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(54) **METAL CONNECTOR FOR CONNECTING WITH METAL PROFILE**

(57) The object of the invention is a metal connector, a system and a method for connecting the metal connector to a metal profile. The metal connector, the system and the method for connecting is used in the construction industry. It serves, e.g., to attach and/or seal the ends of metal profiles, to connect two or more metal profiles with the provision of tightness of the connection between the metal connector and the metal profile. A metal connector (2) for connecting to a metal profile (1), wherein the metal connector (2) has a body (11) comprising at least one wall (7) for connecting to the metal profile (1) and a cham-

ber (5) located in the body (11), the chamber having at least one hole (6) located in a wall of the chamber (5), wherein the hole (6) lies in the plane of the wall (7), characterised in that in the chamber (5), there is a previously-hardened elastic sealing material (3), wherein the previously- hardened elastic sealing material (3) protrudes from the chamber (5) through the hole (6), out of the body (11), thereby forming a sealing part (9), and the chamber (5) and the hole (6) have the shape allowing the sealing part (9) to be pressed into the chamber (6) through the hole (6).

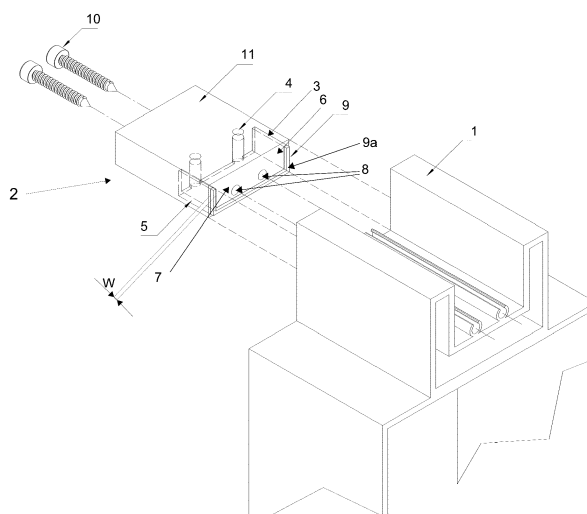


Fig. 1A

Description

[0001] The object of the invention is a metal connector for connecting to a metal profile.

The metal connector according to the invention is used in the construction industry. It serves, e.g., to attach and/or seal the ends of metal profiles, to connect two or more metal profiles with the provision of tightness of the connection between the metal connector and the metal profile. The metal profiles are, e.g., aluminium profiles, steel profiles constituting, for example, structures of windows, doors or curtain walls.

[0002] In the prior art, the metal connector connected to the metal profile is used, e.g., in stud mullion and transom curtain walls in which the metal connector is used as a transom connector, in sliding doors of metal profiles in which the metal connector is used as a mullion connector, in windows of metal profiles in which the metal connector is used as a window mullion connector, as a corner connector of a window jamb or as a connector of a window sash, in prefabricated curtain walls with a metal stud in which the metal connector is used as a corner connector. In all applications of the metal connector, it is required to provide a reliable, moisture-proof seal between the metal connector and the metal profile to ensure water and air tightness of the whole structure. This is a particularly important issue because these structures are usually exposed to atmospheric agents which are inextricably linked to the presence of rainwater. Further, structures containing the above elements are subject to stresses during operation, and hence also to thermal and structural deformations, which increases even more the risk of leakage of water or moisture penetration into the building.

[0003] The metal connectors known in the prior art require the assembler both to have additional structural elements and to perform additional operations during assembly in order to make such a connection to the metal profiles, that would meet the minimum tightness requirements.

[0004] For example, in the known methods of connecting the metal connector to the metal profile, in order to provide a moisture-proof seal, semi-liquid sealing compounds are used which are applied to the contact surface between the metal connector and the metal profile, at the stage of connecting together these elements, i.e. at the stage of assembly. An alternative known method of providing a seal is the introduction of a sealing compound through holes in the metal connector, which is known from patent specification EP0884426, and is also performed at the stage of assembling the metal connector and the metal profile. Ducts, formed in the metal connector, are connected to these holes. The sealing compound flows, through these ducts, to a duct outlet, located in the metal connector on the surface which contacts the metal profile. The sealing compound fills up the space formed between the metal connector and the metal profile, thereby forming a seal. The sealing compounds used in the

above-described techniques known from the prior art are semi-liquid sealing materials.

[0005] A disadvantage of known metal connectors and methods of providing a seal between the metal connector and the metal profile is the need to use semi-liquid sealing compounds during assembly, the need to thoroughly clean the surface of the connected parts, difficulties in the application at low and very high temperatures and the inability to effectively carry out the control of proper distribution of the sealing compound on the contact surface of the connected elements.

[0006] Disadvantages of the known methods of sealing metal connectors result directly from the structure of these connectors, which do not contain a sealing material, therefore, the application of the sealing material is carried out not sooner than during assembly. More specifically, in the solutions known from the prior art, the sealing compound is introduced at such a stage of assembly when the connector contacts the metal profile.

The sealing compound is introduced in the space formed between the connector and the profile, therefore it is not visible during its introduction. This prevents the control of the formed seal, and the quality of the connection depends largely on the assembler's skills. Consequently, the aim of the present invention is to provide a metal connector ready for assembly, providing tightness, and having reproducible, controlled sealing properties. The aim of the invention is also to provide a method of connecting a metal connector to a metal profile, which would provide a very good tightness of the connection.

[0007] According to the invention, a metal connector for connecting to a metal profile has been provided, wherein the metal connector has a body comprising at least one wall for connecting to the metal profile and a chamber located in the body, the chamber having at least one hole located in a chamber wall, wherein the hole lies in the plane of the wall, characterised in that in the chamber, there is a previously- hardened elastic sealing material, wherein the previously- hardened elastic sealing material, wherein the previously- hardened elastic sealing material protrudes further through the hole, out of the body, thereby forming a sealing part, and the chamber and the hole have the shape allowing the sealing part to be pressed into the chamber through the hole.

[0008] Preferably, the chamber, the hole and the sealing part have substantially the same cross-section in planes parallel to the wall.

[0009] Preferably, the metal connector comprises opening for insertion of fastening means.

[0010] Preferably, the metal connector comprises two chambers having holes located on the same wall.

[0011] The connector according to claim 1, characterised in that the metal connector comprises two walls for connecting to the metal profile and two chambers, wherein each of the chambers has a hole located on a different wall.

[0012] Preferably, the hardened elastic sealing material is an ethylene propylene diene monomer.

[0013] Preferably, the hardened elastic sealing material is a silicone.

[0014] Preferably, the hardened elastic sealing material is a vulcanised thermoplastic elastomer.

[0015] A connection system comprising a metal connector which has a body comprising at least one wall for connecting to a metal profile and a chamber located in the body, the chamber having at least one hole located in a chamber wall, wherein the hole lies in the plane of the wall, wherein in the chamber, there is a previously-hardened elastic sealing material, wherein the previously-hardened elastic sealing material further protrudes through the hole, out of the body, thereby forming a sealing part, and the chamber and the hole have the shape allowing the sealing part to be pressed into the chamber through the hole, the metal profile and fastening means for connecting the metal connector to the metal profile, wherein the metal profile comprises a front surface, and the sealing part comprises a front surface which has a shape corresponding to the shape of the front surface.

[0016] A method of connecting a metal connector to a metal profile, wherein the method includes:

- providing a metal profile comprising a front surface,
- providing a metal connector which has a body comprising at least one wall for connecting to the metal profile and a chamber located in the body, the chamber having at least one hole located in a chamber wall, wherein the hole lies in the plane of the wall, wherein in the chamber, there is a previously-hardened elastic sealing material, wherein the previously-hardened elastic sealing material further protrudes through the hole, out of the body, thereby forming a sealing part, and the chamber and the hole have the shape allowing the sealing part to be pressed into the chamber (6) through the hole,
- the sealing part comprises a front surface having a shape substantially corresponding to the shape of the front surface,
- placing the front surface in contact with the front surface,
- pressing the front surface against the front surface with a force causing the sealing part to retreat through the hole into the chamber,
- blocking the sealing part in the chamber in a position in which the sealing part is substantially entirely located in the chamber.

[0017] Preferably, the stage of introducing the sealing part into the chamber is carried out by pressing the metal connector against the metal profile by means of the fastening means.

[0018] Preferably, the stage of blocking the sealing part is carried out by connecting the metal connector to the metal profile by means of the fastening means which are bolts or screws.

