

(19) **DANMARK**



Patent- og
Varemærkestyrelsen

(10) **DK/EP 3512657 T3**

(12) Oversættelse af
europæisk patentskrift

-
- (51) Int.Cl.: **B 23 B 27/16 (2006.01)**
- (45) Oversættelsen bekendtgjort den: **2020-07-20**
- (80) Dato for Den Europæiske Patentmyndigheds
bekendtgørelse om meddelelse af patentet: **2020-05-13**
- (86) Europæisk ansøgning nr.: **18712553.9**
- (86) Europæisk indleveringsdag: **2018-03-16**
- (87) Den europæiske ansøgnings publiceringsdag: **2019-07-24**
- (86) International ansøgning nr.: **EP2018056709**
- (87) Internationalt publikationsnr.: **WO2018172218**
- (30) Prioritet: **2017-03-22 DE 102017204825** **2017-03-24 DE 102017205029**
2017-08-30 DE 102017215156 **2017-09-11 DE 102017215972**
- (84) Designerede stater: **AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV
MC MK MT NL NO PL PT RO RS SE SI SK SM TR**
- (73) Patenthaver: **CeramTec GmbH, CeramTec-Platz 1-9, 73207 Plochingen, Tyskland**
- (72) Opfinder: **HENZLER, Uwe, Bismarckstr. 14, 73269 Hochdorf, Tyskland**
- (74) Fuldmægtig i Danmark: **NORDIC PATENT SERVICE A/S, Bredgade 30, 1260 København K, Danmark**
- (54) Benævnelse: **VÆRKTØJSSYSTEM**
- (56) Fremdragne publikationer:
EP-A2- 1 595 648
WO-A1-03/013770
WO-A1-2016/110596
DE-A1-102010 029 616
US-A1- 2003 086 766

DESCRIPTION

[0001] The invention relates to a tool system, comprising a cutting plate and comprising a tool holder which has a plate seat for receiving the cutting plate having a trough, and, at a distance from this plate seat, has a surface which is inclined at an obtuse angle with respect to the surface of the tool holder that is adjacent to the plate seat, comprising a clamping element which has an opening with a stop in which opening a clamping screw having a guide portion is received, a surface, and a projection, the lug of the clamping element having an annular surface and the trough of the cutting plate having an annular surface, the annular surface of the clamping element and the annular surface of the cutting plate abutting one another in an interlocking manner when the cutting plate is clamped, and, during the process of fastening the clamping element to the tool holder, i.e. while producing a torque, during rotation of the clamping screw, the surface of the clamping element slides on the surface of the tool holder, as a result of which the clamping element moves relative to the tool holder and pulls the cutting plate into the plate seat and clamps it therein.

[0002] When clamping a cutting plate in a tool holder, it is necessary for a plurality of requirements to be met. Therefore, it is necessary for machining work piece that the cutting plate is held precisely so as to be fixed in a tool holder. The receiving space, i.e. the plate seat of the cutting plate, should be formed such that, in the event of wear, the cutting plate can be positioned exactly at the same point as the cutting plate to be replaced without additional time or effort. The ability to repeat the cutting plate position is an indispensable requirement for a plate seat of a tool holder. Furthermore, it is necessary for the actual clamping process of the cutting plate, i.e. for firmly clamping the cutting plate in the tool holder, to be designed as simply as possible since situations are possible in production in which access to a cutting plate is difficult. This can be the case if a plurality of tool holders is arranged on a tool carrier and a cutting plate has to be replaced. Optionally, it can be necessary for a cutting plate to be exchanged “over head.”

[0003] Different arrangement options and fastening options of a cutting plate are disclosed in the prior art. For example, clamping a cutting plate which has a trough into which a counterpart of a clamping jaw engages is known. The counterpart can be arranged as one piece with the clamping jaw or on a pressure plate which interacts with the clamping jaw.

[0004] Clamping a cutting plate without a trough over its flat surface is also known. The clamping jaw or a corresponding pressure piece also then has a flat clamping surface.

[0005] Combinations of the aforementioned clamping methods are also disclosed. Therefore, the prior art also describes fastening a cutting plate by means of a trough and simultaneously over the surface of the cutting place.

[0006] WO 2003/013770 discloses a clamping plate which has a clamping trough in the shape of a “donut.” A circular ring of a pressure piece engages into the clamping trough. The pressure piece has shaping means on its side opposite the cutting plate that interact with the corresponding shaping means of the clamping jaw. When tightening a clamping screw, clamping the cutting plate in the carrier tool is secured by means of an inclined surface on the clamping jaw and on the carrier tool, in connection with the shaping means of the pressure piece and the clamping jaw, and on the circular ring of the pressure piece. Therefore, there is a punctiform or linear contact between the circular ring of the pressure piece and the clamping trough in the cutting plate. The effects of forces by means of this punctiform or linear contact on the cutting plate can be so huge that this plate breaks. This can be the case in particular with very brittle ceramic materials.

[0007] A cutting tool system which consists substantially of a carrier tool which has a recess for receiving a cutting plate is known from WO 2007080151 A1. The cutting plate is provided with a clamping trough. The cutting plate is held by a clamping element in the carrier tool. The clamping element is in turn fastened to the carrier tool by means of a clamping screw. An engaging element is arranged on the lower face of the clamping element that faces the cutting plate, which engaging element is in clamping contact with the clamping trough and anchors the cutting plate on the carrier tool thereby. The clamping element is guided over an inclined surface on the carrier tool such that, when the clamping screw is tightened, the clamping element is pulled toward the carrier tool.

[0008] WO 2013/060752 discloses a tool system suitable for high cutting data and feed speeds, wherein the clamping element is movably held in a groove having parallel clamping element guides, and a clamping element hole for the clamping screw is arranged in the clamping element and, in the clamped state of the cutting plate, the wall of the clamping element hole that faces the cutting plate abuts the clamping screw and the engaging element of the clamping element, seen from the cutting edge of the cutting plate, engages interlockingly in the clamping trough in front of the center of this trough.

[0009] Generic document, WO 2016/110596 A1, describes a tool system, comprising all the features of the preamble of claim 1.

[0010] DE 10 2010 029616 A1 describes an interlocking and force-fitting cutting plate-clamping system, comprising an anti-rotation means.

[0011] EP 1 595 648 A2 describes a two-part clamping element.

[0012] The invention has the object of improving a tool system according to the preamble of claim 1 in such a way that it is possible to clamp a cutting plate in an exact position and in a secure and repeatable manner, and such that damage to the cutting plate is prevented.

[0013] According to the invention, this object is achieved by the features of claim 1.

[0014] The invention relates to a tool system which comprises a tool holder comprising a clamping element which has a clamping element lug and comprising a cutting plate which has a trough on the cutting plate surface, for machining workpieces. The trough has a trough bottom which merges into upper face of the cutting plate via an annular surface. In a particular embodiment, an elevation can be arranged in the trough, the top of which elevation ends at a distance from the cutting plate surface. A lug or an attachment of a clamping element or of a pressure plate arranged on the clamping element engages in the trough of the cutting plate in the clamped state and clamps this plate on the carrier tool or on the holding element thereby.

[0015] The clamping element according to the invention has a clamping means arranged outside the center of the clamping element. A sliding surface arranged at an angle on an end of the clamping element is operatively connected to a surface, arranged at an angle, of the tool holder during the clamping process. As a result, the clamping element moves relative to the tool holder fixed in the tool system and clamps the cutting plate, repeatably and true to position, in the plate seat of the tool holder. The horizontal relative movement of the clamping element is limited in that a guide portion of the clamping means comes into contact with a stop, a wall of the clamping element. According to the invention, the distance between the stop and the center of the trough of the cutting plate or the lug of the clamping element is determined such that, at the maximum permissible torque, a completely planar interlocking connection occurs between the lug of the clamping element and the trough of the cutting plate. In order to ensure that this occurs, both the lug of the clamping element and the trough have an annular surface. In the clamped state of the tool system, the two annular surfaces are operatively connected.

[0016] The clamping means is arranged outside of the center of the clamping element. Preferably, the clamping element is offset from the center at a distance of 30% of half of the length of the clamping element. Particularly preferably, the clamping means is offset in the direction of the sliding surface.

[0017] On the basis of the arrangement, according to the invention, of the annular surfaces, the sliding surface and the clamping means, a contact region over a wide area of the annular surfaces is produced. This contact region extends fully over the entire annular surfaces such that a force is applied to the cutting plate in a region of 360 degrees.

