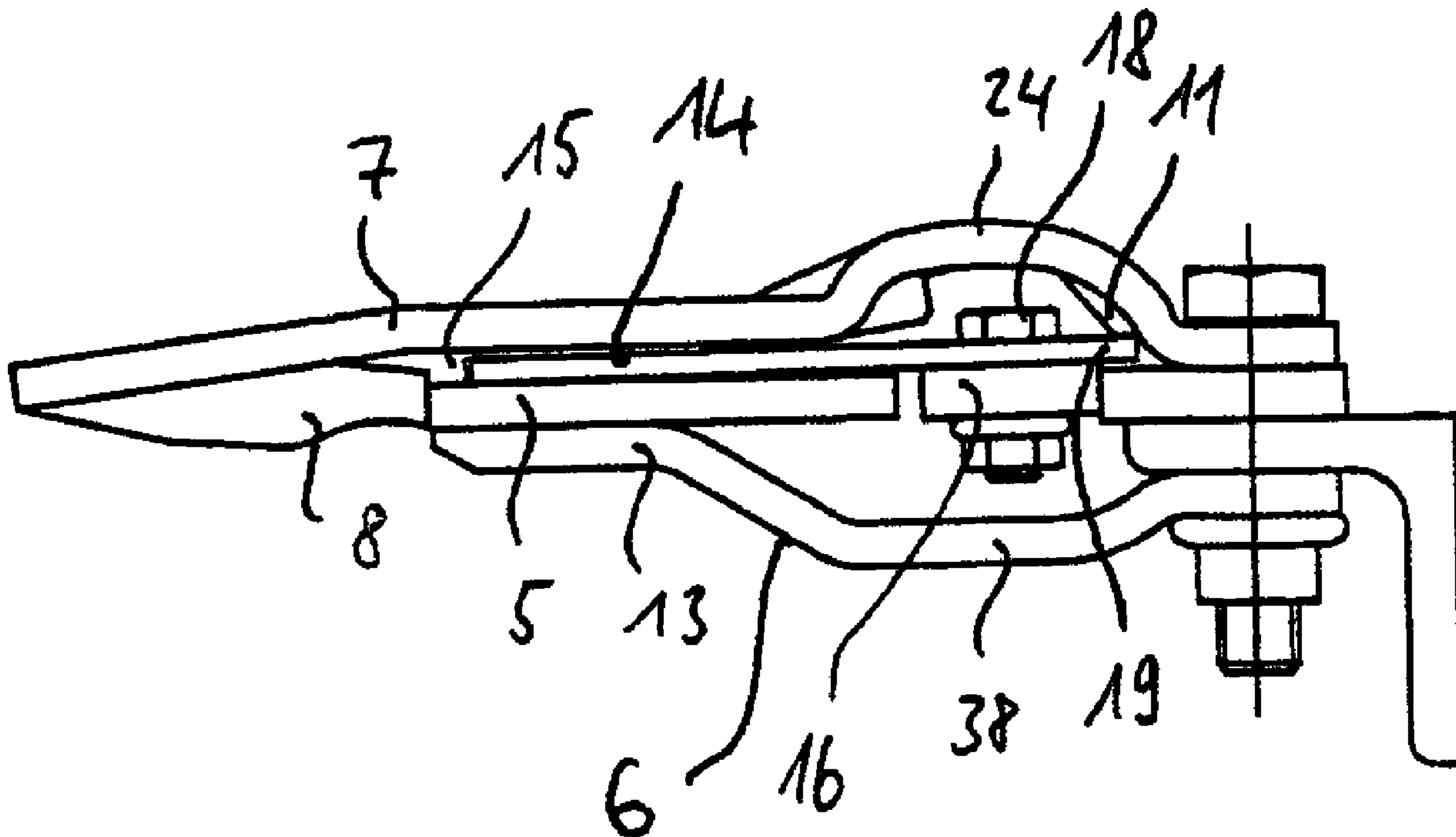




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(57) Abrégé/Abstract:
Mowing finger arrangement and mowing bar for finger bar mowers of harvester, as well as a method for manufacturing mowing fingers. The mowing finger arrangement serves to guide a mowing sickle and forms counter cutting edges for the sickle blades arranged on the mowing sickle.

Abstract

Mowing finger arrangement and mowing bar for finger bar mowers of harvester, as well as a method for manufacturing mowing fingers. The mowing finger arrangement serves to guide a mowing sickle and forms counter cutting edges for the sickle blades arranged on the mowing sickle.

Mowing finger arrangement

Description

The invention relates to a mowing finger arrangement and a mowing bar for finger bar mowers for harvesters, as well as a method for manufacturing mowing fingers. The mowing finger arrangement serves for guiding a mowing sickle and forms counter cutting edges for the cutting blades arranged on the mowing sickle.

Mowing bars comprise generally a finger bar, on which several mowing fingers are arranged. Relative to the finger bar, a mowing sickle is guided reciprocatingly, wherein the sickle comprises a sickle bar, on which several sickle blades are mounted. The sickle blades form cutting edges, which interact with counter cutting edges, which are formed by the mowing finger.

Sickle blades generally have a triangular base shape. During the cutting process, the harvesting good is pressed by the reciprocating movement of the mowing sickle by the sickle blades against the mowing fingers and is cut. During such a scissor-like cutting process, each individual sickle blade is pushed by the cutting load backwards, when seen in a working direction. In order to hold the mowing sickle in its position relative to the finger bar, a supporting guidance of the mowing sickle relative to the finger bar is necessary. Such a guide is shown in the publication DE 198 50 261 A1. On the mowing bar, shown there, a sheet metal guide, which forms a guide face, which extends in direction of the movement direction of the mowing sickle and faces the mowing sickle, is mounted on the finger bar. The mowing sickle is supported, when seen in working direction, to the rear with the sickle bar on the guide face of the sheet metal guide. While the sickle bar is reciprocatingly moved, the sheet metal guide is rigidly mounted on the finger bar. The mowing sickle is pushed in dependency of the cutting force more or less

strongly against the sheet metal guide. The cutting force can increase greatly because of difficult to cut harvesting good or because of blunt sickle blades, so that increased frictional forces are acting between the sickle bar and the sheet metal guide. This leads to a large wear on the sickle bar and on the sheet metal guide. Furthermore, besides the driving energy, which is necessary for cutting the harvesting good, a large portion of the driving energy is necessary for the reciprocating movement of the mowing sickle. The necessary driving energy for the movement of the mowing sickle is often higher than the necessary driving energy for the cutting process.

According to the European Patent EP 1 551 214 B1, the frictional force is reduced by a roller guide. The roller holders in form of a bridge between, respectively, two mowing fingers, offer a stable support of the rollers and ensure a passing-through of dirt. Furthermore, no frictional resistance has to be overcome between the mowing sickle and the finger bar. Only the rolling friction of the rollers has to be overcome, which is distinctly smaller. Furthermore, the rollers can be formed with circumferentially extending collars, to reduce a tipping of the mowing sickle by the cutting forces. The mowing sickle can still be deformed between the rollers, in so far it is not guided by a mowing finger. Especially, when using double mowing fingers, no roller is mounted in the intermediate space, so that it can be deformed. If the sickle blades enter then again a mowing finger, a large friction is produced between the cutting edge of the mowing finger and the sickle blade, which leads to large wear.

