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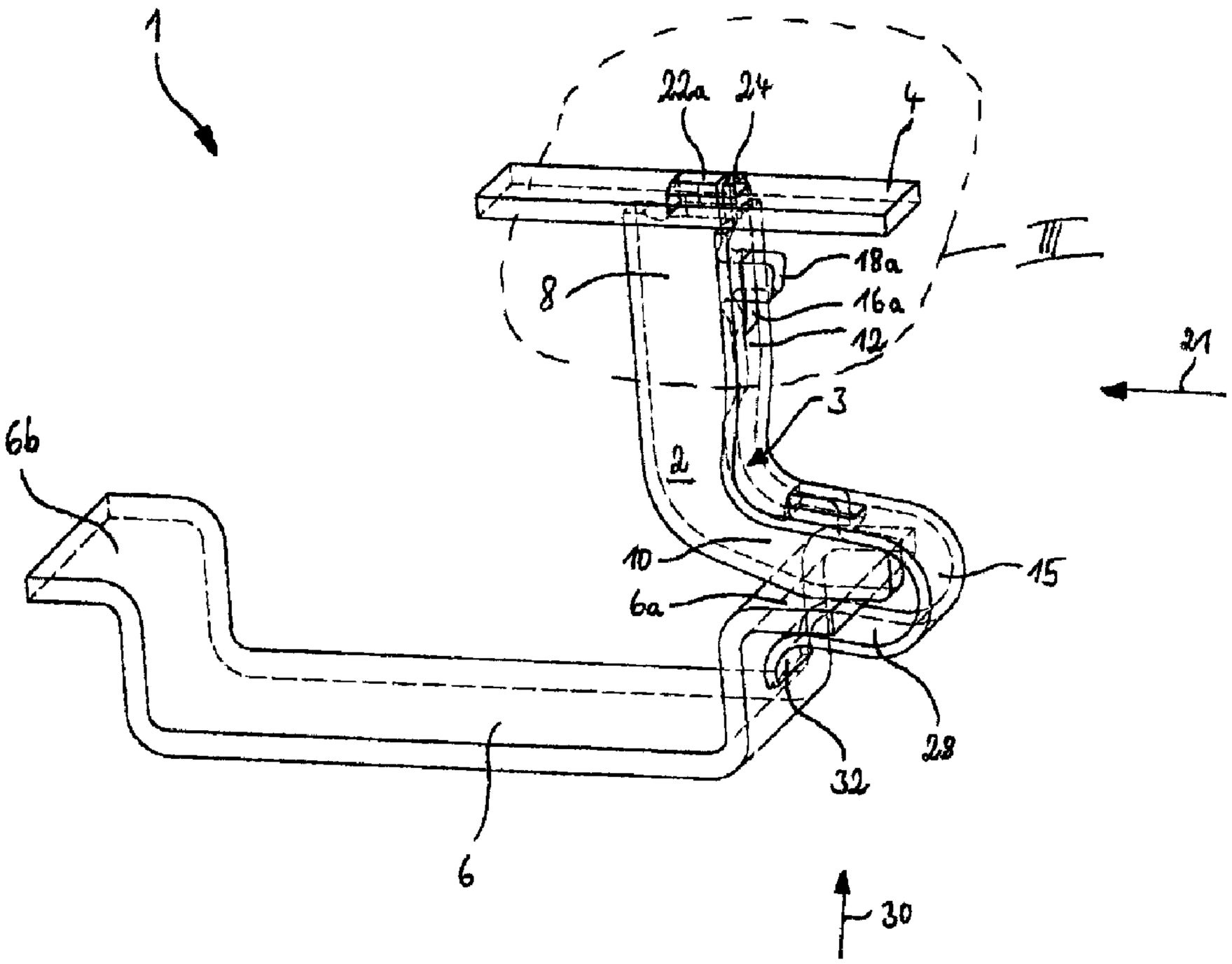

(57) Abrégé/Abstract:
In a connection system (1) with a current bar (4) and a contact foot (2,2') as well as a clamping element (3,3') and a bearing bar (6) with an edge (6a) behind which the clamping element (3,3') reaches, for purposes of simplifying production, the contact foot (2,2') is held at the current bar (4) by means of a resilient clamp connection.

Abstract

In a connection system (1) with a current bar (4) and a contact foot (2,2′) as well as a clamping element (3,3′) and a bearing bar (6) with an edge (6a) behind which the clamping element (3,3′) reaches, for purposes of simplifying production, the contact foot (2,2′) is held at the current bar (4) by means of a resilient clamp connection.

Fig. 1

CONNECTION SYSTEM

The invention relates to a connection system with a current bar and a contact foot and with a clamping element and a bearing bar with an edge, whereby the clamping element reaches behind the bearing bar edge and fixes the contact foot at the bearing bar.

This type of connection system, which is known from EP0 554 519 B1, for example, is usually part of a protective conductor terminal or a ground conductor terminal which serves for producing a conductive connection between one or more electrical conductors and a protective conductor busbar. To that end, a conductor bar with conductor terminals and a connection system comprising a mounting foot or contact foot, which is connected to said current bar, are installed in an insulating housing of the protective conductor series terminal or ground series terminal. The metallic mounting foot connects the current bar to the protective conductor busbar, also referred to as a bearing bar or cap bar.

In the known connection system, the contact foot and current bar are contacted by a fixed mechanical, and therefore permanent, connection, for instance by means of a weld, solder, or rivet joint between the contact foot and the current bar as according to the German utility model DE 77 12 331 U1. Additional assembly devices are needed in order to produce these permanent connections, which leads to an unwanted production expenditure in the assembly of the connection system and thus the assembly of the protective conductor terminal.

It is thus the object of the invention to simplify a connection system of the above type with respect to production.

This object is inventively achieved by a connection system with a current bar and a contact foot and with a clamping element and a bearing bar with an edge, whereby the clamping element reaches behind the bearing bar edge and fixes the contact foot at the bearing bar, characterized in that the contact foot is contacted at the current bar by means of a resilient clamp connection. The connection between the contact foot and the current bar of the connection system is constructed as a resilient clamp connection. In this context, resilient clamp connection also encompasses a catch mechanism whose spring action guarantees not only a secure mechanical retention or fixing but also a reliable electrical contact between the contact foot and the current bar. The clamp connection can be advantageously unmade.

The invention is based on the idea that such a connection system can be simplified with respect to production if the interconnection among its individual parts is achieved simply by putting the parts together. In order to ensure reliable conductive contact as well as mechanical stability, gaps in the connection between the current bar and the contact foot, which may arise as a result of production tolerances, for example, should be avoided or at least compensated. Such compensation can be easily and reliably achieved by placing at least one of the relevant parts in the connection under a certain initial mechanical tension.