List of reference signs

1	Tool system
2	Tool holder

4	Clamping element
5	Attachment, projection, lug of 4
6	Cutting plate
7	Trough of 6
10	Upper face of 6
11	Lower face of 6
15	Clamping means, screw
16	Pressure plate
17	Plate seat
18	First end of 4
19	Second end of 4
20	Surface
21, 21'	Face of 4
22	Surface of 2
23	Fastening portion of 15
24	Clamping portion of 15
25	Guide portion of 15
26	Opening, hole
27	Stop, wall of 26
28	Contact surface of 4
30, 30'	Bottom of 7
31	Annular surface 31 of 7
32	Opening in 7
33, 34	Narrow face of 4
36	Annular surface of 5
38	Securing means
39	Recess
40	Main body of 4
41	Receiving space
42	Stop surface
43, 43'	Guide surface, inner face
44, 44'	Groove
45	Mouth

46	Spring
47	Fastening means
48, 48'	Projection, finger
49	End region of 48
51	Opening in 40
52	End region of 48
53	Surface of 2
Q1	Cross-sectional surface of 30
Q2	Cross-sectional surface of 32
T	Depth of 7
H	Height of 35
m1	Diameter of 30, 30'
m2	Diameter of 32
m3	Diameter of 35
m4	Diameter of 35
A1	Distance of 45

[0018] In the following, the invention will be explained with reference to the figures in which:

Fig. 1 partly and schematically shows a cross section of the tool system, comprising a tool holder, a cutting plate, a clamping element and a clamping means;

5 Fig. 2 partly and schematically shows the cross section of a trough of a cutting plate according to Fig. 1;

Fig. 3 schematically shows a plan view of Fig. 2;

Fig. 4 partly and schematically shows the cross section of an alternative form of a trough, according to the invention, of a cutting plate;

10 Fig. 5 schematically shows the clamping element from below;

Fig. 6 schematically shows a detail of the first end of a clamping element having a projection;

Fig. 7 partly and schematically shows the trough, according to the invention, of the cutting plate in plan view;

Fig. 8 schematically shows a detail of the mating trough having a projection;

15 Fig. 9 schematically shows a detail of an alternative embodiment of a clamping element having a pressure plate;

Fig. 10 shows the clamping element according to Fig. 9 from below; and

Fig. 11 shows an alternative design of the clamping element according to Fig. 9.

[0019] All the figures show the invention schematically and in detail and are used as an example to explain the invention. Particular embodiments of the invention may deviate from these figures.

[0020] Fig. 1 schematically shows a tool system 1, comprising a tool holder 2, a cutting plate 6 which has a trough 7, and a clamping element 4 having a lug 5 which engages into the trough 7

5 of the cutting plate 6 in the clamped state of the tool system 1. The clamping element 4 which corresponds substantially to the shape of a cuboid and has two broad faces 21, 21' and two narrow faces 33, 34 is fastened to the tool holder 2 by means of a clamping means 15. The cutting plate 6 which has a trough 7 on its upper face 10 can be, and preferably is, formed as an indexable cutting plate. On an indexable cutting plate 6, a trough 7 is formed on the upper face 10 and on
10 the lower face 11. The two troughs are identical such that it is possible to position the cutting plate 6 in the plate seat 17 of the tool holder 2 so as to be rotatable about 180 degrees. The lug 5 is arranged at the first end 18 of the cuboid clamping element 4. The shape and the function of the lug 5 are described below. The clamping element has a surface 20 arranged at an angle at the second end 19 of the clamping element 4. Preferably, this surface 20 forms an obtuse angle Y in
15 the range of from 120 to 170 degrees, particularly from 145 to 165 degrees, with the surface 53 of the upper face of the tool holder 2. The upper face 10 of the cutting plate 6 is preferably oriented in parallel with the surface 53.

[0021] The tool holder 2 has a surface 22 congruent with the respect to the surface 20 in the region of the surface 20 of the clamping element 4. The two surfaces 20 and 22 form an inclined
20 plane. The tool holder 2 is fixedly held in the machine tool (not shown). During the process of fastening the clamping element 4 to the tool holder 2, i.e. while producing a torque, during rotation (tightening) of the clamping means 15, the surface 20 of the clamping element 4 slides on the surface 22 of the tool holder 2 (lower right in Fig. 1). As a result of this clamping mechanism, the clamping element 4 moves relative to the tool holder 2 and pulls the cutting plate
25 into the plate seat 17 and clamps it therein by means of the connection of the projection 5 to the trough 7 of the cutting plate 6. The quality of the surfaces of the surfaces 20 and 22 is designed such that sliding these surfaces on one another is supported.

[0022] In the embodiment according to Fig. 1, the clamping means 15 is designed as a screw, also called a clamping screw. The screw 15 has a fastening means 23 in the shape of a head and
30 a substantially cylindrical clamping portion 24 and guide portion 25. The clamping portion 24 can be designed as a thread, for example as an external thread, which interacts with a counterpart in the tool holder 2, for example with an internal thread. The guide portion 25 of the screw 15 can be used as a stop in order to limit the linear mobility, in Fig. 1 the horizontal mobility, of the clamping element 4. This mobility is limited by means of the interaction of the guide portion 25

of the screw 15 with the stop, the wall 27 of the opening 26 of the clamping element 4, through which the screw 15 engages in order to fasten the clamping element 4 to the tool holder 2. This limitation prevents the cutting plate 6 from being damaged by a torque M which is too high during clamping. Additionally, this limitation prevents the annular surface 36 of the lug 5 of the clamping element 4 from sliding out of the trough 7 of the cutting plate 6 during clamping. The opening 26 can be designed as a circular hole, for example. Different shapes of this opening 26 are also possible, such as slit-shaped or oval openings. All forms of the opening 26 have a stop means 28 and a wall 27. The stop means 28 can be in the form of a contact surface and interacts with the fastening means 23 of the screw 15. The wall 27 of the opening 26 interacts with the guide portion 25 of the clamping means 15. The clearance available between the external thread of the clamping portion 24 and the inner thread of the tool holder 2 can be used to compensate for production tolerances. This clearance preferably makes a movement in the range of from 0.1 to 0.2 mm in all directions possible.

[0023] Fig. 1 shows a cross section through the clamping mechanism. According to this embodiment, the force is applied by means of the clamping means 15 outside the center of the clamping element 4 and therefore outside the center of the clamping mechanism. The center of the clamping element 4 is half the distance E_x between the first end 18 and the second end 19 of the clamping element 4. Preferably, the clamping means is arranged at a distance $< E_x/2$ from the second end 19. According to the invention, the force is applied at a distance in the range of from 20 to 40% of $E_x/2$, preferably 30% of $E_x/2$, between the second end 19 and the center of the clamping element 4. On the basis of the tolerances of the individual parts, in conjunction with the properties (sensitivity with regard to tensile and compressive stresses) of the cutting plate 6, the clamping mechanism must meet high requirements in order to ensure that the cutting plate 6 is fastened securely and repeatably in the tool seat 17 without the cutting plate 6 being damaged.

[0024] The distance between wall 27 of the opening 26 and the center, the middle point of the lug 5 or the trough 7 is referred to as functional dimension F_x . According to the invention, this dimension is selected such that, at the maximum permissible torque M , the lug 5 or its annular surface 36 forms a completely planar interlocking connection to the trough 7 or its annular surface 31 and they abut one another. The contact region therefore extends over 360 degrees of the two annular surfaces 31 and 36. There is no distance between the annular surfaces 31 and 36 in the clamped state of the tool system.

[0025] One part of the clamping mechanism is the trough 7 of the cutting plate 6 which is shown in Fig. 2. The trough 7 of the cutting plate 6 is arranged in the center of the upper face 10 or

lower face 11 of the cutting plate 6. A trough 7 which is arranged on the upper face 10 of the cutting plate 6 is described below. This description also applies correspondingly to a trough 7 which is arranged on the lower face 11 of an indexable cutting plate 6. The trough 7 is embedded in the cutting plate 6 as a depression and has the depth T. The trough 7 can have a level bottom 30. The bottom 30 can be parallel to the upper face 10 of the cutting plate 6 and transitions into the upper face 10 via an annular surface 31 arranged at an angle α . The angle α between annular surface 31 and bottom 30 is an obtuse angle α in the range of from 135 to 155 degrees, preferably this angle α has a range of from 140 to 150 degrees. This gives an opening angle β of the trough 7 in the range of from 90 to 130 degrees, preferably in the range of from 100 to 120 degrees. The cross-sectional surface Q1 of the bottom 30 of the trough 7 is smaller than the cross-sectional surface Q2 of the opening 32 of the trough 7 (Fig. 3). The trough has a diameter m1 at the bottom 30 and a diameter m2 at the opening 32. The diameter m1 is smaller than the diameter m2. The transitions between bottom 30 and annular surface 31 and between upper face 10 and annular surface 31 can be rounded. The radii of these transitions are in a range between 0.2 mm to 2.5 mm. Preferably, they are 0.6 mm, particularly preferably 2.0 mm. The trough 7 therefore consists of the bottom 30 of the annular surface 31, the opening 32 and the rounded transitions.

