the edge of the base surface intended to be joined to the horizontal foot of the bearing surface is shaped with a first fold which positions the top surface of the said edge at a height in the vertical direction Z-Z greater than that of the rest of the surface and with a second fold which positions the free end portion of the edge underneath and substantially parallel to the latter, forming a seat in the form of an inverted C extending in the longitudinal direction X-X and open in the transverse direction Y-Y on the opposite side to the side directed towards the bearing surface and designed to receive the horizontal foot of the vertical surface for joining together of the two surfaces; in this connection, the horizontal foot of the vertical bearing surface may have a first fold and a second fold such as to determine a C-shaped form of the foot arranged opposite the inverted C form of the edge of the base surface and with arms substantially parallel to the said base surface. According to further preferred variants which may be implemented singly or in combination:

- each transverse rib has an end directed towards the vertical bearing surface with a bottom seat suitable for engagement with a fold of the raised edge of the base surface;
- the depth of the seat in the vertical direction is such as to determine the coplanar arrangement of the bottom side thereof with the top side of the base surface;
- at least one of said transverse ribs is arranged between each end hole and the corresponding transverse side edge; and in that
- at least two of said transverse ribs are connected, at their end directed towards the free edge of the base surface, to the rib extending in the longitudinal direction X-X.

[0012] Preferably, each hole is situated between two respective raised ribs extending in the transverse direction Y-Y, and the clamp may also have a free end of the vertical side having a first folded-back portion substan-

tially parallel to the base surface. Each folded-back portion may in turn have a free end folded back towards the bearing surface at an angle of between 115° and 165° and preferably between 135° and 145°.

[0013] Advantageously, the free edge of the vertical surface, opposite to the edge for joining together with the base surface, has recesses arranged between first folded-back portions and substantially parallel to the transverse direction Y-Y.

[0014] Preferably, in a clamp according to the invention the base surface can be joined to bearing surfaces having different dimensions in the vertical direction Z-Z.

[0015] A particularly advantageous embodiment is one in which the vertical bearing surface has a constant thickness equivalent to the thickness of the metal sheet from which it is formed.

[0016] Further details may be obtained from the following description of a non-limiting example of embodiment of the subject of the present invention, provided with reference to the accompanying drawings, in which:

Figure 1: shows an exploded perspective view of a clamp according to the present invention;

Figure 2: shows a perspective view of the clamp according to Fig. 1 in the assembled condition;

Figure 3: shows a schematic cross-section along the plane indicated by III-III in Fig. 2;

Figure 4: shows a schematic cross-section of the clamp according to the invention during mounting on a roof and

Figure 5: shows a schematic cross-section of the clamp according to Fig. 4 in the mounted and closed condition.

[0017] As shown and assuming solely for the sake of simpler description and without a limiting meaning a set of three reference axes with directions defined independently of the orientation of the figures, i.e. longitudinal direction X-X conventionally referred to as "length" of the clamp, transverse direction "Y-Y" conventionally referred to as "width" of the clamp, and vertical direction Z-Z perpendicular to the other two directions, an L-shaped clamp according to the invention comprises essentially:

- a base surface 10, with a lengthwise dimension extending in the longitudinal direction X-X and widthwise dimension extending in the transverse direction Y-Y and also defined below as conventionally "horizontal".
- a bearing surface 20, which extends parallel to the vertical direction Z-Z, substantially perpendicular to the surface 10, and the dimension of which in the longitudinal direction X-X corresponds to the length of the base surface 10, which can be joined together as will be described more clearly below.

[0018] In greater detail:

the top side of the horizontal base surface 10 has, formed therein, first holes 11 arranged in the proximity of the opposite transverse side edges 10a, 10b of the base surface 10.

[0019] Between the two first end holes 11 and in alignment therewith the base surface 10 has at least one third hole 12 situated between the two said holes 11.

