DESCRIPTION

Mounting System, Mounting Assembly, and Solar Installation

The invention relates to a mounting system for plate-shaped solar modules, comprising at least one base rail, which can be arranged on, in particular rested on and/or fastened to a roof of a building, comprising at least one L-shaped solar module carrier, which has a retaining leg and a carrying leg, which is aligned at least essentially perpendicularly thereto, wherein the carrying leg has a support for at least one solar module, and wherein the retaining leg is formed to rest on the base rail at least in some regions, comprising at least one retaining element for fastening the retaining leg to the base rail, and comprising a sliding block, which can be moved in the base rail and which is connected or can be connected to the retaining element by means of a screw connection for fastening the retaining leg to the base rail.

The invention furthermore relates to a mounting assembly, which is formed in particular from the above-described mounting system, for one or several solar modules, and which has a base rail and at least one L-shaped solar module carrier, which has a retaining leg and a carrying leg, which is aligned at least essentially perpendicular thereto, wherein the carrying leg has a support, on which the at least one solar module rests, and wherein the retaining leg rests on the base rail at least in some regions, a retaining element, which fastens the retaining leg to the base rail, and a sliding block, which can be moved in the base rail and which is connected to the retaining element by means of a screw connection for fastening the retaining leg to the base rail.

The invention additionally relates to a solar installation comprising at least one, in particular plate-shaped, solar module and comprising a mounting assembly as described above, by means of which the at least one solar module is retained on a roof of a building.

Mounting systems and mounting assemblies of the above-mentioned type are already known from the prior art. Solar module carriers, on the supports of which the solar modules can be rested spaced apart from the roof, are used in order to fasten plate-shaped solar modules to a roof of a building, such as, for example, a residential building or office building. In order to fix the solar module carriers on the roof, base rails are generally used, to which the solar module carriers can be fastened. The base rail thereby provides the advantage that the solar module carriers can be

fastened at different positions along the base rail, whereby a high flexibility is ensured during the mounting of the solar modules. Known solar module carriers are formed in an L-shaped manner and have a retaining leg and a carrying leg, which is aligned at least essentially perpendicularly thereto, wherein the retaining leg is formed for resting on the base rail, and wherein the carrying leg has a support for the solar module in particular on its free end. The solar module carrier is often clamped to the base rail with the help of a sliding block connection by means of a retaining element, which is connected by means of a screw connection to a sliding block, which can be moved in the base rail. A flexible and nonetheless secure locking of the solar modules on the roof is thus possible.

A generic mounting system is already known, for example, from the published patent application EP 2348263 A2. The retaining element used there is formed in a U-shaped manner, so that it has a central base portion and two lateral bracing portions, which protrude from the base portion. The bracing portions thereby in each case engage behind a protrusion of the retaining leg of a solar module carrier, in order to establish a positive connection between the solar module carrier and the retaining element. The bracing portions are thereby in each case assigned to one of the solar module carriers.

A further mounting system for solar modules is known from published patent application EP 2211391 A1, in the case of which a retaining element is attached to retaining legs of L-shaped solar module carriers, in order to clamp them between the retaining element and the base rail.

Summary

In an aspect, the present disclosure refers to a mounting system for plate-shaped solar modules, comprising at least one base rail, which can be arranged on a roof of a building, comprising at least one L-shaped solar module carrier, which has a retaining leg assigned to the base rail, and a carrying leg, which is aligned at least essentially perpendicularly thereto, wherein the carrying leg has a support for at least one solar module, and the retaining leg is formed to rest on the base rail at least in some regions, and comprising a retaining element for fastening the retaining leg to the base rail, and comprising a sliding block, which can be moved in the base rail and which is connected or can be connected to the retaining element by means of a screw connection for

fastening the retaining leg to the base rail, characterized in that in a base portion, the retaining element has an edge portion, which can be rested on the retaining leg and which can be connected in a positive manner to the retaining leg, and, spaced apart from the edge portion, at least one spacer, which protrudes from the underside of the base portion, for resting on the base rail, which spacer at least reduces a clamping force, which can be generated by means of the screw connection and which acts on the retaining leg.

In another aspect, the present disclosure refers to a mounting assembly for one or several solar modules, in particular formed from a mounting system according to the above aspect, comprising a base rail and comprising at least one L-shaped solar module carrier, which has a retaining leg assigned to the base rail and a carrying leg, which is aligned at least essentially perpendicularly thereto, wherein the carrying leg has a support for at least one solar module, and the retaining leg rests on the base rail at least in some regions, comprising a retaining element for fastening the retaining leg to the base rail, and comprising a sliding block, which can be moved in the base rail and which is connected to the retaining element by means of a screw connection for fastening the retaining leg to the base rail, characterized in that in the base portion, the retaining element has an edge portion, which is rested on the retaining leg and which is connected in a positive manner to the retaining leg, and, spaced apart from the edge portion, at least one spacer, which protrudes from the underside for resting on the base rail and which at least reduces a clamping force, which is generated by the screw connection and which acts on the retaining leg.

In another aspect, the present disclosure refers to a solar installation for a or on a roof of a building, comprising at least one in particular plate-shaped solar module and comprising a mounting assembly, by means of which the at least one solar module can be arranged or is arranged on the roof, characterized in that the mounting assembly is formed according to the above aspect.

The present disclosure is based on the object of creating an improved mounting system as well as an improved mounting assembly, which offers an increased robustness with simple mounting and high flexibility.