[0026] In a particular embodiment, the ground 30 of the trough 7 can be curved in the shape of a radius 30' or a polygenic curve, a spline (Fig. 4). Seen from the upper face 10 of the cutting plate 6, the bottom 30 formed by the radius 30' can have a concave shape. A particularly advantageously formed trough 7 according to the invention comprises exclusively rounded transitions r and therefore has no sharp-edged corners. A rounded trough 7 makes a high application of force possible without the risk that cracks and, as a result, fractures can occur in the cutting plate 6. Particular requirements are placed on the transitions between different surface shapes. These are predetermined places where cracks may preferably occur. Therefore, these transitions r are preferably rounded according to the invention.

[0027] In a particular embodiment (not shown), an elevation can be arranged centrally in the trough. The elevation extends from the bottom 30, 30' of the trough in the direction of the upper face 10 and ends below this upper face.

[0028] Fig. 5 shows the clamping element 4 from its lower face of its broad face 21. The lower face 21 denotes the face of the clamping element 4 that is opposite the cutting plate 6 and the tool holder 2 in the clamped state of the tool system 1. A lug 5 in the form of a projection is arranged at the first end 18 of the clamping element 4. Starting from the face 21, the projection 5 rises away from the face 21. The projection has a height h1 (Fig. 6). At a distance h2 from the face 21, the projection 5 transitions into an angularly arranged annular surface 36. The height at

which the annular surface 36 has a constant value around its entire circumference is denoted by H. Starting from a diameter m_3 , the annular surface 36 extends to the end of the projection 5 to a diameter m_4 . Therefore, m_3 is greater than m_4 . The distance between m_3 and m_4 is the height H of the projection 5. The annular surface 36 is arranged at an obtuse angle φ with respect to the face 34. This angle φ is preferably equal to the angle α between the annular surface 31 and the upper face 10 of the cutting plate 6.

[0029] The height H of the projection 5 correlates to the depth T of the projection 7. They can comprise the same values, but they can also deviate from one another. For example, H can be greater than T. The diameter m_3 of the projection 5 correlates to the diameter m_2 of the trough 7. The diameters m_3 and m_2 can have the same values, but they can also deviate from one another. For example, m_3 can be greater than m_2 .

[0030] In a tool system according to the invention, the value of the angle α and φ is equal; it is in the range of from 135 to 155 degrees, preferably these angles are in a range of from 140 to 150 degrees. As a result, a precise interlocking connection occurs on the entire annular surface (360 degrees) between lug 5 of the clamping element 4 and the trough 7 of the cutting plate 6. In equal angles α and φ , the following configurations are possible according to the invention:

$m_3 > m_2$, then $H > T$, or $H = T$, or $H < T$

$m_3 = m_2$, then $H = T$, or $H < T$

$m_3 > m_1$, then $H < T$, or $H = T$, or $H > T$

[0031] In a tool system comprising a cutting plate 6 having a trough 7 as described above, and comprising a clamping element 4 having a projection 5 as described above, in connection with the clamping mechanism described above, the force has an effect on the entire annular surface 31 of the trough 7 (Fig. 7 and 8). The force acts on the entire circumference of the annular surface 31. A completely planar interlocking connection occurs between the annular surface 36 of the lug 5 and the annular surface 31 of the trough 7. The annular surfaces 31 and 36 can be level. Therefore, the force of the force $F_{\text{clampingelement}}$ of the clamping element 4 is introduced by means of force vectors F_{nx} . These force vectors are arranged uniformly around the annular surface 31. Due to the relative movement of the clamping element 4 with respect to the tool holder 2, caused during clamping by the sliding of the surface 20 of the clamping element 4 on the surface 22 of the tool holder 2 and the force F pull-back generated thereby, the value of the force vectors F_{nx1} is higher than the value of the force vectors F_{nx2} . Therefore, the force vector F_{nx1} , which acts on the clamping element in parallel with the pull-back movement, has the highest value. Starting from the value of this force vector F_{nx1} , the values of the force vectors which act on the annular surface 31 are reduced continuously as far as to force vector F_{nx2} . The direction in which the

force vector F_{nx1} acts is opposite to the direction in which the force vector F_{nx2} acts. Between these two force vectors, n further force vectors act on the annular surface 31.

[0032] The size, the diameter, the depth, the angle α of the trough and force $F_{clampingelement}$ can be selected independently of the size of the cutting plate and the process parameters, such as the material to be processed, supply speed, etc.

[0033] Fig. 9 shows an alternative embodiment of the clamping element 4. As this clamping element is identical to the one described above, the same reference signs have been used. While the clamping element 4 described above is designed as one piece, the clamping element 4 according to Fig. 9 consists of two parts. It comprises a main body 40, a pressure plate 16 and a fastening means 47. A pressure plate 16 is movably arranged on the first end 18 of the clamping element 4 according to Fig. 9. This pressure plate 16 can be produced from a wear-resistant material, such as hard metal or ceramic. As a result, the first end 18 of the clamping element 4 can be designed to be more wear-resistant than its main body 40. The damage which can occur on the clamping element 4 due to chips which occur in the process are reduced, and preferably completely avoided, due to increasing the wear-resistance. In order to receive the pressure plate 16 in the clamping element 4, the clamping element has a receiving space 41 having a stop surface 42, a recess 39 and a guide surface 43 (Fig. 10). The stop surface 42 can be level and parallel to the face 21. A recess 39 can also be integrated into the stop surface 42. The region in which the guide surface 43 is arranged can be in the form of a groove 44 and can comprise narrow points. The distance A1 from the mouth 45 of the groove 44 is preferably smaller than the distance A2 within the groove 44. The distance A2 is arranged at a greater distance from the first end 18 than distance A1. Due to the design of the groove 44, the main body 40 has projections in the form of fingers 48. The outer faces 49 of the fingers 48 can be identical to the outer faces of the main body 40. They can, however, also partly or completely deviate in their shape and can be curved in the direction of the central axis of the main body. In Fig. 10, the fingers are curved in their end region 52 in the direction of the central axis and deviate in this region from the outer shape of the main body 40 from the clamping element 4. The inner faces 43 of the fingers correspond to the guide surfaces of the groove 44 and form the receiving space of the groove 44 together with a region of the stop surface 42 and the recess 39. An undercut is formed by the fingers 48 which are arranged inwardly.

[0034] A pressure plate 16 which has a spring 46 that correlates to the groove 44 and engages into the groove 44 cannot be removed in the region of the mouth 45 in the direction of the first end 18 due to the undercut, the narrowing. A shoulder between recess 39 and stop surface 42 forms an additional securing means 38. Due to this recess 39, the height of the groove, measured

from the face 21 of the main body 40 of the clamping element 4 to the bottom of the recess 39, is greater than the distance measured from the face 21 of the main body 40 of the clamping element 4 to the stop surface 42. If a region of the spring 46 extends into the recess 39, the transition of the recess 39 to the stop surface 42 then forms the securing means 38 which additionally limits the horizontal freedom of movement of the main plate 16. Due to the design of the groove 44 of the clamping element 4 and the spring 46 of the pressure plate 16, the pressure plate 16 is held in a captive manner in the horizontal direction of movement of the clamping element 4. According to the invention, the coupling between pressure plate 16 and the clamping element 4 has clearance. The clearance is 0.1 to 0.5 mm, preferably 0.3 mm in the axial direction and 5 degrees at most, preferably 2 degrees in the radial direction. The axial direction is therefore parallel to the face 21, the radial direction is arranged around the opening 41. Due to this clearance (axial and radial), there is an additional possibility of compensating for the existing tolerances due to the production of individual parts of a tool system. The pressure plate 16 is movably held by means of a fastening means 47, for example a cylinder pin, in an opening 51 in the main body 40 of the clamping element 4.

[0035] What is described above applies correspondingly to the lug 5 arranged on the pressure plate 16, the shape of which lug correlates to the trough 7 of a cutting plate 6. The force generated by the clamping means 15 acts on the entire annular surface 31 of the trough 7 of a cutting plate 6 via the annular surface 36 of the lug 5 of the pressure plate 16.

[0036] Fig. 11 shows a further embodiment of the first end 18 of the clamping element 4. In so far as it relates to the same features as the clamping element 4 according to Fig. 10, the corresponding reference signs and the prior description apply. A clamping element 4 according to Fig. 10 has a modified groove 44' at its first end 18. The projections 48' are straight and not inwardly curved, as in the embodiment according to Fig. 10. The guide surfaces 43' of the inner face of the groove 44' are parallel to one another. This creates a groove 44', of which the distances A1 and A2 are equal. The width of the groove 44' in the region of its mouth 45 is equal to its size in a region which is arranged at a distance from the mouth. As a result, this groove 44' does not have an undercut. The horizontal mobility of a pressure plate 16 which has a spring 46 which is congruent with respect to the groove 44' is limited exclusively by means of the securing means 38. The spring 46 engages into the recess 39 which is in the form of a cavity. The pressure plate 16 is held movably in the clamping element 4 by means of a fastening means 17. Fig. 11 shows a simplified form of the first end 18 of a clamping element 4 which meets the requirements of a tool system according to the invention.