The resilient clamp connection thus enables easy assembling of the mounting foot and the current bar without additional assembly devices, and on the other hand, it enables reliable contacting of the contact foot to the current bar, and therefore makes possible a durable electrical current.

In an expedient development of the connection system, two contact legs are provided, at least one of which is resilient. According to a first variant, both the first contact leg and the second contact leg are formed on the contact foot, whereas in a second variant, the first contact leg is formed on the contact foot, and the second contact leg is part of the clamping element.

In the first variant, the contact foot consists of a resilient material, whereby the two contact legs form a V prior to being contacted with the current bar. After the contact foot, which comprises the contact legs, has been connected to the current bar by the squeezing together of the two contact legs and the subsequent insertion of the free ends of the legs into receptive recesses or openings in the current bar, the contact legs in the clamp connection are under initial tension as a result of their spring force being exerted on the wall of the recess or opening. For purposes of accepting the two contact legs, one current bar opening can be provided for each of the free ends, or a common opening can be provided for both free ends.

In the second variant, the second contact leg extends as part of the clamping element parallel to the first leg, which is part of the contact foot, in the clamp connection to the current bar.

In either variant, the clamping element can be attached or arranged at the contact foot in different ways, the connection being either permanent or detachable. In the first variant, the clamping element is expediently formed at the contact foot. The clamping element is then a united or one-piece component of the contact foot, which makes possible a high degree of pre-production. The contact foot is then preferably a metallic punched profile part.

In the second variant, the clamping element is expediently a separate part consisting of resilient material, preferably in the form of a steel clamping spring produced from a punch-bent part. In this case, in order to guarantee precise positioning, the clamping element comprising the second contact leg includes a recess or holding opening, through which a holding or positioning nose that is formed at the contact foot reaches when these two individual parts have been put together. In the connection to the current bar, the second contact leg – which is united with the clamping element in this variant – is under an initial tension as a result of the spring force of the clamping element that is exerted on the edge of the recess or opening facing the clamping element. The free end of the leg of the clamping element is inserted in the same current bar opening as the free end of the (first) contact leg of the contact foot.

Whereas, in the one-piece variant, the spring effect that is required for the resilient clamp connection is achieved by the two contact legs being moved in the direction of one another and contacted with the current bar during the assembling process, in the two-piece variant, the end of the clamping element near the current bar only is led in the direction of the rigid contact foot, i.e. the first contact leg. To that end, in a development of the invention, an abutment is provided at the contact foot in the form of a camber that is directed toward the clamping element. This forms a bending edge for the clamping element during the compressing of the two contact legs for purposes of generating the initial tension required in the clamp connection to the current bar.

Instead of the fixing or receiving opening in the current bar for guaranteeing reliable contacting of the contact foot to the current bar, this can also have collar-type contours which then form the corresponding installation surfaces

for the free ends of the contact legs. For a catch connection, recesses or fixing openings are expediently provided in the current bar, which openings are engaged on the top side of the current bar, which is averted from the contact foot, in the region of their edges by catch elements which are formed on the free ends of the contact legs. In this current bar contacting mechanism by means of a catch, one contact opening (catch opening) can be provided for each contact leg, or one opening can be provided for both legs.

In either variant, the clamping element is at least partially arc-shaped or semicircular for purposes of fixing or holding the contact foot at the bearing bar with secure contact. This shape makes possible a reliable reach-around at the edge of the bearing bar with sufficient spring force. The arc-shaped or semicircular shape forms a clamping leg with a large clamping power at the free end of the clamping element on the bearing bar side.

The connection system is a component of a protective conductor terminal or ground conductor terminal. The connection system is inserted in the isolating housing of the protective conductor terminal and positioned there. Internally, the current bar is conductively connected to connection devices in the form of spring clamps or what are known as cage tension springs for the clamp contacting of ground conductors or protective conductors. For the clamp contacting, the protective conductor terminal is snapped onto the bearing bar, usually together with other series mounted devices, particularly for the phase conductors of a three-conductor or four-conductor network.

According to one aspect of the invention there is provided a connection system comprising:

a current bar;

a bearing bar having a bearing bar edge;

a contact foot having a first contact leg, said contact foot being contacted at said current bar in a resilient clamp connection;

a clamping element being separate from said contact foot and having a second contact leg, said clamping element extending behind said bearing bar edge and removably fixing said contact foot at said bearing bar; and

one of said first and second contact legs serving as an abutment for and resiliently prestressing the other of said first and second contact legs in said resilient clamp connection with said current bar.

According to a further aspect of the invention there is provided a connection system comprising:

a current bar;

a bearing bar having a bearing bar edge;

a contact foot having a first contact leg and a second contact leg formed thereon, said contact foot being contacted at said current bar in a resilient clamp connection, and one of said first and second contact legs being deflected towards and resiliently prestressing the other of said first and second contact legs in said resilient clamp connection with said current bar; and

a clamping element formed on said contact foot, extending behind said bearing bar edge and removably fixing said contact foot at said bearing bar.

According to another aspect of the invention there is provided a protective conductor terminal comprising:

a current bar;

a bearing bar having a bearing bar edge;

a contact foot having a first contact leg, said contact foot being contacted at said current bar in a resilient clamp connection;

a clamping element being separate from said contact foot and having a second contact leg, said clamping element extending behind said bearing bar edge and removably fixing said contact foot at said bearing bar; and

one of said first and second contact legs serving as an abutment for and resiliently prestressing the other of said first and second contact legs in said resilient clamp connection with said current bar.

According to yet another aspect of the invention there is provided a protective conductor terminal comprising:

a current bar;

a bearing bar having a bearing bar edge;

a contact foot having a first contact leg and a second contact leg formed thereon, said contact foot being contacted at said current bar in a resilient clamp connection, and one of said first and second contact legs being deflected towards and resiliently prestressing the other of said first and second contact legs in said resilient clamp connection with said current bar; and

a clamping element formed on said contact foot, extending behind said bearing bar edge and removably fixing said contact foot at said bearing bar.

The advantages of the invention consist specifically in the ability to assemble the individual parts of the connection system easily by virtue of a resilient connection in the form of a plug, clamp, or catch connection between a current bar and a contact foot of a connection system, with or without a separate clamping or spring element. In addition, with few individual parts, a particularly high level of pre-production can be achieved for the connection system, and with it a protective conductor terminal. By developing the individual parts as plug elements, a modular connection system, particularly for ground conductor

terminals, is provided according to a unit assembly system, with which a number of different instances can be realized.