An object of the invention is, to improve the guide of the mowing sickle in the area of the mowing finger without increasing the friction at a harvesting situation with low loading of the mower.

The object is solved by a mowing finger arrangement according to claim 1. The mowing finger arrangement according to the invention with an upper element, which

is connectable for forming at least one mowing finger to a lower element, has a blade gap for guiding a mowing sickle between the lower element and the upper element. The direction, in which a mower is moved relative to the harvesting good, is designated as the working direction. The upper element has according to the invention on a side, facing the lower element, i.e. in the assembled condition also on the side, facing the mowing sickle, a projection as an abutment for a rear portion of the mowing sickle, when seen in working direction.

An advantage of the mowing finger arrangement according to the invention is, that the projection serves for guiding the mowing sickle, so that a tilting of the mowing sickle is prevented by the projection, wherein the projection is arranged in the area of the mowing finger, i.e. distanced to the roller-like or other supports or retainers for the mowing sickle. By the rear portion of the mowing sickle that part of the mowing sickle is to be understood, which is arranged in working direction behind an attachment of the sickle blade on a sickle bar. If the sickle blade is bent over by the harvesting good, this takes place in direction towards the ground, while the rear portion is deflected in opposite direction, i.e. upwards, which is, however, prevented by the abutment in form of the projection on the upper element of the mowing finger. The abutment, delimiting the deflection, has, furthermore, the advantage, that this does not contact the mowing sickle at low loads of the mower and, thus, the friction is not increased.

Preferably, the rear portion of the mowing sickle, when seen in working direction, is supported by the projection in a direction towards the upper element, i.e. in the assembled condition upwards, so that the tilting of the sickle blade downwards is advantageously prevented.

According to a preferred embodiment, the projection is formed by an impression in the upper element on a side facing away from the mowing sickle. Furthermore, a rear web of the upper element is arranged, preferably, on a rear end of the at least

one mowing finger, when seen in working direction, wherein the rear web of the upper element serves for attaching the mowing finger arrangement on a finger bar and wherein the projection is arranged, when seen in working direction, in front of the rear web. In front of the rear web, at least one topside bulge is, preferably, arranged, wherein the at least one topside bulge has the projection on a concave face facing the mowing sickle in the assembled condition. Concave and convex designate in the sense of the invention only the main direction of the bulge and represent no limitation concerning the shape or configuration of the bulge.

The projection on the concave side of the bulge can be manufactured by suitable measures. According to a preferred embodiment, the projection is formed by the impression in the topside bulge from a convex side, facing away from the mowing sickle in the assembled condition. The impression can be made separately, i.e. on the already produced upper element, or can be formed by a correspondingly modified embossing shape during the actual manufacture of the upper element by means of deformation in one working step.

The rear web of the upper element has an attachment bore, wherein the impression according to a preferred embodiment is arranged in an area of the topside bulge, facing the attachment bore. An especial advantage of this embodiment is, that the impression can be used simultaneously to provide a free area around the attachment bore, which is necessary when attaching the mowing finger arrangement for a screw head or a screw nut. Thus, two forming tasks are advantageously solved at the same time.

The mowing finger arrangement according to the invention can have one or several mowing fingers. Preferably, the upper element and the lower element form two mowing fingers. The rear web of the upper element is, then especially, formed as the rear connection web of the upper element, wherein the two mowing fingers are connected to each other via the rear connection web and a front connection web on

the upper element as well as via a rear connection web and a front connection web on the lower element. This double finger arrangement is, compared to a single mowing finger, advantageously stable and at the same time lighter as arrangements with three or even more mowing fingers.

Preferably, the rear connection web of the lower element serves for attaching the mowing finger arrangement on a finger bar. The lower element has especially a first mowing sickle support on a first of the two mowing fingers and a second mowing sickle support on a second of the two mowing fingers, wherein the two mowing sickle supports are connected to each other via the front connection web of the lower element and wherein the front connection web of the lower element forms a third mowing sickle support. Preferably, the first and the second mowing sickle support form, respectively, two lower counter cutting edges.

Furthermore, the upper element has a first mowing sickle support on a first of the two mowing fingers and a second mowing sickle support on a second of the two mowing fingers, wherein the two mowing sickle supports are connected to each other via the front connection web of the upper element and wherein the front connection web of the upper element forms a third mowing sickle support, wherein the first and the second mowing sickle supports form especially, respectively, two upper counter cutting edges.

Especially, the mowing sickle supports of the lower element and the mowing sickle supports of the upper element form the blade gap.

The upper element is, preferably, formed flat in the area of the first and the second mowing sickle support and the topside bulges start, when seen in working direction, in front of a rear edge of the front connection web. The connection webs of the upper element and the topside bulges form an opening, which partially extends into the

rear connection web. Furthermore, the lower element has, preferably, a support plate, which forms the mowing sickle supports, wherein the lower element has a carrier, which is connected to the support plate and comprises the rear connection web of the lower element.

In the rear connection web of the lower element, preferably, attachment through holes are provided for attaching the mowing finger arrangement on a sickle bar, which has a cross-section, deviating from a circle.

A further subject of the invention is a method for manufacturing a mowing finger

- by embossing an upper element, wherein on the upper element, a projection, directed towards a lower element, is formed as an abutment for a rear portion of a mowing sickle, when seen in working direction, and

- by connecting the upper element to the lower element.

The projection serves as an abutment for a rear portion of a mowing sickle and prevents, thus, advantageously a tilting of the mowing sickle, as described above. The projection can be formed easily during the manufacture of the upper element, preferably in one working step with embossing the upper element, wherein the projection is formed especially by an impression on a side of the upper element facing away from the lower element.

Advantageously, during the embossing of the upper element, a rear web is formed on a rear end of the mowing finger, when seen in working direction, and a topside bulge, arranged in front of it, is formed, wherein the projection is especially formed in a concave side of the bulge.

An especially advantageous embodiment is achieved, when the projection is manufactured by an impression in a convex side of the topside bulge, wherein by the impression, especially a space is provided around an attachment bore of the rear web. The space enables then advantageously the arrangement of a screw head or a screw nut in the area of the attachment bore.

A further subject of the invention is a mowing bar of a finger bar mower of a harvester comprising

- a finger bar,
- at least one mowing finger arrangement according to the invention, as described above, which is mounted on the finger bar,
- a mowing sickle with sickle blades, which are attached on a blade bar and which have respectively cutting edges,

wherein the mowing sickle is reciprocatingly guided relative to the finger bar.

Concerning further features of the mowing bar it is referred to printed publication EP 1 551 214 B1.

