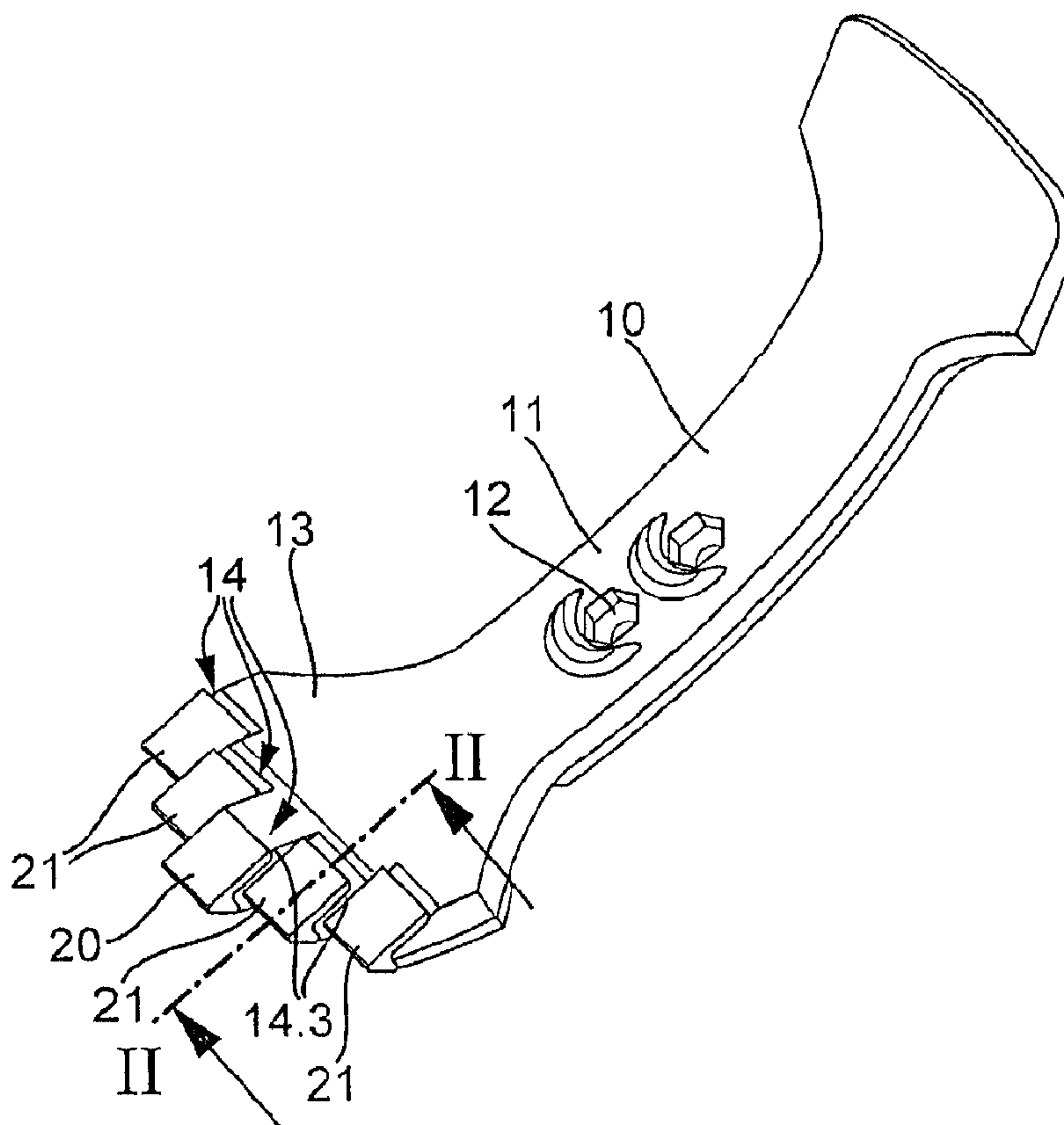




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(54) Titre : OUTIL DE TRAVAIL DU SOL
 (54) Title: SOIL WORKING TOOL



(57) Abrégé/Abstract:

The invention relates to a soil working tool, in particular a cultivator tip, having a carrier (10) which bears a primary cutting element (20) and at least two secondary cutting elements (21) on a cutter holder (13), wherein both the primary cutting element (20) and the secondary cutting elements (21) comprise a cutting edge (20.3, 21.3). In order to optimize the penetration so as to achieve better cutting results, the cutting edges of the secondary cutting elements (21) are arranged offset with respect to the cutting edges of the primary cutting element (20).

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(54) Title: SOIL WORKING TOOL

(54) Bezeichnung : BODENBEARBEITUNGSWERKZEUG

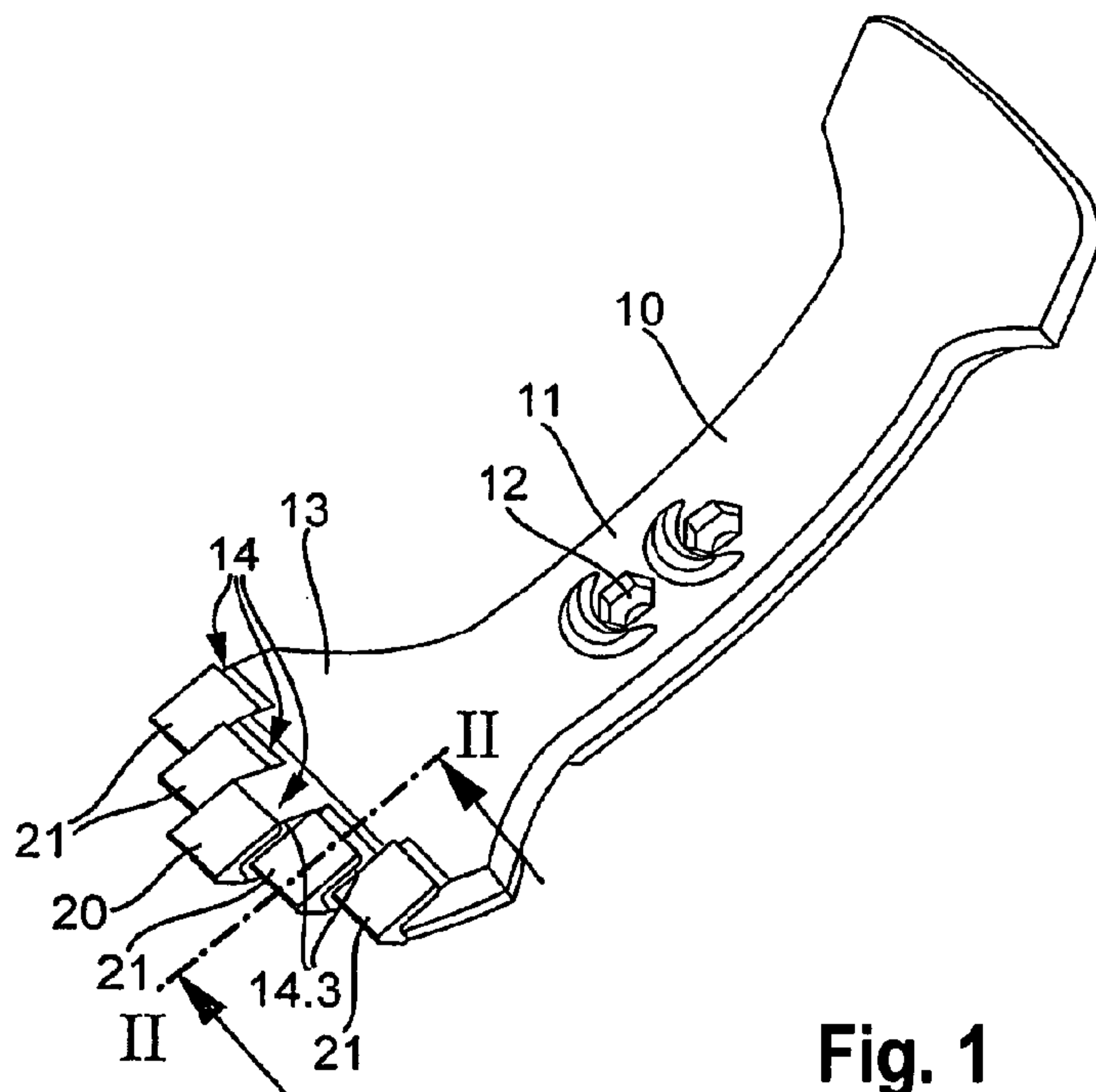


Fig. 1

(57) Abstract: The invention relates to a soil working tool, in particular a cultivator tip, having a carrier (10) which bears a primary cutting element (20) and at least two secondary cutting elements (21) on a cutter holder (13), wherein both the primary cutting element (20) and the secondary cutting elements (21) comprise a cutting edge (20.3, 21.3). In order to optimize the penetration so as to achieve better cutting results, the cutting edges of the secondary cutting elements (21) are arranged offset with respect to the cutting edges of the primary cutting element (20).

(57) Zusammenfassung: Die Erfindung betrifft ein Bodenbearbeitungswerkzeug, insbesondere eine Grubberspitze mit einem Träger (10), das an einem Schneidenhalter (13) ein Haupt-Schneidelement (20) und wenigstens zwei Neben-Schneidelemente (21) trägt, wobei sowohl das Haupt-Schneidelement (20) als auch die Neben-Schneidelemente (21) jeweils eine Schneidkante (20.3, 21.3) aufweisen. Um eine Optimierung der Penetration zu Gunsten eines besseren Schneidergebnisses zu erhalten, ist es vorgesehen, dass die Schneidkanten der Neben-Schneidelemente (21) gegenüber den Schneidkanten des Haupt-Schneidelementes (20) versetzt angeordnet sind.

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CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG). — *mit internationalem Recherchenbericht (Artikel 21 Absatz 3)*

Soil Working Tool

The invention relates to a soil working tool, in particular a cultivator tip, having a support, which supports a primary cutting element and at least two secondary cutting elements on a cutter holder, wherein both the primary cutting element and the secondary cutting elements each have a respective cutting edge. A soil working tool of this kind is known from Patent DE102009029894 in which the cutting elements are soldered to the cutter holder and the primary cutting element forms a cutting edge transverse to the advancing direction of the tool. The secondary cutting elements are set at an angle to the primary cutting element.

The object of the invention is to create a soil working tool of the kind mentioned at the beginning that makes it possible to optimize penetration for the benefit of a better cutting result.

This object is attained with the soil working tool in which the cutting edges of the secondary cutting elements are situated so that they are offset relative to the cutting edges of the primary cutting element, with the cutting edges of the secondary cutting elements extending parallel to one another.