The object, on which the disclosure is based, is in each case solved by means of a mounting system comprising the features of the above aspects, as well as by means of a mounting assembly comprising the features of the above aspects.

The mounting system has the advantage that, on the one hand, the solar module carrier can be retained particularly securely on the base rail and that, on the other hand, a temperature-related length compensation is nonetheless made possible, which prevents a tensioning and straining or overloading of a mounting assembly constructed from the mounting system in spite of heat-related length changes. According to the disclosure, this is attained in that

in the base portion, the retaining element has an edge portion, which can be rested on the retaining leg, and spaced apart from the edge portion, at least one spacer, which protrudes from the underside of the base portion, for resting on the base rail, which spacer at least reduces, thus in particular reduces or completely eliminates a clamping force, which can be generated by means of the screw connection and which acts on the retaining leg, and can thus be transferred to the retaining leg by means of the retaining element. During the mounting, the retaining element is thus rested with the base portion on the retaining leg of the solar module carrier. The retaining element is clamped on the base rail by means of the screw connection. In the prior art, the retaining leg of the solar module carrier is thereby clamped between the retaining element and the base rail, so that the retaining element is secured or clamped, respectively, on the base rail by indirectly, namely by interconnecting the retaining leg. By means of the advantageous spacer, which, according to the disclosure, is arranged on the underside in the base portion of the retaining element and spaced apart from the edge portion, and which serves the purpose of being rested on the retaining element, it is attained that the retaining element rests or comes to rest on the base rail, respectively, directly in spite of the retaining leg, which lies between retaining element and base rail. It is attained thereby that when the screw connection is tightened, a clamping force resulting therefrom initially acts directly between retaining element and base rail, namely by means of the spacer. If the screw connection is further tightened, a clamping force can optionally also be exerted on the retaining leg of the solar module carrier. However, the clamping force, which acts on or can be exerted on the retaining leg, is reduced in any event by means of the spacer and the direct mechanical connection of retaining element and base rail resulting therefrom. Depending on the formation of the spacer as well as on the tightening force of the screw connection, the clamping force on the retaining leg can also be eliminated completely. Due to the fact that the clamping force between retaining leg and retaining element is reduced, the static friction between retaining leg and retaining element on the one hand, and between retaining leg and base rail on the other hand, is reduced, and an easy movement of the retaining leg and of the retaining element relative to one another on the one hand, and of the retaining leg and of the base rail relative to one another on the other hand, is made possible, whereby an advantageous compensation of temperature-related length changes is ensured in an advantageous manner. Due to the fact that the retaining element is connected in a positive manner to the retaining leg of the edge portion, a captive arrangement of the solar module carrier on the retaining element or on the base rail, respectively, is additionally ensured in the mounted state. The positive connection defines in particular the permissible play between retaining element and retaining leg to a desired or permissible value, respectively. A

secure connection of retaining element and solar module carrier is thus permanently ensured in spite of the reduced clamping force.

According to a preferred further development of the disclosure, the retaining element comprises the base portion and two bracing portions, which protrude from the underside of the base portion, which is assigned to the base rail, wherein the bracing portions are formed for receiving the base rail between them in a rotationally fixed manner. During the mounting, the bracing portions are moved laterally over the base rail, so that they laterally encompass the base rail, and the retaining element is then retained in a rotationally fixed manner on the base rail. The robustness of the mounting system is further increased thereby. A protection against rotation is thereby formed between the retaining element and the base rail, which ensures that the retaining element cannot be removed from the retaining leg by means of a rotation. A particularly robust connection and retention of the at least one solar module carrier on the base rail is ensured thereby. The bracing portions preferably extend over the entire length of the base portion, so that they also laterally encompass the retaining leg, whereby the solar module carrier is also retained or can be retained on the base rail by means of the retaining element so as to be protected against rotation.

According to a preferred example of the disclosure, the retaining leg has, on its free end on the top side facing the carrying leg, a depression for the positive connection with the retaining element. The depression thereby preferably limits the above-mentioned play between retaining leg and retaining element. The positive connection in particular permits a play in the longitudinal extension and/or in the transverse extension of the base rail or of the retaining element, respectively. In the height direction (perpendicular to the transverse extension and longitudinal extension of the base rail), the retaining element cooperates at least in a positive manner with the retaining leg, optionally without play, in particular so that a clamping force by means of the screw connection also acts on the retaining leg. The depression is optionally formed by means of two protrusions on the top side of the retaining leg, which are arranged spaced apart from one another, so that a depression is created between them. In the alternative, the depression is formed directly in the retaining leg.

According to a preferred further development of the disclosure, a retaining clamp for storage on the retaining leg is fastened to the retaining element. According to this example, the retaining element is thus not directly connected to the retaining leg of the solar module carrier, but by interconnection of the retaining clamp. The interconnection of the retaining clamp has the advantage that, on the one hand, an advantageous length compensation and, on the other hand, a simple mounting of retaining element and retaining leg is made possible on the base rail. The

retaining clamp furthermore has advantages when an electrical connection or a potential compensation, respectively, is to be attained. The solar module carrier and the retaining element are preferably made of aluminum. If an oxide layer forms on them, the retaining clamp advantageously penetrates this oxide layer and thus ensures an improved electrical conductivity between retaining element and solar module carrier or retaining leg, respectively. For this purpose, the retaining clamp is preferably made of an electrically conductive material, which is harder and less susceptible to corrosion than the aluminum of retaining element and/or retaining leg. The retaining clamp particularly preferably has a hardness, which also penetrates, in particular scratches, electrically non-conductive corrosion protection layers, such as, for example, anodizing, varnishing, or powder coating, when being pushed onto the retaining element and/or the retaining leg, in order to establish the electrically conductive contact to retaining element and retaining leg thereby. Due to the fact that solar installations are also included in the potential compensation or the grounding of the building, respectively, as in the case of all other metallic constructions on buildings, the advantageous formation of the mounting system or of the described mounting assembly, respectively, provides the advantage of an improved electrical connection and thus of an improved grounding of a solar installation, which has the mounting system.

