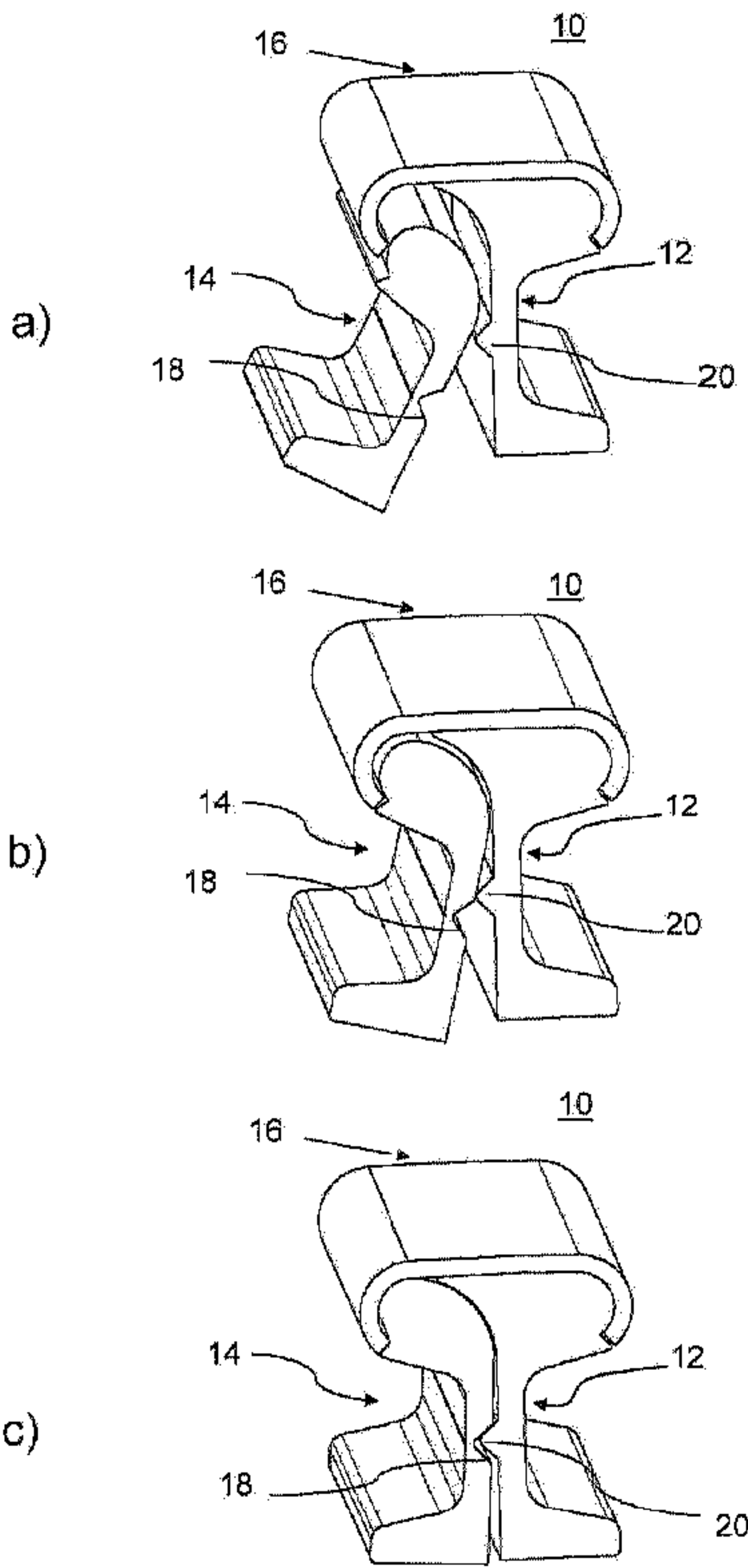




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(54) Titre : BARRE CONDUCTRICE, PROCEDE DE MONTAGE ET DE DEMONTAGE AINSI QUE SYSTEME DE BARRES CONDUCTRICES ASSEMBLEES
(54) Title: POWER RAIL, MOUNTING AND DISMOUNTING METHOD AND ARRANGEMENT COMPOSED OF COMBINED POWER RAILS



(57) **Abrégé/Abstract:**
The invention relates to a power rail (10) for movable power consumers, in particular for electrically driven vehicles, preferably rail vehicles, having a carrier profile which comprises a first carrier profile element (12) and a second carrier profile element (14) which

(57) Abrégé(suite)/Abstract(continued):

are coupled to one another along a surface (13a, 13b) which is partially curved, and a head profile (16) which has a first lateral section (16a) and a second lateral section (16b) lying opposite, and which is connected in a positively engaging and/or frictionally engaging fashion to the first carrier profile element (12) and to the second carrier profile element (14), wherein an end of the surface (13a, 13b) which faces the head profile (16) is arranged closer to the second lateral section (16b) than to the first lateral section (16a). The power rail according to the invention is characterized in that the two carrier profile elements (12, 14) are coupled to one another in a positively locking fashion and/or frictionally locking fashion along the surface (13a, 13b) by means of the head profile part (16). Furthermore, the invention relates to a corresponding method for mounting or dismounting a power rail (10) and to a system composed of multiple axially combined power rails.

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(54) Title: POWER RAIL, MOUNTING AND DISMOUNTING METHOD AND ARRANGEMENT COMPOSED OF COMBINED POWER RAILS

(54) Bezeichnung : STROMSCHIENE, MONTAGE- UND DEMONTAGEVERFAHREN SOWIE ANORDNUNG AUS ZUSAMMENGESETZTEN STROMSCHIENEN

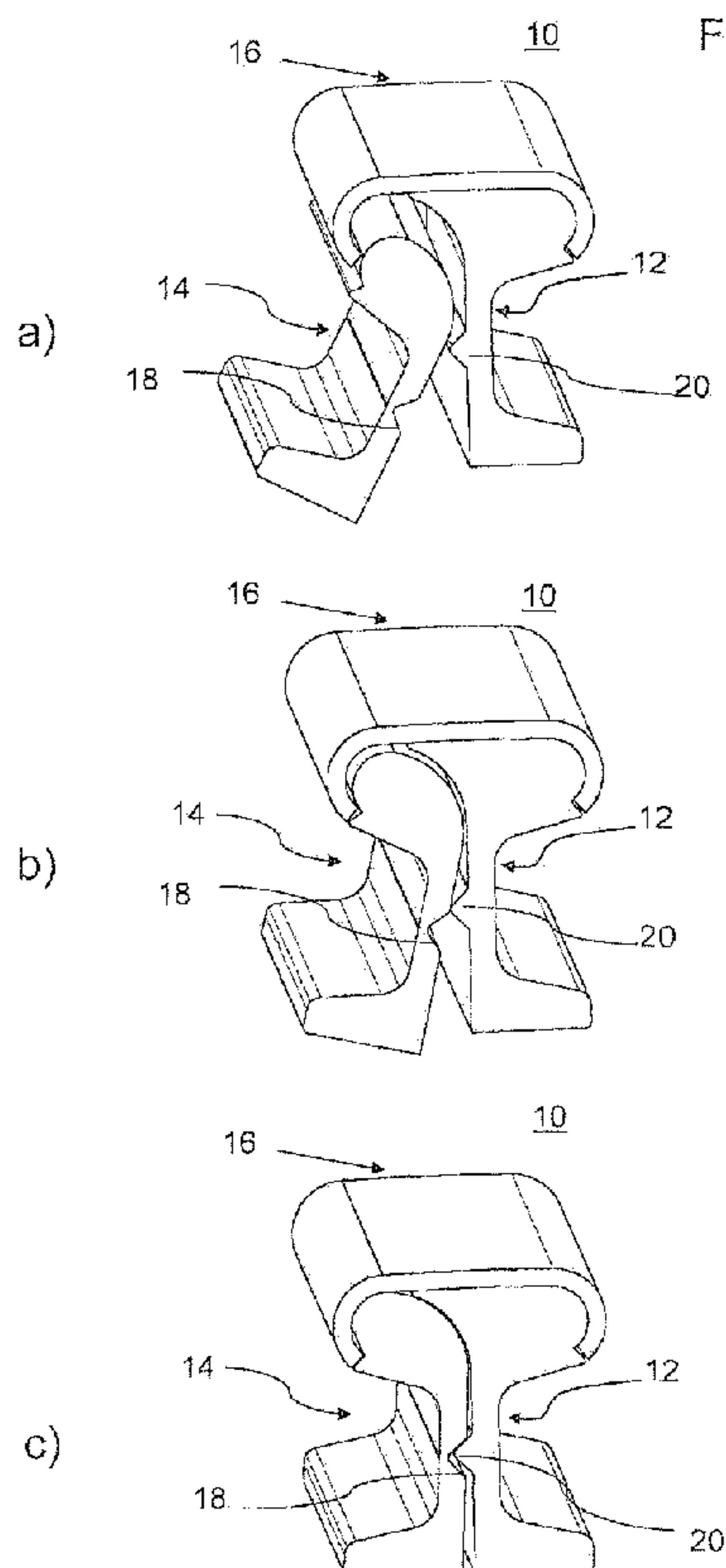


Fig. 3

(57) Abstract: The invention relates to a power rail (10) for movable power consumers, in particular for electrically driven vehicles, preferably rail vehicles, having a carrier profile which comprises a first carrier profile element (12) and a second carrier profile element (14) which are coupled to one another along a surface (13a, 13b) which is partially curved, and a head profile (16) which has a first lateral section (16a) and a second lateral section (16b) lying opposite, and which is connected in a positively engaging and/or frictionally engaging fashion to the first carrier profile element (12) and to the second carrier profile element (14), wherein an end of the surface (13a, 13b) which faces the head profile (16) is arranged closer to the second lateral section (16b) than to the first lateral section (16a). The power rail according to the invention is characterized in that the two carrier profile elements (12, 14) are coupled to one another in a positively locking fashion and/or frictionally locking fashion along the surface (13a, 13b) by means of the head profile part (16). Furthermore, the invention relates to a corresponding method for mounting or dismounting a power rail (10) and to a system composed of multiple axially combined power rails.

(57) Zusammenfassung:

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Die Erfindung betrifft eine Stromschiene (10) für bewegliche Stromverbraucher, insbesondere für elektrisch getriebene Fahrzeuge, vorzugsweise Schienenfahrzeuge, mit einem Trägerprofil, das ein erstes Trägerprofilelement (12) und ein zweites Trägerprofilelement (14) umfasst, die entlang einer abschnittsweise gekrümmten Fläche (13a, 13b) miteinander gekoppelt sind, und einem Kopfprofil (16), das einen ersten seitlichen Abschnitt (16a) und einen gegenüberliegenden zweiten seitlichen Abschnitt (16b) aufweist und das mit dem ersten Trägerprofilelement (12) und dem zweiten Trägerprofilelement (14) formschlüssig und/oder kraftschlüssig verbunden ist, wobei ein dem Kopfprofil (16) zugewandtes Ende der Fläche (13a, 13b) näher dem zweiten seitlichen Abschnitt (16b) als dem ersten seitlichen Abschnitt (16a) angeordnet ist. Die erfindungsgemäße Stromschiene ist dadurch gekennzeichnet, dass die beiden Trägerprofilelemente (12, 14) durch das Kopfprofilteil (16) entlang der Fläche (13a, 13b) formschlüssig und/oder kraftschlüssig miteinander gekoppelt sind. (16). Weiterhin bezieht sich die Erfindung auf ein entsprechendes Verfahren zur Montage oder Demontage einer Stromschiene (10) sowie auf ein System aus einer Vielzahl von axial zusammengesetzten Stromschienen.

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**Power Rail, Mounting and Dismounting Method and Arrangement
Composed of Combined Power Rails**

The invention relates to a power rail for moveable power consumers, in particular for electrically driven vehicles, preferably rail vehicles, having a carrier profile which comprises two carrier profile elements and a head profile which has two lateral sections lying opposite one another and which is connected in a positively locking and/or frictionally locking fashion to the carrier profile.

Moreover, the invention relates to a system composed of multiple axially combined power rails and to a method for mounting and dismounting a power rail.

Generally, generic power rails known from the prior art serve as the supply line for electrical current in order to be able to make current available, for example, to moveable power consumers such as electrically driven rail vehicles (urban and underground trains, monorails etc.). Likewise, these known power rails are also used, however, in connection with other moveable power consumers known from the prior art (e.g. rail-conveyed power consumers used in industrial halls).

In connection with electrically driven rail vehicles, such as for example urban and underground trains, monorails etc., the generic power rails are provided and mounted at different locations as required. For example, power rails are often mounted running to the side of the running rails of electrically driven rail vehicles next to the running rails.

In differently configured cases these power rails can, however, also run over the running rails. Such cases occur, for example, in industrial halls or in tunnels.

