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

(11) EP 2 436 849 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
04.04.2012 Bulletin 2012/14

(51) Int Cl.:
E04D 3/365 *(2006.01)* ***E04D 1/30*** *(2006.01)*

(21) Application number: **11183459.4**

(22) Date of filing: **30.09.2011**

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

(30) Priority: **01.10.2010 FI 20106017**

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(54) Profile sheet and joint between profile sheets

(57) The present invention refers to joints between profile sheets (1) used for roofing, the joints being perpendicular to the roof ridge, and to providing support in the ridge direction for the profile sheets. The invention is based on providing the profile sheet (1) comprising, as viewed from above, a designed transverse profiling (7), with such a shape of the longitudinal profiling (4) at the lateral edges (2, 3) of the profile sheet (1), which enables overlapping profile sheets adjacent to each other in the ridge direction, in such a way, that the folds (12) of the longitudinal profiling (4) overlap only partly. Thus a larger effective width is achieved as well as an improved support in the ridge direction of adjacent profile sheets (1).

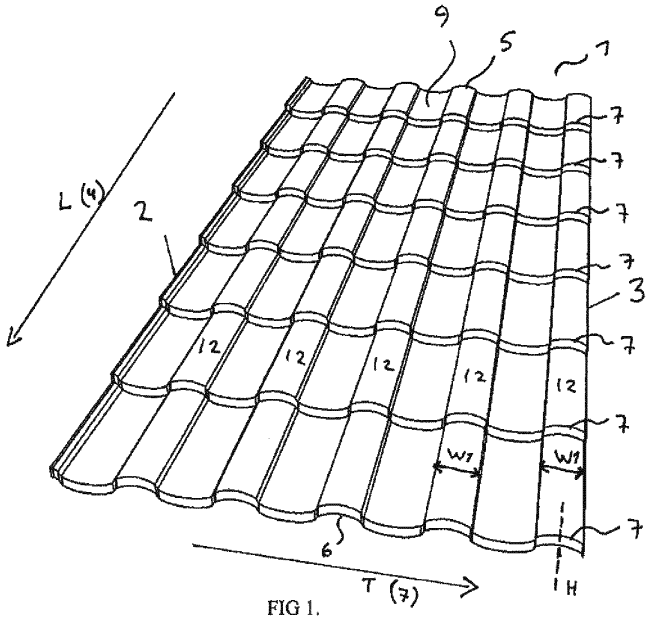

FIG 1.

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Description

Field of the Invention

[0001] The invention refers to joints extending in the direction of the lateral edges of profile sheets used as roofing, and to the profile sheet support in the ridge direction. Specifically, the invention refers to profile sheets produced out of sheet metal, according to the preamble part of claim 1, having a certain design in the ridge direction, i.e. profile sheets profiled in the transverse direction. Additionally, the present invention refers to a joint between profile sheets according to the preamble part of claim 12.

Background of the Invention

[0002] Profile sheets used as roofing almost exclusively comprise a design perpendicular to the ridge direction, which, in this context is called longitudinal profiling. It serves as a water track, a shape stiffening the profile sheet, and/or a joint means in the joint between profile sheets adjacent to each other in the ridge direction. This longitudinal profiling often makes the profile sheet a so called corrugated sheet comprising a plurality of folds extending in a direction perpendicular to the ridge. Profile sheets are often produced out of a reeled steel strip of standard width. The achievable effective width will be influenced by the selected profile design and the overlap between adjacent profile sheets.

[0003] As is well known, overlapping of profile sheets, used for roofing, adjacent to each other in the ridge direction, is done such, that the lateral edges of profile sheets adjacent to each other in the ridge direction overlap at least to the extent of one fold width. In other words, the outermost folds of adjacent profile sheets will be positioned on top of each other, i.e. they overlap, whereby support in the ridge direction between adjacent profile sheets and a simple joint between the profile sheets will be obtained. A disadvantage of this prior art solution, regarding the achievable effective width, is the overlapping sheet material used in the joint. Furthermore, the prior art sheets and joints cause abrasion in the overlapping area of two joined sheets.