In the longitudinal section, the retaining clamp is preferably bent at least essentially in a U-shaped manner, and is pushed onto the edge portion of the base portion of the retaining element for fastening to the retaining element. The retaining clamp thus clasps the base portion of the retaining element, and can be entrained with the retaining element after its mounting on the retaining element. The retaining clamp is in particular pushed onto the retaining element under elastic deformation, so that the retaining clamp is fastened to the retaining element at least by means of a frictionally engaged connection, which results from the inherent elasticity of the retaining clamp.

According to a preferred further development of the disclosure, the retaining clamp has a lower leg and an upper leg, between which the edge portion of the retaining element can be received or is received. The lower leg is thereby formed to be movably stored in the depression of the retaining leg. For this purpose, the lower leg is formed, for example, in such a way that it is movably stored or can be movably stored within the depression so as to rest on the bottom of the depression, wherein the movability is limited by the side walls of the depression or the already mentioned protrusions, respectively, in order to limit the movement play as described above.

The lower leg particularly preferably has a storage portion comprising a bent-out retaining tab, which extends in the depression. The retaining tab is thus the part of the lower leg, lying in the

According to a preferred further development of the disclosure, the retaining element has a further depression in the edge portion, wherein the retaining clamp has a lock portion in the upper leg for locking the retaining clamp in the further depression of the retaining element. The retaining element is locked in particular in a positive manner and in a captive manner on the retaining element by means of the lock portion. The retaining element is thus no longer captively retained on the retaining element solely by means of the elasticity, but also in a positive manner. This simplifies the mounting and the use of the mounting system as a whole.

The lock portion particularly preferably has a bent-out locking lug, which protrudes in the direction of the lower leg in order to engage with the further depression when being pushed onto the retaining element. A simple mounting and a secure locking are thus ensured. The retaining clamp is pushed onto the edge portion under elastic deformation of the locking lug, until the locking lug reaches into the depression and thus locks the retaining clamp on the retaining element.

On its end located in the front in the push-on direction, the locking lug is thereby preferably connected in one piece with the upper leg, and is bent out with the rear end facing away from the end located in the front in the direction of the lower leg. A simple pushing onto the retaining element under elastic deformation of the locking lug is thus ensured, while a retraction is prevented in a positive manner by means of the locking lug, which lies in the further depression.

According to an alternative example, retaining element and solar module carrier are connected to one another without interconnection of a or the above-described retaining clamp, respectively. For this purpose, the retaining element has an opening or a trough-shaped depression in the edge portion, and the second protrusion of the retaining leg is formed to engage with the opening or depression for locking the retaining leg on the retaining element. Retaining element and retaining leg are thus mechanically connected to one another directly in a positive manner. When placing the retaining element onto the retaining leg, the second protrusion is thus inserted into the opening of the retaining element. In the alternative, the retaining leg is inserted underneath the already pre-mounted retaining element during the mounting, whereby the retaining element is lifted by means of the second protrusion, until the second protrusion reaches into the opening, and the retaining element falls onto the retaining leg.

For the connection of retaining element and retaining leg with play, the second protrusion is preferably formed to be shorter in the longitudinal extension of the retaining element than the

opening in the longitudinal extension of the retaining element. A tolerance play in the longitudinal extension of the base rail between retaining leg and retaining element is thus ensured.

For the connection between retaining element and retaining leg with play, the second protrusion is particularly preferably formed to be narrower in the transverse extension of the retaining element than the opening in the transverse extension of the retaining element. An advantageously possible tolerance compensation or temperature compensation balance in the transverse extension of the base rail result thereby.

It is furthermore preferably provided that the spacer of the retaining element is formed in a web-shaped or trough-shaped manner and extends transversely over the retaining element, in order to rest on both longitudinal sides of the base rail, or that two spacers, which in particular extend in a web-shaped manner and longitudinally, are formed on the underside of the base portion, in order to rest in each case on one of the longitudinal sides of the base rail. It is ensured in both cases that the retaining element rests securely on the base rail and does not tilt, for example. It is thus ensured that desired forces, which act between retaining element and base rail on the one hand, and between retaining element and retaining leg on the other hand, can be set systematically. It can thus in particular be ensured securely that the retaining leg between the retaining element and the base rail is not tensioned, when necessary, in order to provide a friction, which is as low as possible, between retaining element and retaining leg, for an advantageous compensation for play of temperature-related length changes. The spacer is optionally formed in a trough-shaped manner, so that it extends longitudinally as well as transversely, in order to rest on both longitudinal sides of the base rail in particular by forming a respective at least linear touch contact. The respective spacer is particularly preferably formed as a trough-shaped depression in the retaining element, for example in the manner of a bead. A simple and cost-efficient production of the retaining element as well as a secure spacing is thus ensured.

