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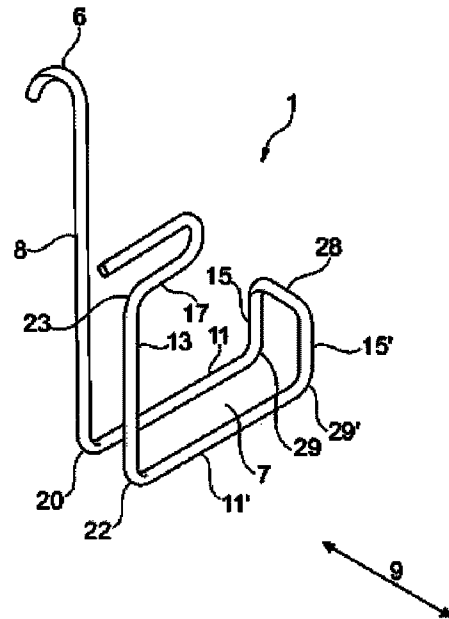
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(54) Title **Taksteinklips for å sikre en sidekant av en nedre del av en takstein til en lekt.**

(56) References Cited:
SE 512570 C2
DE 4421098 A1
NO 177758 B
DE 3507460 C2
DK 1462585 T3
EP 2325412 B1
GB 1174891 A

(57) Abstract

A roof tile clip (1) for securing a lateral edge (3) of a lower portion of a roof tile (2) to a batten (5), the lower portion of the roof tile (2) rests on an upper portion of a below roof tile (2'), which in turn rests on the batten (5), the roof tile clip (1) comprises a hook (6) for hooking over the lateral edge (3) of the roof tile (2), a securing device (7) for securing the clip (1) to the batten (5), and a shaft (8) between the hook (6) and the securing device (7), wherein the securing device comprises a retainer (7) slidable in a longitudinal direction (9) of the batten (5).



A ROOF TILE CLIP

The invention relates to a roof tile clip for securing a lateral edge of a lower portion of a roof tile to a batten, the lower portion of the roof tile rests on an upper portion of a below roof tile, which in turn rests on the batten, the roof tile clip comprises a hook for
5 hooking over the lateral edge of the roof tile, a securing device for securing the clip to the batten, and a shaft between the hook and the securing device.

Roof tiles are used for covering sloping roofs, and are placed on horizontal battens extending in the transverse direction of the roof. The distances between the battens are smaller than the lengths of the roof tiles. The upper portions of the roof tiles rest
10 on the battens, while the lower portions of the roof tiles rest on the upper portions of the roof tiles below. In this way, the roof tiles overlap in the sloping direction of the roof. The roof tiles also overlap in the transverse direction of the roof, i.e. in the direction of the battens.

The gravitation prevents the roof tiles from sliding upwards of the roof, and lugs on
15 the underside of the roof tiles around the battens and prevents the roof tiles from sliding downwards of the roof. The roof tiles are thereby held in place in the sloping direction of the roof. Lateral edges of the roof tiles have features that interlock with corresponding features of the roof tiles overlapping in the transverse direction of the roof, and the roof tiles are thereby held in place also in the transverse direction of the
20 roof.

In windy areas, however, the wind may grab the edges of the roof tiles and lift them, and possibly rip them off the roof, if they are not positively secured. In windy areas roof tiles may therefore be secured to the battens by roof tile clips. They come in various designs, and are also known as "wind clips", "storm clips" and "hurricane
25 clips". Depending on the expected wind, roof tile clips are used for some, or in rare cases, all of the roof tiles. Particularly the roof tiles along the sides of the roof are secured by clips.

The hook of the roof tile clip is hooked over the top surface of the lateral edge of the roof tile. The distance between the top surface of the lateral edge of the roof tile and
30 the batten depends on the type of roof tiles. The roof tile clips therefore come in different lengths for different types of roof tiles. The distances between the top surface of the lateral edge of the roof tile and the batten also vary due to inaccuracies.

Lonevåg Beslagfabrik, Norway, produces a roof tile clip named PK followed by a number indicating size corresponding to the distance between the top surface of the

lateral edge of the roof tile and the batten, see www.lobas.no. This clip comprises a hook for hooking over the lateral edge of the roof tile, a securing device for securing the clip to the batten, and a shaft between the hook and the securing device. The securing device is formed by a double spike integral with the clip, for hammering into the batten. A similar storm clip is shown on <http://www.igarasjen.no/>, with an integral nail as a securing device.

For these two roof tile clips, varying distances between the roof tiles and the battens due to inaccuracies are accommodated by adapting the position for hammering the spike or nail into the batten.

10 NO321881 describes a roof tile clip made from wire, which is secured by a separate nail inserted through a loop of the wire. This clip is therefore more complicated and slower to mount than the clips with integral spike or nail.

NO301603 describes a roof tile clip made from plate, with an integral spike for securing to a batten.

15 NO305610 describes a roof tile clip made from plate and wire, the wire is pointed for securing to a batten.

NO311845 describes a roof tile clip made from plate and wire, the wire is pointed for acting like a nail.

20 SE 512570 describes a fastener comprising a curved section for engaging with a roof tile, and an anchor section for securing to a lath in a roof frame. The anchoring section only comprises a single bended wire piece.

25 DE4421098 describes a fastener comprising an anchor fitted to a roof beam. It further comprises a spike connectable to a roof tile and engaging an eyelet in the anchor. The spike may pass through an aperture in the roof tile. The fastener then comprises two separate elements in order to fasten a roof tile.

NO177758 describes a bracket comprising a hook section to be driven into a batten and an anchoring section for securing a roof tile. The bracket is a rigid unit and cannot be adjusted when the hook section is placed in the batten.

30 When laying roof tiles, it is sometimes required to adjust the position of a roof tile, i.e. move the roof tile in the longitudinal direction of the batten, after the clip has been mounted. The above prior art roof tile clips are attached to the batten by spikes or nails penetrating the batten, and when adjusting the position of a roof tile secured by

one of these clips, the spike or nail first have to be removed from the batten. This is time consuming and might be awkward due to the narrow space underneath the roof tile.