[0004] Well known is also the transverse profiled profile sheet, the transverse profiling having a shape, as the roofing plane is viewed from above, constituting a straight line in the ridge direction, i.e. the step of the profile sheet being formed comprises no profiling in the edge direction as the roofing plane is viewed from above. In this prior art technology, a solution to said disadvantage has bee attempted by forming the joint between profile sheets adjacent to each other in the ridge direction in such a way, that the profile sheets overlap just by less than half a fold width. However, a disadvantage of this prior art technology is, that, in this solution, the profile sheets' support in the ridge direction is poor, since the joints between adjacent profile sheets provide little supporting effect. Thus, support in the ridge direction of the profile sheets is based exclusively on the shapes of the longitudinal profiling and support provided by any fastening screws. This poor support of the profile sheet will cause abrasion in the joint area.

Brief Description of the Invention

[0005] The object of this invention is to solve the disadvantages of the prior art solutions and to provide a profile sheet and a joint between profile sheets having a minimal overlap usage of sheet material while still providing notable support in the ridge direction for the profile sheets in the joints between the profile sheets.

[0006] The object of the invention is achieved by means of the profile sheet and the joint between profile sheets according to the independent

[0007] Claims 1 and 12. Preferred embodiments of the invention are presented as objects of the dependent claims.

[0008] The invention is based on providing such a longitudinal profile design in the area of the lateral edges of the profile sheet to a profile sheet comprising a transverse profiling as the roofing plane is viewed from above, which design enables overlapping of profile sheets adjacent to each other in the ridge direction such, that the folds of the longitudinal profile overlap just fractionally. Thus, a wider effective width and an improved support in the ridge direction of adjacent profile sheets are achieved.

[0009] The profile sheet forming a roof plane comprises upper and lower edges and first and second lateral edges. The profile sheet according to the present invention further comprises a longitudinal profiling extending in the direction of a first and a second lateral edge of the profile sheet. The longitudinal profiling comprises folds having two descent portions and a ridge portion between the descent portions. The longitudinal profiling of the profile sheet, at a second lateral edge in the lateral direction of the profile sheet, ends in an essentially complete fold. The longitudinal profiling, at a first lateral edge in the lateral direction of the profile sheet, ends in an essentially fractional fold. The fractional fold of the first lateral edge comprises fractional ridge portion of a fold and just one of the descent portions. The fractional fold is further provided with a water groove. The water groove is provided to the fractional ridge portion of the fractional fold or between the descent portion and the fractional ridge in the fractional fold. Two adjacent profile sheets are overlapped in the edge region for forming a joint such that the complete fold of the second lateral edge of a profile sheet is

arranged over the fractional fold of the first lateral edge of another profile sheet. Surprisingly, in the invention, the observation has been made, that a sufficient level of weather resiliency of the joint between adjacent profile sheets is achieved with the fractional overlap when the profile sheets are designed in the manner according to the invention. On account of the transverse profiling design of the profile sheet, the joint between adjacent and overlapping profile sheets provides excellent ridge direction support of the profile sheets, whereby potential movement of the joint perpendicular to the ridge is minimized and the conditions for decreasing the overlap of the joint are improved. In addition, the design of the transverse profiling of the overlapping profile sheets provides an excellent fixing effect during the mounting of adjacent profile sheets. Furthermore, the design of the fractional fold with the one descent portion and the fractional ridge portion of fold provide increased effective width for the profile sheet and also edge region with a good support in the overlapping area. The water groove provided to the fractional fold of the first lateral edge provides combined support effect to the joint area. Due to the above mentioned the movement adjacent profile sheets relative to each other is minimized in the joint area, and thus also abrasion of the overlapped profile sheets is minimized. According to the invention, the technical effective width of the profile sheets can be increased for the same steel strip width, which, as a technical solution, reduces the amount of sheet material used for the roofing surface.