[0020] The horizontal edge 15 of the base surface 10 intended to be joined together with the vertical bearing surface 20 is conveniently shaped as a first fold 15a which positions the top side of the said edge 15 at a height in the vertical direction Z-Z greater than the height of the remainder of the surface 10; beyond this first fold 15a the free joining edge 15 has a second fold 15b which positions the free end portion 16 of the edge 15 below and substantially parallel to the latter, forming a seat in the form of an inverted C 17 extending in the longitudinal direction X-X and open the transverse direction Y-Y on the opposite side to that directed towards the bearing surface 20, being instead closed in the transverse direction Y-Y on the side thereof directed towards the bearing surface 20. As will become clear below, once the clamp has been assembled, this C-shaped seat 17 is designed to receive a horizontal foot of the bearing surface 20, for joining together of the two surfaces.

[0021] Each hole 11 and the at least one hole 12 is preferably situated between two respective raised ribs 18a extending in the transverse direction Y-Y and connected at the end directed towards the free edge 10c opposite to the joining edge of the base surface 10 to a rib 18b extending in the longitudinal direction. One of the said transverse ribs 18a therefore extends between each end hole 11 and the respective transverse side edge 10a, 10b, preferably at a certain distance from the said edge 10a, 10b.

[0022] Each rib 18a has an end directed towards the vertical bearing surface 20 with a bottom seat 18c suitable for engagement with the fold 15a of the raised edge 15 of the base surface 10; the depth in the vertical direction of the seat 18c is such as to ensure the coplanar arrangement of the bottom side thereof with the top side of the base surface 15.

[0023] The vertical bearing surface 20 has in turn a foot 21 with a lengthwise dimension extending in the longitudinal direction X-X and widthwise dimension extending in the transverse direction Y-Y (below also conventionally defined as "horizontal direction") which has a first fold 21a and a second fold 21b such as to determine a C-shaped form of the foot arranged opposite the inverted C form of the edge 15 of the base surface 10.

[0024] The C-shaped foot preferably has dimensions such that:

- the top arm may be inserted inside the seat 17, and
- once insertion has been performed, the bottom side of the foot 21 is coplanar with the bottom side of the base surface 10.

[0025] As shown in Fig. 3, it is thus possible to join together the edge 15 of the base surface and the foot 21 of the bearing surface 20 by inserting one inside the other; the joint is such as to allow the relative movement of the two surfaces 10,20 in the longitudinal direction X-X and ensure the coplanar arrangement of the two respective bottom sides of the base surface 10 and the foot 21, which are intended to make contact with the stringer 3 of the roof.

[0026] In general, joining together of the base surface 10 and the bearing surface 20 is performed between edges 15,16,21 thereof lying in planes parallel to the base surface 10, allowing, in preferred embodiments, the formation of the vertical bearing surface 20 with a constant thickness equivalent to the thickness alone of the sheet metal from which it is formed.

[0027] This allows the bearing surface 20 to be made with a thickness substantially smaller than that of the base surface 10. In one preferred embodiment the thickness of the base surface 10 is between 1.5 and 2.5 times the thickness of the bearing surface 20.

[0028] As a result of the smaller thickness of the bearing surface 20 it is also possible to leave, during seaming, a wider space in the transverse direction between the said surface 20 and the metal sheet, thus favouring compensation of expansion thereof in the transverse direction Y-Y and making it possible to fold back the free edge 22 of the bearing surface 20 together with the metal sheet which is to be fixed, without an excessive thickness of the edge 22 causing compression, pressure and undesirable reactions during seaming.

[0029] It is envisaged, moreover, that the free edge 22 of the vertical surface 20, opposite to the foot 21 for joining together with the base surface 10, has recesses 22 arranged between first folds 22a substantially parallel to the transverse direction Y-Y and that each fold 22a has a free end 22b in turn folded back towards the second surface 20 at angle of between 115° and 165°, and preferably between 135° and 145°, so as to allow folding and closing without difficulty of the clamp onto the stringer 3 of a roof.

[0030] As shown in Fig. 4, the transverse ribs 18a and longitudinal rib 18b of the base surface 10 of the flange perform the dual function of reinforcing the flange itself and guiding a centring tool 200 for inserting and screwing fixing screws 1. Conveniently and as shown in Fig. 4 the tool 200 forms part of a screwdriver device 400 with a screwing head 401 so that, during positioning and securing of the metal sheets 2 to the beams and/or stringers 3 of the roof, the hole 11,12 of the base surface 10 of the clamp may be centred and the screw 1 screwed precisely to the said beam while keeping the clamp squarely arranged and positioned.

