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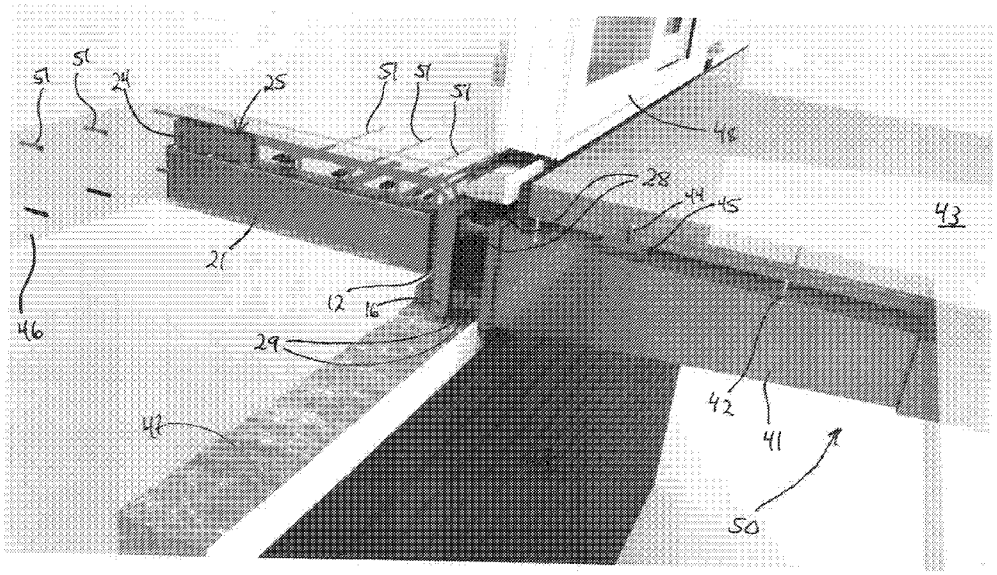


Fig. 7

(57) Abstract: An attachment device (10) for a cantilever part (50) is described, where the attachment device (10) comprises a box element (21) for casting into a building element (46) for a building. The box element (21) has an end opening (26) for insertion of a knife element (12) of a knife device (1 1), where the knife element (12) has a height Hκ in a height direction, a width Bκ in width direction and a length LK that are smaller than the inner height HB, inner width BB and inner length LB in a length direction such that the attachment device (10) has an adjustment width for the knife device (1 1) in the width direction and an adjustment length for the knife device (1 1) in the length direction whereby the position of the knife element within the box element (21) can be adjusted. There is also described a method for mounting of a cantilever floor element (43) to the wall of a building.

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ATTACHMENT DEVICE AND A METHOD FOR MOUNTING OF A CANTILEVER PART TO A BUILDING

The present invention relates to an attachment device for a balcony, gallery or a similar cantilever part that projects out from the wall of a building, and a building comprising one or more such attachment devices for attachment of a balcony, gallery or similar and a method for mounting of a cantilever part to the wall of a building.

When building are erected with a balcony, a gallery or another structure that projects out from the wall of the building, these structures must be mounted at the same time as the rest of the building. Balconies and galleries will therefore project out from the wall and that means that it is not possible to set up hydraulic scaffolding where a single platform is raised and lowered hydraulically and can be stopped in a desired position such that those who are working always will get a desired position and a good work position for completing specific work tasks on the building. During the construction of buildings with cantilever balconies, galleries and similar structures, it is necessary through the further construction to erect a fixed scaffolding that extends from the ground and up along the entire building. This means that all platforms is given a fixed position and height and for many tasks that means that those that are working will get a suboptimal work position during the performance of many tasks.

Buildings that are erected today often comprise prefabricated parts that are being assembled on the building site. This provides an efficient and economical building process. Problems may, however, arise with getting the different building elements to fit exactly together when the different building elements are manufactured separately and often in several different workshops. Small discrepancies in various predefined dimensions during the manufacturing can make it difficult to get different elements to fit together. The building process on the building site can make up for some of this, but may also make things worse.

An object of the present invention has been to find a solution that makes it possible to avoid fixed scaffolding during the building of buildings with cantilevered elements, such as balconies, galleries and similar.

At the same time it has been an object to develop a solution that makes it possible and simple to erect and use hydraulic scaffolding after the skeleton or load-bearing structure has been erected.

It has also been an object that the solution should provide good control with the facade of the building such that it is water proof.

It has also been an object to achieve an efficient thermal insulation such that thermal bridges are avoided and a good damping of sound from balcony or gallery into the building.

These objectives are achieved with an attachment device as defined in claim 1, a building as defined in claim 12 and a method for mounting of a cantilever element on the wall of a building as defined in claim 14. Further embodiments of the present invention are defined in the dependent claims 2-11, 13 and 15-16.

The present invention comprises a box element with an end opening in one end and a top opening on top of the box element in the opposite end of the box element. The box element is cast into a building element, normally in a floor element, such that the end opening faces out of a side face of the building element that a cantilever part, for example a balcony or a gallery, is to be mounted to.

When the floor elements and wall elements of the building are erected and most of the work on the building's outer facades, that often will require a scaffolding, is completed, the cantilever part can be mounted to the outer facade of the building.

For mounting of a cantilever part, normally at least two support elements that supports the cantilever part, typically a precast cantilever floor element that typically can be a balcony floor or the floor of a gallery, is required. For support of a cantilever floor element, normally two box elements will then be used for mounting of two support elements.

Before the support elements can be mounted, a knife element is entered into each box element. The box element is formed with an inner length, an inner width and inner height that is larger than the corresponding length, width and height of the knife element such that the position of the knife element in the box element can be adjusted. That provides a possibility for compensating for any possible deviations during the manufacturing of the building elements that would otherwise give problems and a lot of extra work during the mounting of the cantilever floor element on the support elements.

It should be emphasized that the adjustment length, adjustment width and adjustment height, i.e. the difference between the inner length of the box element and the length of the knife element, the inner width of the box element and the width of the knife element and the inner height of the box element and the height of the knife element, are substantially larger than a usual tolerance of a few millimeters to assure that the knife element can be entered into the box element. Typically the adjustment length can be around 10mm, the adjustment width around 30mm and the adjustment height around 10mm, but it should be understood that other values can be chosen as long as there is a real possibility to adjust the position of the knife element within the box element such that it is possible to compensate

for deviations during production of the various building elements that is involved, particularly building floor elements and cantilever floor elements, but also knife elements and support elements for the cantilever elements.

The knife element is in one end provided with a flange element that the support elements are mounted to. Before the support elements are mounted to the knife device, the position of the knife element in their respective box elements are adjusted, in the width direction, the length direction and the height direction of the box element, until the mutual position of the knife devices is achieved such that problems will not arise later when the cantilever floor elements are being mounted on the support elements.

The knife elements are preferably provided with a locking bolt hole, preferably at the end of the knife element that extends the farthest into the box element. The locking bolt hole may for example be provided by attaching a locking bolt element, for example a pipe element, with a desired inner diameter to the end of the knife element. The locking bolt element may be secured to the knife element with a suitable method, for example by welding.

When the knife elements have been adjusted such that they have the desired position in the box element, the box element is filled with liquid concrete through the top opening of the box element such that the knife element is cast into the box element in the desired position. Before casting of the knife element into the box element, a locking bolt is preferably entered into the locking bolt hole. The locking bolt is so long that it projects out of the locking bolt element and thereby into the liquid concrete when the box element is filled with liquid concrete. The projecting locking bolt thereby ensures that horizontal forces on the knife element is taken up by the locking bolt and prevents the knife element from moving in a horizontal direction.

After the knife element has been cast into the box element, a support element is fastened to each knife device. The support element will project out from the facade of the building such that a cantilever floor element, for example a balcony floor or the floor of a gallery, can be mounted on the support elements.