Brief Description of the Figures

[0010]

Figure 1 shows a profile sheet according to the invention;
Figure 2 shows, in more detail, the shape of the transverse profiling of a profile sheet according to the invention;
Figure 3 shows a fractional fold at a first lateral edge of a profile sheet according to the invention;
Figure 4 shows a joint between profile sheets according to the invention; and
Figure 5 shows a front view in the direction of the roofing plane of the longitudinal profiling of a profile sheet according to the invention

Reference Numbers

[0011]

1	Profile sheet
2	First lateral edge
3	Second lateral edge
4	Longitudinal profiling
5	Upper edge
6	Lower edge
7	Transverse profiling
9	Roofing plane
10	First profile sheet
11	Second profile sheet
12	Fold
13	Fractional fold
14	Water track
15	Joint
16	Portion of the transverse profiling, extending essentially in the direction of the lateral edges
17	Descent portion of a fold
18	Ridge portion
19	Fractional ridge portion
W1	Width of a fold
W2	Width of an incomplete fold
H	Center line of a fold

Detailed Description of the Invention

[0012] Figure 1 shows a profile sheet 1 according to the invention, comprising a longitudinal profiling 4, that comprises

folds 12, extending in the direction of a first and a second lateral edge 2, 3, and a transverse profiling 7 with a design as the roofing plane 9 is viewed from above, extending in the direction of the upper and lower edge 5, 6. In other words, the transverse profiling 7 is not straight, as the roofing plane 9 is viewed from above, but comprises, for example, a wave-like shape. The profile sheet according to the invention is formed out of sheet metal, preferably out of coated sheet steel, with a thickness of 0,4 - 1 mm.

[0013] A preferable shape of the longitudinal profiling is shown in Figure 5, in which the longitudinal profiling 4 comprises upwards directed folds 12 ending, in the lateral direction T of the profile sheet, in the folds' descent portions 17. Each fold 12 comprises two descent portions 17 and a ridge portion 18 between the descent portions 17. The ridge portion is substantially planar or only slightly curved, as shown in figure 4. The substantially planar or only slightly curved ridge portion extends thus substantially in the direction of the roofing plane 9. The two descent portions 17 and the substantially planar ridge portion 18 form a shape corresponding design corresponding the design of a roof tile. The longitudinal profiling is extending in the direction of the lateral edges 2, 3. The folds of the longitudinal profiling are preferably of identical shape, with the exception of the lateral edges 2, 3 of the profile sheet. The folds 12 of the longitudinal profiling end, in the lateral direction T of the profile sheet, in a certain way at the lateral edges of the profile sheets, since the edge-most folds constitute the joint 15 between profile sheets adjacent to each other in the ridge direction.

[0014] In the joint 15 between profile sheets 10, 11 adjacent to each other in the ridge direction of a roof, shown in figure 4, one can see that, at the lateral edges 2, 3 of the profile sheet, the longitudinal profiling in the lateral direction T of the profile sheet ends in such a way, that, at the second lateral edge 3, the fold of the longitudinal profiling is complete, comprising a full ridge portion 18 of the fold 12 and two descent portions 17 directed downwards from the ridge portion 18 of the fold 12, of which descent portions 17 one preferably constitutes the second lateral edge 3 of the profile sheet.

[0015] At the first lateral edge 2, the fold 12 of the longitudinal profiling is a fractional fold 13, meaning that a fractional fold is incomplete. In other words, the fractional fold 13 comprises a fractional ridge portion 19 of a fold 12 and just one of the descent portions 17 of the fold 12, but not both. This descent portion 17 of the fold 12, located at the first lateral edge 2, does not constitute the first lateral edge 2 of the profile sheet, whereby the first lateral edge 2 is formed by the fractional ridge portion 19 of the fold 12.

[0016] Preferably, the width W2 of the fractional fold 13 is less than half of the width W1 of a complete fold 12, i.e. $W2<(W1/2)$, whereby, according to the invention, a larger effective width is achieved with the same width of the web. In other words, in the joint 15 between profile sheets according to the invention, the fractional fold 13 does not extend past the center line H of the complete fold 12. As shown in figure 4, the width of the fractional ridge portion 19 of the fractional fold 13 may be less than half of the width of the ridge portion 18 of a complete fold 12.