Because the cutting edges of the secondary cutting elements are no longer oriented obliquely and positioned in a V shape relative to one another as in the prior art, a cleaner, straighter cut is produced, which produces a more definite cutting result and because of the shorter cutting edges, requires less tractive effort. This improves penetration into the soil. Furthermore, for the benefit of lower manufacturing costs, shorter lengths of hardened metal can also be used, making it possible to maintain the same plowshare width as in the prior art.

According to a preferred variant of the invention, it is possible for the cutting edges of the secondary cutting elements to be arranged flush with one another. This produces a uniform tool load during the cutting engagement, which in particular prevents damage to the attachment of the cultivator tip.

It is particularly preferable for the cutting edge of the primary cutting element to extend parallel to the cutting edges of the secondary cutting elements. This produces a stepped cutting engagement with clean, straight cuts.

Particularly good cutting results can be achieved especially if the cutting edge of the primary cutting element is spaced at least 4 mm apart from the cutting edge of the secondary cutting element. This spacing achieves a stepped cutting engagement for the benefit of a lower required advancing power. This also avoids the formation of a trench bottom.

It has turned out that the cutting edge of the primary cutting element should be spaced a maximum of 15 mm from the cutting edge of the secondary cutting element. This achieves a particularly stable tool design.

A soil working tool according to the invention can be embodied so that the cutter holder has cutting element mounts for the primary cutting element and the secondary cutting elements; the cutting element mounts have a seat surface and a contact surface situated at an angle thereto; the primary cutting element and the secondary cutting elements are each supported with a fastening section on the seat surface and with a cutting attachment on the contact surface. This achieves a mechanically stable cutting geometry. Furthermore, it is also possible for the contact surfaces and/or the seat surfaces of the secondary cutting elements and of the primary cutting element to be oriented parallel to one another. This makes it possible to ensure a simple, exact, and reproducible orientation of the secondary cutting elements and the primary cutting element.

According to a conceivable embodiment of the invention, it is possible for the primary cutting element to protrude in the advancing direction relative to the secondary cutting elements or for it to be recessed relative to them.

Preferably, the seat surfaces are spaced apart from one another by a distance in the range from 8 to 14 mm. This produces stable tooth geometries on the cutter holder for accommodating the cutting elements. In this connection, it is also particularly possible

for the contact surfaces to be spaced apart from one another by at least 4 mm, but preferably by a distance in the range from 15 mm to 30 mm.

If the diverting surfaces are oriented at an angle to one another, preferably by an angle in the range between 0.1° and $< 90^\circ$, then the aggressiveness of the soil working tool can be adjusted by the way in which the diverting surfaces of the secondary cutting elements are set relative to the primary cutting element. More steeply angled diverting surfaces result in a more powerful displacement of material, while more gently sloped angles reduce the required traction force of the machine.

In another preferred variant of the invention, both the primary cutting element and the secondary cutting elements have diverting surfaces that are situated so that they are parallel to one another and spaced apart from one another by at least 4 mm, but preferably by a distance in the range from 5 mm to 11 mm. The provision of parallel diverting surfaces makes it possible to convey the cut material away in a precise fashion. The diverting surfaces also serve to protect the steel body from erosion.

For the benefit of a symmetrical distribution of force, it is conceivable according to the invention for the secondary cutting elements to be arranged on the cutter holder symmetrical to the primary cutting element and on both sides of it. This produces an inward-directed flow of material from the secondary cutting elements to the primary cutting element. The secondary cutting elements are subjected to a greater level of abrasive wear, which is accompanied by the benefit of a lower stress on the primary cutting element. In addition, the inward-directed material flow subjects the cutter holder to less abrasive wear on the sides.

In particular, it is also conceivable for at least two secondary cutting elements to be provided on each side of the primary cutting element. This makes it possible to produce a plurality of cutting steps.

A good distribution of force on both the primary cutting element and the secondary cutting elements can be achieved in a simple way by embodying the width of the cutting

edges of the secondary cutting elements to be at least 0.5 times the width of the cutting edge of the primary cutting element.

A soil working tool according to the invention can be embodied so that the cutting edge of the primary cutting element is arranged perpendicular to the advancing direction (V) and is offset in the direction of the force of gravity relative to the cutting edge of the secondary cutting element; this achieves a furrow-opening action and reduces the undesirable formation of a trench bottom.

In a particularly preferred embodiment, it is also possible for the support to have a raised breaking rib and/or a recessed breaking groove. This achieves a breaking up of clods and/or a displacement of soil.

The invention will be explained in detail below in conjunction with exemplary embodiments shown in the drawings.

Fig. 1 is a perspective depiction of a cultivator tip

Fig. 2 is a sectional view of the cultivator tip from Fig. 1, viewed along the cutting line labeled II – II in the figure;

Fig. 3 shows another embodiment variant of a cultivator tip;

Fig. 4 is a sectional view along the cutting line labeled IV – IV in Fig. 3;

Fig. 5 is a perspective depiction of another embodiment variant of a cultivator tip;

Fig. 6 is a sectional view along the cutting line labeled VI – VI in Fig. 5;

Fig. 7 is a perspective depiction of another embodiment variant of a cultivator tip;

Fig. 8 is a sectional view along the cutting line labeled VIII – VIII in Fig. 7;

- Fig. 9 is a perspective depiction of another embodiment variant of a cultivator tip;
- Fig. 10 is a sectional view along the cutting line labeled X – X in Fig. 9;
- Fig. 11 is a sectional view along the cutting line labeled XI – XI in Fig. 9;
- Fig. 12 is a perspective depiction of another embodiment variant of a cultivator tip;
- Fig. 13 is a sectional view of the cultivator tip according to Fig. 12, viewed along the cutting line labeled XIII – XIII in the figure;
- Fig. 14 is a perspective depiction of another embodiment variant of a cultivator tip;
- Fig. 15 is a sectional view of the cultivator tip according to Fig. 14, viewed along the cutting line labeled XV – XV in the figure; and
- Fig. 16 is a sectional view along the cutting line labeled XVI – XVI in Fig. 14.

Fig. 1 shows a cultivator tip with a support 10 composed of a steel body. The cultivator tip has a fastening section 11 that is provided with fastening mounts 12 in the form of through openings. The support 10 has a cutter holder 13 at one end, which is equipped with cutting element mounts 14.

As is clear from Fig. 2, the cutting element mounts 14 have a seat surface 14.1 that is oriented in the advancing direction V of the cultivator tip. This seat surface 14.1 is adjoined at an angle by a contact surface 14.2. The cutting element mounts 14 serve to accommodate a primary cutting element 20 and four secondary cutting elements 21, as shown in Fig. 1. The primary cutting element 20 and the secondary cutting elements 21 can be embodied identically. If necessary, however, it is also possible for the secondary cutting elements 21 to have a narrower width transverse to the advancing direction V, but to otherwise be identical to the primary cutting element 20 so that they can be manufactured in the same tool mold equipped with sliding side walls. The principle cutting element 20 and the secondary cutting elements 21 have a fastening section 20.1,

21.1, which is embodied as plate-shaped. The fastening section 20.1, 21.1 forms a support surface 20.6, 21.6. The fastening section 20.1, 21.1 has a cutting attachment 20.2, 21.2 integrally formed onto it. The cutting attachment 20.2, 21.2 forms another support surface 20.7, 21.7. The support surfaces 20.6, 20.7 and 21.6, 21.7 are oriented at right angles to each other. The primary cutting element 20 and the secondary cutting elements 21 form a frontal diverting surface 20.4, 21.4 that tapers down to a rounded cutting edge 20.3, 21.3. The cutting edge 20.3, 21.3 transitions into an open surface 20.5, 21.5 that faces toward the rear.

A soldered connection is used to fasten the primary cutting element 20 and secondary cutting elements 21, which are composed of a hard material, in particular hard metal. It is also conceivable to use an adhesive connection so as to enable a more advantageous manufacture. The primary cutting element 20 and the secondary cutting elements 21 are placed with their support surfaces 20.6, 20.7 and 21.6, 21.7 against the corresponding seat surfaces 14.1 and contact surfaces 14.2. The integrally joined connection takes place on these surfaces. When mounted, the cutting edges 20.3, 21.3 of the primary cutting element 20 and secondary cutting elements 21 are oriented parallel to one another. In this position, the cutting edges 21.3 of the secondary cutting elements 21 are situated flush with one another in pairs. In addition, the diverting surfaces 20.4 and 21.4 and the open surfaces 20.5 and 21.5 are respectively situated parallel to one another, as is clearly visible in Fig. 2. The diverting surfaces 20.4 and 21.4 and/or the open surfaces 20.5 and 21.5 can also be situated at an angle to one another, as shown in the exemplary embodiment according to Figs. 5 and 6. Fig. 2 also shows that the seat surfaces 14.1 are adjoined at right angles by flanks 14.3 of the cutter holder 13. The fastening sections 20.1 of the primary cutting element 20 and the secondary cutting elements 21 cover the seat surfaces 14.1 in a direction transverse to the advancing direction V so that the relatively softer material of the cutter holder 13 is protected.

Figs. 3 and 4 show another embodiment variant of a cultivator tip. In this case, a primary cutting element 20 and two secondary cutting elements 21 are built into a cutter holder 13. The design of the primary cutting element 20 and the secondary cutting elements 21 essentially corresponds to that shown in Figs. 1 and 2, thus permitting reference to the preceding explanations. In addition, the embodiment of the cutting element mounts 14

essentially corresponds to that of the cultivator tips shown in Figs. 1 and 2. To this extent, reference is also made to the preceding explanations. By contrast with the cultivator tips according to Figs. 1 and 2, in the present case, only two secondary cutting elements 21 are provided, whose cutting edges 20.3 are oriented parallel to each other and are flush with each other. It is also conceivable for the cutting edges 20.3 to be parallel but offset from each other. In addition, the cultivator tip according to Figs. 3 and 4 has a rib structure formed onto it at the front, which facilitates the penetration of the cultivator tip into the soil. In addition, excavated material can be compressed in the recesses between the ribs. This results in a "natural" wear protection.

The cultivator tip according to Figs. 5 and 6 is a modification of the cultivator tip according to Figs. 3 and 4. As already mentioned above, the diverting surfaces 21.4 and the open surfaces 21.5 of the secondary cutting elements 21 are oriented at an angle relative to the diverting surface 20.4 and open surface 20.5 of the primary cutting element 20. The primary cutting element 20 in this case is in a flatter orientation relative to the advancing direction *V* than the secondary cutting elements 21. As a result, the primary cutting element 20 bites into the soil more sharply, while the secondary cutting elements 21 provide a greater displacement.

