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An agency of Industry Canada

CA 2745263 C 2015/11/03

(11)(21) **2 745 263**

(12) BREVET CANADIEN / CANADIAN PATENT

(13) **C**

(86) **Date de dépôt PCT/PCT Filing Date:** 2009/12/04
(87) **Date publication PCT/PCT Publication Date:** 2010/06/24
(45) **Date de délivrance/Issue Date:** 2015/11/03
(85) **Entrée phase nationale/National Entry:** 2011/05/31
(86) **N° demande PCT/PCT Application No.:** EP 2009/066389
(87) **N° publication PCT/PCT Publication No.:** 2010/069783
(30) **Priorité/Priority:** 2008/12/19 (DE10 2008 055 559.2)

(51) **Cl.Int./Int.Cl.** ***B25B 13/04*** (2006.01), ***B25B 13/08*** (2006.01), ***B25B 13/56*** (2006.01), ***B25B 23/00*** (2006.01)

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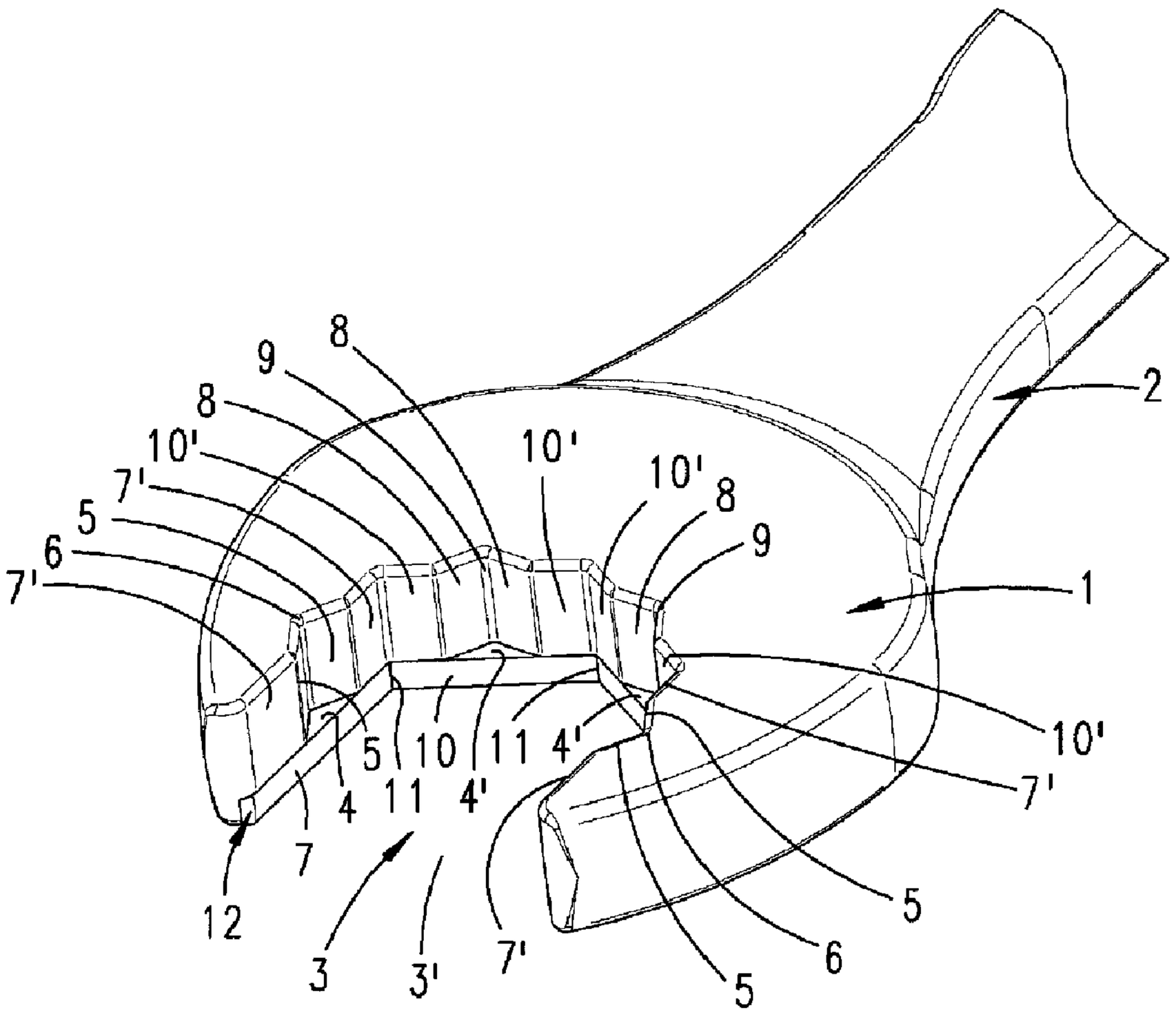
(54) **Titre : CLE MIXTE**
(54) **Title: COMBINATION WRENCH**



