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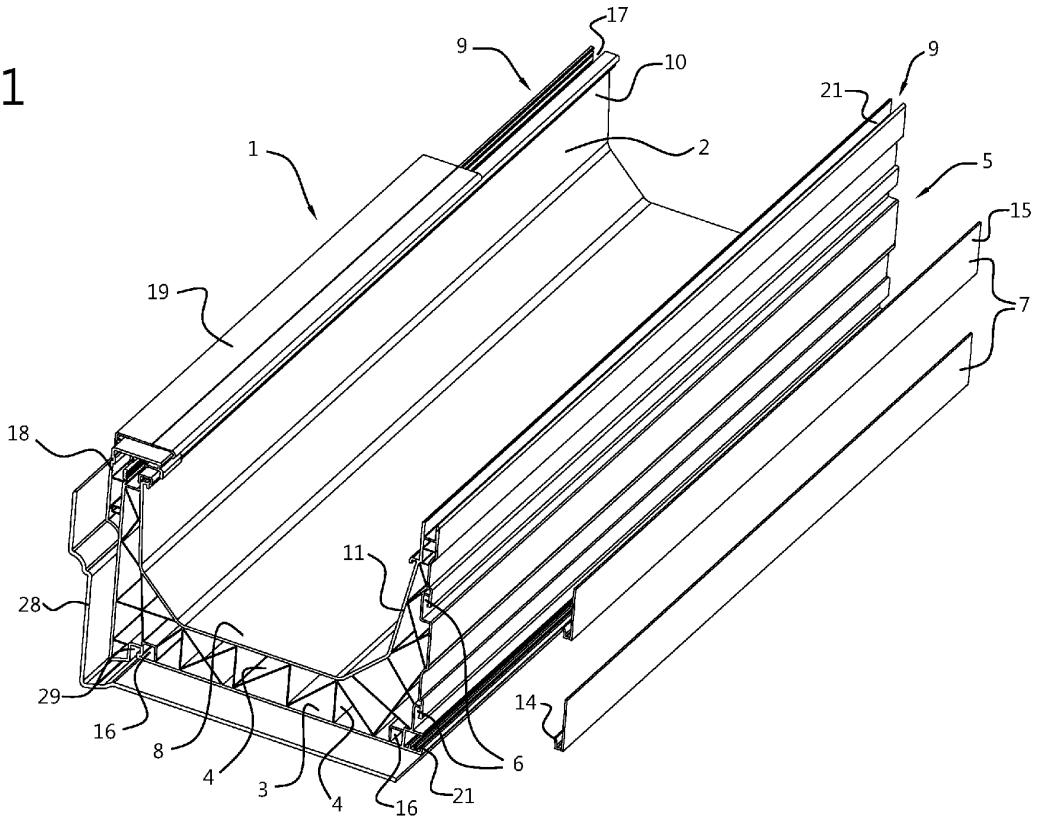
(54) **GUTTER**

(57) The invention provides a gutter assembly, comprising a gutter which is double walled, and comprises an inner wall and an outer wall and ribs connecting said inner wall and outer wall, providing a functionally self supporting gutter, said ribs comprising slanted ribs connecting the inner wall and outer wall, wherein the gutter has a thickness of the inner wall and outer wall of 1-4 mm.

Fig. 1



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Description

Field of the invention

[0001] The invention relates to an extruded or through additive manufacturing produced gutter.

Background of the invention

[0002] Gutters have been known almost as long as people make buildings and houses. Known gutters mostly connect to roofs. These gutters were made from wood, ceramic, and even from tin (pewter) or copper. In the last 50 years, gutters made from polymer material have been introduced. Most of these gutters were single walled, requiring much coupling support. Examples of these gutters are in EP869230.

[0003] NL194090 introduced one of the first self-supporting gutters from synthetic material or polymer, in that case from PVC (polyvinylchloride). In the abstract, it was introduced as "Polyester gutter element for a bracketless corner gutter of a sloping roof, comprising an elongate strip for positioning and attaching the gutter element to a top surface of the lower area of the eaves, and a front upstand, which is essentially perpendicular to the positioning strip, and a rear upstand, which projects at an angle downwards from the positioning strip, as well as a bottom wall, which together with the front upstand defines a substantially V-shaped flow profile, the rear upstand being provided with a supporting or bearing surface which perpendicularly adjoins the positioning strip, in order to provide support against the end side of the bottom edge of the roof. The gutter element is hollow-walled and is provided with double walls which are connected to one another by longitudinal partitions, which at least locally form a framework structure."

[0004] EP971083 in its abstract states: "Device for roof gutter parts (2a,2b) to be connected to each other, which roof gutter parts have a front wall (6a,6b), a bottom wall (3a,3b) and a rear wall (4a,4b), which merge into each other via discontinuities - such as buckles-, comprising two coupling members (8,9), which each substantially follow the shape of the roof gutter parts in cross-section, as well as means for biassing the coupling members to each other to hold the adjacent ends of the roof gutter parts in between them, the upper coupling member being provided with at least one receiving space, such as a channel, for attaching a sealing profile therein which profile is destined to lie on the ends of the roof gutter parts, the sealing profile being formed by injection moulding, the biassing means being adapted to exert a pressure force on the sealing profile to press it against the inner surface of the gutter wall."

[0005] WO2004/011738 in its abstract states: "The invention is directed to a gutter system for channeling rainwater from a building. The gutter system includes gutter sections that are interconnected with joint members having gaskets incorporated thereon. Each gutter section has a substantially hollow space defined between inner and outer walls that are spanned by a plurality of ribs."

[0006] JPH0532549U in its description in [0007] (machine translated) states: "For this reason, the inner surface connection structure of the eaves gutter according to the present invention is connected by abutting the ends of the eaves gutter bodies having curved flow paths having a substantially U-shaped cross section. However, it has an inner surface connection structure of an eaves gutter in which an inside joint is attached to the surface of the flow path of the connection portion, and a locking portion obtained by folding back the edge of the inside joint is inserted into the upper edges on both sides of the eaves gutter body. The inside joint is a plate-like material having an elastic portion that has a groove portion to support and tries to return to the flat plate state, and both edges are folded back to form a locking portion, and the locking portion is formed in the groove portion of the eaves gutter main body. An attempt is made to achieve the above object by a configuration characterized in that the entire back surface of the inside joint is crimped to the surface of the flow path by the elasticity when the inside joint is inserted by pressing."

[0007] JPS638317U seems to relate to coupling of gutter ends using complementary end parts that abut (figure 1-8). A (machine) translation of the description states: "The connecting device for an eaves gutter is characterized in that a sealing material filling space for holding a sealing material is formed between both connecting members when the projecting part of the other connecting member is fitted into a recessed part provided in one connecting member."

Summary of the invention

[0008] A disadvantage of prior art is that most gutters from synthetic material lack functionality and can not be applied on many known buildings. Most gutters are too heavy, deform, are complicated to install, especially when working in high places. Furthermore, they are often aesthetically not pleasing as they are 11 similar.

[0009] Hence, it is an aspect of the invention to provide an alternative gutter, gutter system and method for providing a gutter, which preferably further at least partly obviates one or more of above-described drawbacks.

[0010] There is provided a gutter assembly according to claim 1.

further embodiments are listed in the dependent claims, partly included in the description, and below.

[0011] The gutter is self supporting, even under high loads like snow. Mounting is improved, aesthetics is improved. Thermal expansion can be handled.

[0012] In particular, a mounting rail allows a sliding degree of motion of the gutter with respect to the mounting rail and thus a building in the longitudinal direction of the gutter.

[0013] The gutter is produced in lengths of up to 8 meters. Such a length can easily be transported to a site of

use. Usually, a gutter of this type will be produced in an extrusion process. This type of process is well known and results in a double walled, self supporting gutter. Attachment of such a gutter can be simplified and swifter. Furthermore, the attachment allows gutter ends to slide when mounted. This makes the mounting able to handle dynamic situations, like working of building parts, temperature changes, and the like.

[0014] Furthermore, the production allows for incorporating additional features like additional rails, or other coupling means that allows attachment or coupling of further parts like lists, aesthetic profiles, reinforcement parts, braces.

[0015] The current gutter is also referred to as synthetic material gutter or plastic gutter. The gutter can in particular be made of synthetic material that can be extruded. In order to make the gutter better weathering resistant, the synthetic gutter can be made of polyvinylchloride (PVC).

[0016] In an embodiment, the gutter is produced by additive manufacturing. This is also referred to as "3D printing". In this method, each time a new layer is added, thus producing a length of gutter.

[0017] In an embodiment, Dependent claims attachment rail comprises a mounting recess in said outer wall part, and said mounting rail comprising a mounting ledge fitting said attachment rail.

[0018] In an embodiment, the mounting recess comprised an undercut groove, and said mounting rail comprises a U-shaped edge fitting, in particular snap-fitting, into said undercut groove of said mounting recess.

[0019] In an embodiment, the inner gutter wall comprises a gutter bottom, a building side inner wall extending from said gutter bottom and an opposite outer side inner wall extending from said gutter bottom, and said gutter comprising an building side gutter edge and an opposite outer gutter edge.

[0020] In an embodiment, the gutter assembly further comprising a gutter coupling assembly for coupling two gutters with their ends for providing a continuous gutter.

[0021] In an embodiment, the gutter coupling assembly comprises:

- a first gutter coupling part comprising a gutter attaching end for attaching to said end of one of said two gutters, and a first closing flange, and
- a second gutter coupling part comprising a gutter attachment end for attaching to said end of the other of said two gutters, and gutter coupling sealing flange complementary with said first closing flange to provide a water tight coupling.

[0022] In an embodiment, said first gutter coupling part comprising a gutter attaching end for attaching to said end of one of said two gutters, and a first coupling flange.

[0023] In an embodiment, said second gutter coupling part comprising a gutter attachment end for attaching to said end of the other of said two gutters, and gutter coupling sealing flange shaped for in operation allowing said first coupling flange to slide over said gutter coupling sealing flange.

[0024] In an embodiment, the gutter attachment end of said first and said second gutter coupling part each comprise a coupling plate substantially matching a cross section of said gutter, for attaching, in particular fixing, to a gutter end, for instance fixing using adhesive.

[0025] In an embodiment, the gutter attachment end further comprises a gutter coupling attachment flange comprising an outer surface matching an inner surface of the gutter for allowing coupling, in an embodiment attaching, the gutter coupling attachment flange and said inner surface of the gutter.

[0026] In an embodiment, the coupling flange has a gutter side, and said second sealing flange has a sealing surface which sealing surface and gutter side are sealingly flush with an inner surface of the gutter attachment flange.

[0027] In an embodiment, the gutter is produced in a process selected from extrusion and additive manufacturing, and which is substantially from a polymer material, preferably from PVC.

[0028] In an embodiment, the gutter assembly further comprises a water sensor for providing a warning signal in case of gutter clogging.

[0029] In an embodiment, the water sensor comprises a sensing element for detecting a water level in said gutter, in an embodiment extending into said gutter up to a predefined height above a gutter lower inner wall for detecting water above a predefined water height level (wh) in said gutter.

[0030] In an embodiment, the water sensor further comprises an attachment part for attaching, in particular snapping, said water sensor onto said gutter.

[0031] In an embodiment, the water sensor comprises a power supply, in particular a photovoltaic element (101), for providing operational electrical power to said water sensor.

[0032] In an embodiment, the water sensor comprises a wireless transmitter for transmitting a signal when a water level is detected.

[0033] There is further provided a water sensor for determining a water level in a gutter, said water sensor comprising:

- an attachment end for attaching said water sensor on a gutter;
- a power source;
- a water detector coupled to said attachment end for detecting a predefined water level in a gutter once attached to said gutter;
- a wireless transmitter, and
- a processor for running a computer program.

[0034] In an embodiment, the computer program when receiving a first signal from the water detector, and when receiving a further signal from said water detector at a

predetermined time from said first signal, issues a gutter clogged signal via said wireless transmitter. In an embodiment, said gutter clogged signal is issued after receiving several signals from said water detector at predetermined time intervals.

[0035] There is further provided a coupling assembly for coupling ends of gutter together allowing water to flow between the ends of gutter, wherein said gutter attachment end of said first and said second gutter coupling part each comprise a coupling plate substantially matching a cross section of said gutter, for attaching, in particular fixing, to a gutter end, for instance fixing using adhesive.