According to a preferred embodiment of the mowing bar, rollers are provided, by means of which the mowing sickle is supported to the rear on the finger bar, when seen in working direction, wherein the rollers are, respectively, rotatably supported on a roller holder and the roller holders are mounted on the finger bar, wherein the roller holders are preferably formed in form of bridges between two neighbouring mowing fingers.

The mowing finger and the roller holders can, preferably, be attached by means of joint attachment screws on the finger bar. Especially, the roller holders are attached,

respectively, between two mowing finger arrangements, arranged next to each other, and are attached by means of attachment screws of both mowing finger arrangements arranged next to each other.

Instead of rollers, also guide plates can be used with a top guiding roller for guiding on the sickle back.

Following the invention is described in more detail using the embodiments shown in the drawings. The embodiments concern the mowing finger arrangement according to the invention, the mowing bar and the method according to the invention at the same time. The embodiments are exemplary and do not limit the general idea of the invention.

It shows

- Fig. 1 an upper element of a mowing finger arrangement according to the invention,
- Fig. 2 a mowing finger arrangement according to the invention in a side view,
- Fig. 3 the upper element according to Fig. 1 in a further representation,
- Fig. 4 a detail designated in Fig. 2 with IV,
- Fig. 5 the upper element according to Fig. 1 in a perspective representation,

Fig. 6 the mowing finger arrangement according to Fig. 2 in a perspective representation,

Fig. 7 the mowing finger arrangement according to Fig. 2 with a mowing sickle and

Fig. 8 the mowing finger arrangement according to Fig. 7 with the mowing sickle in a position deflected up to the abutment.

Figures 1 to 3 are described together. Figures 1 and 3 show an upper element 3 of a mowing finger arrangement according to the invention, which is connectable to a lower element 4 according to the mowing finger arrangement in Fig. 2. The mowing finger arrangement, shown in the embodiment, has two mowing fingers 1, 2. The space between the upper element 3 and the lower element 4 is provided to accommodate the mowing sickle, which is described later with reference to the Figures 7 and 8 in more detail. The arrow A represents a working direction, in which the mowing finger arrangement is moved during mowing operation. By the working direction A the moving direction of the whole mower during the mowing process is meant. A portion of the upper element 3, arranged at the rear, when seen in working direction A, forms a rear web 26, which serves for attaching the mowing finger arrangement on a not shown mowing bar by means of the bore 27. The webs 26 of the upper elements 3 of the two mowing fingers 1, 2 are connected by a rear connection piece 26a to a connection web. The specialist can see, that without such a connection 26a, a mowing finger arrangement with only one mowing finger would be present, which is also considerable in the sense of the invention, like three or more connected mowing fingers in a mowing finger arrangement. Components, which are provided once for each mowing finger, are described in singular. The specialist can see, that the total number depends on the number of mowing fingers.

A front connection web 29 connects also the two mowing fingers 1, 2 at the upper element 3 and forms a portion of the blade gap 15.

When seen in working direction A, in front of the rear web 26, a topside bulge 24 is formed in the upper element 3, which provides a space for the accommodation of the not shown mowing sickle. The bulge 24 is, thus, formed concave towards the lower element 4, wherein the term concave only indicates the main direction of the molding of the bulge 24, without limiting this to a geometric shape, like for example spherical, elliptical or rectangular. The lower element 4 has a corresponding downside bulge 38, also formed away from the mowing sickle.

In the rear part of the upper bulge 24, when seen in working direction A, a projection 11 is arranged, which projects in the direction towards the lower element 4 from the bulge 24.

In Fig. 4 a detail designated with IV of Fig. 2 is shown enlarged. It shows the projection 11 in the topside bulge 24, in the area of the transition to the rear web 26, wherein the projection 11 has an inclined extending flank 9 and a face 10 facing the mowing sickle. By the face 10 of the projection 11, an abutment is formed for the mowing sickle, which delimits its deflection as later described in more detail. Opposite to the projection 11 on the convex side of the bulge 24, a mating impression 12 is arranged on the concave side of the bulge 24. The projection 11 is preferably manufactured by embossing the impression 12 on the convex side of the bulge 24, facing away from the mowing sickle. By the forming process, the pushed-away material has to escape and forms the projection 11 on the concave side of the bulge 24. In Figures 3 and 6 it is easily visible, that the impression 12 can advantageously serve to provide a flat portion around the bore 27, which provides sufficient space for a screw bolt or a screw nut.

In Fig. 5, the upper element 3 is shown in a perspective view from its side facing the lower element, whereby the position of the rear web 26, the topside bulge 24 with the projection 11 and the front connection web 29 is visible.

In Fig. 6 a mowing finger arrangement according to Fig. 2 is shown in a perspective view. Between the rear connection web 26 and the front connection web 29 of the upper element 3 and the topside bulge 24, an opening is formed, which extends into the rear connection web 26 of the upper element 3. Thus, it is ensured that the rear connection web 26 of the upper element 3 is not bulged, which could lead to distortions in the forming process. The front connection web 29 of the upper element 3 is approximately arranged parallel to a front connection web 34 of the lower element 4. The front connection web 29 of the upper element 3 is, thus, not bulged. The front connection web 29 of the upper element 3 and the front connection web 34 of the lower element 4 form a gap, which is part of the blade gap 15 (see Fig. 2).

In Fig. 7 the mowing finger arrangement according to Fig. 2 is shown with a mowing sickle 16 in a neutral, not loaded position, while in Fig. 8 the mowing finger arrangement according to Fig. 7 is shown with the mowing sickle 16 in a position deflected up to the abutment 11.

The upper element 3 is preferably formed as a sheet metal moulding and has an upper finger portion 7. A support plate 5 is especially a stamped piece, which is manufactured from sheet metal and has a lower finger portion 8. The upper finger portion 7 and the lower finger portion 8 are connected, preferably welded, to each other at a free end of the mowing finger 1. A carrier 6 has a carrier arm 13, which is rigidly connected, for example by means of welding, to the lower finger portion 8. The carrier 6 is, in this case also, as the upper element 3, manufactured from a sheet metal piece.

The mowing sickle 16 has a blade 14, a cutting portion of which is guided in the blade gap 15. A rear portion 19 of the blade 14, arranged in working direction A behind an attachment 18, is deflected during mowing operation in direction towards the upper element 3, when the blade 14 is pulled at the front by the cutting forces during the mowing process downwards, i.e. towards the ground or towards the harvesting goods. Due to this, the rear portion 19 of the blade 14 abuts the projection 11, as shown in Fig. 8. The projection 11 prevents, thus, advantageously a tilting of the blade 14 downwards.

Reference numerals list

1	first mowing finger
2	second mowing finger
3	upper element
4	lower element
5	support plate
6	carrier
7	upper finger portion
8	lower finger portion
9	flank
10	face
11	projection
12	impression
13	carrier arm
14	blade
15	blade gap
16	mowing sickle
18	attachment
19	rear portion
24	topside bulge
26	rear web of the upper element
26a	connection
27	bore
29	front web of the upper element
34	front web of the lower element
35	rear web of the lower element
38	downside bulge
A	working direction

Claims

1. **Mowing finger arrangement with an upper element (3), which is connectable for the formation of at least one mowing finger (1) to a lower element (4) and with a blade gap (15) for guiding a mowing sickle (16) between the lower element (4) and the upper element (3),**

wherein the upper element (3) has on a side, facing the lower element, a projection (11) as an abutment for a rear portion of the mowing sickle, when seen in a working direction (A).