[0031] As shown in Figs. 4 and 5 during positioning and securing of the metal sheets 2 to the crossbeams and/or stringers 3 of the roof, which are lined with felt 3a, the screws 1 are applied, centring the holes 11 in the base surface 10 of the clamp, and then seaming to the

crossbeam or stringer 3 is performed, while keeping the clamp squarely arranged and positioned also during folding-over (Fig. 5) of the free edges 22a, 22b of the surface 20 for definitive relative fixing.

[0032] It is therefore clear how, owing to the joint, freely slidable in the longitudinal direction X-X, between the base surface 10 and the bearing surface 20, but also the coplanar arrangement of the respective bottom sides of the base surface and the foot of the bearing surface intended to make contact with the roof stringer, the clamp according to the invention is able to compensate for the relative movements in the longitudinal direction due to thermal expansion/contraction of the metal sheets fixed by means of the clamp itself, leaving moreover a space between the bearing surface and the metal sheet able to compensate for the expansion movements in the transverse direction thereof and ensuring a longer working life of the roof which is not damaged by the said thermal expansion movements, as well as the substantial absence of noise normally caused by them, solving the problems mentioned in connection with the clamps of the prior art.

[0033] In addition to this, the clamp according to the invention can be applied by means of a fast screwing and centring tool which ensures fixing of the metal sheets forming the roofing to the said clamps with a laying speed comparable to that of nailing, but with a greater precision and the use of screws which ensure a tensile strength far superior to that of nails.

[0034] The better squared arrangement of the clamp once fixed also ensures a more silent behaviour of the sheet-metal roof since the movements due to the temperature variations take place in parallel directions which do not cause squeaking.

[0035] Moreover joining together of the base surface 10 and the bearing surface 20 may be performed using alternative joining systems, such as longitudinal eyelets formed in the respective edges and connected together by means of vertical rivets; these systems are within the scope of the person skilled in the art and therefore all equivalent to each other depending on the degree of freedom which is left between the two parts for relative sliding in the longitudinal direction and the space for transverse expansion of the seamed sheets. Furthermore, owing to the particular configuration of the clamp according to the invention, said clamp may be produced with vertical bearing surfaces 20 having different dimensions in the vertical direction Z-Z, resulting in the possibility of obtaining a clamp assembled with a vertical bearing surface having a height better suited to the specific application.