[0036] The terms "upstream" and "downstream" relate to an arrangement of items or features relative to the flow of water from a source position to a drain position. For instance, in the gutter water flows from an upstream end to a downstream end.

[0037] There is further provided A gutter and a gutter assembly. They comprise a gutter produced in a process selected from extrusion and additive manufacturing or a combination thereoff, and which is substantially from a polymer material, preferably from PVC, said gutter comprising a building side and an opposite outer side, which gutter is double walled, and comprises an inner wall and an outer wall and ribs connecting said inner wall and outer wall, providing a functionally self supporting gutter. This cam be combined with the mounting elements described here, with the coupling, the reinforcement, the corner, its transport reinforcement, the water sensor and other elements, in combination, in further divisional applications.

[0038] The term "substantially" herein, such as in "substantially rectangular" or in "substantially consists", will be understood by the person skilled in the art. The term "substantially" may also include embodiments with "entirely", "completely", "all", etc. Hence, in embodiments the adjective substantially may also be removed. Where applicable, the term "substantially" may also relate to 90% or higher, such as 95% or higher, especially 99% or higher, even more especially 99.5% or higher, including 100%. The term "comprise" includes also embodiments wherein the term "comprises" means "consists of'.

[0039] The term "functionally" will be understood by, and be clear to, a person skilled in the art. The term "substantially" as well as "functionally" may also include embodiments with "entirely", "completely", "all", etc. Hence, in embodiments the adjective functionally may also be removed. When used, for instance in "functionally parallel", a skilled person will understand that the adjective "functionally" includes the term substantially as explained above. Functionally in particular is to be understood to include a configuration of features that allows these features to function as if the adjective "functionally" was not present. The term "functionally" is intended to cover variations in the feature to which it refers, and which variations are such that in the functional use of the feature, possibly in combination with other features it relates to in the invention, that combination of features is able to operate or function. For instance, if an antenna is functionally coupled or functionally connected to a communication device, received electromagnetic signals that are receives by the antenna can be used by the communication device. The word "functionally" as for instance used in "functionally parallel" is used to cover exactly parallel, but also the embodiments that are covered by the word "substantially" explained above. For instance, "functionally parallel" relates to embodiments that in operation function as if the parts are for instance parallel. This covers embodiments for which it is clear to a skilled person that it operates within its intended field of use as if it were parallel.

[0040] Furthermore, the terms first, second, third and the like in the description and in the claims, are used for distinguishing between similar elements and not necessarily for describing a sequential or chronological order. It is to be understood that the terms so used are interchangeable under appropriate circumstances and that the embodiments of the invention described herein are capable of operation in other sequences than described or illustrated herein.

[0041] The devices or apparatus herein are amongst others described during operation. As will be clear to the person skilled in the art, the invention is not limited to methods of operation or devices in operation.

[0042] It should be noted that the above-mentioned embodiments illustrate rather than limit the invention, and that those skilled in the art will be able to design many alternative embodiments without departing from the scope of the appended claims. In the claims, any reference signs placed between parentheses shall not be construed as limiting the claim. Use of the verb "to comprise" and its conjugations does not exclude the presence of elements or steps other than those stated in a claim. The article "a" or "an" preceding an element does not exclude the presence of a plurality of such elements. The invention may be implemented by means of hardware comprising several distinct elements, and by means of a suitably programmed computer. In the device or apparatus claims enumerating several means, several of these means may be embodied by one and the same item of hardware. The mere fact that certain measures are recited in mutually different dependent claims does not indicate that a combination of these measures cannot be used to advantage.

[0043] The invention further applies to an apparatus or device comprising one or more of the characterising features described in the description and/or shown in the attached drawings. The invention further pertains to a method or process comprising one or more of the characterising features described in the description and/or shown in the attached drawings.

[0044] The various aspects discussed in this patent can be combined in order to provide additional advantages. Furthermore, some of the features can form the basis for one or more divisional applications.

Brief description of the drawings

[0045] Embodiments of the invention will now be described, by way of example only, with reference to the accompanying schematic drawings in which corresponding reference symbols indicate corresponding parts, and in which:

Figure 1 schematically depicts a perspective view of a gutter;
Figure 2 shows an end view of the gutter of figure 1;
Figure 3 a perspective view of a gutter with end part;
Figure 4 the embodiment of figure 3 from opposite viewpoint;
Figure 5 a perspective view of a corner of a gutter, showing two gutter ends are coupled in a mitre joint;
Figure 6 shows a corner gutter with a transport brace;
Figure 7 shows a gutter while a reinforcement brace is being attached;
Figure 8 a perspective view of figure 7;
Figure 9 a cross sectional view of the gutter of figure 7 with attached reinforcement brace;
Figure 10 a perspective view of figure 9;
Figure 11 a perspective view of two gutter ends according to figure 1 with gutter coupling assembly;
Figure 12 the gutter of figure 1 with water sensor,
Figures 13-16 a further/other development of a coupling assembly for the gutter,
Figure 17 an alternative water sensor design.

[0046] The drawings are not necessarily on scale

Description of preferred embodiments

[0047] Figure 1 schematically depicts a perspective view of a gutter 1, and figure 2 shows a side/en view. The gutter 1 is an extruded gutter or is manufactured using additive manufacturing, also referred to as 3D printing.

[0048] The depicted parts and elements have particular design choices that may be part of design protection, and even copyright.

[0049] The gutter 1 is double walled, comprising an inner wall 2, and outer wall 3, and reinforcing ribs 4 connecting the inner wall 2 and outer wall 3. The inner wall 2 and outer wall 3 connect at opposite gutter edges 9. The gutter 1 is generally channel shaped and has a gutter bottom 8. The gutter 1 has a side that is in used mounted against or directed towards a building. This side is indicated with B, Building side. The opposite side is indicated O, outer side.

[0050] The gutter 1 is elongated or extends in longitudinal direction. Connected to and extending from the gutter bottom 8 are a building side inner wall 11 and an outer side inner wall 10. The building side inner wall 11, outer side inner wall 10, and gutter bottom 8 together define the channel shape for receiving water and guiding the received water away to a drain pipe.

[0051] The gutter 1 comprises several grooves, rails, recesses and flanges extending in longitudinal direction. These grooves, rails, flanges and recesses provide attachment, mounting and/or coupling parts for various other parts.

[0052] The gutter 1 has a building side outer wall 5. This building side outer all 5 here comprises two parallel mounting recesses 6 providing gutter attachment rails. that in this embodiment provide a one-sided undercut groove 12. The undercutting 12 provides the mounting recess 6 with a gutter mounting flange 13. The gutter mounting flange 13 extends in gutter bottom 8 direction.

[0053] The gutter 1 comprises in this embodiment two mounting strips 7, one for each mounting recess 6. Mounting strip 7 on one side has a U-shape side which proves the mounting strip 7 with a mounting strip/rail flange 14. The dimensions of the mounting recess 6, undercutting 12 and gutter mounting flange 13 on one side and the U-shape side and mounting strip flange 14 are mutually designed and dimensioned to provide a snap fit when mounting strip flange 14 is introduced into the undercutting 12 as depicted in figure 2. For better mounting and fixing, the mounting strip flange 14 extends away from the strip body. Thus, mounting rail flange 14 and mounting rail body 15 are not parallel. The angle is between 5 and 20 degrees. In particular between 10 and 20 degrees.

[0054] In an embodiment, the end of gutter mounting flange 13 is thickened in te direction of the building side inner wall 11. Furthermore, in this embodiment, the flaring out or extending of the mounting strip flange 14 starts about one third of its width. When the gutter mounting flange 13 enters the U-shaped side of the mounting strip, it pushes the flange a little away from the mounting strip 7 and against a wall of the mounting recess 6. This provides fixation.

[0055] In the illustrated embodiment, the mounting strip 7 runs along substantially the full length of the gutter 1. In this way, a secure and aligned mounting is ensured. It is also possible to use shorter ends of mounting strip 7, but in such instances, mutual alignment of these ends of mounting strip 7 is required. In the illustrated embodiment, the gutter 1 has two mounting recesses 6. This allows either more firm fixation, or can provide two different mounting options.

[0056] Using for instance a screw through the mounting strip/rail body 15, a mounting rail 7 can be attached or fixed to a building. If a screw head extends, it will fall in the additional recess above the mounting recess 6. The mounting rail 7 can be made from synthetic material. It may also be made from aluminium.

[0057] The gutter 1 comprises here two tubular profiles 16, here having a rectangular cross section. The tubular profiles 16 run along the length of a gutter. They can be used for receiving a coupling rod as illustrated in figure 5. Such a mounting rod can have a rectangular cross section, preferably matching the tubular profile 1 cross section. This can provide additional fixation of gutter

parts. The outer side bottom wall 25, the inner side of it, provides one wall of the tubular profile 16. The tubular profiles 16 are provide at/near opposite lower corners of the gutter 1.

[0058] In the building side outer wall 5, the gutter 1 further comprises a plate groove 22. Plate groove 22 is provided for receiving an edge of a board or panel, for instance a board covering an overhang of a roof.

[0059] The gutter 1 further comprises an inner flange 23 extending inward and comprising an end bending towards the gutter bottom 8. This in fact provides an undercut rail.

[0060] Gutter 1, or better the gutter edge 9 at the outer side of the gutter 1, is further provided with an outer side gutter edge groove 17.

[0061] The gutter edge 9 at the outer side of gutter 1 has various features that allow mounting/snapping of various decorative strips. These decorative strips and trims and rails are both decorative and functional. For instance a snap-fit cornice 18 is depicted in figure 1 and 2. A further snap fit cornice decorative strip 19 covers the top of the cornice 18. The embodiment of figures 1 and 2 can be provided with a gutter cladding profile 28 for covering a further attachment rail 29 and providing the gutter with a custom colour. The gutter cladding profile can further be provided with a colouring foil for allowing further custom colours. The snap fit cornice decorative strip 19 covers an edge of the gutter cladding profile 28, so as to fix it and clear its edge of sight. It may be a piece covering a coupling of gutter ends.

[0062] The gutter 1 has a thickness of the inner wall 2 and outer wall 3 of 1-4 mm. In particular the thickness is 1.5-3 mm. Specifically, the thickness is 2.2-2.7 mm.

[0063] The ribs 4, 4′, 4″, 4‴ have a thickness of between 0.2-2 mm. In particular, the thickness of the ribs is 0.5-1.5 mm. Specifically, the ribs have a thickness of 0.7-1.1 mm. It was found that this provides an optimal trade off between raw material used and strength. Furthermore, the thickness allows gluing ends and other parts. A distance between the inner wall and outer wall is between 1 cm and 5 cm. In particular the distance between the bottom inner wall and outer wall is between 1.5-5 cm.

[0064] It allows single gutter lengths of 8 meters long. The recesses, profiles and flanges are functional for attaching parts, and provide additional strength and reinforcement.

[0065] The ribs 4 that extend longitudinally have been carefully designed orientation that provides optimal strength while at the same time reducing material and weight.

[0066] In particular, in the bottom region ribs 4 are provided that are slanted. In particular, these slanted bottom ribs 4′ connect the gutter bottom wall 8 and the outer gutter wall 3. In cross section these slanted bottom ribs 4′ are at an angle of between 35 and 55 degrees, in particular between 38 and 52 degrees. In the current design, there are four of these slanted bottom ribs 4′. The slanted ribs 4′ are slanted from the gutter bottom wall 8 away from the building side B. There are furthermore vertical ribs 4″ at the gutter bottom. These are attached at the same location as the slanted ribs 4′.

[0067] The gutter bottom wall 8 has uprising parts 8′ at the building side B and the outer side O. These uprising parts 8′ have ribs 4‴ that are in plane with the uprising parts 8′ and connect to the outer gutter wall 3 (one of the slanted ribs 4′ is also a rib 4‴ of one of the uprising parts 8.

[0068] These ribs 4′, 4″, 4‴ provide additional strength, especially against bending of the outer side O away from the building side B and of the bottom downward (in mounted state).

[0069] Figures 3 and 4 show perspective views from opposite sides. Depicted is an gutter closing piece 30 that can be fitted to an end of the gutter 1 in order to close it. In the figures 3 and 4, furthermore a gutter coupling piece 20 is depicted, for coupling two ends of gutter butted together.