2. **Mowing finger arrangement according to claim 1,**

characterised in

that a movement of the rear portion of the mowing sickle (16), when seen in the working direction (A), is delimited by the projection (11) in a direction towards the upper element (3).

3. **Mowing finger arrangement according to one of the preceding claims,**

characterised in

that the projection (11) is formed by an impression (12) in the upper element (3) from the side facing away from the mowing sickle (16).

4. **Mowing finger arrangement according to one of the preceding claims,**

characterised in

that a rear web (26) of the upper element (3) is arranged on a rear end of the at least one mowing finger (1), when seen in the working direction (A), wherein the rear web (26) of the upper element (3) serves for the attachment

of the mowing finger arrangement on a finger bar and wherein the projection (11) is arranged in front of the rear web (26), when seen in the working direction (A).

5. Mowing finger arrangement according to claim 4,
characterised in

that, when seen in working direction (A), at least one topside bulge (24) is arranged in front of the rear web (26), wherein the projection (11) is arranged on a concave side of the topside bulge (24).

6. Mowing finger arrangement according to claim 5,
characterised in

that the rear web (26) of the upper element (3) has an attachment bore (27), wherein the impression (12) is arranged in an area of the topside bulge (24) facing the attachment bore (27).

7. Mowing finger arrangement according to one of the preceding claims,
characterised in

that the upper element (3) and the lower element (4) form two mowing fingers (1, 2).

8. Mowing finger arrangement according to claim 7,
characterised in

that the rear web (26) of the upper element (3) is formed as a rear connection web (26, 26a) of the upper element (3),

wherein the two mowing fingers (1, 2) are connected to each other via the rear connection web (26, 26a) and a front connection web (29) on the upper element (3) as well as via a rear connection web (35) and a front connection web (34) on the lower element (4).

9. Method for producing a mowing finger (1)

- by means of embossing an upper element (3), wherein on the upper element a projection (11), directed towards a lower element (4), is formed as an abutment for a rear portion of a mowing sickle (16), when seen in working direction (A) and
- by means of connecting the upper element to the lower element.

10. Method according to claim 9,

characterised in

that the projection (11) is formed by an impression (12) on a side of the upper element (3) facing away from the lower element (4).

11. Method according to one of claims 9 or 10,

characterised in

that, during the embossing of the upper element (3), a rear web (26) is formed on a rear end of the mowing finger (1), when seen in working direction (A), and a topside bulge (24), arranged in front, is formed, wherein the projection (11) is formed on a concave side of the topside bulge (24).

12. Method according to claim 11,

characterised in

that the projection (11) is made by means of an impression (12) on a convex side of the topside bulge (24), wherein by means of the impression (12) a space is especially provided around an attachment bore (27) of the rear web (26).

13. Method according to one of claims 9 to 12,

characterised in

that the embossing of the upper element (3) and the forming of the projection (11) are carried out in one working step.

14. Mowing bar of a finger bar mower of an agricultural machine comprising

- a finger bar
- at least one mowing finger arrangement according to one of claims 1 to 8, attached on the finger bar,
- a mowing sickle with sickle blades, which are attached on a blade bar and, respectively, have cutting edges,

wherein the mowing sickle is guided reciprocatingly relative to the finger bar.

15. Mowing bar according to claim 14,

characterised in

that rollers are provided, by means of which the mowing sickle is supported to the rear on the finger bar, when seen in working direction, wherein the rollers are, respectively, supported rotatably on a roller holder and the roller holders are mounted on the finger bar, wherein the roller holders are formed especially in the form of bridges between two neighbouring mowing fingers.