Since the support elements for the cantilever floor elements are mounted on the knife elements, the mounting can take place after the facade works have been carried out. Thereby, there will be no balcony floors or similar elements that projects out from the wall of the building while the facade works are taking place. For this reason, it will be easy to use a hydraulic scaffolding during the facade works and setting up a traditional scaffolding that covers the whole facade is avoided. A hydraulic scaffolding comprises a platform that can be moved up and down along the facade and can thereby easily be positioned in the position that at any time is optimal relative to the work that is to be done on the facade. In addition,

it will be much simpler to get all types of material and tools to the place where they will be used since the scaffolding can be moved down to the ground and be loaded with all the necessary material before the scaffolding is moved, together with the workers, to the position on the facade where the works will be carried out.

An attachment device for a cantilever part is therefore provided, where the attachment device comprises a box element for casting into a building element for a building. The box element has an end opening for insertion of a knife element of a knife device, where the knife element has a height in a height direction, a width in a width direction and a length that are smaller than the inner height, inner width and inner length of the box element in a length direction such that the attachment device has an adjustment width for the knife device in the height direction, an adjustment height for the knife device in the width direction and an adjustment length for the knife device in the length direction whereby the position of the knife element within the box element can be adjusted.

The advantage of being able to adjust the position of the knife element within the box element is that deviations in the building process can be compensated for by adjusting the position of the knife element in their box elements, both in height, width, and length direction, and also the angular position of the knife element within the box element in case the box element has been casted slantingly in the building element.

The knife element is preferably provided with a flange element with at least one upper threaded hole that is provided above the knife element, and at least one lower threaded hole that is provided below the knife element.

The attachment device preferably further comprises at least one upper fastening bolt and at least one lower fastening bolt for screwing into the at least one upper threaded hole and the at least one lower threaded hole respectively. The attachment device further comprises a corresponding upper sleeve and a corresponding lower sleeve with respective through-going holes that the at least one upper fastening bolt and the at least one lower fastening bolt is passed through.

The knife element preferably further comprises a locking bolt hole for insertion of a locking bolt such that the locking bolt projects out of the locking bolt hole after the locking bolt is placed in the locking bolt hole. The locking bolt hole is preferably provided at an end portion of the knife element, but may of course be provide at other positions along the knife element if that is desirable.

The attachment device preferably comprises an O-ring that is arranged between the at least one upper sleeve and the flange element of the knife device and preferably an O-ring that is arranged between the at least one lower sleeve and the flange element of the flange device. The O-rings extend around the at least one upper

fastening bolt and the at least one lower fastening bolt respectively. The use of the O-rings means that an extra barrier against penetration of water into the building is obtained.

The at least one upper sleeve and the at least one lower sleeve preferably comprises a cavity around the through-going opening for placement of the O-ring.

During use tension forces will arise in the at least one upper bolt and compression forces in the at least one lower bolt. The at least one upper sleeve may therefore be made of POM (polyoxymethylene plastic) and the at least one lower sleeve may be made of acid-proof steel. Both POM and acid proof steel will provide a reduction of heat transfer from the cantilever element and into the building.

The attachment device preferably comprises an insulation element that has a shape that corresponds to the shape of the flange element of the knife device, and has through-going openings for the at least one upper fastening bolt with the upper sleeve and the at least one lower fastening bolt with the lower sleeve, and that has a thickness that substantially corresponds to the length of the upper sleeve and the lower sleeve.

The attachment device preferably comprises a membrane element that abuts the surface of the insulation element that is turned away from the flange element of the knife device and that has a surface that is greater than said surface of the insulation element, i.e. the membrane element extends further out than the flange element I a plane that is substantially perpendicular to the length direction of the knife element.

The box element comprises an opening for pouring of liquid concrete into the box element. The opening is preferably provided on the top of the box element, i.e. the opening is a top opening. Liquid concrete will normally be filled in the box element after the knife element is arranged in a desired position in the box element.

The attachment device preferably comprises a support element, which support element is formed with at least one upper bolt hole and at least one lower bolt hole that are adapted for passing through of the at least one upper fastening bolt and the at least one lower fastening bolt respectively. The support elements may thereby be arranged abutting the membrane and fastened on the at least one upper fastening bolt and the at least one lower fastening bolt by using associated nuts.

Since the support elements are attached to the knife elements at a desired moment, the work on the facade may, as mentioned above, be made simple by using a hydraulic scaffolding with a platform that is moved up and down.

A building is further provided comprising a cantilever floor element, which building comprises at least one attachment device, but preferably two or more attachment devices, for mounting and supporting of a cantilever floor element.

The building preferably further comprises a support element, where the support element is formed with at least one upper bolt hole and at least one lower bolt hole that are adapted for passing through of the at least one upper fastening bolt and the at least one lower fastening bolt respectively such that the support element can be fastened to the knife device of the at least one attachment device.

There is further provided a method for mounting of a cantilever part comprising a cantilever floor element to the wall of a building that is under construction, where the method comprises the following steps:

- providing a building element in a building where the cantilever floor element is to be mounted, which building element comprises at least one box element that is cast into the building element and is formed with an opening at an end portion such that the end portion of the box element with the opening lie substantially flush with a side face of the building element,
- placing a knife element of a knife device in the at least one box element,
- adjusting the position of the knife element within the at least one box element in width direction and/or a height direction and/or a length direction as required until the knife element has a desired position in the at least one box element,
- fill the at least one box element with liquid concrete through an opening in the at least one box element such that the knife element is cast into the desired position in the box element,
- mounting a support element to the knife device,
- mounting the cantilever floor element on the support element.

The method further comprises inserting a locking bolt into a locking bolt hole in the knife element before the box element is filled with liquid concrete, where the locking bolt is adapted to the locking bolt hole such that it projects out of the locking bolt hole.

The method further comprises mounting the support element to the knife device after the exterior facade work of the building has been done such that a platform of a hydraulic scaffolding can be lifted and lowered along the outer side of the building without being obstructed by support elements and cantilever floor elements.

Other features and advantages of the invention will be evident from the following description of a non-limiting, preferred embodiment of the present invention, with reference to the figures, where:

Figure 1 shows a knife device of an attachment device according to the present invention seen from the side.

Figure 2 shows a perspective view of a box element of an attachment device according to the present invention.

Figure 3 shows the knife device in figure 1 seen from above.

Figure 4 shows a section B-B through the knife device as indicated in figure 1.

Figure 5 shows a segment C of the knife device as shown in figures 1, 3 and 4, where segment C is enlarged as compared to what is shown in figure 4.

Figures 6-8 show three dimensional sections of a building that is provided with attachment devices according to the present invention for mounting of a cantilever part to the building.

It is mentioned that various features of the embodiment of the invention that is shown in the figures have the same reference number in all figures.

In figure 2 a box element 21 of an attachment device 10 is shown. The box element 21 is adapted for being cast into a building, for example into a building floor element 46 in the building as indicated in figures 6-8.

The box element 21 preferably has a rectangular cross sectional shape with a first end portion 22 and a second end portion 23. The box element may be manufactured for example from a rectangular pipe element where a plate is welded to the end of the pipe element at the second end portion 23. The cross sectional shape of the box element 21 may of course also be square or have other shapes as long as it can stand the loads that it will be exposed to during use.

The box element 21 is further preferably provided with an elevated portion 24 that is provided on the box element 21 at the second end portion of the box element. The elevated portion 24 and the box element comprise a through-going opening 25 for among other things, pouring of liquid concrete into the box element 21. The height of the elevated portion 24 is preferably such that the upper edge of the elevated portion 24 lie a little below the upper surface of the building element that the box element 21 is cast into. Thereby access to the interior of the box element 21 is achieved after it has been cast into the building element.

The box element 21 is hollow inside and has an end opening 26 at the first end portion. The opposite end of the box element 21, at the second end portion 23, is preferably closed, for example by a lid that is welded on. The inside of the box element 21 has the measurements B_B in a width direction, L_B in a length direction and H_B in a height direction as indicated in figure 2.

