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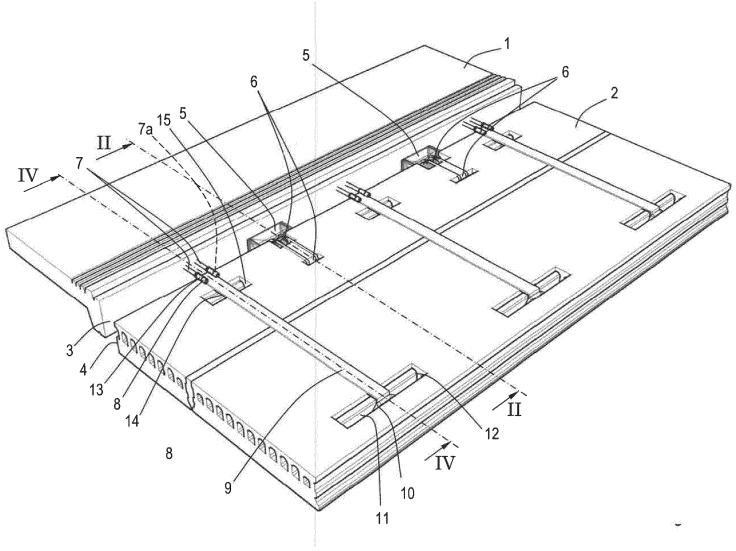
(54) **A mounting system and a method for mounting a cantilever building element to an edge of a floor construction of a building**

(57) A mounting system for mounting a cantilever building element (1) to an edge (4) of a floor construction (2) of a building comprises a floor construction (2) including an edge (4) which is provided with a support (5), a building element (1) which rests on the support (5) in mounted condition of the building element (1), and which comprises a coupling element (7) for fixing the building element (1) to the floor construction (2), a tension bar (9) which is fixed to the floor construction (2) at at least a main anchoring location (11) remote from the edge (4), before installing the building element (1), and which extends from the main anchoring location (11) towards the edge (4), wherein the coupling element (7) and the tension bar (9) have respective cooperating fixing portions (7a, 13) at which the coupling element (7) and the tension bar (9) can be fixed to each other so as to jointly transfer a horizontally directed tension force from the building element (1) to the floor construction (2) when the building element (1) is mounted to the floor construction (2), wherein the fixing portion (13) of the tension bar (9) is remote from the main anchoring location (11), wherein in the mounted condition the fixing portions (7a, 13) are located such that the resultant force of the coupling element (7) on the fixing portion (13) of the tension bar (9) in a direction along the line along which the resultant force in the tension bar (9) remote from its fixing portion (13) acts, acts along a line which is substantially aligned or nearly aligned to the line along which the resultant force in the tension bar (9) remote from its fixing portion (13) acts, as seen in at least one of the horizontal and vertical direction.



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Description

[0001] The present invention relates to a mounting system for mounting a cantilever building element, such as a balcony or access balcony, to an edge of a floor construction of a building.

[0002] According to a conventional mounting system a balcony is fixed to a building by a so-called wet installation during a rough phase of a building process. In that case a prefabricated balcony including projecting steel bars is anchored in a building by positioning the balcony against the building such that the steel bars are located in the building structure, after which concrete is poured at the location where the steel bars meet the building structure. A drawback of the wet mounting system is that during the building activities the balcony must be temporarily supported until the concrete has fully cured. This affects the progress of the building process.

[0003] Therefore, it is desired to mount a balcony to a floor construction of a building by means of dry installation, preferably after the rough building phase of the building. In that case the balcony can be mounted at a later stage in the building process, such that it is taken out of the critical logistical path, for example. Mounting a balcony to a floor construction of a building, however, requires a fundamentally different approach. For example, fixing a cantilever balcony to a floor construction means that the tension force caused by the bending moment which is exerted by the balcony on the building must be transferred to the floor construction in a direction parallel to the plane of the floor construction.

[0004] The present invention aims to provide a safe and reliable mounting system which provides the opportunity to install a building element to a floor construction of a building by means of a dry installation process.

[0005] For this purpose the mounting system comprises:

a floor construction including an edge which is provided with a support for bearing a building element in upward direction,

a building element which rests on the support in mounted condition of the building element, and which comprises a coupling element for fixing the building element to the floor construction,

a tension bar which is fixed to the floor construction at at least a main anchoring location remote from the edge, before installing the building element, and which extends from the main anchoring location towards the edge,

wherein the coupling element and the tension bar have respective cooperating fixing portions at which the coupling element and the tension bar can be fixed to each other upon mounting the building element to the floor construction so as to jointly transfer a horizontally directed tension force from the building element to the floor construction when the building element is mounted to the floor construction, wherein the fixing portion of the tension bar is remote from the main anchoring location,

wherein in the mounted condition the fixing portions are located such that the resultant force of the coupling element on the fixing portion of the tension bar in a direction along the line along which the resultant force in the tension bar remote from its fixing portion acts, acts along a line which is substantially aligned or nearly aligned to the line along which the resultant force in the tension bar remote from its fixing portion acts, as seen in at least one of the horizontal and vertical direction.

[0006] The tension bar may be any rod or elongate member, which may be made of steel or the like. The tension bar is fixed at at least a main anchoring location remote from the edge in order to minimize local horizontal forces at the edge of the floor construction in a direction of the edge. In the mounted condition the vertical force caused by the building element is mainly exerted onto the support. The moment caused by the building element is transferred to a horizontally oriented tension force which is guided through the coupling element and the tension bar which are fixed to each other at the fixing portions. Due to the fact that the line along which the resultant force of the guide element on the fixing portion of the tension bar acts is substantially aligned or nearly aligned to the line along which the resultant tension force in the tension bar remote from its fixing portion acts, the occurrence of an internal moment in the tension bar is minimized.

[0007] In practice the support is located at a lower level than the tension bar and the coupling element. The tension bar may extend at the top of the floor construction or at least at the upper half thereof. The fixing portions may be located at the edge.

[0008] If the resultant force of the coupling element on the fixing portion of the tension bar acts along a line which is nearly aligned to the line along which the resultant force in the tension bar remote from its fixing portion acts, the distance between said lines may be less than five times of the thickness of the tension bar remote from its fixing portion as seen in the same direction, preferably less than three times of the thickness of the tension bar remote from its fixing portion as seen in the same direction. In this case the lines along which the respective resultant forces act are parallel, but close to each other. In practice, the eccentricity between the mentioned lines of resultant forces may be the same as the distance between the centreline of the fixing portion of the tension bar and the centreline of the tension bar remote from the fixing portion as seen in the same direction. For example, in vertical direction the distance between the centreline of the fixing portion of the tension bar and the centreline of the tension bar remote from its fixing portion may be twice the thickness of the tension bar remote from the fixing portion in vertical direction, hence creating a small eccentricity in vertical direction.

[0009] In a preferred embodiment the tension bar has one end which is fixed to the floor construction at the main anchoring location, before installing the building element, whereas the remainder of the tension bar is loose from the floor construction and the fixing portion of the tension bar is located at the loose portion thereof, wherein the tension bar is bendable with respect to the main anchoring location such that its fixing portion is movable in transverse direction of the tension bar before fixing the coupling element and the tension bar to each other.

[0010] The possibility of bending the tension bar simplifies a method of moving the fixing portion of the tension bar in a fitting position with respect to the fixing portion of the coupling element of the building element. For example, depending on the manner of fixing, the fixing portions may be aligned in an easy way, such as in case of a pin-in-hole coupling. This means that the invention accelerates the installation activities and the mounting of the building element is not time critical in the planning and is not sensitive to manufacturing tolerances. In other words, the mounting system compensates for manufacturing tolerances.

[0011] It is noted that the tension bar and the coupling element are intended for transferring a horizontal force from the building element to the floor construction rather than transferring a vertical force. In the mounted condition the vertical force caused by the building element is mainly exerted onto the support.

[0012] The embodiment including the bendable loose portion of the tension bar is independent from the alignment of the lines along which the resultant force of the coupling element and the resultant force in the tension bar act as described hereinbefore. Therefore, an aspect of the invention is a mounting system for mounting a cantilever building element, such as a balcony or access balcony, to an edge of a floor construction of a building, comprising a floor construction including an edge which is provided with a support element for bearing a building element in upward direction, a building element which rests on the support in mounted condition of the building element, and which comprises a coupling element for fixing the building element to the floor construction, a tension bar having one end which is fixed to the floor construction at a main anchoring location remote from the edge, before installing the building element, whereas the remainder of the tension bar is loose from the floor construction and extends from the main anchoring location towards the edge, wherein the coupling element and the loose portion of the tension bar have respective cooperating fixing portions at which the coupling element and the tension bar can be fixed to each other upon mounting the building element to the floor construction so as to jointly transfer a horizontally directed tension force from the building element to the floor construction when the building element is mounted to the floor construction, wherein the fixing portion of the tension bar is remote from the main anchoring location and the tension bar is bendable with respect to the main anchoring location such that its fixing portion is movable in transverse direction of the tension bar before fixing the coupling element and the tension bar to each other.

[0013] In a practical embodiment the floor construction is made of concrete and the tension bar has a main cross bar at the above-mentioned one end of the tension bar, and the main cross bar is anchored in a main cavity of the floor construction by means of pouring mortar into the main cavity and curing it. This allows the tension bar to be fixed reliably to the floor construction. The main cavity in the floor construction can be made on site or left out during manufacturing the floor construction.

[0014] The floor construction may be made of concrete by means of prefabricated slabs, for example hollow-core slabs. Alternatively, the floor construction is made of concrete at the building site. In that case the tension bar may be fixed at at least the main anchoring location upon pouring concrete to create the floor construction. In the latter case the tension bar may also be fixed to the reinforcement of the floor construction before pouring concrete, for example.

[0015] Preferably, the tension bar is at least partly located on top of the floor construction, which facilitates installing the tension bar to the floor construction. In that case the main cavity may comprise a recess in the upper side of the floor construction. It is noted that the top of the floor construction may be substantially flat, but that is not necessary. For example, the upper surface may be provided with an elongate slot in which the tension bar extends.