On its free end, the carrying leg particularly preferably has a groove profile rail for receiving a further sliding block, wherein the mounting system has at least one further sliding block, which can be inserted into the groove profile rail, as well as at least one solar module holding down clamp, wherein sliding block and solar module holding down clamp can be connected or are connected to one another by means of a screw connection for fastening a solar module to the support of the carrying leg.

It is furthermore preferably provided that the retaining element is formed in a mirrored manner in the longitudinal extension for fastening two solar module carriers. Two solar module carriers can thus be fastened to the base rail by means of the retaining element in the longitudinal extension of the retaining element. A compact arrangement of a plurality of solar modules on the roof of the building is thus possible with the help of only a few base rails. Due to the advantageous formation of the solar module carrier of the retaining element, as described above, a temperature-related length compensation is possible in an advantageous manner between both solar module carriers and the retaining element.

The mounting assembly according to the disclosure comprising the features of the above aspects is characterized in that in the base portion, the retaining element has an edge portion, which is rested on the retaining leg and which is connected in a positive manner to the retaining leg, and, spaced apart from the edge portion, at least one spacer, which protrudes from the underside and which rests on the base rail and which reduces a clamping force acting on the retaining leg by means of the screw connection. The already mentioned advantages thus result. The spacer is optionally formed and arranged in such a way that the clamping force acting on the retaining leg is completely eliminated. The screw connection optionally acts between the spacer and the edge portion, so that a clamping force can also be exerted on the retaining leg when the screw connection is tightened sufficiently strongly.

It is furthermore preferably provided that a retaining clamp for locking the solar module carrier on the retaining element is pushed onto an edge portion of the retaining element. The retaining clamp is preferably formed as described above and is arranged in order to reach the mentioned locking.

It is furthermore preferably provided that the retaining leg of the solar module carrier has a protrusion, which engages with play with the opening in the edge portion of the retaining element. This protrusion is advantageously formed and arranged like the above-described second protrusion of the retaining leg.

Two solar module carriers are particularly preferably arranged on the base rail spaced apart from one another in the longitudinal extension of the base rail, and the retaining element rests on the retaining legs of both solar module carriers. The connection between retaining element and solar module carrier is thereby formed on the retaining element as described above for the one solar module carrier.

The solar installation according to the disclosure comprising the features of the above aspects is characterized by the formation according to the disclosure of the mounting assembly. The advantages, which have already been mentioned above, result thereby.

Further advantages and preferred features and feature combinations follow in particular from what is described above as well as from the claims. The invention will be described in more detail below on the basis of the drawings, for the purpose of which

Figure 1 shows a first exemplary embodiment of an advantageous mounting assembly in a perspective illustration,

Figure 2 shows a detail top view onto the mounting assembly from Figure 1,

Figure 3 shows a cross sectional illustration of the mounting assembly from Figure 1,

Figure 4 shows a longitudinal sectional illustration of the mounting assembly from Figure 1,

Figure 5 shows a second exemplary embodiment of the mounting assembly in a perspective illustration,

Figure 6 shows a longitudinal sectional illustration of the mounting assembly from Figure 5,

Figure 7 shows a third exemplary embodiment of an advantageous mounting assembly in a perspective illustration,

Figure 8 shows a detail top view onto the mounting assembly from Figure 7,

Figure 9 shows a longitudinal sectional illustration of the mounting assembly from Figure 7, and

Figure 10 shows an enlarged longitudinal sectional illustration of the mounting assembly from Figure 7.

Figure 1 shows, in a perspective illustration, a first exemplary embodiment of an advantageous solar installation comprising a mounting assembly 1, which is formed from an advantageous mounting system 2 for solar modules. The mounting assembly 1 serves the purpose of mounting plate-shaped solar modules 3, which are suggested in **Figure 2** only in an exemplary manner by

means of dashed lines, on a roof of a building, which is not illustrated here. It goes without saying that the mounting assembly can also be mounted on other surfaces.

According to the present first exemplary embodiment, the mounting assembly 1 has a base rail 4, which can be mounted on the roof directly or by interconnecting a damping element 5 on the roof. The base rail 4 is formed essentially in a U-shaped manner, comprising a base plate 6 and comprising two longitudinal sides 7 protruding parallel and spaced apart from one another from the base plate 6. On their end, which faces away from the base plate 6, the longitudinal sides 7 in each case have a laterally protruding protrusion or retaining web 8, wherein the retaining webs 8 are arranged on the inner sides of the longitudinal sides 7, which face one another.

An L-shaped solar module carrier 9 is arranged on the base rail 4, which solar module carrier has a retaining leg 10 resting on the top side of the base rail 4 and thus on the free ends of the longitudinal sides 7, and a carrying leg 11, which is aligned essentially perpendicularly to the retaining leg 10. On its free end 12, thus the end facing away from the retaining leg 10, the carrying leg 11 has a support 13, on which the above-mentioned solar modules 3 can be rested. The support 13 is in particular aligned parallel to the base rail 4 and is formed in this case by a groove profile rail 14, in which a sliding block 15 is movably stored. The groove profile rail 14 is thereby aligned transversely to the base rail 4, so that the sliding block 15 can be moved transversely to the longitudinal extension of the base rail 4. The sliding block 15 is thereby guided in lateral recesses of the groove profile rail 14 and is retained so as to be protected against rotation and in a captive manner. The sliding block 15 has in particular a thread, into which a fastening screw 16 is screwed, the screw head of which rests on a solar module holding down clamp 17, through which the fastening screw 16 extends. The solar module holding down clamp 17 has two holding down portions 18, which are aligned parallel to one another and which face away from one another, which in each case apply the clamping force, which can be effected by means of the fastening screw 16, to one of the solar modules 3 on the top side, which faces away from the support 13, in order to fasten the solar modules 3 to the solar module carrier 9 in this way. It goes without saying that, in the alternative, only a single solar module 3 can also be fastened to the support 13 by means of a solar module holding down clamp 17, which is suitable for this purpose.