[0070] Gutter closing piece 30 comprises an end plate 31 matching the shape of the cross section of a gutter 1. A closing piece flange 32 extends from the end plate 31. The end plate 31 at the closing piece side in an embodiment is provided with adhesive, for instance resulting from an applied double sided tape end. The shape of the closing piece flange is adapted to tightly fit the building side inner wall 11, the outer side inner wall 10 and the gutter bottom 8. In an embodiment, the closing piece flange 32 has a coupling surface which in use contacts the inner surface of the gutter 1 for providing additional attachment or sealing. In an embodiment, the coupling surface is provided with a rubber sealing strip. In used, this rubber sealing strip is between the coupling surface and the inner surface of the gutter 1. Usually, such a rubber strip will be slightly compressed for improved sealing. In another embodiment, the coupling surface is provided with an adhesive for attaching the closing piece flange 32 to the inner surface of the gutter 1.

[0071] In figures 5 and 6, it is illustrated how two ends of gutter 1 or gutter ends are connected using a mitre joint. Jointing rods 40 that are here 90 degree angles, i.e., corresponding to the angle of the mitre joint, having a cross section dimensioned and fitting the tubular profiles 16 are inserted in the tubular profiles 16 of one of the gutter ends. Double sided tape end is fitted to one of the butt ends of a gutter end. Next, the gutter ends are pressed together with the other ends of the joining rods 40 inserting the tubular profiles 16 of the opposite gutter end. Once pressed together, a tape end can applied to the inner surface or channel side and over the mitre joint 26.

[0072] For additional strength, a further joining rod 40 can be fitted in the joined outer side gutter edge groves 17. Yet a further joining rod 40 can be fitted in the building side gutter edge groove 21.

[0073] In figure 6, a corner reinforcement bar 50 is shown. This bar can for instance be applied when a ready-to-fit gutter is transported to a building site, The

corned reinforcement bar 50 at its ends comprises fitting ends that fit into the respective building side gutter edge groove. These fitting ends 51 are at an opposite angle with respect to a longitudinal axis of the reinforcement bar 50. In case of a 90 degree angle of the gutter ends, both fitting ends are at 45 degrees and thus mutually at 90 degrees. Usually, the corner reinforcement bar 50 is temporary.

[0074] In figures 7-10, application of a reinforcement brace 60 for a gutter 1 is depicted. Such a reinforcement brace 60 can be applied at for instance 50 cm interspacing along the length of a gutter 1. This reinforces a gutter 1, for instance in case of heavy snowfall. In an embodiment, these reinforcement braces can be applied in winter. Gutter reinforcement brace 60 comprises a gutter brace lever 61 and a gutter brace bar 62. Gutter brace lever 61 is hingingly connected to gutter brace bar 62. The connection allows the gutter brace lever 62 and the gutter brace bar 61 to form a scissor mechanism. The gutter reinforcement brace 60 can clamp on the inner flange 23 described earlier on/near one gutter edge 9 and clamp on a flange and top surface on the opposite gutter edge. The length of the gutter reinforcement brace 60 is dimensioned to the width of the gutter 1. In this embodiment, when bringing the gutter brace lever 61 and gutter brace bar in line, one end of the gutter brace lever 61 engages the inner flange 23 at the bottom side and the corresponding end of the gutter brace bar 62 engages the opposite side of the inner flange 23. The opposite end of the gutter brace lever 61 engages the upper side of gutter edge 9 and the corresponding end of the gutter brace bar 61 engages a further inner flange 26. It is evident that operation can be reversed, with the gutter reinforcement brace 60 rotated.

[0075] When in line, the gutter brace bar 62 and gutter brace lever 61 snap together. When a gutter gets loaded with snow, for instance, the gutter 1 will have additional reinforcement.

[0076] The depicted gutter 1 of these embodiments has an alternative gutter edge strip 27. It snaps onto the gutter edge 9 via a small longitudinally extending slot and notch, and a flange snapping behind a profile. The gutter edge strip 27 has a decorative aspect, and provides an engagement surface for the gutter brace lever engagement surface 64.

[0077] In figure 11, a gutter coupling assembly 20A, 20B is depicted. Such a gutter coupling assembly 20A, 20B allows a (longitudinal, water) coupling of two gutter ends 1. The depicted gutter ends (or "ends of gutter (1)") 1 correspond to the gutter 1 of figure 1. In particular, it was found that when coupling longer gutter ends, for instance for providing a continuous gutter along several houses, the dynamics of the environment and of the buildings/houses may put stress on such a (water) coupling. Dotted lines visualize the continuous coupling. The provided coupling assembly 20A, 20B allows a longitudinal change in gutter end distance. In practice, a gutter (1) can be 3-15 meters long, in practice a gutter (1) can be 3-8 meter long. In extreme circumstances, lengths due to temperature changes may change 1-5 cm.

[0078] In the current embodiment, the gutter coupling assembly 20A, 20B comprises two cooperating gutter coupling parts 20A, 20B. Each of the gutter coupling parts 20A, 20B has a gutter coupling means for coupling the respective gutter coupling part 20A, 20B to a gutter end. In the depicted embodiment, the gutter coupling parts 20A, 20B comprise a gutter coupling attachment flange 43.

[0079] Extending at opposite side of each gutter coupling part 20A, 20B, each gutter coupling part 20A, 20B comprises a complementary coupling means for coupling the gutter coupling parts 20A, 20B. In the current embodiment, one gutter coupling part 20A comprises a gutter coupling flange 41 and the complementary gutter coupling part 20B in the depicted embodiment comprises a gutter coupling sealing flange 42. This sealing flange comprises a sealing part comprising in the depicted embodiment a trench for holding a sealing rubber strip.

[0080] The outer surface of the gutter coupling flange 41 slides over the inner side of the gutter coupling sealing flange 42 is a (water) sealing manner.

[0081] In an embodiment, the gutter coupling means of the gutter coupling parts 20A, 20B each comprises a gutter coupling plate 40. The gutter coupling plates have a shape matching a cross section of the gutter (1). For attaching each of the gutter coupling parts 20A, 20B to its respective gutter (1), a connecting side of the gutter coupling plates 40 can be provided with an adhesive of for instance with a double sided tape part. With the gutter coupling plates 40 attached to its respective gutter 1, the gutter coupling attachment flanges 43 rest with a gutter side against the inner surface of its gutter 1. The dotted arrows extending try to visualize this. The gutter side of the gutter coupling attachment flange 43 can be attached to the inner surface of the gutter (1) by means of an adhesive or a double sided tape. Alternative, the gutter side of the gutter coupling attachment flange 43 can be provided with a sealing rubber strip. In general, for providing sealing, gutter side of the gutter coupling attachment flange 43 matches the inner surface of the gutter (1). Usually, the gutter coupling attachment flange 43 extends between 0.5 and 5 cm. In general, it extends between 1 and 3 cm.

[0082] In the depicted embodiment, the gutter coupling plate 40 on its connecting side has the gutter coupling attachment flange 43 attached to it, extending from it. At its opposite side, the gutter coupling plate 40 has attached to it the gutter coupling flange 41. For the gutter coupling part 20B, the cutter coupling sealing flange 42 is attached or injected onto or together with the gutter coupling plate 40. It is provided on the gutter coupling plate 40 in such a way that the sealing surface of the gutter coupling sealing flange 42 is functionally continuous or flush with an inner surface of the gutter coupling attachment flange 43. In the depicted embodiment, the gutter coupling sealing flange 42 provides a trench for

holding a rubber sealing strip (not depicted).

[0083] For allowing the gutter coupling flange 41 to slide over the gutter coupling sealing flange 42 (in fact, its sealing surface), an gutter side surface of the gutter coupling flange 41 is flush with the inner surface of gutter coupling attachment flange 43, or even a little elevated to be able to slide. The gutter coupling flange can extend between 5-10 cm from the gutter coupling plate 40.

[0084] The gutter coupling assembly in an embodiment further comprises the earlier-described gutter coupling cladding profile 28. Usually, it will be around 5-30 cm long. It is to cover the gap (distance between adjacent gutter ends) filled with the gutter coupling parts 20A, 2B. It will be attached to one of the gutter ends 1. For instance, it may be attached using adhesive, of for instance via a mechanical connection, for instance using screws.

[0085] In figure 12, an embodiment of a gutter water sensor 100 is depicted. Water sensor 100 comprises a housing 102 allowing attachment to the gutter 1. In the current embodiment, the housing comprises an attachment means for snap-coupling on further inner flange or rail 26. The housing 102 may for instance snap fit on the rail 26 and the gutter edge strip 27. Alternatively, the water sensor can be attached to the gutter 1 via adhesive or a mechanical attachment lite s screw.

[0086] The water sensor comprises a sensor part 103 that indicates when a water level reaches a predetermined height wh. The water sensor issues a signal when this water level wh remains for a predetermined amount of time. For instance, it can measure starting from the first measurement time and measure at fixed time intervals to determine if the water level wh remains. If the water level wh remains at or above the pre-set water level wh, the water sensor can issue a wireless signal indicating clogging of the gutter 1. The water sensor 100 comprises a power source, for instance comprising a photovoltaic panel 101. The wireless signal mar be transmitted using Bluetooth, Wi-Fi, ZigBee, or any similar signal processing method and protocol. The sensor part 103 is for instance set at a water level wh.

[0087] In figures 13-16, a further/other development of a coupling assembly for a gutter is illustrated.

In this embodiment, each gutter end is provided with a gutter coupling part similar to the earlier explained gutter coupling part 20B. and it mirror image 20C. (plane mirror image...). As explained above, these gutter coupling parts 20B, 20C comprise a gutter coupling plate 40. It has an outer boundary matching a straight (with respect to the longitudinal direction) cross section of the gutter 1. The gutter coupling plate 40 at its side which in use is directed towards its respective gutter end can be provided with an adhesive layer for attaching it to its respective gutter end. A double side tape can be used.

[0088] The gutter coupling attachment flange or collar 43 helps in aligning of the gutter coupling plate 40 to the gutter end, and/or prevents static load. It is provided on the gutter end side or adhesive surface 70 - side of gutter coupling plate 40.

[0089] The gutter coupling plate 40 further supports the gutter coupling sealing flange or collar 42. This sealing flange of collar 42 provides a small gutter that holds or supports a sealing strip (not shown) that extends only 1-3 mm above the gutter inner surface once the gutter coupling part 20B, 20C is mounted to its gutter end. This sealing strip is from a resilient, compressible rubber. The sealing strip may be coated with a smoothening coating to reduce wear, explained later.

[0090] The current gutter coupling parts 20B, 20C have a removable adjustment part 44, here a cam 44. This is provided at the gutter coupling sealing flange or collar 42 - side of the gutter coupling plate 40. It extends away from the gutter coupling sealing flange or collar 42. Usually, it extends between 1 and 4 cm. Usually, the adjustment parts 44 are breakable, allowing easy removal from the gutter coupling parts 20B, 20C. When mounting two gutters or more, the adjustment parts 44 abut, making sure that the distance between gutters is correct and allowing thermal expansion. Once the gutters are mounted, the adjustment parts 44 are broken away and a gutter coupling cover plate 80 is installed. It snaps between inner flanges 23 and further inner flange 26 (also provided for the gutter braces 60!!) and presses with its gutter coupling cover plate outer surface or gutter facing surface 82 against the sealing rubber in the gutter coupling sealing flange or collar 42, keeping it placed.

[0091] The gutter coupling cover plate 80 has a gutter coupling cover plate inner surface 81 and a gutter coupling cover plate outer surface 82

[0092] The gutter coupling cover plate 80 has end flanges or guiding collars 83 that extend from the gutter facing surface 82 and correspond to the inner surface of the gutter 1.

[0093] The gutter coupling cover plate 80 further has gutter coupling cover plate limit rib 84 that is placed between the gutter coupling parts 20B, 20C. It prevents the cover plate 80 from "walking away" after many instances of expansion and contraction of the gutters 1, as the limit rib 84 will remain between the coupling parts 20B, 20C.

[0094] The (inner) cover plate 80 thus has a flexibility and dimension with respect to the gutter 1 to snap between its inner flange 23 and further inner flange 26 both near opposite edges

[0095] It will also be clear that the above description and drawings are included to illustrate some embodiments of the invention, and not to limit the scope of protection. Starting from this disclosure, many more embodiments will be evident to a skilled person. These embodiments are within the scope of protection and the essence of this invention and are obvious combinations of prior art techniques and the disclosure of this patent.