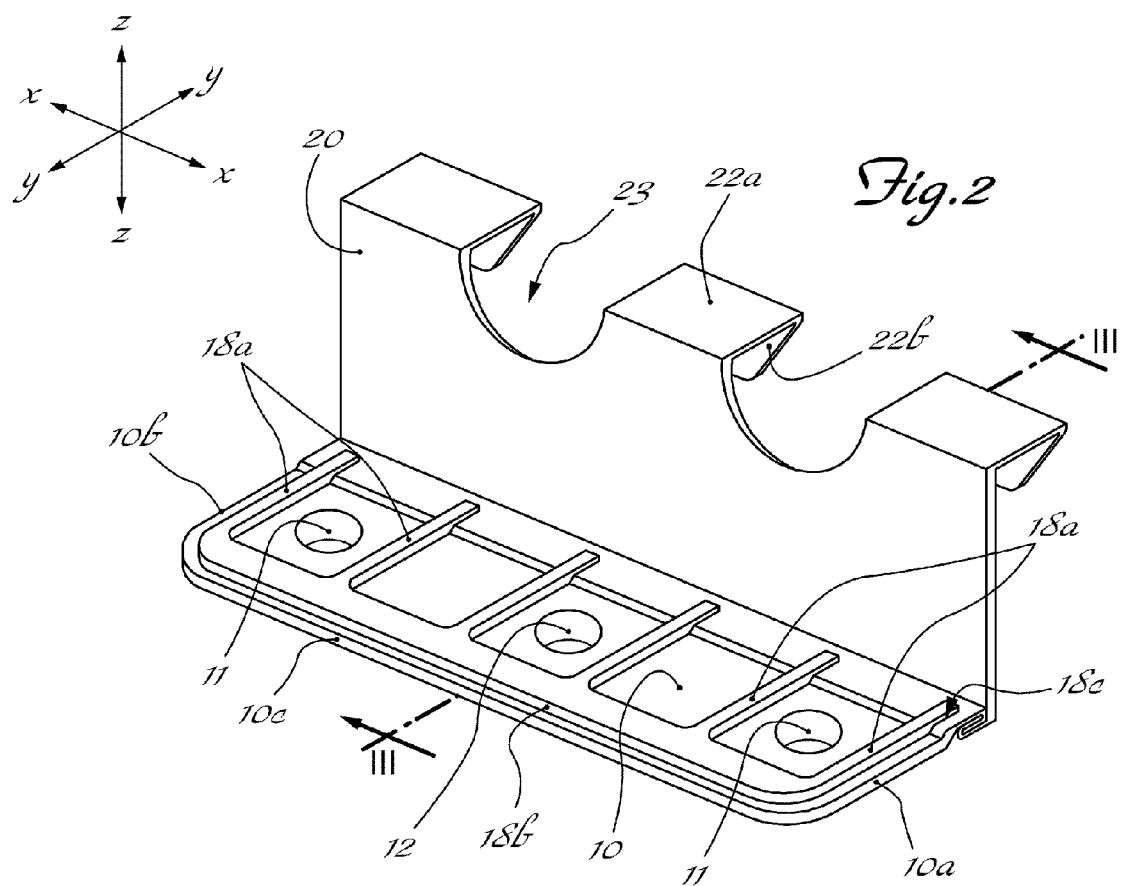
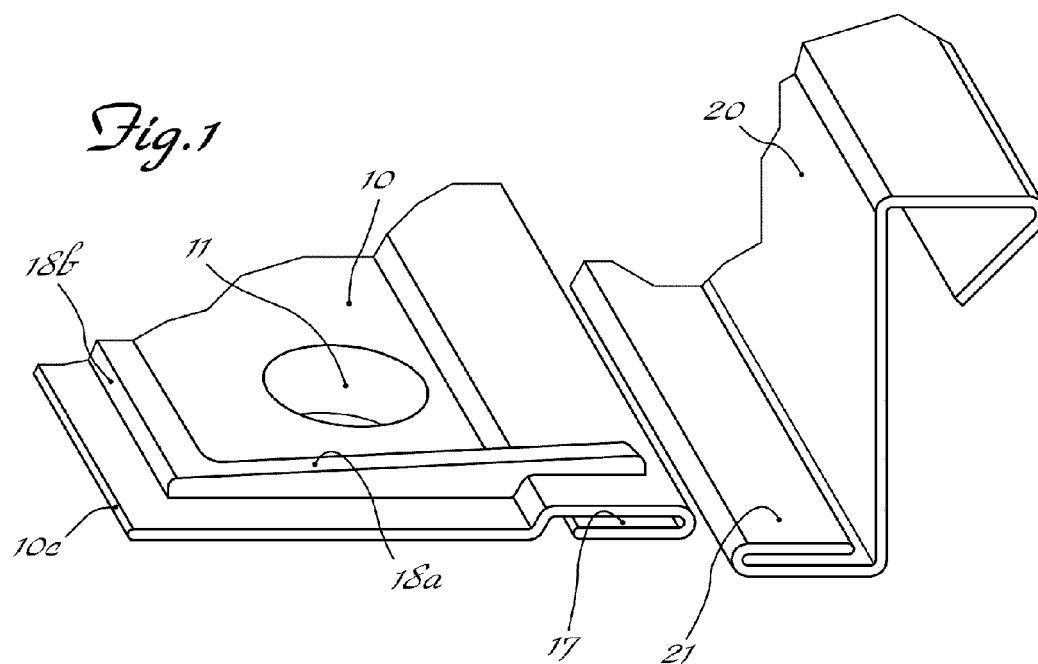
[0036] In addition, economies of scale for production and warehouse management are thus also achieved, it being possible to use a single base model for different bearing surfaces.