5 When removing roof tiles secured by the above prior art roof tile clips, which may be required when the roof tiles are old and need replacement, or for other maintenance reasons, it is required to remove the clips, and therefore also the spikes or nails. Again this is time consuming and might be awkward.

10 The purpose of the invention is to provide a roof tile clip which allows adjusting the position of the roof tile in the longitudinal direction of the batten after the clip has been mounted. A further purpose is that the clip shall be sturdy after mounting. A further purpose is that the clip shall be easy to remove. A further purpose is that the clip preferably to some extent shall be adaptable to different distances between the roof tile and the batten. A further purpose is that the clip preferably shall be in one piece, for simple handling and mounting. A further purpose is at least to provide an
15 alternative to prior art.

The purposes are achieved by the features of the claims, description and drawings.

The invention thus relates to a roof tile clip for securing a lateral edge of a lower portion of a roof tile to a batten, the lower portion of the roof tile rests on an upper portion of a below roof tile, which in turn rests on the batten, the roof tile clip
20 comprises a hook for hooking over the lateral edge of the roof tile, a securing device for securing the clip to the batten, and a shaft between the hook and the securing device. According to the invention the securing device comprises a retainer slidable in a longitudinal direction of the batten. This allows adjusting the position of the retainer, and thereby the clip and the roof tile, in the longitudinal direction of the batten after
25 the clip has been mounted. The adjustment can be made by hand. Removal of the clip can also easily be done by hand.

The invention will now be described with reference to the accompanying drawings, in which:

Fig. 1 illustrates a first embodiment of a roof tile clip according to the invention;

30 Fig. 2 illustrates the roof tile clip of fig. 1 securing a roof tile to a batten;

Fig. 3 illustrates the roof tile clip of fig. 1 securing the roof tile to the batten in a different view;

Fig. 4 illustrates the roof tile clip of fig. 1 securing the roof tile to the batten in another different view;

Fig. 5 illustrates a second embodiment of a roof tile clip according to the invention;

Fig. 6 illustrates the roof tile clip of fig. 5 securing a roof tile to a batten;

5 Fig. 7 illustrates a third embodiment of a roof tile clip according to the invention;

Fig. 8 illustrates a fourth embodiment of a roof tile clip according to the invention;
and

Fig. 9 illustrates a fifth embodiment of a roof tile clip according to the invention.

10 Fig. 1 illustrates a first embodiment of a roof tile clip 1 according to the invention. The roof tile clip 1 comprises a hook 6 for hooking over the lateral edge of a roof tile, a retainer 7 for securing the clip to a batten, and a shaft 8 between the hook 6 and the retainer 7. Before a more detailed description of the roof tile clip, its use will be discussed.

15 Fig. 2 illustrates the use of the roof tile clip 1. Two wooden battens 5, 5' extend horizontally in a longitudinal direction 9, which coincides with a transverse direction of a not illustrated underlying roof. The battens 5, 5' are fastened to the roof by screws 32. The roof slopes, typically between 25° and 45°, in direction 10, perpendicularly to the longitudinal direction 9 of the battens 5, 5'. A roof tile 2' has an upper portion resting on batten 5. An above roof tile 2 has a lower portion resting on the upper portion of roof tile 2', and an upper portion resting on batten 5'. Batten 5' is located
20 upwards of batten 5, and the roof tiles thereby overlap in the sloping direction 10 of the roof. Lugs 34 on the underside of the upper portions of the roof tiles 2, 2', see fig. 4, have contact surfaces 35 in contact with proximal sides 14 of the battens 5, 5', and prevent the roof tiles from sliding downwards in direction 10. In a completely covered
25 roof lateral edges 3, 3' of the roof tiles 2, 2' are covered by lateral edges of not illustrated neighbouring roof tiles. In this way the roof tiles overlap also in the longitudinal direction 9 of the battens 5, 5', i.e. in the transverse direction of the roof. The top surfaces of the lateral edges 3, 3' of the roof tiles have two grooves 4 for guiding water downwardly of the roof, and also for interlocking with corresponding
30 ridges on the underside of the lateral edges of the not illustrated neighbouring roof tiles.

To prevent wind from grabbing the edges of the roof tiles, and possibly lift the roof tiles and rip them off the roof, the lateral edge 3 of roof tile 2 is secured to the below batten 5 by the roof tile clip 1 of fig. 1. The hook 6 is hooked over the lateral edge 3 of the roof tile 2, and the retainer 7 is arranged around the batten 5. The shaft 8
 5 interconnects the hook 6 and the retainer 7.

Fig. 3 shows the roof tiles 2, 2', batten 5 and clip 1 in a perspective view from above, and fig. 4 shows the same from below.

The retainer 7, see fig. 1, comprises a lower portion 11, 11' for contact with a lower side 12 of the batten 5, an inner portion 13 for contact with a proximal side 14 of the batten 5, and an outer portion 15, 15' for contact with a distal side 16 of the batten 5.
 10 The illustrated retainer 7 also comprises an upper portion 17 for contact with an upper side 18 of the batten 5.

The clip 1 of fig. 1-4 is formed by a continuous springy steel wire. The lower portion of the retainer 7 is formed by two lower wire portions 11, 11' traversing the batten 5.
 15 The outer portion of the retainer is formed by two outer wire portions 15, 15' connected to the lower wire portions 11, 11' by bends 29, 29', interconnected by a bridging portion 28. The inner portion of the retainer 7 is formed by an inner wire portion 13 connected to one of the lower wire portions 11' by a bend 22. The upper portion of the retainer is formed by an upper wire portion 17 connected to the inner
 20 wire portion 13 by a bend 23. The shaft is formed by a shaft wire portion 8 connected to one of the lower wire portions 11 by a bend 20. The shaft 8 also forms a part of the inner portion 13 of the retainer 7. The hook 6 is formed by a hook of the wire at the end of the shaft wire portion 8.