[0019] Due to the structure of the metal connector ac-

cording to the invention, a tight connection between the connector and the profile is provided. Further, due to the fact that the sealing material is formed during the production of the metal connector, the stage of introducing the sealing material to the metal connector was eliminated from the process of assembling the structure. As a result, the assembler obtains the connector comprising the sealing material, thereby the risk of improper formation of the seal in the connector and between the connector and the metal profile is eliminated.

[0020] Further, thanks to specially formed elastic material protruding from the completed metal connector, which is visible to the assembler before starting the assembly, and is not visible at the moment of proper connection to the metal profile, the ability to control the quality of the connection of both elements is ensured.

[0021] The metal connector according to the invention has many advantages, namely:

- the metal connector with the elastic material contained is ready for assembly, without having to use sealing compounds,
- the need to clean the surface of the elements connected is eliminated,
- the need to control the proper distribution of the sealing material (elastic material) on the surface of the metal connector before connecting the elements is eliminated,
- thanks to the use of commonly-used vulcanised elastic materials in solid state instead of conventional semi-liquid sealing compounds, higher durability and resistance to ageing are provided, which has a significant effect on properties of the connection subjected to external factors (temperature changes, moisture changes, exposure to UV radiation, etc.).

[0022] The object of the invention is presented in embodiments in the drawing, in which:

Fig. 1A is a perspective view of the connector according to the invention with the metal profile before connecting these elements,

Fig. 1B is a perspective view of the connector according to the invention with the metal profile after connecting these elements,

Fig. 2A is a perspective view of the connector according to the invention with the metal profile before connecting these elements,

Fig. 3 is a perspective view of the connector according to the invention with the metal profile before connecting these elements,

Fig. 4A and Fig. 4B are perspective views of the connector according to the invention with the metal profile before connecting these elements in the applica-

tion of the metal connector as a transom connector of a stud curtain mullion and transom wall,

Fig. 5 is a perspective view of the connector according to the invention with the metal profile before connecting these elements in the application of the connector as a connector in a door mullion,

Fig. 6A and Fig. 6B are perspective views of the connector according to the invention with the metal profile before connecting these elements in the application of the connector as a connector of a window mullion,

Fig. 7 is a perspective view of the connector according to the invention with the metal profile before connecting these elements in the application of the connector as a corner connector of a prefabricated curtain wall,

Fig. 8 is a perspective view of the connector according to the invention with the metal profile before connecting these elements in the application of the connector as a corner connector of a window jamb frame or a window sash.

[0023] Fig. 1A shows a metal connector 2 according to the invention before connecting it to a metal profile 1. The metal connector 2 has a body 11 which substantially has the form of a solid matched with its shape to the solid of the metal profile 1 to which it is to be connected. Person skilled in the art will know how to choose a suitable shape of the external surface of the metal connector 2. Inside the metal connector 2, there is a chamber 5 filled with an elastic material 3. The chamber 5 is presented with a dashed line in all the figures. The chamber 5 is extended over at least a part of the metal connector 2. The chamber 5 comprises a hole 6 which is located in a wall of the chamber 5, from the side of a wall 7 of the metal connector, wherein the wall 7 is intended to be connected to the metal profile 1. The sealing material protrudes through the hole 6, outside the metal connector 2, beyond the surface of the wall 7, thereby forming a sealing part 9 having a thickness W. The shape of the hole 6 of the chamber 5 is substantially the same as the desired shape of the sealing part 9 in order to allow the material of the sealing part 9 do be retreated into the chamber 5 through the hole 6 at the moment of connecting the metal connector 2 to the metal profile 1. The sealing part 9 has a front surface 9a which, during assembly, comes into direct contact with the metal profile 1. The shape of the front surface 9a of the sealing part 9 corresponds to the shape of a front surface 12 of the metal profile 1, which is sealed (see Fig. 1B). Preferably, the shape of the front surface 9a of the sealing part 9 is the same as the shape of the front surface 12 of the metal profile 1. In the metal connector 2 according to the invention, the chamber 5 and the hole 6 have a shape allowing the material, sub-

jected to compression during assembly, of the sealing part 9 to be retreated through the hole into the chamber 5. In the metal connector 2, shown in Fig. 1A, the chamber 5, the hole 6 and the sealing part 9 are U-shaped in cross-section, in a plane parallel to the wall 7. This implies that the chamber 5 has preferably the form of a solid having a cross-section in a plane parallel to the plane of the wall 7, which is the cross-section of the hole 6 in the plane of the wall 7, wherein the chamber 5 has this shape at least in the part adjacent to the hole 6. Due to such a selection of the shape of the chamber 5, after connecting the metal connector 2 to the metal profile 1, the sealing material 3 located throughout the depth of the chamber 5 and protruding as the sealing part 9 is subject to compression and flexibly amortises the connection between the elastic connector 2 and the metal profile 1. Due to the fact that the sealing material 3 protrudes above the surface of the wall 7 in the form of the sealing part 9 during connection of the metal connector 2 to the metal profile 1, the compression of the elastic material 3 is achieved thanks to pressing the connected elements against each other, e.g. by means of screws 10, which ensures tight connection of the connected elements. The screws 10 are introduced, through openings 8 located in the metal connector 2, to bolt holes located in the metal profile 2. The pressing surface is the front surface 9a of the sealing part 9 which directly contacts the front surface 12 of the metal profile 1, but the compression of the elastic material takes place throughout the depth of the chamber 5, which is possible thanks to the formation of the chamber 5 in a manner allowing the sealing part 9 to be retreated into the chamber 5. The chamber 5 has such a depth that the sealing material 3 located in the chamber 5 and the sealing part 9, after being pressed are able to fit in the chamber 5. Depth of the chamber may assume any desired values, matched to the type of connection between the metal connector 2 and the metal profile 1. Typically, depth of the chamber 5 is greater than thickness W of the sealing part 9. For example, for the sealing part 9 made of EPDM (ethylene propylene diene monomer) having thickness W of 1 mm, depth of the chamber is preferably 2 - 3 mm.

[0024] During the production of the metal connector 2, the sealing material 3 is introduced into the chamber 5 through at least one duct having an inlet 4 located on any wall of the metal connector 2 with the exception of the wall 7. During the production of the metal connector 2, from the side of the hole 6, there is a matrix (not shown) which delimits the hole 6 with a forming surface of the matrix. Having filled the chamber 5 with the sealing material 3, a part of the sealing material 3 flows out through the hole 6. Due to the matrix, the sealing material 3 flows out of the hole 6 only in the amount which fills up the forming surface of the matrix. The forming surface of the matrix is a negative reflection of the shape of the sealing part 9 which is formed from the sealing material 3 at the outlet of the hole 6. In one method of producing the metal connector 2 according to the invention, the introduction of the elastic material 3 into the chamber 5 is carried out,

e.g., through high-pressure injection of the elastic material 3. Exemplary elastic materials are EPDM, silicone, vulcanised thermoplastic elastomers (TPV) and the like. The mentioned exemplary elastic materials are characterised by high durability and resistance to ageing, which makes the connection comprising the metal connector 2 according to the invention resistant to external factors, including temperature changes, moisture changes, exposure to UV radiation, etc.

[0025] A system of tight connection according to the invention is shown in Fig. 1B. The system comprises the metal connector 2 attached to the metal profile 1 by means of the fastening means 10, preferably bolt or screws, which provide pressing of the metal connector 2 against the metal profile 1. Person skilled in the art will be able to foresee other fastening means fulfilling the same function. In the embodiments shown in the figures, the fastening means are fastening bolts 10. In the metal connector 2, there are openings 8 for the fastening bolts 10. The fastening bolts 10 pass through the metal connector 2, enter longitudinal sockets (not shown) of the fastening bolts 10, located in the metal profile 1. Thereby, the metal connector 2 is connected to the metal profile 1. The bolted connection used herein provides pressing of the metal connector 2 against the surface of the metal profile 1. Having pressed the metal connector 2 against the metal profile 1 by means of the fastening bolts 10, the elastic material 3 constituting the sealing part 9 is substantially completely introduced into the chamber 5, thereby providing a tight connection between the metal connector 2 and the metal profile 1. Preferably, the system according to the invention may comprise the metal connector 2 connected to two or many metal profiles 1, as further described with reference to the following figures.