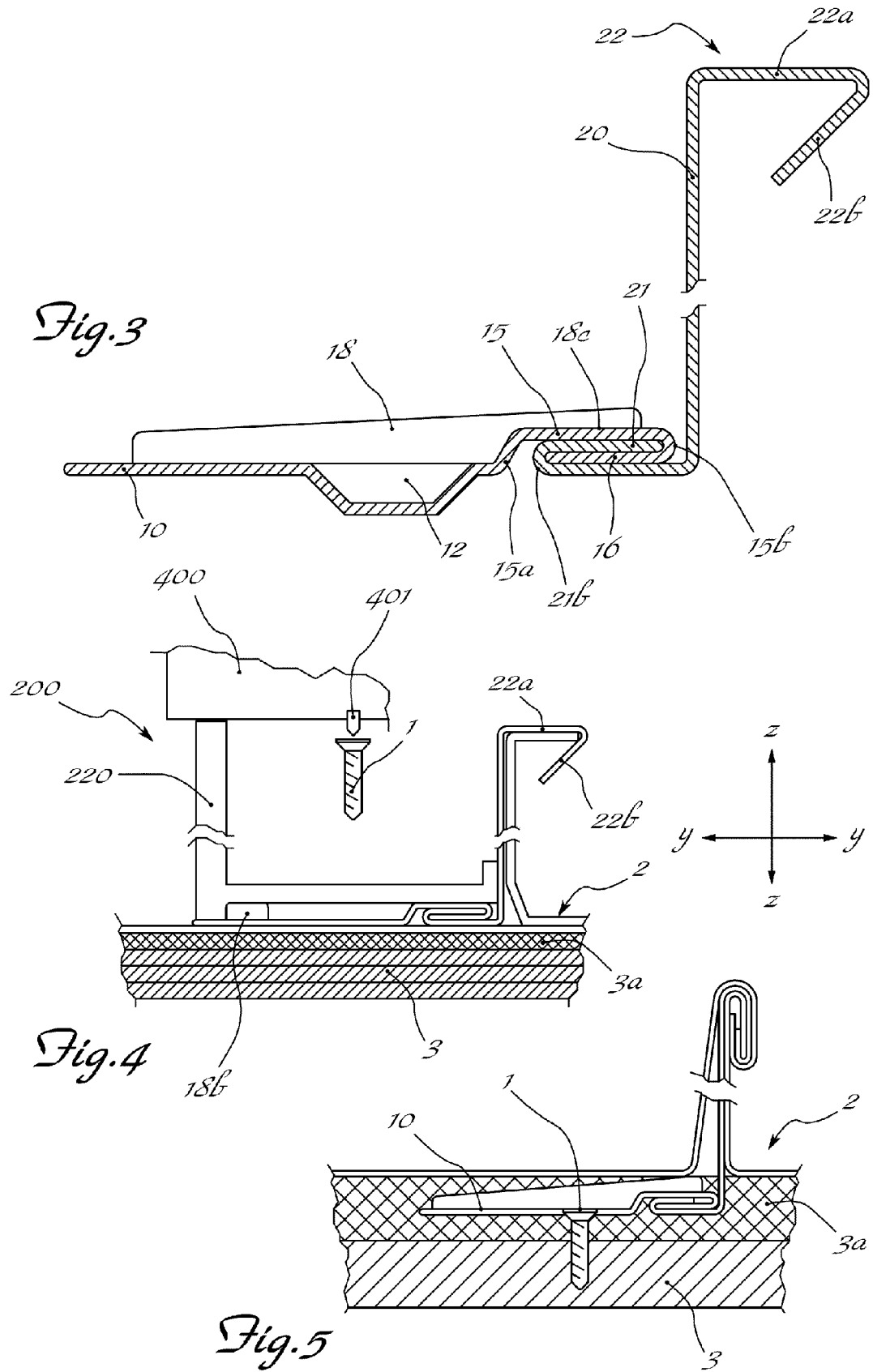
[0037] Although described in connection with a number of embodiments and a number of preferred examples of embodiment of the invention, it is understood that the scope of protection of the present patent is de-

terminated solely by the claims below.