Fig. 6 shows that the cutting edges 21.3 of the secondary cutting elements 21 are offset transversely to the advancing direction *V* and opposite the force of gravity relative to the cutting edge 20.3 of the primary cutting element 20. This produces less of a tendency to form a trench bottom since the primary cutting element 20 opens deeper furrows.

The same effect can also be achieved if the cutting edges 21.3 of the secondary cutting elements 21 are lower than the cutting edge 2.3 of the primary cutting element 20. Figs. 7 and 8 show such an embodiment variant. As Figs. 9 and 11 show, the support 10 is once again provided with a breaking rib 16 on its side oriented in the advancing direction *V*. This breaking rib forms the cutting element mount 14 for the primary cutting element 20. Starting from the primary cutting element 20, the breaking rib 16 continuously widens in the direction toward the end of the support 10 oriented away from the primary cutting element 20. This achieves a structure that is optimized in terms of stress. In addition, the breaking rib 16 also reinforces the support 10 and increases the

section modulus in opposition to flexion in the main direction of force. Fig. 10 shows that a breaking groove 17 is recessed into the back of the support 10. Once again, this groove extends starting from the primary cutting element 20 in the direction toward the rear end of the support 10, as shown in Figs. 9 and 10.

The above-mentioned breaking rib 16 breaks up clods in a favorable way and a certain amount of material flow into the breaking groove 17 can be produced for the benefit of a lower required traction force. In addition, this design also counteracts the undesirable formation of a trench bottom.

The same effect can also be achieved if on the contrary, a breaking groove 17 is formed into the front of the support 10 and a breaking rib 16 is formed onto the back. Such a design is featured in the exemplary embodiment according to Figs. 13 through 15.

Figs. 7 and 8 and Figs. 11 through 15 show exemplary embodiments in which the primary cutting element 20 is recessed in relative to the secondary cutting elements 21 the opposite direction from the advancing direction V. Consequently, the front pair of secondary cutting elements 21 always engages the soil first, producing an initial separating action. Then, the second pair of secondary cutting elements 21 (Figs. 11, 12) and then the primary cutting element 20 dig in. More of the wear is thus distributed onto the two secondary cutting elements 21. As a result of this wear-optimized tool design, it is in particular also possible to use the same parts for the secondary cutting elements 21 and the primary cutting element 20.

Claims:

1. A soil working tool having a support (10), wherein the support (10) has a cutter holder (13) at one end, which is equipped with cutting element mounts (14), wherein the support (10) supports a primary cutting element (20) and at least two secondary cutting elements (21) on the cutter holder (13), wherein the cutting element mounts (14) accommodate the primary cutting element (20) and the at least two secondary cutting elements (21) wherein both the primary cutting element (20) and the secondary cutting elements (21) each have a respective cutting edge (20.3, 21.3), wherein the cutting edges (21.3) of the secondary cutting elements (21) are situated offset from the cutting edge (20.3) of the primary cutting element (20).
2. The soil working tool as recited in claim 1, wherein the cutting edges (21.3) of the secondary cutting elements (21) are parallel to one another.
3. The soil working tool as recited in claim 1 or 2, wherein the cutting edges (21.3) of the secondary cutting elements (21) are flush with one another.
4. The soil working tool as recited in any one of claims 1 through 3, wherein the cutting edge (20.3) of the primary cutting element (20) is parallel to the cutting edges (21.3) of the secondary cutting elements (21).
5. The soil working tool as recited in any one of claims 1 through 4, wherein the cutting edge (20.3) of the primary cutting element (20) is situated spaced at least 4 mm apart from the cutting edge (21.3) of the secondary cutting element (21).
6. The soil working tool as recited in any one of claims 1 through 5, wherein the cutting edge (20.3) of the primary cutting element (20) is situated spaced at most 15 mm apart from the cutting edge (21.3) of the secondary cutting element (21).

7. The soil working tool as recited in any one of claims 1 through 6, wherein the cutter holder (13) has the cutting element mounts (14) for the primary cutting element (20) and the secondary cutting elements (21), the cutting element mounts (14) have a seat surface (14.4) and a contact surface (14.2) situated at an angle thereto, the primary cutting element (20) and the secondary cutting elements (21) are each supported with a respective fastening section (20.1; 21.1) against the seat surface (14.1) and with a respective cutting attachment (20.2; 21.2) against the contact surface (14.2).
8. The soil working tool as recited in claim 7, wherein the contact surfaces (14.2) and/or the seat surfaces (14.1) of the secondary cutting elements (21) and of the primary cutting element (20) are oriented parallel to one another.
9. The soil working tool as recited in any one of claims 1 through 8, wherein the primary cutting element (20) is situated so that it protrudes in an advancing direction (V) relative to the secondary cutting elements or is recessed relative to them.
10. The soil working tool as recited in any one of claims 7 through 9, wherein the seat surfaces (14.1) are situated spaced apart from one another by a distance in the range from 8 mm to 14 mm.
11. The soil working tool as recited in any one of claims 7 through 10, wherein the contact surfaces (14.2) are situated spaced apart from one another by a distance of at least 4 mm.
12. The soil working tool as recited in claim 11 wherein said distance is in a range from 10 mm to 15 mm.
13. The soil working tool as recited in any one of claims 1 through 12, wherein both the primary cutting element (20) and the secondary cutting elements (21) have diverting surfaces (20.4; 21.4) that are situated parallel to

one another and spaced apart from one another by a distance of at least 4 mm.

14. The soil working tool as recited in claim 13 wherein said distance is in a range from 5 mm to 11 mm.
15. The soil working tool as recited in claim 13 or 14, wherein the diverting surfaces (20.4; 21.4) are situated at an angle to each other, the angle being in the range between 0.1° and $< 90^\circ$.
16. The soil working tool as recited in any one of claims 1 through 15, wherein on the cutter holder (13), the secondary cutting elements (21) are situated symmetrical to the primary cutting element (20) and on both sides of it.
17. The soil working tool as recited in any one of claims 1 through 16, wherein said at least two secondary cutting elements (21) are respectively situated on both sides of the primary cutting element (20).
18. The soil working tool as recited in any one of claims 1 through 17, wherein the width of the cutting edges (21.3) of the secondary cutting elements (21) is at least 0.5 times the width of the cutting edge (20.3) of the primary cutting element (20).
19. The soil working tool as recited in any one of claims 1 through 18, wherein the support (10) has a protruding breaking rib (16) and/or a recessed breaking groove (17).