The free end of the retaining leg 10 facing away from the carrying leg 11 lies between the base rail 4 and a retaining element 19 arranged on the base rail 4. The solar module carrier 9 is locked in a positive manner on the base rail 4 by means of the retaining element 19, whereby the connection between retaining element 19 and solar module carrier 9 permits a play in the longitudinal and/or

transverse direction with respect to the base rail 4, so that the length changes can be absorbed or compensated, respectively, by means of the available play when temperature-related length changes occur in the mounting assembly 1, without creating mechanical tensions in the mounting assembly 1, which can lead to a straining or overloading of parts of the mounting assembly 1.

For this purpose, **Figure 2** shows the connecting region of solar module carrier 9 and retaining element 19 in a detail top view. On its free end, the retaining leg 10 has a protrusion 20, which engages with an opening 21 in a front-side edge portion 22 of the retaining element 19. The outer contour of the protrusion 20 thereby preferably corresponds at least essentially to the inner contour of the opening 21, wherein, viewed in the longitudinal extension of the base rail 4, the protrusion 20 is formed to be shorter than the opening 21, and narrower in the transverse extension, so that the protrusion 20 can be moved in the longitudinal and transverse extension in the opening 21, as shown in Figure 2 by means of double arrows 23 and 24, relative to the retaining element.

Figure 3 shows a cross sectional illustration of the mounting assembly 1 from **Figure 1** along the line A-A shown in **Figure 2**. As already shown in **Figure 2**, the retaining plate 19 has a trough- or bead-shaped depression 25, which forms on the underside 26 of the retaining element 19 as a protrusion 27, which protrudes from the underside 26 in the direction of the base rail 4. The protrusion 27 forms a spacer 28, which serves the purpose of resting on the free top side of the longitudinal sides 7 of the base rail 4 when the retaining element 19 is mounted correctly. Regions of the retaining element 19 adjacent to the depression 25 thus lie above the base rail 4, spaced apart therefrom.

As furthermore shown in **Figure 3**, a sliding block 29 is held in a rotationally fixed manner in the base rail 4 and in a movable manner in the longitudinal direction of the base rail 4. The sliding block 29 is formed to be wider than the clear width between the retaining webs 8, so that the sliding block 29 is captively held in the base rail 4 in a movable manner. The sliding block 29 has an opening comprising an internal thread 30, into which a fastening screw 31 is screwed with its screw shaft 32, which has an external thread for forming a screw connection 48 with the retaining element 19. A screw head 33 of the fastening screw 31 rests on the top side 34 of the retaining element 19, which faces away from the underside 26. The depression 25 is thereby formed in such a way that it surrounds the region of the screw head support of the screw head 33, so that the screw head support itself does not lie in the depression, as also shown in Figures 1 and 2. By tightening the fastening screw 31, retaining element 19 and sliding block 29 are moved towards one another,

whereby, in the region of the protrusions 8, the base rail 4 is clamped between these two protrusions. A retaining force is thus exerted on the retaining element 19, by means of which the retaining element 19 is pressed or clamped, respectively, onto the top side of the longitudinal sides 7, so that it is prevented by means of static friction or by means of frictional engagement, respectively, from being longitudinally moved on the base rail 4. By tightening the fastening screw 31, the retaining element 19 can thus be secured or is secured, respectively, on the base rail 4 by means of the spacer 28.

As can furthermore be seen in **Figure 3**, the retaining element 19 has a C-shaped cross section, so that the retaining element 19 has a central base portion 34, in which the opening for the guide-through of the screw shaft 32 as well as the spacer 28 is formed, and has two bracing elements or bracing portions 35, which in each case protrude from the base portion 34 from the underside 26 and which are formed in such a way that they receive the base rail 4 between them. As shown in Figure 1, the bracing portions 35 extend in the entire length of the base portion 34, so that the retaining element 19 is retained so as to be protected against rotation on the base rail 4 by means of the bracing portions 35. This results in a high robustness of the mounting assembly 1 against external influences. The C-shape of the cross section of the retaining element 19 additionally results in that, on their free ends, the bracing portions 35 rest closely on or are brought closely to the outer side of the longitudinal side 7, so as not to permit any or only slight oblique positions of the retaining element 19 in its longitudinal extension relative to the base rail 4.

Figure 4 shows a longitudinal sectional illustration of the mounting system 1 from the preceding figures. The fastening screw 31 or the screw opening for the fastening screw 31, respectively, which is formed in the retaining element 19, is arranged between the spacer 28 and the solar module carrier 9. On its free end, the retaining leg 10 of the solar module carrier 9 has a first protrusion 36 and, viewed in the longitudinal extension of the retaining leg 10, the protrusion 20, which hereby forms a second protrusion. The second protrusion is arranged directly on the free end of the retaining leg 10, and the protrusion 36 spaced apart therefrom, so that a depression 37 is formed between the two protrusions 36 and 20. On the free end, the protrusion 20 additionally has a run-on slope 38, by means of which the protrusion 20 is formed at an acute angle or in a wedge-shaped manner, respectively, towards the free end.