[0026] In the embodiment shown in Figs. 1A and 1B, the metal connector 2 has two inlets 4 through which the sealing material 3 was introduced into the chamber 5. It should be noted that the two inlets 4 in the metal connector constitute a preferred embodiment of the metal connector 2, wherein it is possible to make the connector having only one inlet 4. In particular, due to the fact that the metal connector 2, shown in Figs. 1A and 1B, has the chamber 5 the cross-section of which has a symmetrical low-complexity shape, it is possible to properly distribute the sealing material 3 through one inlet 4. In the case of the chambers 5, and thus the sealing parts 9 having more complex shapes, shown in particular in Fig. 3 and Figs. 5-12, it is usually preferable when the sealing material 3 is introduced into the metal connector 2 through at least two inlets 4. One skilled in the art will be able to design a number and positions of the inlets 4 on the walls of the metal connector 2.

[0027] Fig. 4A and Fig. 4B show a preferred embodiment of the metal connector 2 according to the invention, wherein the metal connector 2 is made as a transom connector of a stud mullion and transom curtain wall. In this embodiment, the sealing part 9 is U-shaped, whereas

the metal connector 2 was attached to the metal profile 1 by means of one screw 10, which is shown in Fig. 4B. The chamber 5 has a small depth as compared to the total length of the metal connector 2, in contrast to the embodiments shown in Figs. 1, 2, 3.

[0028] Fig. 5 shows another embodiment of the metal connector 2 according to the invention which is used as a metal connector in a door mullion. In this embodiment, the metal connector 2 according to the invention has two unconnected chambers 5, wherein each of the chambers 5 is filled with the sealing material 3. The chambers 5 and the sealing parts 9 have the same shape and are disposed opposite to each other. Further, the sealing parts 9 are located on the same wall 7 of the metal connector 2. Each of the chambers 5 of the metal connector 2 has one inlet 4 through which the sealing material 3 was introduced. The metal connector 2 has two bolt openings 8 for the introduction of the screws 10 in order to connect the metal connector 2 to the metal profile 1. It is possible to make the metal connector 2 according to the invention in which each of the chambers has a different depth and each of the seals has a different thickness. It is also possible to make the metal connector 2 according to the invention, which has more than two chambers and sealing parts 9.

[0029] Fig. 6A and Fig. 6B show the metal connector 2 used as a window mullion connector. In this embodiment, the metal connector 2 has one chamber 5 which has four inlets 4 through which the sealing material 3 was introduced therein. The metal connector 2 used as a mullion connector has one through hole intended for the introduction of the fastening means in the form of screws 10.

[0030] In another embodiment, the metal connector 2 according to the invention is a corner-type metal connector 2, used in a prefabricated curtain wall, which is shown in Fig. 7. In such a case, the metal connector 2 is intended to be connected to two metal profiles 1a, 1b disposed at a right angle relative to each other. The metal connector has two chambers 5, each of which is extended over the depth of the metal connector 2 relative to the adjacent walls 7 which are intended to be connected to the metal profile 1. The corner-type metal connector 2 has four openings 8 for the introduction of the fastening means 10 therein, for example screws 10, wherein the first pair of the screws 10 connects the metal connector 2 to the first metal profile 1a, and the second pair of the screws 10 connects the metal connector 2 to the second metal profile 1b.

[0031] Fig. 8 shows also the corner-type metal connector 2 except that it is used as a metal connector 2 of a window jamb frame or a window sash. Also in this embodiment, the metal connector 2 has two unconnected chambers 5 comprising the sealing material 3. The metal connector 2 shown in Fig. 8 is attached to each of the metal profiles 1a, 1b by means of two screws 10.

[0032] A method of connecting the metal connector 2 according to the invention to any metal profile 1 proceeds

as follows. The person making the connection, i.e. the assembler, is equipped with at least one ready metal connector 2 according to the invention and with at least one metal profile 1. At a subsequent stage, the assembler brings together the metal connector 2 and the metal profile 1 with their front surfaces 9a and 12 against each other. Preferably, bringing together the metal connector 2 and the metal profile 1 is carried out by introducing the fastening means 10, for example screws 10, into the corresponding openings 8 in the metal connector 2 and in the metal profile 1, however it is possible to carry out the bringing together by other means. With the use of appropriate tools for handling the fastening means 10, the assembler forces the fastening means 10 to generate a pressing force, which results in the front surfaces 9a and 12 further approaching each other. As the front surfaces 9a and 12 approach each other, the sealing material, which is preferably made of a material having a colour clearly visible to the assembler, is retreated to at least one chamber 5. At the moment when the fastening means 10 assume the position in which a further generation of the pressing force would result in detrimental deformation of the metal connector 2 or the metal profile 1, the sealing part is significantly compressed and substantially entirely hidden in at least one chamber 5. Substantially, the body 11 of the metal connector contacts the metal profile 1. Lack of any visible sealing part 9 is a sign for the assembler that the connection of both elements was performed correctly.

[0033] It should be noted that the above embodiments do not limit the scope of protection of the present invention and many modifications of the connector according to the invention are possible within the scope defined by the appended claims.

Claims

1. A metal connector (2) for connecting to a metal profile (1), wherein the metal connector (2) has a body (11) comprising at least one wall (7) for connecting to the metal profile (1) and a chamber (5) located in the body (11), the chamber having at least one hole (6) located in a wall of the chamber (5), wherein the hole (6) lies in the plane of the wall (7), **characterised in that** in the chamber (5), there is a previously-hardened elastic sealing material (3), wherein the previously-hardened elastic sealing material (3) protrudes from the chamber (5) through the hole (6), out of the body (11), thereby forming a sealing part (9), and the chamber (5) and the hole (6) have the shape allowing the sealing part (9) to be pressed into the chamber (6) through the hole (6).
2. The connector according to claim 1, **characterised in that** the chamber (5), the hole (6) and the sealing part (9) have substantially the same cross-section in planes parallel to the wall (5).
3. The connector according to claim 1, **characterised in that** the metal connector (2) comprises openings (8) for the introduction of fastening means.
4. The connector according to claim 1, **characterised in that** the metal connector (2) comprises two chambers (5) having holes (6) located on the same wall (5).
5. The connector according to claim 1, **characterised in that** the metal connector (2) comprises two walls (5) for connecting to the metal profile and two chambers (6), wherein each of the chambers (5) has a hole (6) is located on a different wall (5).
6. The connector according to claim 1, **characterised in that** the previously- hardened elastic sealing material is constituted by an ethylene propylene diene monomer.
7. The connector according to claim 1, **characterised in that** the previously- hardened elastic sealing material is constituted by a vulcanised thermoplastic elastomer.
8. The connector according to claim 1, **characterised in that** the previously- hardened elastic sealing material is constituted by a silicone.
9. A connection system comprising a metal connector (2) which has a body (11) comprising at least one wall (7) for connecting to a metal profile (1) and a chamber (5) located in the body (11), the chamber having at least one hole (6) located in a wall of the chamber (5), wherein the hole (6) lies in the plane of the wall (7), wherein in the chamber (5), there is a previously- hardened elastic sealing material (3), wherein the previously- hardened elastic sealing material (3) further protrudes through the hole (6), out of the body (11), thereby forming a sealing part (9), and the chamber (5) and the hole (6) have the shape allowing the sealing part (9) to be pressed into the chamber (5) through the hole (6), the metal profile (1) and fastening means (10) for connecting the metal connector (2) to the metal profile (1), wherein the metal profile (1) comprises a front surface (12), and the sealing part (9) comprises a front surface (9a) which has a shape corresponding to the shape of the front surface (12).
10. A method of connecting a metal connector (2) to a metal profile (2), wherein the method includes:
 - providing a metal profile (1) comprising a front surface (12),
 - providing a metal connector (2) which has a body (11) comprising at least one wall (7) for connecting to the metal profile (1) and a chamber (5) located in the body (11), the chamber

having at least one hole (6) located in a wall of the chamber (5), wherein the hole (6) lies in the plane of the wall (7), wherein in the chamber (5), there is a previously- hardened elastic sealing material (3), wherein the previously- hardened elastic sealing material (3) further protrudes through the hole (6), out of the body (11), thereby forming a sealing part (9), and the chamber (5) and the hole (6) have the shape allowing the sealing part (9) to be pressed into the chamber (5) through the hole (6), wherein the sealing part (9) has a front surface (9a) having a shape corresponding to the shape of the front surface (12),

- placing the front surface (9a) of the sealing part (9) in contact with the front surface (12) of the metal profile (1),
- pressing the front surface (9a) against the front surface (12) with a force causing the sealing part (9) to retreat through the hole (6) into the chamber (5),
- blocking the sealing part (9) in the chamber (5) in a position in which the sealing part (9) is substantially entirely located in the chamber (5).

