ABSTRACT

Retaining rail (1) for holding down roofing membranes of flat roofs comprises a web (13) and lateral edge folds (14,14'). The web (13) is provided with openings (11) for attaching fastening means (10). Each of the lateral edge folds (14,14') forms bearing-side shoulders (21,21'). The web (13) lies above the bearing plane (26) defined by the bearing-side shoulders (21,21').
RETAINING RAIL FOR ROOFING MEMBRANES

TECHNICAL FIELD

[0001] The invention relates to a retaining rail for holding down roofing membranes in flat roofs, according to the preamble of the first claim.

PRIOR ART

[0002] Flat roofs usually have a multi-layer structure and substantially comprise a load-bearing roof substructure which can be composed of a trapezoidal steel sheet, of reinforced wooden panels or of reinforced or aerated concrete. Above this load-bearing roof substructure is generally situated a vapor barrier layer of bitumen, polymer bitumen or plastic. This vapor barrier layer is intended to retard or prevent the diffusion of water vapor into the thermal insulation and under the sealing system. On top of this vapor barrier layer is situated a thermal insulating layer which can consist, for example, of mineral fiber felt, polystyrene (PS), expanded polystyrene (EPS) or extruded polystyrene (XPS) and which in turn is covered by a roof skin. This roof skin generally comprises a plurality of adjacent, welded-together sealing membranes which cover the roof to make it watertight, i.e. protect it from penetrating water. These sealing membranes, or protective sheets, are generally plastic membranes consisting of plastics which are provided with fillers and colorants, such as PVC, PO, FPO or TPO, for example.

[0003] Given the wind suction forces which act on the roof surface during windy weather conditions, these sealing membranes must additionally be secured to the roof. Thus, these sealing membranes are, for example, adhesively bonded to the thermal insulation or held on the roof by means of mechanical aids. A simple and frequently used method for holding sealing membranes on the roof comprises pouring a 5 to 10 cm thick layer of gravel over the sealing membranes. However, this way of mechanically securing the roof skin has the disadvantage that it is very weight-intensive and relatively expensive, in other words negates the advantages of a flat roof construction (lightweight, cost-effective and capable of being walked on). In particular, sharp-edged pieces of gravel can injure and damage the sealing membranes if the roof is routinely used as a walkable surface.

[0004] Owing to these disadvantages, there has been a switch to using panel- or disk-shaped or strip- or rail-shaped elements for holding down the roofing membranes. Such elements are described, for example, in US-2005/0196253 or US-2004/0040243 and comprise openings for receiving fastening means, such as screws or nails. In order to be able to securely hold down the roofing membranes when exposed to wind suction, the fastening means must extend right through all the layers and into the roof substructure. It is self-evident that the perforations in the roofing membranes caused by the fastening means must be sealed again. This customarily entails using cover pieces or strips which are fitted over the disk- or panel-shaped or strip- or rail-shaped elements for holding down the roofing membranes.

[0005] Utility model specification DE 20 2005 006 231 U1 describes a rail-shaped component for holding down a sealing membrane, wherein the longitudinally extending edge zones have wall-shaped deformations or bent-over portions. This has the advantage that the cover strips fitted over the rail-shaped components do not bear directly on the heads of the fastening means (screw heads or nail heads), and it is thus possible to avoid a situation in which these fastening means can damage the roofing membrane cover strips and cause losses of sealing. This is especially applicable if these rail-shaped components are stepped on when walking over the flat roof. Components or hold-down means having such wall-shaped deformations or bent-over portions prove to be particularly safe to walk on. In addition, such wall-shaped deformations or bent-over portions have the advantage that they provide the rail-shaped hold-down means with an increased bending stiffness in the longitudinal direction. They reduce the risk during mounting of unintentional downward buckling and of further injury to the sealing membrane.

[0006] In the case of these profiled hold-down rails, the contact pressure on the roofing membrane acts substantially along the mid-line of the rail, that is to say at locations where the forces of the fastening means act. Unfortunately, these rails bend during mounting owing to the elastic substrate (thermal insulation below the sealing membrane) and to the self-elasticity of the rail in the transverse direction, a situation which can even result, in the mounted state, in the edges lifting off the roofing membrane and in laterally located welding beads sliding under the retaining rail, which means that these beads are no longer available for the welding operation. In any event, the contact pressure on the sealing membrane considerably reduces toward the edges of the rail when mounting these retaining rails. If, during squally, i.e. strongly changing, wind conditions, roofing membranes secured in this way are exposed to wind suction forces of greater or lesser strength coming from different directions, this results not only in vertical movements but also in horizontal movements of the sealing membrane, which in turn can result in the sealing membrane being torn in the region of the fastening means. The retaining rails described in the aforementioned utility model specification cannot prevent such tearing.