[0016] The tension bar may comprise a strip-shaped portion, which is advantageous to minimize the height of the tension bar on top of the floor construction. This minimizes the required thickness of a finishing layer which can be applied on the floor construction after installing the building element.

[0017] The building element may be made of concrete, for example a prefabricated balcony, whereas its coupling element comprises a reinforcement bar which projects therefrom at a mounting side which faces the edge of the floor construction in mounted condition. In this case the reinforcing bar is mechanically fixed to the tension bar in mounted condition. The tension bar and the reinforcement bar may be substantially aligned. If the fixing portions are symmetrically placed with respect to centrelines of the respective reinforcement bar and tension bar, the resultant force of the reinforcement bar on the fixing portion of the tension bar acts along the same line as the resultant force of the tension bar.

[0018] In a practical embodiment the building element is made of concrete and the coupling element comprises a pair of reinforcement bars which projects therefrom at the mounting side which faces the edge of the floor construction in mounted condition, wherein the reinforcement bars are fixed symmetrically to opposite sides of the tension bar at the fixing portions. In this case the two reinforcement bars have a joint resultant force which acts along a line which may substantially coincide with the

centreline of the tension bar.

[0019] The fixing portion of the tension bar may comprise a through-hole through which the projecting reinforcement bar of the building element fits. As described above, upon installing the building element in case of the bendable loose portion, the through-hole can be aligned with the reinforcement bar due to bending the tension bar.

[0020] In a practical embodiment the fixing portion of the projecting reinforcement bar comprises a threaded end portion and a nut which can be screwed onto the threaded end portion after the reinforcement bar is put through the through-hole so as to fix the reinforcement bar and the tension bar to each other. Numerous alternative fixing means instead of a screw and threaded end portion are conceivable.

[0021] The tension bar may have an auxiliary anchoring element for anchoring the tension bar to the floor construction at an auxiliary anchoring location at a distance from the main anchoring location after fixing the tension bar and the coupling element to each other. The auxiliary anchoring element constitutes an additional attachment of the tension bar to the floor construction. An advantage of additionally anchoring the tension bar at the auxiliary anchoring location is that the effective elastic length of the tension bar is shortened. This minimizes a downward displacement of the building element upon placing a load thereon or a tendency to vibration.

[0022] In a practical embodiment the floor construction is made of concrete and the auxiliary anchoring element comprises a lateral projection of the tension bar which fits in an auxiliary cavity of the floor construction and is anchored to the floor construction by means of pouring mortar into the auxiliary cavity and curing it.

[0023] Regarding the support, the position and orientation of the support may be adjustable with respect to the floor construction before mounting the building element to the floor construction. This enables the builder to level the support before installing the building element.

[0024] In practice the support may comprise at least two supporting elements located at a distance from each other along the edge of the floor construction, wherein each of the supporting elements is adjustable in at least vertical direction before mounting the building element to the floor construction.

[0025] The support may be partly received in a support cavity of the floor construction and fixed thereto by means of pouring mortar into the support cavity and curing it after adjusting.

[0026] It is noted that the support and the tension bar are located close to each other along the edge of the floor construction, or the support and the tension bar are located at the same location as seen along the edge. It is also conceivable that the support and the tension bar constitute an integrated member.

[0027] The invention is also related to a method for mounting a cantilever building element, such as a balcony or access balcony, to an edge of a floor construction of a building by means of the mounting system as described hereinbefore, wherein the building element is placed on the support such that a mounting side of the building element faces the edge of the floor construction, and the respective fixing portions are brought in a mutually fitting position by bending the tension bar about the main anchoring location in which mutual position the fixing portions are attached to each other.

[0028] The invention will hereafter be elucidated with reference to the schematic drawings showing embodiments of the invention by way of example.

Fig. 1 is a perspective view of an embodiment of the mounting system according to the invention.

Fig. 2 is a sectional view along the line II-II in Fig. 1.

Fig. 3 is a similar view as Fig. 2 of an alternative embodiment.

Fig. 4 is a sectional view along the line IV-IV in Fig. 1.

Fig. 5 is a similar view as Fig. 4 of an alternative embodiment.

Figs. 6-11 are similar views as Fig. 1, which illustrate an embodiment of the method of installing a building element according to the invention.

Fig. 12 is a similar view as Fig. 11, but seen from an opposite side.

Fig. 13 is a similar view as Fig. 12, but illustrating different embodiments of supporting elements.

Figs. 14 and 15 are perspective views of an embodiment of a tension bar.

Figs. 16 and 17 are similar views as Figs. 14 and 15 of an alternative embodiment.

[0029] Fig. 1 shows an embodiment of a mounting system according to the invention. The system comprises a cantilever building element in the form of a prefabricated balcony 1 which is mounted to a floor construction 2 of a building (not shown). The balcony 1 is made of concrete and has a rectangular shape, but alternative shapes are conceivable. The building may be a multi-level building which must be provided with a plurality of balconies. The floor construction 2 is made of concrete hollow-core slabs. The mounting system is suitable to fix the balcony 1 to the floor construction 2 at a late stage in the building process, independent from the critical path of the building process, for example after the outer side of the building has almost been finished, i.e. after the rough building phase. Upon installing the balcony 1 it can be positioned near its final position by using a crane and then fixing the balcony 1 to the floor construction 2. This means that temporary supports, such as in case of wet installing, are not necessary.

[0030] The embodiment according to Fig. 1 shows the balcony 1 in a virtual mounted condition, in which a mounting side 3 of the balcony 1 faces an edge 4 of the floor construction 2. It is called virtual since the situation as shown in Fig. 1 does not represent an entirely mounted condition, as not all of the parts of the mounting system are shown in entirely mutual fixed condition, in order to be able to explain the functioning of the mounting system.

[0031] The edge 4 of the floor construction 2 comprises two supporting elements 5 which are located at a distance from each other along the edge 4. The supporting elements 5 are provided with horizontal projections on which the balcony 1 rests in the mounted condition. The positions and orientations of the supporting elements 5 are adjustable before mounting the balcony 1 to the floor construction 2. In this case the supporting elements 5 are partly received in support cavities 6 of the floor construction 2 within which the supporting elements 5 are movable before adjusting them to desired settings. Before installing the balcony 1, for example a few weeks, the supporting elements 5 are set and fixed to the floor construction 2 by pouring mortar into the support cavities 6 such that they are anchored in the floor construction 2. In this embodiment the balcony 1 only exerts a vertical force onto the supporting elements 5.

[0032] It is noted that the supporting elements 5 may be combined with thermal breaks in order to avoid thermal bridges at the supporting elements 5.

[0033] Fig. 1 shows that three pairs of reinforcement bars 7 project from the balcony 1 at its mounting side 3. Each of the projecting reinforcement bars 7 has a threaded end portion 7a on which a nut 8 can be screwed for fixing the reinforcement bars 7 to the floor construction 2.

[0034] The mounting system also comprises three tension bars 9 to which the respective pairs of reinforcement bars 7 of the balcony 1 are fixed. In this embodiment the tension bars 9 comprise steel strips which are fixed to the floor construction 2 at one end thereof. The fixed end has a main cross bar 10 which is anchored at a main anchoring location 11 of the floor construction 2 before installing the balcony 1. The main anchoring location 11 lies at a distance from the edge 4 and the floor construction 2 comprises a main cavity 12 at the main anchoring location 11. The main cavity 12 is formed by a recess in the upper side of the floor construction 2.

[0035] Figs. 14 and 15 show a first embodiment of the strip-shaped tension bar 9, and Figs. 16 and 17 show an alternative embodiment having a differently shaped or main cross bar 10. Numerous alternative shapes are conceivable.

[0036] Upon installing the tension bars 9 to the floor construction 2 the main cross bars 10 are placed in the main cavities 12 such that the remainders of the respective tension bars 9 extend from the main anchoring locations 11 towards the edge 4, mainly on top of the floor construction 2. Subsequently, mortar is poured into the main cavities 12 and cured afterwards. The remainders of the respective tension bars 9 remain loose from the floor construction 2 until the moment of installing the balcony 1.

[0037] The free ends of the tension bars 9 are provided with pairs of sleeves 13 through which the reinforcement bars 7 of the balcony 1 fit. The sleeves 13 are located symmetrically with respect to the centreline of the tension bar 9, at opposite sides of the strip-shaped portion of the tension bar 9 in horizontal direction. The tension bars 9 are bendable with respect to the main anchoring location 11 such that each pair of sleeves 13 is movable in transverse direction of the corresponding tension bar 9. In other words, the pairs of sleeves 13 are movable in horizontal and vertical direction before installing the balcony 1. This provides the opportunity to align the pairs of sleeves 13 with the pairs of reinforcement bars 7 upon installing the balcony 1, hence allowing deviating manufacturing tolerances.

[0038] After the reinforcement bars 7 have been put through the respective sleeves 13 during installing, the respective nuts 8 are screwed onto the respective threaded end portions 7a. After fixing the balcony 1 to the floor construction 2 the reinforcement bars 7 and the tension bars 9 together transfer horizontally directed tension forces from the balcony 1 to the floor construction 2. In other words, the moment of the balcony 1 about an axis at the edge 4 of the floor construction 2 is compensated by tension forces in the reinforcement bars 7 and the tension bars 9.

[0039] In the embodiment according to Fig. 1 each of the tension bars 9 is attached to two parallel reinforcement bars 7. As seen from above the centreline of the tension bar 9 as well as the centrelines of the reinforcement bars 7 extend perpendicularly to the edge 4 of the floor construction 2. The pair of reinforcement bars 7 as well as the pair of sleeves 13 are arranged symmetrically with respect to the centreline of the tension bar 9. This means that the resultant force of the pair of reinforcement bars 7 on the pair of sleeves 13 of the tension bar 9 acts along a line which substantially coincides with the centreline of the tension bar 9 as seen in vertical direction.

[0040] Figs. 4 and 5 show cross-sectional views of two different embodiments of the mounting system along the line IV-IV in Fig. 1. In these views it can be seen that the centrelines of the pair of parallel reinforcement bars 7 substantially coincide with the centreline of the tension bar 9. In other words, the reinforcement bars 7 and the tension bar 9 substantially lie in a common horizontal plane. This means that the resultant force of the pair of reinforcement bars 7 on the pair of sleeves 13 of the tension bar 9 acts along a line which substantially coincides with the centreline of the tension bar 9 as seen in horizontal direction.