11. The method according to claim 10, wherein the stage of introducing the sealing part (9) into the chamber (5) is carried out by pressing the metal connector (2) against the metal profile (1) by means of fastening means (10).

12. The method according to claim 10, wherein the stage of blocking the sealing part (9) in the chamber (5) is carried out by connecting the metal connector (2) to the metal profile (1) by means of the fastening means (10) which are bolts or screws.

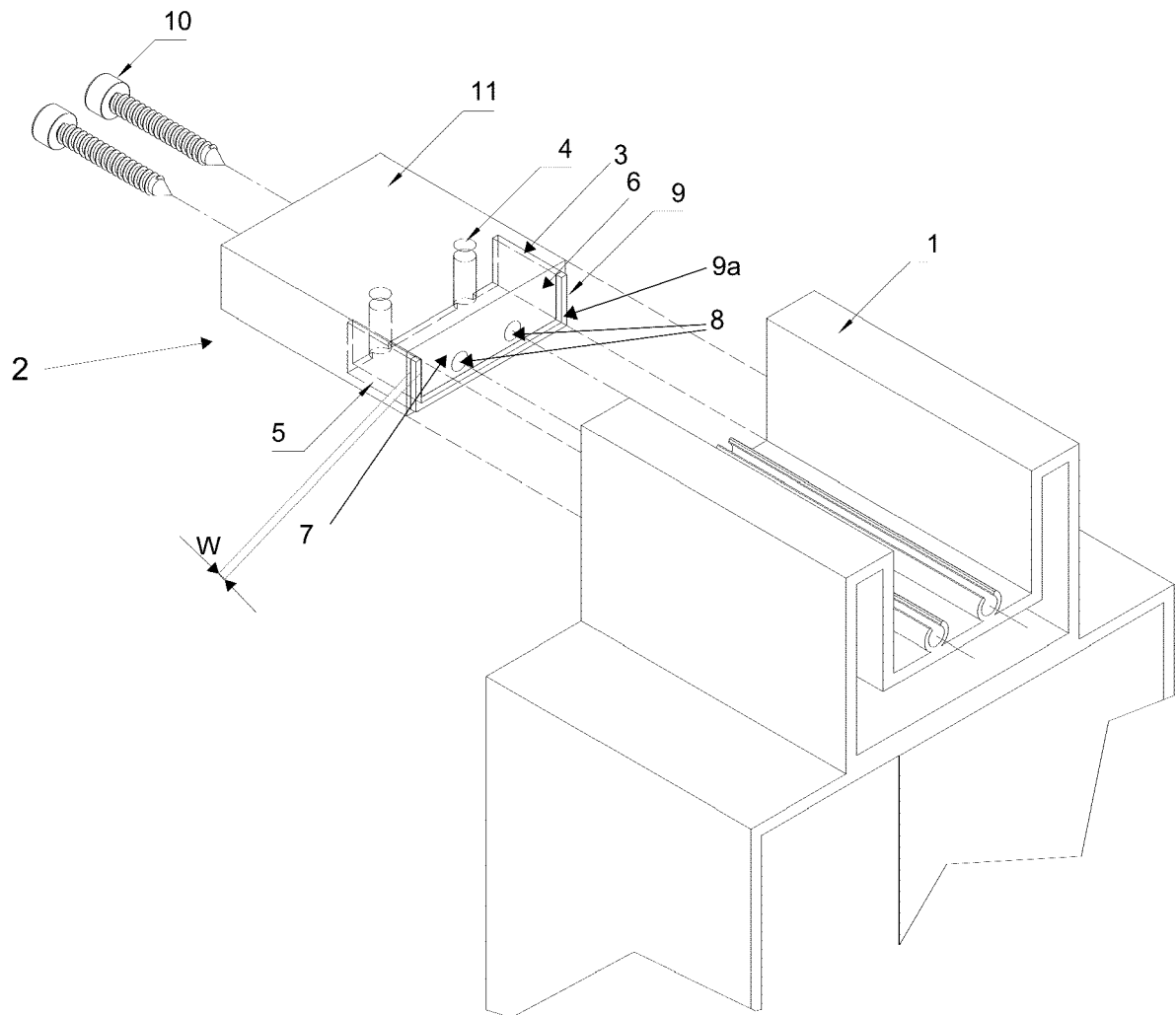