When securing a roof tile 2 by the clip 1 of fig. 1-4, it is usually most convenient first
 25 to lay the roof tile 2 in place, and then mount the roof tile clip 1. The retainer 7 of clip 1 of fig. 1 is springy and arranged to be snapped on the batten 5 by hand. This may be done by placing the clip 1 close to the batten 5, with the opening between the upper portion 17 and the outer portion 15, 15' of the retainer 7 preferably at a corner of the batten 5, and then push and twist the retainer in place around the batten 5.
 30 Due to the springiness of the steel wire forming the retainer 7, the retainer 7 is held tight to the batten 5. Then the hook 6 is hooked into one of the grooves 4 of the lateral edge 3 of the roof tile 2. Both the lower portion of the roof tile 2 and the upper portion of the below roof tile 2', being locked between the lower portion of the roof tile 2 and the batten 5, are thereby secured to the batten 5.

There are no fastening devices that penetrate the batten 5, and the retainer 7 is therefore slidable in the longitudinal direction 9 of the batten 5. If adjustment of the roof tile 2 in the longitudinal direction 9 is required after mounting of the clip 1, this can be done by simply sliding the retainer 7 along the batten 5 by hand. Further, if it
 5 is required to remove the clip 1, this can be done by unhooking the hook 6 from the lateral edge 3 of the roof tile 2, and, since there are no fastening devices that penetrate the batten 5, simply pull the retainer 7 off the batten 5 by hand.

Fig. 5 illustrates a second embodiment of a roof tile clip 1 according to the invention, and fig. 6 illustrates the clip 1 of fig. 5 securing a roof tile 2 to a batten 5. This clip is
 10 similar to the clip of fig. 1, except that the lower wire portion 11 is extended by an extended wire portion 21, locating the bend 20 distant from the inner wire portion 13. This means that in use the bend 20 and the shaft 8 will be located distant from the batten 5. The extended wire portion 21 can deflect in direction 30. In fig. 6 the
 15 extended wire portion 21 has deflected towards the roof tiles 2, 2', and the bend 20 has moved to a position 20' closer to the roof tiles. Like the rest of the clip 1, the extended wire portion 21 is springy, and thereby forms a spring portion for the shaft wire portion 8. This makes the clip 1 adaptable to various distances between the roof tile 2 and the batten 5.

Going back to fig. 4, the below roof tile 2' has an upper end 36 projecting from the
 20 batten 5. The shaft 8 of the roof tile clip is located adjacent the lateral edge 3' of the upper portion of the below roof tile 2'. The shaft 8 is thereby allowed to move alongside the lateral edge 3'. It has been found that in order to stabilize the clip, this movement of the shaft 8 preferably should be hindered.

Fig. 6 illustrates a roof tile which is adapted to contact between the shaft 8 and the
 25 upper end 36 of the below roof tile 2'. This prevents the shaft 8 from moving in the sloping direction 10 of the roof, and provides a favourable, sturdier mounting of the clip. This feature of the clip has been achieved by adapting the length of the extended wire portion 21 to the length of the projecting upper end 36 of the below roof tile 2'. More precisely, with reference to fig. 4 and 6, a distance 37 between a side of the
 30 retainer inner portion 13 facing the retainer proximal side 14 and the shaft 8, is made to correspond to a distance 33 between the contact surface 35 of the lug 34 (see fig. 4) and the upper end 36 of the below roof tile 2'. The distance 33 may vary with the type of roof tiles, and the roof tile clips can be adapted to this by varying the distance 37.

Fig. 7 illustrates a third embodiment of a roof tile clip 1 according to the invention. This clip is similar to the clip of fig. 5, except that the upper portion 17 of the retainer 7 has an upwardly sloping portion 19 for guiding the retainer when mounting the clip 1. When mounting the clip, the upwardly sloping portion 19 may be placed against the batten 5, to open up the opening between the upper portion 17 and the outer portion 15, 15' of the retainer 7, and to guide the retainer around the batten 5 and in place. The upwardly sloping portion 19 thus eases the mounting of the clip 1.

Fig. 8 illustrates a fourth embodiment of a roof tile clip 1 according to the invention. This clip is punched from a plate and bent into the illustrated shape. The hook 6, the shaft 8 and the inner portion 13 of the retainer are relatively large and stiff. The outer portion 15 contacts the distal side 16 of the batten 5. This roof tile clip is also adapted to contact between the shaft 8 and the upper end 36 of the below roof tile 2'. This has been achieved by adapting the shape of the shaft 8 and the inner portion 13 of the retainer to the length of the projecting upper end 36 of the below roof tile 2'.

Fig. 9 illustrates a fifth embodiment of a roof tile clip 1 according to the invention, in which the shaft 8 and the retainer 7 are separate items, arranged to be connected after the retainer 7 is secured to the batten 5. The retainer 7 has a channel shape, bent from steel plate. The retainer has two elongated holes 26, 27 in the longitudinal direction 9 of the batten 5, in the inner 13 and outer 15 portions of the retainer 7, respectively. The shaft 8 is made from steel wire. An end of the shaft 8 is bent into the hook 6. The other end of the shaft 8 is bent into a locking pin 24, essentially in right angle to the shaft 8. The end of the locking pin 24 is bent into a locking hook 25, essentially in right angle to the locking pin.

When mounting the clip 1 of fig. 9, the retainer 7 is placed around the batten 5 from below. Then the locking pin 24 is inserted through the elongated holes 26, 27 with the shaft in horizontal position 8' and the locking hook in horizontal position 25', which allows the insertion of the locking hook through the elongated holes 26, 27. The shaft is turned by hand in direction 31 into vertical position 8, which causes the locking pin 24 and the locking hook to turn correspondingly. The locking hook turns in direction 31 to vertical position 25, and the locking pin 24 and the shaft 8 is thereby locked to the retainer 7. Then the hook 6 is hooked over the lateral edge of the roof tile, not illustrated for this embodiment of the invention. If adjustment of the roof tile and the clip 1 is required, the retainer 7 can be moved along the batten 5 by hand.

