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(54) SYSTEM FOR FLAT-ROOF INSTALLATION OF SOLAR MODULES

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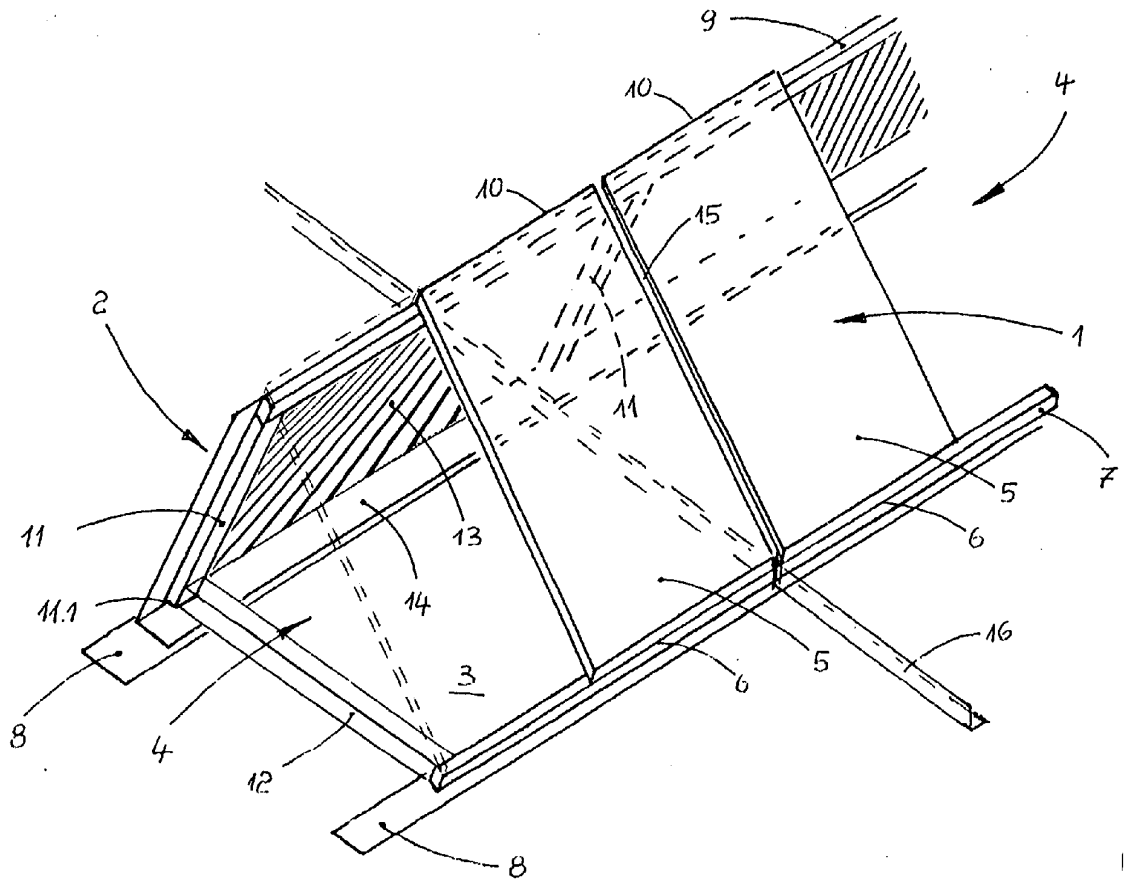
(57) **ABSTRACT**

A flat-roof installation set for solar collector modules (**5**) includes a carrier frame on which the solar collector modules (**5**) are mounted, whereby the solar modules (**5**) are mounted on a first side of an installation set (**1**) adjacent to one another in a plane inclined from the roof surface (**3**) and with their upper and lower edges (**6**, **10**) positioned in parallel to the roof surface (**3**) and aligned with one another. In order to compensate for wind loads using aerodynamic supports, a wind-suppressing or wind-blocking connector is provided between the lower edges (**6**) of the solar module (**5**) and the roof surface (**3**), and the second side of the installation set (**2**) between the upper edges of the solar modules and the roof surface (**3**) is implemented to be of enclosed design, and is inclined with respect to the solar modules (**5**) and opposite them. Both ends of the installation set (**4**) and the underside of the installation set are open to the roof surface (**3**).