Generally, current is delivered by the power rail to the electrically driven rail vehicle via current collectors looped on the power rail. In the case, for example of underground and urban railways, these looped current collectors are made as current collector brackets or contact shoes with power

rails arranged to the side next to the track. These current collector brackets or contact shoes are generally guided looped over, to the side of or below the power rail, such contact shoes often being added on to the side of the bogies of the underground and urban railways. In these systems the current is preferably returned via the wheels and the running rails.

In connection with electrically driven rail vehicles these power rails are often referred to as so-called "third rails" and are designed exclusively for delivering current and not for absorbing the weight of rail vehicles.

In order to counter excessive wear of the power rail caused by power tapping by means of the current collector described above, generic power rails comprise, in addition to a carrier profile that can be produced for example from an electrically conductive light metal material, a holding profile connected electrically conductively to the carrier profile which is preferably made as a head profile strip and in comparison to the carrier profile is produced from a more wear-resistant material. Correspondingly, excessive wear of the power rail is reduced by the current being collected by the current collector bracket or the contact shoes of the rail vehicle on the more wear-resistant holding profile or head profile strip, while the carrier profile only serves to convey current.

An example of a generic power rail is shown in publication DE 10 2005 004 547 A1.

The power rail described in this publication is made as a composite profile that has a carrier profile extruded from a light metal material and a profile strip spanning the head surface of the carrier profile and made of a harder metal in order to reduce wear of the power rail due to power tapping. In order to fasten the profile strip to the carrier profile, the profile strip is welded with an insertion rod which in turn engages in a slot formed in the carrier profile.

It is therefore a disadvantage of the power rail known from DE 10 2005 004 547 A1 that it is extremely laborious to fit. In particular, the profile strip must always be welded with the insertion rod so as to thus fasten the profile strip to the carrier profile. The dismounting of this power rail is therefore also associated with a large amount of effort.

Furthermore, it is a disadvantage of this power rail that when connecting or coupling a number of these power rails in their axial or longitudinal direction, corresponding connection flanges must always be provided in order to be able to connect adjacent or adjoining power rails to one another. This is brought about, for example, by the respective carrier profiles and profile strips being cut away at the corresponding points and then being screwed together, or by further electrically conductive profile elements being screwed onto lateral surfaces of the carrier profiles of different power rails, in particular at their ends.

A power rail is known from publication DE 2 219 252 A1 which has a two-part carrier profile made of aluminium and a head profile produced from wear-resistant steel. The two carrier profiles are braced together in a frictionally locking fashion against the C-shaped head profile by means of screws or wedges.

Described in publication DE 2 147 956 A1 is a further conventional power rail the structure of which is similar to that of the power rail known from publication DE 2 219 252 A1. Here too the two carrier profiles are braced against one another by means of a screw connection.

The object underlying the invention is to further develop the generic power rails and mounting and dismounting methods of such power rails such that the aforementioned disadvantages are at least partially overcome. In particular, the invention is supposed to simplify the mounting and dismounting of these power rails and significantly facilitate the axial connection of these power rails. Furthermore, by means of the invention at least some laborious mounting and dismounting steps generally required by the generic power rails should be avoided, and at the same time the flexibility of these power rails should be increased as regards their mounting/dismounting.

This object is achieved by the features of the independent claims.

Advantageous configurations and further developments of the invention emerge from the dependent claims.

The power rail according to the invention for moveable power consumers, in particular for electrically driven vehicles, preferably rail vehicles, comprises a carrier profile which comprises a first carrier profile element and a second carrier profile element which are coupled to one

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another along a surface which is partially curved, and a head profile which has a first lateral section and a second lateral section lying opposite, and which is connected in a positively locking and/or frictionally locking fashion to the first carrier profile element and to the second carrier profile element, wherein an end of the surface which faces the head profile is arranged closer to the second lateral section than to the first lateral section. The power rail according to the invention is characterised in that the two carrier profile elements are coupled to one another in a positively locking and/or frictionally locking fashion along the surface by means of the head profile.

The power rail according to the invention is accordingly formed by a composite power rail which comprises a multi-part carrier profile preferably produced from a well electrically conductive light metal, formed by the respective carrier profile elements, and a head profile. Here the head profile is connected electrically to the latter, in particular on a head surface of the carrier profile, and engages around the same in a positively locking and/or frictionally locking fashion. Preferably, the carrier profile is made in two parts. Likewise, embodiments of the carrier profile with more than two parts are conceivable however. On the basis of this multi-part embodiment of the carrier profile the latter can be produced with better technological properties from a mechanical and electrical point of view and more cost-effectively.

The carrier profile elements are preferably inserted individually or separately and one after the other into the head profile, by means of the corresponding configuration of the carrier profile elements the first carrier profile elements being inserted first of all into the holding profile, and the second carrier profile element, guided by the first carrier profile element, establishing the positively and frictionally locking connection between the carrier profile and the head profile by means of a "screwing in" motion. In other words, a change to the position of the carrier profile elements leads to a change to the geometry, in particular the width, of a head section of the carrier profile behind which or around which the head profile engages. In this way the positively and/or frictionally locking connection between the carrier profile and the head profile can be established or eliminated depending on the position of the carrier profile elements in relation to one another. In particular, the position of the carrier profile elements in relation to one another

designates a position in which the carrier profile elements face one another at least partially along the direction of their longitudinal extension.

Within the framework of this disclosure the positively locking connection is to be understood to mean a connection in which one of the connection partners effectively stands in the way of another. Thus, in a corresponding position in relation to one another the carrier profile elements inserted into the head profile establish the positively locking connection to the holding profile and can not be removed from the head profile, at least in the corresponding position. In this connection the frictionally locking connection is to be understood as a connection which requires a normal force to be applied to the surfaces to be connected to one another, i.e. in the given case between the adjoining surfaces of the carrier profile elements and between adjoining surfaces of the carrier profile elements and the head profile. Accordingly, their reciprocal displacement is prevented provided the counter-force caused by static friction is not exceeded. Consequently, the frictionally locking connection is to be understood as meaning at least partial clamping or bracing between the carrier profile elements and the head profile, by means of which ultimately the frictional locking is brought about.

By means of the configuration according to the invention of the carrier profile elements, with a well worn head profile, for example, the power rail according to the invention can be easily disassembled into its individual parts. The recyclability of some elements of the power rail according to the invention is thus considerably increased. For example, either the carrier profile elements or the head profile can be replaced. In other words, the assembly principle of the power rail is greatly simplified by the combination, in this case, of three profile parts, namely the carrier profile elements and the head profile, with the result of a positively and frictionally locking connection by means of a type of screwing-in mechanism and a subsequent single fixing mechanism between the carrier profile elements. The fixing connection process between the carrier profile elements is preferably to be chosen here such that the latter in no way has any negative impact upon the material properties in the cross-over between the head profile and the carrier profile. In particular, the carrier profile elements are inserted into the head profile perpendicularly to a longitudinal direction of the carrier profile or of the head profile.

Advantageously, the power rail according to the invention can be further developed such that the positively locking connection between the carrier profile elements and the head profile is only formed when the carrier profile elements are in first specific relative positions when inserted into the head profile. When inserting the first carrier profile element into the head profile and subsequently inserting the second carrier profile element into the head profile, the positively locking connection is accordingly only brought about when the second carrier profile element is in a certain position in relation to the first carrier profile element. In this position the carrier profile elements can no longer be removed from the head profile because the positively locking connection blocks removal of the carrier profile elements. Since in this position, however, there is preferably no frictionally locking connection, this is a loose positively locking connection.

Furthermore, the power rail according to the invention can be realised such that the frictionally locking connection between the carrier profile elements and the head profile is only formed when the carrier profile elements are in second specific relative positions when inserted into the head profile. If the second carrier profile element finally passes into a further specific position in relation to the first carrier profile element, due to bracing or clamping of the two carrier profile elements and the head profile the frictionally locking connection between these components is established (in addition to the positively locking connection).

Moreover, the power rail according to the invention can be realised such that the first carrier profile element and the second carrier profile element are configured such that the carrier profile elements adjoin one another by means of respective profile element surfaces when forming the carrier profile, the respective profile element surfaces of the carrier profile elements being at least partially curved. Preferably, the curved surfaces of the carrier profile elements are configured such that the second carrier profile element can slide over its curved surface on the curved surface of the first carrier profile element already inserted into the holding profile so as thus to be inserted into the holding profile in addition to the first carrier profile element until the positively and frictionally locking connection to the holding profile is finally achieved.

Therefore, at the very least the curved surfaces of the carrier profile elements constitute sliding or guiding surfaces which determine the screwing-in guiding motion of the second carrier profile element relative to the first carrier profile element. By means of the configuration of the curved surfaces of the carrier profile elements the type or the course of the screwing-in movement of the second carrier profile element is thus pre-specified.

Furthermore, the power rail according to the invention can be made such that the carrier profile formed by the carrier profile elements has a section behind or around which the holding profile at least partially engages in order to form the positive locking and/or frictional locking between the carrier profile and the holding profile. In this case a particularly stable connection can be achieved between the carrier profile elements and the holding profile because the carrier profile elements can provide both positive and frictional locking with the holding profile.

Furthermore, the power rail according to the invention can be formed such that the carrier profile is formed by a double T-shaped profile and/or the holding profile is formed by a C-shaped profile. Accordingly, the C-shaped holding profile or head profile engages around or behind a section of the double T-shaped profile, in particular the head section of the carrier profile or the head sections of the carrier profile elements. Preferably, the C-shaped holding profile or head profile can on the one hand enclose the carrier profile and on the other hand be made such that it digs into the carrier profile. In this way longitudinal displacement of the carrier profile elements relative to the head profile strip is largely avoided.

Furthermore, the power rail according to the invention can be further developed such that the material of the head profile is more resistant to wear in relation to the material of the carrier profile, in particular of the carrier profile elements. The wear-resistant head profile is made in a C-shape and is preferably also designed to be spring elastic to a certain extent, by means of which establishing the positively and/or frictionally locking connection between the carrier profile elements and the holding element is facilitated. For example, provision can be made such that the C-shaped head profile slightly expands or deforms elastically when the second carrier profile element is

inserted and with the first carrier profile element already inserted until the positive locking and/or the frictional locking is finally established.

Furthermore, the power rail according to the invention can be realised such that a conductive layer is arranged between the carrier profile and the head profile and/or between the carrier profile elements in order to facilitate an electrically conductive connection between the carrier profile and the holding profile and/or the carrier profile elements. The conductive layer can be provided in particular in solid, pasty or liquid form, and for example be applied to or coated onto the head profile or the carrier profile or between the carrier profile elements in advance.

Moreover, the power rail according to the invention can be provided such that the carrier profile elements are coupled to one another by means of a substance-to-substance connection and/or a positively locking connection and/or a frictionally locking connection. The two carrier profiles are connected to one another securely after screwing in and pre-tensioning using a fixing connection method, preferably "Friction Stir Welding" (FSW). In order to dismantle the fully mounted power rail into its individual components, it is then only necessary to execute a separation step on the weld seam. By means of the friction stir welding the carrier profile elements are thermally loaded to a lesser extent than is the case with at least some other known welding methods. Likewise, the energy to be expended for this purpose is reduced.

The method according to the invention for mounting or dismounting the power rail according to the invention has the following steps:

establishing or eliminating the positively locking and/or frictionally locking connection between the carrier profile elements and the head profile by changing the position of the second carrier profile element while the first carrier profile element does not change its position relative to the head profile.

The properties and advantages described in connection with the power rail according to the invention are thus produced in the same or in a similar way, and this is why reference is made to the above comments made in connection with the power rail according to the invention so as to avoid any repetition.

The same applies correspondingly to the following preferred embodiments of the method according to the invention, and this is why

reference is also made in this regard to the corresponding comments made in connection with the power rail according to the invention.

The method according to the invention can advantageously be further developed such that at the very least positive locking is established between at the very least the carrier profile elements and the head profile only by arranging the carrier profile elements in first specific relative positions when the carrier profile elements are inserted into the head profile.

Furthermore, the method according to the invention can be executed such that frictional locking between the carrier profile elements and the head profile is only established by arranging the carrier profile elements in second specific relative positions when the carrier profile elements are inserted into the head profile.

Moreover, the method according to the invention can be realised such that the first carrier profile element and the second carrier profile element are arranged such that the carrier profile elements adjoin one another when forming the carrier profile by means of respective at least partially curved profile element surfaces.

Furthermore, the method according to the invention can be realised such that the head profile engages at least partially behind or around a section of the carrier profile formed by the carrier profile elements in order to form the positive and/or frictional locking between the carrier profile and the head profile.

Furthermore, the method according to the invention can be implemented such that a conductive layer is arranged between the carrier profile and the head profile and/or between the carrier profile elements in order to facilitate an electrically conductive connection between the carrier profile and the head profile and between the carrier profile elements.