Exemplifying embodiments of the invention will now be described with the aid of a drawing. Shown are:

Fig. 1: perspective representation of a connection system with a contact foot and a separate clamping spring;

Fig 2: the connection system according to Fig. 1 in an exploded view;

Fig. 3: a section III from Fig. 1 with an enlarged view of a resilient single-hole clamp connection in the region of the current bar;

Fig. 4: perspective view of an alternative embodiment of the connection system with a clamping element that is formed on the contact foot;

Fig. 5: the connection system according to Fig. 4 in an exploded view; and

Fig. 6: a section VI from Fig. 4 in an enlarged view with a resilient two-hole clamp connection in the region of the current bar.

Corresponding parts are provided with identical reference characters in all Figures.

In a first two-part embodiment – previously referred to as the second variant – of the inventive connection system 1 according to Figures 1 to 3, a contact foot or attachment foot 2 and a clamping element 3 are disposed between a current bar 4 and a bearing bar 6 as separate parts. The top half of the contact foot 2, which is the side nearer the current bar, is constructed as a contact leg 8, whereas the second half, the side near the bearing bar, forms a contact nose 10. The contact foot 2 is a one-piece component, preferably a punched part.

The clamping element 3, which is produced from a bent or rolled sheet part, is disposed at the contact foot 2. The top half of the clamping element 3, the side near the current bar, likewise serves as contact leg 12, which is adapted to the shape and curve of the contact or attachment foot 2. In the bottom region on the bearing bar side, the clamping element 3 comprises an arc-shaped or U-shaped clamping leg 15, whereby a clamp opening 14 is formed, which leg, in joining with the bearing bar 6, reaches around, and makes clamping contact with, the

edge 6a of the bearing bar and the contact nose 10, which abuts said edge, of the contact foot 2.

The clamping element 3 has a holding opening and a positioning opening 16a and 16b, respectively, in the form of rectangular through-opening or recesses on the current bar side and bearing bar side. Corresponding holding noses 18a and 18b which are formed at the contact foot 2 reach through these holding openings 16a and 16b, respectively, so that the clamping element 3 is positioned and fixed in place in the assembled condition.

An expediently rectangular fixing or clamping opening 20 is located in the current bar 4. On the free end, which faces the current bar 6, of the contact leg 8 of the contact foot 2, a fixing nose 22a is formed, which is inserted into the clamping opening 20 together with a clamping nose 24 which is realized on the free end of the contact leg 12 of the clamping element 3. In order to insert the two contact legs 8 and 12 into the clamping opening 20, the contact leg 12, and with it the clamping nose 24, are pressed in bending direction 25 parallel to the bearing bar 6 and the current bar 4.

The bending, which generates initial spring tension, occurs around a bending edge 25, which is formed by a camber 27 that is formed on the contact foot 2 in the region of the leg 8 thereof. The camber 27, which is raised in the direction of the clamping element 3, thus serves as an abutment or an abutment cam for the clamping element 3 for purposes of prestressing it when the contact leg 8 of the contact foot 2 and the contact leg 12 of the clamping element 3 are pressed together. This prestressing of the clamping element 3 guarantees a reliable resilient clamp or catch connection and thus a reliable contacting of the contact foot 2 to the current bar 4. The spring deflection of the clamping nose 24, and thus of the contact leg 12 of the clamping element 3, which deflection the resilient clamping element 3 requires for correction, is blocked by the edge of the fixing or clamping opening 20, which acts as a stop.

For fixing the contact foot 2 to the bearing bar 6, the U-shaped clamping leg 15 of the clamping element 3 forms a clamping arm 28, which is located on the bottom side of the bearing bar 6, the side averted from the contact nose 10.

By swinging out during the insertion of the bearing bar edge 6a into the clamping element opening 14, the clamping arm 28 exerts a clamping pressure on the bearing bar edge 6a in the clamping pressure direction 30. In order to guarantee easy insertion of the bearing bar edge 6a into the clamping element opening 14, an incline 32 which runs opposite the clamping pressure direction 30 is formed on the clamping arm 28 at the free end.

Figure 2 represents relatively clearly the shapes and designs of the contact foot 2 and the clamping element 12 in the two-part variant. The clamp contacting of the contact foot 2 at the bearing bar 6 by means of the separate clamping element 3 occurs only at one of the two bearing bar edges 6a or 6b, which is advantageous particularly in view of the small material requirement.

Figure 3 is a detail representation of the clamp connection between the current bar 4 and the two clamp or contact legs 8 and 12 of the contact foot 2 and the clamping element 3 in perspective. A cushion-type inwardly bulging edge of the fixing or clamping opening 20 is evident. This achieves a precise positioning of the free ends of the legs in the form of the fixing nose 22a of the contact foot 2 and the clamping nose 24 of the clamping element 3, which reach through the clamping opening 20 in the clamp connection. In addition, the two clamp legs 8, 12 are led close to one another in the direction of pressure 34, forming only a small clamp gap 35, whereby the approximately linear contact leg 12 of the clamping element 3 is pressed to the contact foot 2.

Due to the camber 27 acting as an abutment cam, a certain amount of pressure is required in order to be able to insert the fixing nose 22a and the clamping nose 24 into the fixing opening 20. The clamping nose 24 exerts a clamping pressure on the fixing opening 20 by way of the spring pressure that is directed against the direction of pressure 34. This resilient clamp contact can be unmade by moving the contact leg 3 further in pressure direction 34, whereby the width d of the clamping gap 35 is reduced, and the clamping between the contact foot 2, the clamp element 12, and the current bar 4 is released.

In the one-part embodiment of the connection system 1, which is represented in Figures 4 to 6 (previously referred to as the first variant), the

contact foot 2′ and the clamping element 3′ are a one-piece or united molded part. In this variant, the clamping element 3′ is formed on the contact foot 2′ in the region of the contact nose 10. This unified contact-clamp element is a punched profile part, preferably a metallic punched profile part consisting at least partly of a copper special alloy. In contrast to the variants according to Figures 1 to 3, in this variant, both the first contact leg 8′ and the second contact leg 12′ are formed on the contact 2′. The two contact legs 8′ and 12′ extend substantially parallel to one another in the clamp connection shown in Figures 4 and 6, whereas the contact legs 8′ and 12′ form an approximate V shape in the initial condition according to Figure 5. Each of the fixing noses 22b and 22c which are formed on the first contact leg 8′ and the second contact leg 12′ reaches through a respective fixing opening 20a or 20b in the current bar 4.