Reference numbers

[0096]

1	gutter

2	inner gutter wall
3	outer gutter wall
4	reinforcing rib
4′	slanted rib
4″	vertical rib
4‴	ribs in plane with slanted gutter bottom
5	building sided outer wall
6	mounting recess
7	mounting rail
8	gutter bottom
8’	slanted gutter bottom
9	gutter edge
10	outer side inner wall
11	building side inner wall
12	undercutting (of mounting recess)
13	gutter mounting flange
14	mounting rail flange
15	mounting rail body
16	rectangular tubular profile
17	outer side gutter edge groove
18	cornice
19	cornice decorative strip
20A, 20B	gutter coupling part
21	building side gutter edge groove
22	plate/panel groove
23	Inner flange
24	outer side outer wall
25	outer side bottom wall
26	Further inner flange
27	gutter edge strip
28	gutter coupling cladding profile
29	gutter attachment rail
30	gutter closing piece
31	end plate
32	gutter closing piece flange/collar
40	gutter coupling plate
41	gutter coupling flange/collar
42	gutter coupling sealing flange/collar
43	gutter coupling attachment flange/collar
44	gutter coupling removable adjustment cam
50	corner reinforcement bar
51	reinforcement bar fitting end
60	gutter brace
61	(upper) gutter brace lever
62	(lower) gutter brace bar
63	gutter brace bar engagement flange
64	gutter brace lever engagement surface
65	gutter brace lever engagement flange
66	gutter brace bar engagement surface
70	Adhesive surfaces
80	gutter coupling cover plate
81	gutter coupling cover plate inner surface
82	gutter coupling cover plate outer surface or gutter facing surface
83	gutter coupling cover plate guiding collar
84	gutter coupling cover plate limit rib
100	water sensor
101	solar panel
102	housing comprising processor and wireless transmitter
103	water sensing end
B	Buiding side
O	Outer side
wh	water height
P	Gutter building side plane

Claims

1. A gutter assembly, comprising a gutter (1) produced in a process selected from extrusion and additive manufacturing and combinations thereof, and which is substantially from a polymer material, preferably from PVC, said gutter comprising a building side (B) and an opposite outer side (O), which gutter (1) is double walled, and comprises an inner wall (2) and an outer wall (3) and ribs (4) connecting said inner wall (2) and outer wall (3), providing a functionally self supporting gutter (1), said ribs (4) comprising slanted ribs (4′, 4‴), in particular at least three slanted ribs (4′, 4‴), connecting the inner wall (2) and outer wall (3) and slanting in said building side direction.

2. The gutter assembly according to claim 1, wherein said inner wall (2) comprises a longitudinally extending bottom wall 8, in particular said bottom wall (8) is substantially flat, and is flanked by a slanted bottom wall part (8’), in particular flanked at both sides by a said slanted bottom wall part (8’), and further comprising slanted ribs at longitudinal sides of said slanted bottom wall part (8’) or parts (8’) that extend in-plane with said slanted bottom wall part (8’) or parts (8’) and connecting with said outer wall(3), wherein in particular said slanted bottom wall part (8’) or parts (8’) are at an angle of between 35 and 50 degree with said substantially flat bottom (8), more in particular an angle of between 40 and 47 degrees.

3. The gutter (1) assembly according to any one of the preceding claims, wherein said inner wall (8) comprises a or said substantially flat bottom wall (8) and a substantially flat outer wall (3) bottom wall, wherein said substantially flat bottom wall (8) and said substantially flat outer wall (3) bottom wall are connected via said slanted ribs (4′, 4‴), in particular said substantially flat bottom wall (8) and said substantially flat outer wall (3) bottom wall are substantially parallel.

4. The gutter (1) assembly according to any one of the preceding claims, wherein the gutter (1) has a thickness of the inner wall (2) and outer wall (3) of 1-4

mm, in particular the thickness is 1.5-3 mm, specifically, the thickness is 2.2-2.7 mm, and wherein the ribs (4, 4′, 4″, 4‴) have a thickness of between 0.2-2 mm, in particular the thickness of the ribs is 0.5-1.5 mm, specifically, the ribs have a thickness of 0.7-1.1 mm.

5. The gutter (1) assembly according to any one of the preceding claims, wherein distance between the inner wall (2) and the outer wall (3) is between 1 cm and 5 cm, in particular the distance between the bottom inner wall and outer wall is between 1.5-5 cm.

6. The gutter (1) assembly according to any one of the preceding claims, wherein said outer wall comprises a building sided outer wall (5), a bottom sided outer wall substantially rectangular with respect to one another, and an outer sided outer wall, substantially rectangular with respect to said bottom sided outer wall.

7. The gutter (1) assembly according to any one of the preceding claims, wherein said attachment rail comprises a mounting recess (6) in said outer wall part (5), and said mounting rail (7) comprising a mounting ledge (14) fitting said attachment rail.

8. The gutter (1) assembly according to any one of the preceding claims, wherein said mounting recess (6) comprised an undercut groove, and said mounting rail (7) comprises a U-shaped edge fitting, in particular snap-fitting, into said undercut groove of said mounting recess (6).

9. The gutter (1) assembly according to any one of the preceding claims, wherein said inner gutter wall (2) comprises a gutter bottom (8), a building side inner wall (11) extending from said gutter bottom (8) and an opposite outer side inner wall (10) extending from said gutter bottom (8), and said gutter (1) comprising an building side gutter edge (9) and an opposite outer gutter edge (9).

10. A gutter assembly, comprising a gutter (1) produced in a process selected from extrusion and additive manufacturing and combinations thereof, and which is substantially from a polymer material, preferably from PVC, said gutter comprising a building side (B) and an opposite outer side (O), which gutter (1) is double walled, and comprises an inner wall (2) and an outer wall (3) and ribs (4) connecting said inner wall (2) and outer wall (3), providing a functionally self supporting gutter (1), and comprising a gutter coupling assembly for coupling two gutters (1) with their ends for providing a continuous gutter.

11. The gutter (1) assembly of claim 10, wherein said gutter coupling assembly comprises:

- a first gutter coupling part (20B) comprising a coupling plate (40) substantially matching a cross section of said gutter (1), having an attachment side for attaching, in particular fixing, to one gutter (1) end, for instance fixing using adhesive and a gutter coupling sealing flange (42) at the a side opposite said attachment side for holding a compressible resilient sealing strip with a surface following said bottom wall and extending above said gutter bottom wall;
- a second gutter coupling part (20C), which is a point-mirror image of the first gutter coupling section, for attaching to a second gutter (1) end
- a gutter coupling cover plate (80) to provide a water tight coupling between said first and second gutter coupling parts (20B, 20C) with said compressible resilient sealing strips against its gutter side surface.

12. The gutter (1) assembly of claim 11, wherein:

- said first and second gutter coupling parts (20B, 20C) comprising a gutter attaching end (43) for aligning to, in particular for attaching to, said inner surface of its respective gutter (1).

13. The gutter assembly of any one of the preceding claims 10-12, wherein said first and second gutter coupling parts (20B, 20C) comprise a removable, in particular breakable, adjustment cam (44) for in operation when the gutter coupling parts (20B, 20C) are facing one another, touching one another and providing a predefined clearing between the gutter coupling parts (20B, 20C), in particular wherein said gutter attachment end (43) further comprises a gutter coupling attachment flange (43) comprising an outer surface matching an inner surface of the gutter (1) for allowing coupling, in an embodiment attaching, the gutter coupling attachment flange (43) and said inner surface of the gutter (1), in particular wherein said coupling flange (41) has a gutter side, and said second sealing flange (42) has a sealing surface which sealing surface and gutter side are sealingly flush with an inner surface of the gutter attachment flange (43), in particular wherein said gutter (1) comprises an inner flange (23) near an edge of its building side (B) and a further inner flange (26) near an edge of its outer side providing an engagement for holding said gutter coupling cover plate (80), in particular said inner flange and further inner flange being undercut and opening towards the bottom of the gutter or bending towards the bottom of the gutter, for holding ends of said gutter coupling plate (80) for clamping it with its gutter facing surface sealingly compressing the resilient strips of the coupling parts (20A, 20B).

14. a gutter (1) produced in a process selected from ex-

trusion and additive manufacturing and combinations thereof, and which is substantially from a polymer material, preferably from PVC, said gutter comprising a building side (B) and an opposite outer side (O), which gutter (1) is double walled, and comprises an inner wall (2) and an outer wall (3) and ribs (4) connecting said inner wall (2) and outer wall (3), providing a functionally self supporting gutter (1), said ribs (4) comprising slanted ribs (4′, 4‴), in particular at least three slanted ribs (4′, 4‴), connecting the inner wall (2) and outer wall (3) and slanting in said building side direction.