SUMMARY OF THE INVENTION

[0007] It is therefore the object of the present invention to provide a rail for holding down a roofing membrane, also referred to as a retaining rail below, which does not have the disadvantages of the known hold-down rails. In particular, it is intended that a lightweight retaining rail which can withstand being stepped on and has an increased longitudinal rigidity be provided that prevents movements of the membrane, and hence tearing, or wearing, of the sealing membrane in the region of the fastening means, and ensures a watertight welding of the cover strips to the roof covering membrane by means of a welding bead.

[0008] This object is achieved according to the invention by a retaining rail having the features of claim 1 and in particular by a retaining rail which comprises a cross-sectional profile having a central web and having lateral edge folds, the web being provided with openings for affixing fastening means.

[0009] According to the invention, each of the lateral edge folds forms at least one bearing-side shoulder, and the web is situated above the bearing plane defined by these bearing-side shoulders. As a result, the web does not bear on the roof covering membrane and, even in the mounted state, presses it in to only a small extent, if at all. This web arrangement ensures that the force on the retaining rail exerted by the fastening means is transmitted from the web to the edge folds and is not limited to the center. By virtue of the retaining rail profiling according to the invention, the bearing surface is reduced by comparison with conventional retaining rails, and
hence the contact pressure in the region of this bearing surface is increased. The multiple fold leads to an increased longitu-
dinal rigidity and thus allows the number of required fasten-
ing means and the material thickness of the retaining rail to be reduced.

[0010] With particular advantage, each of the lateral edge folds forms a plurality of bearing-side shoulders.

[0011] Apart from the aforementioned advantages, this multiple fold leads to an increased longitudinal rigidity and thus allows the number of fastening means required and the material thickness of the retaining rail to be reduced further.

[0012] Further advantageous refinements of the invention are given in the subclaims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] Exemplary embodiments of the invention will be explained in more detail below with reference to the draw-
ings. Like elements are provided in the various figures with the same reference numbers.

[0014] In the figures:

[0015] FIG. 1 shows a schematic representation of a retaining rail of known type, in cross section;

[0016] FIG. 2 shows a perspective representation of a flat roof of known type, in cross section;

[0017] FIG. 3 shows a schematic representation of a retaining rail of known type mounted on a flat roof, in cross section;

[0018] FIG. 4 shows a schematic representation of a retaining rail according to the invention, in cross section;

[0019] FIG. 5 shows a schematic representation of a particular advantage occurring retaining rail according to the inven-
tion, in cross section;

[0020] FIG. 6 shows a schematic representation of a retaining rail according to the invention as shown in FIG. 5 mounted on a flat roof.

[0021] Only those elements essential for an immediate understanding of the invention are shown.

Way of Implementing the Invention

[0022] FIG. 1 shows a retaining rail 1 of known type, in cross section. This retaining rail 1 comprises a web 2 and lateral edge folds 3, 3'. The term “fold” as used below is intended to mean any type of deformation which follows an arbitrary line. This retaining rail 1 is fastened to the roof substructure using suitable fastening means 10—in this case, for example, using a screw 10' and a washer 10".

[0023] FIG. 2 shows a cross section through the structure of a flat roof 4 in a perspective view. This flat roof 4 comprises a substructure 5 which is generally composed of a trapezoidal steel sheet, of wooden panels or of a reinforced or aerated concrete. On top of this roof substructure 5 is situated a vapor barrier 6 and a thermal insulating layer 7. Sealing membranes are placed over the thermal insulating layer 7. Retaining rails 1 secure the sealing membranes 8 against the wind suction forces and are anchored in the roof substructure via fastening means (not shown). Over the retaining rails 1 are provided cover strips 9 which are welded to the sealing membranes 8 so as to ensure that no water can penetrate the flat roof 4, otherwise laid watertight, at those points on the sealing membranes 8 which are perforated as a result of the fastening means.

[0024] FIG. 3 schematically shows a retaining rail 1 of known type fitted on a flat roof 4. The retaining rail 1 is here fastened to the flat roof 4 by means of a screw 10'. Schematically represented is the conventional roof structure composed of a roof substructure 5, a vapor barrier 6, a thermal insulating layer 7 and a sealing membrane 8. Over the retaining rail 1 is fitted a cover strip 9 which is welded to the sealing membrane 8. The screw 10' is passed through an opening in the retaining rail 1 and anchored in the roof substructure 5. In the mounted state, the contact pressure of the retaining rail 1 on the roofing membrane 8 acts substantially along the mid-line of the retaining rail, that is to say at those locations where the forces of the fastening means 10 act. Because of the elastic substrate (thermal insulation 7 below the sealing membrane 8) and the self-elasticity of the retaining rail 1, the retaining rail 1 bends upon mounting, thereby possibly resulting in the edge regions thereof, together with the edge folds 3, 3', lifting off the roofing membrane. Laterally located welding beads can slide under the retaining rail 1 at these points, which means that these beads are no longer available for the welding operation and unsealed areas arise. This FIG. 3 makes it clear how the contact pressure on the sealing membrane 8 considerably decreases toward the edge regions of the rail 1 during mounting of the retaining rail 1. If, during squally, i.e. strongly changing, wind conditions, roofing membranes 8 secured in this way are now exposed to wind suction forces of greater or lesser strength coming from different directions, this leads not only to vertical movements but also to horizontal move-
ments of the sealing membrane 8, which in turn can result in the sealing membrane 8 being torn in the region of the fasten-
ing means 10.