The clamping element 3′ that is formed on the contact foot 2′ in turn forms an arc-shaped or U-shaped clamping leg 15, which likewise comprises an inclination 32′ on the free end for inserting the bearing bar edge 6a. The clamping element 3′ in turn exerts a clamping force in the clamping direction 30 upon the bearing bar edge 6a, which, analogously to the variant according to the Figures 1 to 3, also lies between the contact nose 10 of the contact foot 2′ and the clamping arm 28′ of the clamping element 3′ in the clamp or catch connection, with the effect that an isolating housing, which accepts the connection system 1, of a protective conductor terminal (which is not represented in detail) is held on or at the bearing bar 6 in a reliable but detachable fashion. For this reason, the clamping element 3′ exhibits the requisite resilient characteristics based on its arch-shaped design.

Fig. 5 represents an insertion gap 38 between the free end of the clamping arm 28′ of the clamping element 3′ and the contact nose 10 of the contact foot 2′, whereby this insertion gap 38 is smaller than the profile thickness of the bearing bar edge 6a. With the insertion or pushing of the bearing bar edge 6a along the inclination 32′ into said gap 38, said gap 38 is enlarged or widened under the initial tension of the clamping element 3′. In turn, the clamping arm 28 exerts the requisite holding or fixing pressure on the bearing bar edge 6a in clamping

pressure direction 30 based on its resilience. The contact nose 10 of the contact foot 2′ serves as abutment therein.

Figure 6 represents a detail view of the resilient clamp connection that is formed in this variant between the two contact legs 8′, 12′ of the contact foot 2′ and the current bar 4. The clamp contact is achieved by way of the two fixing noses 22b and 22c which are formed at the contact legs 8′, 12′. For purposes of penetrating the two fixing openings 20a and 20b, the two contact legs 8′, 12′, which form a V in their resting position, are moved toward one another with their fixing noses 22b and 22c, whereby the two fixing noses 22b and 22c are pressed in bending directions 40 and 42, respectively. The pressure of the two contact legs 8′ and 12′ to correct themselves against their respective bending directions 40 and 42 gives rise to the resilient clamp contact between the contact foot 2′ and the current bar 4. In the clamp connection, the two contact legs 8′ and 2′ are parallel to one another.

This resilient clamp contact can also be unmade by moving the two contact legs 8′ or 12′ in their respective bending directions 40, 42 until the contact between the fixing noses 22b, 22c and the corresponding fixing openings 20a and 20b is lost. The two contact legs 8′ and 12′ can then be withdrawn from the corresponding fixing openings 20a and 20b, whereby the clamping between the contact foot 2′ and the current bar 4 is released.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A connection system comprising:

a current bar;

a bearing bar having a bearing bar edge;

a contact foot having a first contact leg, said contact foot being contacted at said current bar in a resilient clamp connection;

a clamping element being separate from said contact foot and having a second contact leg, said clamping element extending behind said bearing bar edge and removably fixing said contact foot at said bearing bar; and

one of said first and second contact legs serving as an abutment for and resiliently prestressing the other of said first and second contact legs in said resilient clamp connection with said current bar.

2. A connection system according to claim 1, wherein said second contact leg is at least approximately parallel to said first contact leg.

3. A connection system according to claim 1 or 2, wherein:

said clamping element has at least one holding opening; and

said contact foot has a holding nose extending through said at least one holding opening.

4. A connection system according to any one of claims 1 to 3, wherein said contact foot has a camber raised toward said clamping element and forming an abutment for said second contact leg.

5. A connection system according to any one of claims 1 to 4, wherein said clamping element has a clamping region allocated to said bearing bar edge and is arch-shaped in said clamping region.

6. A connection system comprising:

a current bar;

a bearing bar having a bearing bar edge;

a contact foot having a first contact leg and a second contact leg formed thereon, said contact foot being contacted at said current bar in a resilient clamp connection, and one of said first and second contact legs being deflected towards and resiliently prestressing the other of said first and second contact legs in said resilient clamp connection with said current bar; and

a clamping element formed on said contact foot, extending behind said bearing bar edge and removably fixing said contact foot at said bearing bar.

7. A connection system according to claim 6, wherein:

said first and second contact legs have free ends; and

said current bar has at least one opening for receiving said free ends.

8. A connection system according to claim 6 or 7, wherein said first and second contact legs are disposed in a V shape.

9. A connection system according to any one of claims 6 to 8, wherein said clamping element has a clamping region allocated to said bearing bar edge and is arch-shaped in said clamping region.

10. A protective conductor terminal comprising:

a current bar;

a bearing bar having a bearing bar edge;

a contact foot having a first contact leg, said contact foot being contacted at said current bar in a resilient clamp connection;

a clamping element being separate from said contact foot and having a second contact leg, said clamping element extending behind said bearing bar edge and removably fixing said contact foot at said bearing bar; and

one of said first and second contact legs serving as an abutment for and resiliently prestressing the other of said first and second contact legs in said resilient clamp connection with said current bar.

11. A protective conductor terminal comprising:

a current bar;

a bearing bar having a bearing bar edge;

a contact foot having a first contact leg and a second contact leg formed thereon, said contact foot being contacted at said current bar in a resilient clamp connection, and one of said first and second contact legs being deflected towards and resiliently prestressing the other of said first and second contact legs in said resilient clamp connection with said current bar; and

a clamping element formed on said contact foot, extending behind said bearing bar edge and removably fixing said contact foot at said bearing bar.