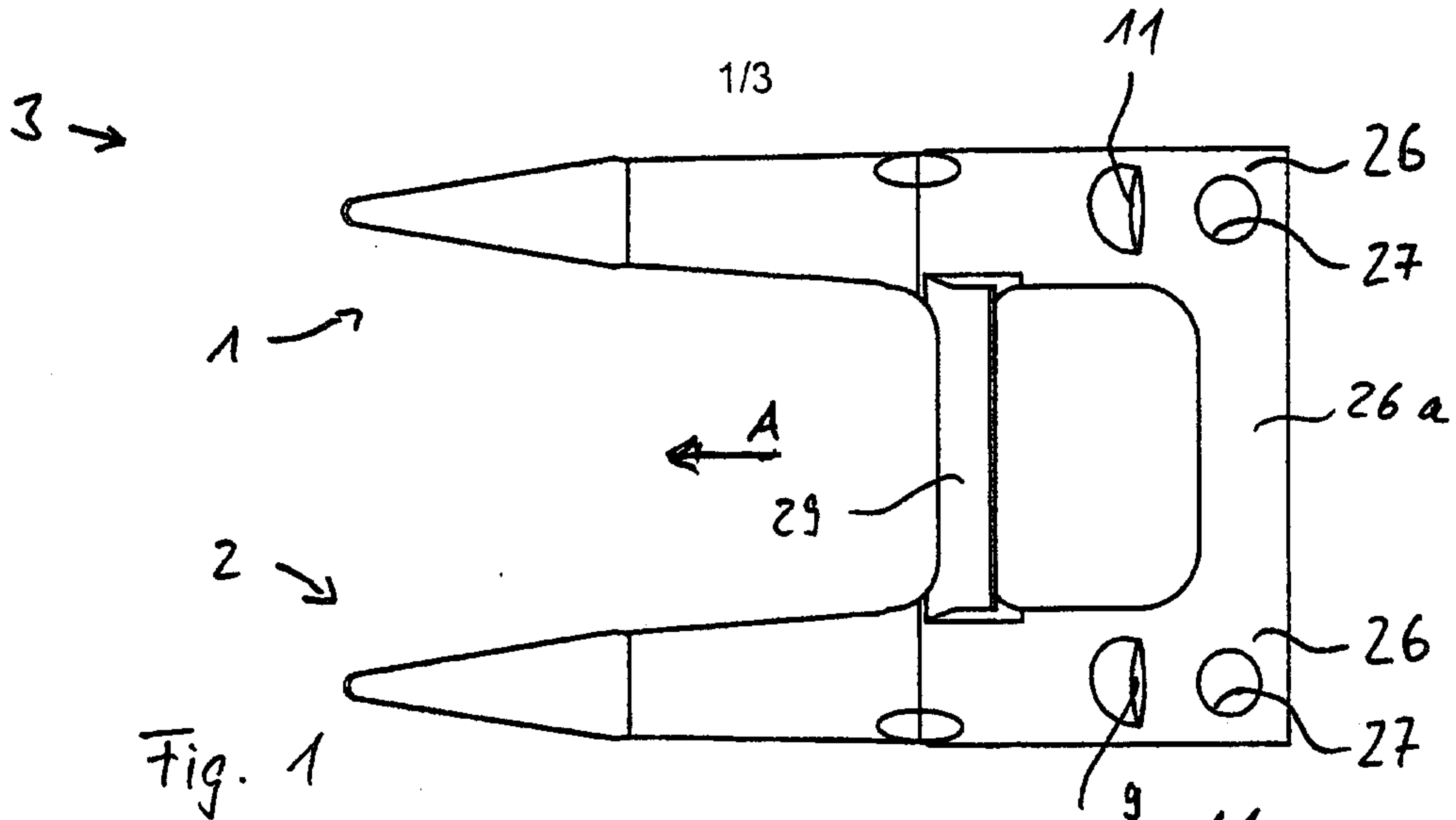


Fig. 1

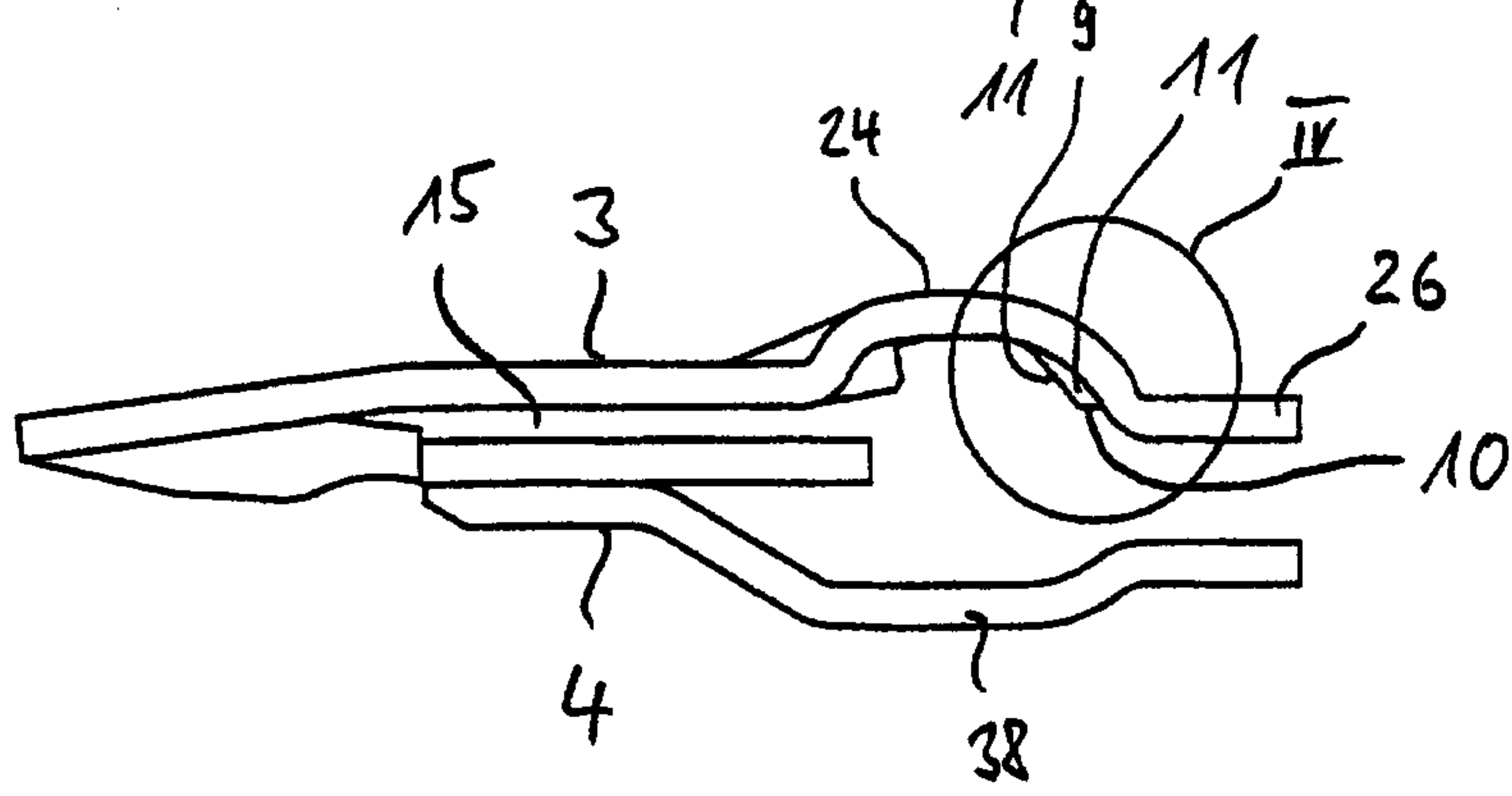