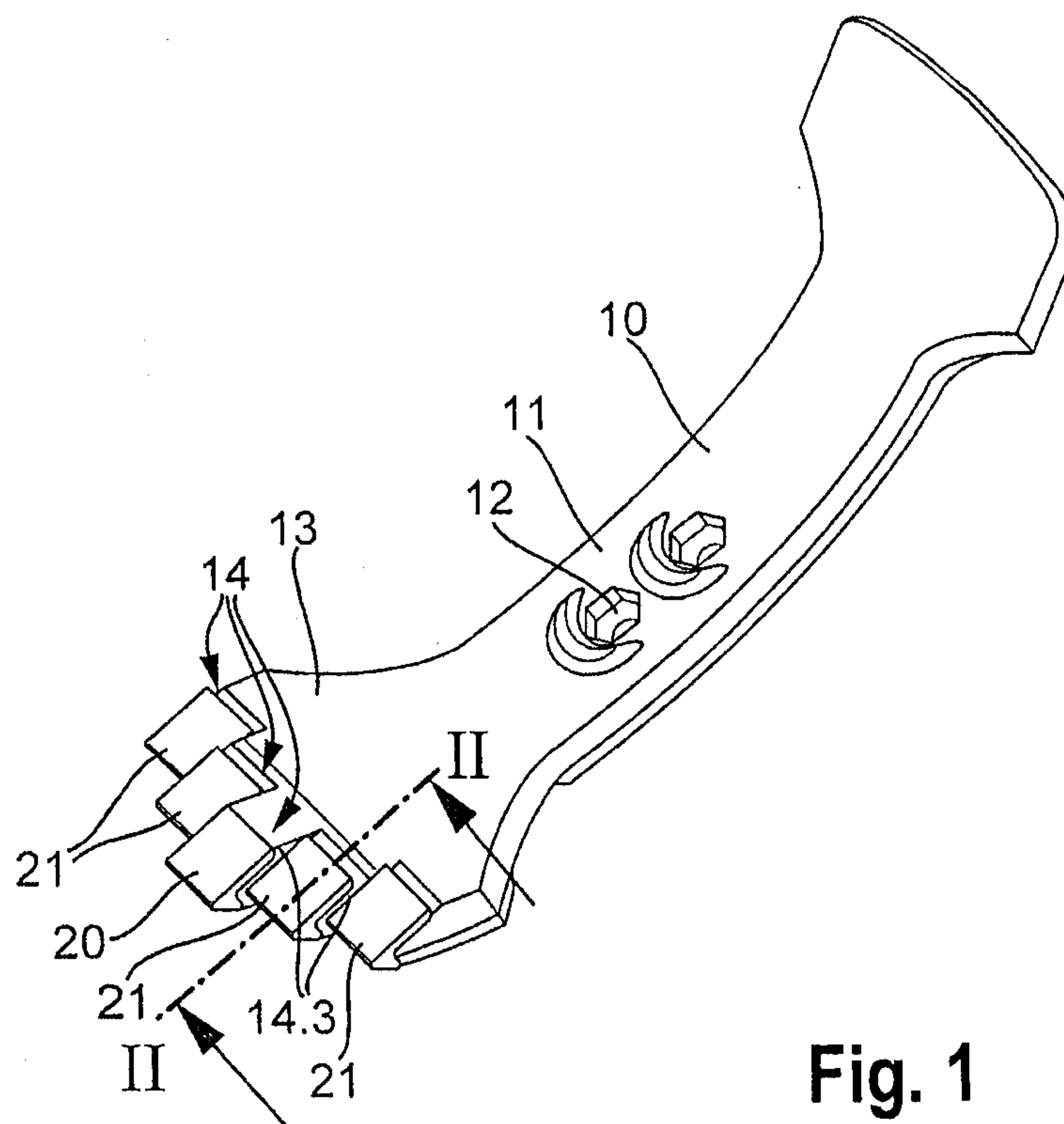


Fig. 1

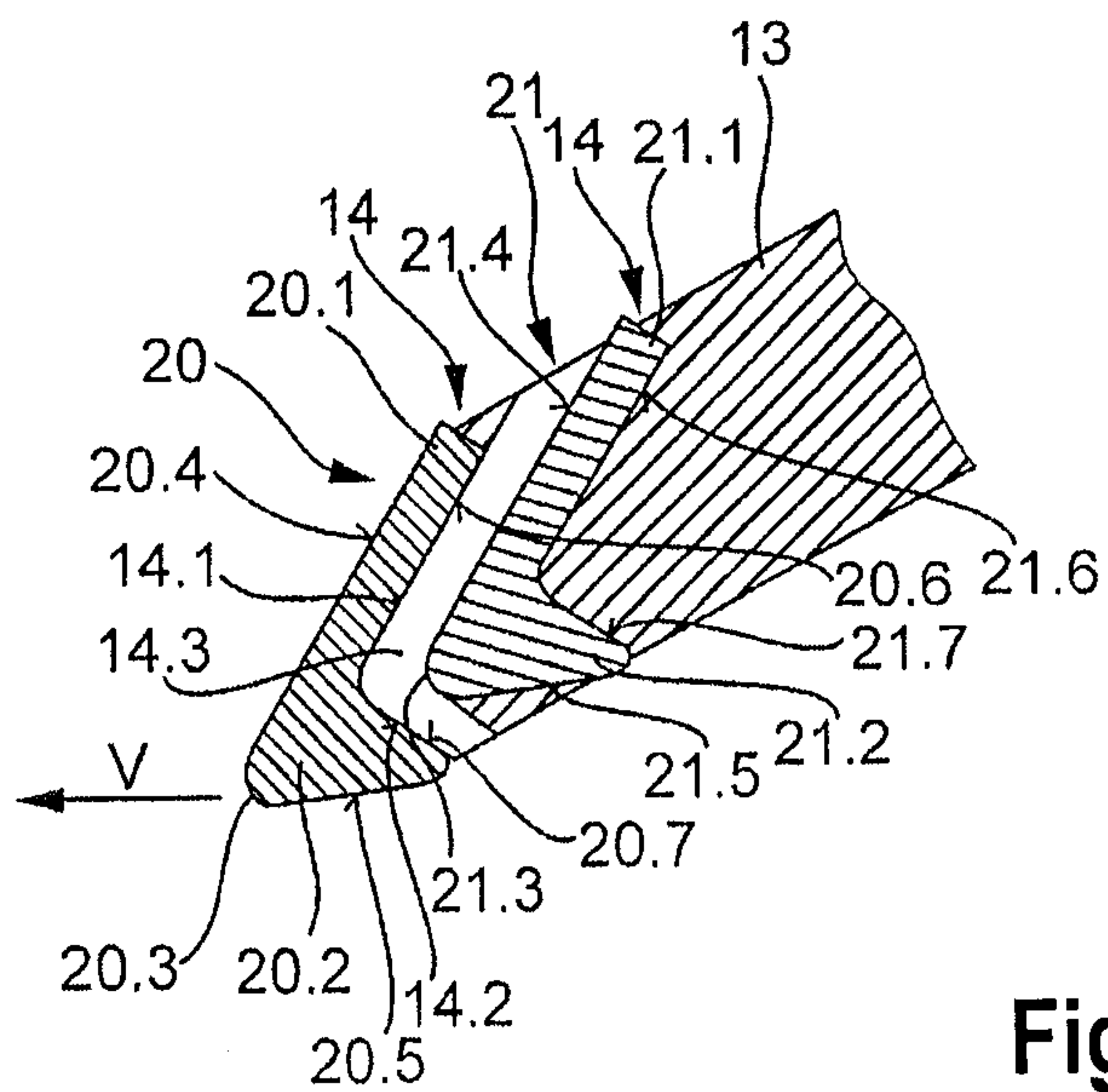


Fig. 2

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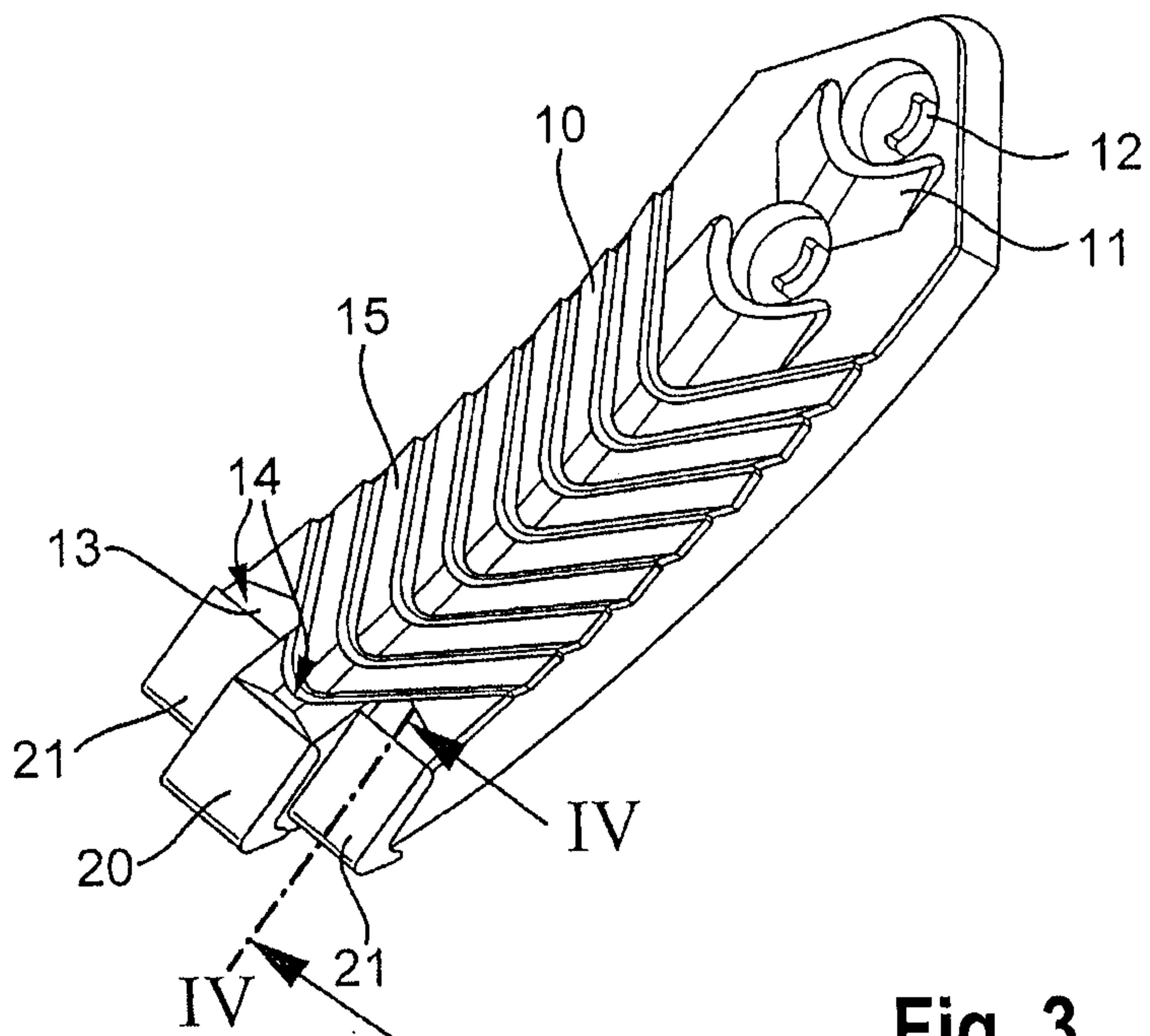