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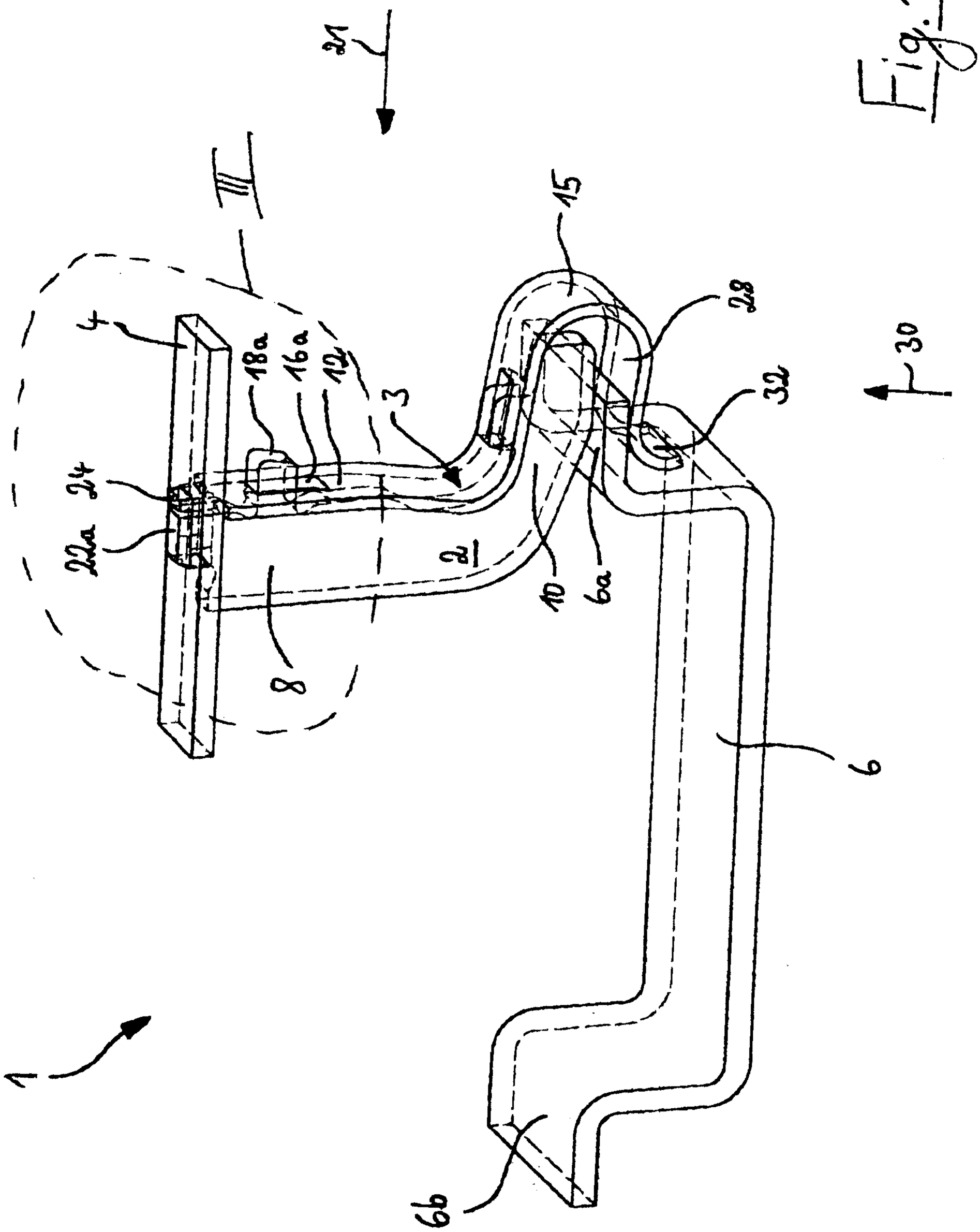