Fig. 2

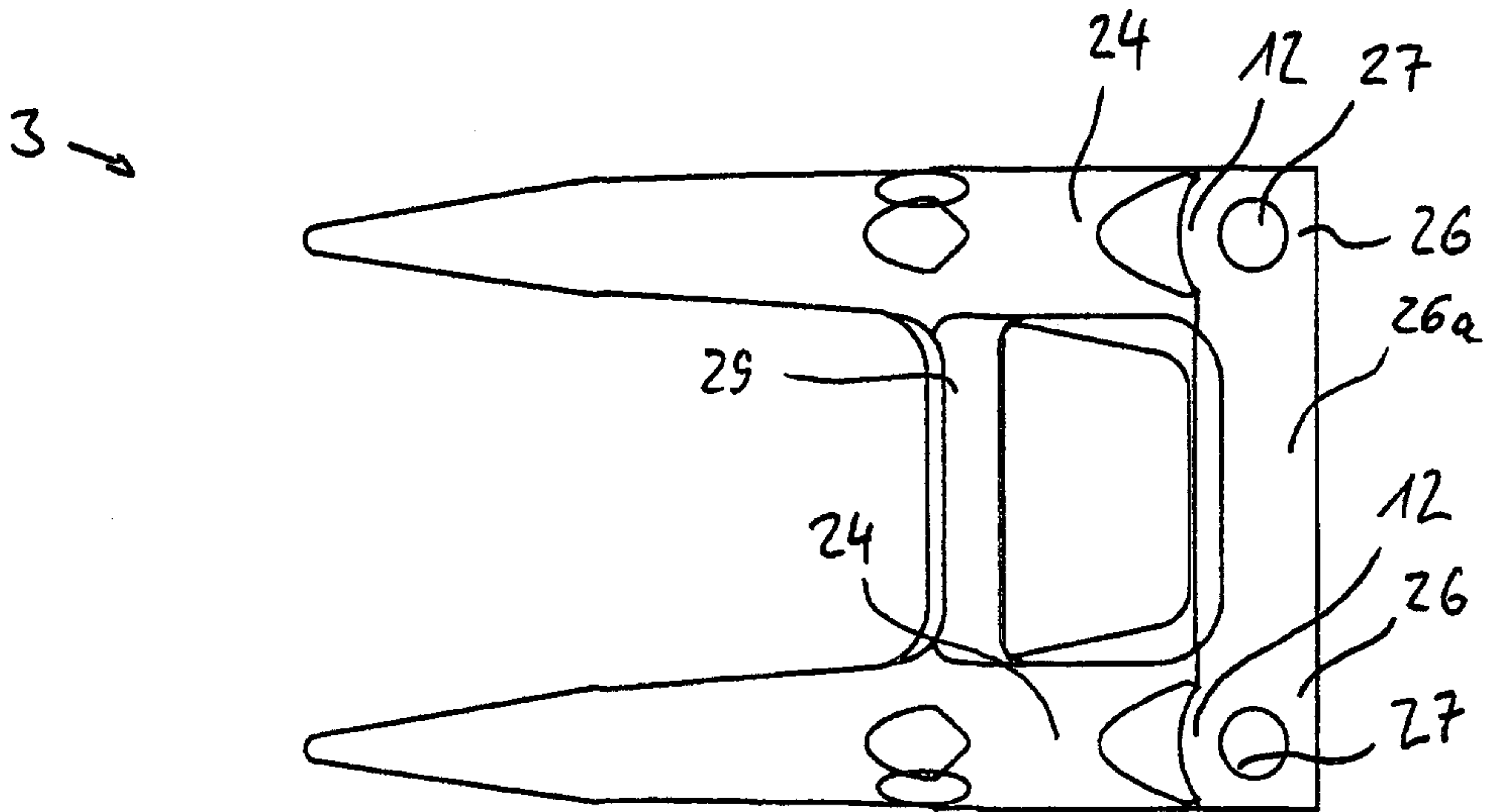
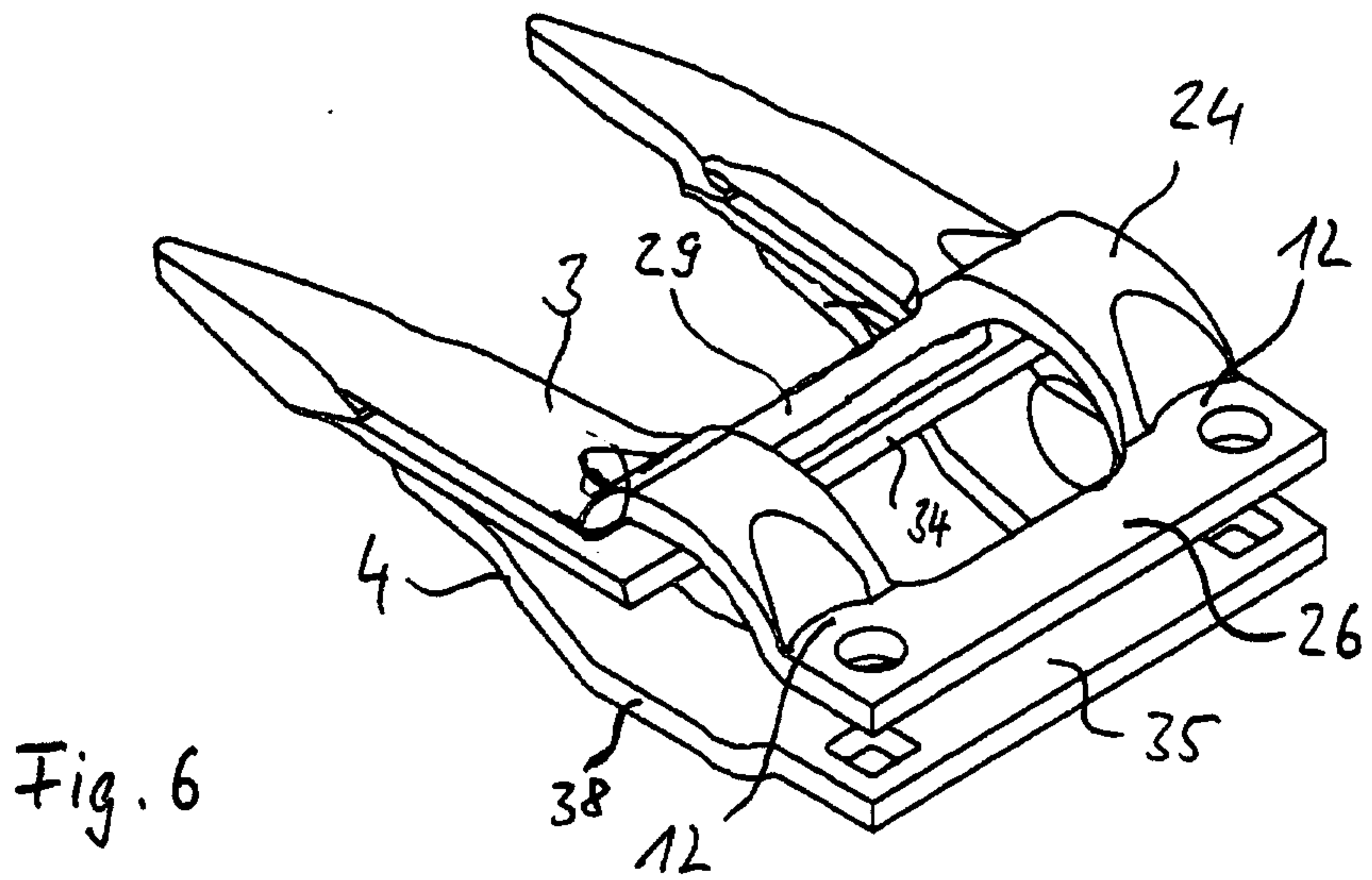