If the solar module carrier 9 with the retaining leg 10 on its free end is pushed with the run-on slope 38 underneath the retaining element 19, which may already be pre-mounted, said retaining element is lifted on the edge portion 22 by means of the protrusion 20 and the run-on slope 38, so

that the solar module carrier 9 can be pushed easily underneath the retaining element 19, until the protrusion 20 reaches completely into the opening 21, and the edge portion 22 of the retaining element 19 can be moved in the direction of the base rail 4 again or falls down, respectively. Viewed in the longitudinal extension, the region 39 between the opening 21 and the free end of the retaining element 19 is thereby formed to be shorter than the depression 37, so that with the end portion 39, the retaining element 19 falls into or engages with, respectively, the depression 37, when the protrusion 20 is displaced into the opening 21.

As shown in **Figure 4**, the depression 37, viewed in the longitudinal extension, is formed to be longer than the end portion 39, and the protrusion 20, viewed in the longitudinal extension, is formed to be shorter than the opening 21, so that, viewed in the longitudinal extension, the solar module carrier 9 can be moved relative to the retaining element 19 with the retaining leg 10 and is limited in a positive manner in its movability by means of the retaining element 19. The solar module carrier 9 is in particular captively held in a positive manner on the retaining element 19 by means of the advantageous connection between retaining element 19 and retaining leg 10. As soon as the fastening screw 31 is tightened and a clamping force is applied to the retaining element 19 in the direction of the base rail 4, an unwanted release of the solar module carrier 9 from the retaining element 19 is no longer possible because it is retained between retaining element 19 and base rail 4.

The spacer 28 thereby limits the clamping force of the fastening screw 31, which can be transferred to the retaining leg 10 by means of the retaining element 19. The spacer 28 is optionally formed in such a way that the fastening screw 31 cannot exert any clamping force on the retaining leg 10, the clamping force is thus eliminated in the region of the retaining leg 10. However, the clamping force is at least reduced in the region of the retaining leg 10, so that the frictional force acting between the end portion 39 or the edge portion 22 and the retaining leg 10, respectively, is so low that a movement of the solar module carrier 9 relative to the retaining element 19 is ensured in spite of the clamping force exerted by means of the fastening screw 31. It is ensured thereby that a length compensation or displacement of solar module carrier 9 to retaining element 19, respectively, is always possible for compensating temperature-related length changes in spite of a fastening force and secure fastening of the solar module carrier 9. As already mentioned above, the movability is thereby ensured in the longitudinal extension as well as transversely to the longitudinal extension of the base rail 4.

In an advantageous manner, the mounting system 2 has a plurality of retaining elements 19, solar module carriers 9, and base rails 4, which are formed as described above, so as to be able to enter into the above-described mechanical connection between retaining element, solar module carrier, and base rail.

While in the first exemplary embodiment the retaining element 19 is formed to only retain one solar module carrier 9, it is provided according to a second exemplary embodiment illustrated in **Figure 5** that the mounting system 2 additionally or alternatively comprises a variation of the retaining element 19, which serves the purpose of fastening two solar module carriers 9 on the base rail 4. As shown in **Figure 5**, the retaining element 19 is formed in a mirrored manner for this purpose, viewed in the longitudinal extension, so that it has a respective opening 21 on both of its two front-side edge portions 22 for receiving a respective protrusion 20 of the respective solar module carrier 9. The mirror axis thereby lies at the height of the fastening screw 31, so that the retaining element 19 can be moved on the base rail 4 by means of the one fastening screw 31 by locking the solar module carriers 9. Both solar module carriers 9 are thus retained on the base rail 4 so as to be movable relative to the retaining element 19 and in a positive manner on the retaining element 19. The solar module carriers 9 in each case optionally have a sliding block-shaped retaining protrusion 40, which protrudes in the direction of the base rail 4 and which is movably stored in the base rail 4. For this purpose, the contour of the retaining protrusion 40 is formed in the same way as the sliding block 29, in order to be captively movable in the base rail 4.

Figure 6 shows a longitudinal sectional illustration of the second exemplary embodiment. It can be seen well thereby that the protrusions 20 of both solar module carriers 9 engage with the respective assigned opening 20 in the edge portion 22 of the retaining element 19. In this exemplary embodiment, the spacer 28 is also formed in an advantageous manner in such a way that it is likewise formed in a mirror-inverted manner on both sides of the fastening screw 31, so that an even and symmetrical bracing of the retaining element 19 on the top side of the longitudinal sides 7 of the base rail 4 is securely ensured.

Figure 7 shows a third exemplary embodiment of the mounting assembly 1 or of the mounting system 2, respectively, in a perspective illustration. In an advantageous manner, the mounting system 2 comprises the individual parts of the exemplary embodiments introduced here, in order to produce a mounting assembly 1 according to one of the exemplary embodiments described herein, as needed. The third exemplary embodiment differs in the manner

of the connection between retaining element 19 and the solar module carriers, as well as in the form of the solar module carriers 9, wherein the two differences can be realized independently of one another and can in this respect also be combined with the above exemplary embodiments independently of one another.