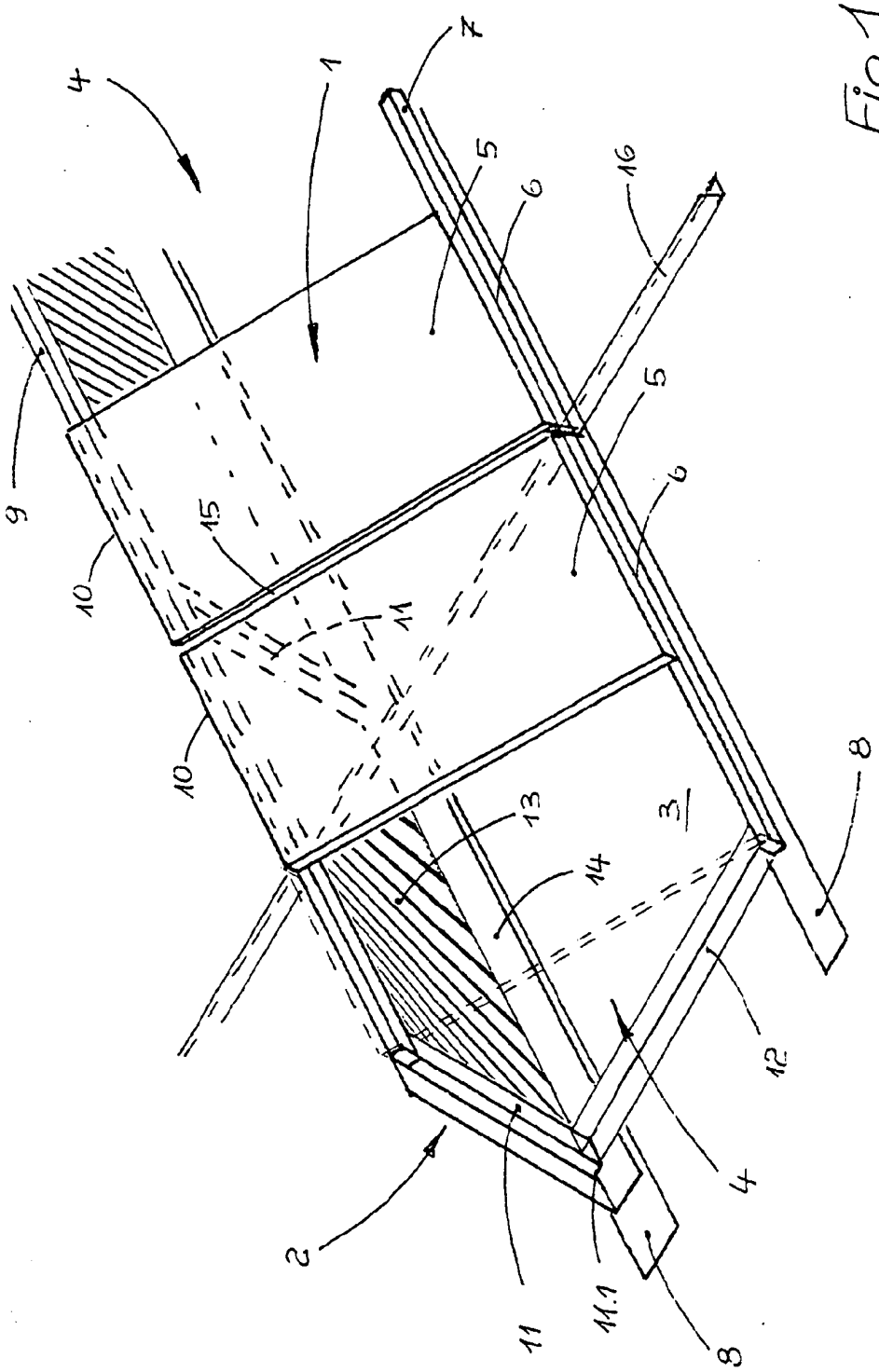


Fig.1

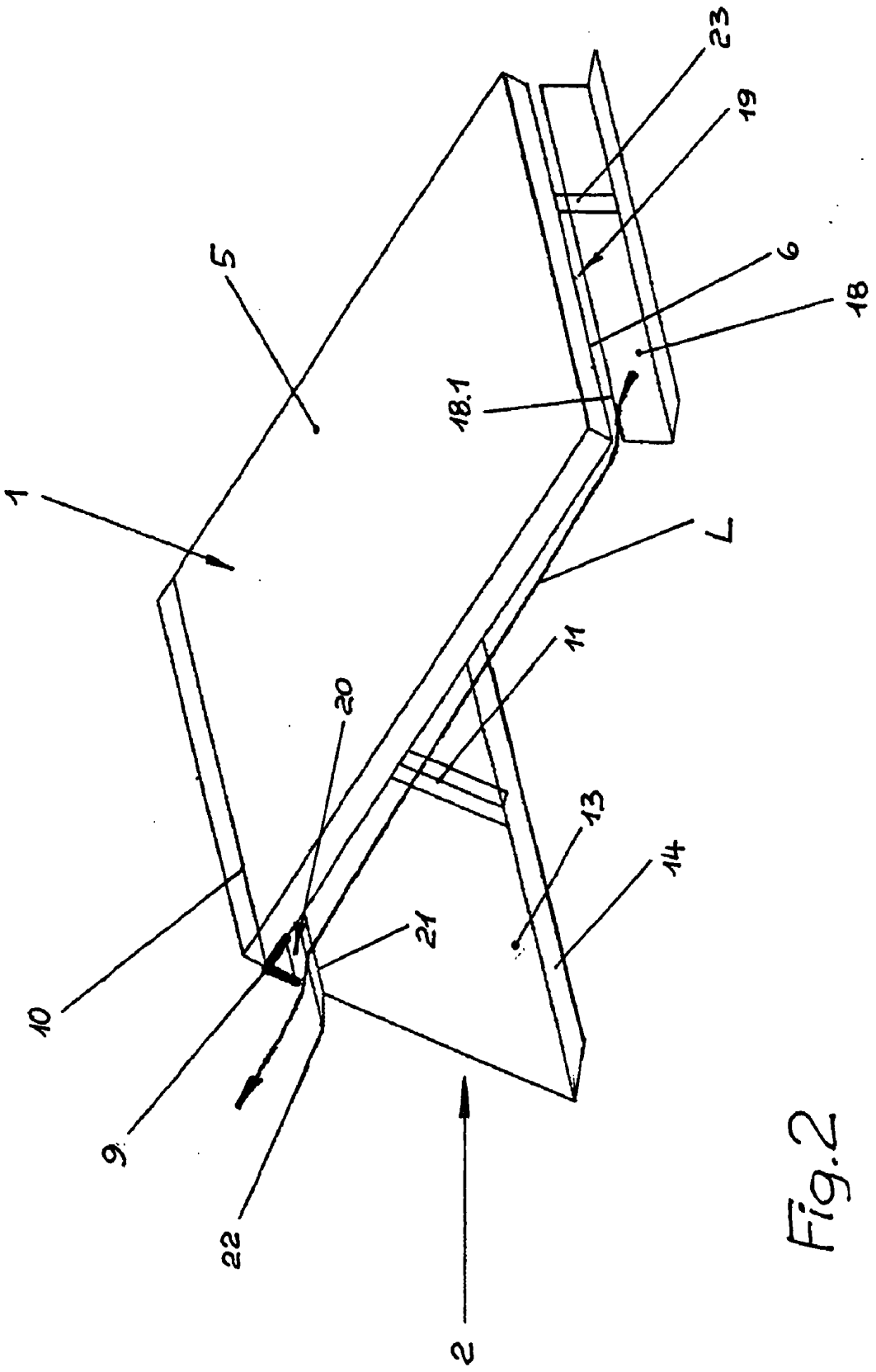


Fig.2

SYSTEM FOR FLAT-ROOF INSTALLATION OF SOLAR MODULES

TECHNICAL FIELD

[0001] The invention relates to a system for installing solar energy collector modules in a flat-roof installation.

BACKGROUND INFORMATION

[0002] Such a roof installation set is known from the patent document DE 10 2005 033 780 A1. In order to secure the roof installation set against wind loads, the carrier is anchored to a proper load-bearing sub-frame of the roof. The supports required on the carrier penetrate the roof surface, which reduces its function as a watertight roof element. In order to compensate for this, expensive sealing measures must be employed at the penetration points.