Furthermore, the method according to the invention can be further developed such that the carrier profile elements are coupled to one another by means of a substance-to-substance connection and/or a positively locking connection and/or a frictionally locking connection.

The power rail according to the invention for moveable power consumers according to a further embodiment comprises a carrier profile and a head profile holding the carrier profile, preferably in a positively locking

and/or frictionally locking fashion, provision being made according to the invention such that the carrier profile is formed by a first carrier profile element and a second carrier profile element that can be coupled to the first carrier profile element, the respective ends of which preferably have an axial offset.

The properties and advantages described in connection with the power rail according to the invention are thus produced at least partially in the same or in a similar way, and this is why reference is made to the above comments made in connection with the power rail according to the invention so as to avoid any repetition. The power rail according to the invention accordingly facilitates in a particularly advantageous way the connection of power rails in their longitudinal direction, i.e. the axial coupling of a plurality of power rails is facilitated. Preferably, the head profile is made with a mitre cut or also step-like sections on the end. At the corresponding ends of the respective carrier profile elements flange connections known to the person skilled in the art are preferably provided in order to be able to connect a carrier profile element of the one power rail to another carrier profile element of the other power rail. Advantageously, the power rails can thus be connected to one another by means of the step-like form of the carrier profiles fixed due to the axial offset or moveably. With a moveable connection an infinite version without additional components is possible for an expansion joint between different power rails. Likewise, a conventional expansion joint without processing of the power rail ends is possible. By means of the flange surfaces of carrier profile elements of different power rails connected to one another the transfer of current takes place without separate conductors necessarily being required in order to produce an electrical connection between the carrier profile elements. Here the cross-section of the flange surfaces for the current transfer is variable and can be determined by the axial offset of the carrier profile elements of a power rail. In this case too there can be a conductive cross-over layer between the flange surfaces in solid, pasty or liquid form to facilitate the electrical conductivity between the power rails. In particular, the graduated ends of the carrier profile are determined by the offset of the carrier profile elements during assembly. Here the individual parts can be configured such that no further processing is required after assembly in order to connect

two rails, such processing having been implemented in the prior art by cutting off the carrier profile ends at an angle.

The arrangement according to the invention composed of at least two power rails according to the invention makes provision such that in order to couple the power rails axially the end of one of the carrier profile elements of the one power rail is coupled to an end of the respective other of the carrier profile elements of the other power rail.

Preferred exemplary embodiments of the invention are described as examples below by means of the figures.

These show as follows:

Fig. 1 a perspective illustration of a power rail according to the invention according to a first exemplary embodiment of the invention;

Fig. 2 an illustration of the power rail according to the invention of Fig. 1 in cross-section;

Figs. 3a)-c) various perspective illustrations of the power rail according to the invention of Fig. 1 in different mounting steps;

Figs. 4a)-c) various illustrations of the power rail according to the invention of Fig. 1 in cross-section in different mounting steps;

Fig. 5 a perspective illustration of a power rail according to the invention according to a second exemplary embodiment of the invention;

Fig. 6 an enlarged illustration of the region marked in Fig. 5;

Fig. 7 a perspective illustration of an arrangement according to the invention of power rails according to the invention of Figure 5 before the axial coupling of the power rails according to the invention; and

Fig. 8 a perspective illustration of the arrangement according to the invention of power rails according to the invention of Figure 5 after the axial coupling of the power rails according to the invention.

Fig. 1 shows a perspective illustration of a power rail 10 according to the invention according to a first exemplary embodiment of the invention, while Fig. 2 shows an illustration of the power rail 10 according to the invention of Fig. 1 in cross-section. According to the first exemplary embodiment the power rail 10 according to the invention is intended for moveable power consumers. In this case such moveable power consumers

are preferably electrically driven vehicles such as rail vehicles (underground and urban railway, etc.).

As shown in Figs. 1 and 2, the power rail 10 according to the invention according to the first exemplary embodiment comprises precisely three profile parts, namely a carrier profile (part) comprising two carrier profile elements 12, 14 and a head profile (part) or holding profile (16) coupled to the carrier profile (part) in a positively and frictionally locking fashion and so at least partially engaging around the carrier profile (part). As can be gathered in particular from Figure 1, all of the profile parts 12, 14 and 16 of the power rail 10 according to the invention are elongate components which can be formed, for example, by steel profiles, construction profiles, roll formed metal sheets etc..

In this exemplary embodiment the carrier profile, i.e. the carrier profile elements 12, 14, is/are formed by an electrically conductive light metal material and serve/s in particular to guide current along the power rail 10 according to the invention. The head profile 16 is formed by a head profile strip the material of which is more resistant to wear in comparison to the material of the respective carrier profile elements 12 and 14, i.e. to the material of the carrier profile. Accordingly, the head profile 16 is used for the power tapping of the current guided by the carrier profile along the power rail 10 according to the invention. In order to facilitate the electrical conductivity between the head profile 16 and the carrier profile and/or between the carrier profile elements 12 and 14, a conductive layer (not shown in the figures) is arranged between the carrier profile and the head profile 16. This conductive layer can be in solid, pasty or liquid form and be applied to or coated onto corresponding sections of the carrier profile elements and/or of the head profile 16 in advance.

As evident in particular from Figure 2, the carrier profile comprises the first carrier profile element 12 and the second carrier profile element 14 coupled to the first carrier profile element 12 which in the correctly assembled state form an approximately double T-shaped profile. Furthermore, it can be gathered from Figure 2 that that head profile 16 is approximately in the form of a C-shaped profile, i.e. the head profile 16 has an upper planar section and two opposite lateral, preferably curved sections 16a, 16b. In the correctly

assembled state the head profile 16 engages around or behind at least the head sections of the carrier profile elements 12, 14. In particular, by means of the configuration and geometry of the carrier profile elements 12, 14 assembled in the correct state and the configuration and geometry of the head profile 16, a positively and frictionally locking connection is established between the carrier profile and the head profile 16. Closer details on the production of this positively and frictionally locking connection between the carrier profile and the head profile 16 are described in more detail below.

As can be seen in particular in the cross-sectional illustration of the power rail 10 according to the invention shown in Figure 2, the first carrier profile element 12 of the carrier profile comprises a foot section 22, a middle or bar section 24 adjoining the foot section 22 and a head section 26 adjoining the middle or bar section 24. The first carrier profile element 12 thus forms approximately half of the double T-shaped profile in relation to an axis of symmetry (axis running from the bottom to the top in the illustration of Figure 2) of the double T-shaped profile. Likewise, the second carrier profile element 14 of the carrier profile comprises a foot section 32, a middle or bar section 30 adjoining the foot section 32, and a head section 28 adjoining the middle or bar section 30. The second carrier profile element 14 thus also forms approximately the other half of the double T-shaped profile in relation to the axis of symmetry of the double T-shaped profile. Accordingly, with the carrier profile elements 12, 14 assembled correctly, the carrier profile comprises a foot section, formed by the foot sections 22, 32, a middle or bar section, formed by the middle or bar sections 24, 30, and a head section, formed by the head sections 26, 28.

As can be gathered, furthermore, from Fig. 2, in the correctly assembled state the carrier profile elements 12, 14 adjoin one another via conjugate surfaces facing one another. In other words, the adjoining surfaces define a contact surface (if an electrically conductive intermediate layer is provided, the contact surface is not a contact surface understood in the literal sense, but rather a surface along which or over which the carrier profile elements are coupled), along which the two carrier profile elements 12, 14 are coupled to one another two-dimensionally. The contact surface 13b is level or planar in form on the foot sections 22, 32 of the carrier profile elements 12,

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14. The same also applies essentially to the bar sections 24 and 30 of the carrier profile elements 12, 14 with the exception that the conjugate surface of the first carrier profile element 12 forms a projection 20 in the bar section 24, while the conjugate surface of the second carrier profile element 14 forms a cut-out 18 in the bar section 30. Here the projection 20 is inserted into the cut-out 18 when the carrier profile elements 12, 14 are assembled correctly. The projection 20 and the cut-out 18 preferably run in a straight line along the longitudinal direction of the carrier profile elements 12, 14, by means of which centring of the carrier profile elements 12, 14 can be achieved when correctly assembled with the head profile 16. In the region of the head sections 26, 28 of the carrier profile elements 12, 14 the contact surface 13a is curved. In this section 13a of the contact surface the radius of curvature is preferably location-dependent and makes possible a screwing-in mechanism 34 described in more detail below. In particular, the conjugate surface on the head section of the first carrier profile element 12 is concave so that it forms a further projection which projects towards the second carrier profile element 14. By contrast, the conjugate surface on the head section of the second carrier profile element 14 is convex so that it forms a further cut-out, at least the sliding interaction of the curved surfaces of the head sections 26, 28 of the carrier profile elements 12, 14 enabling the function of the screwing-in mechanism 34 in co-operation with the head profile 16, as described in more detail below.

Both head sections 26, 28 respectively have on their outer surface a step 15, the depth of which corresponds substantially to the thickness of the head profile 16b. This step facilitates in particular the screwing-in mechanism of the carrier profile element 14 to be described below because the step can effectively serve as a starting point or lever point for the screwing-in motion (Fig. 4b).

The curved section 13a of the contact surface extends from the lower side of the head profile 16, i.e. from the end 13c shown in Fig. 2 substantially to a horizontally running hypothetical line, not shown in Fig. 2, which connects the inner edges of the steps 15 of the head part 16. The end 13c is arranged closer to the lateral curved section 16b than to the lateral curved section 16a.

The screwing-in mechanism 34 is thus made possible by the carrier profile elements 12 and 14, at least by their head sections 26 and 28, which are configured such that the carrier profile elements 12 and 14 can establish or eliminate the positively locking and frictionally locking connection to the head profile 16 depending on their respective position relative to one another provided that the carrier profile elements are inserted into the C-shaped head profile via the open side of the C (i.e. perpendicular to the longitudinal axis of the head profile). In particular, at the very least the geometry, in particular the width of the head section of the carrier profile, can be set by means of the position of the carrier profile elements 12, 14. In other words, sliding of the convex surface on the head section 28 of the second carrier profile element 14 over the concave surface on the head section 26 of the first carrier profile element 12 leads to an increase or reduction of the geometry, in particular of the width, of the head section of the carrier profile depending on the change in position of the carrier profile elements 12, 14 relative to one another.

Needless to say the positions of the middle section and of the foot section of the carrier profile elements 12, 14 relative to one another thus also change, but in this exemplary embodiment this does not contribute directly to establishing the positive or frictional locking with the head profile 16. In particular, the carrier profile elements 12 and 14 are configured such that the positively locking connection between the carrier profile elements 12 and 14 and the head profile 16 is only formed when the carrier profile elements 12, 14 are in first specific positions relative to one another when inserted into the C-shaped head profile 16. In this case the geometry of the head section of the carrier profile is such that the head section is arranged within the C-shaped head profile 16 with play relative to the head profile 16, and so can be moved within the C-shaped head profile 16, but can not be withdrawn from the C-shaped head profile 16.

Furthermore, the carrier profile elements 12 and 14 are configured such that a frictionally locking connection (in addition to the positively locking connection) is additionally only formed between the carrier profile elements 12 and 14 and the head profile 16 if the carrier profile elements are in a second specific position relative to one another when inserted into the C-shaped head profile 16. In this case the geometry of the head section of the carrier profile

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is such that the head section is arranged within the C-shaped head profile 16 at least partially without any play relative to the head profile 16, and so can not move and is clamped within the C-shaped head profile 16. Accordingly, it is just as hard to withdraw the head section of the carrier profile from the C-shaped head profile 16. Therefore, if the positively and frictionally locking connection of the carrier profile to the head profile is established, the carrier profile elements 12, 14 are preferably in their correctly assembled state.

It is important here that the positively locking and frictionally locking coupling of the two carrier profile elements 12, 14 is brought about exclusively by the head profile 16 along the section 13a and preferably also via an upper region of the section 13b of the contact surface.

Even if not explicitly shown in Fig. 2, the foot sections 22, 32 of the carrier profile elements 12, 14 are additionally securely connected to one another by a substance-to-substance connection, preferably by a weld connection, and even more preferably by an FSW weld seam. This substance-to-substance connection only brings about coupling of both carrier profile elements 12, 14 in the region of the foot sections 22, 32, but not in the section 13a of the contact surface. Alternatively, positively locking or frictionally locking connections, in particular non-destructive releaseable or destructive releaseable connections, can also be used in the region of the foot sections 22, 32.

In the following the mounting of the power rail 10 according to the invention is described with reference to Figs. 3a)-3c) and 4a)-c). Figs. 3a)-c) show various perspective illustrations of the power rail 10 according to the invention of Fig. 1 in different mounting steps, while Figs. 4a)-c) show various illustrations of the power rail 10 according to the invention of Fig. 1 in cross-section in different mounting steps.