[0041] In the embodiment of Fig. 1 the centrelines of the sleeves 13 are located slightly higher than the centreline of the tension bar 9 remote from the sleeves 13. This means that the resultant force of the pair of reinforcement bars 7 on the pair of sleeves 13 of the tension bar 9 acts along a line which is parallel to the centreline of the tension bar 9 remote from the sleeves 13 as seen in horizontal direction. However, the vertical distance or eccentricity between the line along which the resultant force of the pair of reinforcement bars 7 acts on the pair of sleeves 13 and the line along which the resultant force in the tension bar 9 at a distance of the sleeves 13 acts, is only a few times the thickness of the tension bar 9 remote from the sleeves 13 in vertical direction. For ex-

ample, the strip-shaped portion of the tension bar 9 has a height of 10 mm, whereas the eccentricity is 25 mm. In horizontal direction the sleeves 13 are located symmetrically with respect to the centreline of the tension bar 9 remote from the sleeves 13 such that the eccentricity is substantially zero.

[0042] In order to minimize elastic stretch in longitudinal direction of the relatively long tension bars 9 during use of the balcony 1, the tension bars 9 are provided with respective auxiliary anchoring elements in the form of auxiliary cross bars 14. Different types of auxiliary cross bars 14 are shown in the embodiments of tension bars 9 in Figs. 14-16. The auxiliary cross bars 14 may extend in horizontal and/or in vertical direction. Before installing the balcony 1 the auxiliary cross bars 14 can freely move within respective auxiliary cavities 15. This allows bending the tension bars 9 about the main anchoring location 11 upon installing, as described hereinbefore. After installing the balcony 1 the auxiliary cross bars 14 are fixed to the floor construction 2 by means of pouring mortar into the auxiliary cavities 15 and curing it. This is illustrated in Figs. 4 and 5.

[0043] Figs. 6-11 illustrate successive steps of an embodiment of a method for mounting a cantilever building element in the form of a balcony 1 to an edge 4 of a floor construction 2 of a building according to the invention. In the embodiment as shown in Figs. 6-11 the mounting system as described hereinbefore and shown in the Figs. 1-5 is used. Corresponding parts are indicated by using the same reference signs.

[0044] Fig. 6 shows the floor construction 2 to which the supporting elements 5 are placed, but still not anchored. Fig. 7 shows that in a next step the tension bars 9 including the respective pairs of sleeves 13, main cross bars 10 and auxiliary cross bars 14 are placed on the floor construction 2. In the situation as shown in Fig. 8 the main cavities 12 and the support cavities 6 are filled with mortar which is cured afterwards. As a consequence, the tension bars 9 are anchored at one end thereof and the supporting elements 5 are fixed to the floor construction 2. Before fixing the supporting elements 5 their positions with respect to the floor construction 2 are adjusted such that when the balcony 1 is placed on the supporting elements 5 it is immediately at the correct level and orientation with respect to the floor construction 2.

[0045] After the mortar has been cured the balcony 1 can be installed as illustrated in Fig. 9. In the meantime, i.e. before installing the balcony 1, the outer side of the building can be built further and the moment of installing the balcony 1 can be chosen at a late stage in the building process. The balcony 1 can be placed onto the supporting elements 5 by a crane, whereas the reinforcement bars 7 can be put through the sleeves 13 of the respective tension bars 9. Since the sleeves 13 are moveable in transverse direction of the tension bars 9 it is easy to align the sleeves 13 with the reinforcement bars 7. Fig. 10 illustrates the condition in which the balcony 1 is fixed to the floor construction 2 by screwing the nuts 8 on the threaded end portions 7a of the reinforcement bars 7. In a next step the auxiliary cavities 15 can be filled with mortar, as shown in Fig. 11. The latter step shortens the effective elastic lengths of the tension bars 9. Fig. 11 shows a situation in which the balcony 1 is entirely attached to the floor construction 2, whereas Fig. 1 shows a situation in which the respective cavities 6, 12 and 15 are still empty such that the tension bars 9 and the supporting elements 5 are loose from the floor construction 2, just for explanatory reasons.

[0046] After mounting the balcony 1 to the building the floor construction 2 may be covered by a finishing layer which also covers the tension bars 9 and parts of the supporting elements 5.

[0047] Fig. 12 shows the mounted condition of Fig. 11 from a different side.

[0048] Fig. 13 shows the floor construction 2 including two different embodiments of supporting elements 5. In practice, a single type of supporting elements 5 will be applied, but in this case two types are shown for explanatory reasons. The supporting element 5 at the right side comprises an angle section including a horizontal bearing surface 5a on which the balcony 1 rests in mounted condition. The supporting element 5 at the left side in Fig. 13 comprises a hooked section including a bearing surface 5a on which the balcony 1 rests in mounted condition. Figs. 2 and 3 show the left and right type of supporting element 5 of Fig. 13 in cross section, respectively. Fig. 2 shows that a vertical plate at the mounting side 3 of the balcony 1 hooks behind the hooked section of the supporting element 5 and rests onto the bearing surface 5a. Fig. 3 shows that the balcony 1 rests on the bearing surface 5a of the angle section. Figs. 2, 3 and 13 also show that the bearing surfaces 5a are mechanically connected to the filled support cavities 6 by inclined reinforcement bars.

[0049] Figs. 4 and 5 show similar cross-sectional views as Figs. 2 and 3 respectively, at the location of the tension bar 9. It can be seen that a relatively wide space is available outside the mounting side 3 of the balcony 1 and the edge 4 of the floor construction 2 between the supporting elements 5.

Figs. 4 and 5 show that the sleeves 13 of the tension bars 9 are located at the edge 4 of the floor construction 2, but it is conceivable that they are located at the space between the mounting side 3 and the edge 4 or on top of the floor construction 2 remote from the edge 4.

[0050] The invention is not limited to the embodiments shown in the drawings and described hereinbefore, which may be varied in different manners within the scope of the claims and their technical equivalents. For example, it is conceivable that the tension bars and/or the supporting elements are fixed to the floor construction in an alternative manner. The number of tension bars and the number of support elements may be different in alternative embodiments. It is also possible to apply the mounting system without the feature of a bendable loose portion

of the tension bar, i.e. a mounting system in which the tension bar between the main anchoring location and its fixing portion is also fixed to the floor construction before installing the balcony.

Claims

1. A mounting system for mounting a cantilever building element (1), such as a balcony or access balcony, to an edge (4) of a floor construction (2) of a building, comprising
a floor construction (2) including an edge (4) which is provided with a support (5) for bearing a building element (1) in upward direction,
a building element (1) which rests on the support (5) in mounted condition of the building element (1), and which comprises a coupling element (7) for fixing the building element (1) to the floor construction (2),
a tension bar (9) which is fixed to the floor construction (2) at at least a main anchoring location (11) remote from the edge (4), before installing the building element (1), and which extends from the main anchoring location (11) towards the edge (4),
wherein the coupling element (7) and the tension bar (9) have respective cooperating fixing portions (7a, 13) at which the coupling element (7) and the tension bar (9) can be fixed to each other upon mounting the building element (1) to the floor construction (2) so as to jointly transfer a horizontally directed tension force from the building element (1) to the floor construction (2) when the building element (1) is mounted to the floor construction (2), wherein the fixing portion (13) of the tension bar (9) is remote from the main anchoring location (11),
wherein in the mounted condition the fixing portions (7a, 13) are located such that the resultant force of the coupling element (7) on the fixing portion (13) of the tension bar (9) in a direction along the line along which the resultant force in the tension bar (9) remote from its fixing portion (13) acts, acts along a line which is substantially aligned or nearly aligned to the line along which the resultant force in the tension bar (9) remote from its fixing portion (13) acts, as seen in at least one of the horizontal and vertical direction.

2. A mounting system according to claim 1, wherein the resultant force of the coupling element (7) on the fixing portion (13) of the tension bar (9) acts along a line which is nearly aligned to the line along which the resultant force in the tension bar (9) remote from the fixing portion (13) acts, wherein the distance between said lines is less than five times of the thickness of the tension bar (9) remote from its fixing portion (13) as seen in the same direction, preferably less than three times of the thickness of the tension bar (9) remote from its fixing portion (13) as seen in the same direction.

3. A mounting system according to claim 1 or 2, wherein the tension bar (9) has one end which is fixed to the floor construction (2) at the main anchoring location (11), before installing the building element (1), whereas the remainder of the tension bar (9) is loose from the floor construction (2) and the fixing portion (13) of the tension bar (9) is located at the loose portion thereof, wherein the tension bar (9) is bendable with respect to the main anchoring location (11) such that its fixing portion (13) is movable in transverse direction of the tension bar (9) before fixing the coupling element (7) and the tension bar (9) to each other.

4. A mounting system according to one of the preceding claims, wherein the floor construction (2) is made of concrete and the tension bar (9) has a main cross bar (10) at one end thereof which is anchored in a main cavity (12) at the main anchoring location (11) of the floor construction (2) by means of pouring mortar into the main cavity (12) and curing it.

5. A mounting system according to one of the preceding claims, wherein the tension bar (9) is at least partly located on top of the floor construction (2).

6. A mounting system according to one of the preceding claims, wherein the tension bar (9) comprises a strip-shaped portion.

7. A mounting system according to one of the preceding claims, wherein the building element (1) is made of concrete and its coupling element comprises a reinforcement bar (7) which projects therefrom at a mounting side (3) facing the edge (4) of the floor construction (2) in mounted condition.

8. A mounting system according to claim 7, wherein the fixing portion of the tension bar (9) comprises a through-hole (13) through which the projecting reinforcement bar (7) of the building element (1) fits.

9. A mounting system according to claim 8, wherein the fixing portion of the projecting reinforcement bar (7) comprises a threaded end portion (7a) and a nut (8) which can be screwed onto said threaded end portion (7a) after the reinforcement bar (7) is put through said through-hole (13) so as to fix the reinforcement bar (7) and the tension bar (9) to each other.