Even though the solar module carriers 9 are also formed in an L-shaped manner according to this exemplary embodiment, the carrying leg 11, which protrudes upwards, is, in contrast to the above exemplary embodiments, provided with a curvature, so that the supports 13 of the carrying legs 10 do not lie in a common plane, as shown in the exemplary embodiment of Figure 5, but are aligned inclined towards one another, so that the solar modules 3, which are placed thereon, lie at planes, which are inclined towards one another. According to the exemplary embodiment of **Figure 7**, the retaining element 19 is formed to simultaneously lock two solar module carriers 9 on the base rail 4, as in Figure 5 and 6. According to a further exemplary embodiment, as shown in **Figure 8**, the retaining element 19 is formed to retain only one solar module carrier 9 on the base rail 4, according to the exemplary embodiment of Figure 1. In contrast, however, the formation in Figures 6 and 7 provides that the respective solar module carrier 9 does not engage with a protrusion 20 in the opening 21 of the retaining element 19, but that a retaining clamp 41 is in each case arranged between solar module carrier 9 and retaining element 19. For this purpose, **Figure 9** shows the exemplary embodiment of **Figure 8** in a longitudinal illustration.

Figure 10 shows an enlarged detail view of the longitudinal sectional illustration for better understanding. The retaining clamp 41 is pushed onto the edge portion 22 of the retaining element 19. For this purpose, the retaining clamp 41 is bent in an essentially U-shaped manner comprising an upper leg 42 resting on the top side of the retaining element 19, and a lower leg 43 resting against the underside. The upper leg 42 has a lock portion 44, in which a locking lug 45 is bent out centrally (viewed in the transverse extension) in the direction of the lower leg 43. The bending point is thereby formed on the front or the free end, respectively, of the end of the locking lug 45 facing the upper leg 42, so that the locking lug 45 protrudes with its free end in the direction of the lower leg 43 and of the closed end of the retaining clamp 41. The locking lug 45 is thereby formed in such a way that the locking lug 45 is initially bent back under elastic deformation when pushing the retaining clamp 41 onto the edge portion 22, and then protrudes into or engages with the opening 21 of the retaining element 19, respectively, due to its inherent elasticity. A retraction of the retaining clamp 41 opposite to the mounting direction is thereby prevented in a positive manner.

The lower leg 43 has storage portion 46 comprising a bent-out retaining lug 47. The retaining lug is also preferably formed centrally in the retaining clamp 41, viewed in a top view or in transverse extension, respectively, as shown, for example, in **Figure 8**, whereby the bending point is arranged on the end of the retaining lug 47 facing the closed end of the retaining clamp 41, so that the free end of the retaining lug 47 protrudes so as to face away from the upper leg 42 in the region of the free end of the retaining leg 10. The protrusion 20 of the retaining leg 10 is formed to be significantly smaller than the protrusion 36 in this case, so that the protrusion 20 can be arranged completely underneath the retaining element 19 or the edge portion of the retaining element 19, respectively, as shown in **Figures 9 and 10**. The protrusion 20 nonetheless protrudes from the retaining leg 10 so far that the depression 37 is formed between protrusion 36 and 20. The retaining lug 47 now protrudes into this depression 37. As soon as the retaining leg 10 is pushed underneath the retaining element 19 with the help of the run-on slope 38, the retaining lug 47 locks in the depression 37, whereby a retraction opposite to the retaining leg 10 against the mounting direction is prevented in a positive manner by means of the retaining clamp 41. The storage portion 46 of the lower leg 43 otherwise rests on the retaining leg 10 and in particular also on the protrusion 20, as shown in **Figure 10**. A simple mounting is thus likewise ensured by means of the advantageous retaining clamp 41, whereby a play, which provides for a temperature-related length compensation, is also still ensured between retaining leg 10 and retaining element 19 due to the fact that the retaining lug 47 is formed to be shorter than the depression 37.

As shown in Figure 8 and also in Figure 7, the retaining clamp 41 is formed to be narrower than the retaining leg 10 and the retaining element 19, so that a movability or a connection of retaining element 19 and retaining leg 10 with play, respectively, in particular also results transversely to the base rail 4, by means of which temperature-related length changes can be compensated in an advantageous manner without creating critical tensions in the mounting assembly 1.

It goes without saying that the retaining element 19 can also be fastened to the base rail 4 by means of more than only one fastening screw 16 with the help of one or a respective sliding block. Several protrusions 27 can also be formed for forming spacers 28 on the retaining element. The respective spacer 28 can also be formed as attachment part or protrusion, which increases the thickness of the retaining element, instead of a bead-shaped formation.

CLAIMS

1. A mounting system for plate-shaped solar modules, comprising at least one base rail, which can be arranged on a roof of a building, comprising at least one L-shaped solar module carrier, which has a retaining leg assigned to the base rail, and a carrying leg, which is aligned at least essentially perpendicularly thereto, wherein the carrying leg has a support for at least one solar module, and the retaining leg is formed to rest on the base rail at least in some regions, and comprising a retaining element for fastening the retaining leg to the base rail, and comprising a sliding block, which can be moved in the base rail and which is connected or can be connected to the retaining element by means of a screw connection for fastening the retaining leg to the base rail, **characterized in** that in a base portion, the retaining element has an edge portion, which can be rested on the retaining leg and which can be connected in a positive manner to the retaining leg, and, spaced apart from the edge portion, at least one spacer, which protrudes from the underside of the base portion, for resting on the base rail, which spacer at least reduces a clamping force, which can be generated by means of the screw connection and which acts on the retaining leg.

2. The mounting system according to claim 1, **characterized in** that the retaining element has the base portion and two bracing portions, which protrude from the underside of the base portion, which is assigned to the base rail, and that the bracing portions are formed for receiving the base rail between them in a rotationally fixed manner.