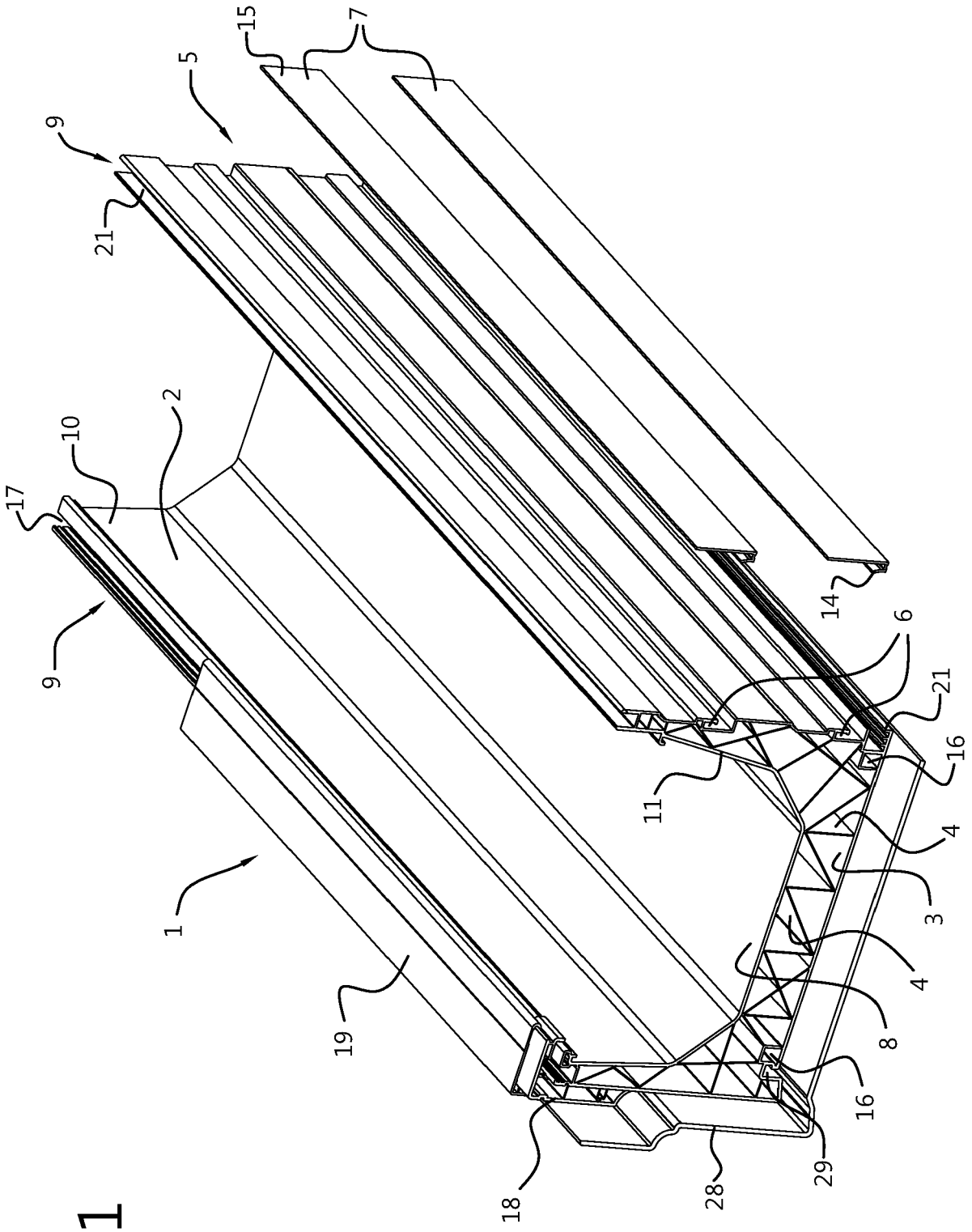


Fig. 1

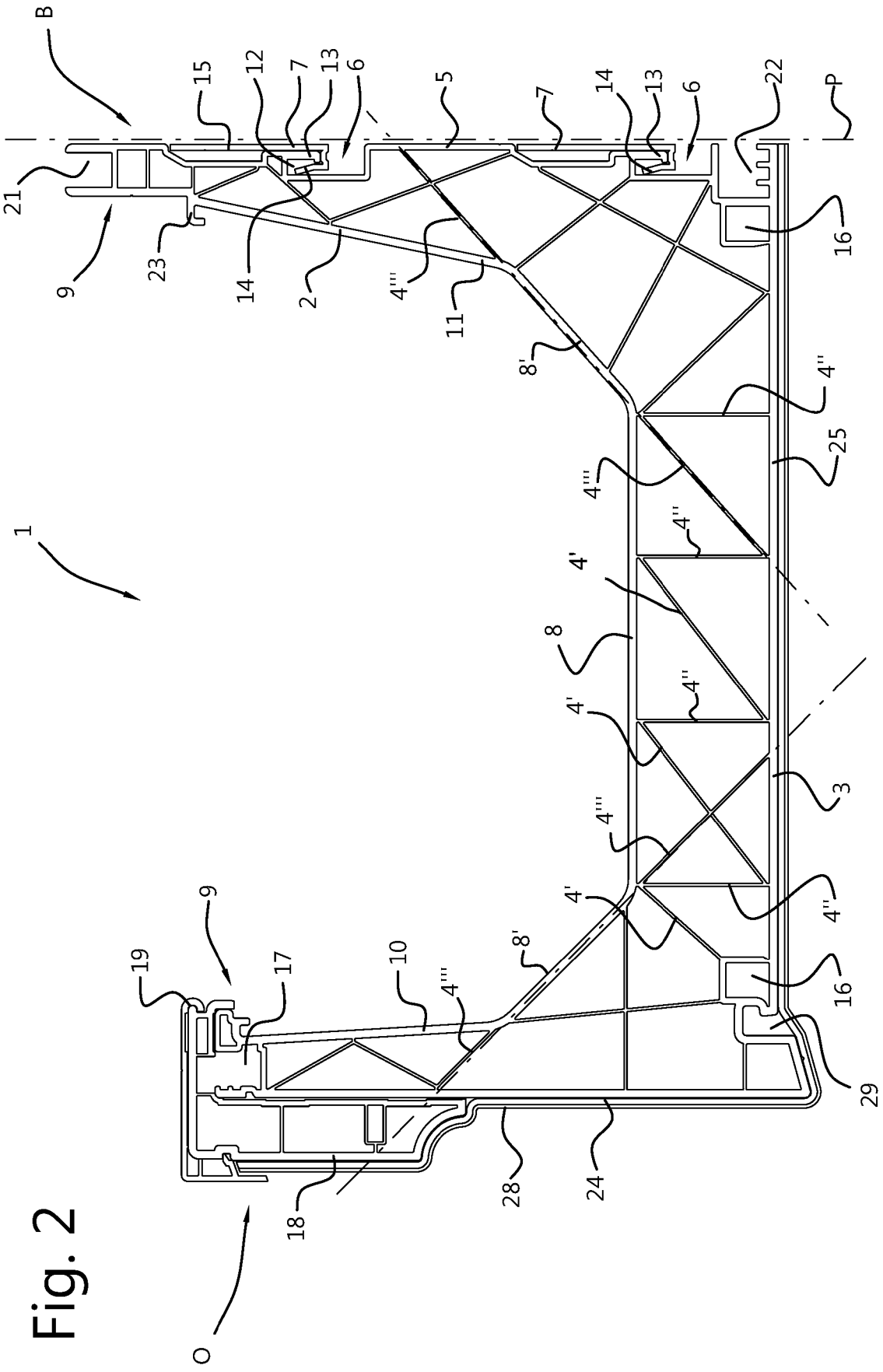

B
15
12
7
13
6
5
7
14
13
6
22
P
21
9
23
14
2
4'''
11
8'
16
4''
25
4'''
4''
4'
8
4'
4''
3
4'''
4'
4''
16
29
9
19
17
10
4'''
8'
18
28
24
1
O