(57) **Abrégé/Abstract:**
The invention relates to a wrench comprising a multi-jaw arrangement (5, 8) for the torque-transmitting and partially encircling grasp on a polygonal profile (13) of an inner opening (3) having a nut or a screw head, wherein a radial jaw opening (3') is

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(57) **Abrégé(suite)/Abstract(continued):**
associated to the inner opening (3) and at least two corner regions (6) of the multi jaw arrangement (5, 8) have in each case a stop (4) for a front face section (16) of the polygonal profile (13). In order to widen the spectrum of applications of said wrench, it is proposed that the jaw opening (3') comprises as a wrench opening two opposite jaws (7), which extend on only one broadside over the corner regions (6) of the multi jaw arrangement (5, 8), for the torque-transmitting grasp on the polygonal profile (13).

ABSTRACT

The invention relates to a wrench comprising a multi-jaw arrangement (5, 8) for the torque-transmitting and partially encircling grasp on a polygonal profile (13) of an inner opening (3) having a nut or a screw head, wherein a radial jaw opening (3') is associated to the inner opening (3) and at least two corner regions (6) of the multi-jaw arrangement (5, 8) have in each case a stop (4) for a front face section (16) of the polygonal profile (13). In order to widen the spectrum of applications of said wrench, it is proposed that the jaw opening (3') comprises as a wrench opening two opposite jaws (7), which extend on only one broadside over the corner regions (6) of the multi-jaw arrangement (5, 8), for the torque-transmitting grasp on the polygonal profile (13).

CA 2,745,263
Blakes Ref: 75432/00004

COMBINATION WRENCH

Field of the Invention

The invention relates to a wrench comprising an inward opening that has a multi-point configuration for partially-surrounding engagement in a torque-transmitting manner on a polygonal profile of a nut or a bolt head, a radial jaw opening being associated with the inward opening and at least two corners of the multi-point configuration each having a stop for a portion of an end face of the polygonal profile.

Background of the Invention

A wrench of this kind is known from US 3,604,106. In this, there is disclosed an open box-end wrench similar to DIN 898 having a radial opening for insertion of a shank of a bolt, the hexagonal head of which can be turned by a polygonal point configuration. In the corner regions of the polygonal point configuration, there are stop balls, which engage against an end face portion of the hexagonal cross-section of the bolt head for axial retention in the inward opening.