Fig. 3

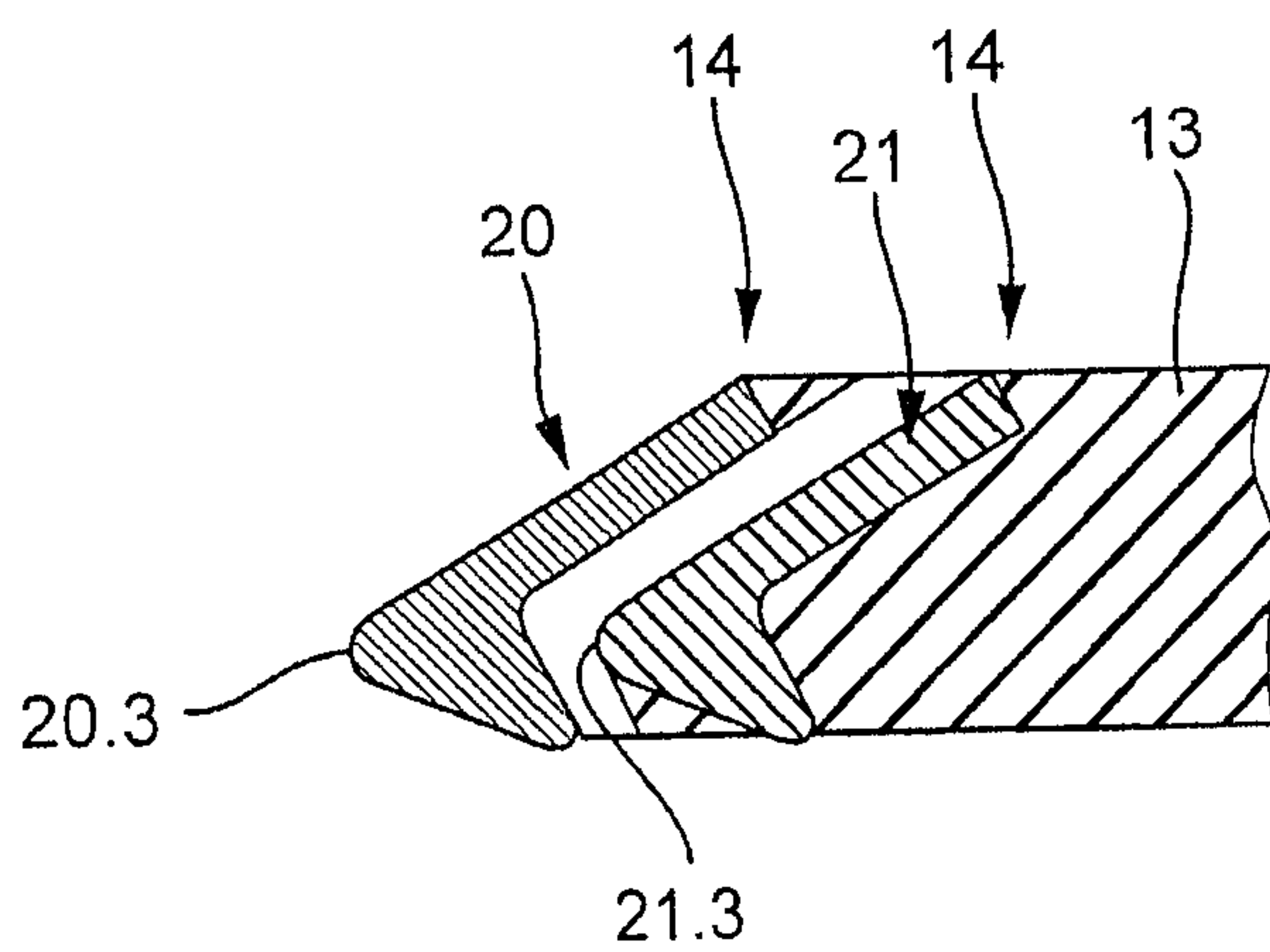


Fig. 4

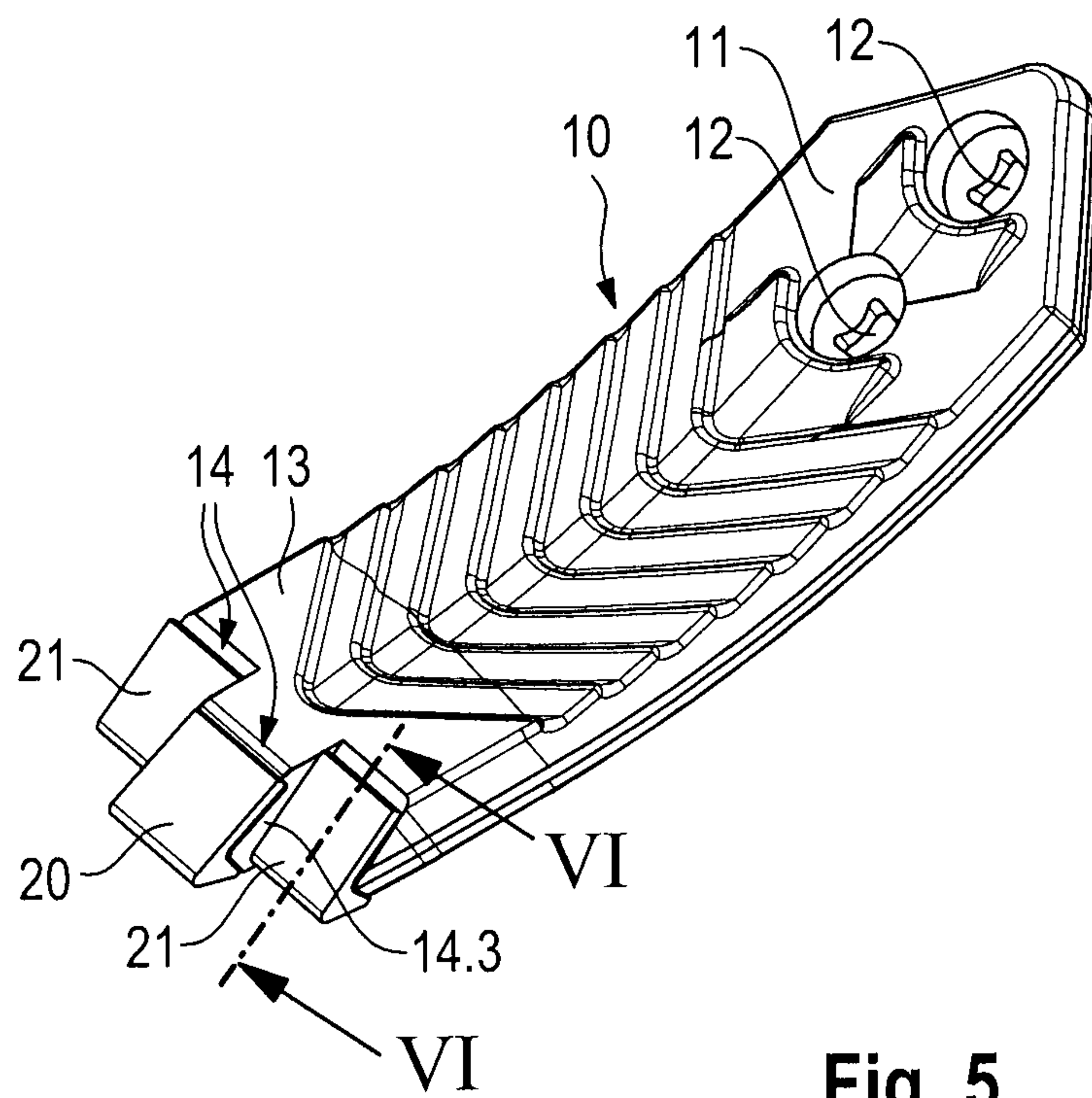


Fig. 5

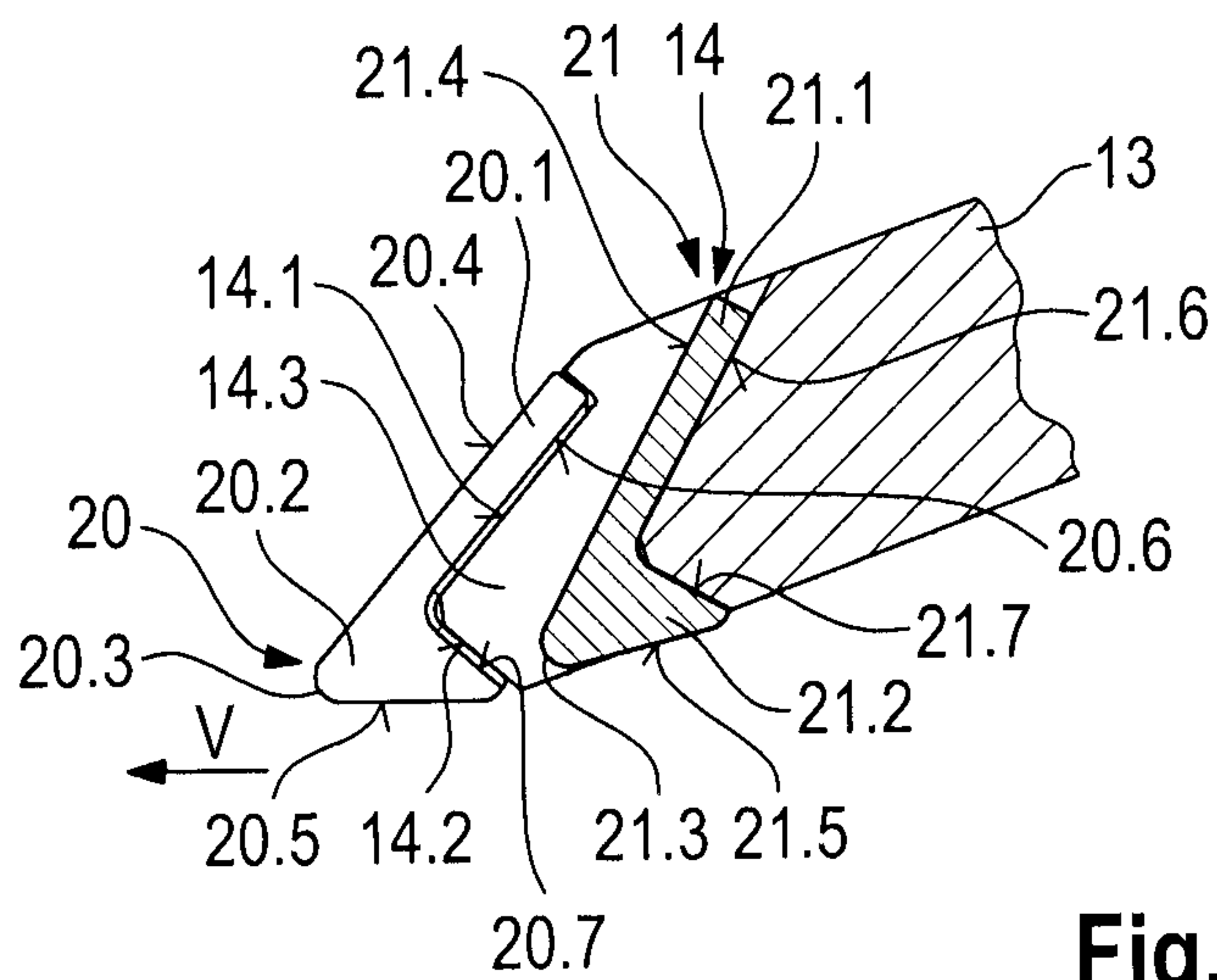


Fig. 6

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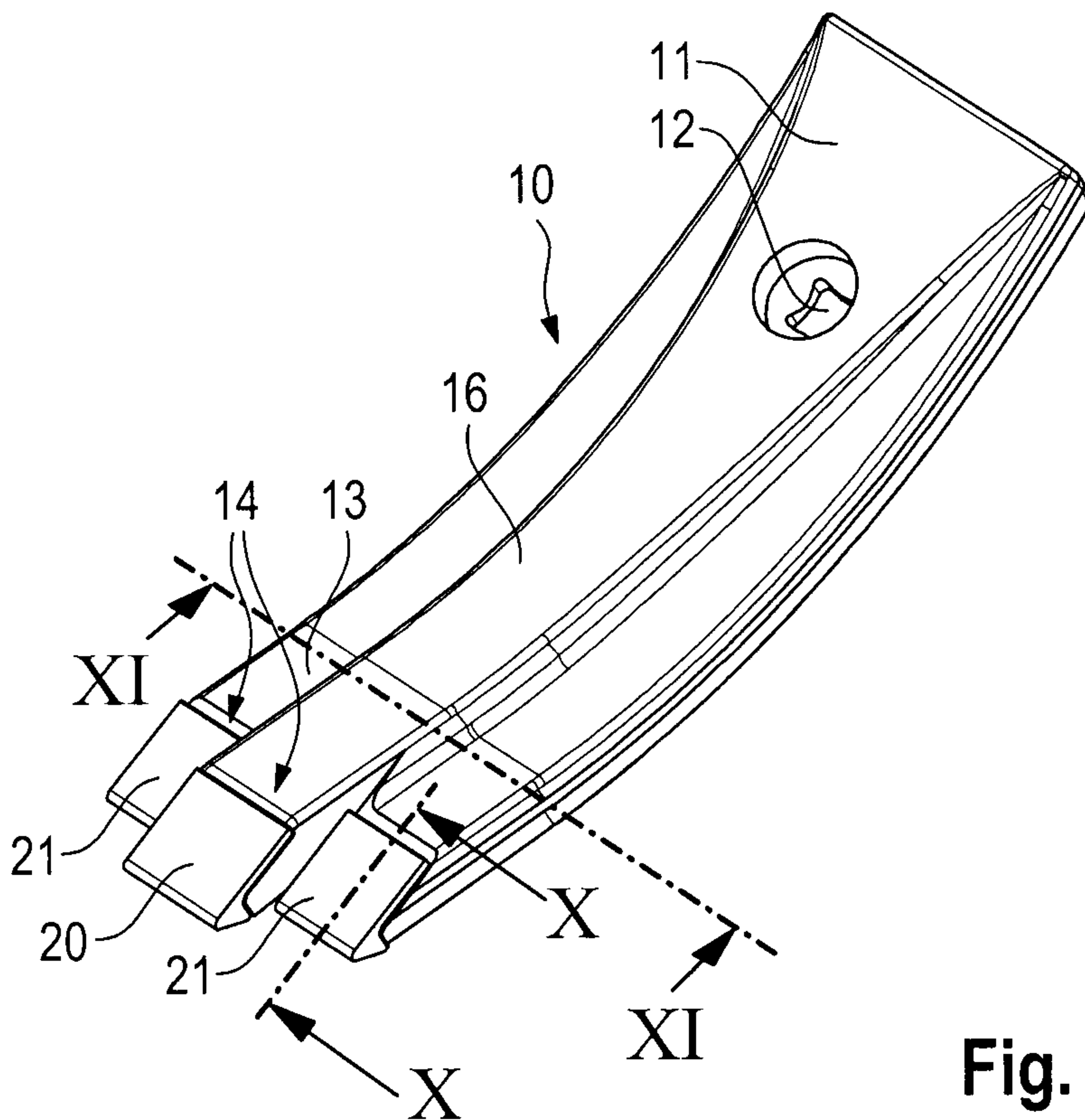