[0037] The invention describes a tool system 1, comprising a tool holder 2 which has a plate seat 17 for receiving a cutting plate 6 having a trough 7, comprising a clamping element 4 which has an opening 26 for receiving a clamping means 15 and a projection 5, comprising a mechanism (functional dimension F_x) which limits the linear mobility of the clamping element 4. This ensures that an indexable cutting plate 6 is clamped in a captive and repeatable manner.

[0038] The fact that, when the cutting plate is clamped, the guide portion 25 of the screw 15 abuts the stop 27 of the wall of the opening 26 in a force-fitting manner means that an automatic limitation of the clamping force of the cutting plate 6 into the plate seat in the tool holder 2 is achieved.

PATENTKRAV

1. Værktøjssystem (1) med en skæreplatte (6) og med en værktøjsholder (2), som har et plattesæde (17) til optag af skæreplatten (6) med en forsækning (7) og med afstand til dette plattesæde (17) en flade (22), som hælder i en stump vinkel (γ) mod værktøjsholderens (2) overflade (53), som grænser op til plattesædet (17), med et spændeelement (4), som har en åbning (26) med et anslag (27), i hvilken en spændeskruer (15) med et føringsafsnit (25) er optaget, en flade (20) og et fremspring (5), hvor spændeelementets (4) næse (5) har en ringflade (36) og skæreplattens (6) forsækning (7) har en ringflade (31), hvor i skæreplattens (6) spændte tilstand, spændeelementets (4) ringflade (36) og skæreplattens (6) ringflade (31) ligger formluttende op ad hinanden og ved fastgørelse af spændeelementet (4) på værktøjsholderen (2), dvs. ved dannelse af et drejningsmoment, ved drejning af spændeskruen (15), spændeelementets (4) flade (20) glider på værktøjsholderens (2) flade (22), hvorved spændeelementet (4) bevæger sig i forhold til værktøjsholderen (2) og trækker skæreplatten (6) ind i plattesædet (17) og spænder den, **kendetegnet ved, at** værktøjssystemet indeholder et funktionsmål F_x mellem forsækningens (7) centrum og åbningens (26) anslag (27), hvor værdien af dette funktionsmål F_x vælges sådan, at ved spændeskruens (15) maksimalt tilladte drejningsmoment M næsens (5) ringflade (36) danner en fuldstændig fladeformet formluttende forbindelse med forsækningens (7) ringflade (31) og i skæreplattens (6) spændte tilstand spændeskruens (15) føringsafsnit (25) ligger kraftsluttende op ad anslaget (27) på åbningens (26) væg.

2. Værktøjssystem ifølge krav 1, **kendetegnet ved, at** området, hvor ringfladen (31) og ringfladen (36) ligger op ad hinanden, omfatter 360 grader.

3. Værktøjssystem ifølge krav 1 eller 2, **kendetegnet ved, at** ringfladerne (31, 36) er udført plant.

4. Værktøjssystem ifølge et af kravene 1 til 3, **kendetegnet ved, at** spændeelementet (4) omfatter en første ende (18) og en anden ende (19), hvor næsen (5) i området med den første ende og fladen (20) i området med den anden ende er anbragt i en afstand E_x til hinanden.

5. Værktøjssystem ifølge krav 4, **kendetegnet ved, at** spændeelementets (4) åbning (26) er anbragt i en afstand $< E_x/2$ fra den anden ende (19).

6. Værktøjssystem ifølge krav 4 eller 5, **kendetegnet ved, at** spændeelementets (4) åbning (26) er anbragt i en afstand på 20 til 40%, foretrukket 30% fra $E_x/2$, fra den anden ende (19).

5 7. Værktøjssystem ifølge et af de foregående krav, **kendetegnet ved, at** kraften i spændt tilstand, som dannes af spændeskruen (15), virker hele vejen rundt på forsænknings (7) ringflade (31).

10 8. Værktøjssystem ifølge et af kravene 4 til 7, **kendetegnet ved, at** kraftvektoren (F_{nx1}), som virker i retning mod den anden ende (19) af spændeelementet (4), har en større værdi end kraftvektoren (F_{nx2}), som virker i retning mod den første ende (18) af spændeelementet (4).

9. Værktøjssystemet ifølge et af de foregående krav, **kendetegnet ved, at** spændeelementet (4) har en trykplade (16), som fremspringet (5) er udformet på.

15 10. Værktøjssystem ifølge krav 9, **kendetegnet ved, at** trykpladen (16) er fremstillet af et slidstærkt materiale, foretrukket hårdmetal eller keramik.

11. Værktøjssystem ifølge krav 9 eller 10, **kendetegnet ved, at** spændeelementet (4) har en rille (44), i hvilken trykpladen (16) holdes med et spillerum i radial og lineær retning.

20 12. Værktøjssystem ifølge krav 11, **kendetegnet ved, at** spillerummet mellem trykpladen (16) og spændeelementet (4) i lineær retning udgør 0,1 til 0,5 mm, foretrukket 0,3 mm, og/eller spillerummet mellem trykpladen (16) og spændeelementet (4) i radial retning udgør maksimalt 5, foretrukket 2 grader.