[0003] Further, flat-roof installation sets with carriers are known that are merely placed on the roof surface of the flat-roof with friction mounts, i.e., they avoid the anchoring elements penetrating the roof surface. Stability against wind loads is provided by their substantial weight, for which the frame components themselves may be of heavy-weight construction as may be taken from the patent document DE 203 12 641 U1. In other cases, the carrier is provided with receptacles such as basins in order to use bulk material to provide increased weight. This option is described by DE 203 11 967 U1.

[0004] Mounting the solar modules using the known roof installation sets is performed without taking aerodynamic factors into account to the extent that the modules are mounted to be overhanging at their edges, offering wind-catching surfaces not only on their upper side, but also on their lower side.

SUMMARY

[0005] It is the task of the invention to provide a flat-roof installation set for solar collector modules of the type mentioned at the outset that avoids anchoring to the roof frame, and in which ballast reduction is provided by taking advantage of aerodynamic forces.

[0006] In accordance with one feature of the invention, the flat-roof installation set and included solar modules present a largely enclosed roof structure on its longitudinal sides that is open on its underside facing the roof surface and on its face or end sides. Critical wind directions are those perpendicular to the longitudinal direction of the flat-roof installation set, or that possess main components perpendicular to it. Such winds strike along the open face sides of the roof installation sets, and create a partial vacuum because of the pressure relationships in the interior of the roof installation set enclosed at its underside by the roof surface while in operating position and given air passages provided in the installation set.

[0007] Thus, the roof installation set is essentially sucked downward onto the roof surface, and the pressure forces arising therefrom in the area of the bearing surfaces of the carrier help prevent the roof installation set from being displaced, overturned, or raised because of the friction created. The aerodynamic effect used here assumes that the area of the roof surface enclosing the roof installation set on its underside is correspondingly made to be windproof and airtight, which is not a problem because of the required water tightness of the roof surface.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] These and other features and advantages of the present invention will be better understood by reading the following detailed description, taken together with the drawings wherein:

[0009] FIG. **1** is a schematic, perspective view of a flat-roof solar module installation set in accordance with the present invention; and

[0010] FIG. **2** is a perspective view of a section of a modified, solar module flat-roof installation set in accordance with the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0011] Specifically, one may recognize in FIG. **1** a solar module flat-roof installation set that has the shape of an acutely-angled or right-angled ridge roof. Thus, the flat-roof installation set possesses a first side **1**, a second **2** positioned at an acute or right angle with respect to the first side **1**, and face sides or end regions **4** open at both ends. When in operating position, the open underside of the flat-roof installation set is closed by the roof surface **3** that is correspondingly watertight and also airtight.

[0012] The first side **1** of the flat-roof installation set is provided with solar modules **5** that possess the shape of rectangular or square panels mounted in a common plane inclined relative to the roof surface **3**. The solar modules **5** are a component of a photo-voltaic system, and generally are mounted in some quantity adjacent to one another as is known in the art of photo-voltaic systems. For this, the lower edges **6** and the upper edges **10** of the solar modules **5** are aligned in a line extending in parallel to the roof surface **3**. Correspondingly, the solar modules **5** possess the same rectangular format and are abutted with one another along the longitudinal direction of the roof installation set, whereby a narrow gap **15** may be left free between the solar modules **5** for thermal reasons.

[0013] The solar modules **5** are mounted on a carrier that possesses an upper crosspiece **9** and a lower crosspiece **7** toward the first installation set side **1**. With insertion of a structural protective mat **8**, the lower crosspiece **7** rests on the roof surface **3**, and the bottom edges of the solar modules **5** in turn rest on the lower crosspiece **7**. Near their lower edges, a wind-suppressing or wind-proof joint exists between the solar modules **5** and the roof surface **3**. In connection with the invention, "wind-proof" here does not mean that an absolutely wind-proof seal must be established, but rather that the desired aerodynamic effect is achieved.