Fig. 9

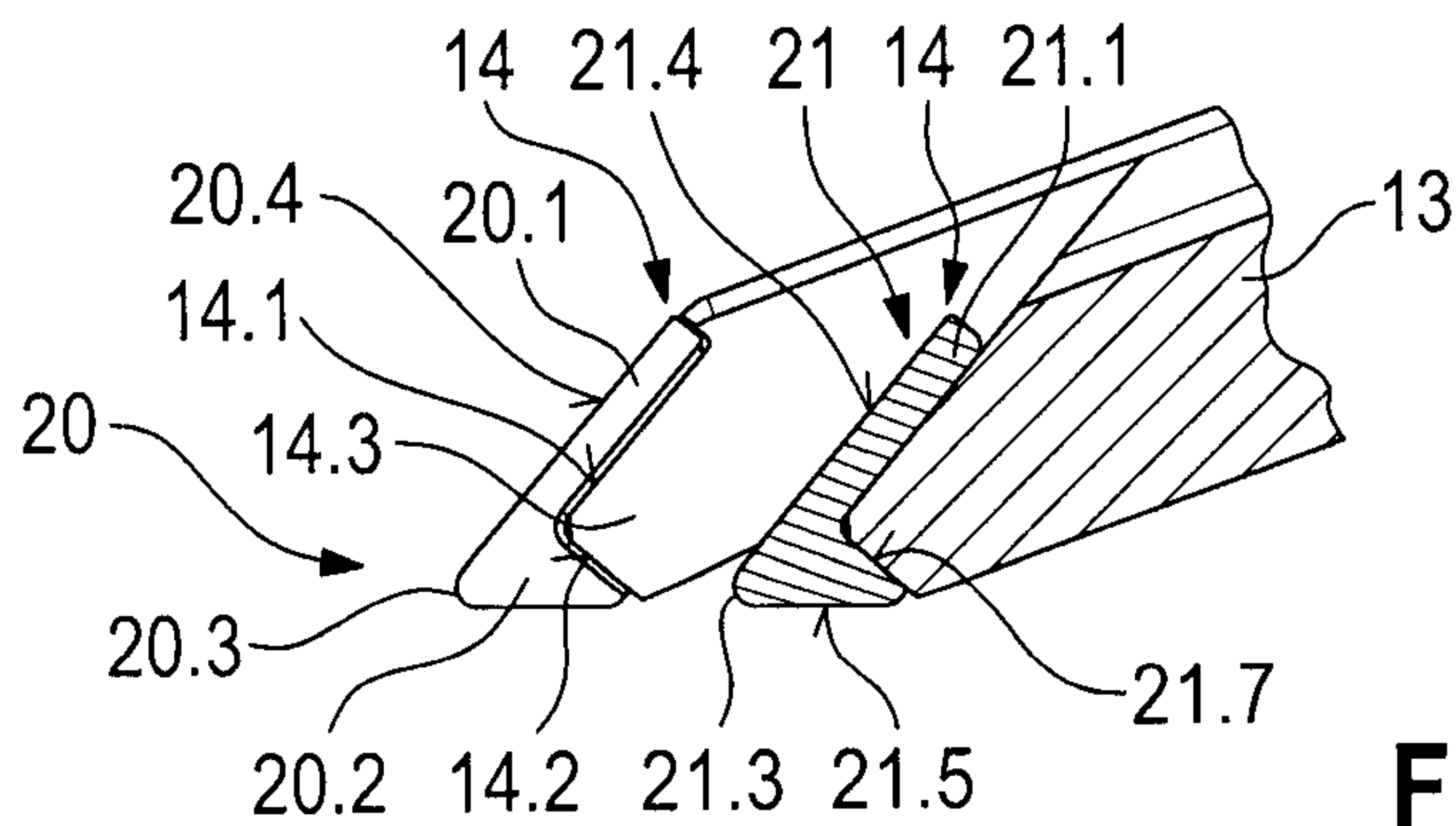


Fig. 10

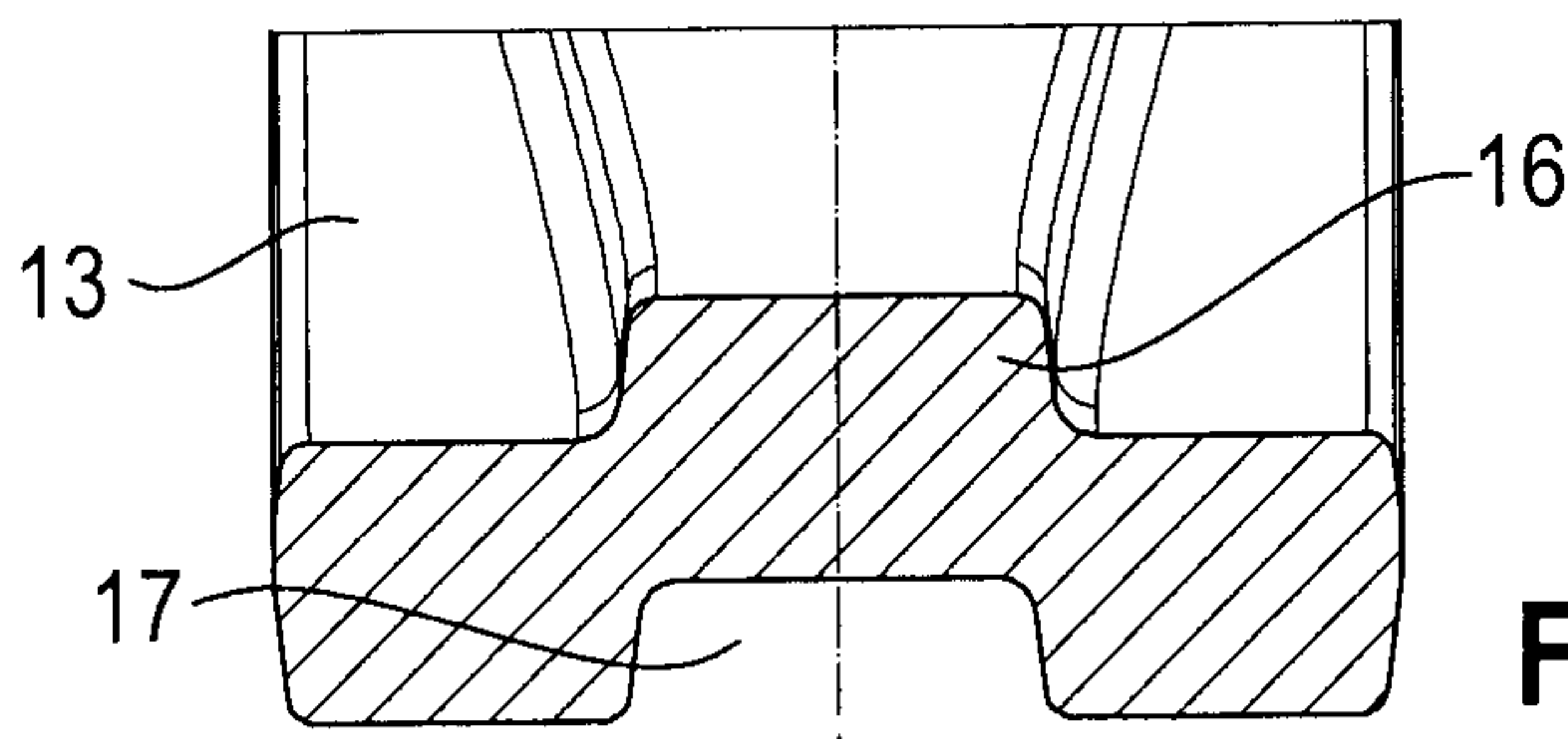
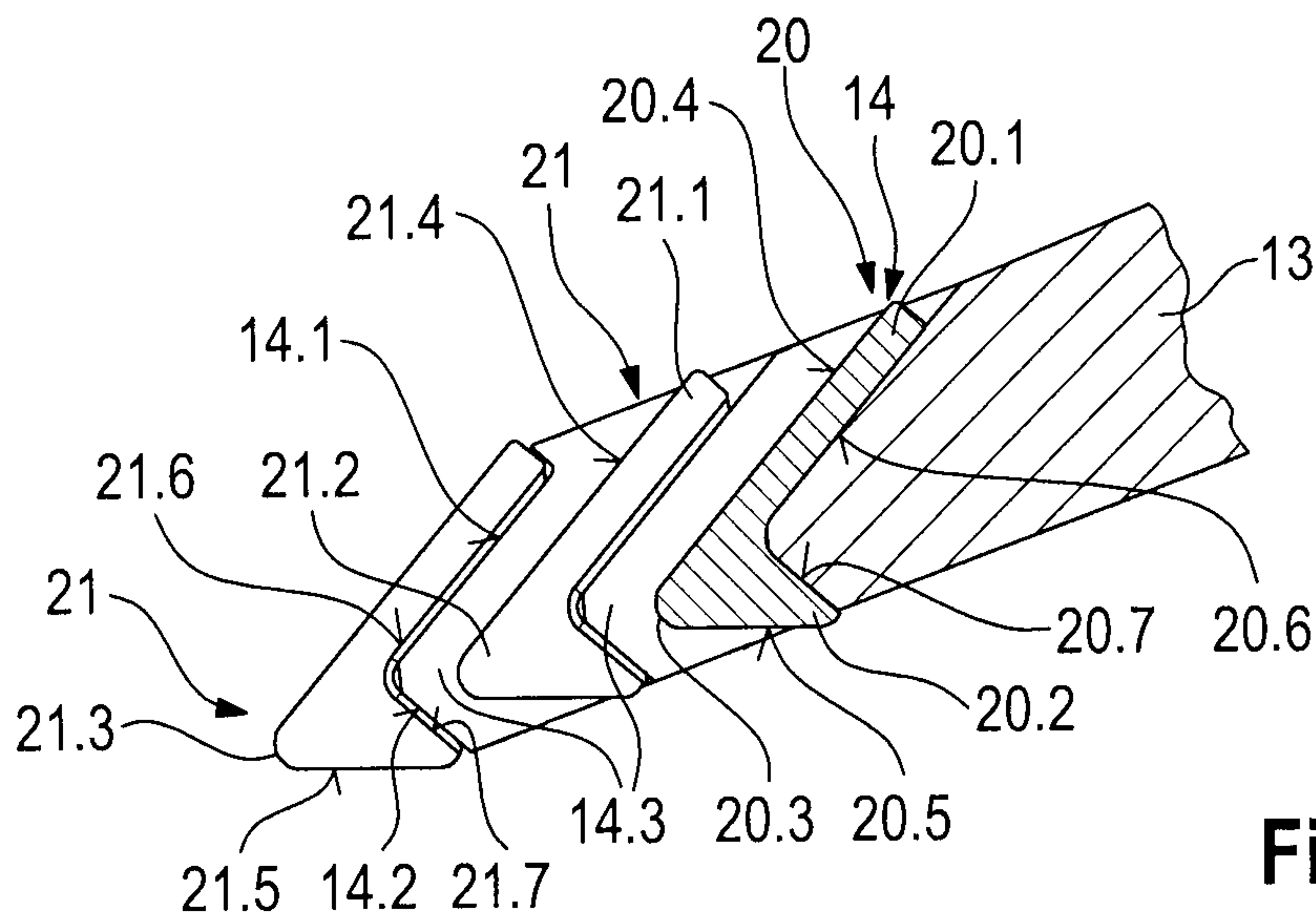
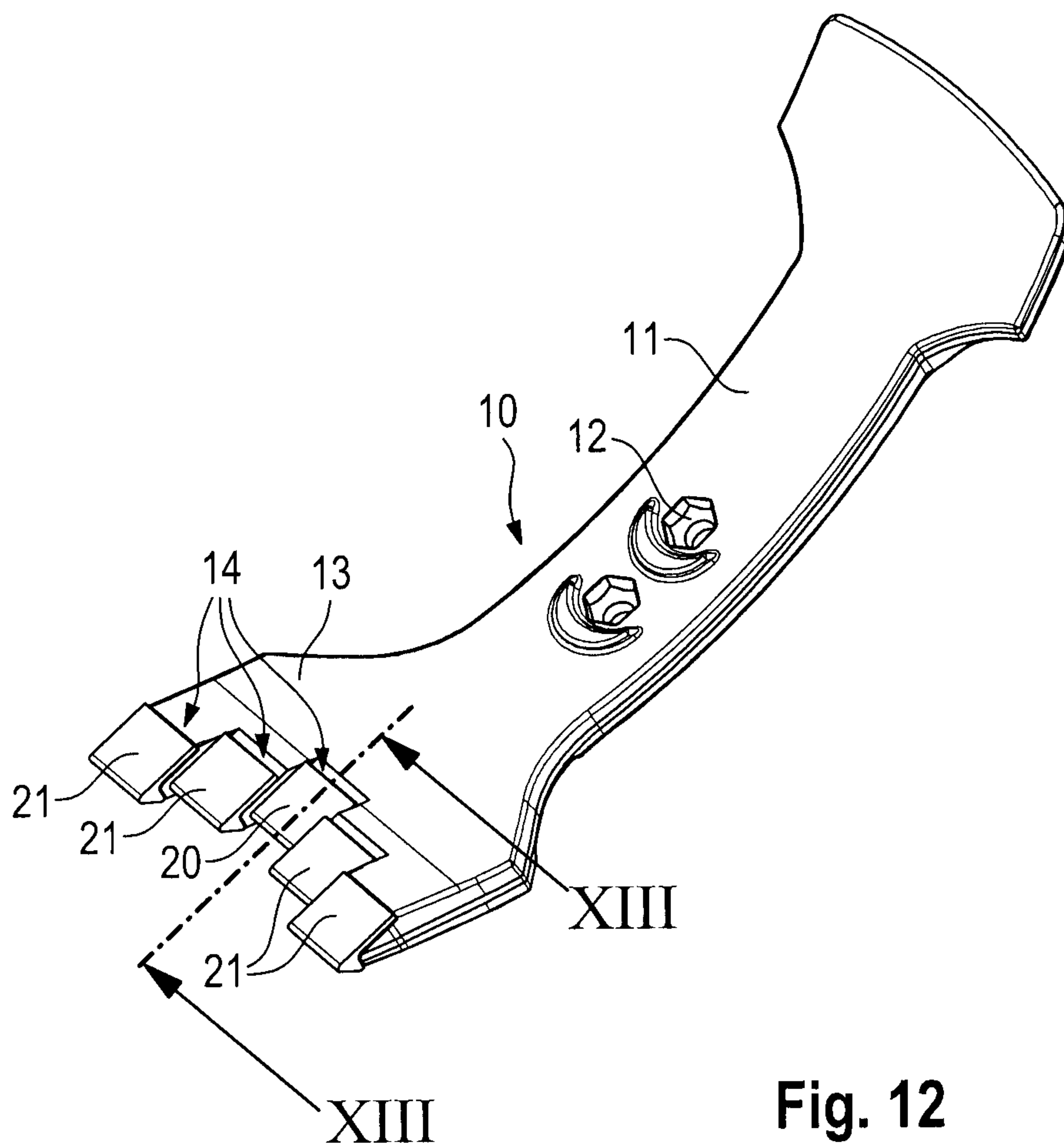