3. The mounting system according to any one of the preceding claims, **characterized in** that the retaining leg has, on its free end on the top side facing the carrying leg, a depression for the positive connection with the retaining element.

4. The mounting system according to any one of the preceding claims, **characterized in** that a retaining clamp for storage on the retaining leg is fastened to the retaining element.

5. The mounting system according to any one of the preceding claims, **characterized in** that in the longitudinal section, the retaining clamp is bent at least essentially in a U-

shaped manner, and is pushed onto the edge portion of the retaining element for fastening to the retaining element.

6. The mounting system according to any one of the preceding claims, **characterized in** that the retaining clamp has a lower leg and an upper leg, between which the edge portion of the retaining element can be received or is received, and that the lower leg is formed to be movably stored in the depression of the retaining leg.

7. The mounting system according to any one of the preceding claims, **characterized in** that the lower leg has a storage portion comprising a bent-out retaining tab, which extends longitudinally in the depression.

8. The mounting system according to any one of the preceding claims, **characterized in** that the storage portion is formed to extend beyond the depression and to rest on the retaining leg.

9. The mounting system according to any one of the preceding claims, **characterized in** that the retaining leg, spaced apart from its free end, has a first protrusion, which limits the depression and which forms an axial stop for the edge portion of the retaining element.

10. The mounting system according to any one of the preceding claims, **characterized in** that on its free end, the retaining leg has a second protrusion, which limits the depression and which protrudes less far than the first protrusion.

11. The mounting system according to any one of the preceding claims, **characterized in** that the second protrusion is formed by a run-on slope formed on the second end for the retaining element.

12. The mounting system according to any one of the preceding claims, **characterized in** that the retaining element has a further depression or opening in the edge portion, wherein the retaining clamp has a lock portion in the upper leg for locking the retaining clamp in the further depression or opening of the retaining element.

13. The mounting system according to any one of the preceding claims, **characterized in** that the lock portion has a bent-out locking lug, which protrudes in the direction of the lower leg in order to engage with the further depression or opening when being pushed onto the retaining element.

14. The mounting system according to any one of the preceding claims, **characterized in** that on its end located in the front in the push-on direction, the locking lug is connected in one piece with the upper leg, and is bent out with the rear end facing away from the end located in the front in the direction of the lower leg.

15. The mounting system according to any one of the preceding claims, **characterized in** that the retaining element has an opening in the edge portion, and that the second protrusion is formed to engage with the opening for locking the retaining leg on the retaining element.

16. The mounting system according to any one of the preceding claims, **characterized in** that for the connection with play, the second protrusion is formed to be shorter in the longitudinal extension of the retaining element than the opening in the longitudinal extension of the retaining element.

17. The mounting system according to any one of the preceding claims, **characterized in** that for the connection with play, the second protrusion is formed to be narrower in the transverse extension of the retaining element than the opening in the transverse extension of the retaining element.

18. The mounting system according to any one of the preceding claims, **characterized in** that the spacer is formed in a web-shaped manner and extends transversely to the base rail, in order to rest on both longitudinal sides of the base rail, or that two spacers, which in particular extend in a web-shaped manner and longitudinally, are formed on the underside of the base portion, in order to rest in each case on one of the longitudinal sides of the base rail.

19. The mounting system according to any one of the preceding claims, **characterized in** that on its free end, the carrying leg has a groove profile rail for receiving a sliding block,

and that the mounting system has at least one sliding block, which can be inserted into the groove profile rail, as well as a solar module holding down clamp, wherein the sliding block and the solar module holding down clamp are or can be connected to one another by means of a screw connection.

20. The mounting system according to any one of the preceding claims, **characterized in** that the retaining element is formed in a mirrored manner in the longitudinal extension for fastening two solar module carriers.

21. A mounting assembly for one or several solar modules, in particular formed from a mounting system according to any one of claims 1 to 20, comprising a base rail and comprising at least one L-shaped solar module carrier, which has a retaining leg assigned to the base rail and a carrying leg, which is aligned at least essentially perpendicularly thereto, wherein the carrying leg has a support for at least one solar module, and the retaining leg rests on the base rail at least in some regions, comprising a retaining element for fastening the retaining leg to the base rail, and comprising a sliding block, which can be moved in the base rail and which is connected to the retaining element by means of a screw connection for fastening the retaining leg to the base rail, **characterized in** that in the base portion, the retaining element has an edge portion, which is rested on the retaining leg and which is connected in a positive manner to the retaining leg, and, spaced apart from the edge portion, at least one spacer, which protrudes from the underside for resting on the base rail and which at least reduces a clamping force, which is generated by the screw connection and which acts on the retaining leg.

22. The mounting assembly according to claim 21, **characterized in** that a retaining clamp for locking the solar module carrier on the base rail is pushed onto an edge portion of the retaining element.

23. The mounting assembly according to claim 21, **characterized in** that the retaining leg of the solar module carrier has a protrusion, which engages with an opening in the edge portion of the retaining element.

24. The mounting assembly according to claim 22, **characterized in** that two solar module carriers are arranged on the base rail spaced apart from one another in the longitudinal extension of the base rail, and that the retaining element rests on the retaining legs of both solar module carriers.

25. A solar installation for a or on a roof of a building, comprising at least one in particular plate-shaped solar module and comprising a mounting assembly, by means of which the at least one solar module can be arranged or is arranged on the roof, **characterized in** that the mounting assembly is formed according to any one of claims 21 to 24.