[0014] On the second side **2** of the flat-roof installation set, the carrier possesses supporting frames **11** whose upper ends are firmly affixed to the upper crosspieces and to whose lower ends **11.1** a crossbeam **12** connecting it with the lower crosspiece at the first installation set **1** is firmly attached. These supporting frames **11** extend in a common plane that, corresponding to the triangular contour shape of the flat-roof installation sets, is inclined away from the inclined plane of the solar modules **5**. On their exterior, the supporting frames **11** bear a closed wall arrangement **13** that is adjacent to the upper edges of the solar modules **5** in a particular wind-

averting manner described in the following, and extending from there down to the wind-proof connection to the roof surface **3**.

[0015] The closed wall arrangement **13** consists of sheet metal that is provided along its lower edge with an angled edge **14**. The angled edge **14** of the flatroof installation is angled inward and extends under the lower ends **11.1** of the supporting frames **11** and lies between the structural protective mat **8** and the roof surface **3**. Since the solar modules **5** are flat, panel-type structures, and also totally enclose the interior of the flat-roof installation set on the side opposite to it, as does the wall arrangement **13**, then if one dispenses with the thermal gaps **15**, then the flat-roof installation set is a ridge-roof-shaped structure enclosed about its circumference that is open merely at the installation set face sides or ends **4**. Depending on the size of the solar-energy system, several of the flat-roof installation sets may be mounted in parallel with one another or aligned at a distance from one another on a flat roof. Connection rails **16** are provided for the mechanical bond of the flat-roof installation sets, of which one is shown in FIG. **1**.

[0016] FIG. **2** shows the basic structure of a flat-roof installation set that involves a thermally improved model. Independent of whether the gaps **15** are provided between the solar modules **5** as described in association with FIG. **1**, this structure includes a first wind passage **19** extending along its longitudinal direction below the lower edges **6** of the solar modules **5**. For this, the lower edges **6** of the solar modules **5** are mounted at a distance from the roof surface **3**, whereby this separation is largely filled by a sill-type, closed wall **18**. This first wind passage **19**, which, when viewed practically, possesses a narrow gap width of about 1 cm, is located between the upper edge **18.1** of this wall **18** and the lower edges **6** of the solar modules **5**. The sill-type wall **18** is also of sheet metal that includes supports **23** on which the lower edges of the solar modules **5** rest.

[0017] As FIG. **2** further shows, a second, upper wind passage **20** is located in the ridge area of the flat-roof installation set that extends correspondingly below the upper edges **10** of the solar modules **5** and in parallel with the first wind passage **19**. The second side of the installation set of the second wind passage is limited from above by the upper crosspiece **9** and from below by an upper edge **21** of the closed wall arrangement **13**. A spar **22** is mounted at the upper edge of the closed wall arrangement **13** that projects at an angle from the outer side of the second side of the installation set **2** in the manner of a spoiler.

[0018] Because of the varying height position of the first, lower wind passage **19** and of the second, upper wind passage **20**, a chimney effect results under heat loading, for which the first, lower wind passage **19** functions as an air inlet and the second, upper wind passage functions **20** as an air outlet. The air flow L achieved by the chimney effect within the flat-roof installation set contributes greatly to cooling and thereby to thermal unloading. This may be further promoted in that the width of the second, upper wind passage **20** is greater than that of the first, lower wind passage **19**, or practically about 1.5 cm. The partial vacuum in the interior of the flat-roof installation set is amplified depending on wind direction, and thus, in spite of the improved heat removal, the main function, namely the affixing of the flat-roof installation set to the roof surface **3** (FIG. **1**), is not impaired.

[0019] The present invention is not intended to be limited to a device or method which must satisfy one or more of any stated or implied objects or features of the invention and should not be limited to the preferred, exemplary, or primary embodiment(s) described herein. Modifications and substitutions by one of ordinary skill in the art are considered to be within the scope of the present invention, which is not to be limited except by the allowed claims and their legal equivalents.

1. A Flat-roof installation set including a carrier frame on which solar modules are mounted wherein the solar modules are mounted on the first side of the installation set (**1**) adjacent to one another in a common plane inclined from the roof surface and with their upper and lower edges positioned in parallel to the roof surface and aligned with one another characterized in that

a wind-suppressing or wind-blocking connector (**18**) is provided between the lower edges (**6**) of the solar modules (**5**) and the roof surface (**3**), and also proximate the second side of the installation set (**2**) between the upper edges (**10**) of the solar modules (**5**) and the roof surface (**3**) is to be of enclosed design, and inclined with respect to the solar modules (**5**) and opposed them, whereby two ends of installation set (**4**) are open and the underside of the installation set is closed off by the roof surface (**3**) while in an operating position.