10. A mounting system according to one of the preceding claims, wherein the tension bar (9) has an auxiliary anchoring element (14) for anchoring the tension bar (9) to the floor construction (2) at an auxiliary anchoring location at a distance from the main anchoring location (11) after fixing the tension bar (9) and the coupling element (7) to each other.

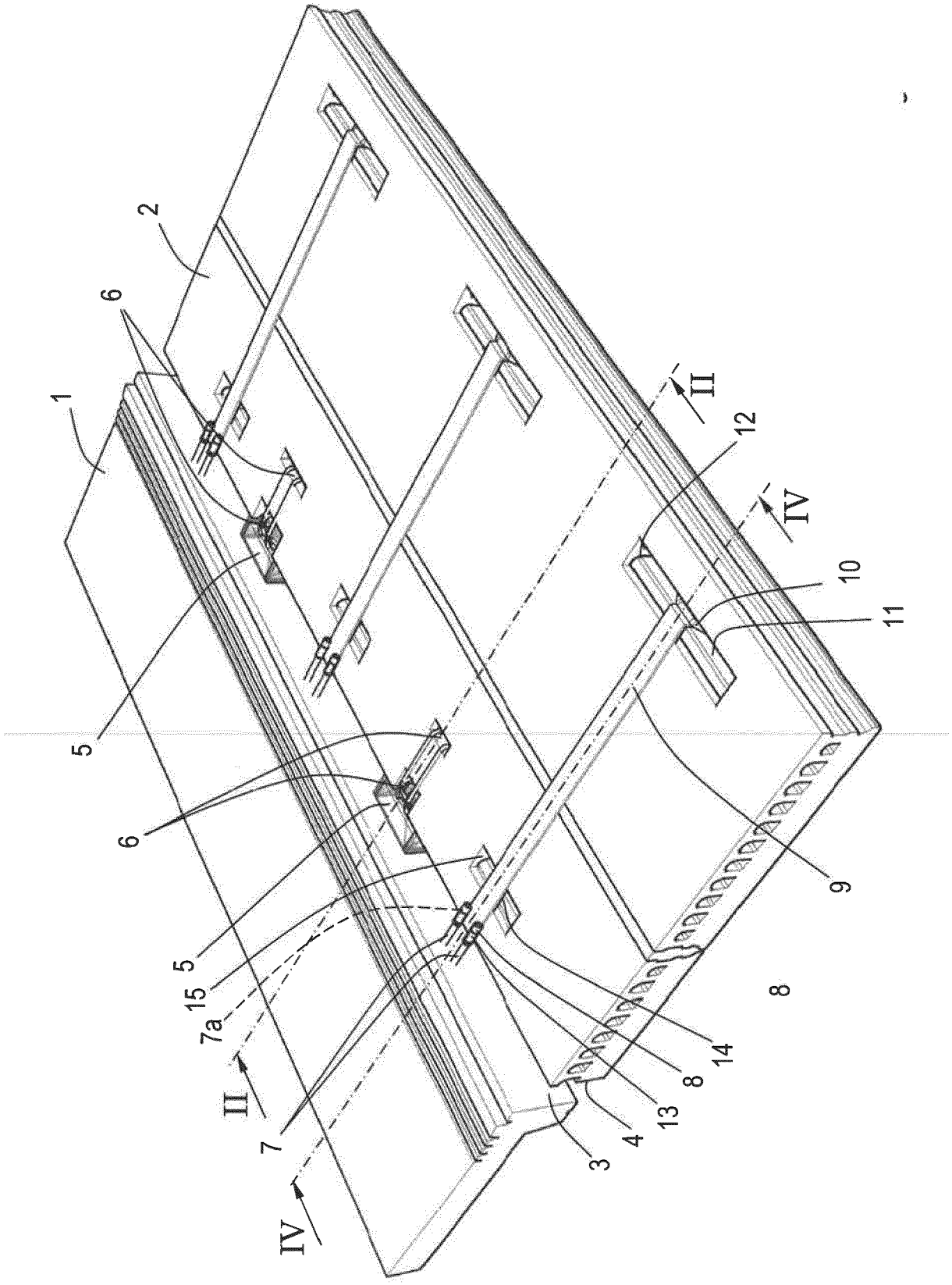
11. A mounting system according to claim 10, wherein the floor construction (2) is made of concrete and the auxiliary anchoring element (14) comprises a lateral projection of the tension bar (9) which fits in an auxiliary cavity (15) of the floor construction (2) and is anchored to the floor construction (2) by means of pouring mortar into the auxiliary cavity (15) and curing it.

12. A mounting system according to one of the preceding claims, wherein the position and orientation of the support (5) is adjustable with respect to the floor construction (2) before mounting the building element (1) to the floor construction (2).

13. A mounting system according to one of the preceding claims, wherein the support comprises at least two supporting elements (5) located at a distance from each other along the edge (4) of the floor construction (2), wherein each of said supporting elements (5) is adjustable in at least vertical direction before mounting the building element (1) to the floor construction (2).

14. A mounting system according to claim 12 or 13, wherein the support (5) is partly received in a support cavity (6) of the floor construction (2) and fixed thereto by means of pouring mortar into the support cavity (6) and curing it after adjusting.

15. A method for mounting a cantilever building element (1), such as a balcony or access balcony, to an edge (4) of a floor construction (2) of a building by means of the mounting system according to one of the preceding claims and claim 3, wherein
the building element (1) is placed on the support (5) such that a mounting side (3) of the building element (1) faces the edge (4) of the floor construction (2), and the respective fixing portions (7a, 13) are brought in a mutually fitting position by bending the tension bar (9) about the main anchoring location (11) in which mutual position the fixing portions are attached to each other.


1
2
6
5
6
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7a
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IV
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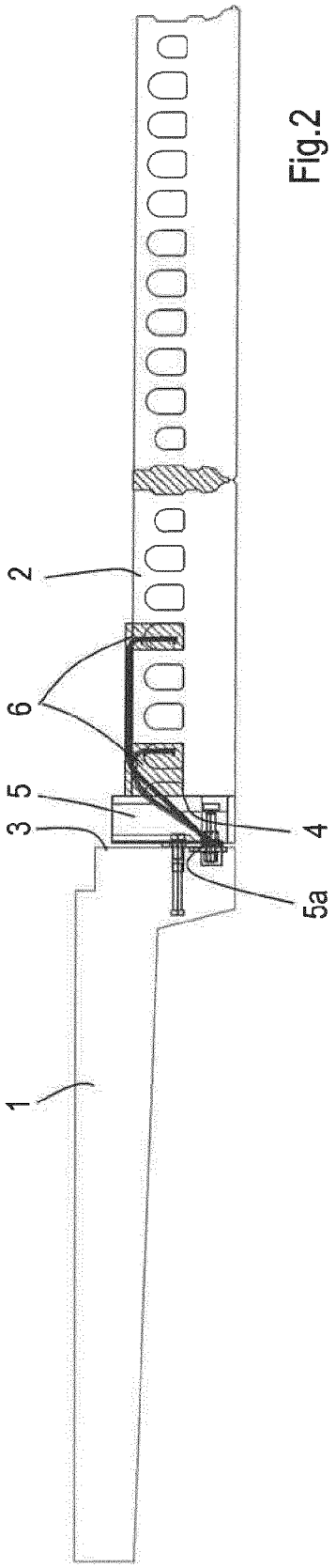