The hook 6 may take various shapes, and may interact with the lateral edge 3 of the roof tile 2 in various ways, e.g. inserted in one or both grooves 4. The invention is not

dependent upon any particular design of the hook 6 or any particular interaction between the hook and the lateral edge 3 of the roof tile 2.

5 The shaft 8 may also take various shapes. Its purpose is to connect the hook to the retainer, to provide adequate stiffness to the clip, and to be a tension element for preventing the hook to move away from the retainer. In a not illustrated alternative, the shaft 8 is springy in its longitudinal direction, for adaption to different distances between the roof tile 2 and the batten 5. This may be realized by a shaft with a spring portion, which may be a wire or plate bent into a helical or zigzag shape.

10 By using a relatively short shaft 8, and by including a spring function either by the embodiment of fig. 5, in which the bend 20 between the shaft wire portion 8 and the lower wire portions 11, 11' is distant from the batten 5, or a design in which the shaft itself has a spring effect, the shaft 8 can be held under a constant tension after mounting. In this case the upper portion 17 of the retainer 7 will not be needed for keeping the retainer in place, and can be dispensed with.

15 In the roof tile clips described with reference to the figures, the retainer 7 is without fastening devices intended to penetrate the batten 5, i.e. without spikes or nails. Further there are no portions intended for such fastening devices, i.e. there are no holes or similar intended for inserting nails, screws or other penetrating items. However, in an alternative design of the invention, features allowing fixing the retainer
20 to the batten by fastening devices that penetrate the batten may be included in addition to the features of the invention. An example of such a feature is making the retainer of fig. 9 by perforated plate, which allows hammering a nail through the retainer and into the batten. Another example may be fastening the retainer made by steel wire with a staple. Such extra fastening will normally not be required, but may
25 be done in special cases.

CLAIMS

1. A roof tile clip (1) for securing a lateral edge (3) of a lower portion of a roof tile (2) to a batten (5), the lower portion of the roof tile (2) rests on an upper portion of a below roof tile (2'), which in turn rests on the batten (5), the roof tile clip (1) comprises a hook (6) for hooking over the lateral edge (3) of the roof tile (2), a securing device (7) for securing the clip (1) to the batten (5), and a shaft (8) between the hook (6) and the securing device (7), said securing device comprises a retainer (7) slidable in a longitudinal direction (9) of the batten (5) and that the clip (1) is formed by a continuous springy wire **characterized in** the lower portion of the retainer (7) is formed by two lower wire portions (11, 11') traversing the batten (5), and the outer portion of the retainer (7) is formed by two outer wire portions (15, 15') forming extensions of the two lower wire portions (11, 11'), the outer wire portions (15, 15') are interconnected by a bridging wire portion (28) and the inner portion of the retainer (7) is formed by an inner wire portion (13) connected to one of the lower wire portions (11') by a bend (22), and the upper portion of the retainer (7) is formed by an upper wire portion (17) connected to the inner wire portion (13) by a bend (23). .
2. The clip (1) of claim 1, wherein the lower wire portion (11, 11') is adapted for contact with a lower side (12) of the batten (5), an inner portion (13) for contact with a proximal side (14) of the batten (5), and an outer portion (15, 15') for contact with a distal side (16) of the batten (5).
3. The clip (1) of claim 1 or 2, wherein the upper wire portion (17) is adapted for contact with an upper side (18) of the batten (5).
4. The clip (1) of claim 3, wherein the upper wire portion (17) of the retainer (7) has an upwardly sloping portion (19) for guiding the retainer (7) when placing it around the batten (5).
5. The clip (1) of any of the claims 2-4, wherein the shaft (8) forms the inner portion (13) of the retainer (7).
6. The clip (1) of any of the preceding claims, the below roof tile (2') has an upper end (36) projecting from the batten (5), wherein the clip (1) is adapted to contact between the shaft (8) and the upper end (36) of the below roof tile (2').

7. The clip (1) of any of the preceding claims, wherein the springy retainer (7) is arranged to be snapped on the batten (5) by hand.
8. The clip (1) of any of the preceding claims, wherein the shaft (8) in its springy longitudinal direction, is arranged to adapt different distances between the roof
5 tile (2) and the batten (5).
9. The clip (1) of any of the preceding claims, wherein the retainer (7) is without fastening devices intended to penetrate the batten (5), and without portions intended for such fastening devices.
10. The clip (1) of any of the preceding claims, wherein the shaft is formed by a shaft
10 wire portion (8) connected to one of the lower wire portion (11) by a bend (20).
11. The clip (1) of claim 10, wherein the lower wire portion (11) is extended by an extended wire portion (21), locating the bend (20) distant from the inner wire portion (13), the extended wire portion (21) forms a spring portion for the shaft wire portion (8).