Fig. 2

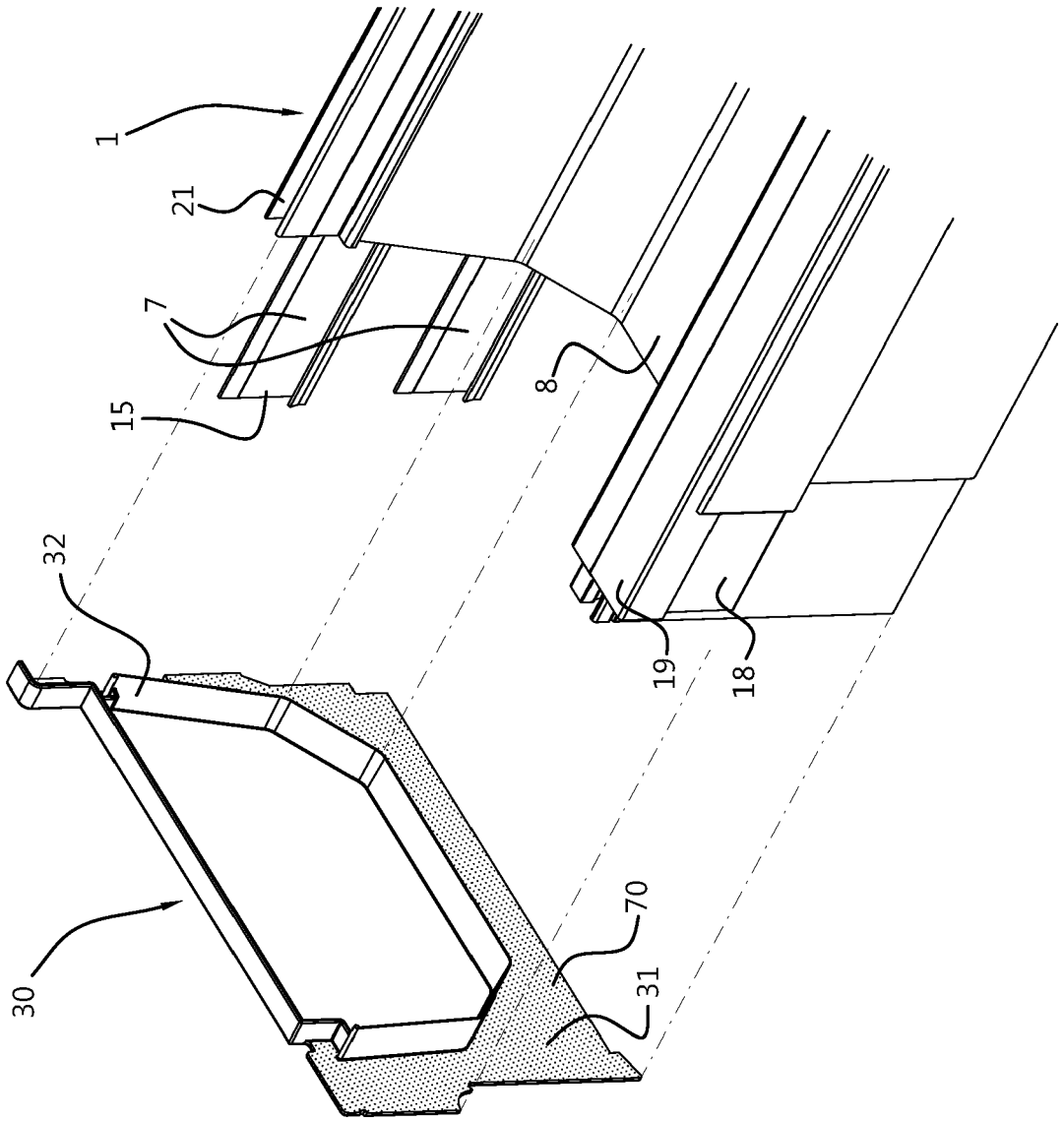


Fig. 3

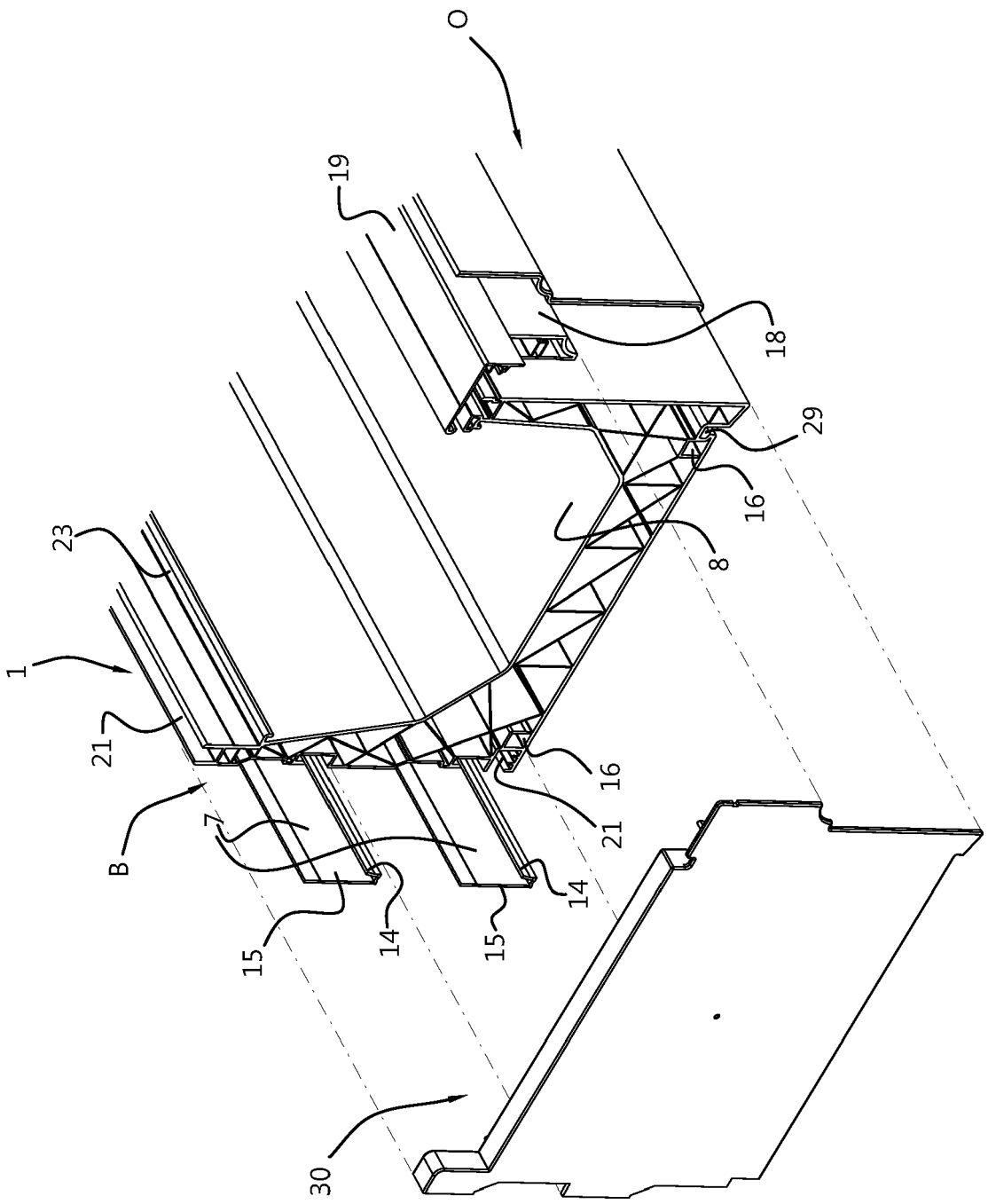


Fig. 4

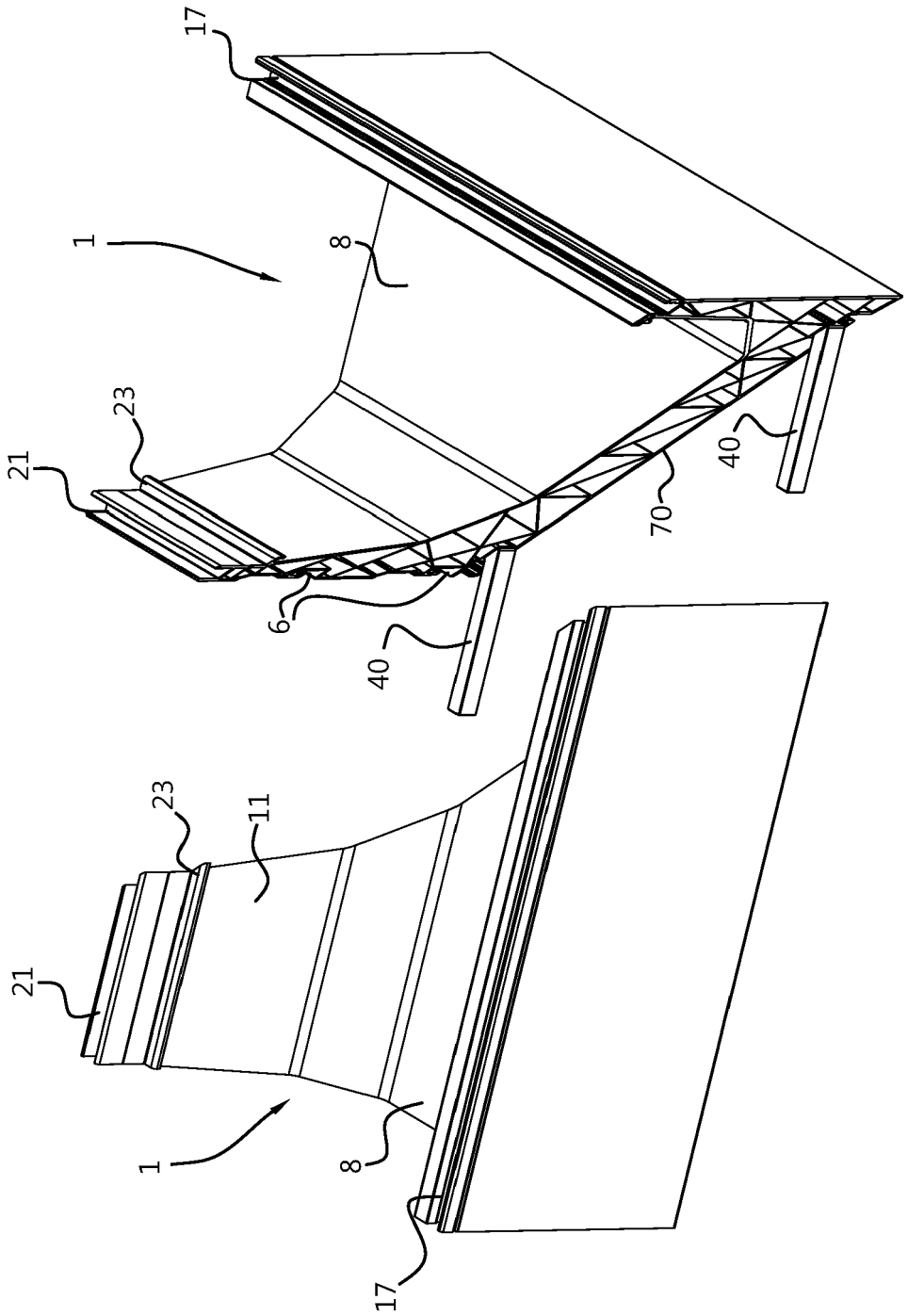


Fig. 5

Fig. 6

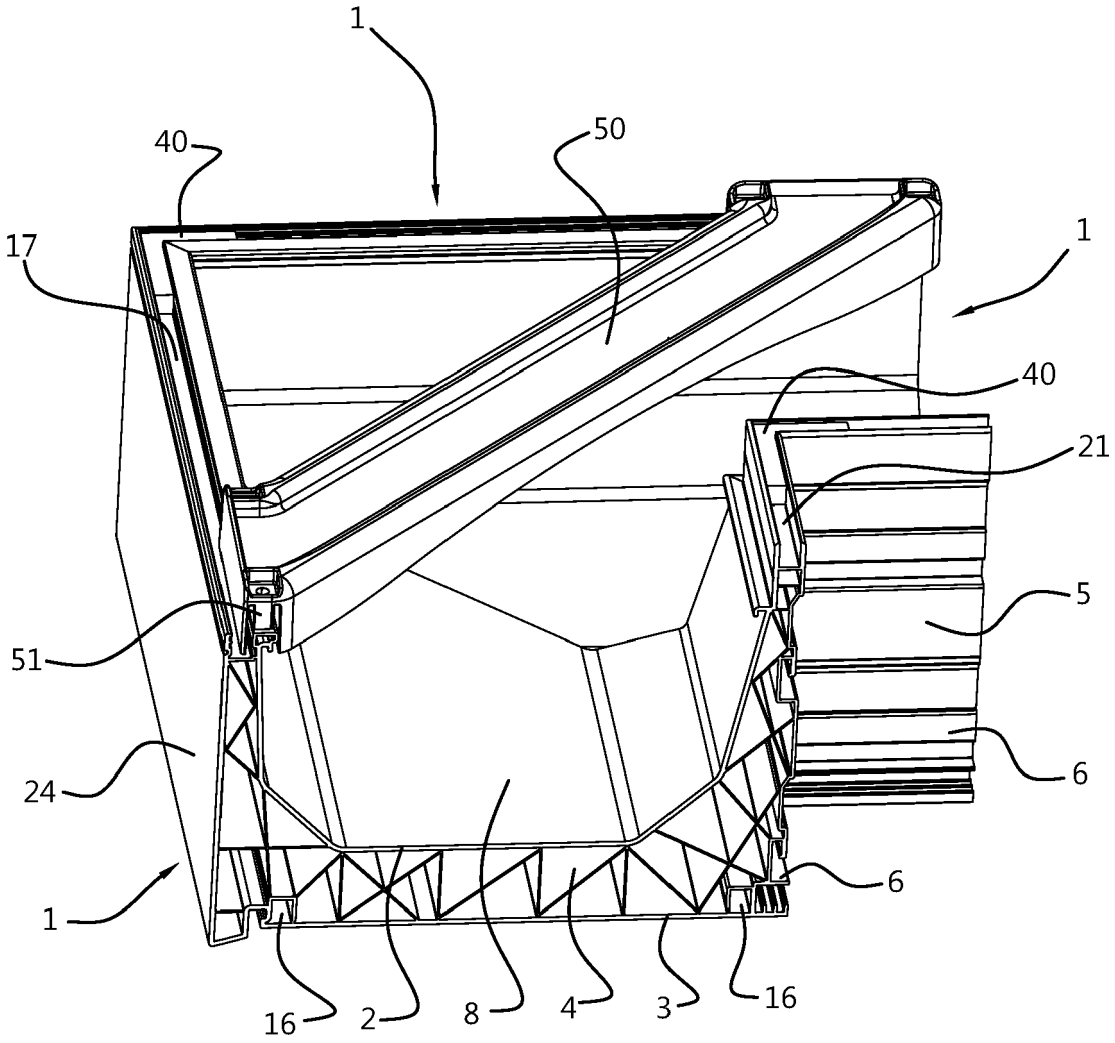