[0025] FIG. 4 shows a retaining rail 1 according to the invention, in cross section. The retaining rail 1 comprises a web 13, openings 11 for receiving fastening means 10, and two edge folds 14, 14' formed in meandering fashion. Each of the lateral edge folds 14, 14' forms a bearing-side shoulder 21, 21', the web 13 being situated above the bearing plane 26 defined by the bearing-side shoulders 21, 21', whereby a gap 20 is formed between the web 13 and the bearing plane 26. Each of the two edge folds 14, 14' formed in meandering fashion is folded such that, starting from the web 13, the profile of this retaining rail 1 has a first fold 15 leading toward the bearing plane 26, which first fold 15 is followed by a second fold 16 which leads away from the bearing plane 26 and which forms a first bearing-side shoulder 21 which is followed by a fold 19 leading back toward the web 13. It will be understood that the folds 24, 24' of the folded profile can be spaced apart from one another in such a way that said profile can be walked on without risk of injury to the cover strip 9.

[0026] Of importance for the invention is the fact that the bearing surfaces of the shoulders 21, 21' are reduced by comparison with the bearing surfaces in conventional retaining rails 1 in order to be able to increase the contact pressure in the region of the bearing surfaces. A fold according to the invention is distinguished in that the first fold 15 directed toward the bearing plane 26 has a curvature of 30°–90°, preferably 45°. The second fold 16 has a curvature of 60°–180°, preferably 135°. The fold 19 has a curvature of 30°–150°, preferably 90°. The ends 24, 24' are dimensioned such that the retaining rail 1 when stepped on does not injure the over-
lying cover strip 9.

[0027] FIG. 5 shows a preferred embodiment of a retaining rail 1 according to the invention, in cross section. The retaining rail 1 comprises a web 13, openings 11 for receiving fastening means 10, and two edge folds 14, 14' formed in meandering fashion. Each of the lateral edge folds 14, 14' forms a plurality of bearing-side shoulders 21, 21', 22, 22', the web 13 being situated above the bearing plane 26 defined by
the bearing-side shoulders 21, 21', 22, 22', whereby a gap 20 is formed between the web 13 and the bearing plane 26. Each of the two edge folds 14, 14' formed in meandering fashion is folded such that, starting from the web 13, the profile of this retaining rail 1 has a first fold 15 leading toward the bearing plane 26, which first fold 15 is followed by a second fold 16 which leads away from the bearing plane 26 and which forms a first bearing-side shoulder 21, which second fold 16 is followed by a third fold 17 which leads toward the bearing plane 26 and which forms a comb 23, which third fold 17 is followed by a fourth fold 18 which leads away from the bearing plane 26 and which forms a second bearing-side shoulder 22, which fourth fold 18 is followed by a fifth fold 19 leading back toward the web 13. It will be understood that the ends 24, 24' of the folded profile can be spaced apart from one another in such a way that said profile can be walked on without risk of injury to the cover strip 9.

[0028] Of importance for the invention is the fact that the bearing surfaces of the shoulders 21, 22 and 21', 22' are reduced by comparison with the bearing surfaces in conventional retaining rails 1 in order to be able to increase the contact pressure in the region of the bearing surfaces. A multiple fold according to the invention is distinguished in that the first fold 15 directed toward the bearing plane 26 has a curvature of 30°-90°, preferably 45°. The second fold 16 has a curvature of 60°-180°, preferably 135°. The third fold 17 has a curvature of 60°-180° and preferably of 180°. The fourth fold 18 has a curvature of 60°-180°, but preferably of 180°. The fifth fold 19 has a curvature of 30°-150°, preferably of 90°. The ends 24, 24' are dimensioned such that the retaining rail 1 when stepped on does not injure the overlying cover strip 9.

[0029] In a further embodiment of the present retaining rail 1, the first bearing-side shoulders 21, 21' are not situated in the same plane as the second bearing-side shoulders 22, 22'.