Claims

1. Clamp for securing metal sheets (2) to roofing beams (3), comprising a horizontal base surface (10) in which at least two through-holes (11) are formed, a vertical bearing surface (20), substantially perpendicular to the base surface (10), the base surface (10) being provided with raised transverse ribs (18a) and at least one raised longitudinal rib (18b), wherein fastening together of the base surface (10) and the bearing surface (20) is performed by means of a joint (16;21a,21b) between a horizontal edge (15) of the base surface and a horizontal foot (21) of the vertical surface (20) which provides at least one degree of freedom for relative sliding of the base surface (10) and bearing surface (20) in the longitudinal direction (X-X),
characterized in that the two respective bottom sides of the base surface (10) and the foot (21) of the bearing surface (20), which are intended to come into contact against the stringer (3) of the roof, are coplanar with each other once joining has been performed.
2. Clamp according to Claim 1, **characterized in that** said joint between the base surface (10) and the bearing surface (20) is formed by means of folded edges (15;16;21) of said surfaces lying in planes substantially parallel to the base surface (10).
3. Clamp according to Claim 1 or 2, **characterized in that** the edge (15) of the base surface (10) intended for joining together with the horizontal foot (21) of the bearing surface (20) is shaped with a first fold (15a) which positions the top side of the edge (15) itself at a height in the vertical direction Z-Z greater than that of the rest of the surface (10) and with a second fold (15b) which positions the free end portion (16) of the edge (15) underneath and substantially parallel with the latter, forming a seat in the form of an inverted C (17) extending in the longitudinal direction (X-X) and open in the transverse direction (Y-Y) on the side opposite to that directed towards the bearing surface (20) and designed to receive the horizontal foot (21) of the vertical surface (20) for joining together of the two surfaces (10;20).
4. Clamp according to Claim 3, **characterized in that** the vertical bearing surface (20) has a horizontal foot (21) with a first fold (21a) and a second fold (21b) such as to determine a C-shaped form of the foot arranged opposite the inverted C form of the edge (15) of the base surface (10) and with arms substantially parallel to the base surface (10) itself.
5. Clamp according to any one of the preceding claims, **characterized in that** each transverse rib (18a) has an end directed towards the vertical bearing surface (20) with a bottom seat (18c) suitable for engagement with the fold (15a) of the raised edge (15) of the base surface (10).
6. Clamp according to Claim 5, **characterized in that** the depth of the seat (18c) in the vertical direction is such as to determine the coplanar arrangement of the bottom side thereof with the top side of the base surface (10).
7. Clamp according to any one of the preceding claims, **characterized in that** at least one of said transverse ribs (18a) is arranged between each end hole (11) and the corresponding transverse side edge (10a;10b).
8. Clamp according to Claim 5, 6 or 7, **characterized in that** at least two of said transverse ribs (18a) are connected, at their end directed towards the free edge (10c) of the base surface (10), to the rib (18b) extending in the longitudinal direction (X-X).
9. Clamp according to any one of the preceding claims, **characterized in that** each hole (11;12) is situated between two respective raised ribs (18a) extending in the transverse direction (Y-Y).
10. Clamp according to any one of the preceding claims, **characterized in that** the free end (22) of the vertical side (20) has a first folded-back portion (22a) substantially parallel to the base surface (10).
11. Clamp according to Claim 10, **characterized in that** each folded-back portion (22a) has a free end (22b) in turn folded back towards the bearing surface (20) at an angle of between 115° and 165° and preferably between 135° and 145°.
12. Clamp according to Claim 10, **characterized in that** the free edge (22) of the vertical surface (20), opposite to that for joining together with the base surface (10), has recesses (23) arranged between first folded-back portions (22a) and substantially parallel to the transverse direction (Y-Y).
13. Clamp according to any one of the preceding claims, **characterized in that** the base surface (10) can be joined to bearing surfaces (20) with different dimensions in the vertical direction (Z-Z).
14. Clamp according to any one of the preceding claims, **characterized in that** the vertical bearing surface (20) has a constant thickness equivalent to the thickness of the metal sheet from which it is formed.







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Place of search The Hague		Date of completion of the search 10 April 2014	Examiner Leroux, Corentine
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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