Fig. 1

Fig. 2

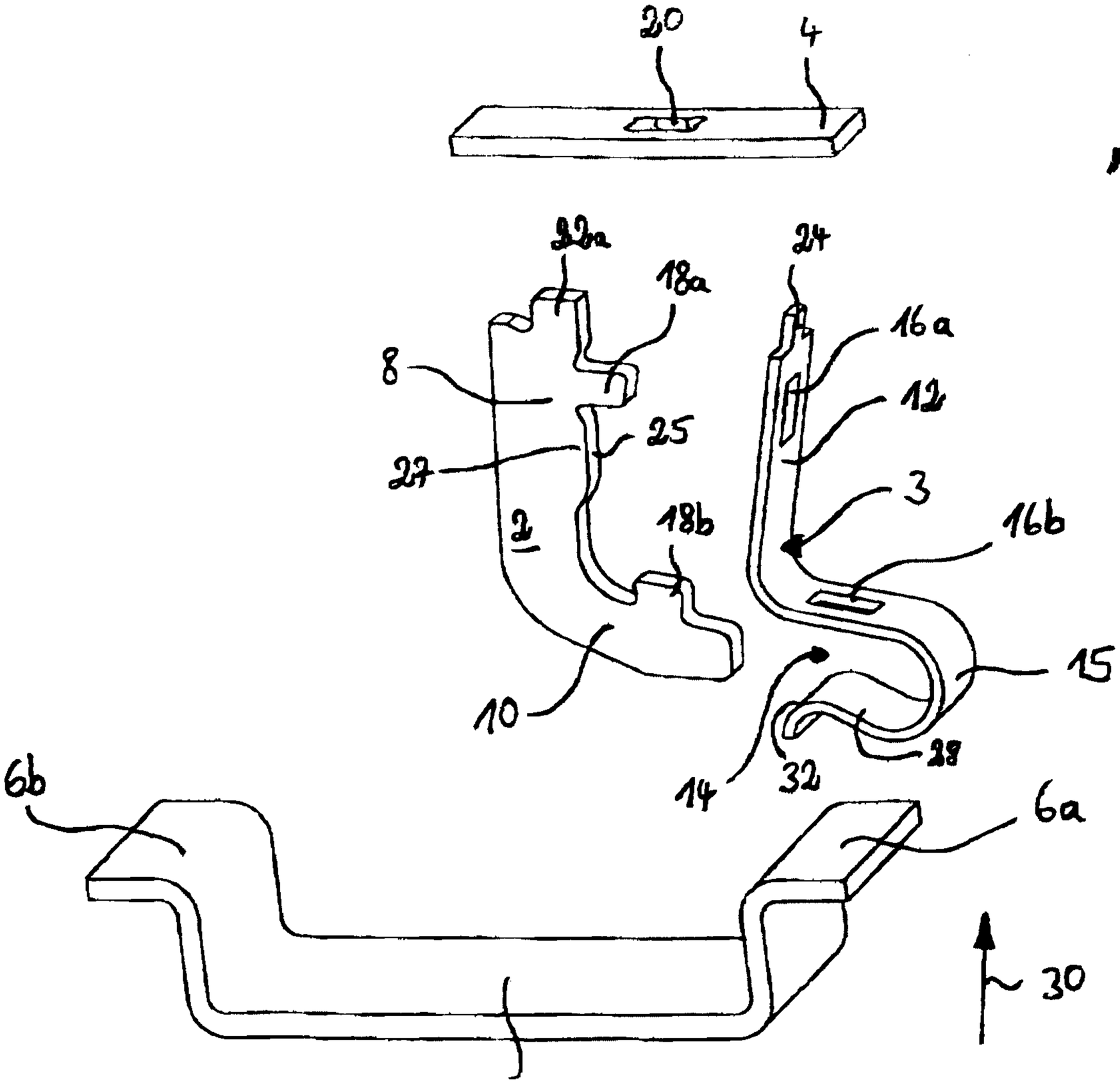

Fig. 3

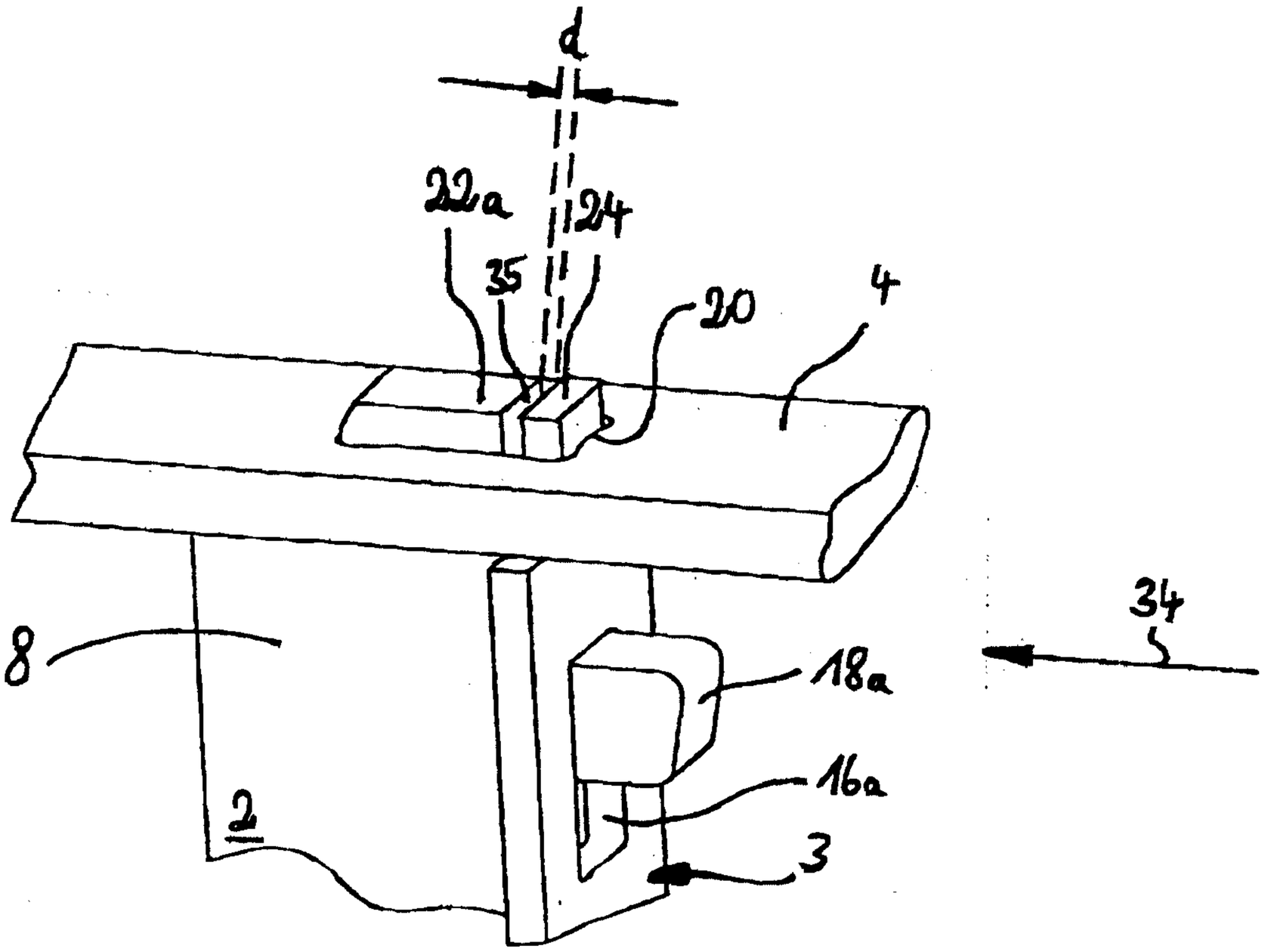

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Fig. 4