When the box element 21 is cast into a building element, preferably in a building floor element 46 (see figures 6-8), the end opening 26 is substantially flush with the

side face of the building floor element 46 that will face out towards the cantilever part 50 when the building.

In figures 2 and 3 a knife device 11 is shown. The knife device 11 comprises a knife element 12 with a first end portion 14 and a second end portion 15. The knife device 11 further comprises a flange element 16 that is attached to the first end portion 14 of the knife element 12. The knife device 11 is adapted so that the knife element 12 can be inserted into the box element 21 through the end opening 26 of the box element.

The knife element 12 is formed with the measurements B_K in a width direction, L_K in a length direction and H_K in a height direction as indicated in figure 3. The knife element 12 is further adapted such that the width B_K of the knife element is smaller than the inner width B_B of the box element, the length L_K of the knife element is smaller than the inner length L_B of the box element and the height H_K of the knife element is smaller than the inner height H_B of the box element.

An adjustment width, an adjustment length and an adjustment height, i.e. the difference between the inner width of the box element and the width of the knife element, the inner length of the box element and the length of the knife element and the inner height of the box element and the height of the knife element respectively, is thereby formed which provides a possibility to adjust the position of the knife element 12 within the box element 21 before it is cast into the box element and thereby compensate for deviations during manufacturing of the building element that the box element 21 is cast into and also deviations that may occur during the building process where the building with the building element is erected.

It should be emphasized that the adjustment width, the adjustment length and the adjustment height is substantially greater than the normal tolerance would have been if the idea had been to place the knife element 12 into the box element without any desire to adjust the position of the knife element in the box element. Such a tolerance would maximum be a few millimeters to ensure that the knife element 12 can be inserted into the box element 21. Typically, the adjustment length can be 10-50mm, the adjustment width be around 30mm and the adjustment height around 10mm, but it should be understood that other values can be chosen as long as there is a real possibility for adjustment of the position of the knife element 12 in the box element 21 such that it is possible to compensate for deviations during manufacturing of the various building elements that are involved, particularly building floor elements 46 and cantilever floor elements 43, but also knife devices 11 and support elements 41 for the cantilever floor elements 43.

The knife element 12 further comprises a locking bolt hole 18 for insertion of a locking bolt 19 (se figure 1). The locking bolt hole 18 may be formed directly in the knife element, for example by drilling out a locking bolt hole, or by using a locking

bolt element 17 that may be a pipe element that is secured to the knife element 12, for example by welding. The placement of the locking bolt hole is preferably such that the locking bolt 19 can be passed through the opening 25 in the box element 21 and down into the locking bolt hole 18. The locking bolt 19 is further adapted such that when the locking bolt is arranged in the locking bolt hole 18, it will project out of the locking bolt hole 18. The locking bolt 19 will thereby take up horizontal forces when the knife element 12 is cast into the box element 21 and prevent that the knife element 12 is displaced in the longitudinal direction of the box element after it has been cast into the box element.

As shown in figures 4-5, the adjustment device 10 further comprises at least one, but preferably two upper fastening bolts 27 that are screwed into corresponding upper threaded holes in the flange element 16 and at least one, but preferably two lower fastening bolts 33 that are screwed into corresponding threaded holes in the flange element 16 as indicated in figures 4 and 5 (figure 5 shows a segment with an upper fastening bolt 27).

The adjustment device 10 further comprises at least one, but preferably two upper sleeves 28 and at least one, but preferably two lower sleeves 29. The upper sleeves 28 and the lower sleeves 29 are provided with through-going holes for passing through of the upper fastening bolts 27 and the lower fastening bolts 33 respectively. The sleeves 28, 29 may of course be formed in many different ways. In the figures it is indicated that the sleeves 28, 29 may be formed with a stem in the middle and an end part at each end of the sleeves 28, 29, where a space 30 is formed between the stems and the insulation 39 with a size that depends on the diameter of the stem of the sleeves 28, 29. In the example in the figures the stems of the upper sleeves 28 are shown with a slightly smaller diameter than the lower sleeves 29.

During use, tension will arise in the two upper fastening bolts 27 and compression in the two lower fastening bolts 33. The two upper sleeves will therefore work best as a distance element and do not need to stand very large forces. The two upper sleeves 28 are therefore preferably made of a plastic material, for example the two upper sleeves 28 may be made of POM (= polyoxymethylene plastic). The two lower sleeves 29 must be able to stand the compression forces that arises during use and they are therefore preferably made of steel. This is also a reason that the lower sleeves usually will have a slightly larger diameter than the upper sleeves 28.

It has been an object of the attachment device 10 to obtain an efficient breaking of cold bridges where the transfer of coldness from the cantilever part 50 is minimized. To achieve this, it has been found that the two lower sleeves 29 preferably are made of acid-proof steel. The upper fastening bolts 27 and the lower fastening bolts 33 are preferably also made of acid-proof steel to obtain optimal breaking of cold bridges. To use acid-proof steel will be more costly, but provides the advantage that

it is avoided that a cold bridge is formed through the attachment points of the cantilever part 50.

The upper sleeves 28 and the lower sleeves 29 are further provided with a groove on their respective surfaces that faces the flange element 16. In each groove there is provided an O-ring 37 that extends around each of the upper and lower fastening bolts 27, 33 and provides an additional sealing against penetration of water. The attachment device 10 therefore leads to that the building will have a two-step water sealing in contrast to other buildings which have a single sealing against water penetration.

The attachment device 10 further comprises an insulation element 39 that is provided on the outside or opposite side of the flange element 16 relative to the knife element 12. The insulation element 39 may be made of rock wool or another suitable insulating material and is provided with four through-going holes for passing through of the upper fastening bolts 27 with the upper sleeves 28 and the lower fastening bolts 33 with the lower sleeves 29. In height and width the insulation elements preferably have substantially the same size as the flange element 16 as indicated in figures 3 and 4. The thickness in the length direction may vary depending on the desired ability to insulate and the thickness of the wall of the building in which the attachment device is used.

On the outside of the insulation element 39, i.e. on the opposite side of the insulation element relative to the flange element 16, there is provided a membrane element 38 that abuts the insulation element and the upper sleeves 28 and the lower sleeves 29. The membrane element is further formed with through-going holes for passing through of the upper bolts 27 and the lower bolts 33.

The membrane elements 38 is preferably made of a rubber material that dampens sound, for example impact sound, from the cantilever part 50 and into the building that the cantilever part 50 is mounted to. The membrane element 38 extends longer in both height direction and width direction than the insulation element as indicated in figures 4 and 5.

On the upper fastening bolts 27 and the lower fastening bolts 33 it is provided inner washers 32 that abut the membrane element 38, and inner fastening nuts 31 that abut the inner washers 31 and presses the inner washers against the membrane element 38 with a desired pressure.

Outside the inner fastening nuts 31 there is provided an outer washer 35 and an outer fastening nut 34 as shown in figure 5. During mounting of a support element 45 to the attachment device 10, after the work on the facade is finished, the outer fastening nuts are unscrewed and the outer washers are removed from their respective upper fastening bolts 27 and lower fastening bolts 33. Then a support

element is brought onto the upper fastening bolts 27 and the lower fastening bolts, and finally the outer washers are brought onto the upper fastening bolts and the lower fastening bolts and the support element 45 is secured to the attachment device 10 by screwing the outer nuts on their respective upper fastening bolts 27 and lower fastening bolts 33.

If the cantilever part 50 is a balcony, usually at least two attachment devices 10 will be used and two retrofitted support devices 45 for support of the cantilever floor element 43, i.e. the balcony floor.

In figures 6-8, how an attachment device 10 can be used to retrofit a cantilever part, for example a balcony or a gallery, to the facade of a building, is shown in more detail. The building comprises one or more building elements 46 and one or more wall structures 47. In the wall structure 47 there is provided one or more doors 48 that rest on support elements 49 in the wall structure and that provides access to the cantilever part 50 that can be retrofit to the building after the work with the facade of the building is finished. As a matter of form it is mentioned that it is same embodiment of the invention that is shown in figures 6-8, but from slightly different angles and with slight difference in which elements that are shown.