Fig.2

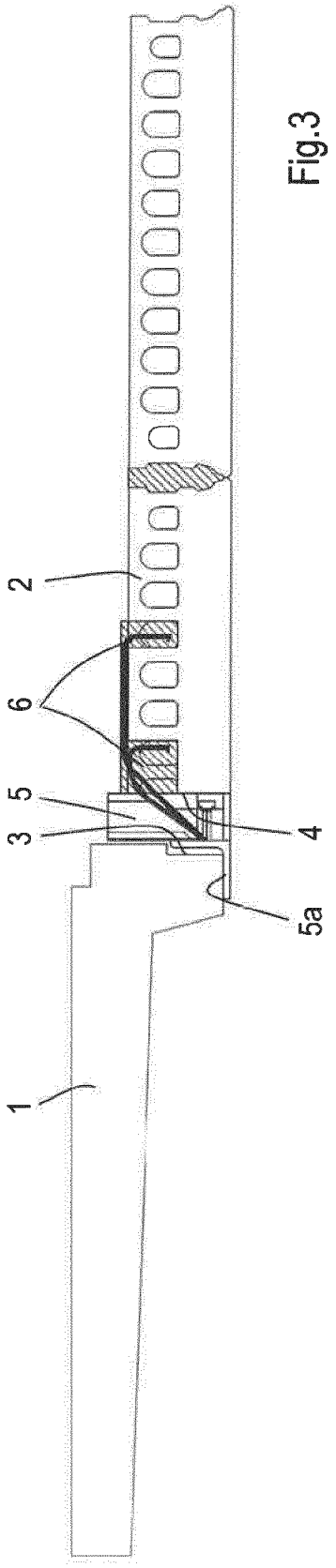

Fig.3

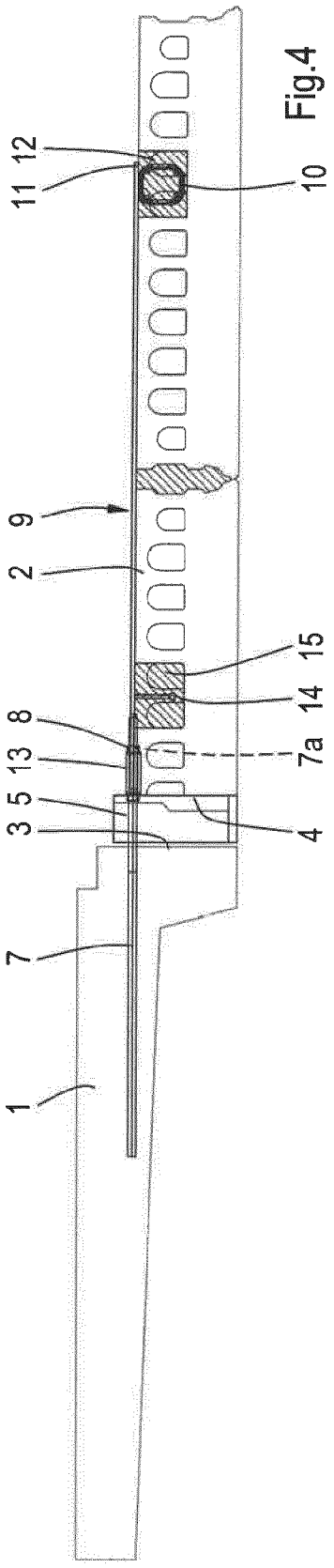

Fig.4

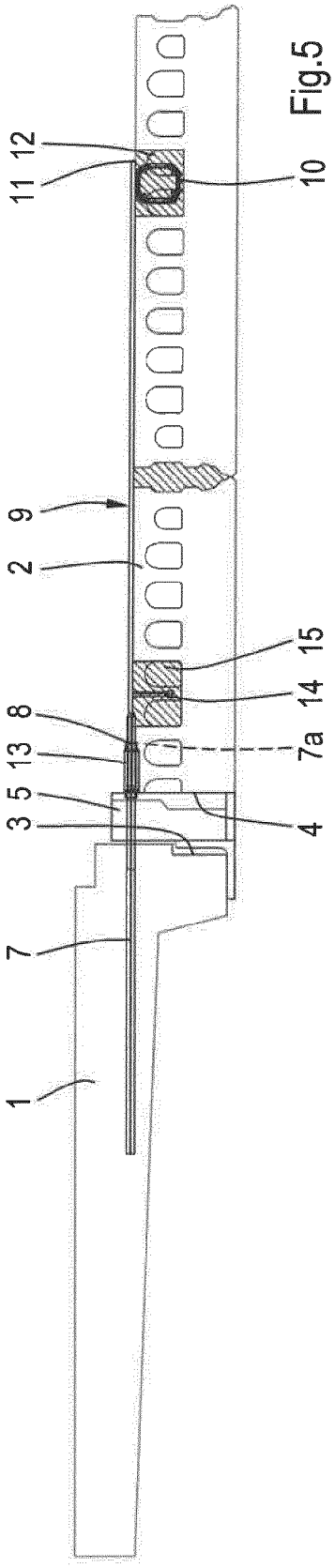

Fig.5

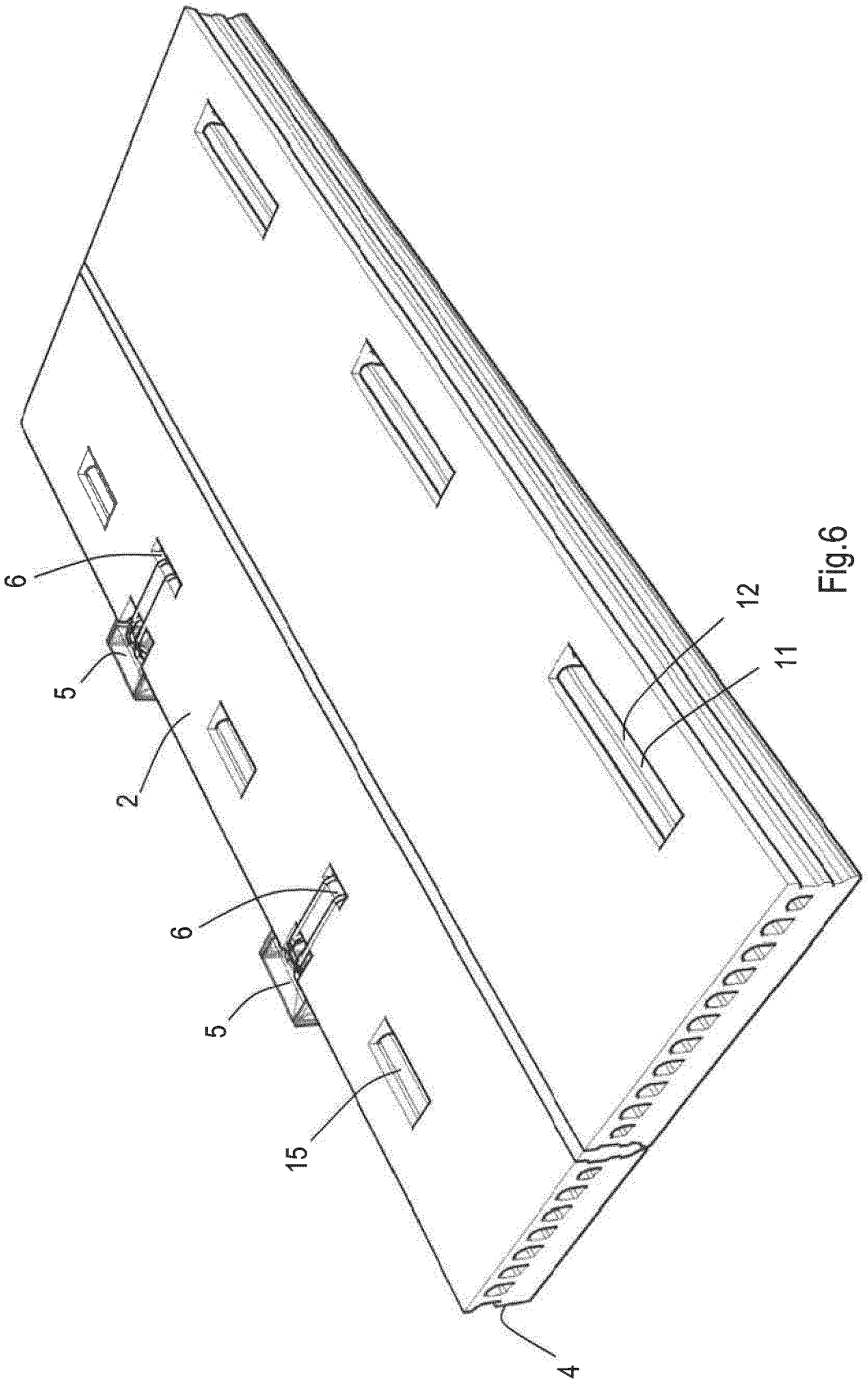

Fig.6

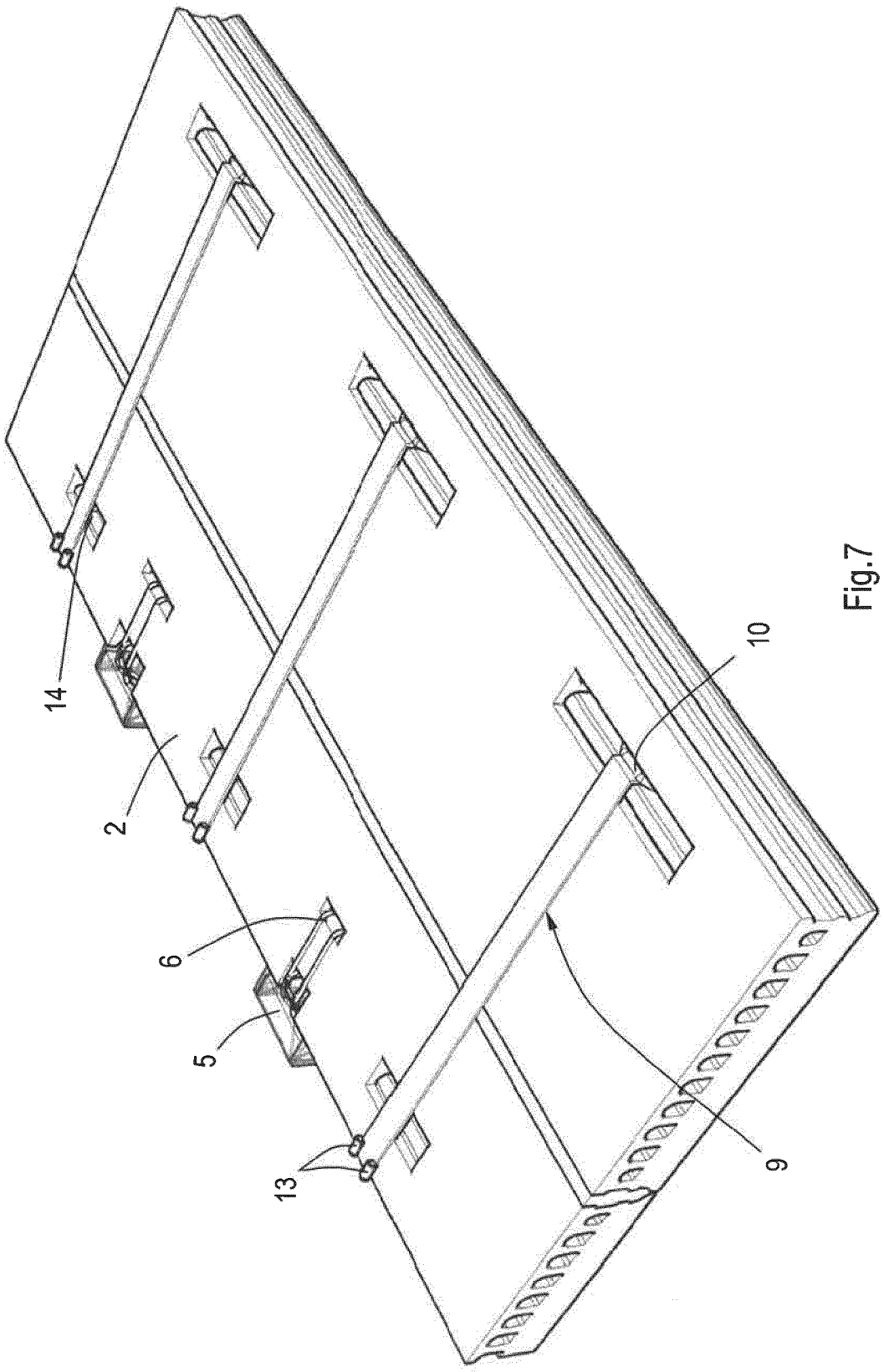

Fig.7

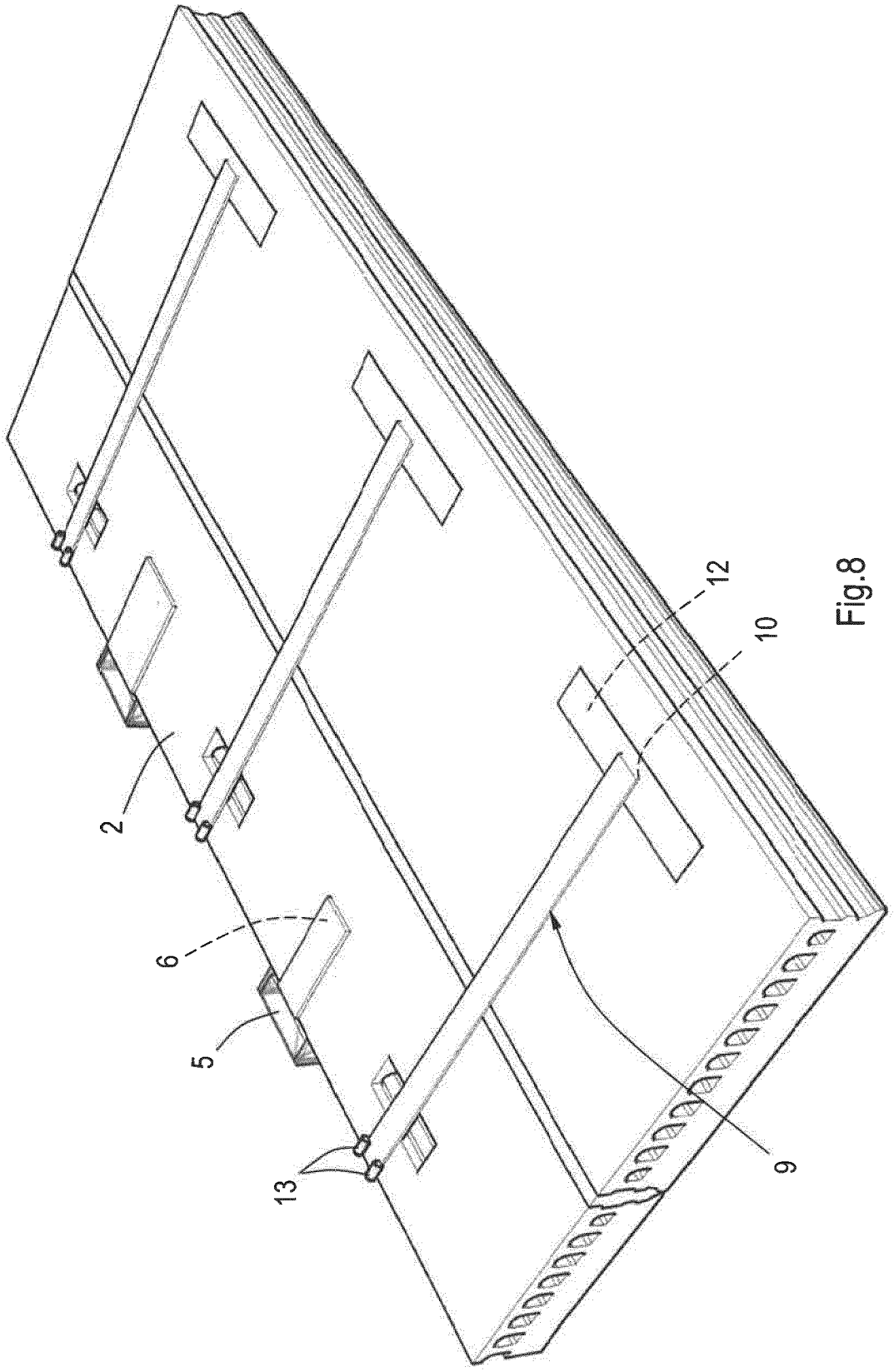