In US 5,782,148, there is described a socket for fitting onto a bolt head that has the shape of a hexagonal profile. The internal cross-section of this tool, which is also called a socket, has two cross-sectional planes, one above the other in the axial direction. The cross-sectional plane adjacent to the opening has a twelve-fold symmetry and twelve angular notches in total, which correspond to the total of six hexagon corners of the hexagonal cross-section of the bolt head. When a bolt head is inserted into the wrench opening, every second angular notch is then occupied by a hexagon corner. The second cross-sectional plane, which is at a distance from the opening, has only a six-fold symmetry, specifically the internal shape of a hexagon. This hexagonal internal cross-section is formed by elongated angular notches. Between these elongated angular notches, there are as a result shorter angular notches, which are closed at the end. These portions of material, which close off the angular notches, provide three flanks that act as stops for end face portions of the hexagon cross-section, when its hexagon corners are inserted into the short angular notches. The hexagonal cross-section of the bolt head can therefore be inserted into the opening of the socket in two angular positions which differ by 30º. It extends therefore more deeply or less deeply into the socket.

A similar jaw arrangement, but on a box-end wrench, is described by EP 1 003 627 B1, in which, depending on the angular position of the hexagon cross-section, the bolt head lies either in a stop position or can be inserted through the jaw opening.

US 7,340,983 B2 describes a ratchet wrench having an internal polygonal cross-section, which consists of two different cross-section portions that lie side by side in the axial direction. A first cross-section portion has a twelve-fold symmetry. A second portion has a six-fold symmetry, so that a nut abuts against stops in a first angular position, and in a second angular position, the nut can be inserted through the opening of the wrench.

It is an object of the invention to broaden the field of use of a wrench of the generic kind.

Summary of the Invention

This object is met by the invention specified in the claims, each claim also representing an independent solution to the problem or in particular relating to a specific development of the invention specified in Claim 1.

First and foremost, it is provided that the jaw opening has two oppositely-disposed jaw cheeks as the opening of an open-end wrench for torque-transmitting engagement on the polygonal profile, the jaw cheeks extending over the corners of the multi-point configuration on only one wide face (of the wrench). The jaw cheeks may be formed as parallel cheeks and be based on a hexagonal cross-section. They may however also be portions of a twelve-sided cross-section, which is displaced relative to the hexagonal cross-section. The jaw opening has a width which corresponds to the size across the flats of the hexagonal cross-section, i.e. to the spacing between the two parallel cheeks. As a result of this opening, it is possible to push the parallel cheeks onto the hexagon faces of the polygonal profile in the radial direction toward the axis of rotation of the hexagonal cross-section. As a result of this configuration, a new kind of open-end/box-end wrench is provided. If the parallel cheeks are used as zones for introducing torque, the tool can then be used as a known open-end wrench. At the same time, it is however also possible to put the wrench onto the bolt head or the nut in the axial direction in an angular position turned through 30º. The polygonal corner regions of the polygonal profile then engage on the jaw cross-section portions, which in each case define one, preferably two, flanks. The tool is then used as a known open box-end wrench, no stop balls now having to be provided.

The stops are instead formed by portions of the parallel cheeks. The preferably two flanks of the jaw cross-section portions form an angular notch. A third flank of this angular notch forms in each case the stops for the end surface portions of the hexagon cross-section, so that the wrench is secured in an axial direction. At the same time, it is assured that the wrench cannot slip off in the radial direction, since diametrically opposed corner regions of the bolt head engage in diametrically opposite angular notches. The bolt head finds a radially restrained seat in the jaw. The angular notches are defined by a total of three flanks, two flanks forming zones for introducing torque, these zones being at angle of 120º to one another. The third flank, which exercises the stop function, is at a right angle to these two flanks. In a development of the invention, it is provided that the third flank, which forms the stop, is defined by the rear of a steel plate. A steel plate of a hardened steel is preferred for this. The hardness of the material of the steel plate is greater than the hardness of the material of the steel base body that forms the head of the wrench. The hardness of the steel plate may be 50 HRC or more. It may be between 50 and 60 HRC. The hardness of the steel of the steel base body is preferably in the range between 35 and 49 HRC. The steel plate also forms at the same time the parallel cheeks and is fixedly connected to the wide side of a head disposed at the end of an actuating arm, the head having the jaw opening. In a preferred development of the invention, the parallel cheeks run into further cheeks, which can likewise enter into a torque-transmitting engagement against the hexagon surfaces of the bolt head, with formation of a 120º angle in the region of the rear of the jaw, i.e. in a region of the jaw which is opposite from the opening. Corner recesses can likewise be locally associated with these two further cheeks. The torque-transferring flanks of these corner recesses are thus aligned with the torque-transferring flanks of the angled cheeks that are spatially associated with the parallel cheeks. In this way, the bolt head is enclosed in a first angular position with four corner regions in a total of four angular notches and is not only secure against rotation, but is also held fixedly in the jaw in the radial direction and in an axial direction. In the second angular position, turned through 30º compared with the first, a total of four hexagon surfaces engage against their corresponding cheeks, which are provided by the steel plate. The connection of the steel plate to the steel base body can be by way of a force-fit, or by a positive connection, or by bonding, i.e. in particular by an adhesive bond, welding, pinning or screwing. It is however advantageous for the connection to the steel base body to be selected in such a way that the steel plate can be exchanged. The plate preferably extends in its size over one-half of the thickness of the material of the steel base body. The wrench according to the invention thus has, in an axial direction relative to the direction of rotation of the