[0017] Preferably, the fractional fold 13 at the first lateral edge 2 comprises a water track 14, which in a controlled manner collects any capillary rising water. Most preferably, the water track 14 is formed in the fractional fold 13 such, that the water track 14 will not be located right at the edge of the profile sheet, as is shown in Figure 4.

[0018] Figure 3 shows an embodiment of a fractional fold 13 of a profile sheet according to the invention, in which fold a water track 14 has been formed. In this embodiment, the fractional fold 13 ends in the water track 14. In the joint between profile sheets, the descent portion 17 of the fractional fold 13 will be positioned tightly against the lower surface of a complete fold 12 of the other profile sheet.

[0019] According to the above mentioned the water groove 14 extends in the direction substantially parallel to the first lateral edge 2. The water groove 14 may be provided between the first lateral edge 2 and the descent portion 17 of the fractional fold 13. In one embodiment the water groove 14 is provided to the fractional ridge portion 19 of the fraction fold 13, as shown in figure 3. In an alternative embodiment the water groove 14 is provided between the fractional ridge portion 19 and the descent portion 17 fractional fold 13, that is to the corner where the descent portion 17 changes to fractional ridge portion 19, as shown in figure 4. Alternative it is also possible to provide the water groove 14 to the descent portion 17 such that the fractional fold 13 comprises a portion rising upwards from the water track 14.

[0020] The water groove 14 provided to the fractional fold 13, and especially to the fractional ridge portion or between the fractional ridge portion 19 and the descent portion 17, stiffens the fractional ridge portion of the fractional fold 13 and at the same time collects capillary water rising between the overlapped profile sheets. Therefore, the water groove 14 may be used for stiffening the fractional fold 12 and especially the fractional ridge portion 19 of the fractional fold 12.

[0021] In the joint 15 between profile sheets, according to the invention, the profile sheets 10, 11 are overlapped over an area less than half the width of a fold (W1) such, that the complete fold 12 at the second lateral edge 3 of the first profile sheet 10 is being laid on top of the essentially fractional fold 13 at the first edge of the second profile sheet 11. In other words: the size of the overlap $< (W1/2)$ for forming a joint 15 having width less than half the width W1 of a complete fold 12.

[0022] Figure 2 shows a detail view of the shape of the transverse profiling of a profile sheet 1 according to the invention, said shape having a certain design as the roofing plane 9 is viewed from above. In other words, in the direction of the upper and lower edges 5, 6, as the roofing plane is viewed from above, the shape of the transverse profiling 7 is not straight, but it partly comprises a shape in the direction of the lateral edges 2, 3, such as a wave-like or angulated

form. In other words, the wave-like form of the transverse profiling 7, or, preferably, the wave-like form of the transverse profiling 7 having a portion 16, essentially parallel to the lateral edges 2, 3, will support mutually overlapping profile sheets in the ridge direction of a roof. The support reaction occurs in the joint between profile sheets 1 adjacent to each other in the ridge direction, when two or more profile sheets 1 are joined together in the ridge direction. This support will compensate for a weakening of the support in the ridge direction, caused by the partial overlap between profile sheets adjacent to each other in the ridge direction. Most preferably, the portion 16, essentially parallel to the lateral edges, of the transverse profiling will be positioned at the descent portions 17 of the folds 12 of the longitudinal profiling. Most preferably, the portion 16, parallel to the lateral edges, is straight as the roofing plane 9 is viewed from above, and comprises a planar surface essentially perpendicular to the roofing plane 9 for further improvement of the support in the ridge direction of a roof. In case several profile sheets 1 are joined, one after each other, in a direction transverse to the ridge direction, overlapping such, that the profile sheets 1 overlap over an area between the upper edge 5 and, in the direction of the lateral edges 2, 3, the first transverse profiling 7, counting from the upper edge, of the lower profile sheet, a shape interlock is formed between the profile sheets to be joined, which interlock further prevents profile sheet movement in the ridge direction.