KRAV

1. Takstein klips (1) for å sikre en sidekant (3) av en nedre del av en takstein (2) til en lekt (5), den nedre delen av taksteinen (2) hviler på en øvre del av en underliggende takstein (2'), som i sin tur hviler på lekten (5), takstein klipsen (1) omfattende en
5 krok (6) for å hekte over sidekanten (3) på taksteinen (2), en festeinnretning (7) for å feste klipsen (1) til lekten (5), og en aksel (8) mellom kroken (6) og festeinnretningen (7), festeinnretningen omfattende en festemekanisme (7) som kan forskyves i lektens (5) langsgående retning (9), og at klipsen (1) er dannet av en
10 kontinuerlig fjærende tråd **karakterisert ved** den nedre delen av festemekanismen (7) er dannet av to nedre tråddeler (11, 11') som krysser lekten (5), og den ytre delen av festemekanismen (7) er dannet av to ytre tråddeler (15, 15') som danner forlengelser av de to nedre tråddelene (11, 11'), de ytre tråddelene (15, 15') er forbundet med hverandre via en brodannende tråddel (28) og den indre delen av festemekanismen (7) er dannet av en indre tråddel (13)
15 som er forbundet til en av de nedre tråddelene (11') via en bøy (22), og den øvre delen av festemekanismen (7) er dannet av en øvre tråddel (17) som er forbundet med den indre tråddelen (13) via en bøy (23).
2. Klips (1) som angitt i krav 1, hvor den nedre tråddelen (11, 11') er tilpasset for
20 kontakt med en underside (12) av lekten (5), en indre del (13) for kontakt med en proksimal side (14) av lekten (5), og en ytre del (15, 15') for kontakt med en distal side (16) av lekten (5).
3. Klips (1) som angitt i krav 1 eller 2, hvor den øvre tråddelen (17) er tilpasset for
25 kontakt med en overside (18) av lekten (5).
4. Klips (1) som angitt i krav 3, hvor den øvre tråddelen (17) av festemekanismen (7) har en oppad skrånende del (19) for føring av festemekanismen (7) når den plasseres
30 rundt lekten (5).
5. Klipsen (1) som angitt i et av kravene 2-4, hvor akselen (8) danner den indre delen (13) av festemekanismen (7).
6. Klips (1) som angitt i et av de foregående kravene, den nedre taksteinen (2') har en
35 øvre ende (36) som stikker ut fra lekten (5), hvor klipsen (1) er tilpasset for å ha kontakte mellom akselen (8) og den øvre enden (36) av den nedre taksteinen (2').

7. Klips (1) som angitt i et av de foregående kravene, hvor den fjærende festemekanismen (7) er anbrakt for å smekkes på lekten (5) for hånd.
- 5 8. Klips (1) som angitt i et av de foregående kravene, hvor akselen (8) i sin fjærende lengderetning, er anbrakt for å tilpasse forskjellige avstander mellom taksteinen (2) og lekten (5).
- 10 9. Klips (1) som angitt i et av de foregående kravene, hvor festemekanismen (7) er uten festeinnretninger som er beregnet for å trenge inn i lekten (5), og uten deler som er beregnet for slike festeinnretninger.
10. Klips (1) som angitt i et av de foregående kravene, hvor akselen er dannet av en akseltråddel (8) forbundet til en av de nedre tråddelene (11) via en bøy (20).
- 15 11. Klips (1) som angitt i krav 10, hvor den nedre tråddelen (11) er forlenget med en forlenget tråddel (21), som lokaliserer bøyen (20) fjernt fra den indre tråddelen (13), den forlengede tråddelen (21) danner en fjærdel for akseltråddelen (8).