Fig. 1

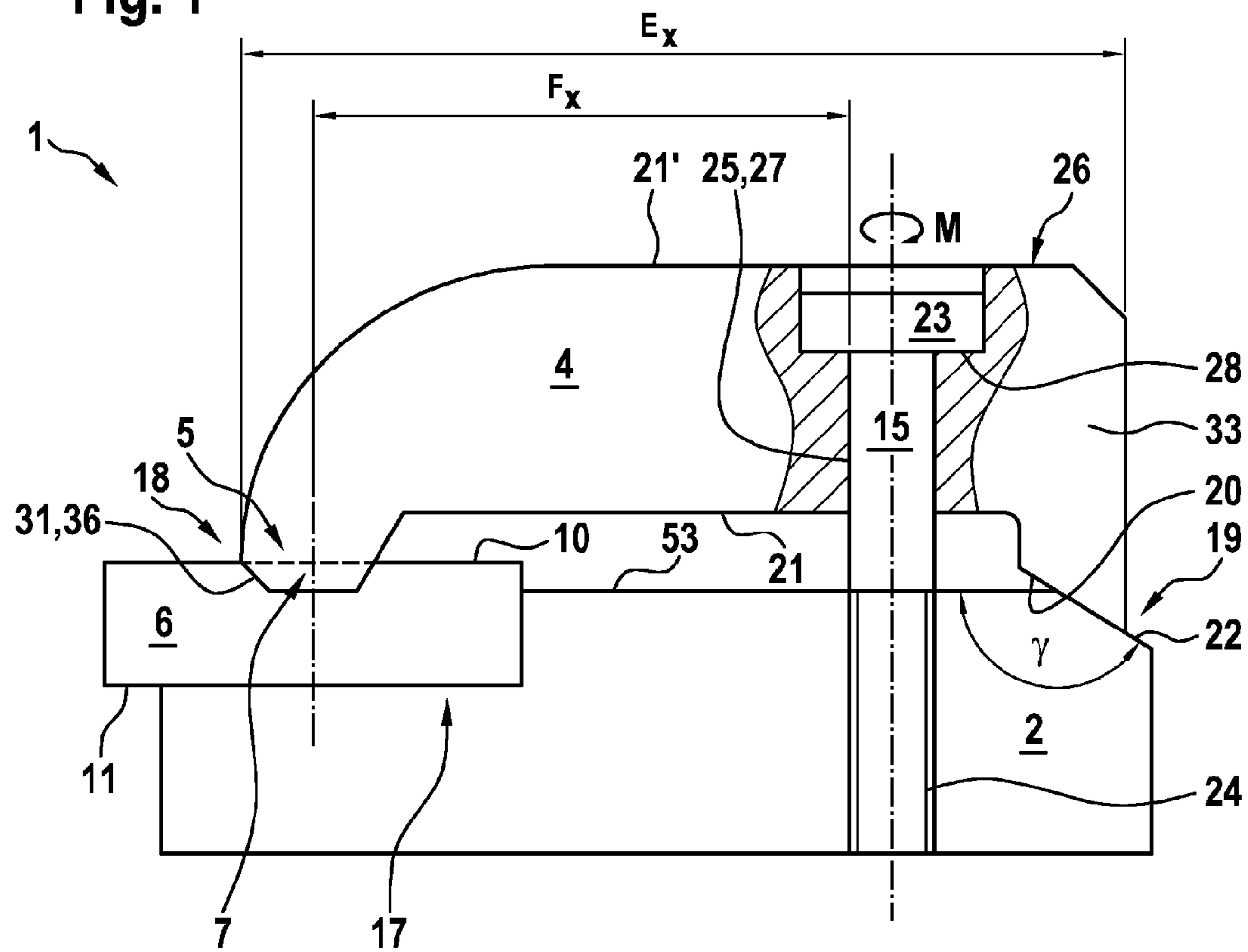


Fig. 2

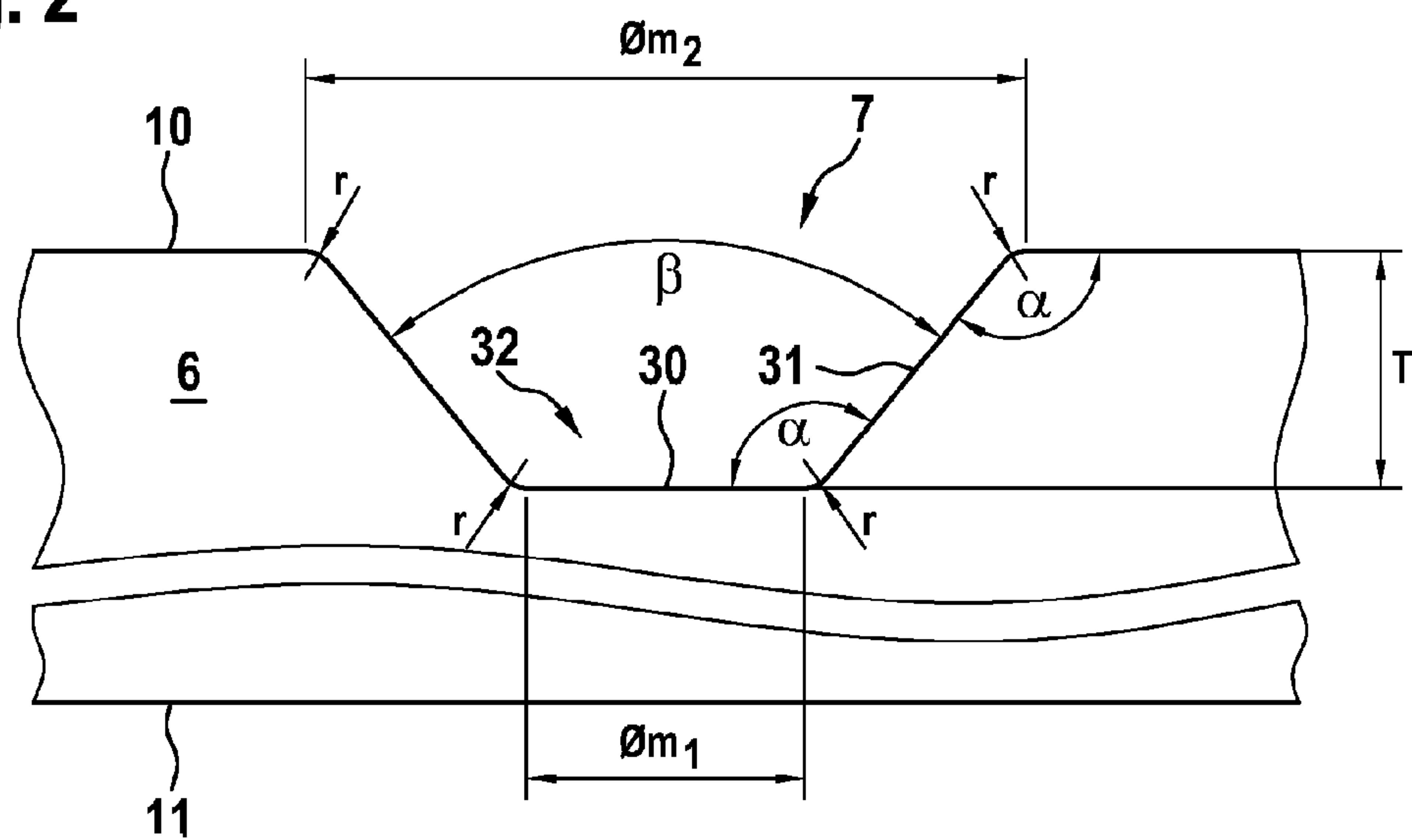


Fig. 3