Fig. 11



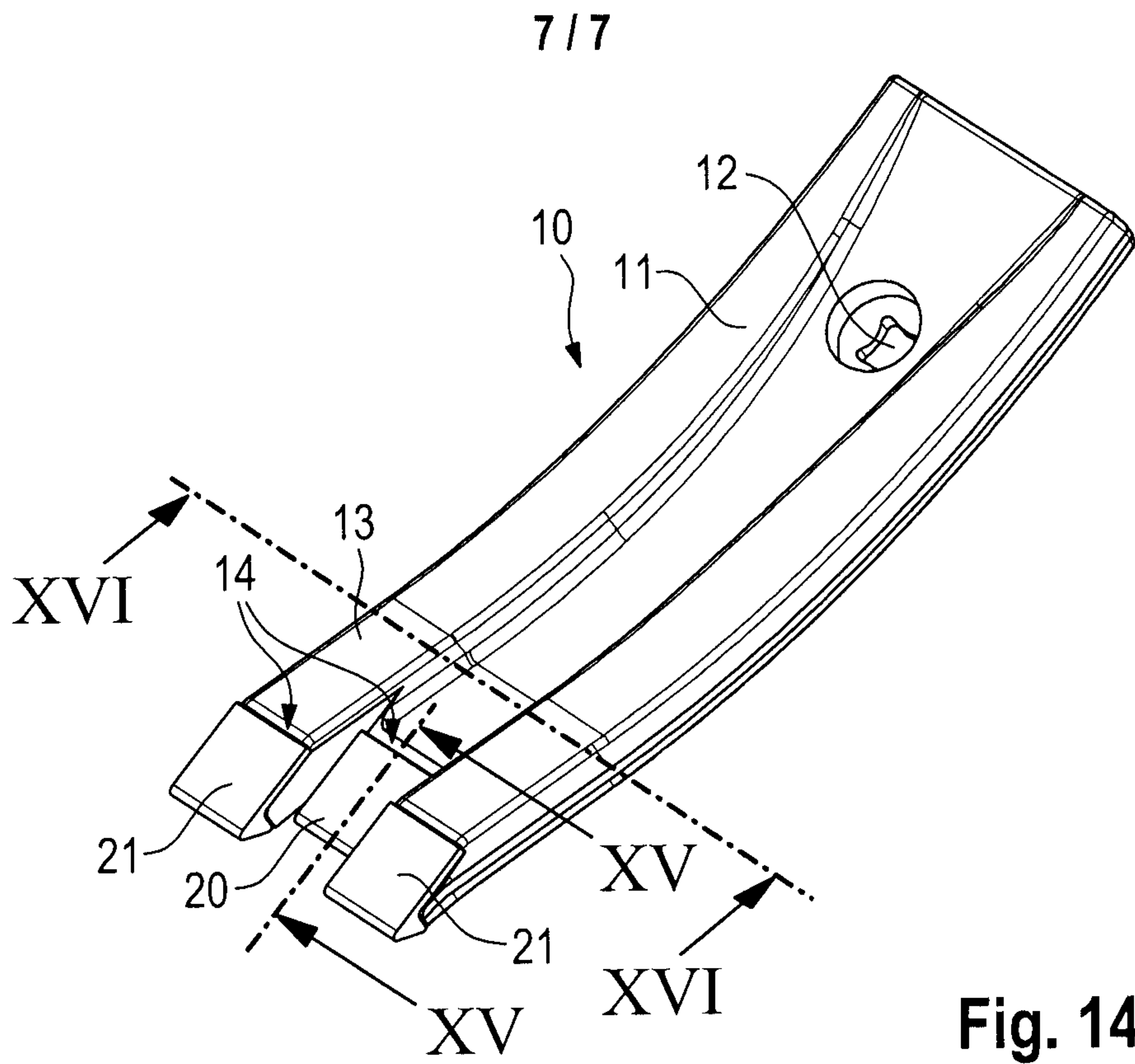


Fig. 14

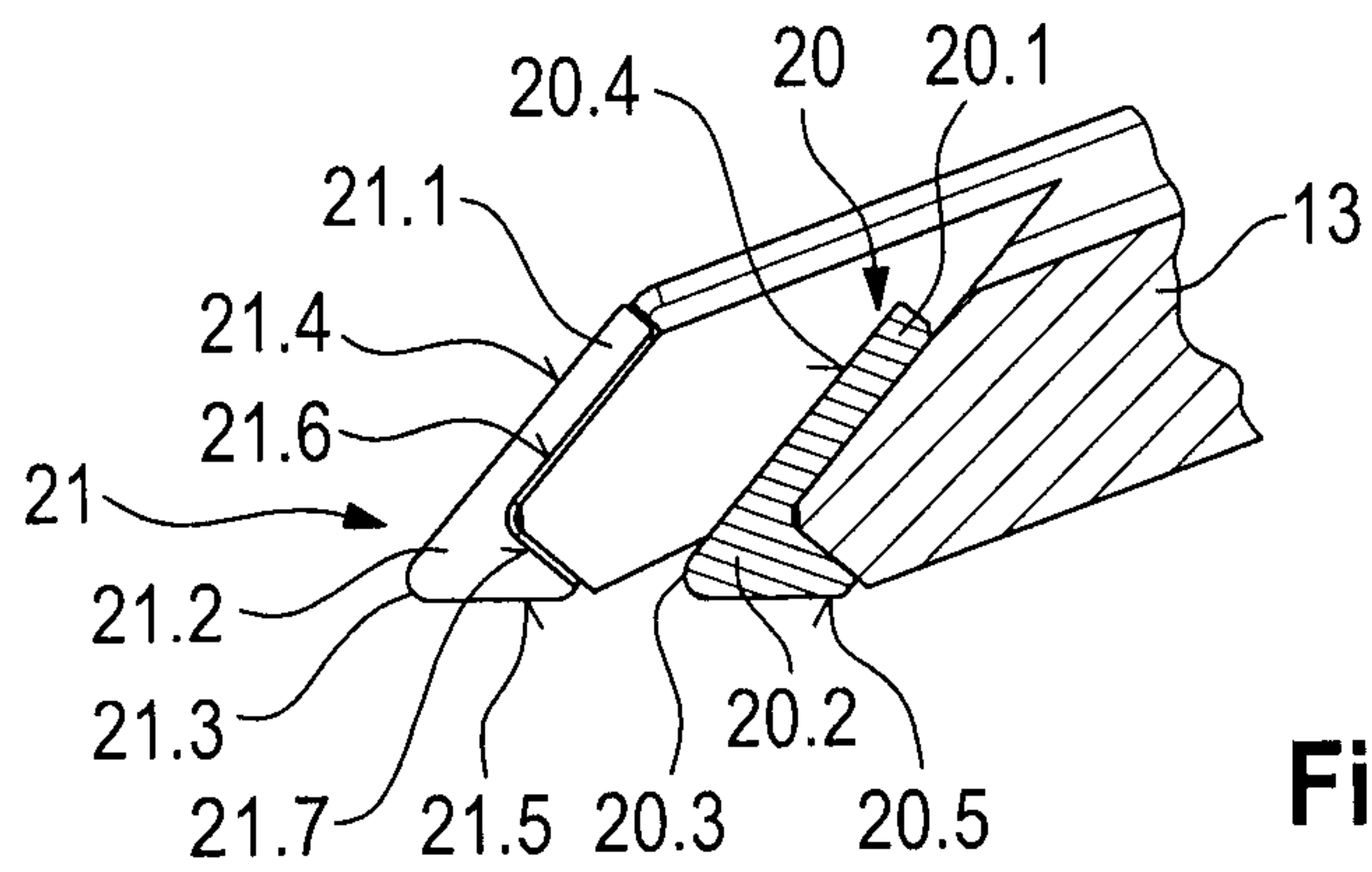