The box element 21 can be seen cast into the building element 46 such that the elevated portion 24 extends up towards, but not entirely up to the surface of the building element 46 and provides access to the interior of the box element 21 for filling of liquid concrete and therewith, casting of the knife element 12 in the box element 21. In the building element 46 there is further provided reinforcement bars 51 as indicated in the figures.

The knife element 12 of the knife device 11 is arranged in the box element 21. The position of the knife element 12 in the box element 21 has been adjusted such that they fit in the facade and such that holes (not shown in the figures) in the cantilever floor element 43 lie in line with guiding bolts 44 on the support elements 41 when the cantilever floor element is laid on the support elements 41. The cantilever floor element 43 is secured to the support elements 41 with suitable fastening means, for example fastening screws 42 as indicated in the figures. Between the cantilever floor element 43 and the support elements, support elements 45 may be placed that the cantilever floor element 43 rests on. The support elements 45 are preferably made of a rubber material that stands the weight of the cantilever floor element 43 and at the same time dampens sounds, such as impact sound, from the cantilever floor element.

The flange element 16, the insulation element 39 (not shown in figures 6-8) and the membrane element 38 (not shown in figures 6-8) will form a part of the wall structure 47 in the building. As mention above, the upper sleeves 28 will be made of POM and the lower sleeves 29 of acid-proof steel. The upper and lower fastening

bolts 27, 33 are preferably also made of acid-proof steel. Since acid-proof steel is a poor conductor of heat, an effective breaking of cold bridges is achieved. Further, the membrane elements 38 and the support elements 45 will provide a good damping of sound from the cantilever floor element 43.

With this system, i.e. an attachment device 10 with a box element 21 that is cast into a building element 46, a knife device 11 with a knife element 12 that can be arranged in the box element adjustable in width direction, height direction and length direction for thereby to compensate for deviations during production of building elements and deviations in the building process itself before the knife element 12 is cast into the box element 21 and a support element 41 that can be mounted to the knife device 11 after the facade work are finished such that an hydraulic scaffolding can easily be used during the work on the facades, a very advantageous method for erecting a building with one or more cantilever parts 50, such as one or more balconies or one or more galleries, both up and along the facade, is achieved.

The invention has been described with reference to a non-limiting embodiment of the invention. A skilled person in the art would, however, understand that the invention, as it is explained above and shown in the figures, may be modified and that changes may be made within the scope of the invention as defined in the patent claims.

CLAIMS

1. Attachment device (10) for a cantilever part (50), which attachment device (10) comprises a box element (21) for casting into a building element (46) for a building, which box element (21) has an end opening (26) for insertion of a knife element (12) of a knife device (11), where the knife element (12) has a height H_K in a height direction, a width B_K in width direction and a length L_K that are smaller than the inner height H_B, inner width B_B and inner length L_B of the box element in a length direction such that the attachment device (10) has an adjustment width for the knife device (11) in the height direction, an adjustment height for the knife device (11) in the width direction and an adjustment length for the knife device (11) in the length direction whereby the position of the knife element (12) within the box element (21) can be adjusted.

2. Attachment device according to claim 1,
characterized in that knife element (12) is provided with a flange element (16) with at least one upper threaded hole that is provided above the knife element (12), and at least one lower threaded hole that is provided below the knife element (12).

3. Attachment device according to claim 1 or 2,
characterized in that the attachment device (10) comprises at least one upper fastening bolt (27) and at least one lower fastening bolt (33) for screwing into the at least one upper threaded hole and the at least one lower threaded hole respectively, and that the attachment device (11) comprises a corresponding upper sleeve (28) and a corresponding lower sleeve (29) with respective through-going holes that the at least one upper fastening bolt (27) and the at least one lower fastening bolt (33) are passed through.

4. Attachment device according to one of the claims 1-3,
characterized in that the knife element (12) comprises a locking bolt hole (18) for insertion of a locking bolt (19) such that the locking bolt projects out of the locking bolt hole (18) after the locking bolt (19) is placed in the locking bolt hole (18).

5. Attachment device according to claim 4,
characterized in that the attachment device (10) comprises an O-ring (37) that is arranged between the at least one upper sleeve (28) and the flange element (16) of the knife device, and an O-ring (37) that is arranged between the at least one lower sleeve (29) and the flange element (16) of the knife device.

6. Attachment device according to claim 5,
c h a r a c t e r i z e d i n that the at least one upper sleeve (28) and the at least one lower sleeve (29) comprises a cavity around the through-going opening for placement of the O-ring (37).

7. Attachment device according to one of the claims 4-6,
c h a r a c t e r i z e d i n that the at least one upper sleeve (28) is made of POM and the at least one lower sleeve (29) is made of acid-proof steel for reduction of sound transmission.

8. Attachment device according to one of the claims 1-7,
c h a r a c t e r i z e d i n that the attachment device (10) comprises an insulation element (39) that has a shape that corresponds to the shape of the flange element (16) of the knife device (11), that has through-going openings for the at least one upper fastening bolt (27) with the upper sleeve (28) and the at least one lower fastening bolt (33) with the lower sleeve (29), and that has a thickness that corresponds to the length of the upper sleeve (28) and the lower sleeve (29).

9. Attachment device according to claim 8,
c h a r a c t e r i z e d i n that the attachment device (10) comprises a membrane element (38) that abuts the surface of the insulation element (39) that is turned away from the flange element (16) of the knife device and that has a surface that is larger than said surface of the insulation element (39).

10. Attachment device according to one of the claims 1-9,
c h a r a c t e r i z e d i n that the box element (21) comprises an opening (25) for pouring of liquid concrete into the box element (21).

11. Attachment device according to one of the claims 1-10,
c h a r a c t e r i z e d i n that the attachment device is adapted for mounting of a support element (41) for a cantilever floor element (43), which support element (41) is formed with at least one upper bolt hole and at least one lower bolt hole that are adapted for passing through of the at least one upper fastening bolt (27) and the at least one lower fastening bolt (33) such that the support element (41) can be secured to the knife device (11) of the at least one attachment device (10).

12. A building comprising a cantilever floor element (43), which building comprises at least one attachment device (10) according to any one of the claims 1-11 for mounting of a cantilever part (50).

13. Building according to claim 12,
c h a r a c t e r i z e d i n that the building comprises at least one support element (41), which support element (41) is formed with at least one upper bolt hole and at least one lower bolt hole that are adapted for passing through of the at least one upper fastening bolt (27) and the at least one lower fastening bolt (33) respectively such that the support element (41) can be secured to the knife device (11) of the at least one attachment device (10).

14. Method for mounting of a cantilever part (50) comprising a cantilever floor element (43) to the wall of a building that is under construction, where the method comprises the following steps:
- providing a building element (46) of a building that the cantilever floor element (43) is to be mounted to, which building element (46) comprises at least one box element (21) that is cast into the building element and is formed with an end opening (26) at an end portion (14) such that the end opening (26) of the box element lie substantially flush with a side face of the building element (43),
- placing a knife element (12) of a knife device (11) in the at least one box element (21),
- adjusting the position of the knife element (12) within the at least one box element (21) in width direction and/or a height direction and/or a length direction as required until the knife element (12) has a desired position in the at least one box element (21),
- fill the at least one box element (21) with liquid concrete through an opening in the at least one box element such that the knife element (12) is securely cast into the desired position in the box element (21),
- mounting a support element (41) to the knife device (11),
- mounting the cantilever floor element (43) on the support element (41).

15. Method according to claim 14,
c h a r a c t e r i z e d i n that a locking bolt (19) is inserted into a locking bolt hole (18) in the knife element (12) before the box element (21) is filled with liquid concrete, which locking bolt (19) is longer than the locking bolt hole (18) such that the locking bolt projects out of the locking bolt hole.