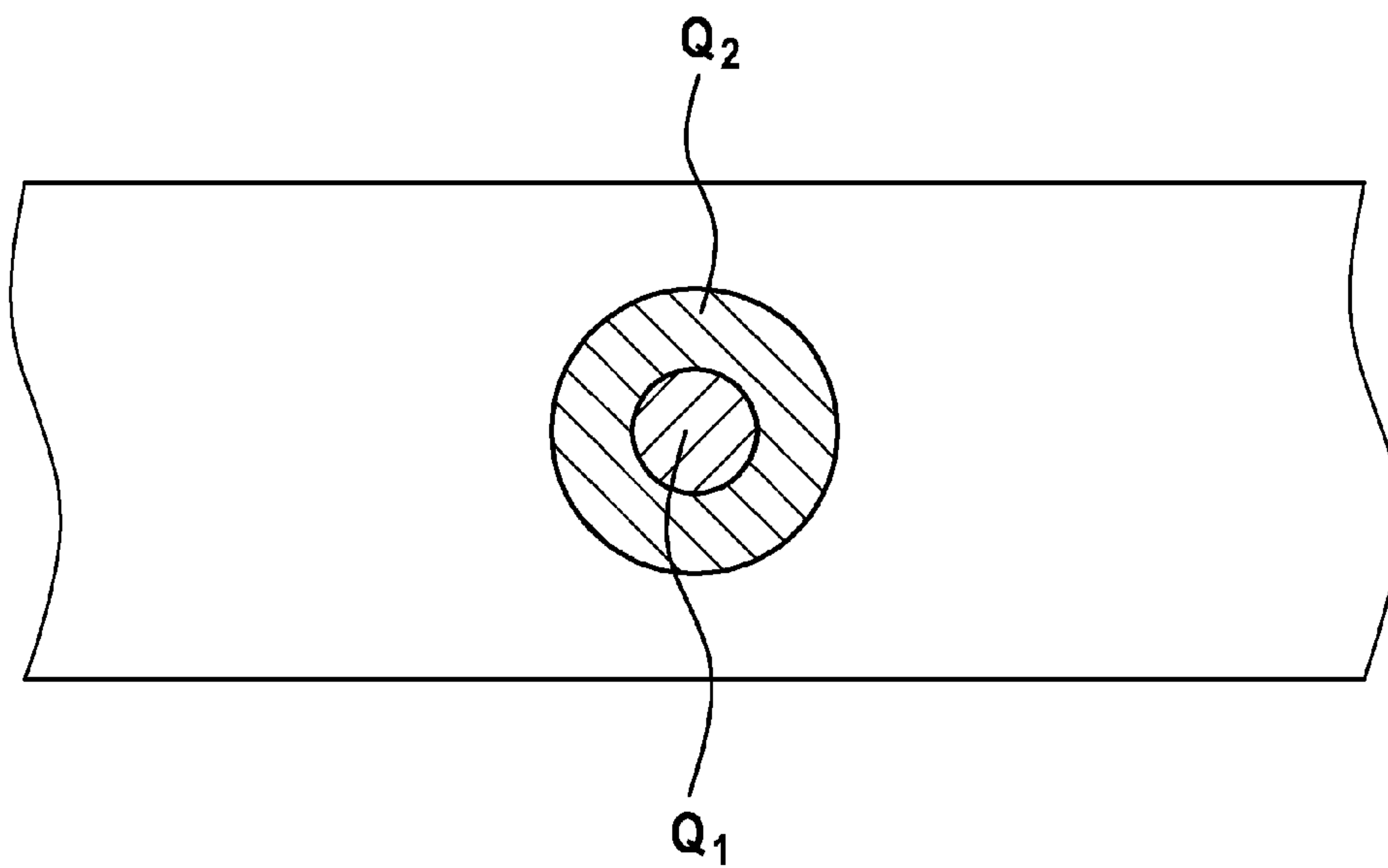


Fig. 4

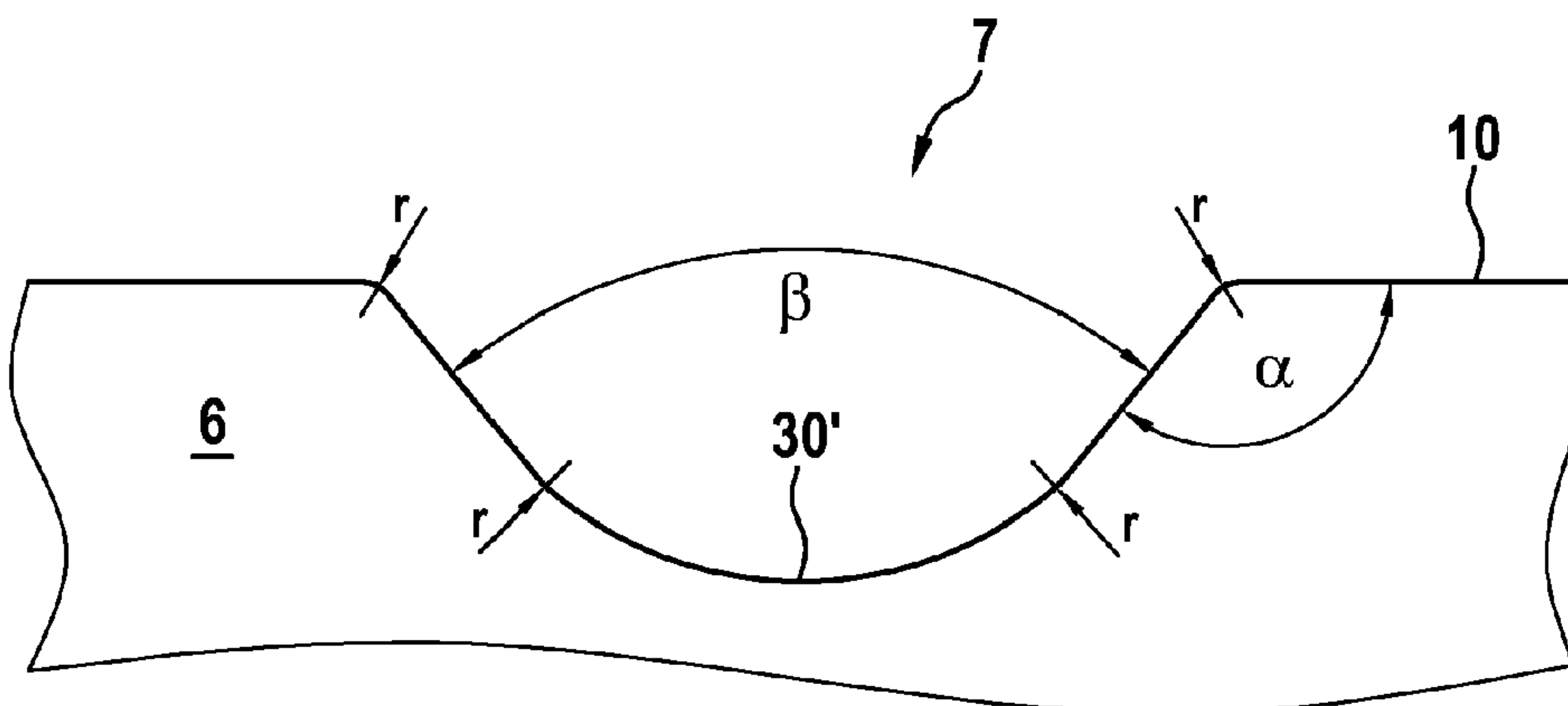


Fig. 5

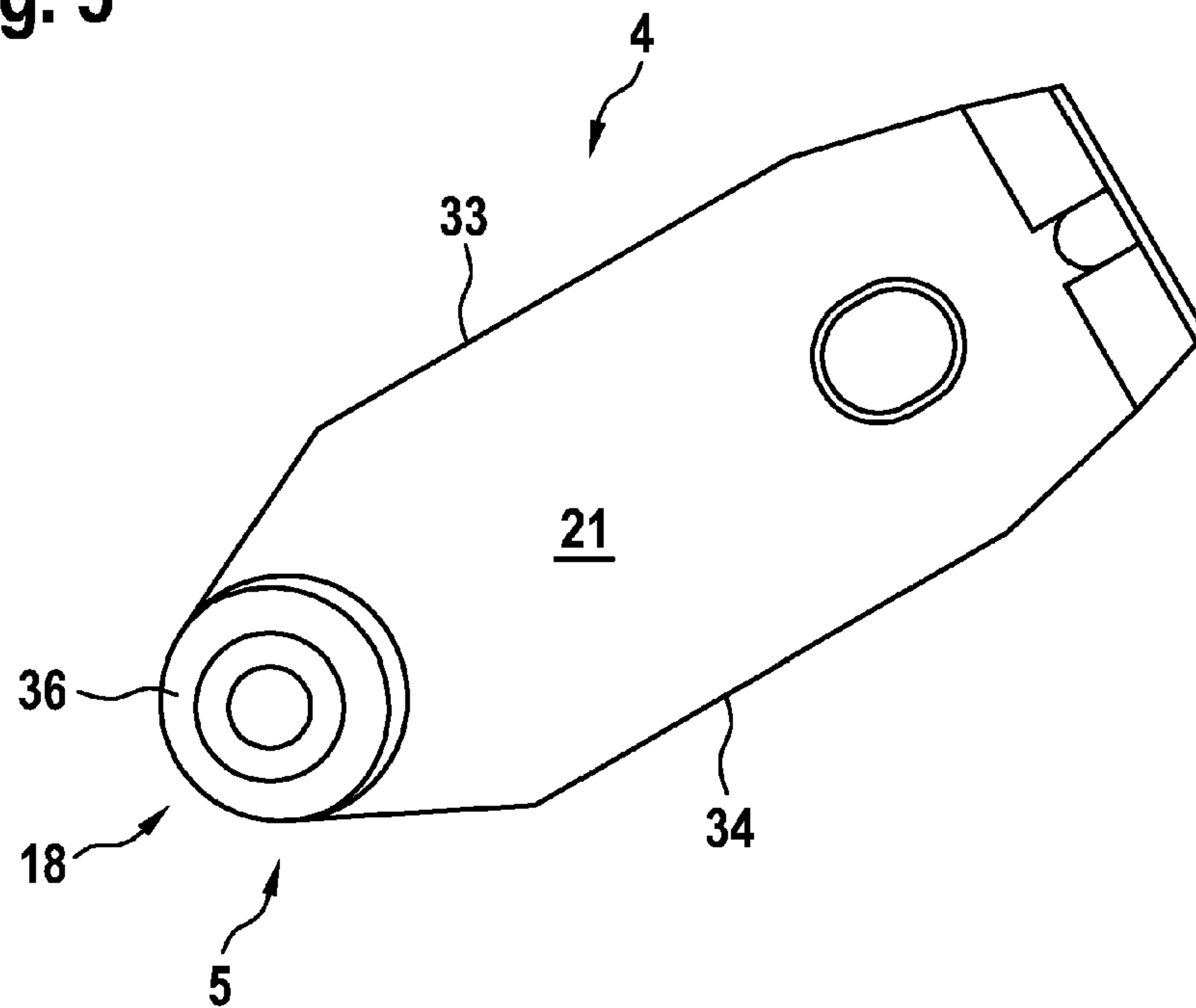


Fig. 6