Fig.8

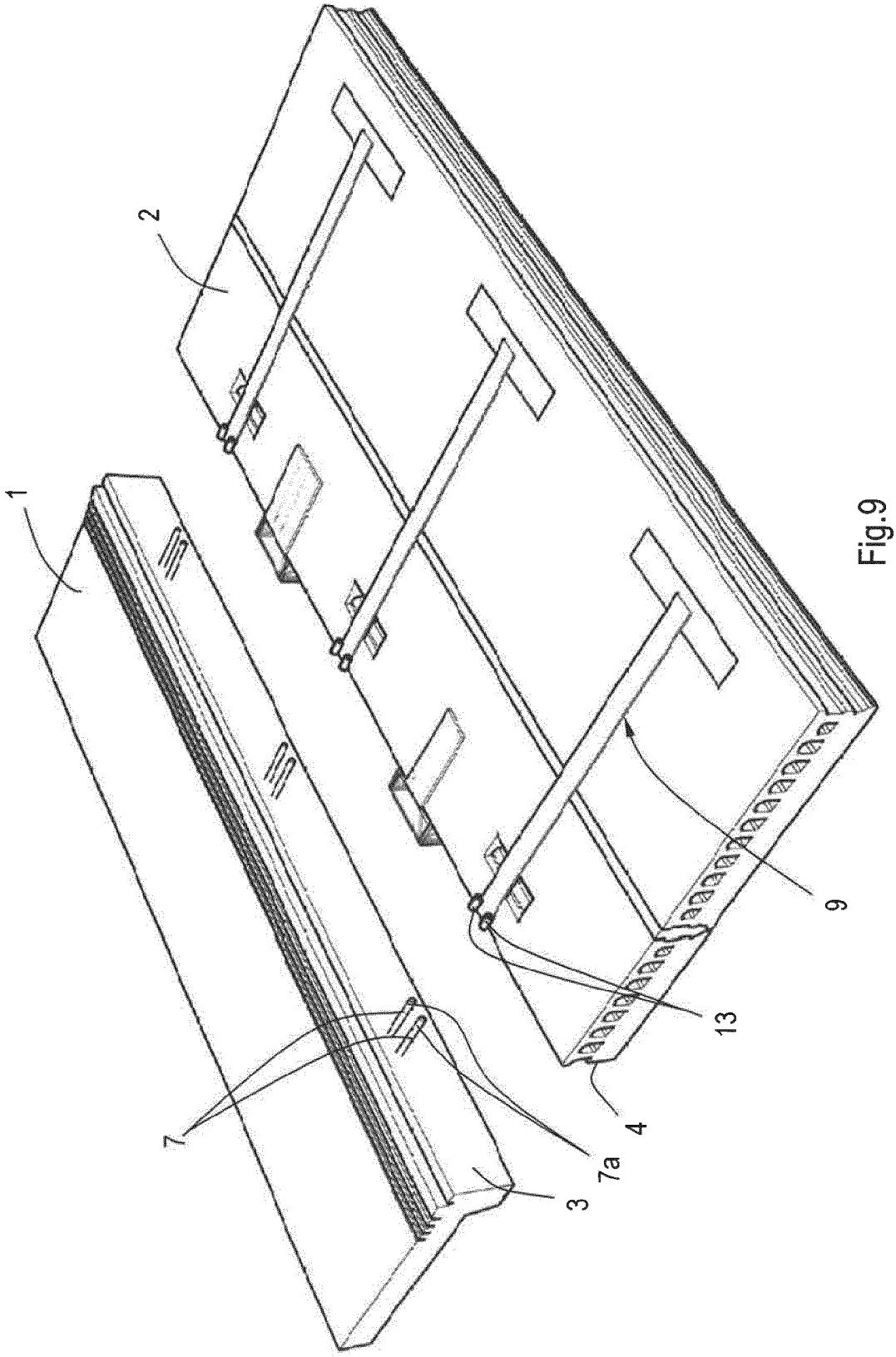

Fig.9

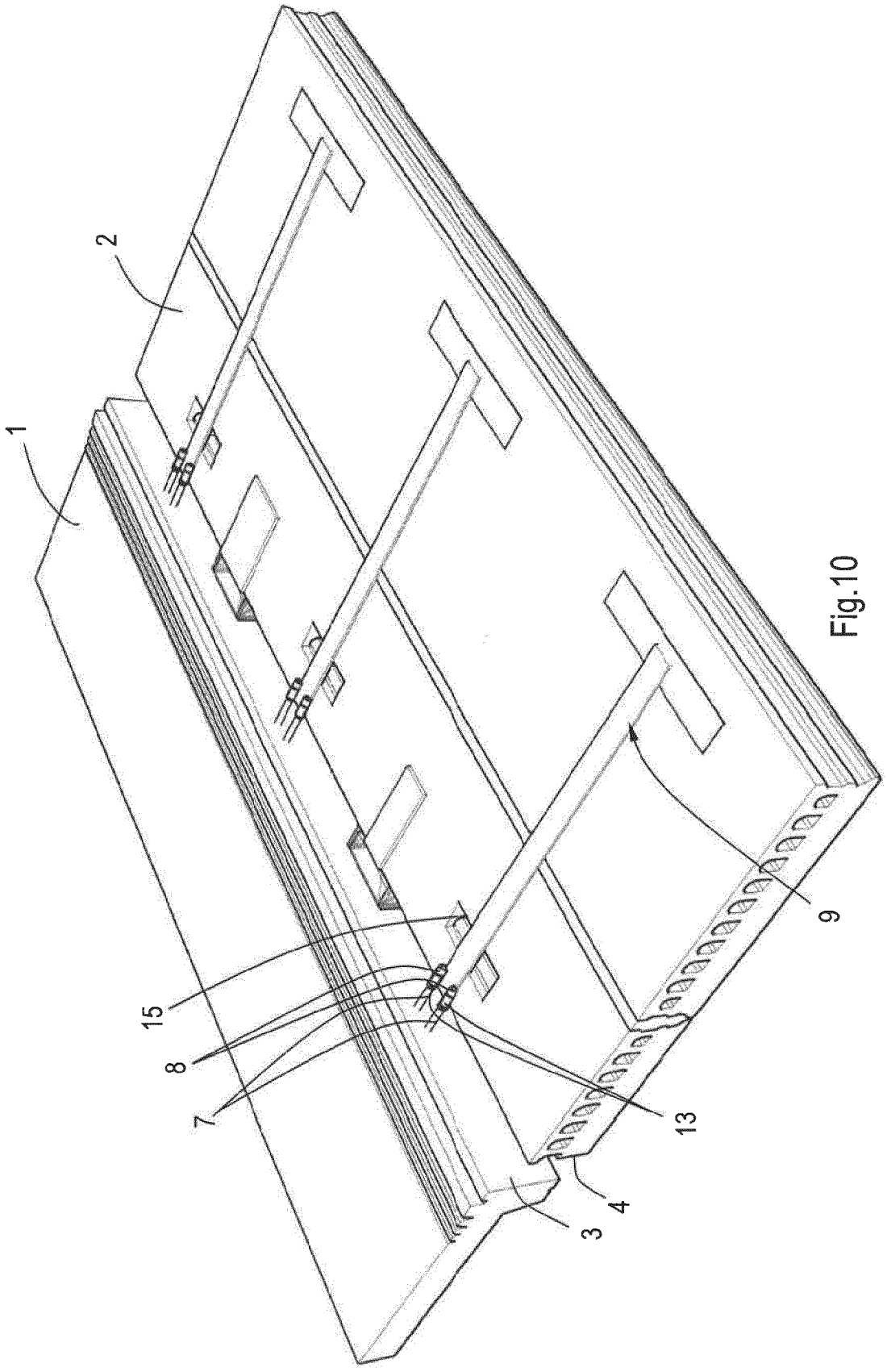

Fig.10

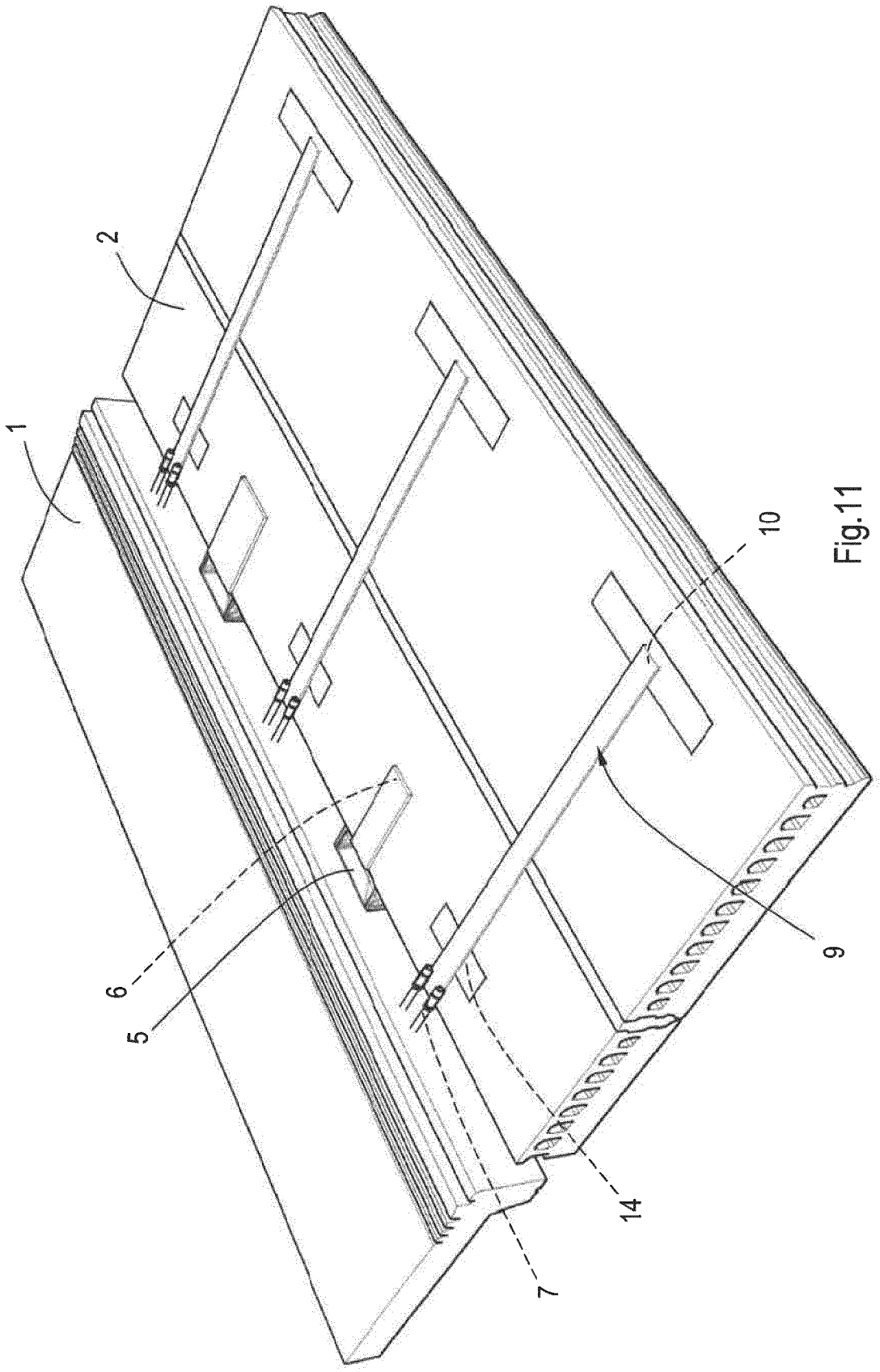

Fig.11

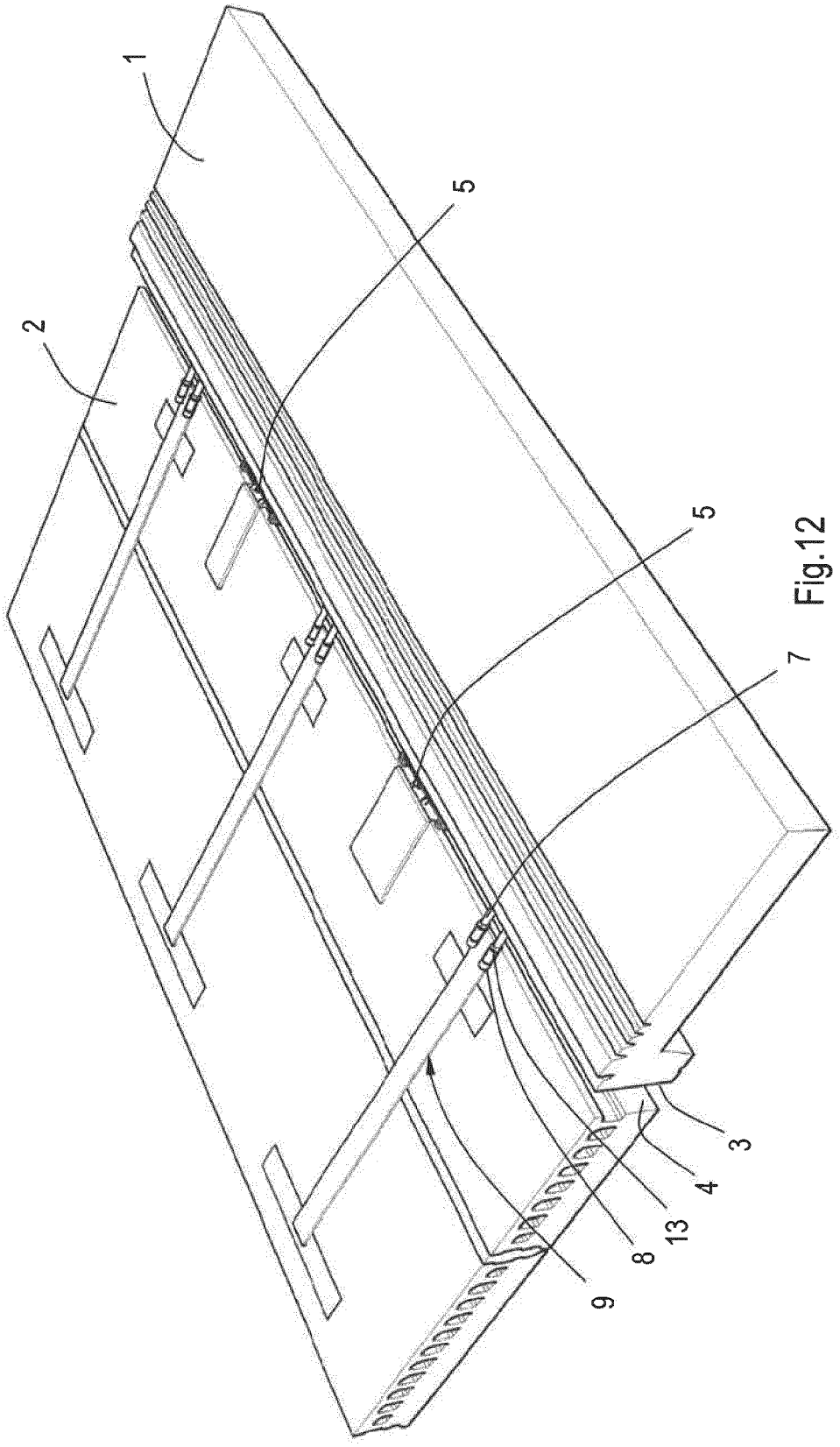

Fig.12

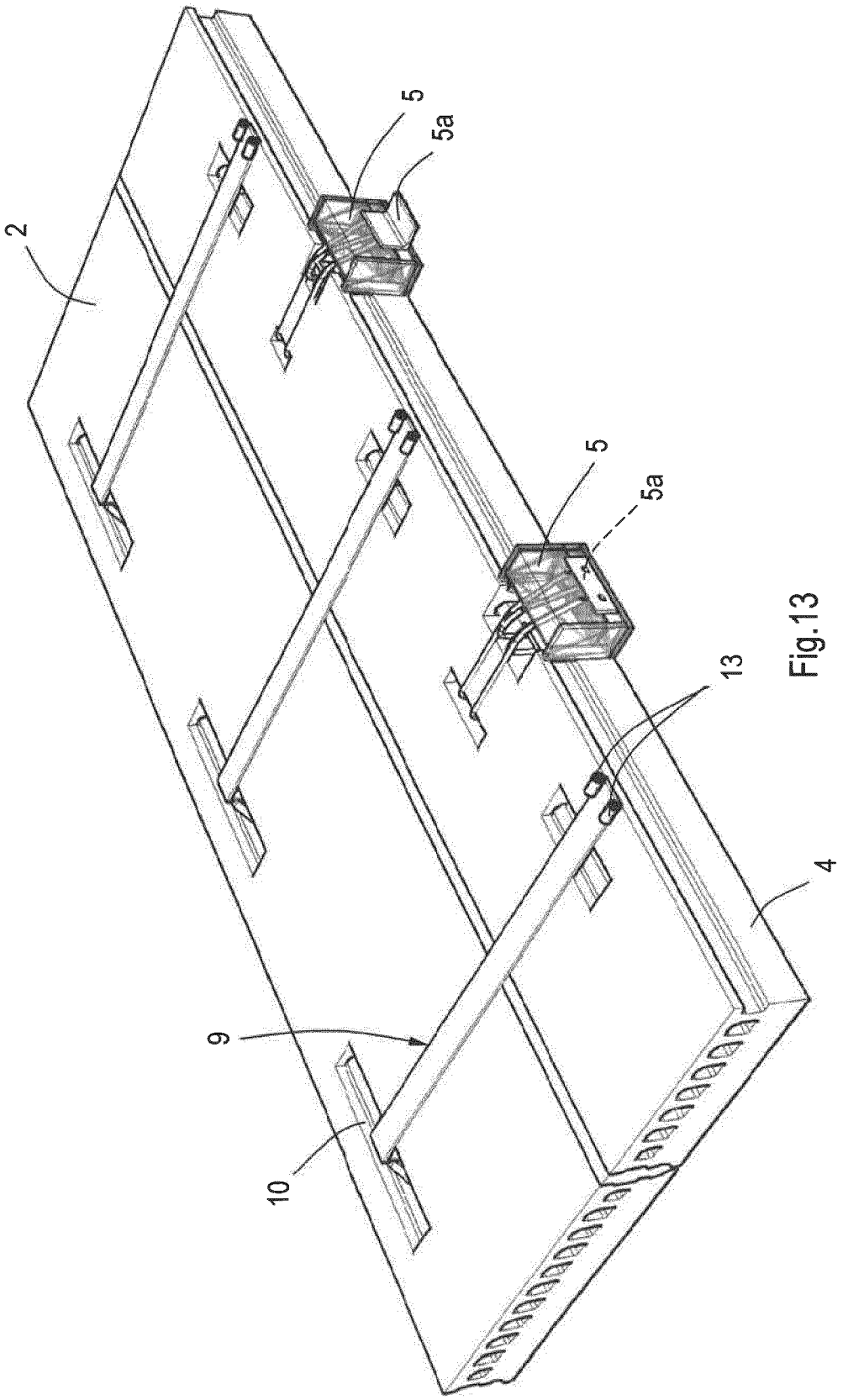

Fig.13

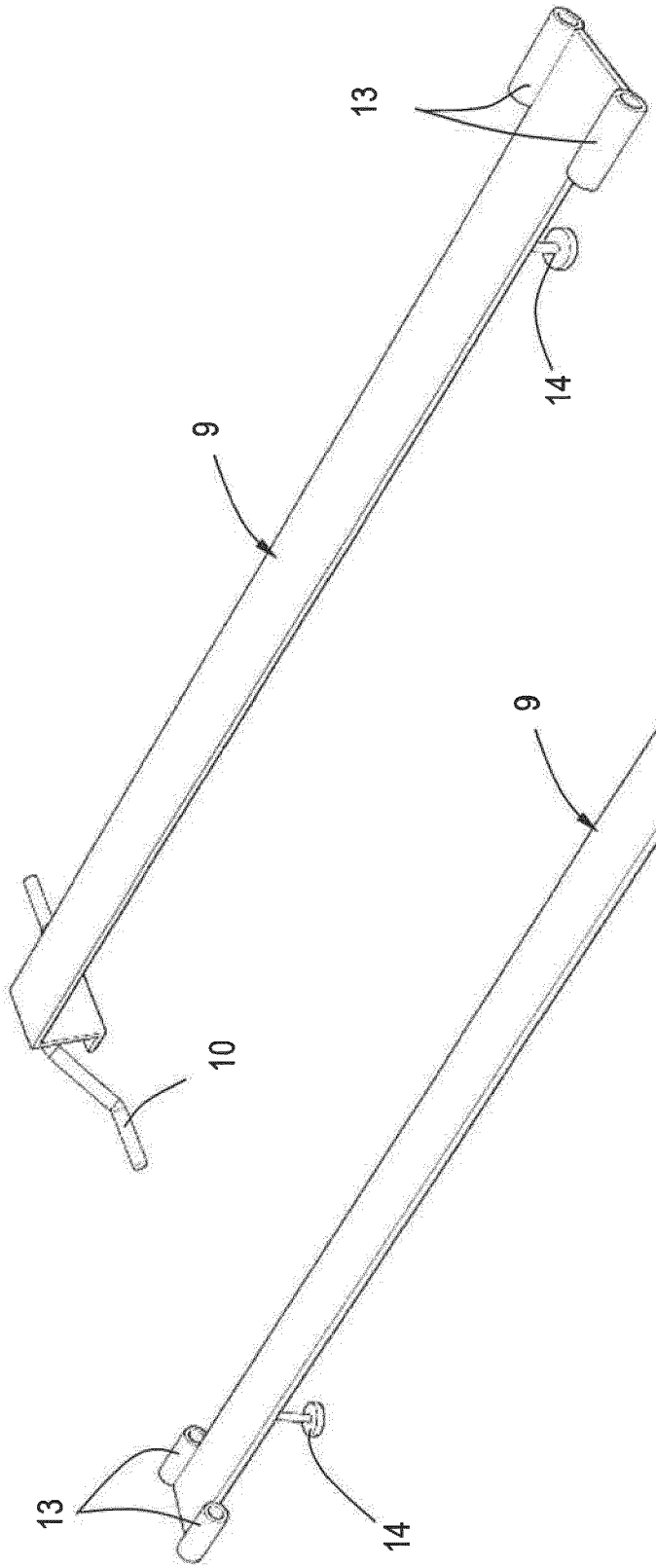