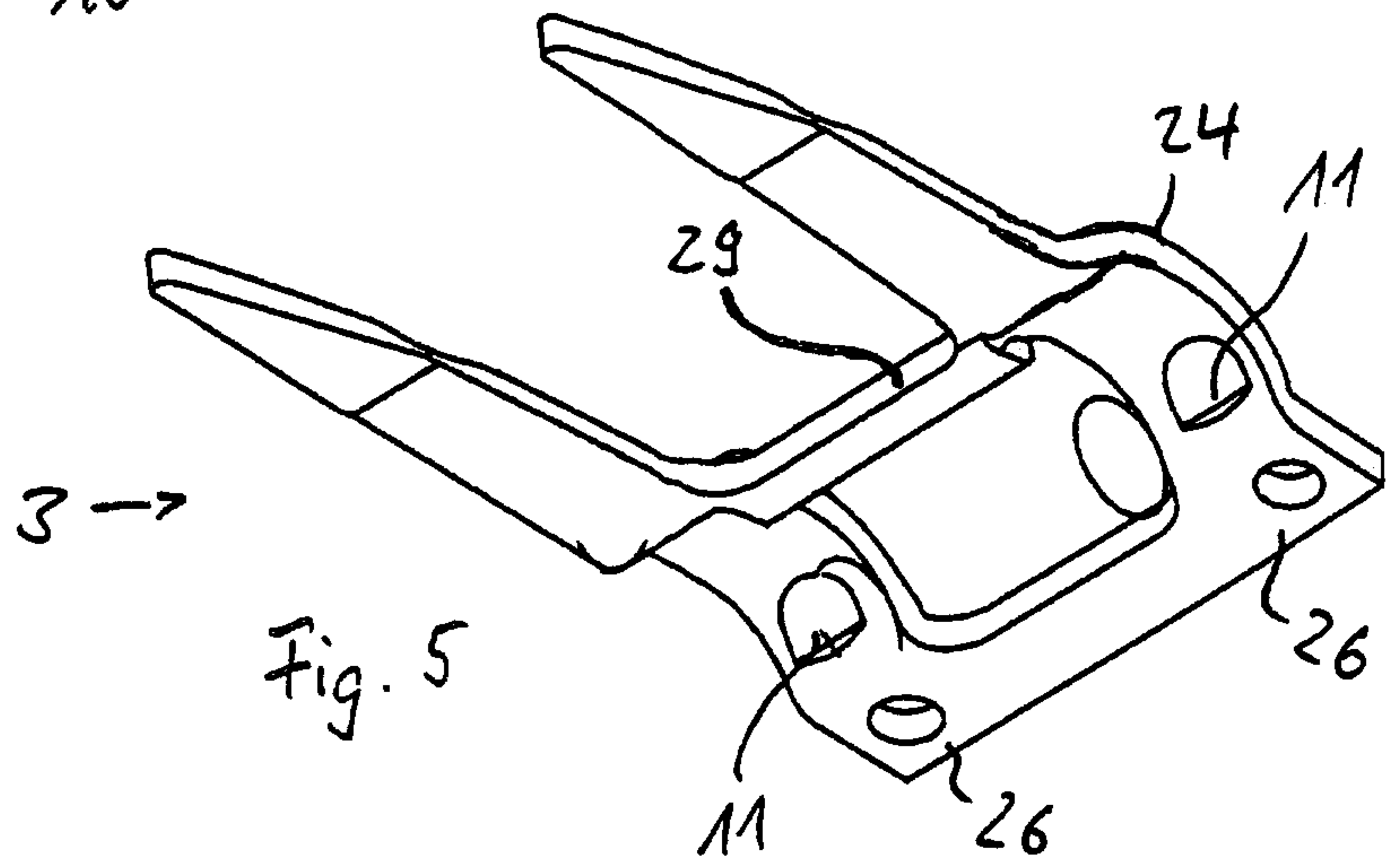
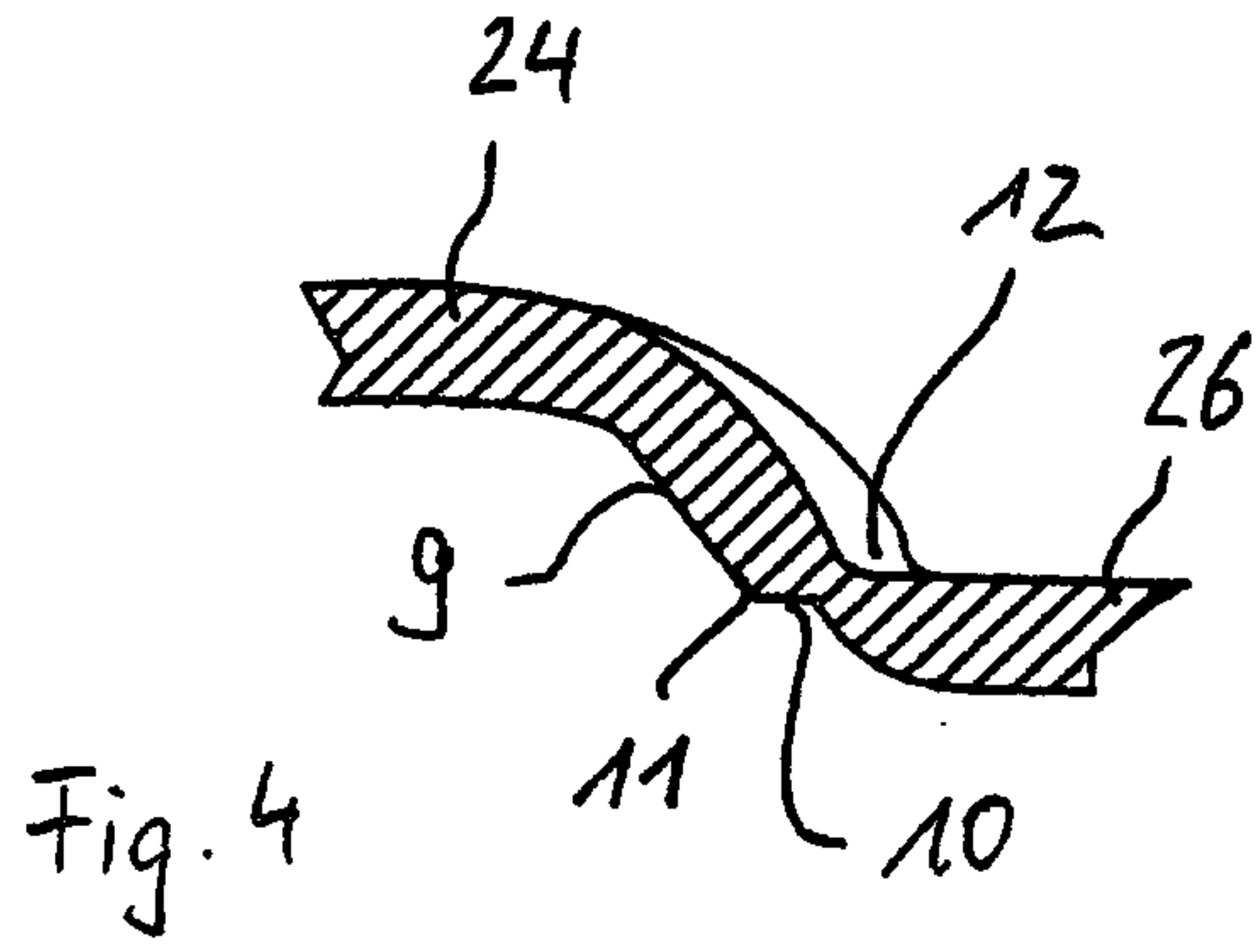