As can be gathered in particular from Figs. 3a) and 4a), the first carrier profile element is first of all arranged in the C-shaped head profile 16 (from the open side of the C-shaped head profile 16) such that a section of the head profile 16 engages around and behind its head section 26 and the head profile 16 and the first carrier profile element 12 adjoin one another (via a conjugate outer surface of the first carrier profile element 12 and a conjugate inner surface of the C-shaped head profile 16). In this mounting state, however,

there is still no positively locking or frictionally locking connection between the first carrier profile element 12 and the head profile 16 because the first carrier profile element can easily be removed again from the C-shaped head profile 16.

Next, the second carrier profile element 14 is inserted by its head section 28 into the head profile 16 by means of a type of "rotating motion" due to the configuration of the conjugate curved surfaces of the carrier profile elements 12, 14 so that with a further screwing-in motion of the second carrier profile element 14 the head section 28 of the second carrier profile element 14 is gradually encompassed by the remaining section of the C-shaped head profile 16, i.e. the head section of the carrier profile gradually becomes wider due to the changes to the relative positions of the carrier profile elements 12 and 14 or the geometry of the head section is increased or changed in certain directions.

Figs. 3b) and 4b) show a position of the carrier profile elements 12 and 14 in which the carrier profile elements 12 and 14 are in the first specific positions relative to one another when inserted into the C-shaped head profile 16 and so at the very least establish the positively locking connection to the head profile 16. In particular, the positively locking connection between the carrier profile elements 12, 14 and the head profile 16 is therefore established because in this position of the carrier profile elements 12, 14, their head sections 26, 28 can not be withdrawn from the C-shaped head profile 16, but are blocked by the C-shaped head profile, in particular by the sections of the C-shaped head profile 16 engaging behind or around the head sections 26, 28 of the carrier profile elements. In other words, the geometry of the head section of the carrier profile has been changed or increased in certain directions so that the head section of the carrier profile establishes positive locking with the head profile 16 within the C-shaped head profile 16.

By screwing the second carrier profile element 14 further into the head profile 16, as shown in Figs. 3c) and 4c), the projection 20 of the first carrier profile element 12 gradually passes into the cut-out 18 of the second carrier profile element 14 by means of which the centring of the carrier profile elements 12, 14 is gradually brought about. Furthermore, the positively locking connection between the carrier profile elements 12, 14 and the head

profile 16 is maintained, a frictionally locking connection between the carrier profile elements 12, 14, in particular the head section of the carrier profile, and the head profile 16 gradually being established, i.e. the C-shaped head profile 16 only engages around the head section of the carrier profile such that there is certain bracing and clamping between the carrier profile and the C-shaped head profile 16, i.e. as soon as the carrier profile elements 12 and 14 are totally adjoining one another, the head profile 16 engages around their head sections such that there is both a positively locking and a frictionally locking connection between the carrier profile elements 12, 14 and the head profile 16. In other words, the geometry of the head section of the carrier profile has been changed or increased in certain directions such that the head section of the carrier profile establishes positive and frictional locking with the head profile 16 within the C-shaped head profile 16.

In order to maintain the positive and frictional locking, in particular the bracing and clamping between the carrier profile elements 12 and 14 and the head profile 16, the carrier profile elements 12 and 14 are preferably welded to one another on their foot sections 22 and 32. Thus, the mounting of the power rail 10 is completed first of all.

In order to now be able to dismount the power rail according to the invention again, it is only necessary to remove the welding of the two carrier profile elements 12 and 14, for example by means of a separating cut, and to carry out the aforementioned mounting steps in reverse. In this way the frictionally locking connection first of all and then the positively locking connection are eliminated again in the same way.

Fig. 5 shows a perspective illustration of a power rail 10 according to the invention according to a second exemplary embodiment of the invention, while Fig. 6 shows an enlarged illustration of the region marked in Fig. 5. In order to avoid any repetition, in the description of this second exemplary embodiment one will only discuss in more detail the differences in comparison to the power rail 10 according to the first exemplary embodiment.

The power rail 10 according to the invention according to the second exemplary embodiment corresponds essentially to the power rail 10 according to the first exemplary embodiment. The carrier profile of the power rail 10 according to the invention according to the second exemplary embodiment is

formed by the first carrier profile element 12 and the second carrier profile element 14 coupled to the first carrier profile element 12 which are of the same length axially, in this case the carrier profile elements 12, 14 being arranged offset axially to one another such that an axial offset between the respective ends of the carrier profile elements 12 and 14 is brought about at the respective ends of the carrier profile elements 12 and 14. As can be seen in particular in Figs. 5 and 6, the end section of the first carrier profile element 12 which projects over the end section of the second carrier profile element 14 can be used accordingly as the coupling point for a further correspondingly formed power rail 10 according to the invention. For this purpose the first carrier element 12 is provided with a connection device 34 which, in the case shown, is formed by bore holes, for example by round bore holes and slot holes, for a bolt and nut connection. Needless to say, other connection devices known to the person skilled in the art can be used to couple the respective carrier profile elements of different power rails.

By choosing the axial length of the offset of the two carrier profile elements 12, 14 appropriately, the current density in this region can be formed variably.

The head profile 16 in the axial offset region runs at an angle to the longitudinal direction of the power rail. The angle to the longitudinal direction is preferably 45° , but can also be in the range of 30° to 60° . As can be seen in Fig. 6, the part of the head profile 16 which engages around the axially projecting carrier profile element 12 projects axially from the latter, and the part of the head profile 16 which engages around the axially set back carrier profile element 14 stands back from the latter axially. Therefore, the head section 26 of the carrier profile element 12 is covered partially by the head profile 16, while the head section 28 of the carrier profile element 14 is partially exposed by the head profile 16 set back axially in this region.

Furthermore, the face surface or contact surface 16d can have a phase running inwards at an angle. The head profile of a further power rail to be applied axially to this face surface 16d has a phase complementary to this, by means of which forces acting perpendicularly, i.e. according to gravity or in the height direction of the power rail, can also be absorbed well by axially

combined power rails, and a vertically continuous gap between two axially combined power rails is avoided.

The axial end of the head profile 16 constitutes a mitre cut that is associated with a number of advantages. The contact surface 16d is thus enlarged in comparison to a cut running perpendicularly to the longitudinal direction, and the head profile can also better absorb forces acting laterally to the longitudinal direction. Moreover, the current collector looped over the power rail strays less from this cross-over region when passing over because it does not pass over this cross-over region at one go at a given time but, as it were, bit by bit.

Fig. 7 shows a perspective illustration of an arrangement according to the invention of the power rails 10 according to the invention of Figure 5 before the axial coupling of the power rails 10 according to the invention. Fig. 8 shows a perspective illustration of the arrangement according to the invention of power rails 10 according to the invention of Figure 5 after the axial coupling of the power rails 10 according to the invention.

As can be gathered from Figs. 7 and 8, different power rails 10 according to the invention can be coupled to one another. For the axial coupling of the power rails 10 the end of one of the carrier profile elements 12 or 14 of the one power rail 10 is coupled to an end of the respective other of the carrier profile elements 12 or 14 of the other power rail 10. As mentioned above, for the coupling of the respective carrier profile elements 12 and 14 of different power rails 10 the connection device 34 is provided in the form of bore holes so that preferably the middle sections 24, 32 can be connected to one another rigidly by means of a nut/bolt connection. Preferably, a carrier profile element, preferably its middle section, of a power rail 10 is provided with round bore holes, while the respective other carrier profile element, preferably its middle section, of the other power rail 10 is provided with slot holes. In this way an expansion joint between power rails 10 coupled to one another can be set in a particularly advantageous manner so that material movements of the respective components of the power rail 10 can be compensated. As can also be seen from Figs. 7 and 8, the head profiles 16 of different power rails 10 according to the invention are formed with corresponding mitre sections so that it is made possible to join flush together

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the different power rails 10 according to the invention. As an alternative to the mitre sections, stepped sections of the head profile 16 of different power rails 10 corresponding to one another can however also be provided in order to be able to connect two different power rails 10 flush to one another (alternatively also with an expansion joint).

The features of the invention disclosed in the above description, in the drawings and in the claims can be essential for realisation of the invention both individually and in any combination.

List of reference numbers

10	power rail
12	first carrier profile element
13a-c	contact surface
14	second carrier profile element
15	step
16	head profile or holding profile strip
16a	first curved section – head profile
16b	second curved section – head profile
16c	end of the head profile
16d	face surface – head profile
18	cut-out
20	projection
22	foot section – first carrier profile element
24	middle section – first carrier profile element
26	head section – first carrier profile element
28	head section – second carrier profile element
30	middle section – second carrier profile element
32	foot section – second carrier profile element
34	connection device

Claims:

1. A power rail for moveable power consumers, in particular for electrically driven vehicles, comprising a carrier profile which comprises a first carrier profile element and a second carrier profile element which are coupled to one another along a surface which is partially curved, and a head profile which has a first lateral section and a second lateral section lying opposite, and which is connected in a positively locking and/or frictionally locking fashion to the first carrier profile element and to the second carrier profile element, wherein an end of the surface which faces the head profile is arranged closer to the second lateral section than to the first lateral section, characterised in that the two carrier profile elements are coupled to one another in a positively locking fashion and/or frictionally locking fashion along the surface by means of the head profile.

2. The power rail according to claim 1, a section of the surface which comprises the end facing the head profile having a location-dependent radius of curvature.

3. The power rail according to claim 2, the section, as viewed in the height direction of the carrier profile elements, being substantially aligned with one end of the lateral sections of the head profile.

4. The power rail according to claim 2 or 3, as viewed in the height direction of the carrier profile elements, the section of the surface adjoining the section to a bottom being substantially planar.

5. The power rail according to any one of claims 1 to 4, the first lateral section and the second lateral section of the head profile at least partially engaging around the carrier profile elements in order to form the positive locking and/or frictional locking between the carrier profile and the head profile.

6. The power rail according to any one of claims 1 to 5, the carrier profile elements respectively comprising a head section facing the head profile and which has a step the depth of which corresponds substantially to the thickness of the head profile.

7. The power rail according to any one of claims 1 to 6, the carrier profile having a double T-shaped profile.

8. The power rail according to any one of claims 1 to 7, the head profile having a C-shaped profile.

9. The power rail according to any one of claims 1 to 8, an electrically conductive layer being arranged between the carrier profile and the head profile.

10. The power rail according to any one of claims 1 to 9, an electrically conductive layer being arranged between the carrier profile elements.

11. The power rail according to any one of claims 1 to 10, the carrier profile elements respectively comprising a foot section, and the foot sections being connected to one another by a substance-to-substance connection.

12. The power rail according to claim 11, in the longitudinal direction of the power rail the carrier profile elements respectively having axial ends which are offset radially to one another.

13. The power rail according to claim 12, an axial end of the head profile being formed at an angle and extending between the axially offset ends of the carrier profile elements.

14. The power rail according to claim 13, wherein the power consumers, in particular the electrically driven vehicles are rail vehicles.

15. A system composed of multiple axially combined power rails according to any one of claims 1 to 14, two axially adjacent power rails being assembled moveably such that an expansion joint is provided between the head profiles of both power rails.

16. The system of claim 15 composed of multiple axially combined power rails according to any one of claims 1 to 14, an axial end of the head profile being formed at an angle and extending between axially offset ends of the carrier profile elements, and two axially adjacent power rails being combined such that a middle section of the first carrier profile element of a power rail is connected in a frictionally locking fashion to a middle section of the second carrier profile element of the other power rail.

17. A method for mounting or dismounting a power rail according to any one of claims 11 to 14, comprising the following steps:

establishing or eliminating the positively locking and/or frictionally locking connection between the carrier profile elements and the head profile by changing the position of the second carrier profile element while the first carrier profile element does not change its position relative to the head profile.

18. The method according to claim 17, wherein the positive locking between the carrier profile elements and the head profile is established when the second carrier profile element adopts a first specific position relative to the first carrier profile element and the head profile.

19. The method according to claim 17 or 18, wherein the frictional locking between the carrier profile elements and the head profile is established when the second carrier profile element adopts a second specific position relative to the first carrier profile element and the head profile.

20. The method according to claim 19 when being dependent on claim 18, wherein the second carrier profile element adopts the first and the second specific positions by being turned.

21. The method according to any one of claims 17 to 20, wherein an electrically conductive layer is arranged between the carrier profile and the head profile.

22. The method according to any one of claims 17 to 21, wherein an electrically conductive layer is arranged between the carrier profile elements.

23. The method according to any one of claims 17 to 22, wherein the foot sections of the carrier profile elements are connected to one another by a substance-to-substance connection.