16. Method according to claim 14 or 15,
c h a r a c t e r i z e d i n that the support element (41) is mounted to the knife device (11) after the exterior wall work of the building has been completed such that a platform of a hydraulic scaffolding can be lifted and lowered along the outer side of the building without being obstructed by support elements (41) and cantilever floor elements (43).

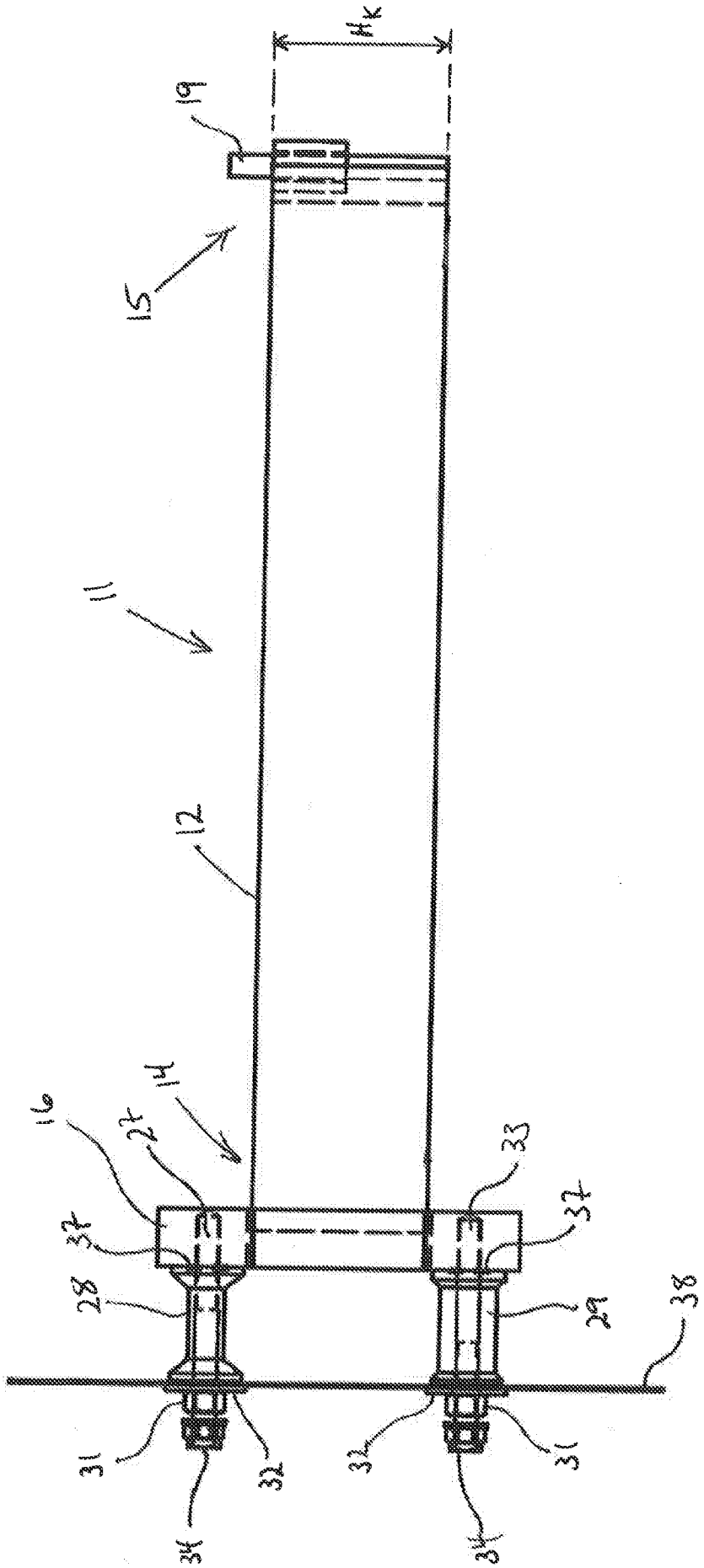


Fig. 1

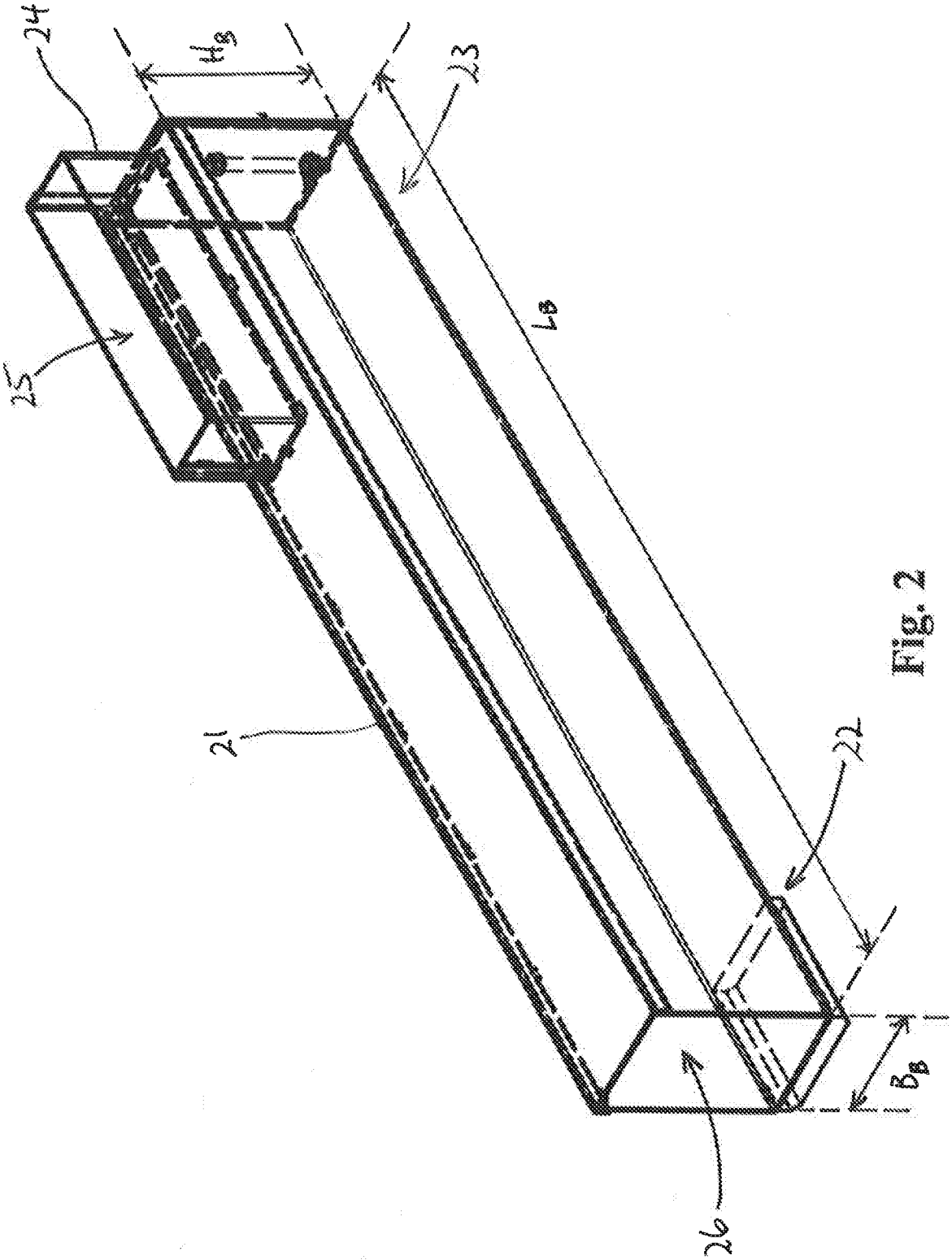