Fig. 1A

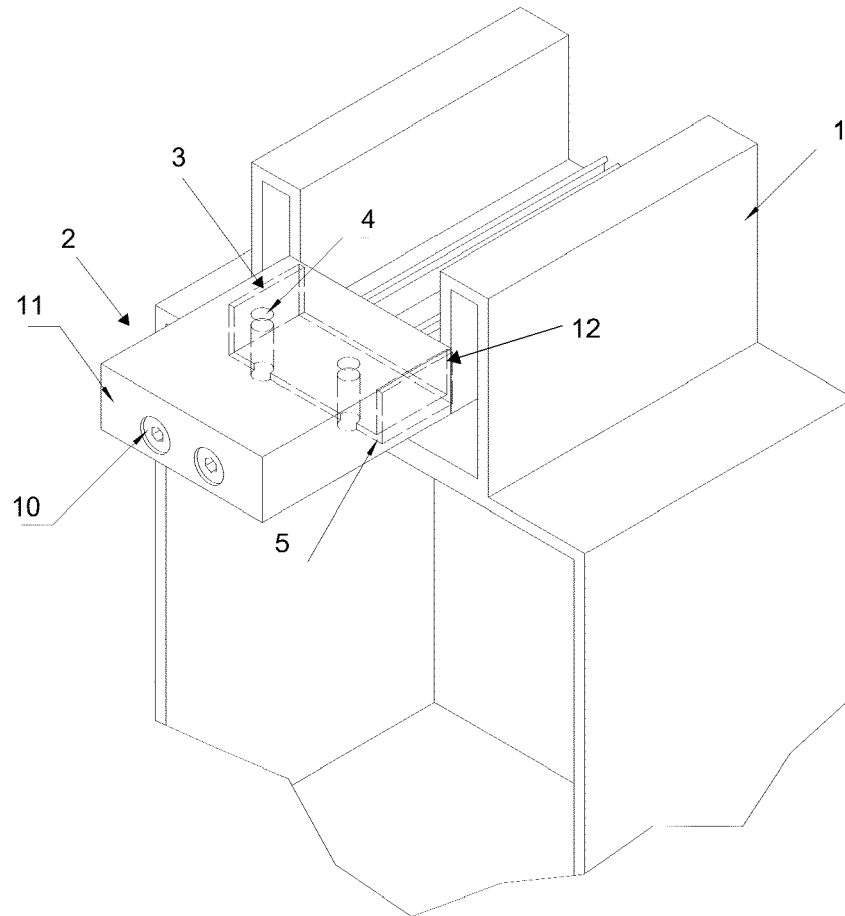


Fig. 1B

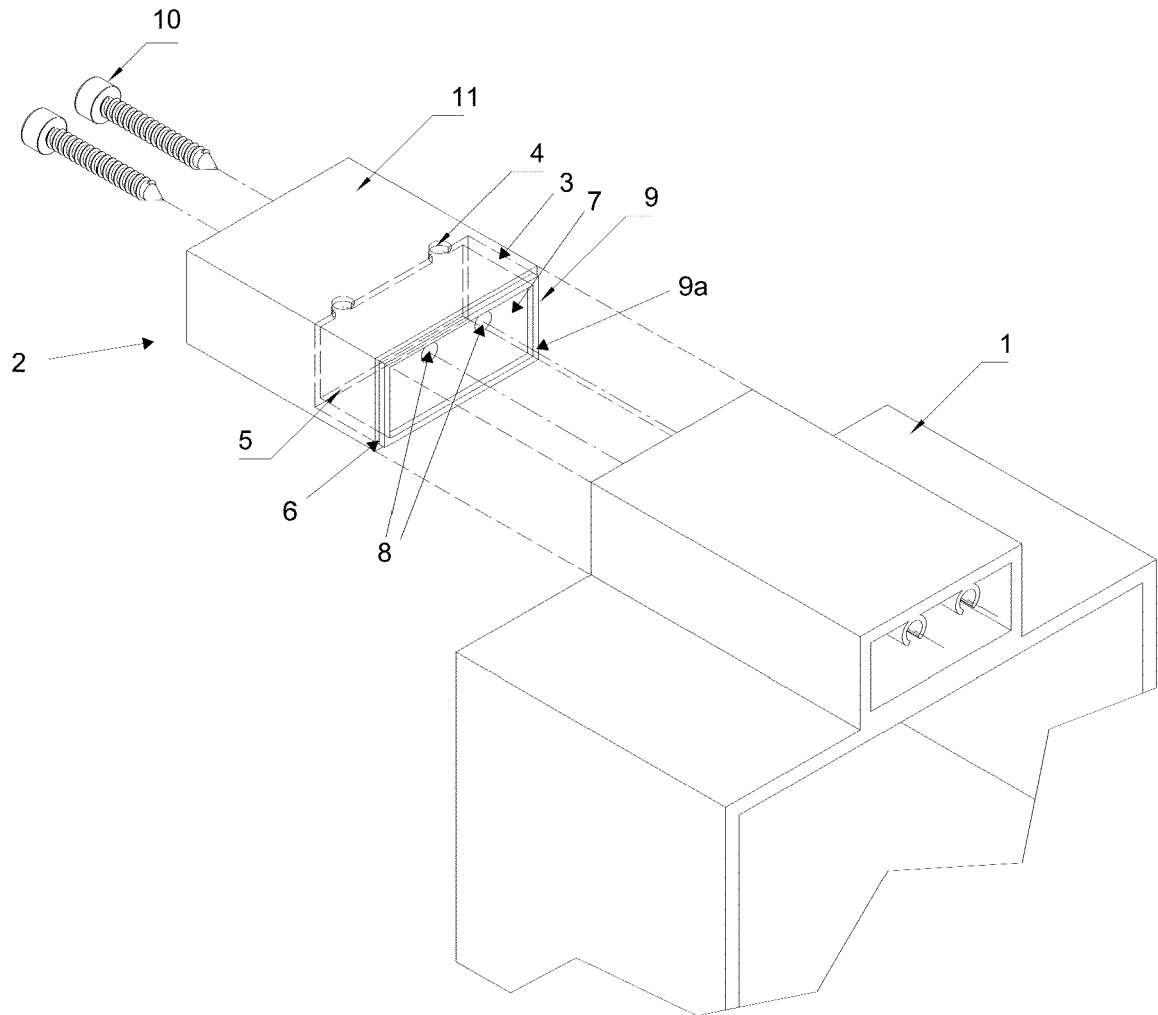


Fig. 2

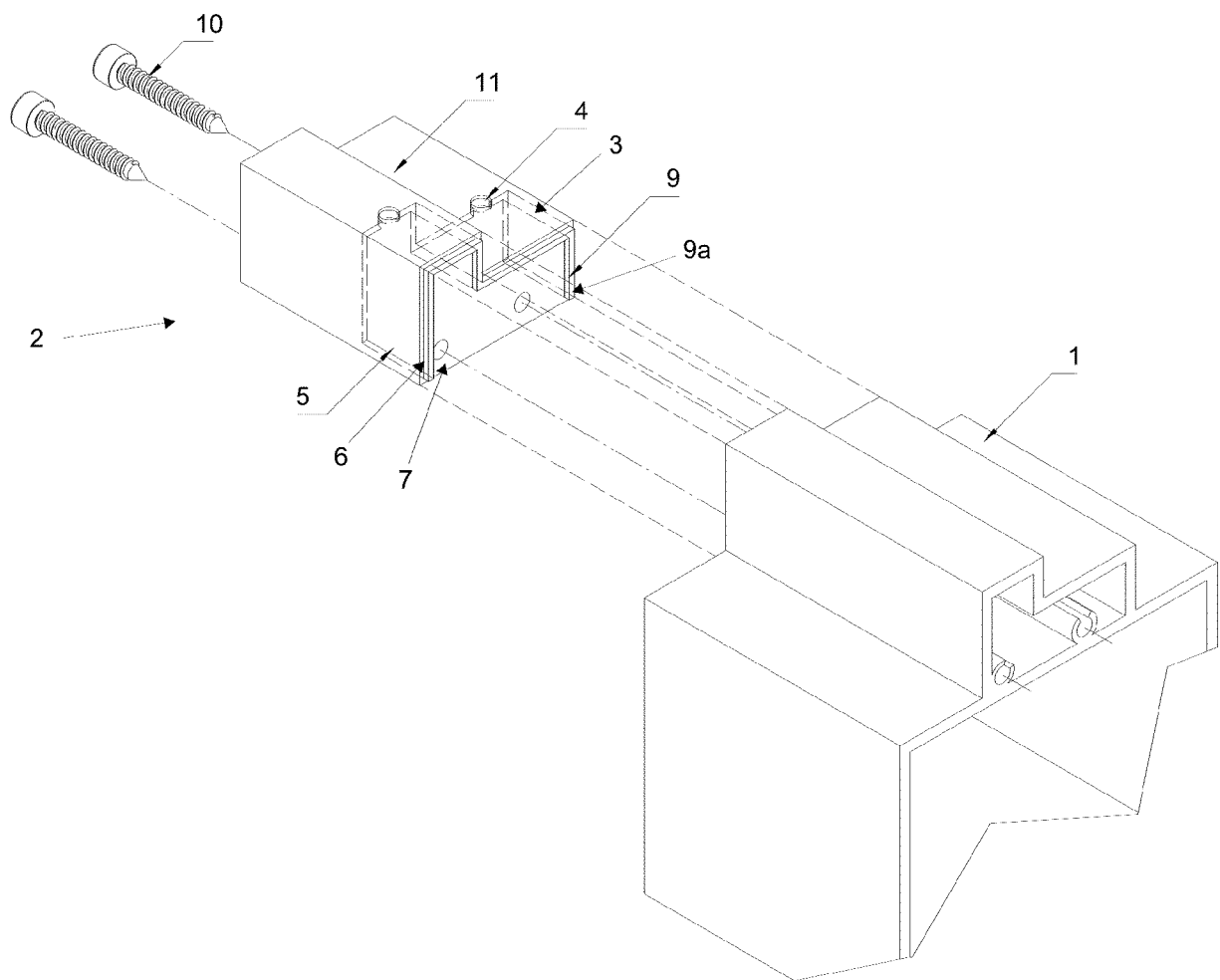


Fig.3

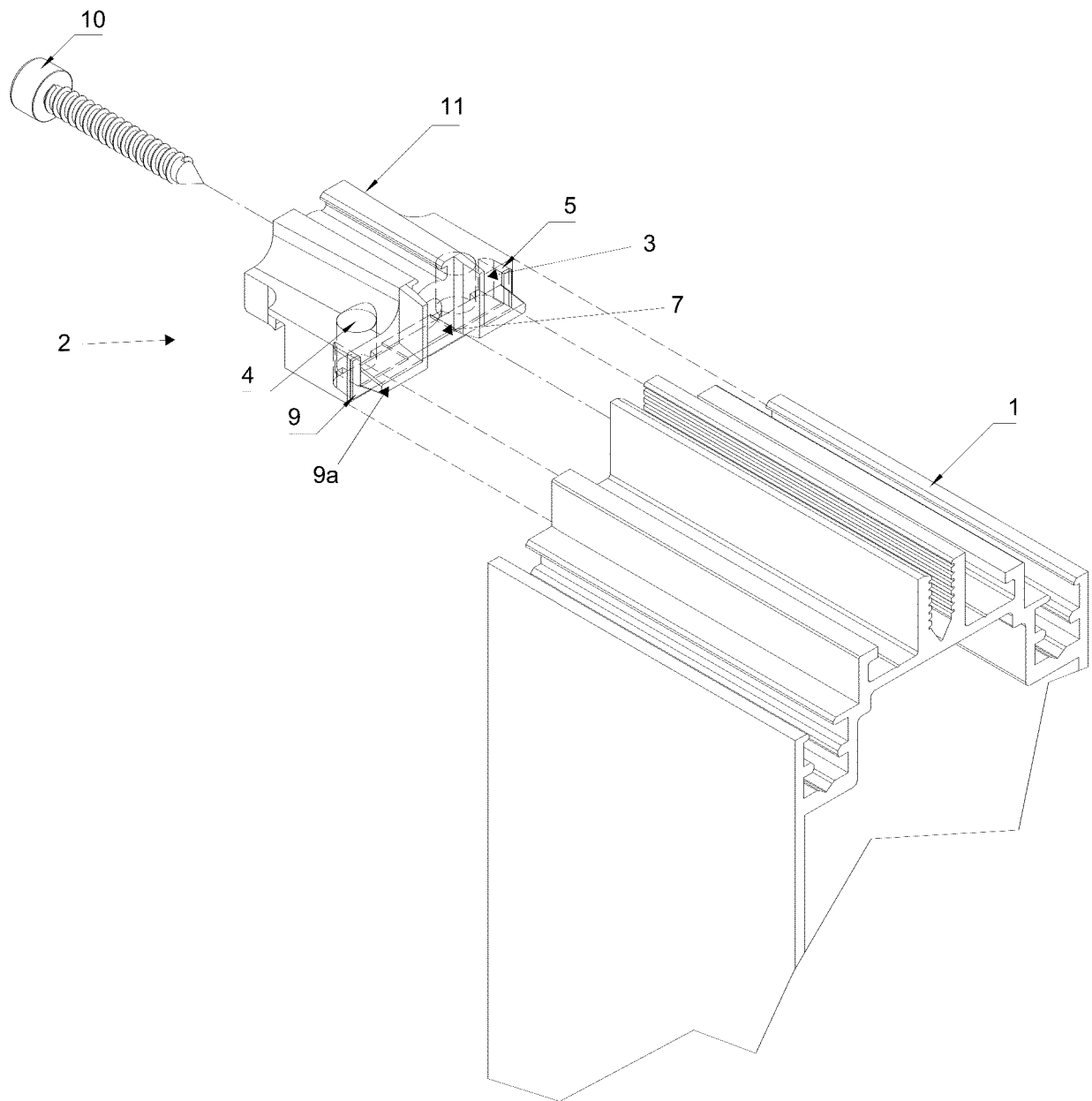


Fig. 4A

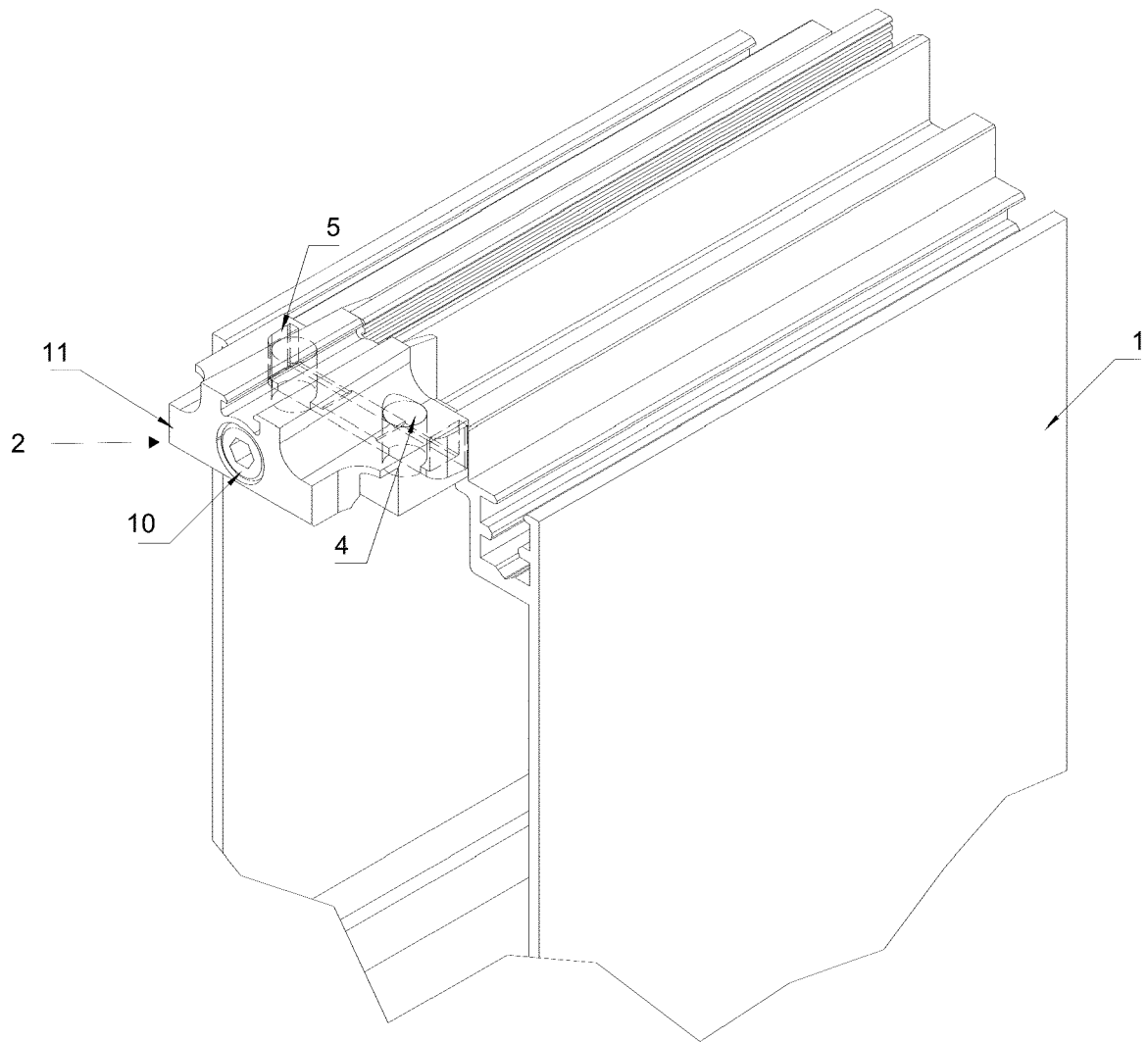