[0023] The term transverse profiling designates the profiling, or design, in the direction of the upper and lower edge of the profile sheet. Preferably the transverse profiling comprises one or more terraced step, or just step, as shown in the figures. Preferably, the plane formed by the steps is essentially perpendicular to the roofing surface 9. The shape of the transverse profiling 7 is contiguous throughout the roofing plane 9, i.e. the terraced steps are identical. According to the invention, between the upper and lower edges 5, 6, there may be one or more instances of transverse profiling 7. Preferably, the lower edge 6 of the profile sheet comprises a design with a shape corresponding to the transverse profiling 7, i.e. a terraced step, whereby it, by means of its lower edge 6, can connect to the first transverse profiling 7, i.e. terraced step, as measured from the upper edge of the profile sheet being installed below the previous profile sheet.

[0024] The roofing plane 9 of the roofing designates the surface of the profile sheet 1, which is inclined, for example, from the ridge of the roof in the roof angle direction. The upper and lower edge 5, 6 of the profile sheet designate the edges parallel to the ridge of the roof or of the roofing surface. The first and second lateral edge 2, 3 of the profile sheet 1 are the edges extending at a right angle to the ridge.

[0025] The profiling designates the design independent of the manner of manufacturing used. Preferably, the longitudinal profiling is produced by roll forming and the transverse profiling by pressing.

[0026] The design of the folds 12, having two descent portions 17 and a substantially planar or only slightly curved ridge portion 18, enables forming durable and tight joints 15 between adjacent profile sheets. The fractional fold 13 according to the present invention enables efficient material use of the profile sheet. Furthermore, providing the water groove 14 to the fractional fold 13 stiffens the fractional fold 13 and the joint 15 between the adjacent profile sheets. The fractional fold 13 with the water groove provides together with the design of the folds 12, 13 a joint in which the abrasion between the overlapped profile sheets is minimized. Especially, the design of the fold 12, 13 and the water groove prevent or at least alleviate the abrasion of the first lateral edge 2 underside of the fold 12 of an other profile sheet in the joint 15 area.

[0027] To a person skilled in the art, it is obvious, that, with developing technology, the basic idea of the invention can be implemented in a multitude of different ways. Thus, the invention and its embodiments are not limited to the examples described above, but rather, they can vary within the scope of the patent claims.

Claims

1. A profile sheet (1) forming a roofing plane (9), said profile sheet (1) comprising a longitudinal profiling (4) extending in the direction of a first and a second lateral edge (2, 3), the longitudinal profiling (4) comprising folds (12) having two descent portions (17) and a ridge portion (18) between the descent portions (17), and one or more transverse profiling (7), extending in the direction of an upper and a lower edge (5, 6), the one or more transverse profiling (7) having a certain design as the roofing plane (9) is viewed from above, the longitudinal profiling (4) of the profile sheet (1), at a second lateral edge (3) in the lateral direction (T) of the profile sheet (1), ends in an essentially complete fold (12), and, at a first lateral edge (2), in an essentially fractional fold (13), for forming a joint (15) extending in the direction (L) of the lateral edges of the profile sheets, **characterized in that** the fractional fold (13) of the longitudinal profiling (4) at the first lateral edge (2) is composed of a fractional ridge portion (19) of a fold and just one of the descent portions (17).

2. The profile sheet according to claim 1, **characterized in, that** the width (W2) of the fractional fold (13) is less than half of the width (W1) of a complete fold (12), and W2<(W1/2).

3. The profile sheet according to claim 1 or 2, **characterized in, that**, at the second lateral edge (3), the fold of the

longitudinal profiling (4) is complete, comprising the ridge portion (18) of a complete fold (12) and, extending downwards from the ridge portion (18) of the complete fold (12), two descent portions (17) of the fold, one descent portion (17) of which constituting the second lateral edge (3) of the profile sheet (1).