Fig. 7

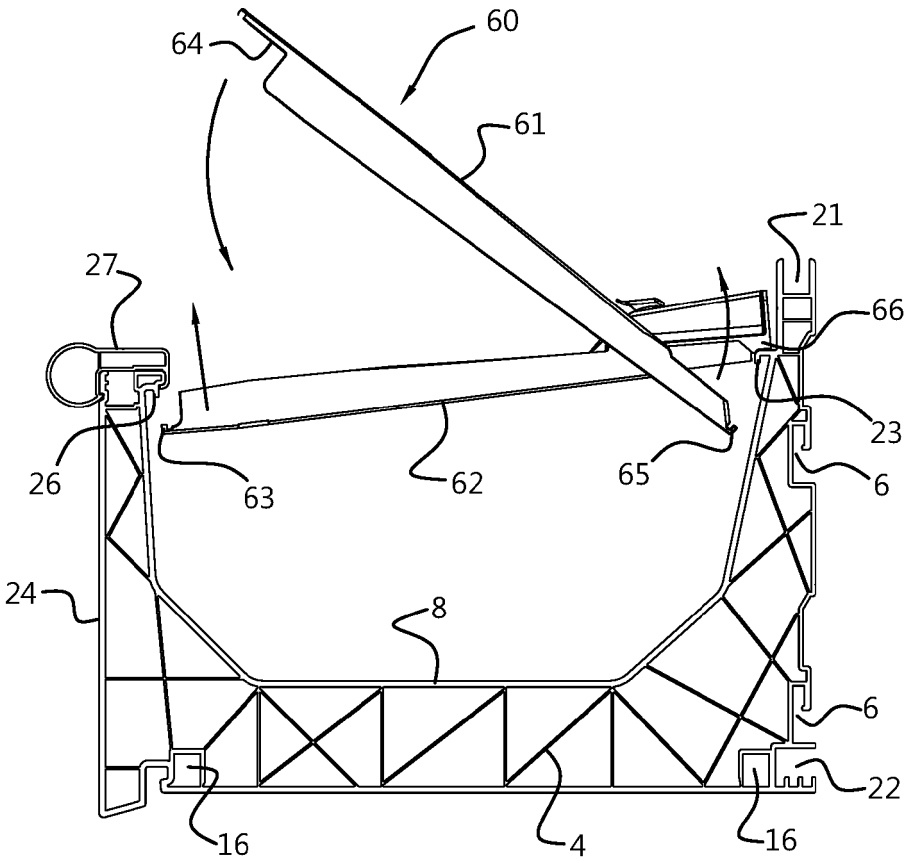


Fig. 8

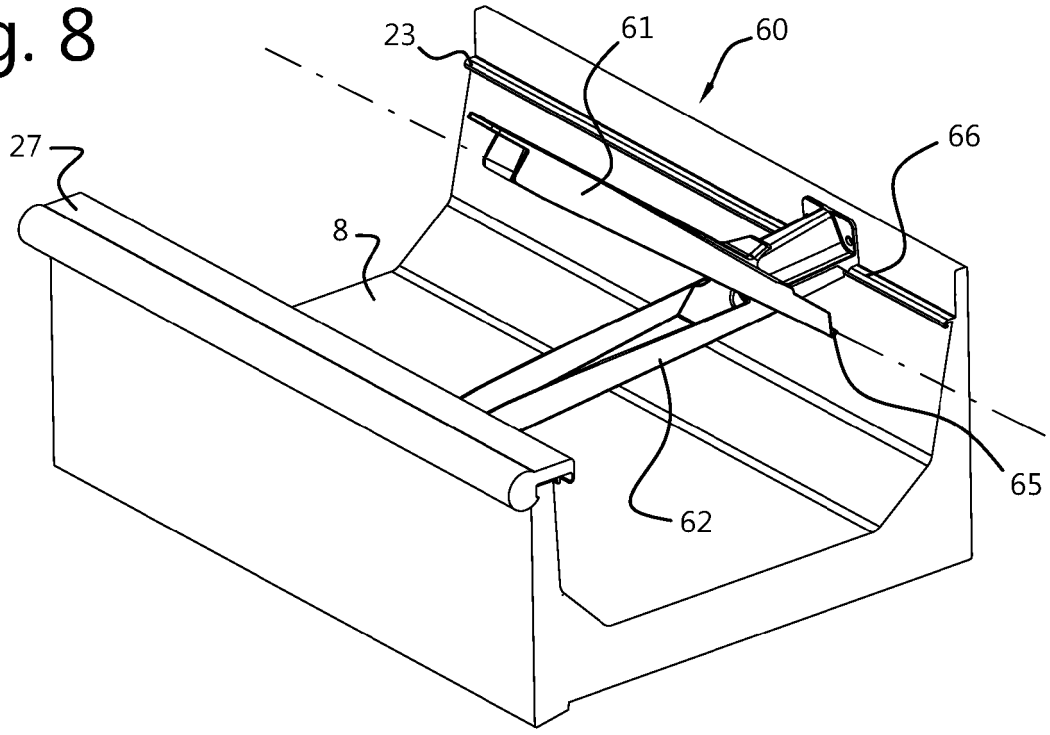


Fig. 9

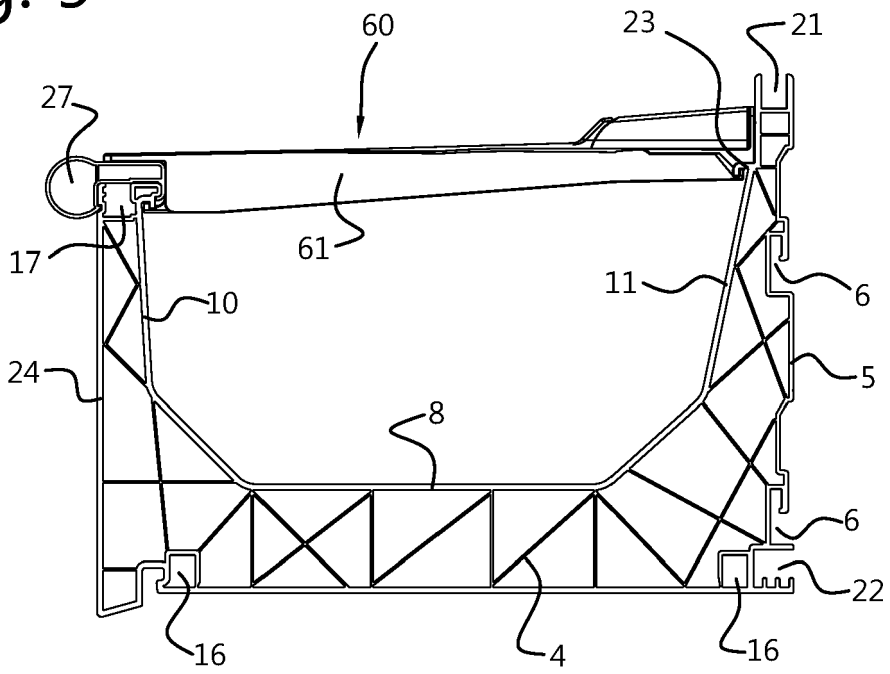
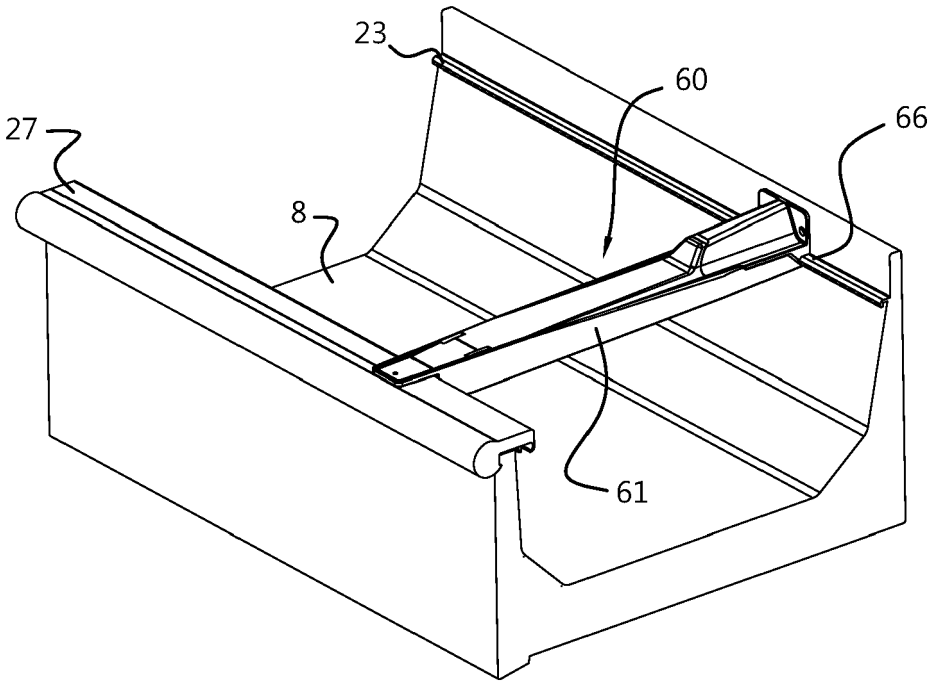