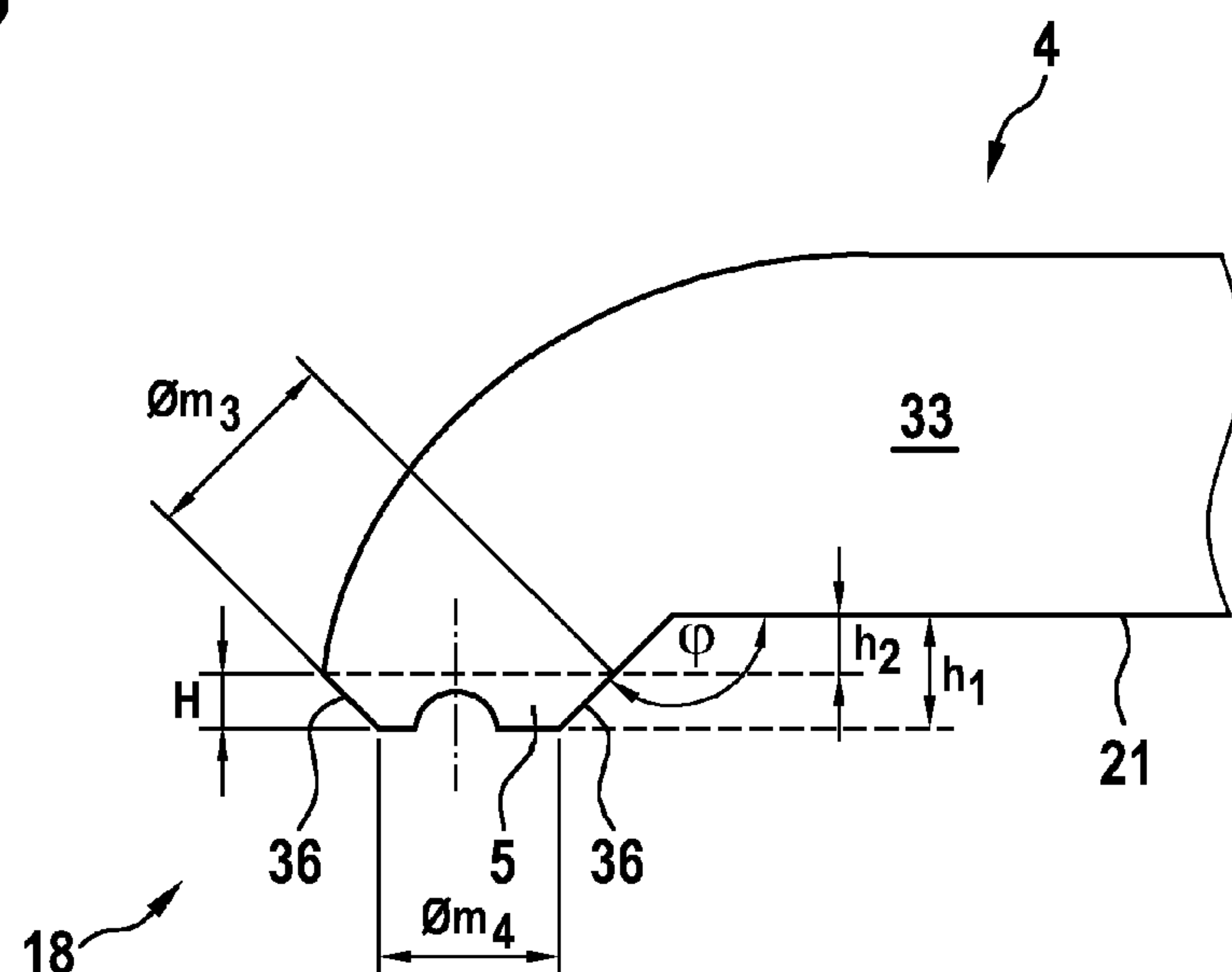


Fig. 7

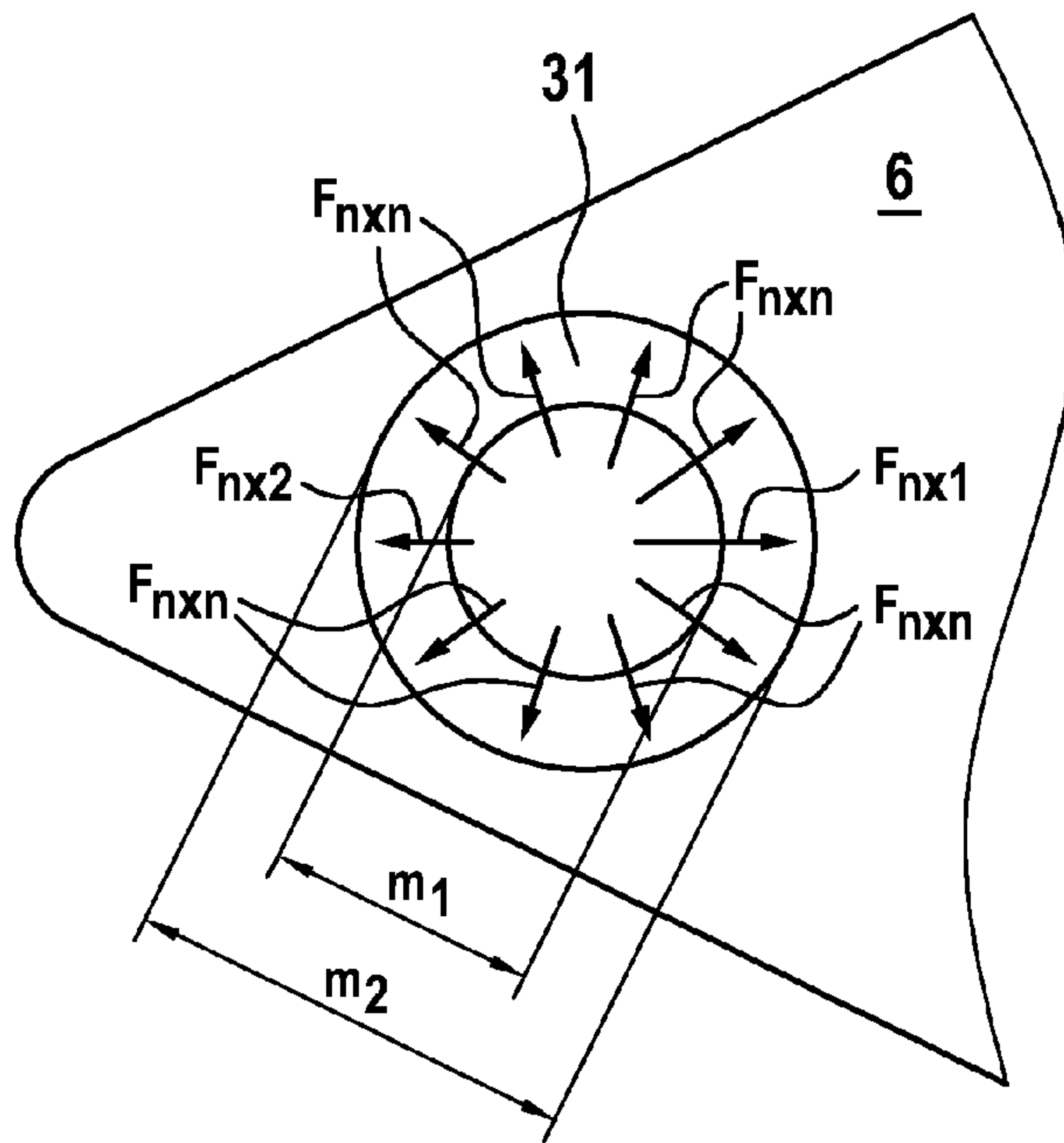


Fig. 8

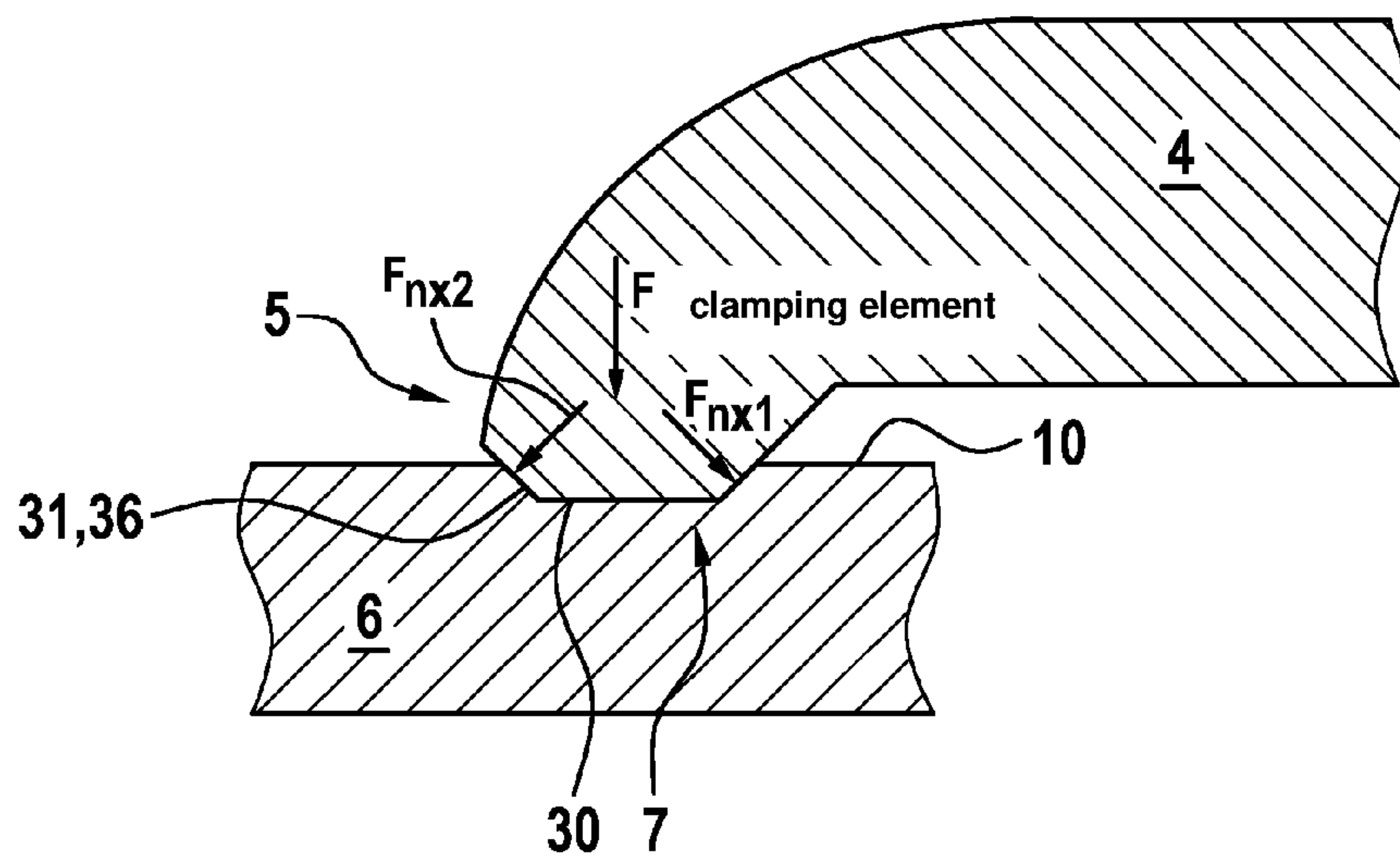