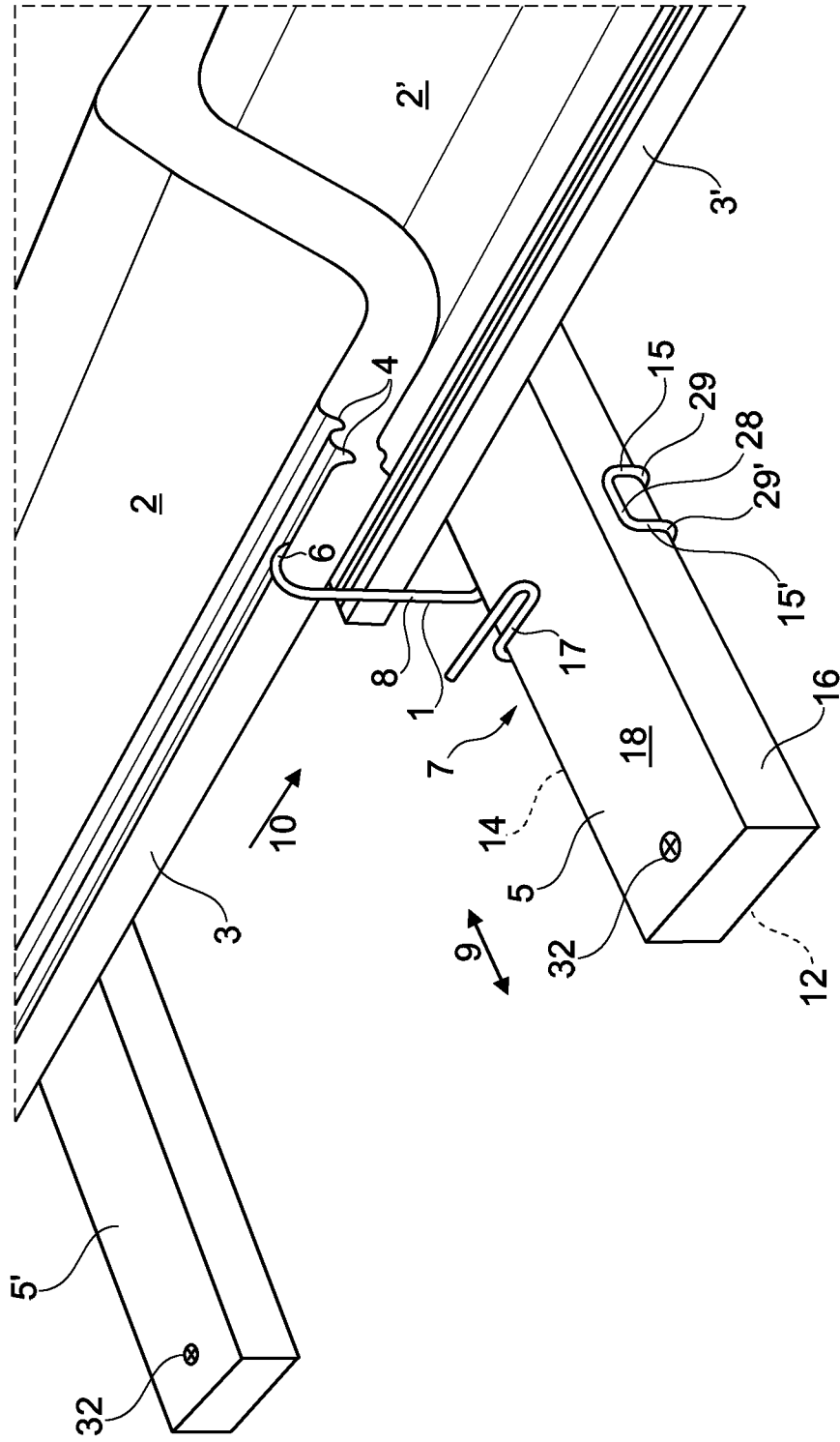


Fig. 2

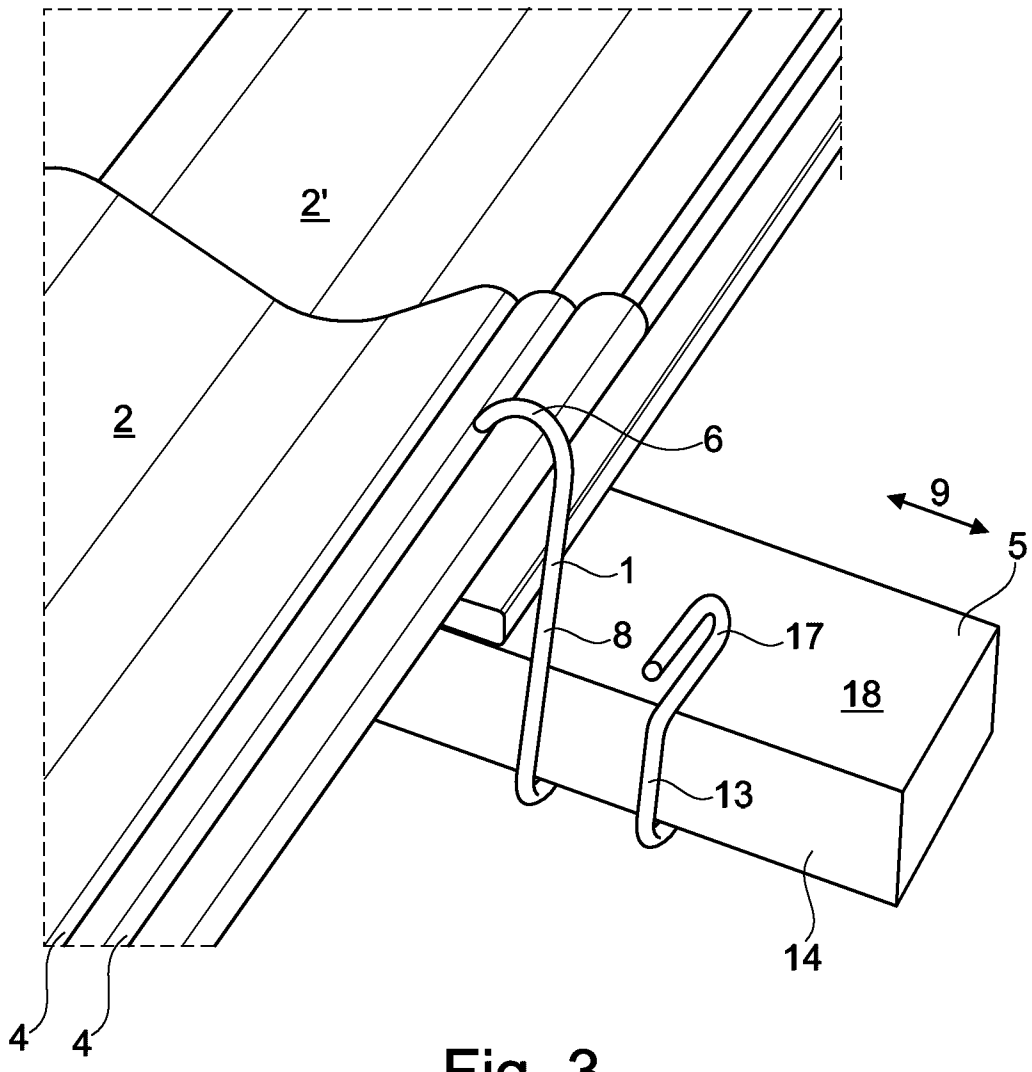


Fig. 3