4. The profile sheet according to any one of claims 1 to 3, **characterized in, that** the width of the fractional ridge portion (19) of the fractional fold (13) is less than half of the width of the ridge portion (18) of a complete fold (12).

5. The profile sheet according to claim 1, **characterized in, that** the shape of the transverse profiling (7), extending in the direction of the upper and lower edge (5, 6), is wave-like, as the roofing plane (9) is viewed from above.

6. The profile sheet according to claim 5, **characterized in, that**, as viewing the roofing plane (9) from above, the shape of the transverse profiling (7), extending in the direction of the upper and lower edge (5, 6), comprises portions (16), essentially parallel to the lateral edges (2, 3), for further improving the support in the ridge direction of adjacent profile sheets.

7. The profile sheet according to claim 6, **characterized in, that** as the roofing plane (9) is viewed from above, the shape of the transverse profiling (7), extending in the direction of the upper and lower edge (5, 6), at the descent portions (17) of the fold (12) of the longitudinal profiling (4) running in the direction of the lateral edges, comprises portions (16), essentially parallel to the lateral edges (2, 3).

8. The profile sheet according to any one of the claims 1 - 7, **characterized in, that** the fractional fold (13) comprises a water groove (14).

9. The profile sheet according to claim 8, **characterized in, that** the water groove (14) extends in the direction substantially parallel to the first lateral edge (2).

10. The profile sheet according to Claim 9, **characterized in, that** the water groove is provided between the first lateral edge (2) and the descent portion (17) of the fractional fold (13).

11. The profile sheet according to claim 8 or 9, **characterized in, that** the water groove (14) is provided to the fractional ridge portion (19) of the fraction fold (13), or that the water groove (14) is provided between the fractional ridge portion (19) and the descent portion (17) fractional fold (13).

12. A joint (15) between profile sheets (1), which profile sheets (1) comprise a longitudinal profiling (4) extending in the direction of a first and a second lateral edge (2, 3), the longitudinal profiling (4) comprising folds (12) having two descent portions (17) and a ridge portion (18) between the descent portions (17), and one or more transverse profiling (7), extending in the direction of an upper and a lower edge (5, 6), the one or more transverse profiling (7) having a certain design as the roofing plane (9) is viewed from above, the longitudinal profiling (4) of the profile sheet (1), at a second lateral edge (3) in the lateral direction (T) of the profile sheet (1), ends in an essentially complete fold (12), and, at a first lateral edge (2), in an essentially fractional fold (13), in which joint (15) the profile sheets (10, 11) overlap on top of each other in the area of the joint between the lateral edges (2, 3) of adjacent profile sheets, the profile sheets (10, 11) being overlapped over an area less than half the width (W1) of a fold (12) such, that the complete fold (12) located at the second lateral edge (3) of the first profile sheet (10) will be positioned on top of the essentially fractional fold (13) located at the first lateral edge (2) of the second profile sheet (11), **characterized in that** the fractional fold (13) of the longitudinal profiling (4) at the first lateral edge (2) is composed of a fractional ridge portion (19) of a fold and just one of the descent portions (17) for forming a joint (15) having width less than half the width (W1) of a fold (12).