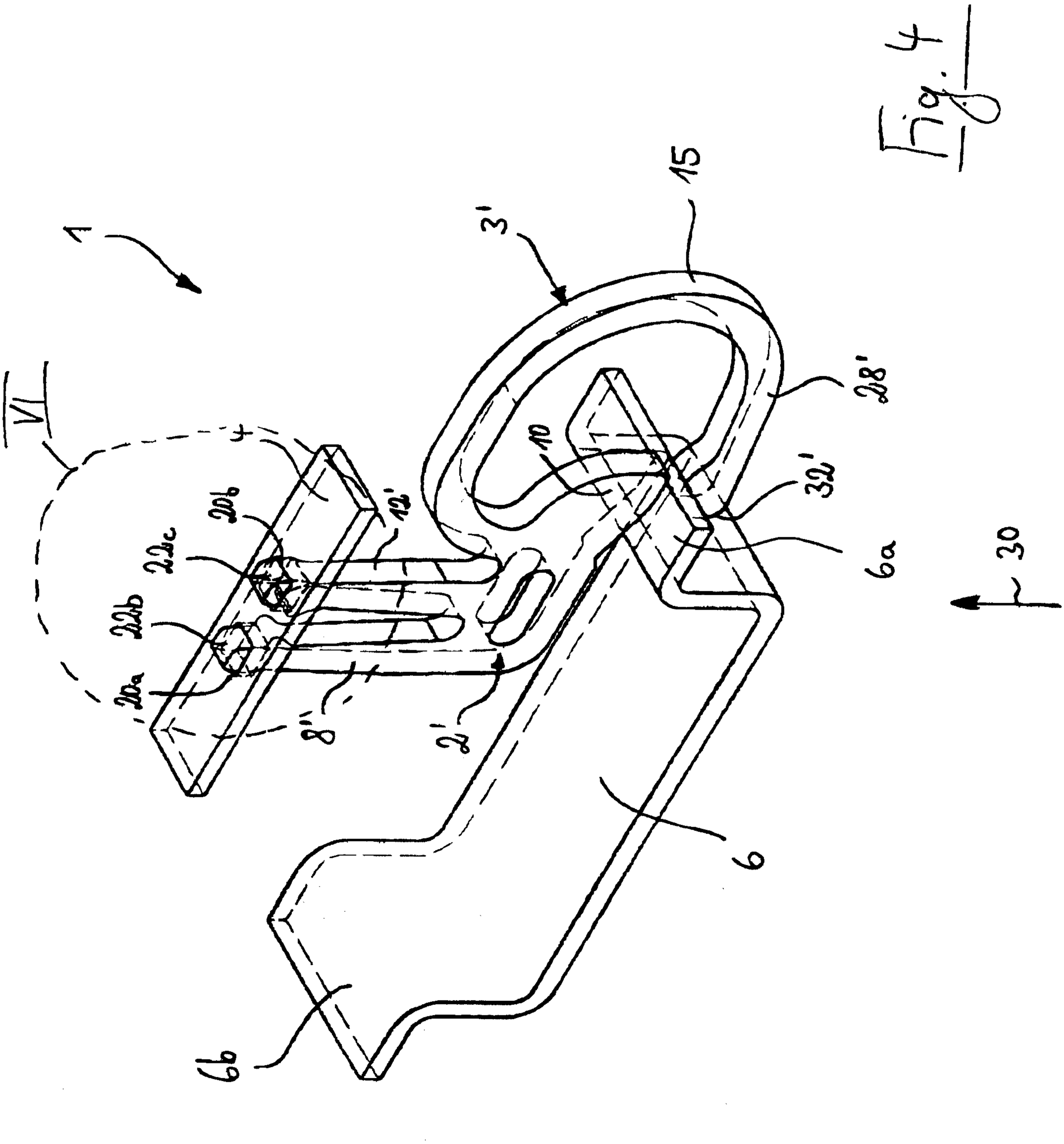

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Fig. 5

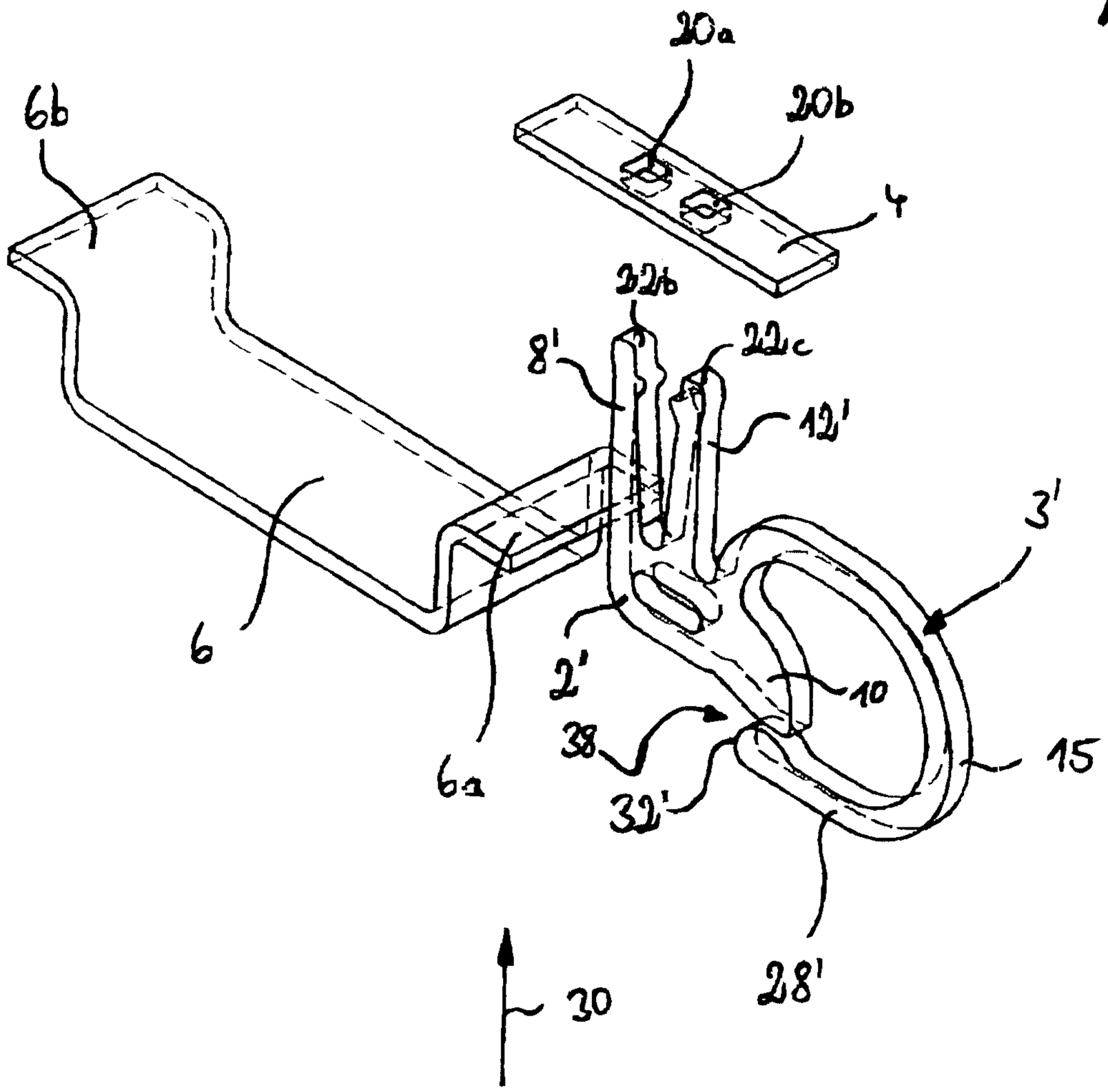
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