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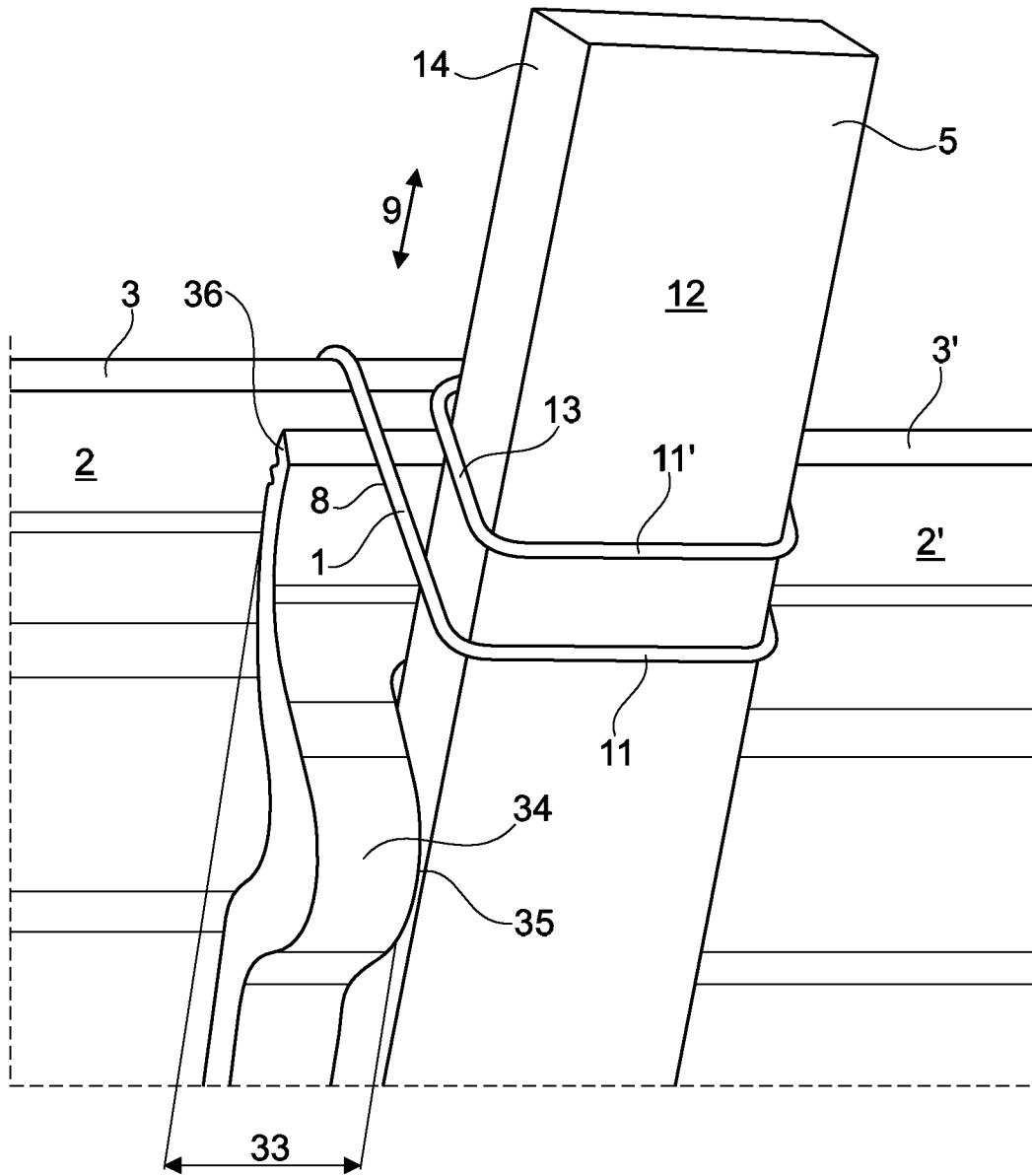