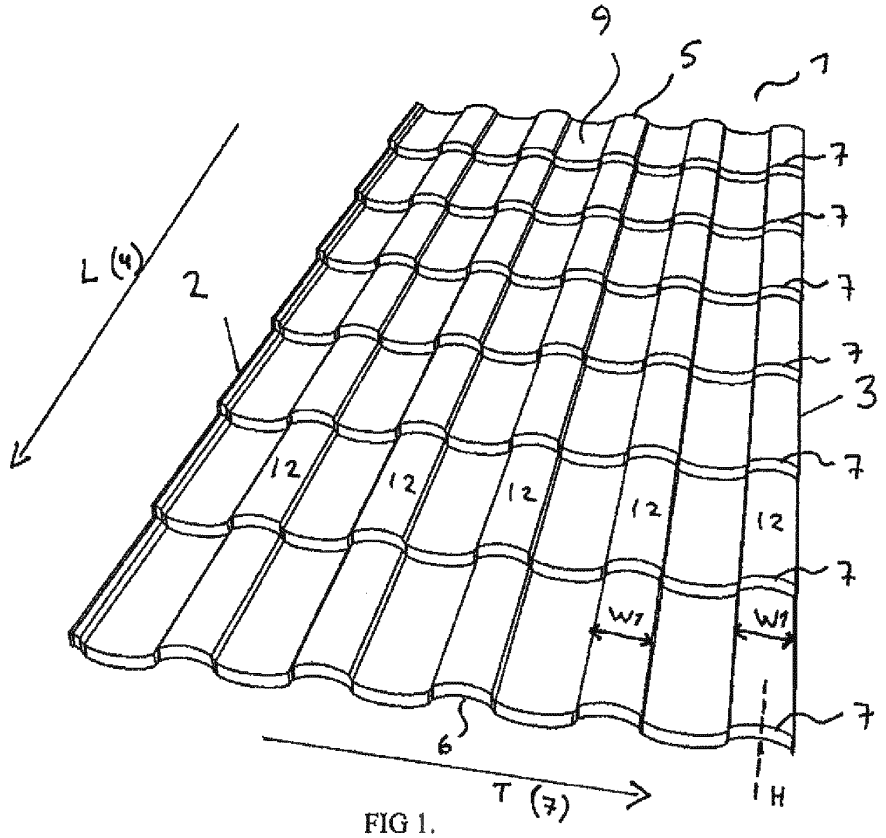
13. The joint (15) according to claim 12, **characterized in, that**, as viewing the roofing plane (9) from above, the shape of the transverse profiling (7), extending in the direction of the upper and lower edge (5, 6) of the profile sheets, comprises portions (16) extending essentially parallel to the lateral edges (2, 3) for further improving the support in the ridge direction of adjacent profile sheets.

14. The joint (15) according to claim 12 or 13, **characterized in, that** the fractional fold (13) comprises a water groove (14).

15. The joint (15) according to claim 14, **characterized in, that** the water groove (14) extends in the direction substantially parallel to the first lateral edge (2).

16. The joint (15) according to claim 14 or 15, **characterized in, that** the water groove (14) is provided between the first lateral edge (2) and the descent portion (17) of the fractional fold (13).

17. The joint (15) according to claim 16, **characterized in, that** the water groove (14) is provided to the fractional ridge portion (19) of the fraction fold (13), or that the water groove (14) is provided between the fractional ridge portion (19) and the descent portion (17) fractional fold (13).


9
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L (4)
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12
12
12
12
12
7
W1
W1
7
6
T (7)
H

FIG 1.

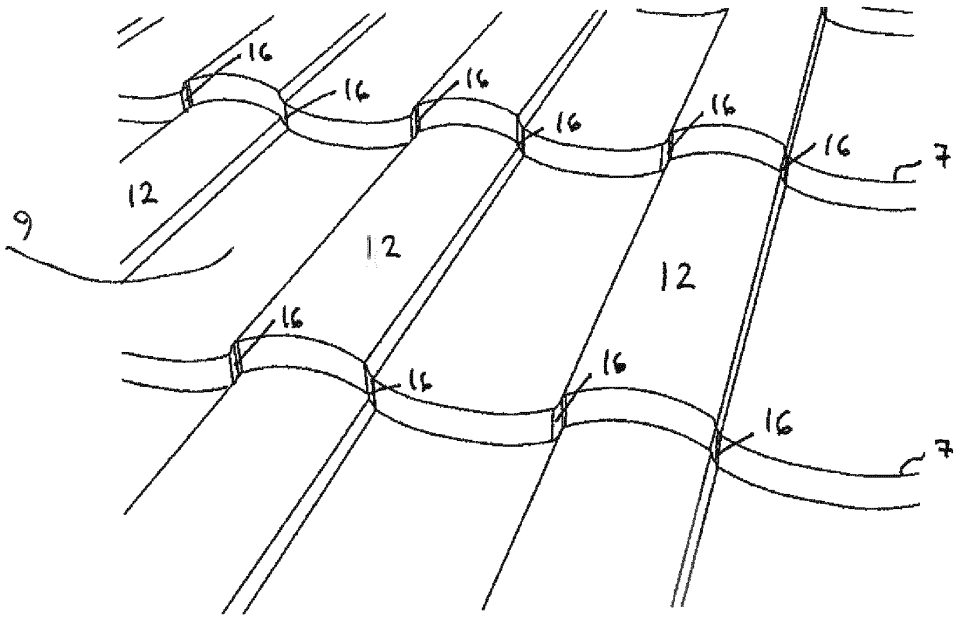
16
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FIG 2.