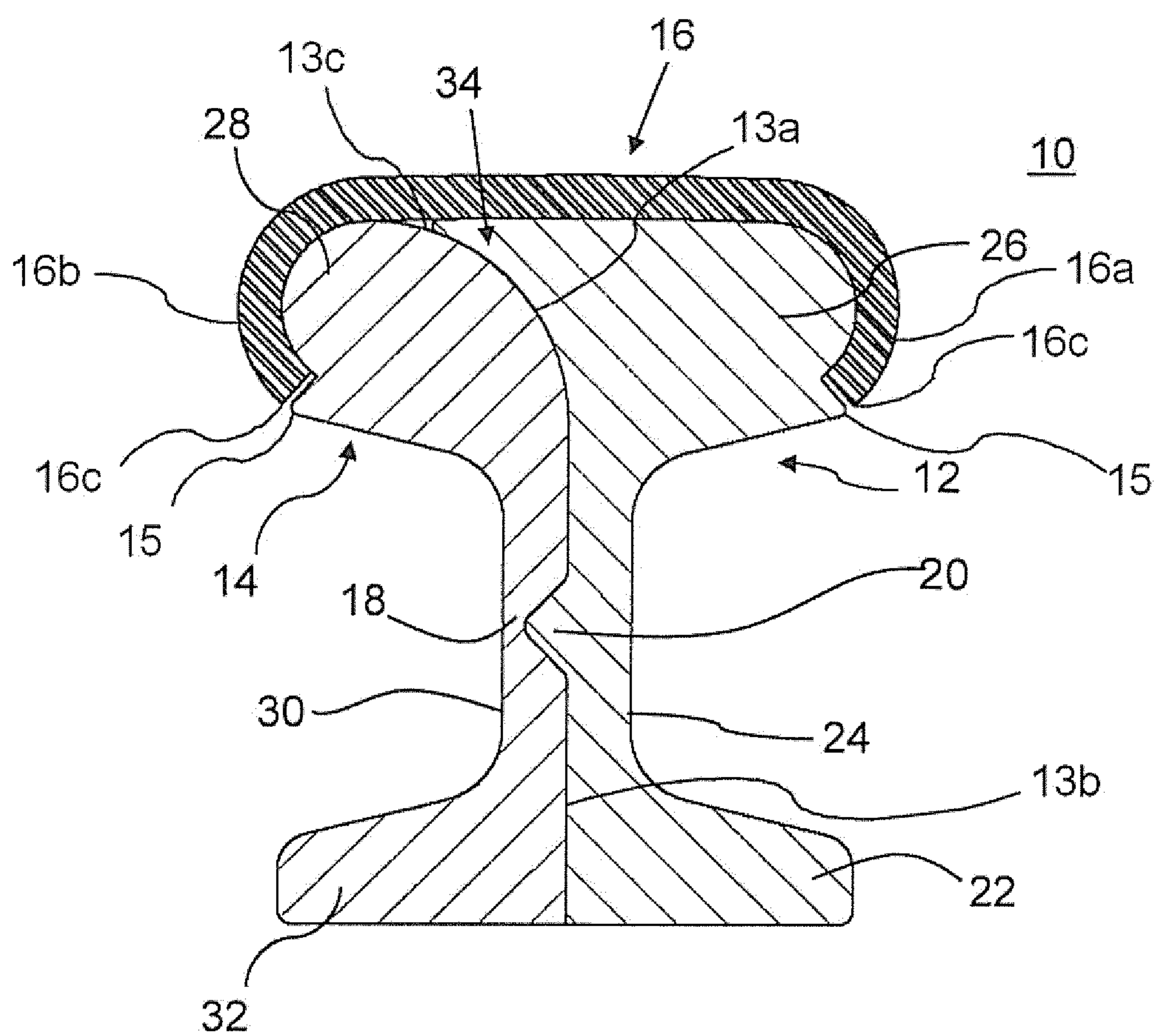
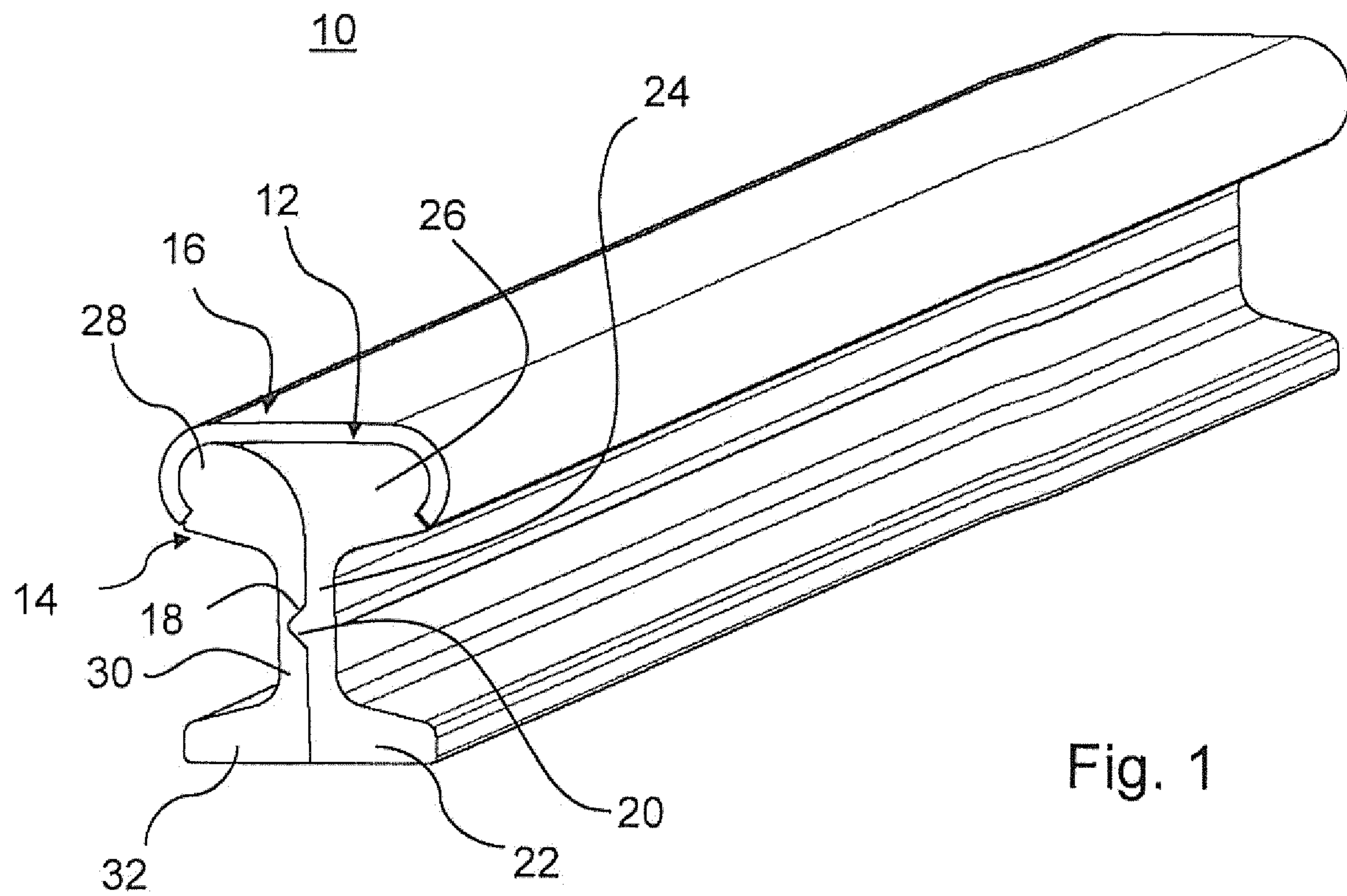