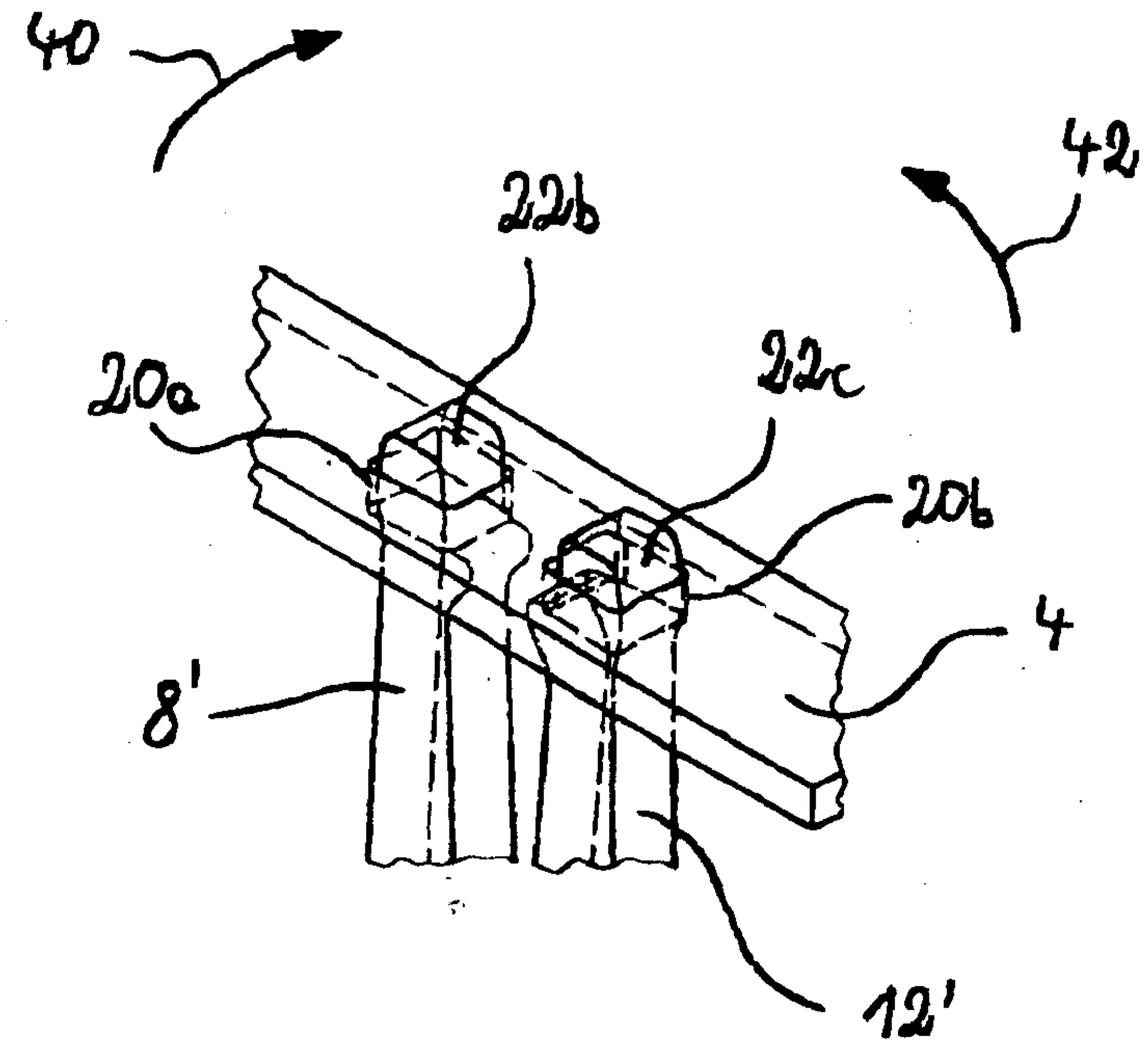
Fig. 6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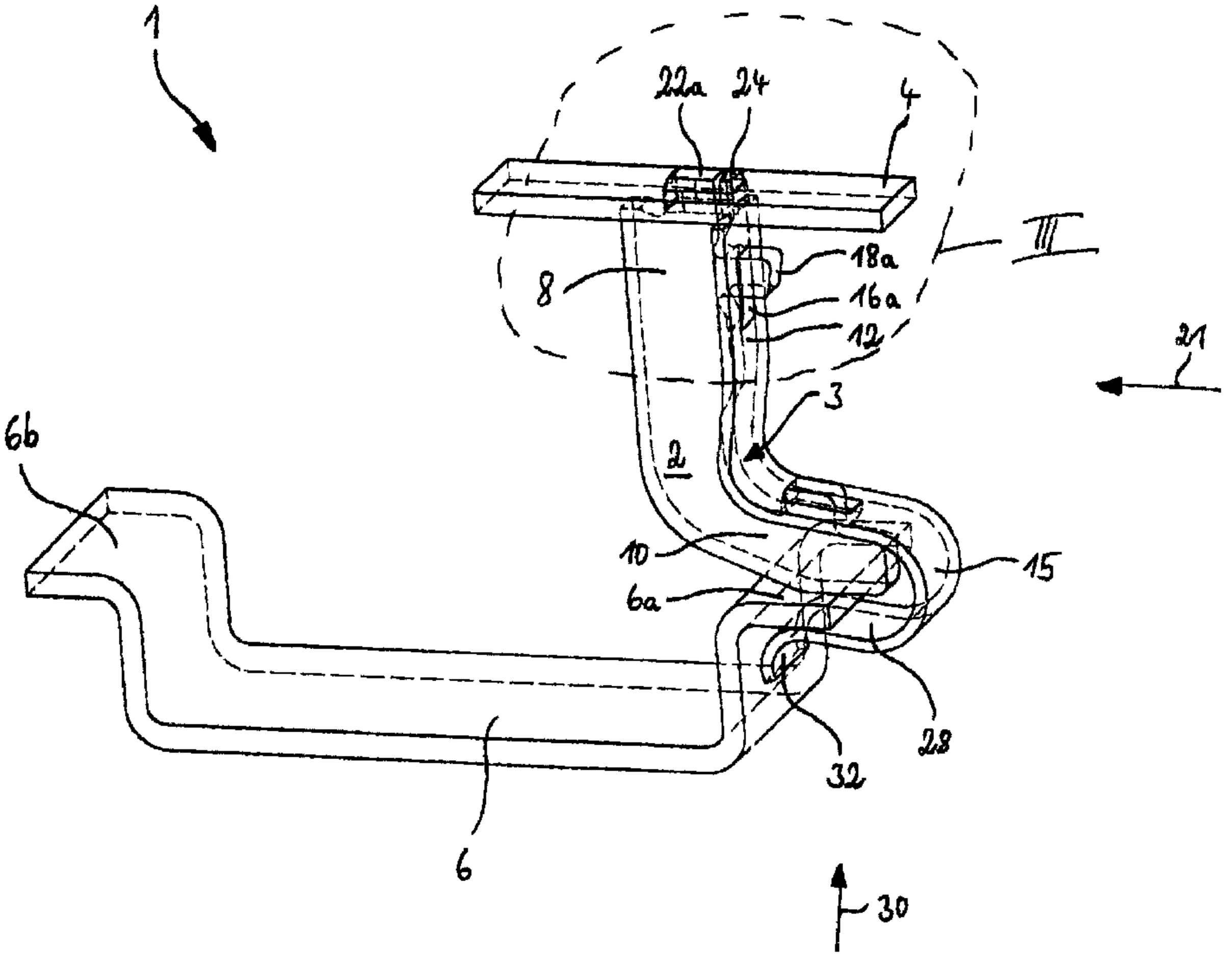
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