Fig. 9

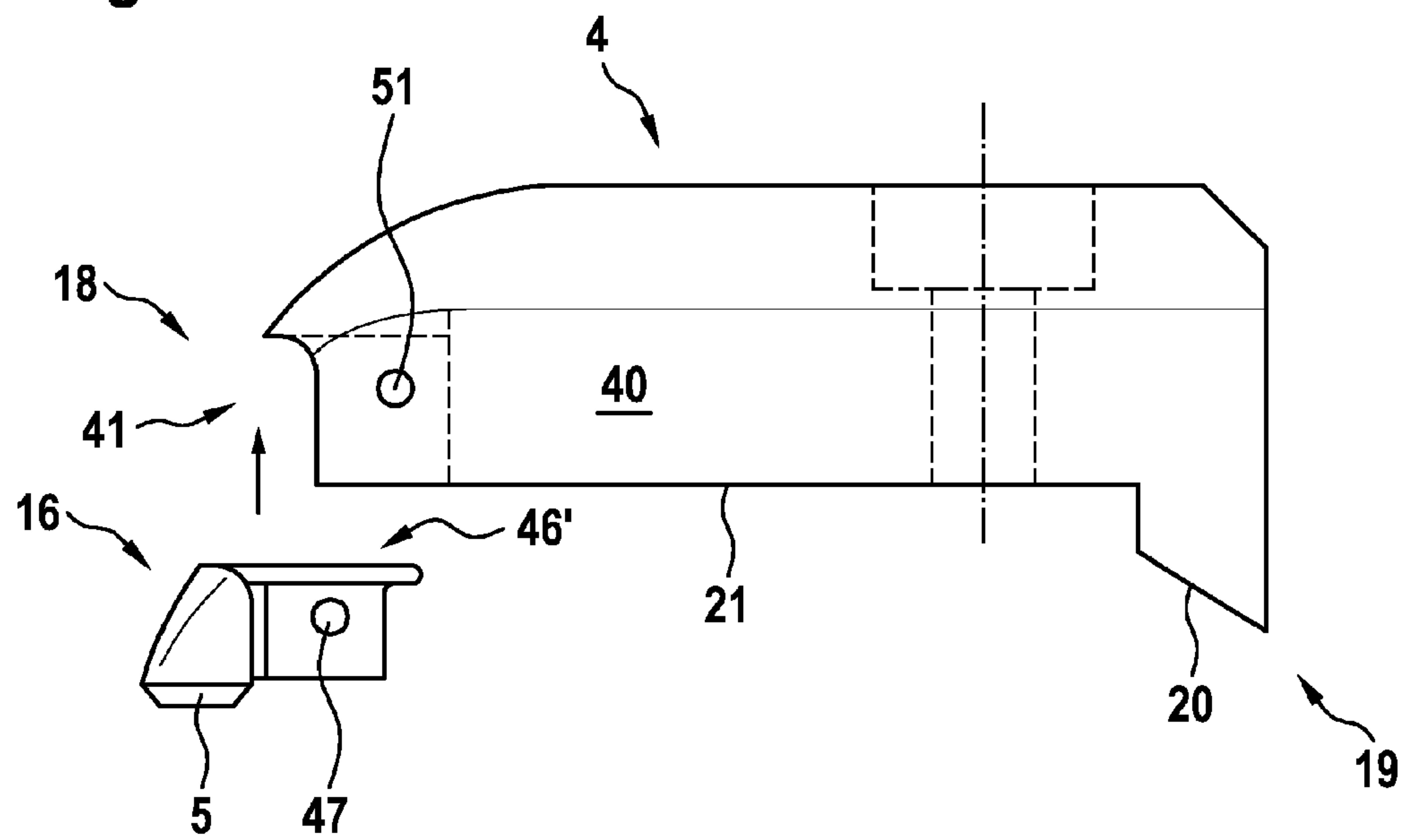


Fig. 10

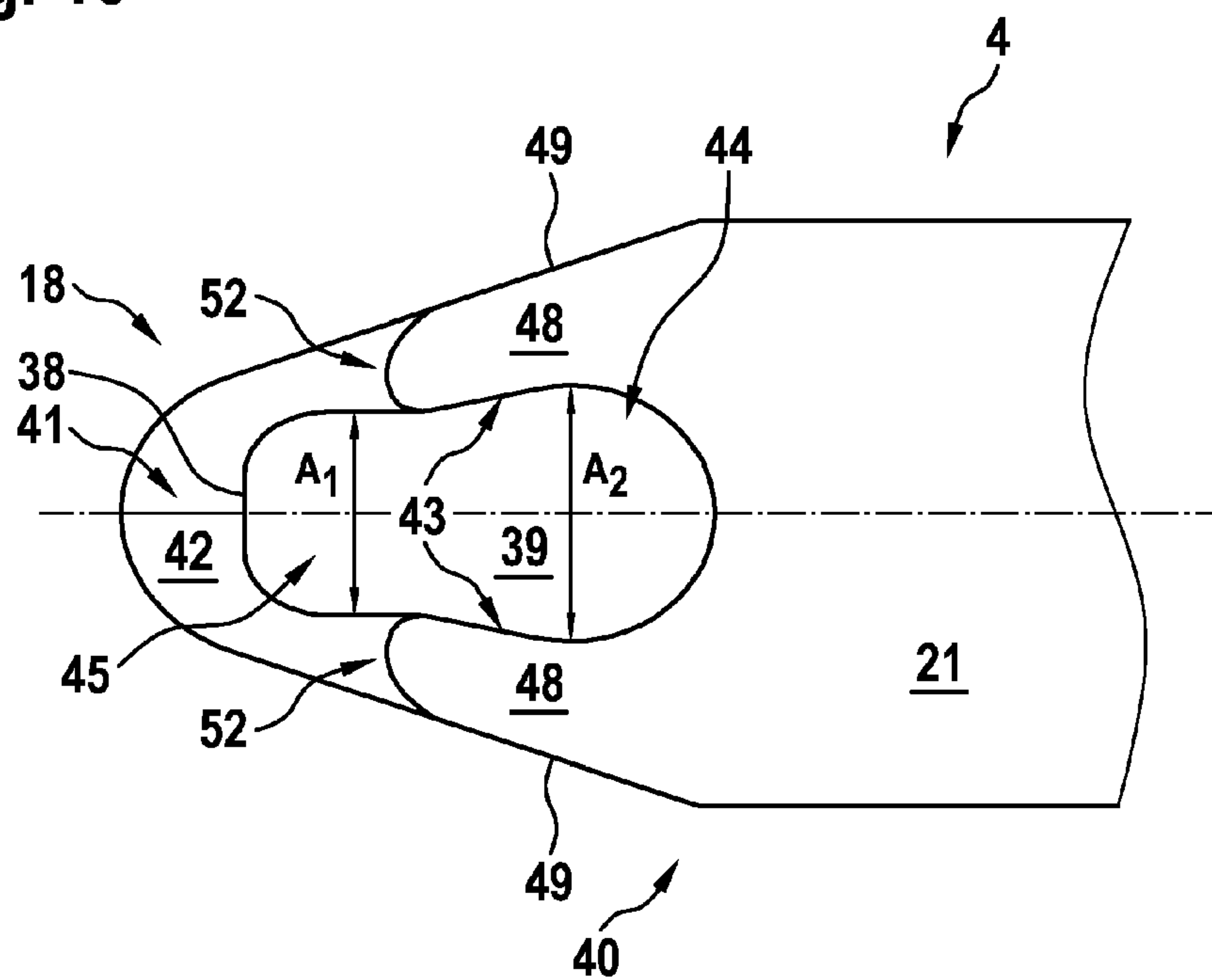


Fig. 11