Fig. 3

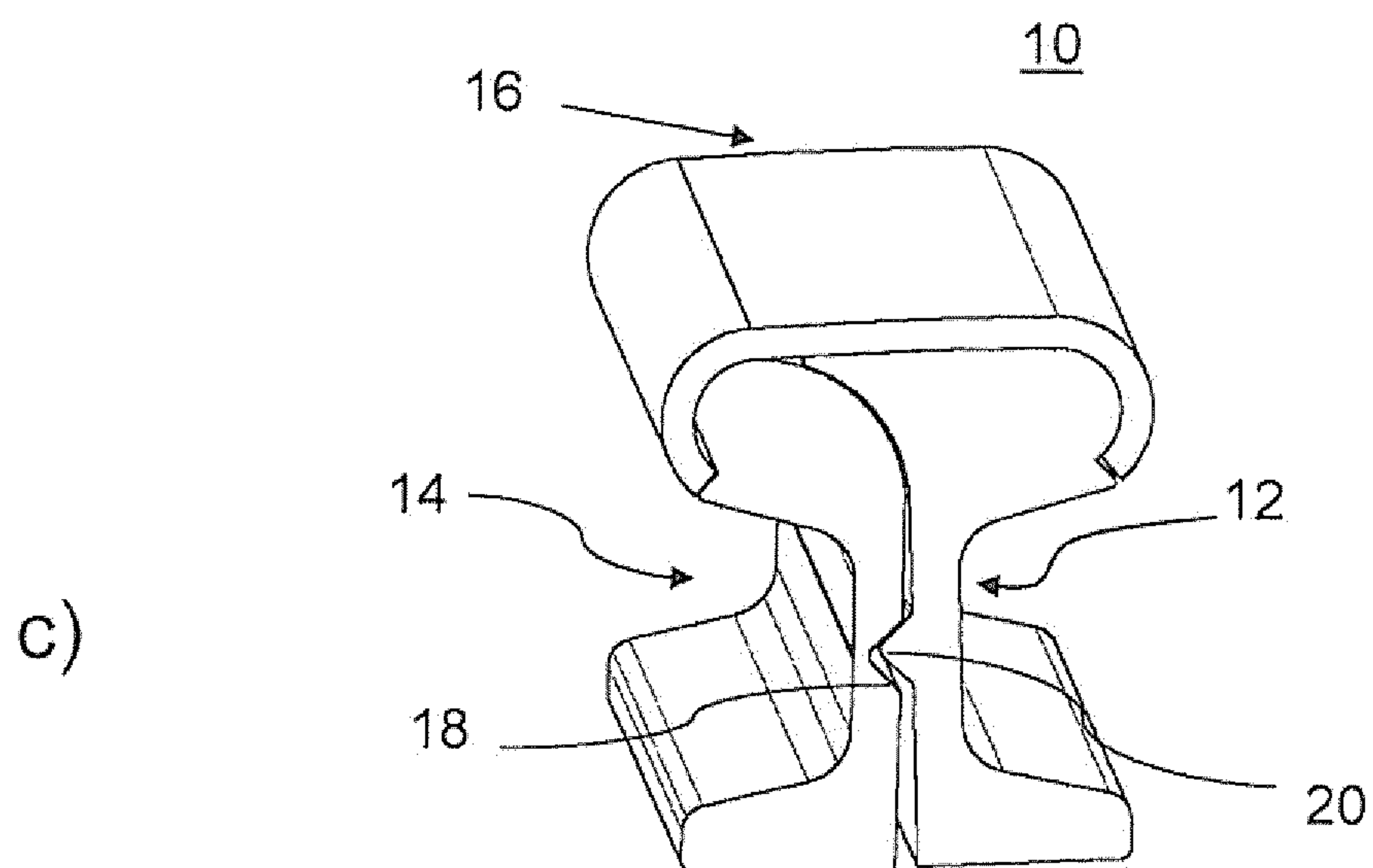
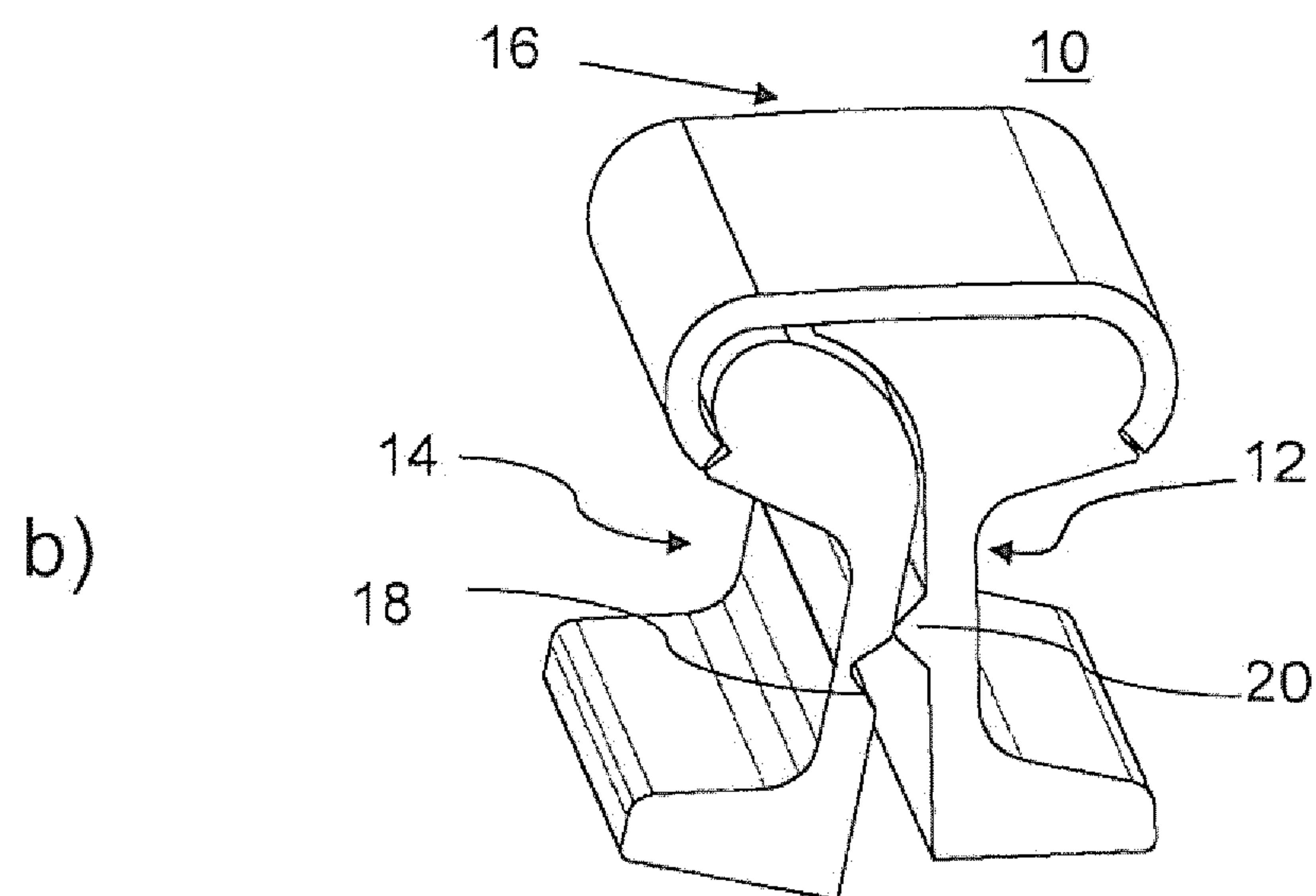
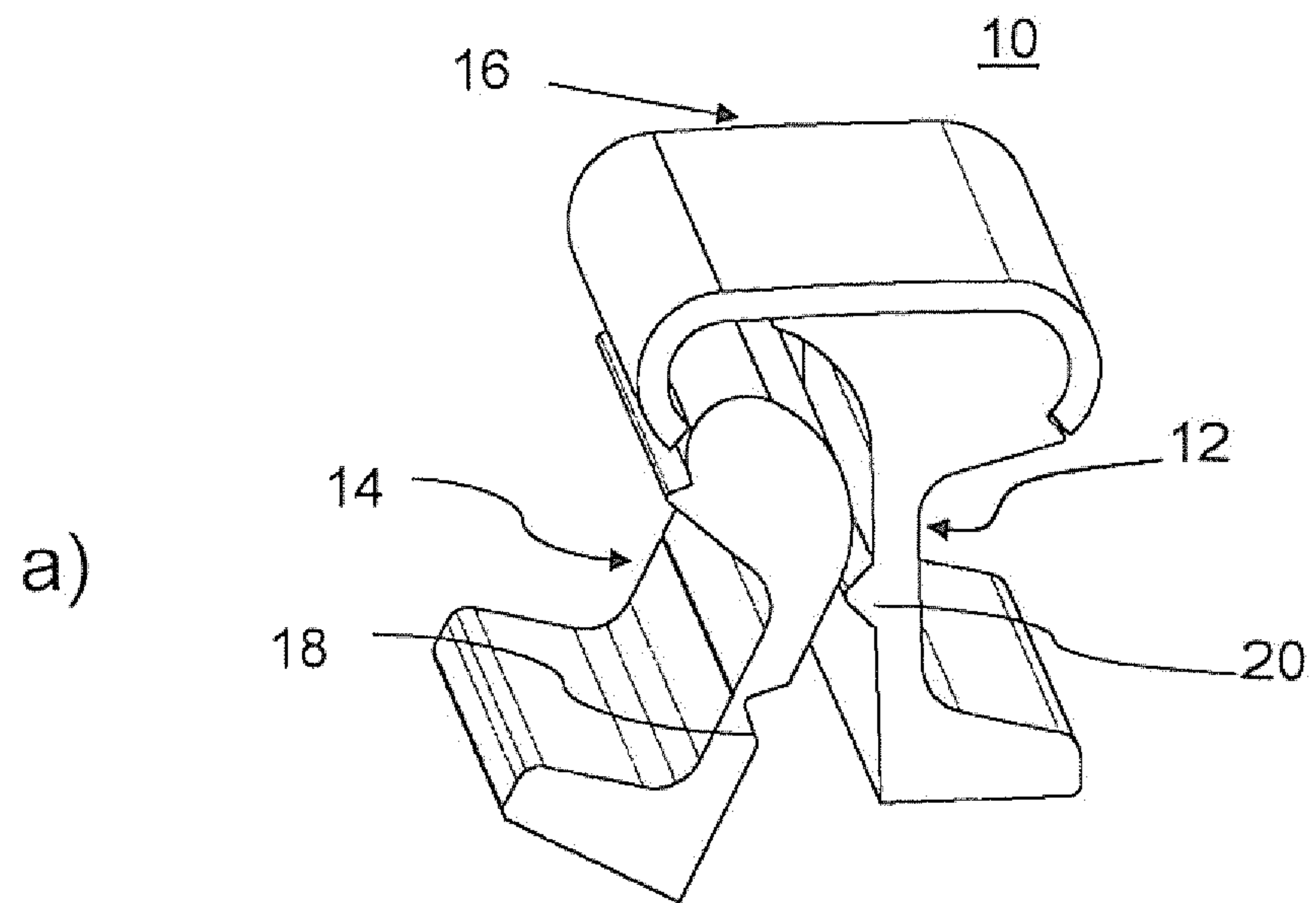
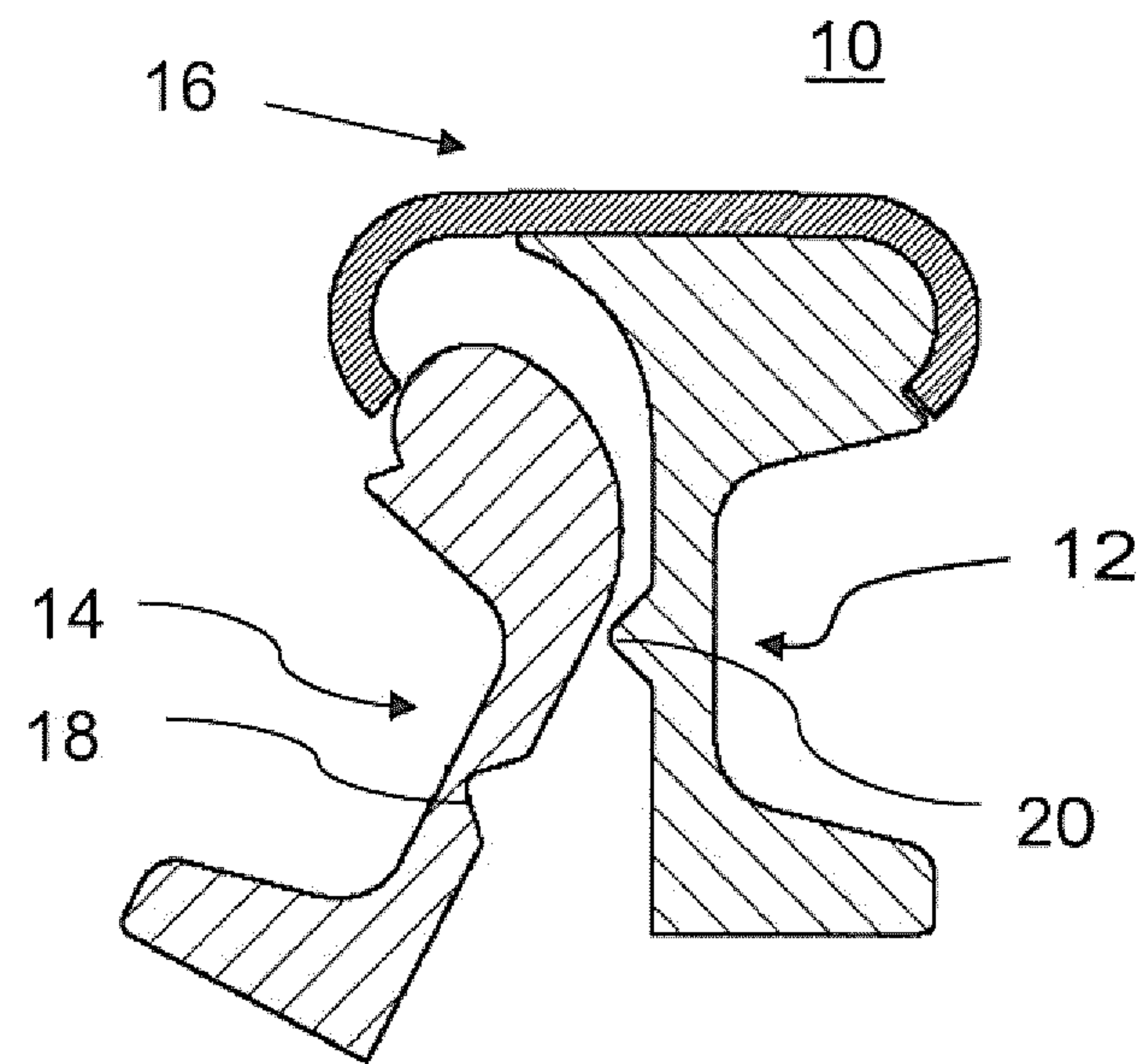
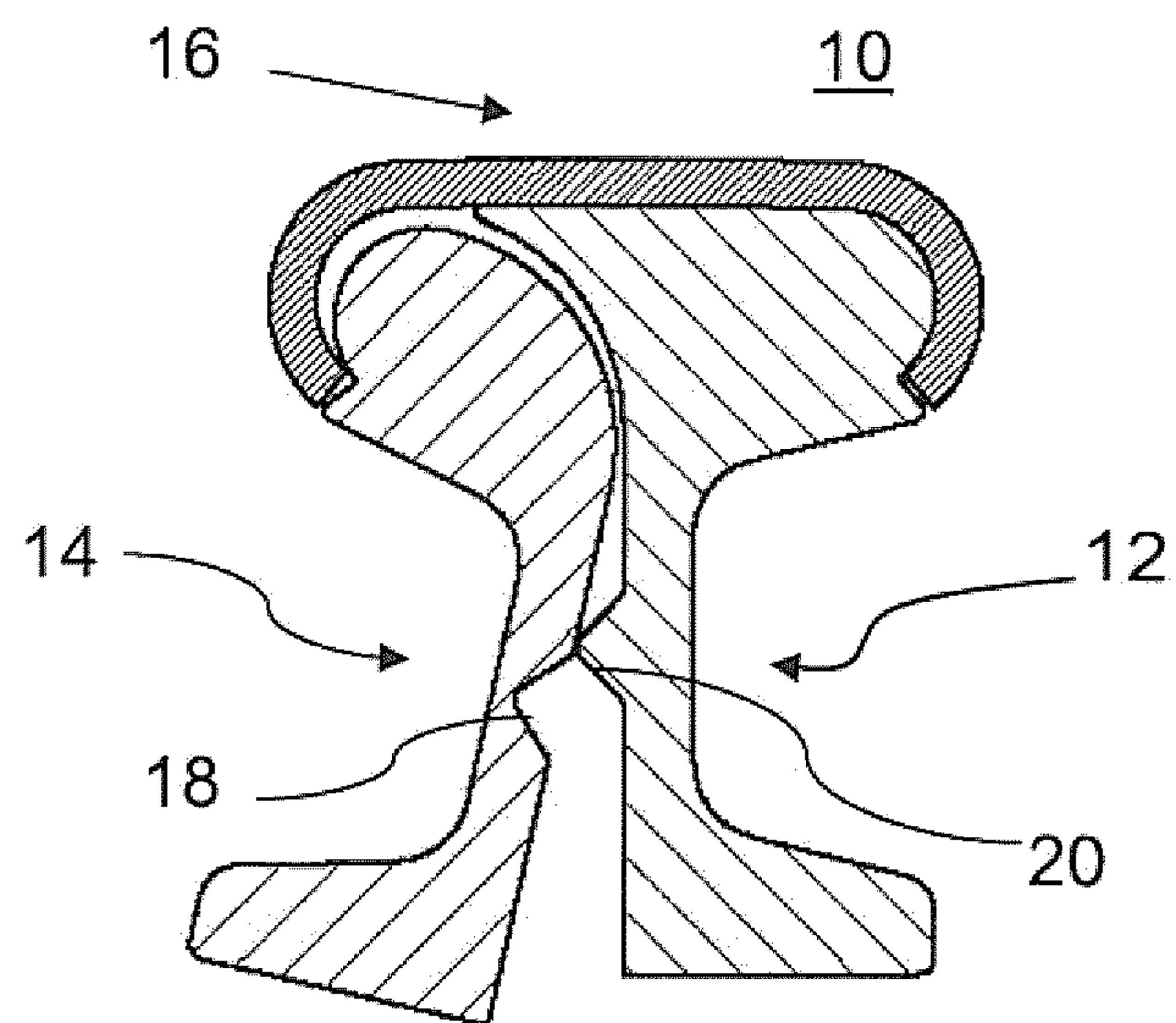