Fig. 3



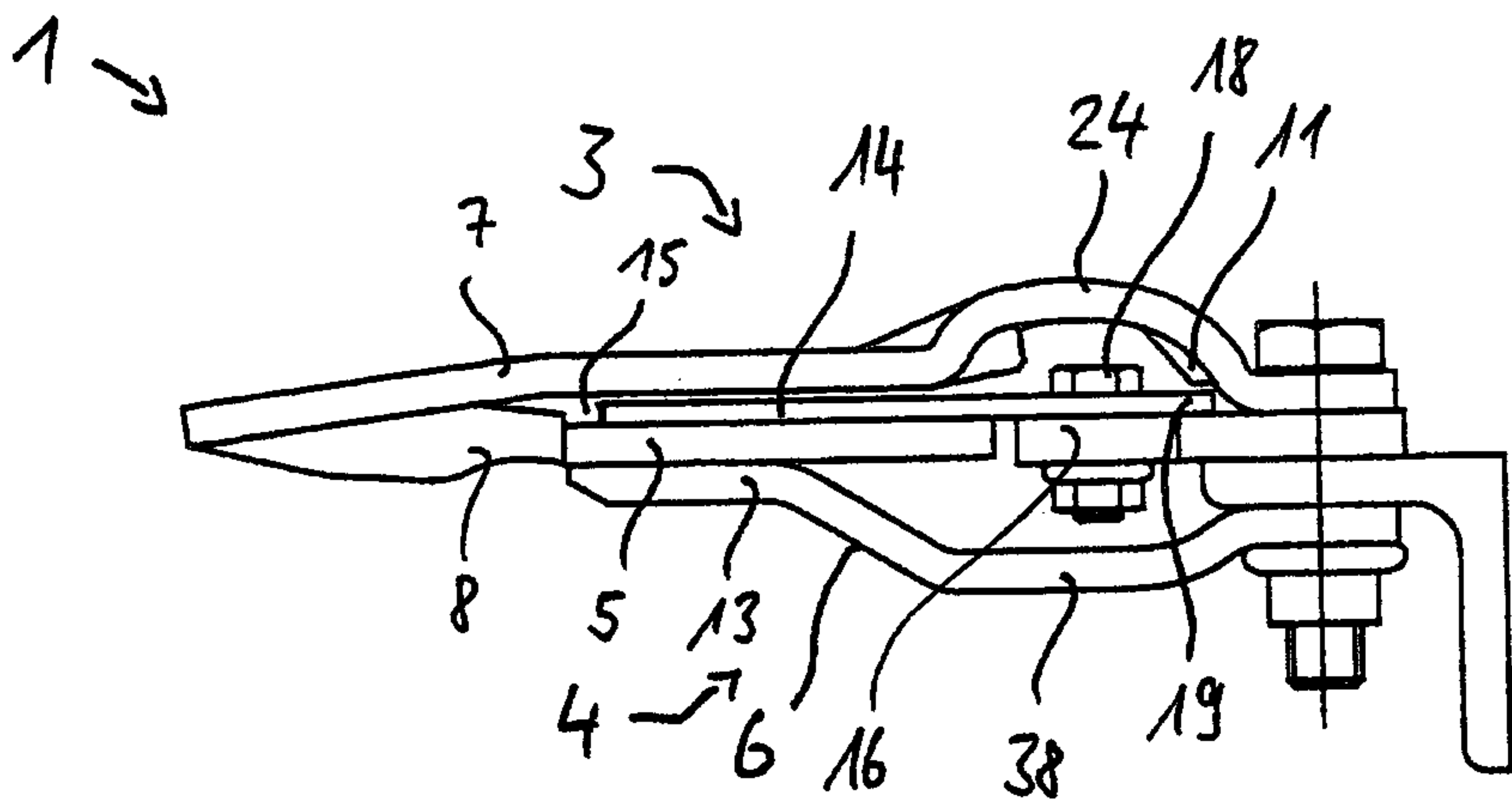


Fig. 7

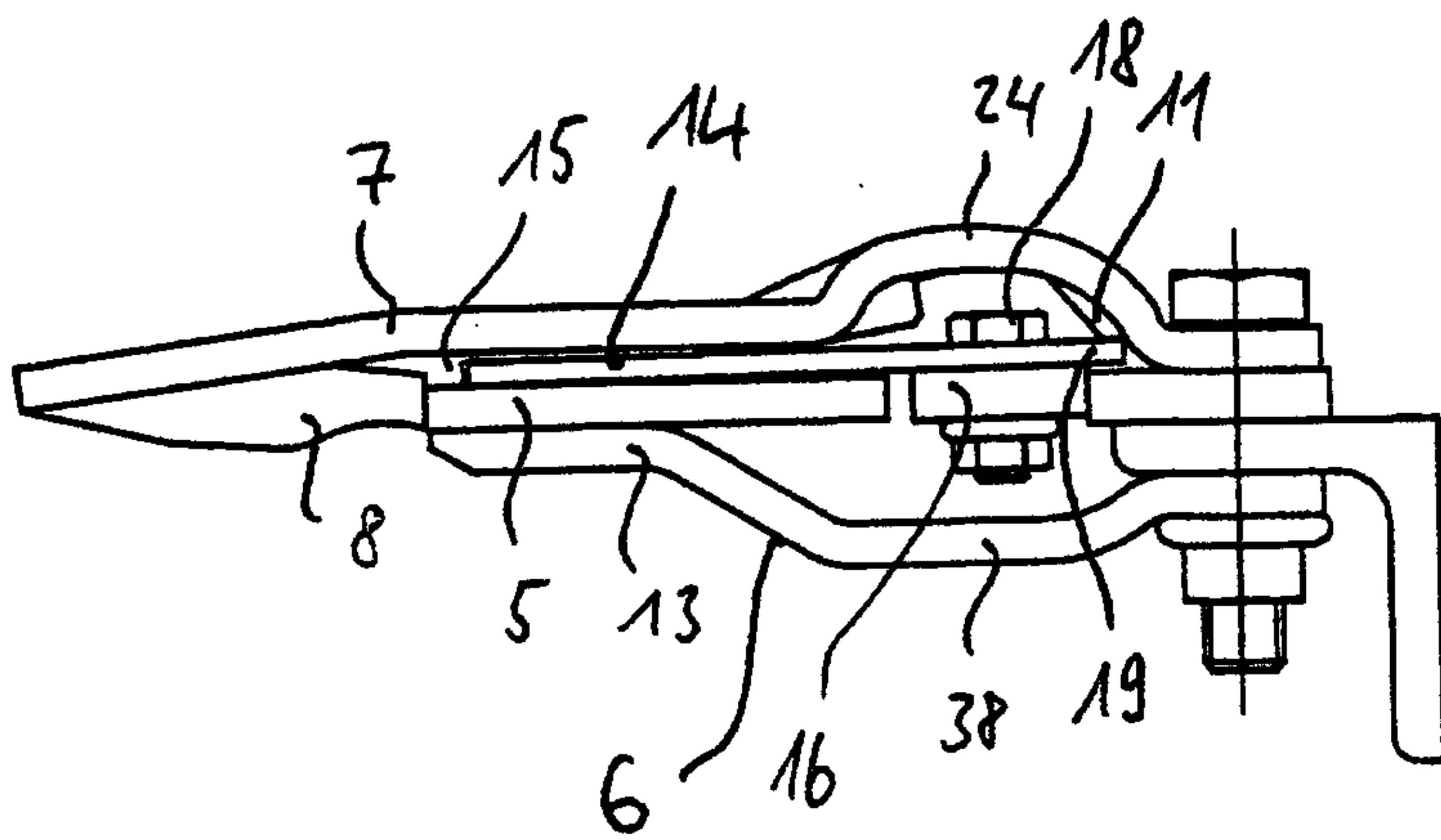


Fig. 8