Fig. 4B

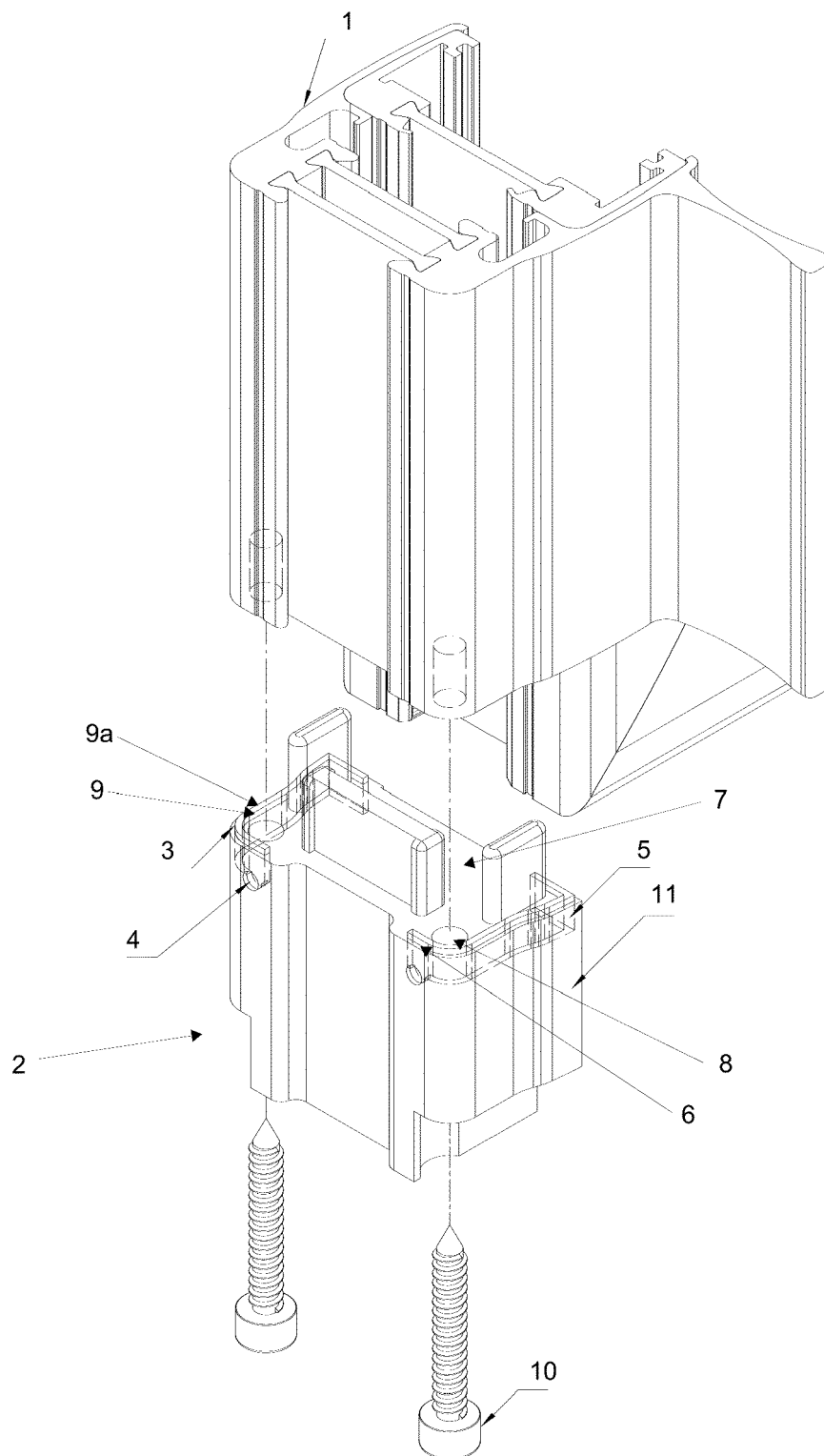


Fig. 5

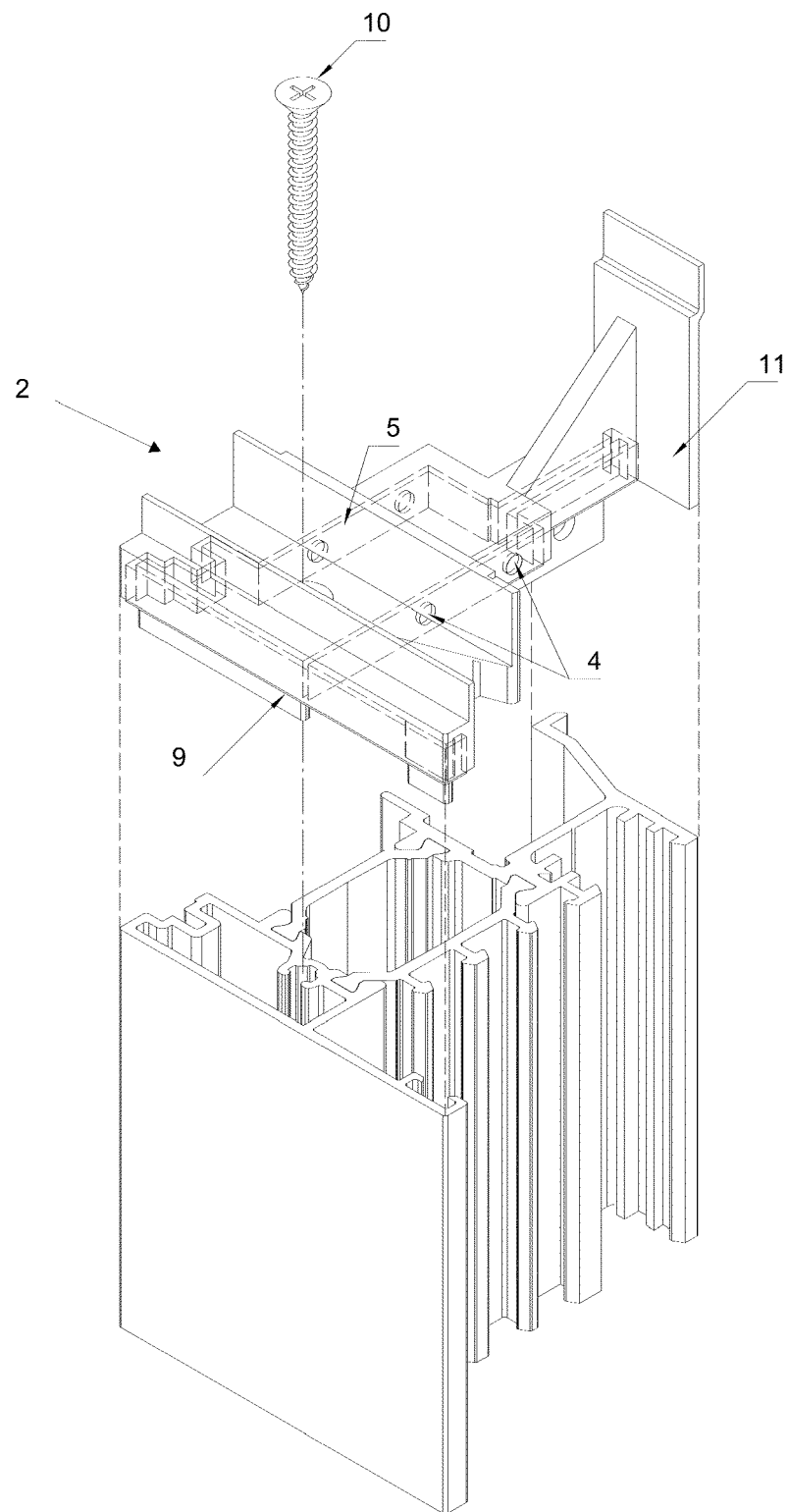


Fig. 6A

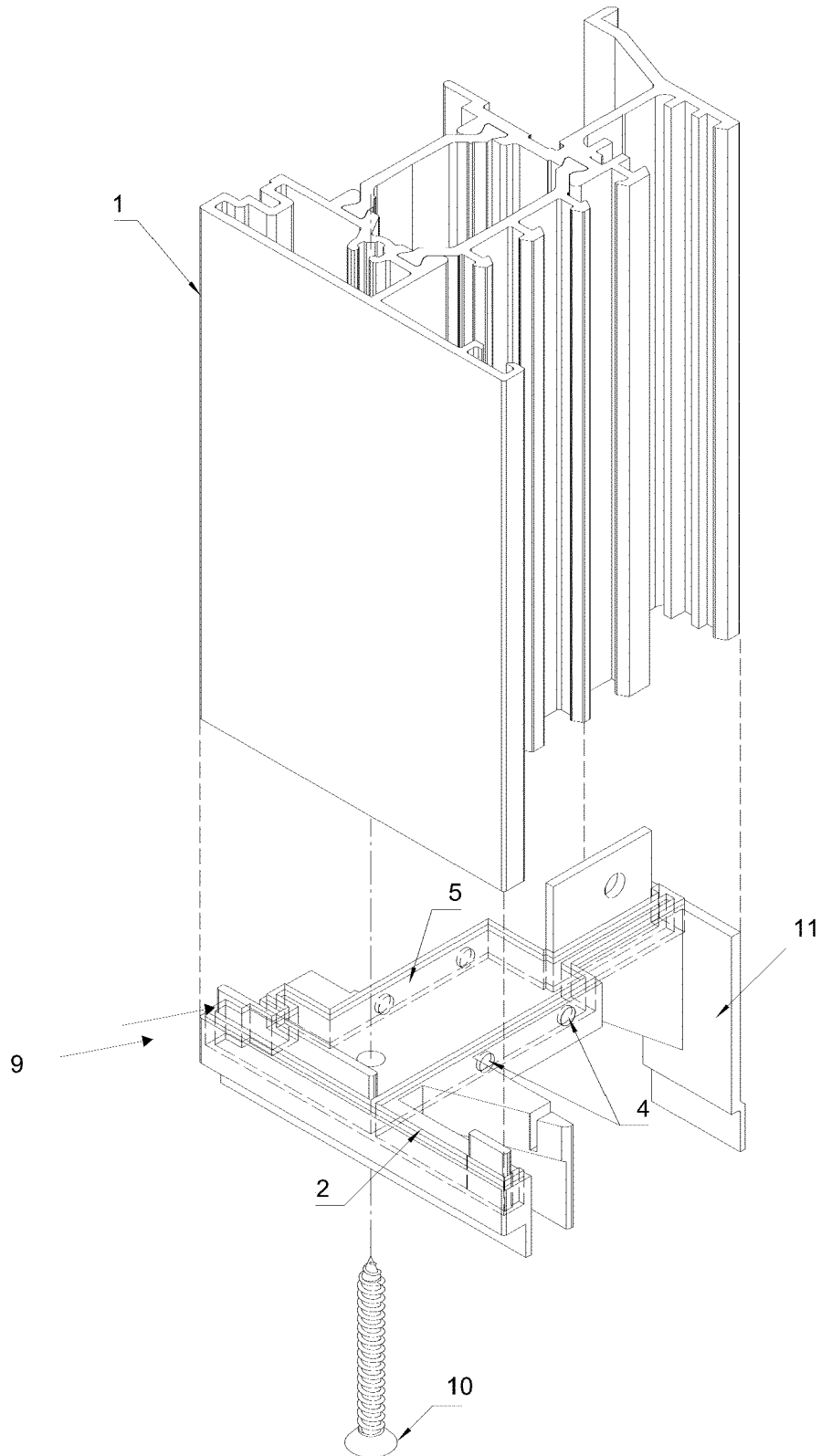


Fig. 6B

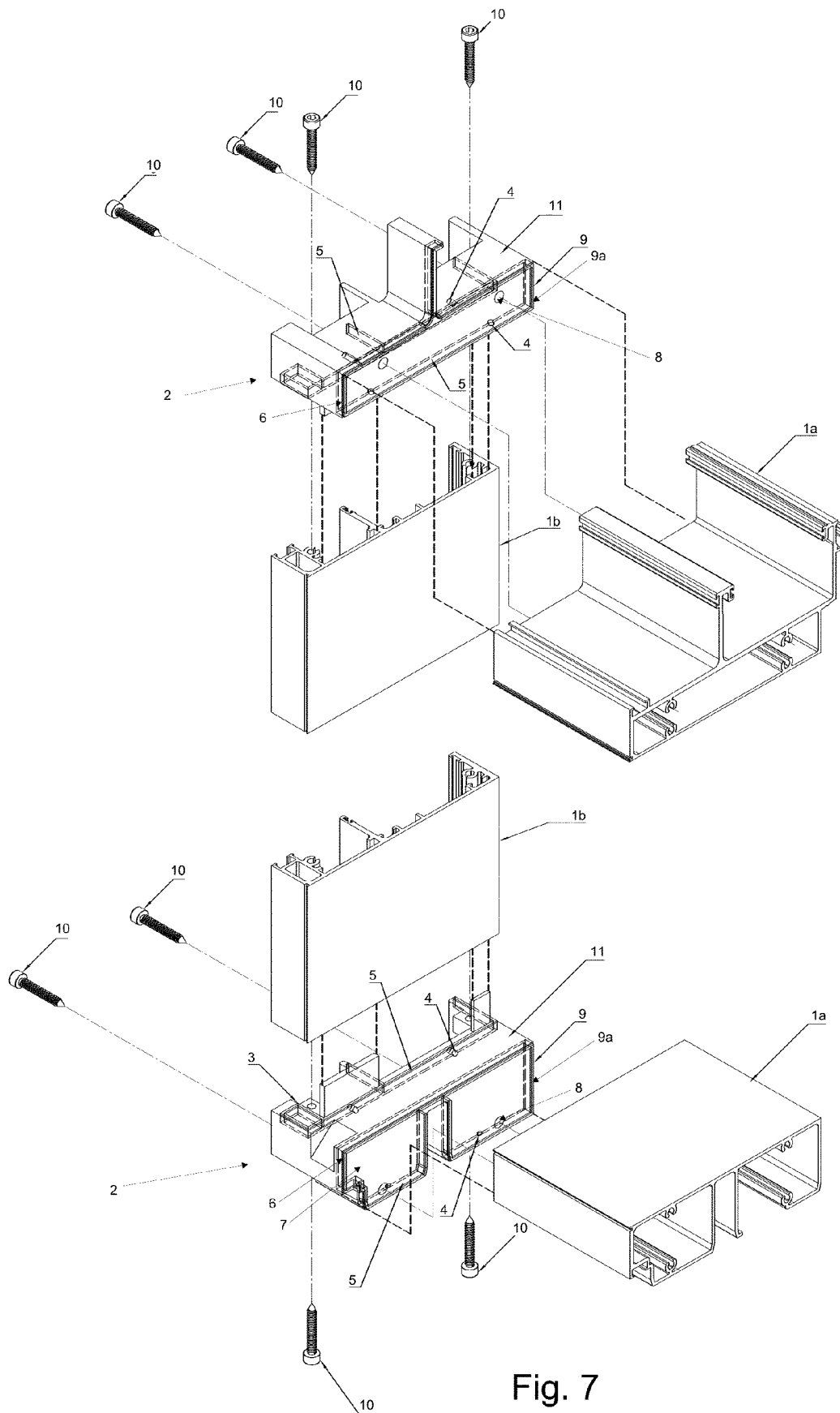


Fig. 7

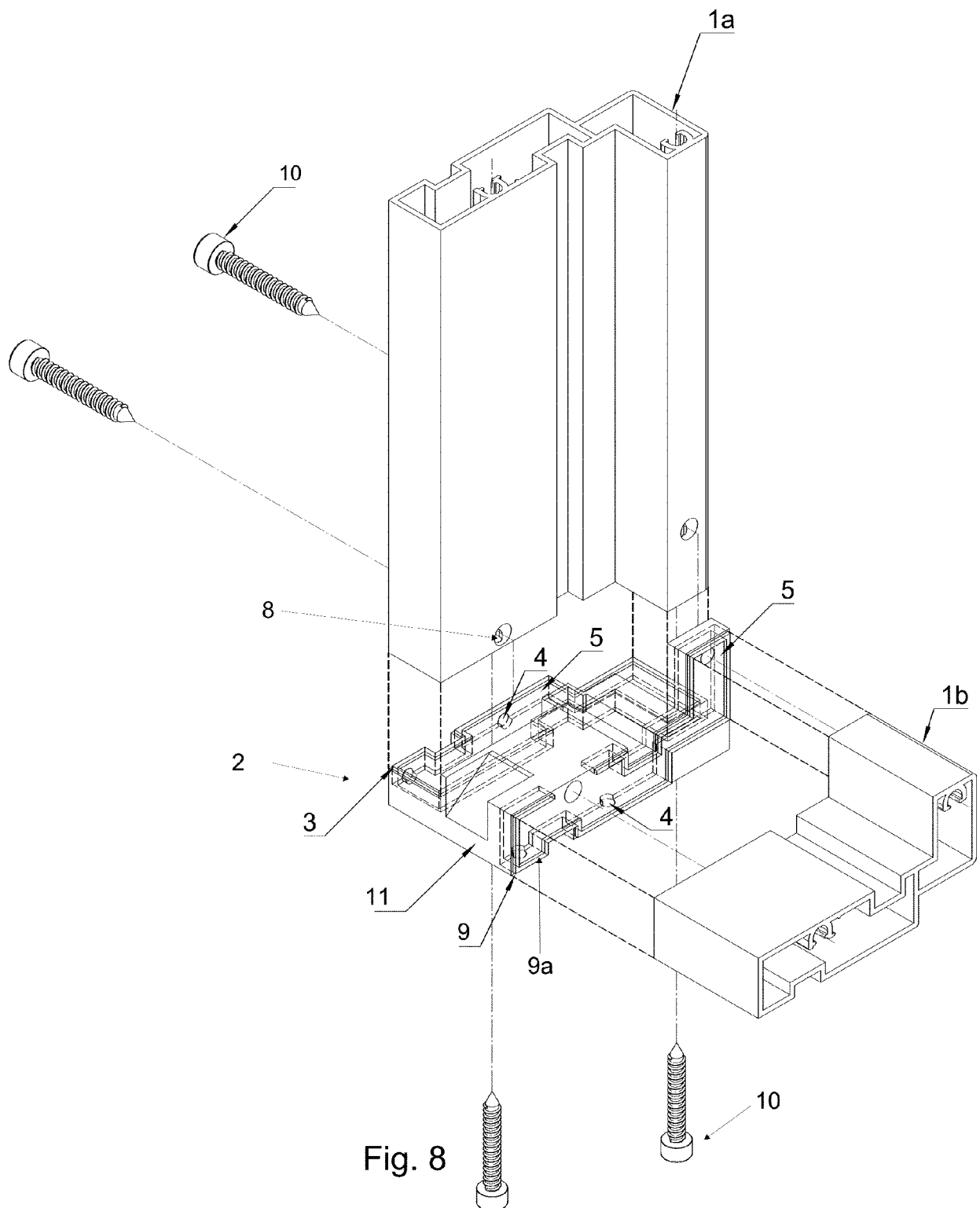


Fig. 8



EUROPEAN SEARCH REPORT

Application Number
EP 15 46 1573

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 22 April 2016	Examiner Galanti, Flavio
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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