[0030] FIG. 6 shows a schematic representation of a retaining rail 1 according to the invention fitted on a flat roof 14. This FIG. 6 makes clear the advantage of the profile according to the invention. In the mounted state, the retaining rail 1 is fastened to the flat roof 14 by means of a screw 10. The web 13 spaced apart from the bearing plane 26 is pulled toward the sealing membrane 8 by the screw 10. The gap 20 allows a free deflection of the web 13. As a result, the force exerted on the retaining rail 1 by the screw 10 is directly transmitted to the edge folds 14, 14' and hence to the shoulders 21, 21' and 22, 22'. The force exerted by the screw 10 thus acts on a very much smaller area than in a conventional retaining rail 1, which in turn results in the fact that, for an identical screw force, the contact pressure on the sealing membrane 8 is very much higher than in a conventional retaining rail 1. In particular, the contact pressure acts via the lateral edge folds 14, 14' of the retaining rail 1 and not via the center of said rail. Consequently, vertical and horizontal movements of the sealing membrane 8 can be completely eliminated and tearing of the sealing membrane 8 can be avoided.

[0031] When subjected to wind suction forces, the multiple fold 14, 14' according to the invention produces an additional spring force on the covering membrane 8 since, when the outer second bearing shoulder 22 is lifted, it is spread apart from the first bearing shoulder 21. Moreover, the multiple fold according to the invention results in an increased longitudinal rigidity of the retaining rail 1, which enables the number of fastening openings 11 to be reduced and the retaining rail 1 to be fabricated from a thinner material, thereby leading both to savings in weight and in cost.

[0032] In a preferred embodiment, the retaining rail 1 according to the invention is fabricated from a stainless steel and has a material thickness of 1.5 mm or less. The retaining rail 1 is 30 mm wide in this embodiment, the web 13 having a width measurement of 16 mm. When the retaining rail 1 bears on an underlying surface, it forms with the bearing plane 26 a gap 20 having a height of about 1 mm. The second and fourth folds 16, 18 form two shoulders 21 and 22 which are preferably situated in one plane. It will be understood that these shoulders 21, 22 can have different heights with respect to the bearing plane 26. The fifth fold 19 is arranged such that the edge portion 24 bears on the comb 23. In this embodiment, the edge fold 14 has an overall height of 7 mm. The length of this retaining rail 1 is about 3 m.

[0033] The advantages of the present retaining rail 1 are immediately obvious to a person skilled in the art and can be seen in particular in the increase in the lateral contact pressure and the increase in the longitudinal rigidity. In particular, the contact pressure zone is located away from the region of the fastening means 10 so as to prevent damage to the sealing membrane 8 in the region of the fastening means 10. Moreover, the frictional connection between the meandering deformation of the edge folds 14, 14' and the sealing membrane 8 prevents a possible welding bead 12 laid laterally alongside the retaining rail 1 from being able to slide under the retaining rail 1 and hence being no longer useable for the welding operation.

[0034] Of course, the invention is not limited to the exemplary embodiment which has been shown and described. The retaining rail can also be made of other materials which are advantageously protected from rust or free of rust, in particular also of hot-dip galvanized steel. The material thickness of the retaining rail can also be dimensioned to be other than described above, with material thicknesses of 2 mm or less being particularly advantageous.

1. A retaining rail for holding down roofing membranes in flat roofs, which retaining rail comprises a profile having a web and lateral edge folds, the web being provided with openings for affixing fastening means, characterized in that each of the lateral edge folds forms at least one bearing-side shoulder, the web being situated above the bearing plane defined by the bearing-side shoulders.

2. The retaining rail as claimed in claim 1, wherein each of the two edge folds is multiply folded in meandering fashion such that, starting from the web, the profile of this retaining rail has a first fold leading toward the bearing plane, which first fold is followed by a second fold which leads away from the bearing plane and which forms a first bearing-side shoulder, which second fold is followed by a third fold which leads toward the bearing plane and which forms a comb, which
third fold is followed by a fourth fold which leads away from the bearing plane and which forms a second bearing-side shoulder, which fourth fold is followed by a fifth fold leading back toward the web.

5. The retaining rail as claimed in claim 2, wherein the first fold has a curvature of 30°-90°, preferably 45°.

6. The retaining rail as claimed in claim 2, wherein the second fold has a curvature of 60°-180°, preferably 135°.

7. The retaining rail as claimed in claim 4, wherein the third fold has a curvature of 60° or more, preferably 180°.

8. The retaining rail as claimed in claim 4, wherein the fourth fold has a curvature of 60° or more, preferably 180°.

9. The retaining rail as claimed in claims 2, wherein the fifth fold has a curvature of 30°-150°, preferably 90°.

10. The retaining rail as claimed in claim 3, wherein the first bearing-side shoulders are situated in the same plane as the second bearing-side shoulders.

11. The retaining rail as claimed in claim 1, wherein it is fabricated from a rust-protected material, in particular stainless steel or hot-dip galvanized steel.

12. The retaining rail as claimed in claim 1, wherein its material thickness is 2 mm or less, in particular 1.5 mm or less.

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