Fig. 4

a)



b)



c)

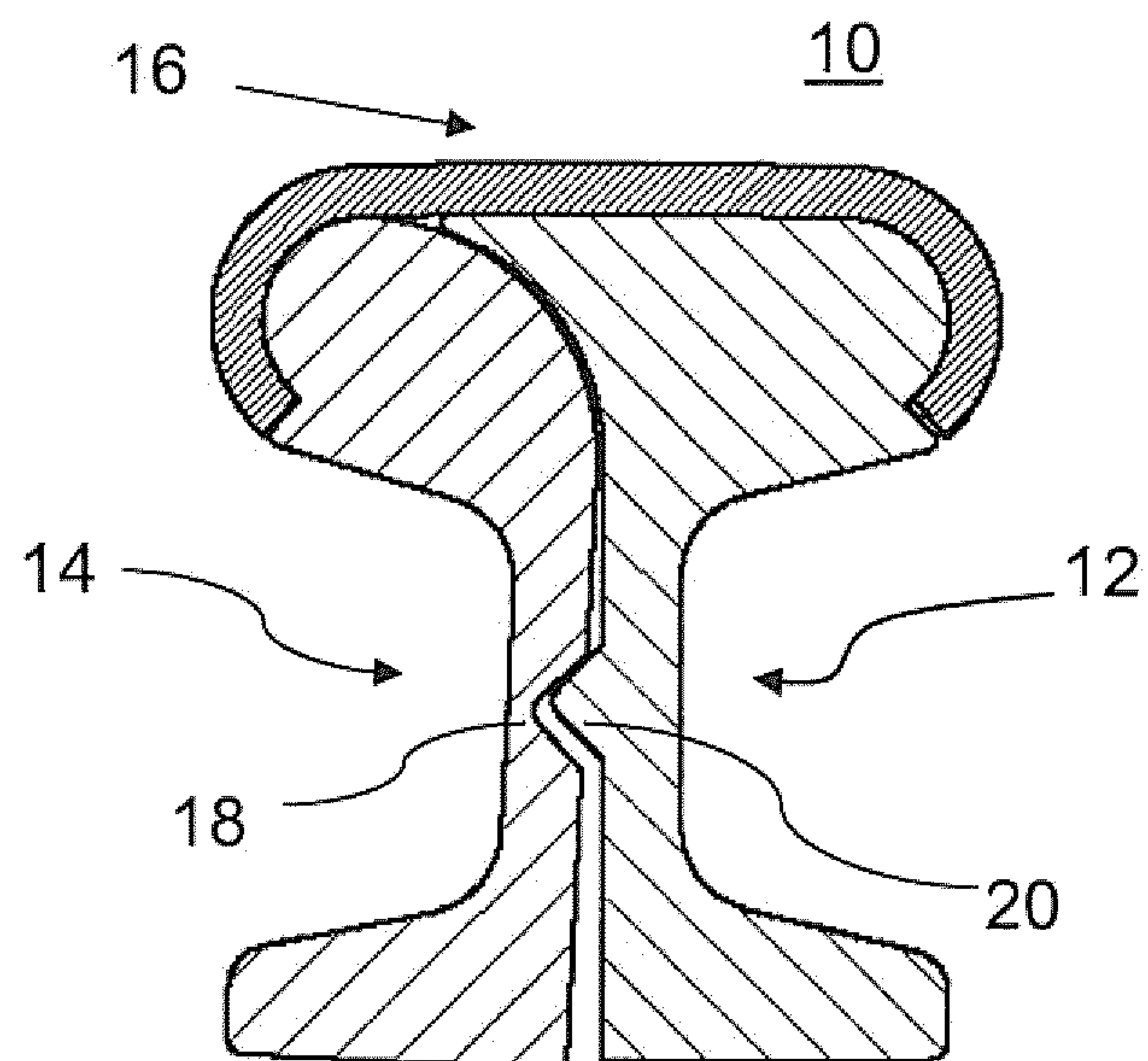


Fig. 5

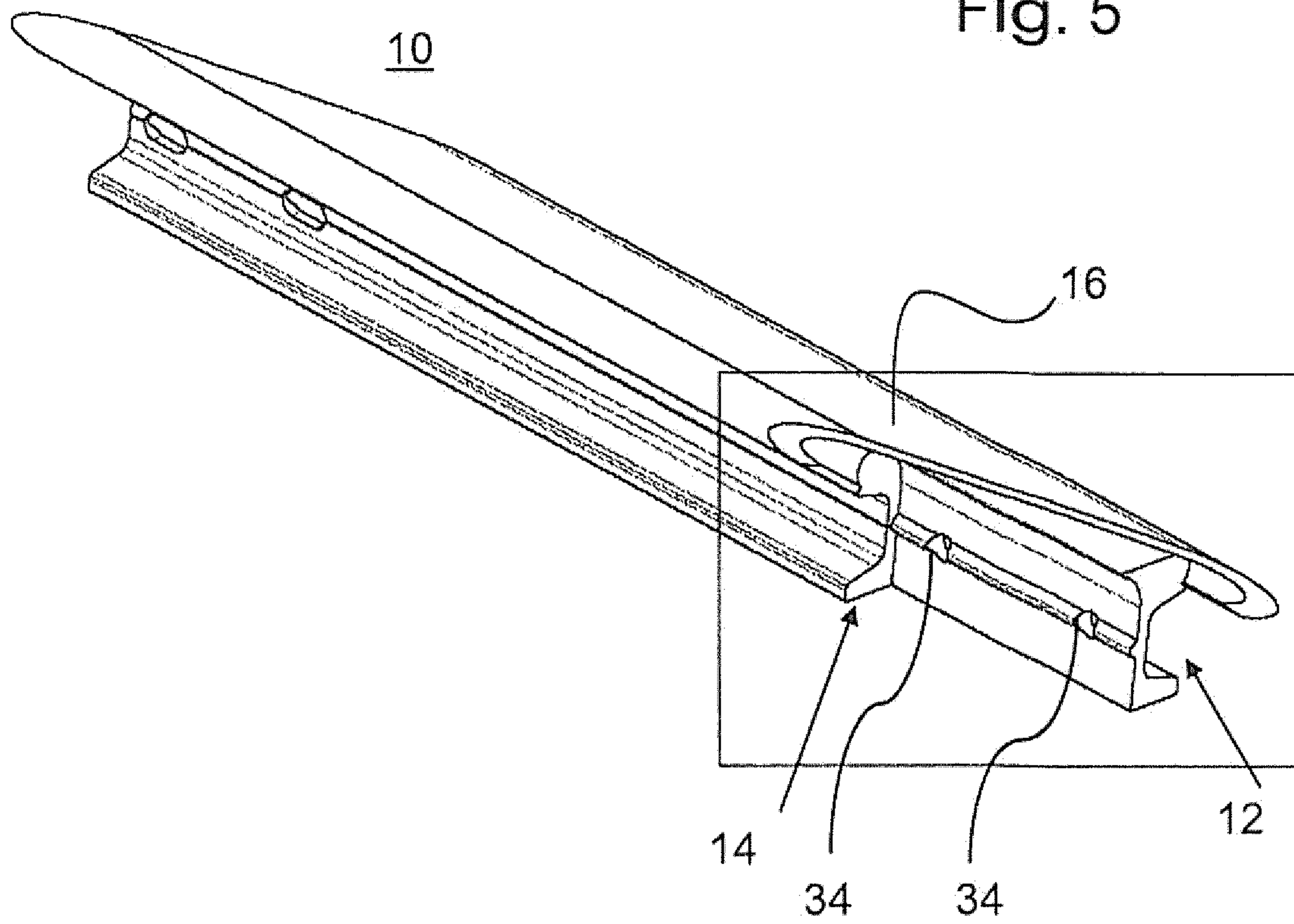


Fig. 6

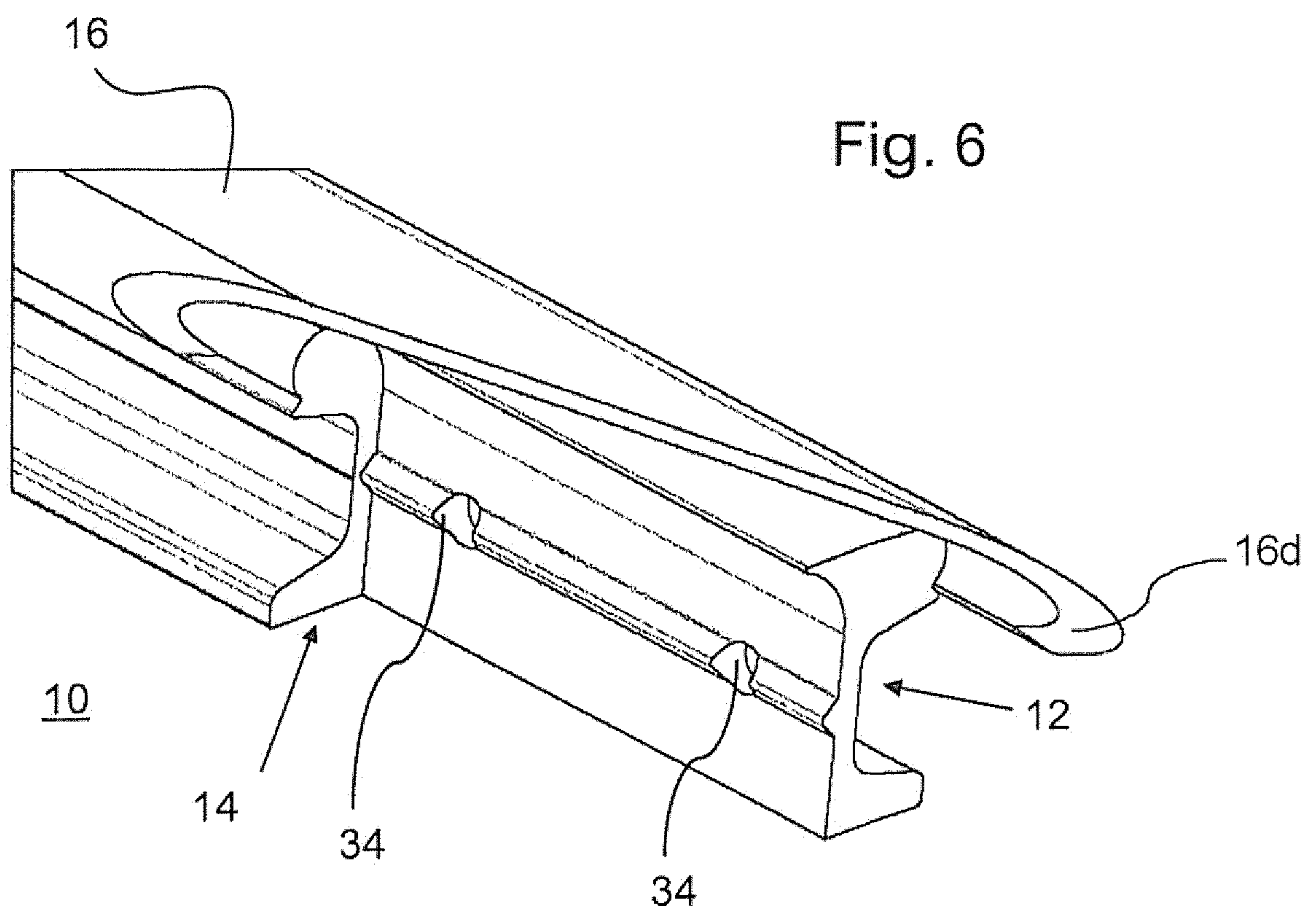


Fig. 7