Fig. 4

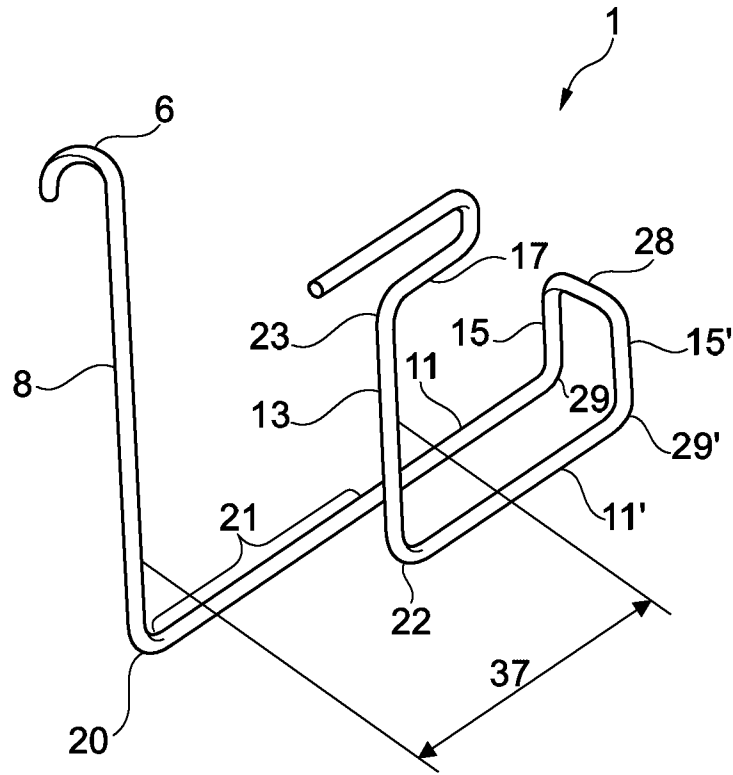


Fig. 5

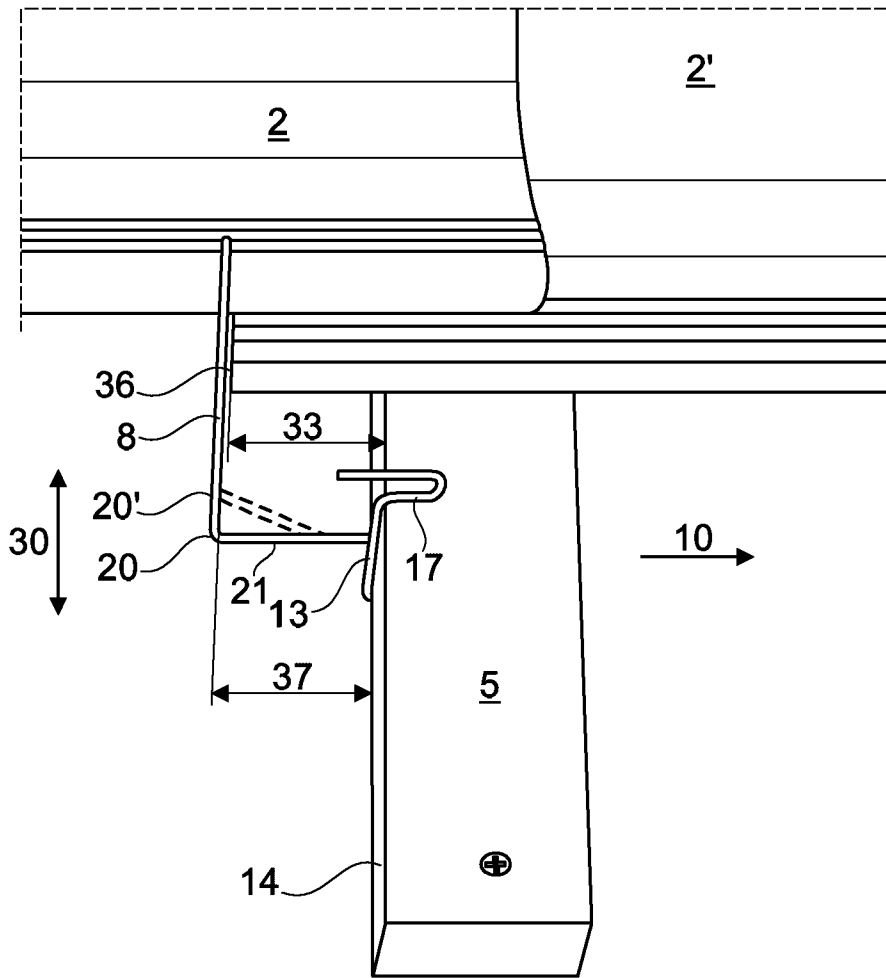


Fig. 6

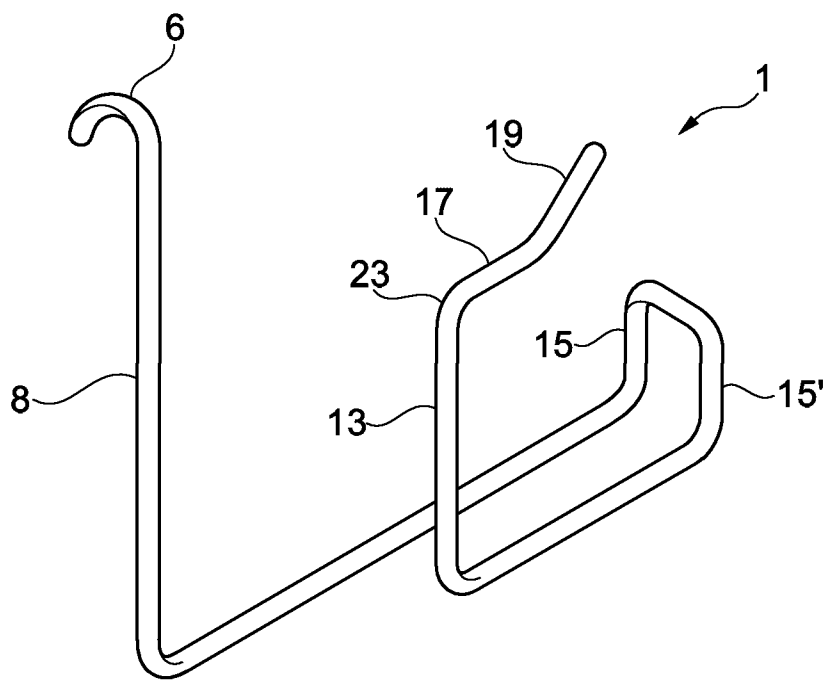


Fig. 7

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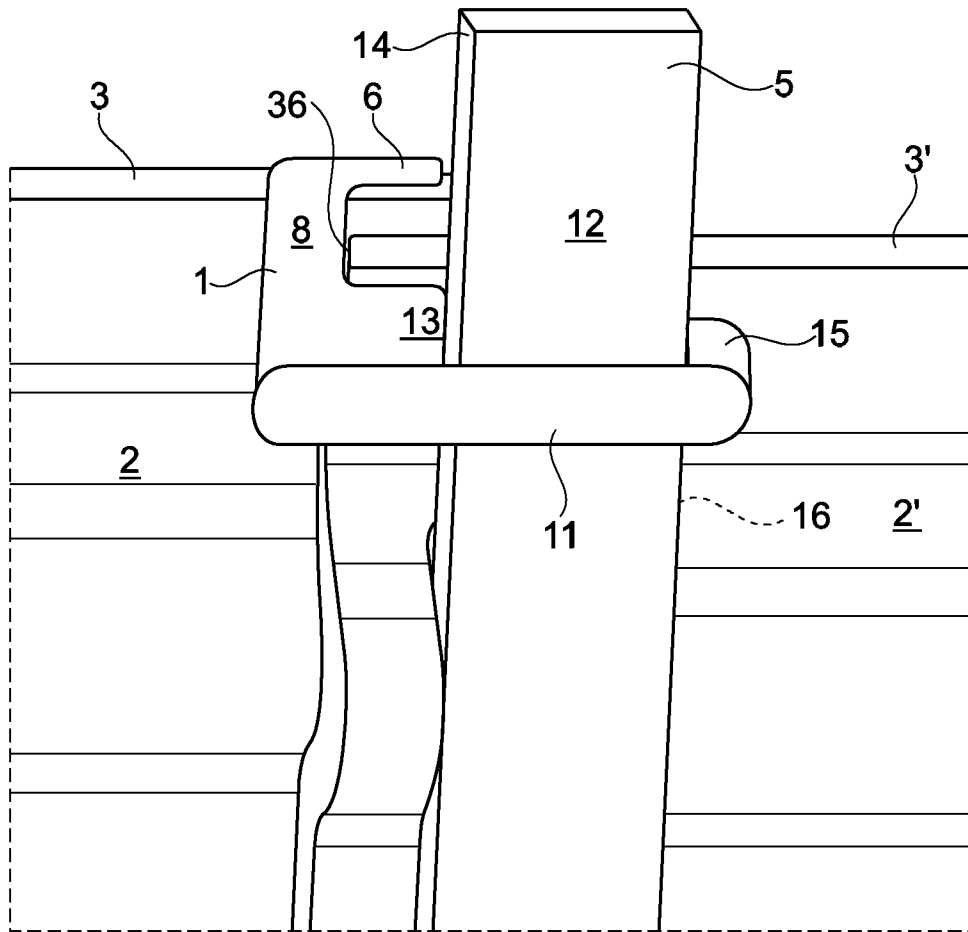


Fig. 8