2. The Flat-roof installation set as in claim **1**, characterized in that the first side of the installation set and the second side of the installation set together form the shape of a ridge roof.

3. The Flat-roof installation set as in claim **1**, characterized in that the carrier frame includes an upper crosspiece (**9**) onto which the upper edges (**10**) of the solar modules (**5**) are affixed and extend to a closed wall arrangement (**13**) at the second side of the installation set (**2**).

4. The Flat-roof installation set as in claim **3**, characterized in that the closed wall arrangement (**13**) at the second side of the installation set is of sheet metal.

5. The Flat-roof installation set as in claim **4**, characterized in that the carrier frame includes supporting frames (**11**) on the second side of the installation set (**2**) that are connected with the upper crosspieces (**9**) and upon which the closed wall arrangement (**13**) rests.

6. The Flat-roof installation set as in claim **5**, characterized in that the sheet-metal plate forming the closed wall arrangement (**13**) on the second side of the installation set (**2**) includes an angled edge (**14**) along its lower edge that extends below the projecting lower end (**11.1**) of the supporting frame (**11**).

7. Flat-roof installation set as in claim **1**, characterized in that a first wind passage (**19**) is provided below the lower edges (**6**) of the solar modules (**5**) in their areas extending down to the roof surface (**3**), and a second wind passage (**20**) is provided below the upper edges (**10**) of the solar modules (**5**) in the area toward the closed wall arrangement (**13**).

8. The Flat-roof installation set as in claim **7**, characterized in that the second wind passage (**20**) below the upper edges (**10**) of the solar modules (**1**) is limited by an upper edge (**21**) of the closed wall arrangement (**13**) at the second side of the installation set (**2**), from which a spar (**22**) projects at an angle from the outer side of the second installation set side (**2**).

9. The Flat-roof installation set as in claim **8**, characterized in that the width of the first wind passage (**19**) is less than the width of the second wind passage (**20**).

10. A Flat-roof installation set including a carrier frame on which solar modules are mounted wherein the solar modules are mounted on the first side of the installation set (**1**) adjacent

to one another in a common plane inclined from the roof surface and with their upper and lower edges positioned in parallel to the roof surface and aligned with one another characterized in that

a wind-suppressing or wind-blocking connector (**18**) is provided between the lower edges (**6**) of the solar modules (**5**) and the roof surface (**3**), and also proximate the second side of the installation set (**2**) between the upper edges (**10**) of the solar modules (**5**) and the roof surface (**3**) is to be of enclosed design, and inclined with respect to the solar modules (**5**) and opposed them, whereby two ends of installation set (**4**) are open and the underside of the installation set is closed off by the roof surface (**3**) while in an operating position, wherein a first wind passage (**19**) is provided below the lower edges (**6**) of the solar modules (**5**) in their areas extending down to the roof surface (**3**), and a second wind passage (**20**) is provided below the upper edges (**10**) of the solar modules (**5**) in the area toward the closed wall arrangement (**13**), wherein the width of the first wind passage (**19**) is less than the width of the second wind passage (**20**).

11. A Flat-roof installation set including a carrier frame on which solar modules are mounted wherein the solar modules are mounted on the first side of the installation set (**1**) adjacent to one another in a common plane inclined from the roof surface and with their upper and lower edges positioned in parallel to the roof surface and aligned with one another characterized in that

a wind-suppressing or wind-blocking connector (**18**) is provided between the lower edges (**6**) of the solar modules (**5**) and the roof surface (**3**), and also proximate the second side of the installation set (**2**) between the upper edges (**10**) of the solar modules (**5**) and the roof surface (**3**) is to be of enclosed design, and inclined with respect to the solar modules (**5**) and opposed them, whereby two ends of installation set (**4**) are open and the underside of the installation set is closed off by the roof surface (**3**) while in an operating position, wherein the carrier frame includes an upper crosspiece (**9**) onto which the upper edges (**10**) of the solar modules (**5**) are affixed and extend to a closed wall arrangement (**13**) at the second side of the installation set (**2**).

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