Fig. 15

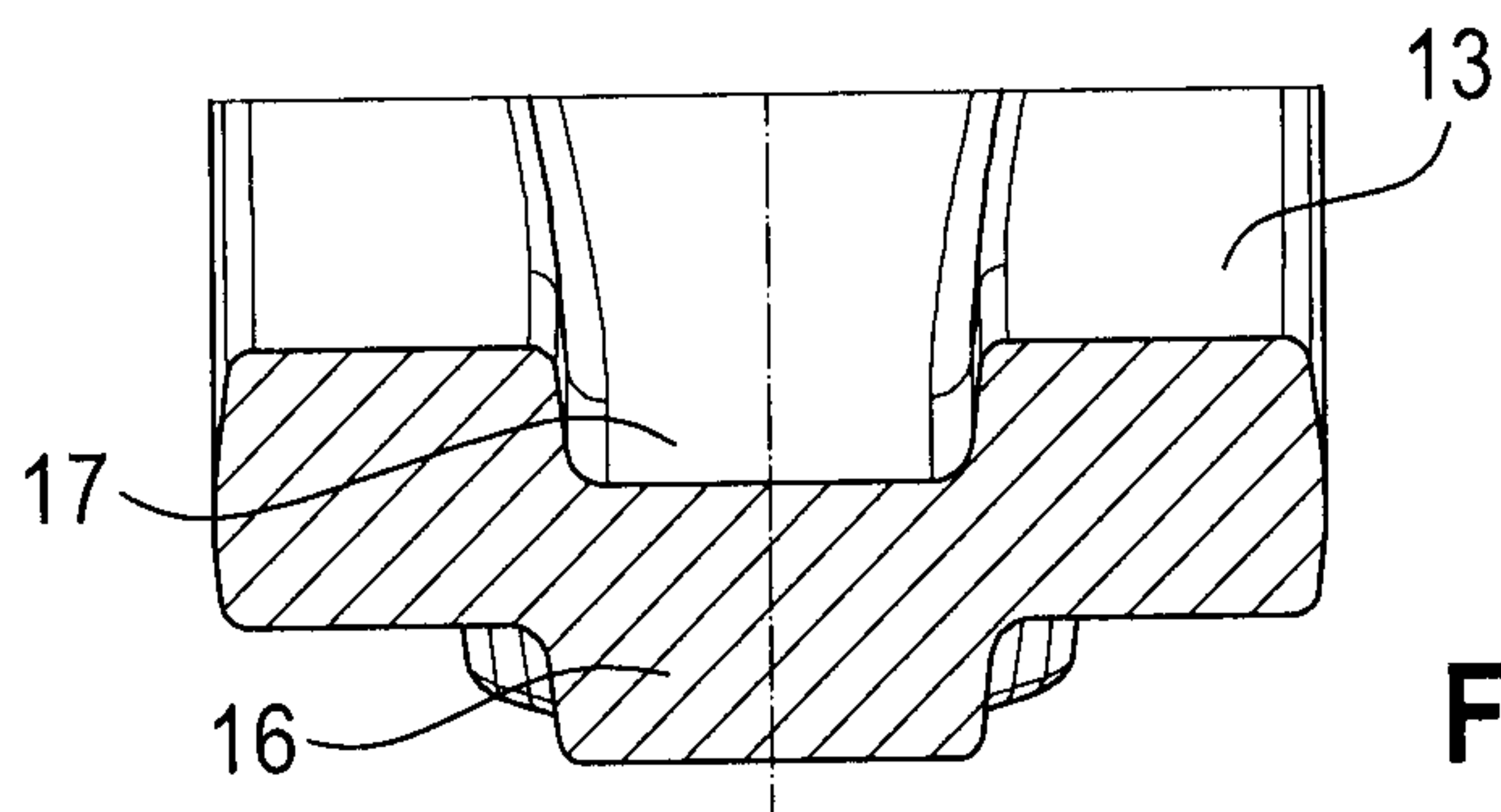


Fig. 16

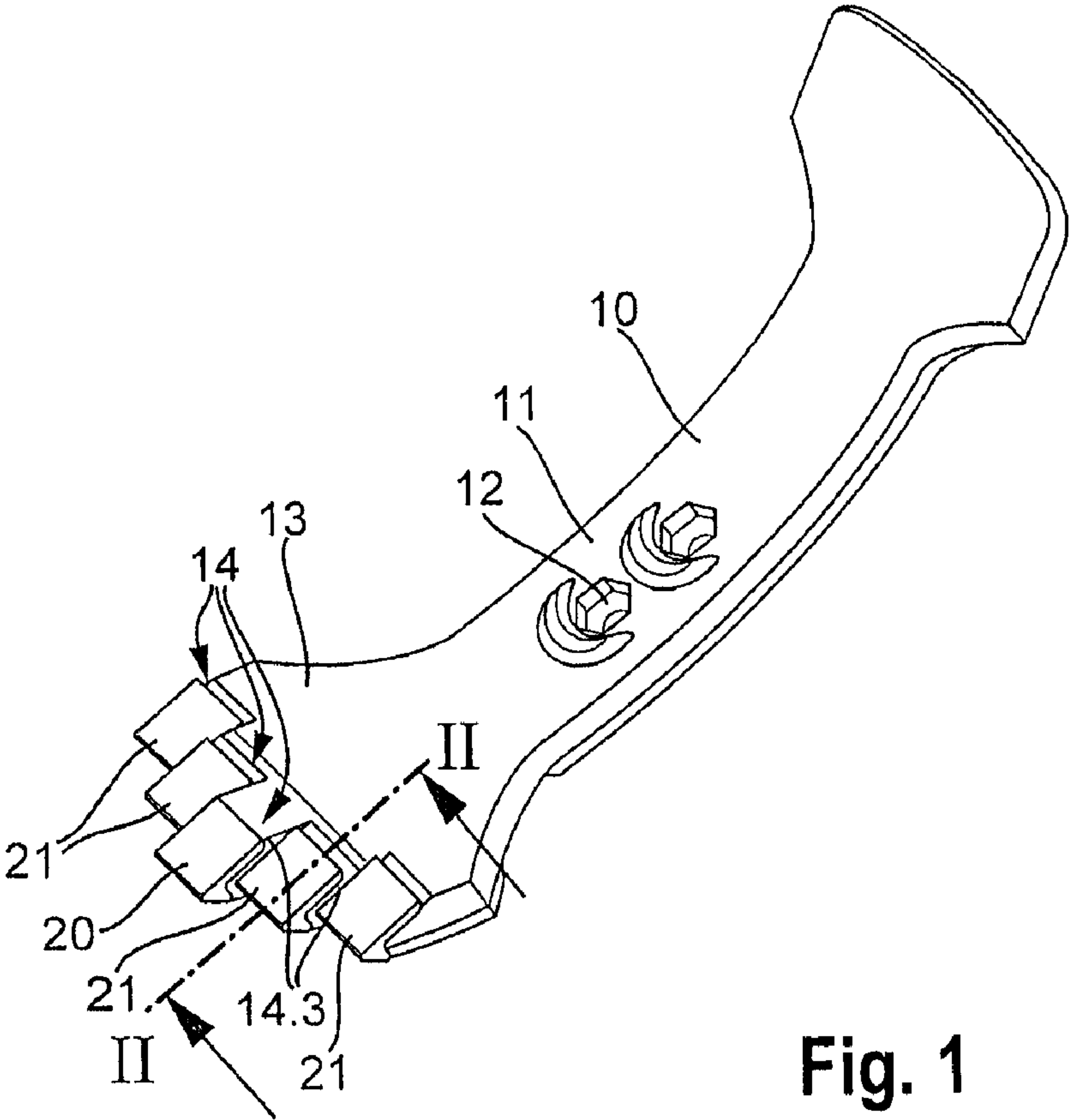


Fig. 1