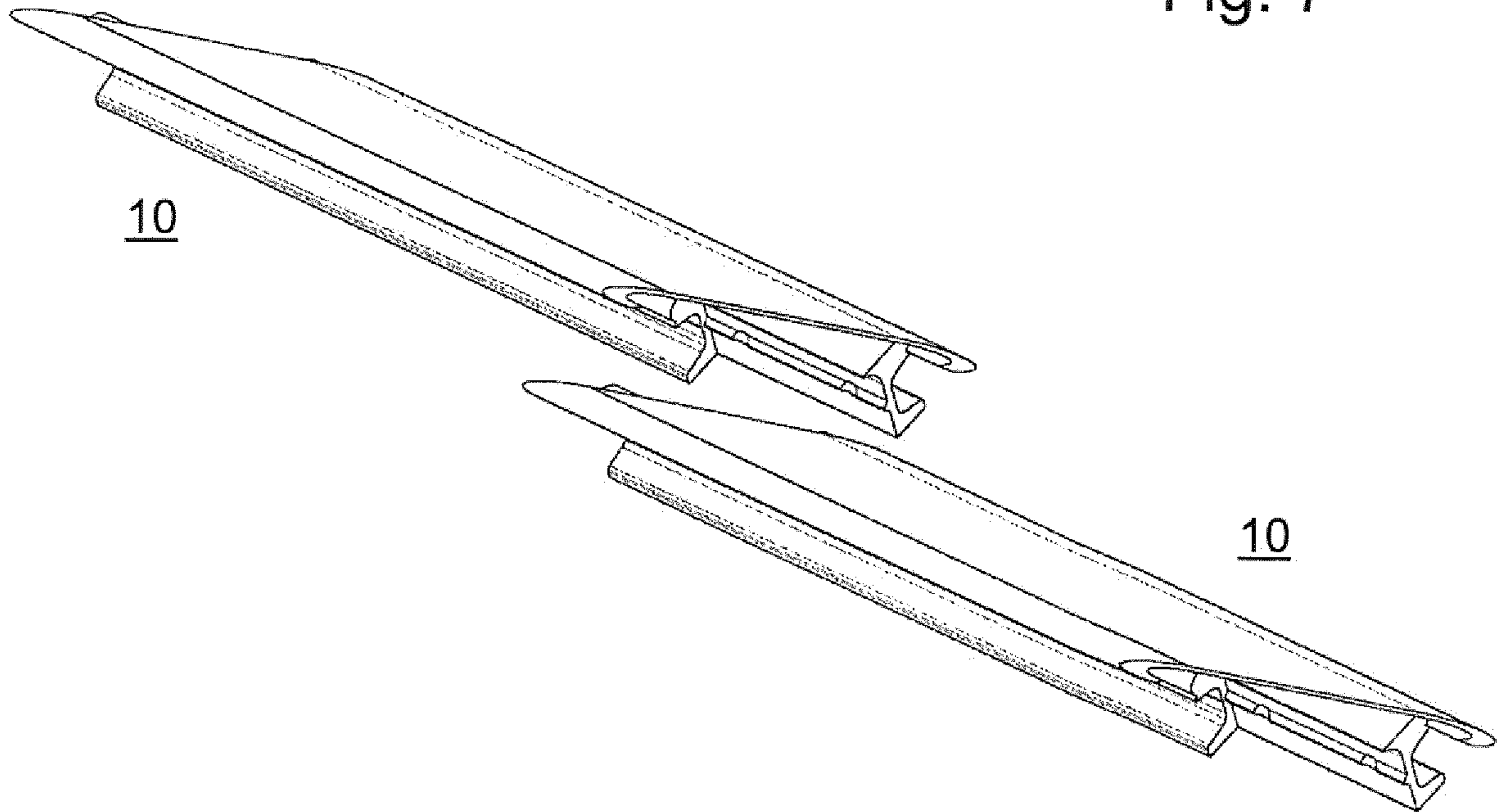
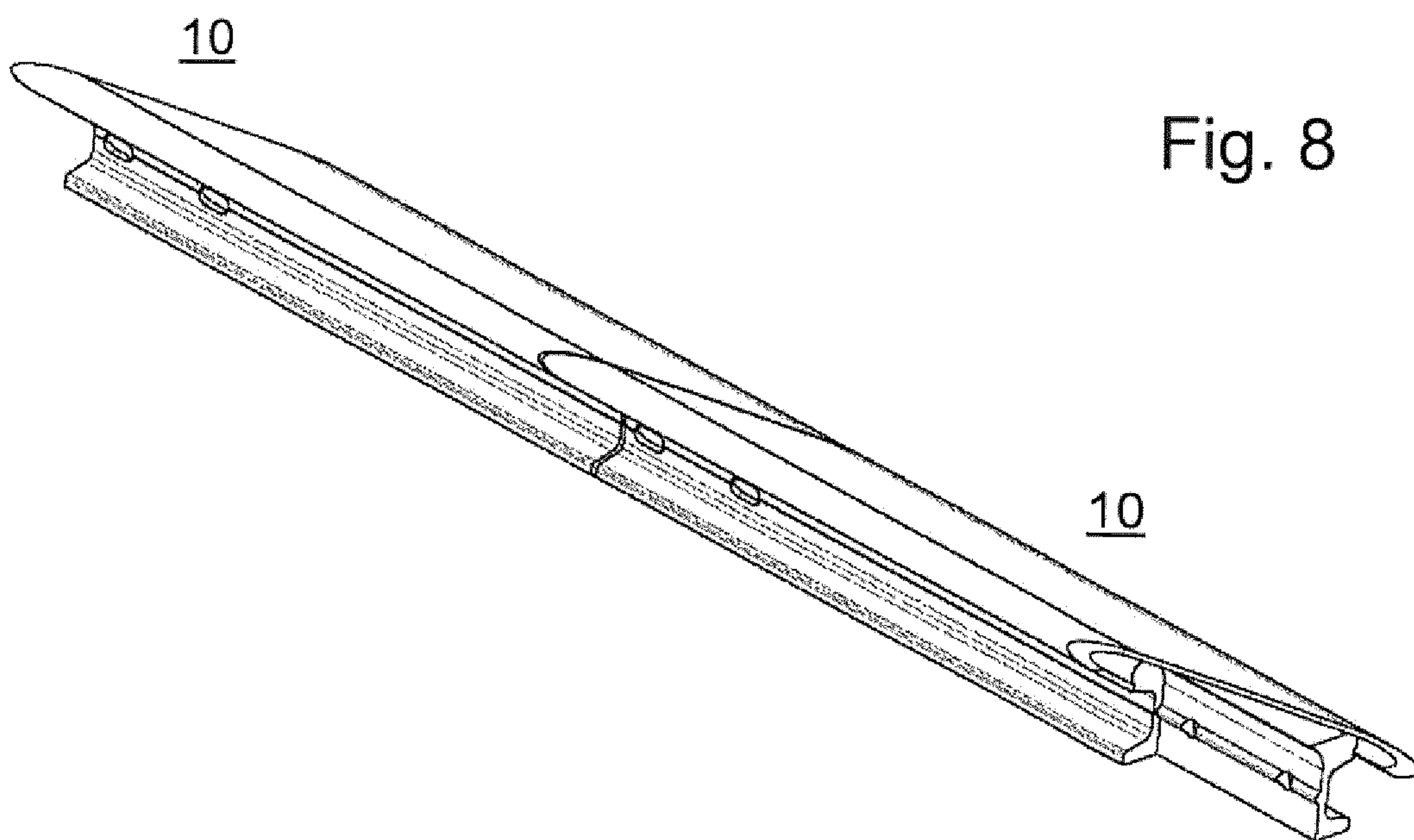
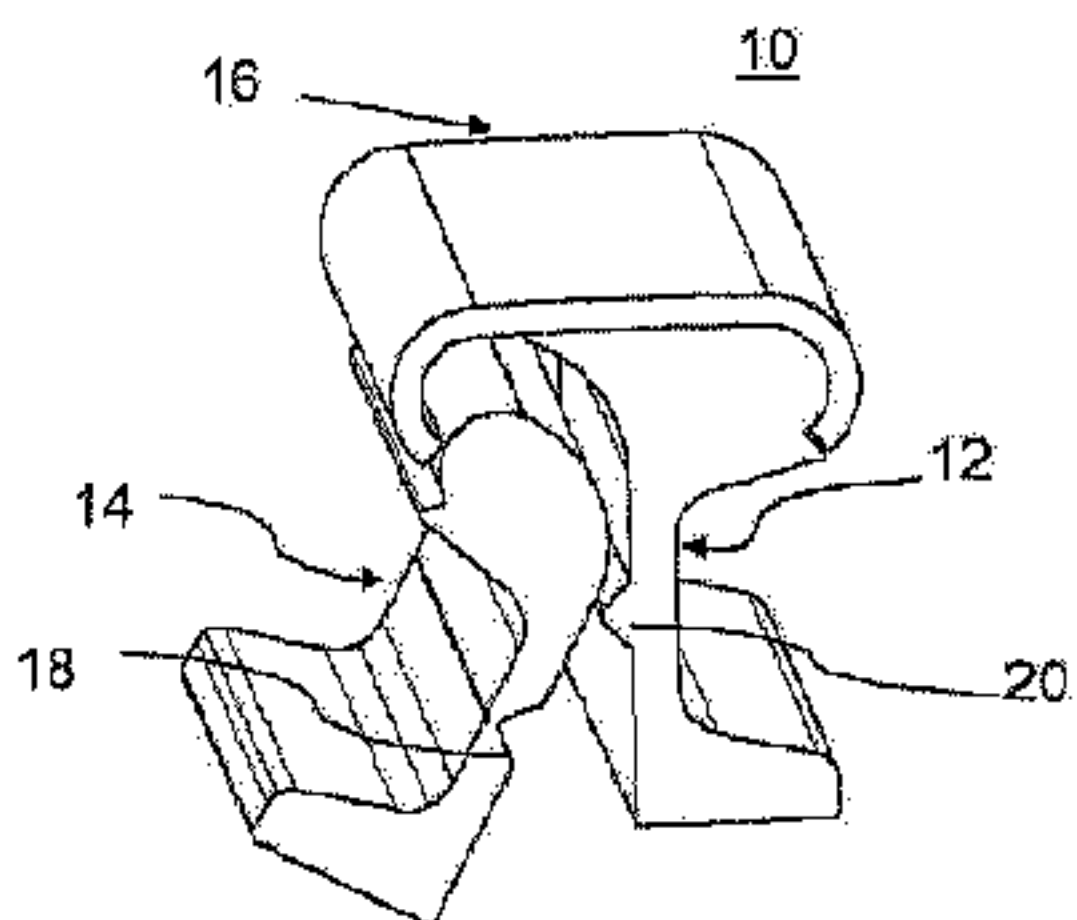


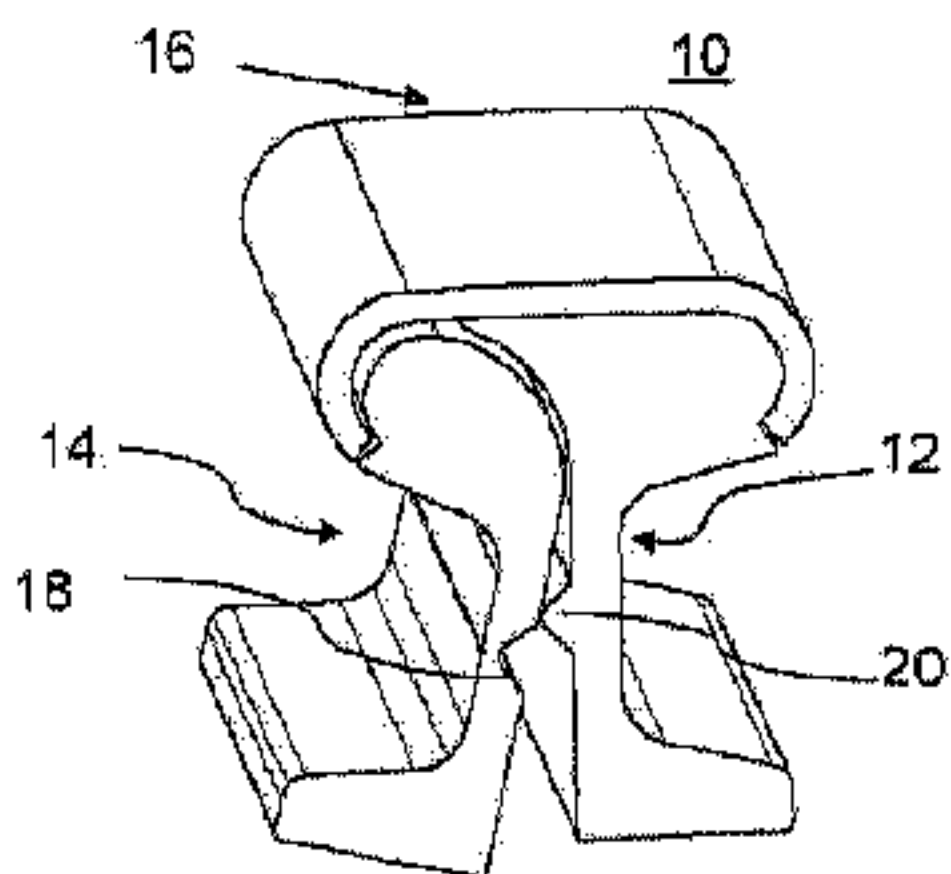
Fig. 8



a)



b)



c)