Fig.15

Fig.14

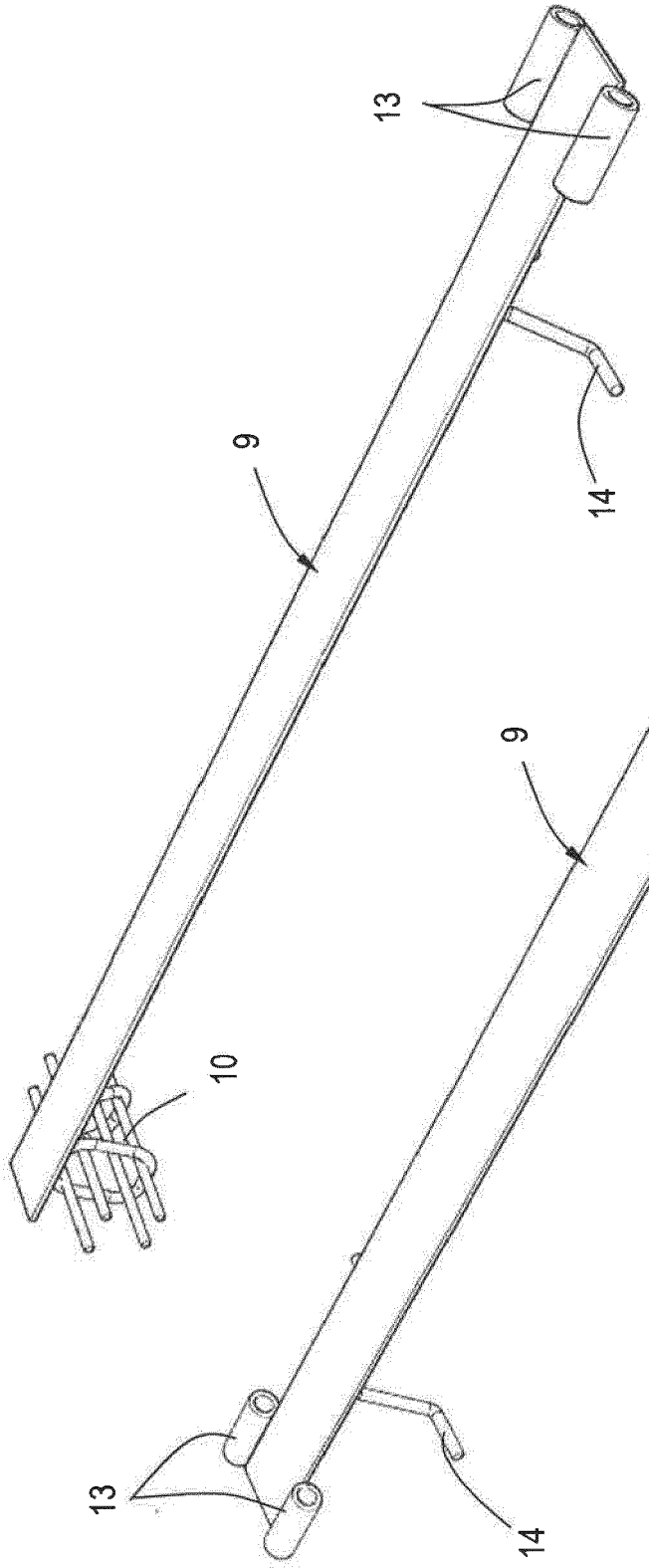

Fig.17

Fig.16

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EUROPEAN SEARCH REPORT

Application Number
EP 15 15 4510

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 2 354 344 A2 (THOMAS KG [DE]) 10 August 2011 (2011-08-10) * paragraph [0068] - paragraph [0075]; figures 1, 2 *	1-15	INV. E04B1/00
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E04B
E04C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	17 July 2015	Couprie, Brice

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