Fig. 10



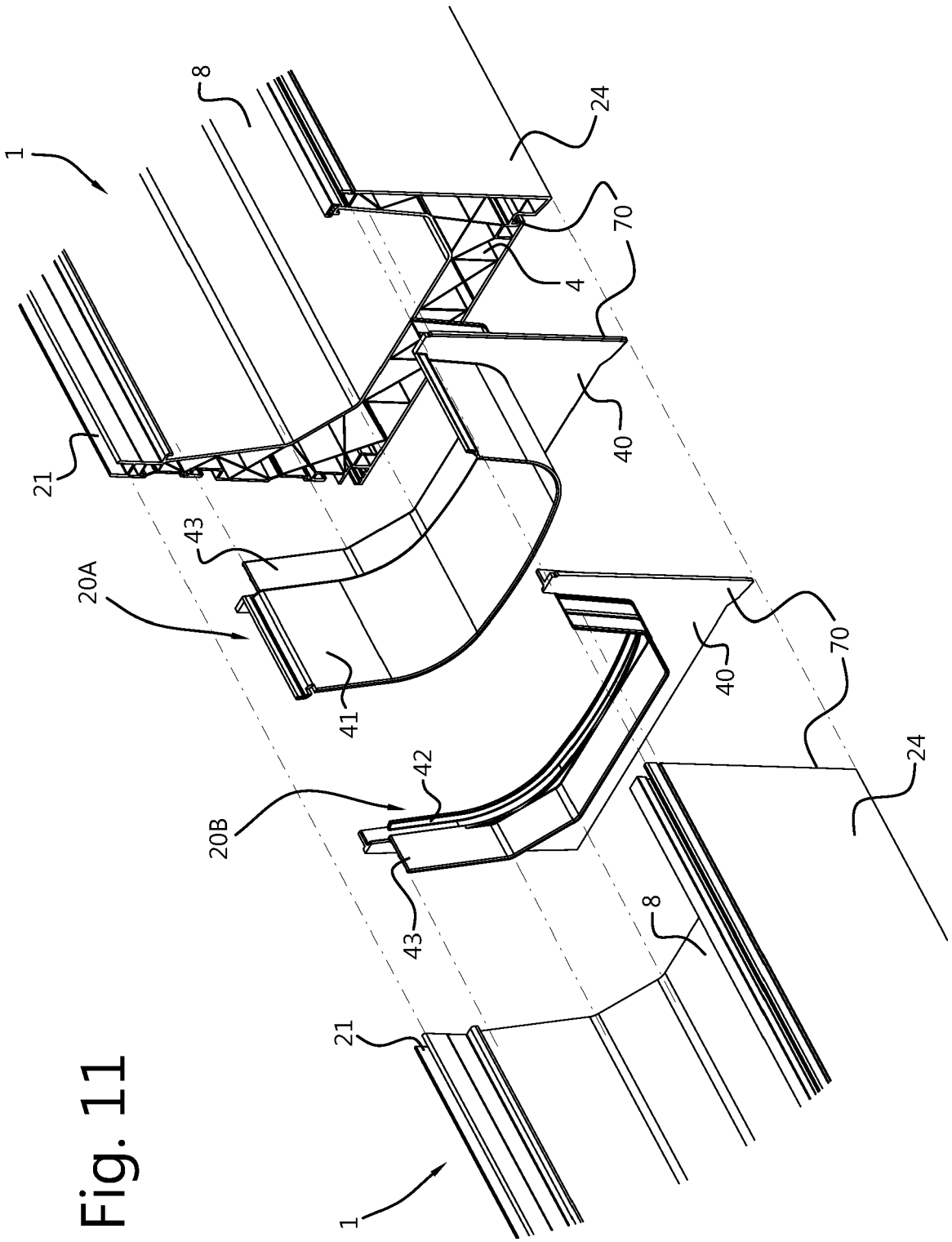


Fig. 11

Fig. 12

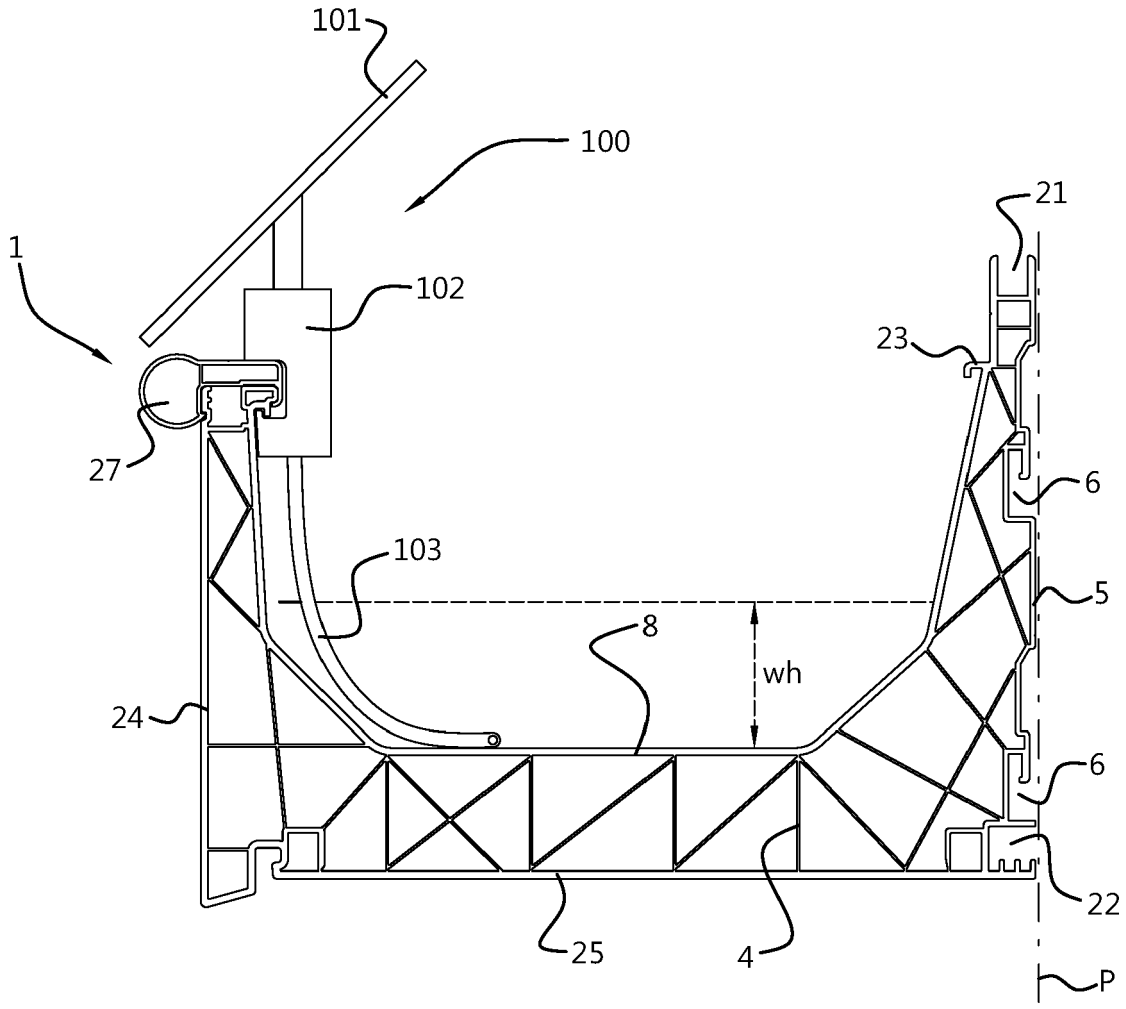


Fig. 13A

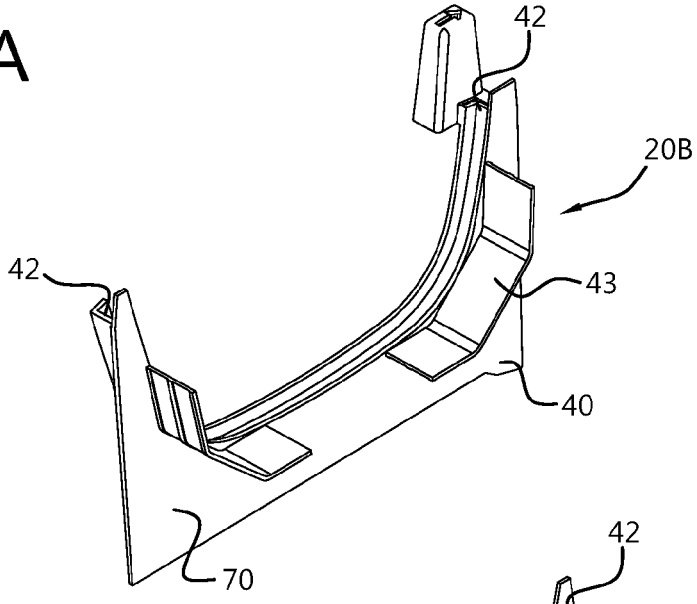


Fig. 13B

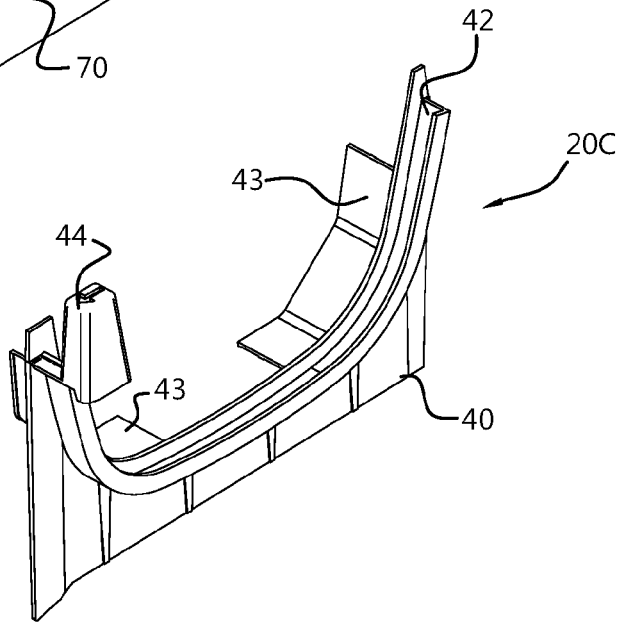


Fig. 13C

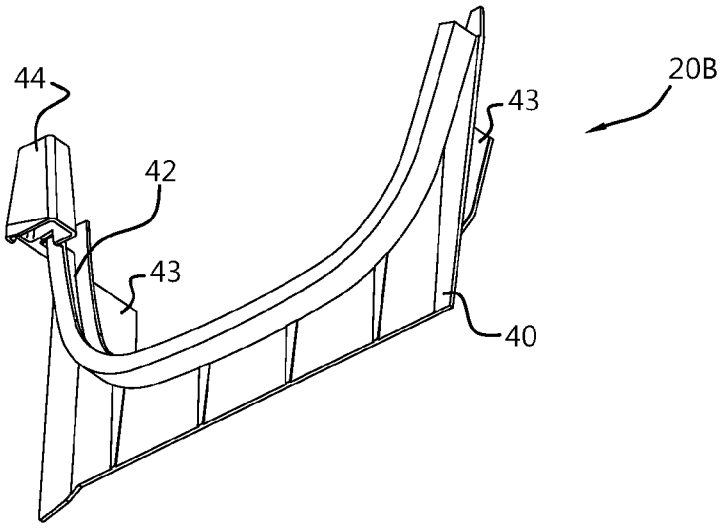


Fig. 14

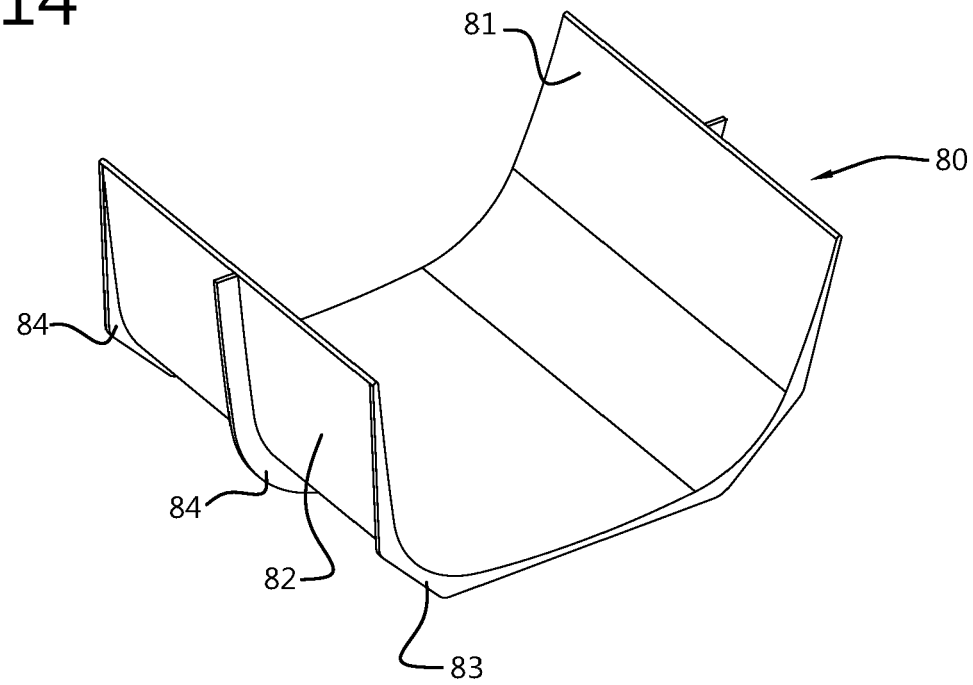
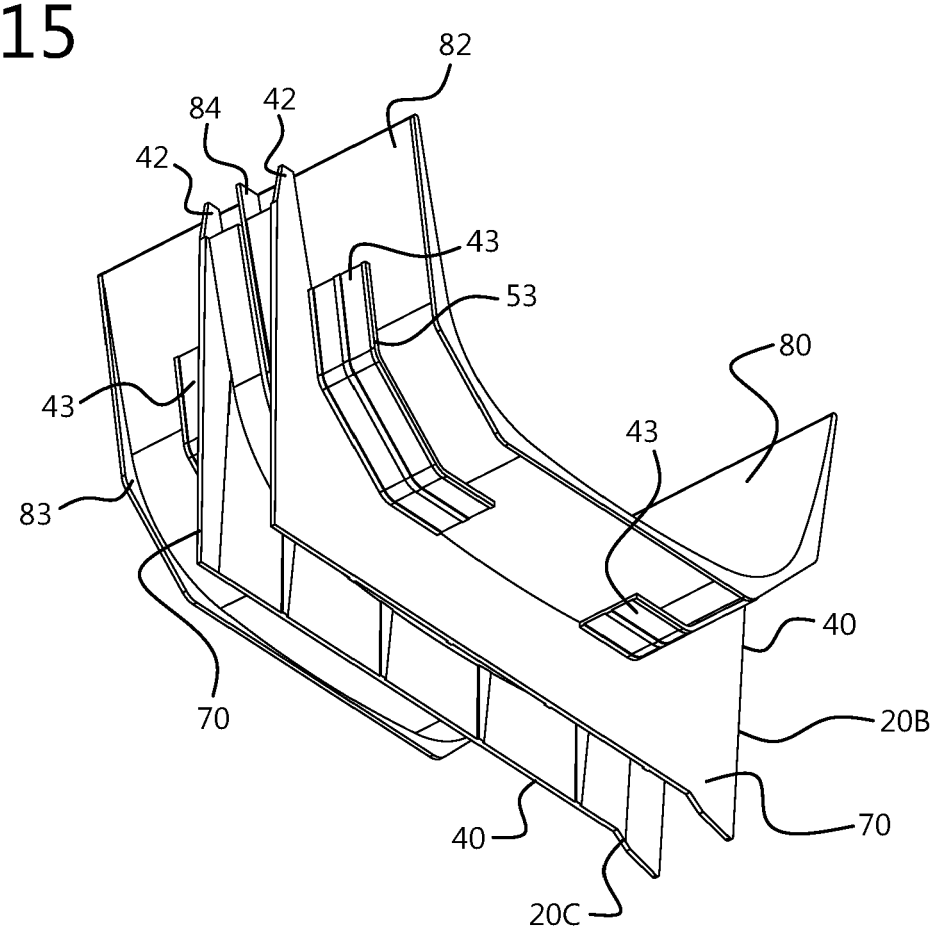


Fig. 15



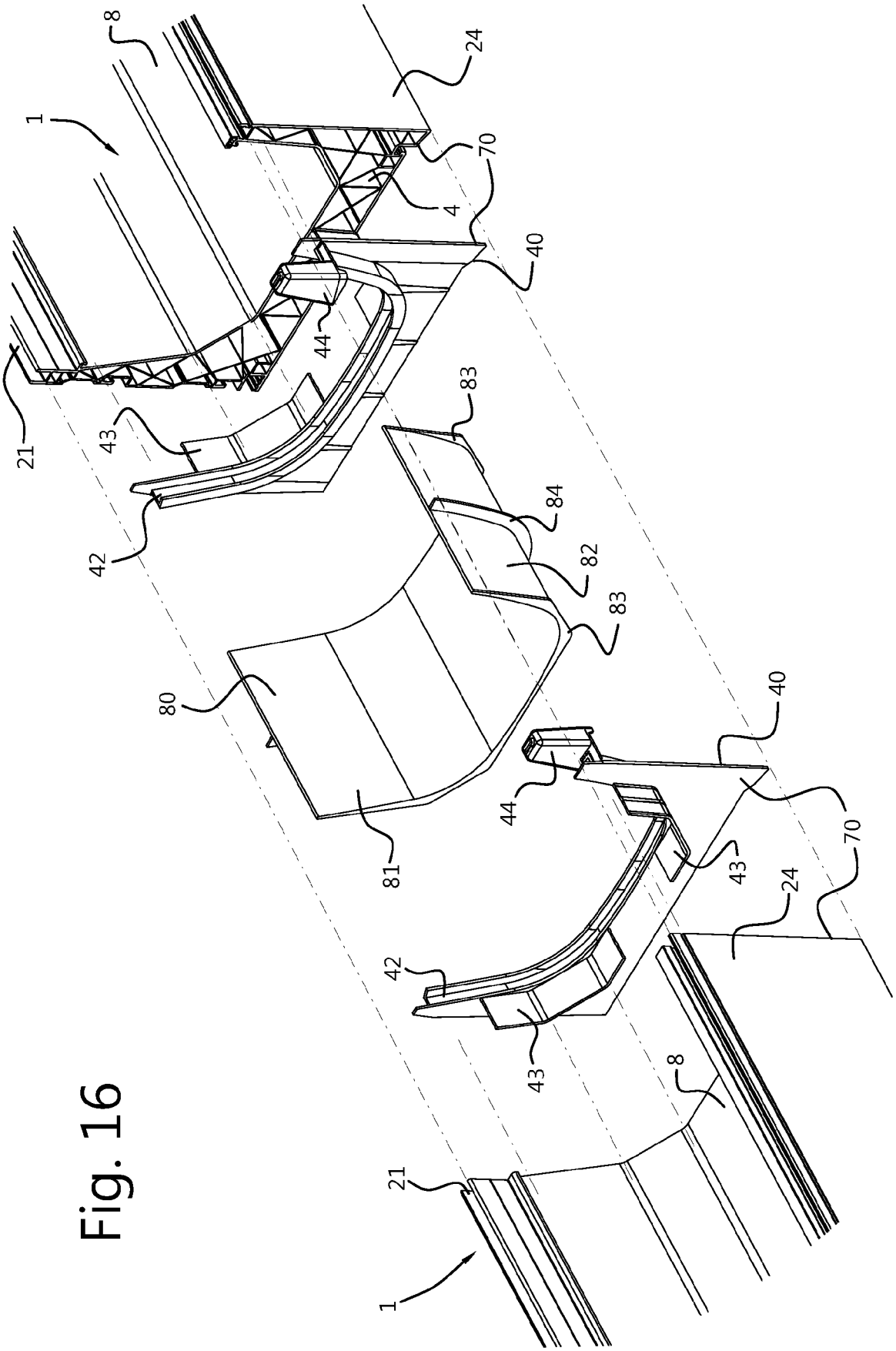


Fig. 16

REFERENCES CITED IN THE DESCRIPTION

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