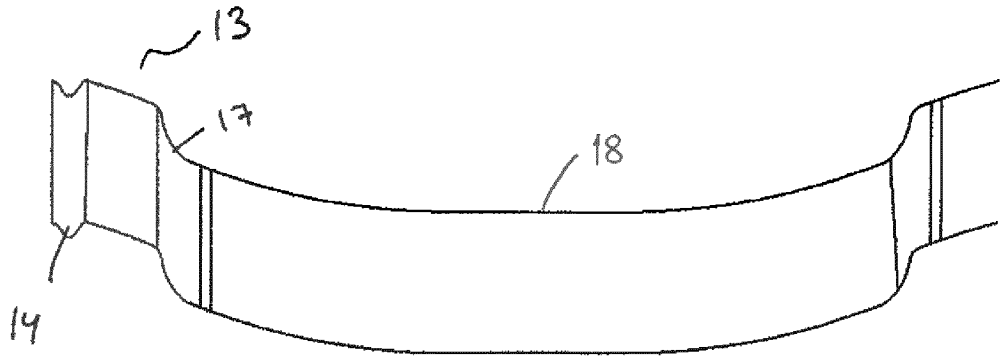


FIG 3.

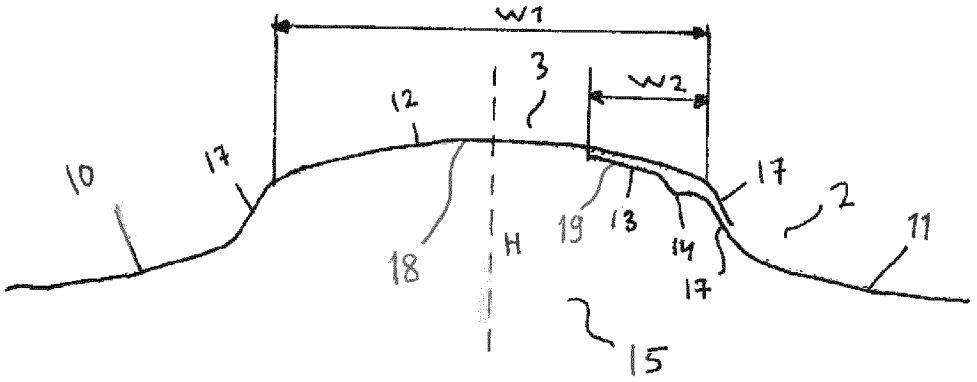
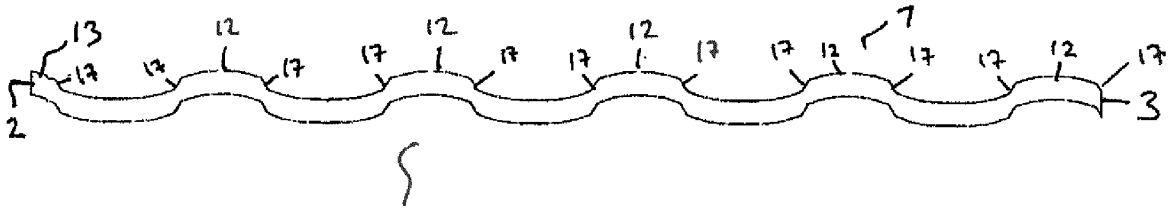


FIG 4.



7, 4 FIG. 5