Fig. 2

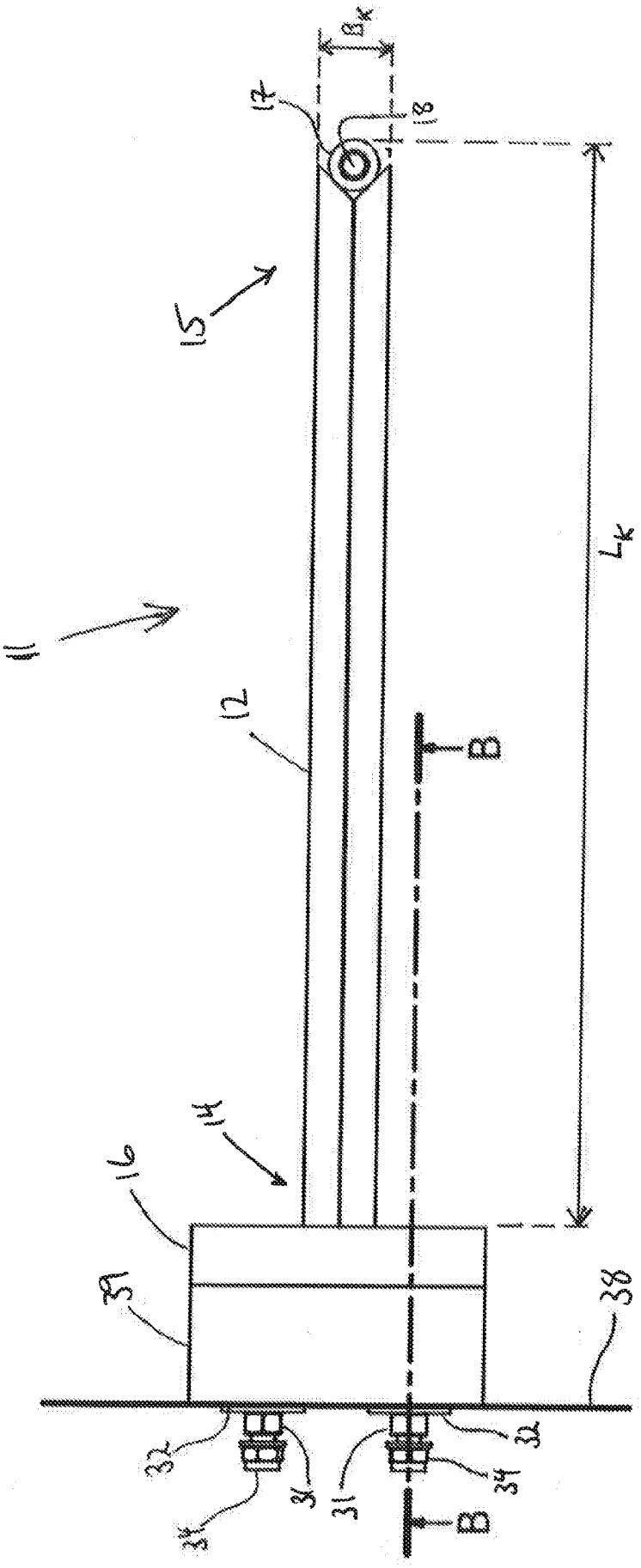


Fig. 3

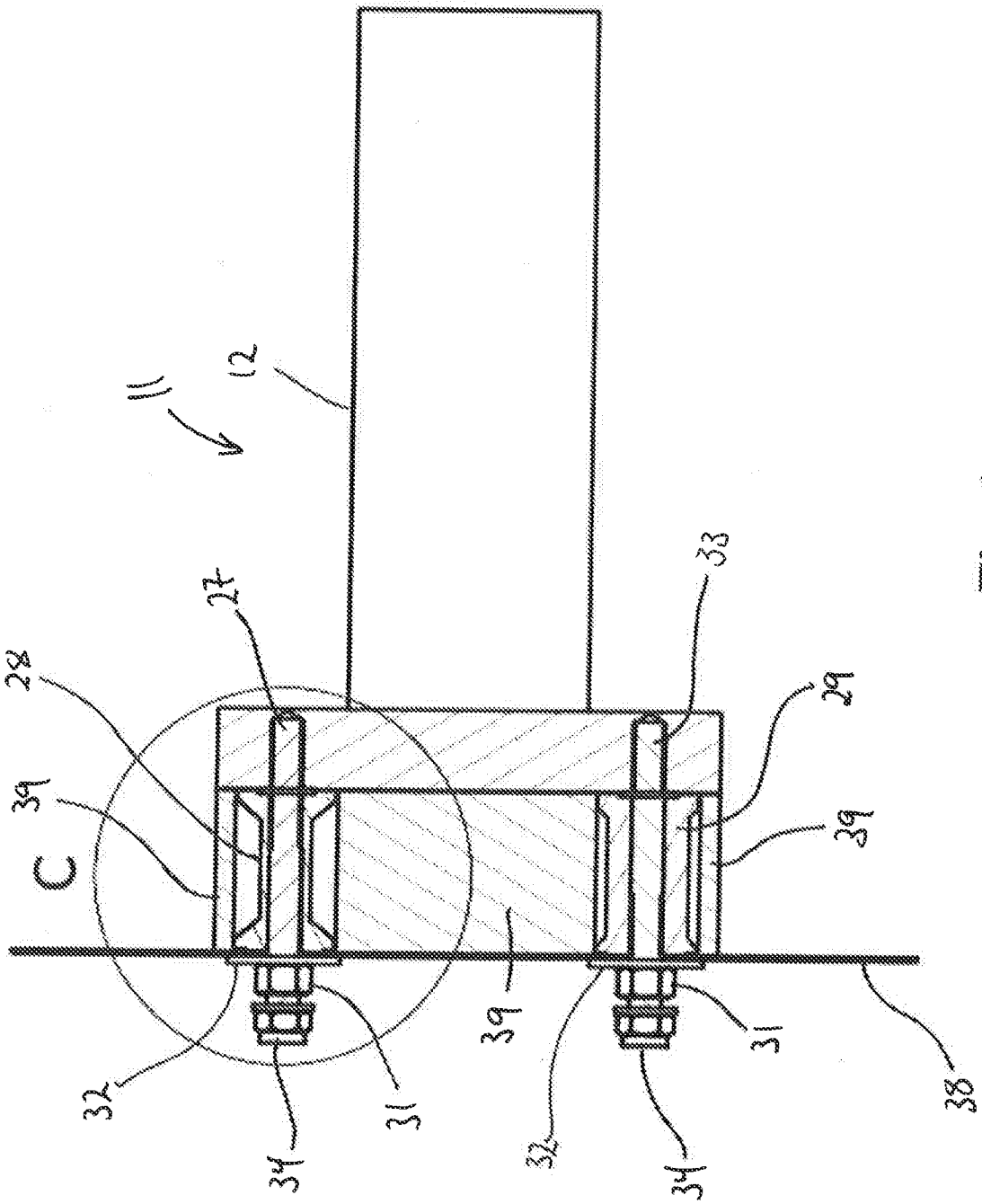


Fig. 4

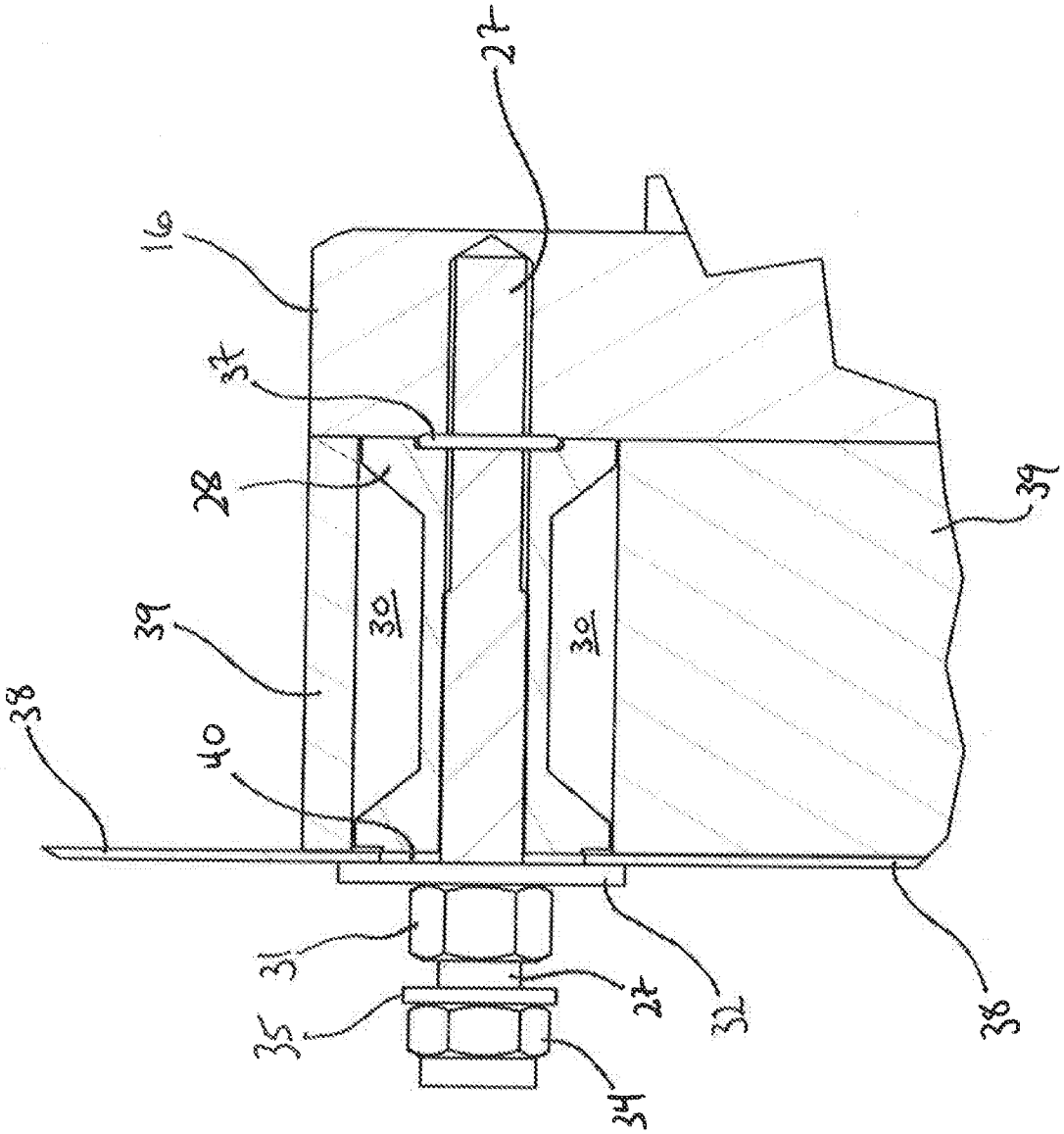


Fig. 5

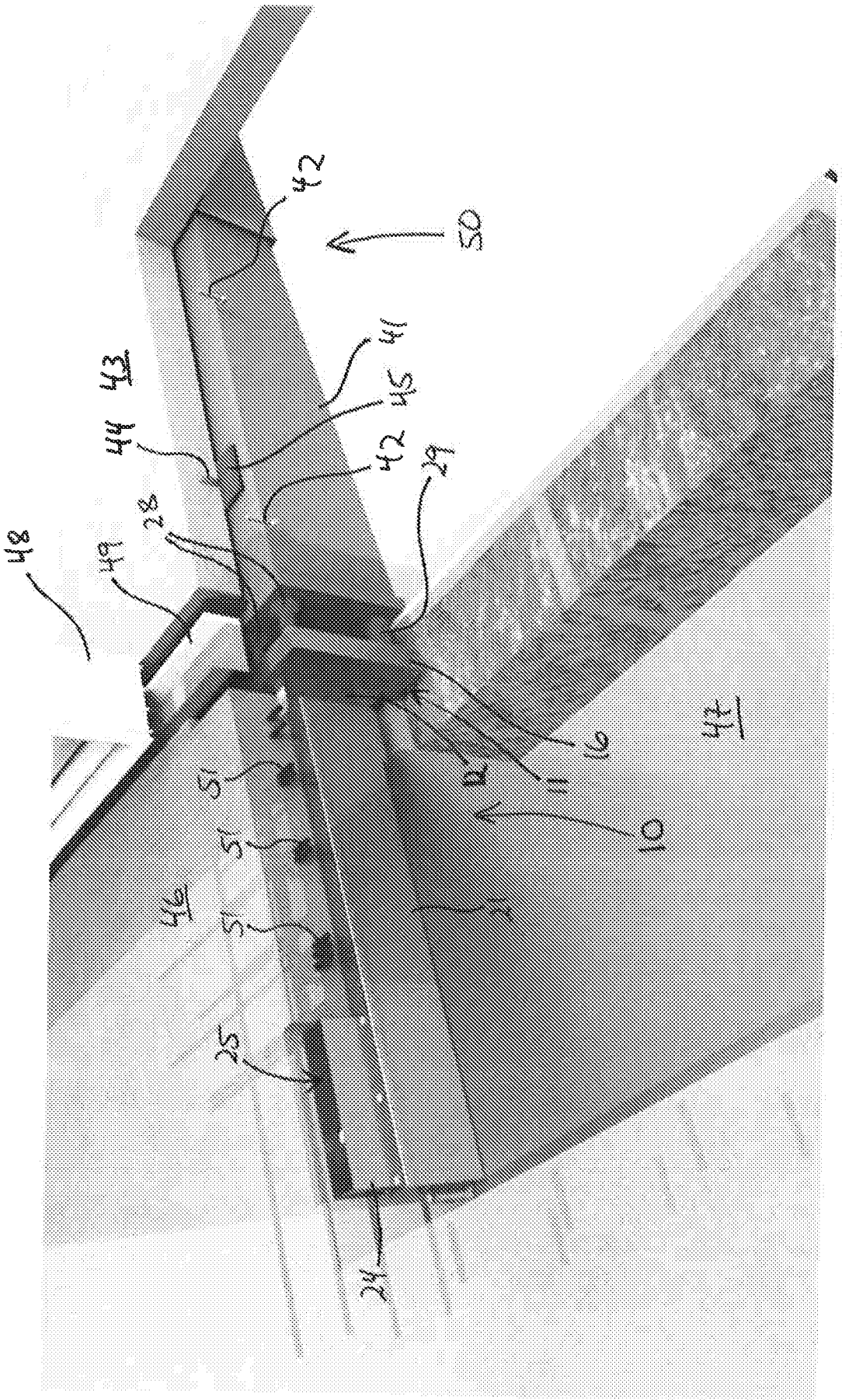


Fig. 6

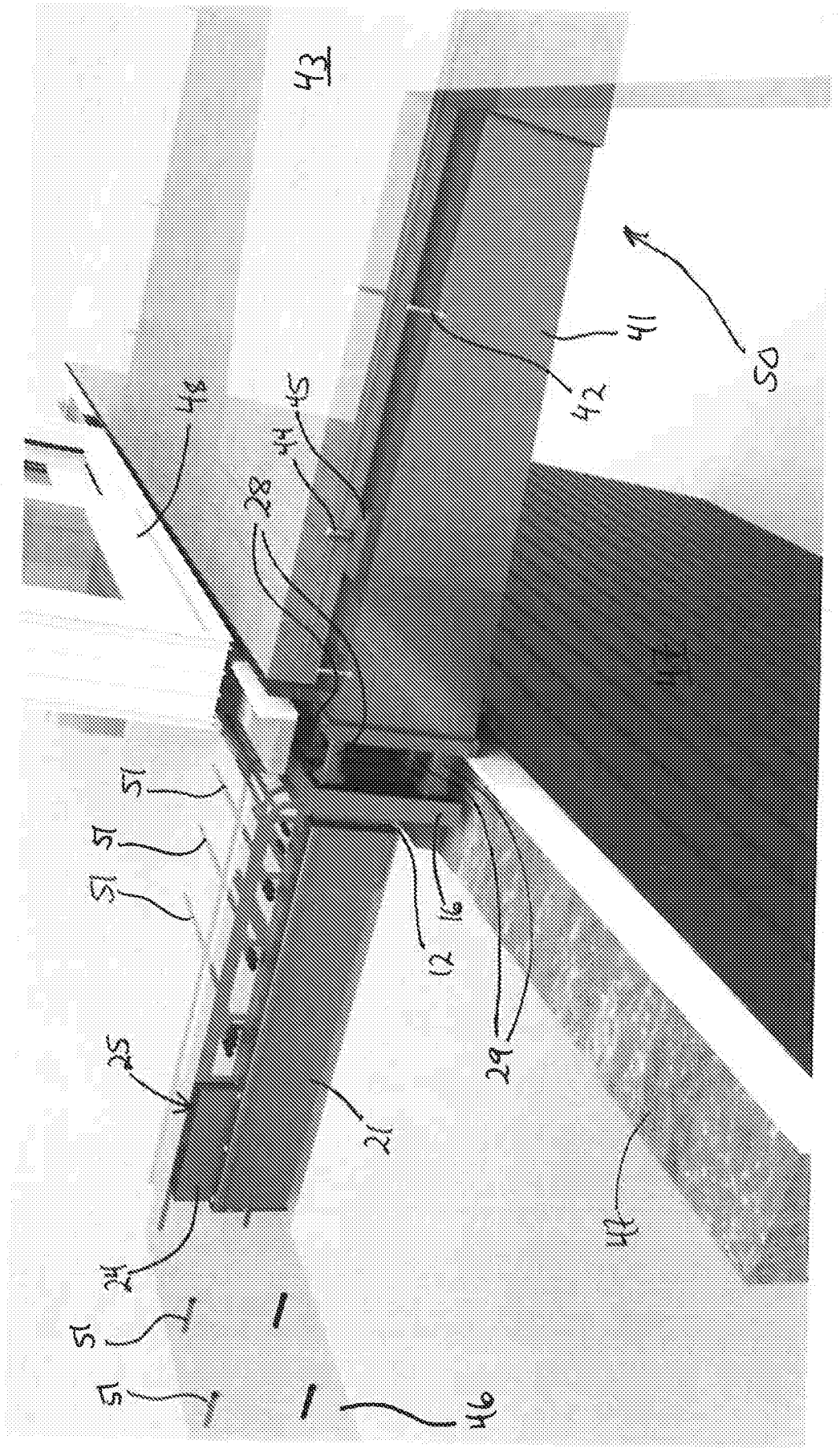


Fig. 7

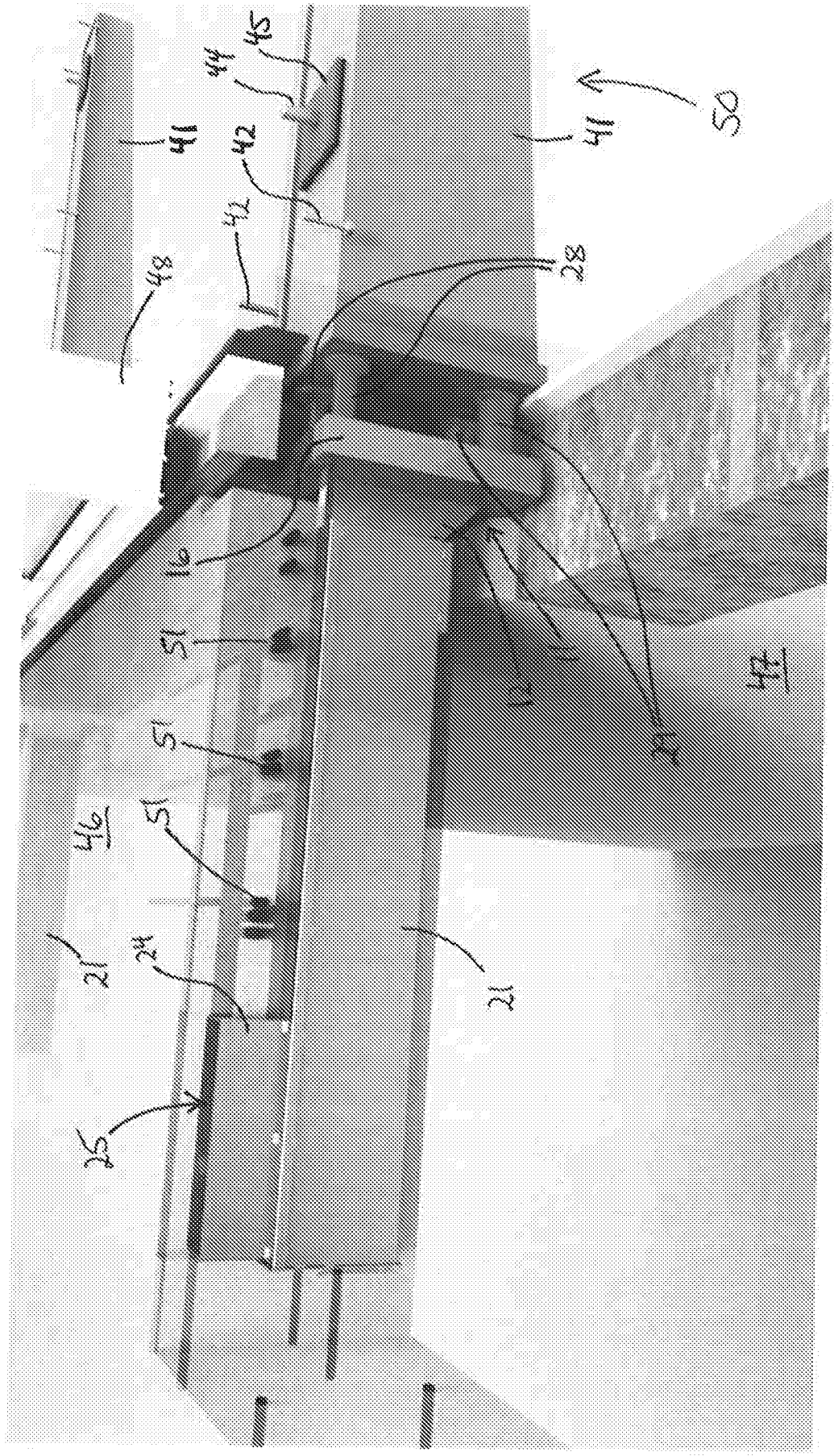


Fig. 8

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2018/051432

A. CLASSIFICATION OF SUBJECT MATTER
INV. E04B1/48 E04B1/00
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
E04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	FR 2 954 374 A1 (BUGAL [FR]) 24 June 2011 (2011-06-24)	1,12,14
A	page 1, lines 2-4 page 5, line 12 - page 6, line 5 page 8, lines 2-3 page 10, lines 25-26; figures -----	2,3,8
X	WO 2010/120179 A2 (SVEIN BERG HOLDING AS [NO]; BERG SVEIN [NO]) 21 October 2010 (2010-10-21) page 1, lines 22-23 page 3, lines 38-40 page 4, lines 10-25; figures -----	1,12,14

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
8 June 2018	18/06/2018

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Stern, Claudio

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/IB2018/051432

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
FR 2954374 A1	24-06-2011	NONE	
WO 2010120179 A2	21-10-2010	CN 102395735 A	28-03-2012
		EP 2419575 A2	22-02-2012
		NO 332957 B1	11-02-2013
		US 2012096800 A1	26-04-2012
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