nut or screw, two torque introducing zones that lie directly adjacent to one another, one of which is formed on the basis of an (open) twelve-edged box-end wrench cross-section and the other on the basis of an open-end wrench profile. Instead of the twelve-edge box-end wrench cross-section, a 24 edge cross-section can however also be adopted as a base. The two torque-introducing zones lie one above the other in the axial direction in such a way that a nut inserted into the torque-introducing zone, which is produced on the basis of an (open) twelve-edge cross-section (or a 24-edge cross-section) of a box-end wrench, abuts on stops by way of two diametrically opposed corner regions of the end face. The nut enclosed in this torque-introducing zone is thus secured in the radial direction and in the axial direction. If the nut or the bolt head is engaged into the torque-introducing zone configured on the basis of an open-end wrench cross-section, the wrench can then be placed onto the hexagon cross-section of the bolt head or of the nut in the radial direction and also in the axial direction. Introduction of the torque is then effected substantially via the steel plate. Since it is hardened, the jaw of the wrench does not bend. The cheek portions of the other torque-introducing zone may in this operating position likewise engage in a torque-transferring manner on the polygon surfaces of the hexagon profile. The flanks of the steel plate opposite the jaw opening may converge in the shape of a Vee at an angle of 120º. These two cheeks that converge toward one another in the shape of a Vee may be offset forwards in the direction of the jaw opening, so that the rear of the steel plate, in the region of these rearward cheeks, forms a stop step, against which two complete edge portions of the end face of the bolt head may abut. In a development of the invention, it is provided that the flanks of the multi-point arrangement of the steel base body that are associated with the two parallel cheeks merge into arcuate portions. These arcuate portions then run into a transverse surface of the steel base body, against which an edge region of the polygonal cross-section can engage. As already explained above, the jaw faces may also be portions of twelve-edge cross-section. The cheeks that run parallel to one another and form the jaw opening are then interrupted by twelve-edge jaw surface portions. In this configuration, the multi-point configuration is based on a 24–edge profile, so that the twelve-edge surfaces form stops. A wrench formed in this way can be used as an open-end wrench, as a box-end wrench with a stop, and as a box-end wrench without a stop.

Brief Description of the Figures

Exemplary embodiments of the invention are described below with reference to accompanying drawings, in which:

Fig. 1 shows the head of an open-end wrench in perspective view in a first viewing direction with the actuating arm being partly broken away,

Fig. 2 shows an illustration corresponding to Fig. 1, but with the tool turned through 180º,

Fig. 3 shows a top view of the tool illustrated in Fig.1,

Fig. 4 shows the rear view of the tool,

Fig. 5 shows a section on the line V-V in Fig. 3,

Fig. 6 shows a section on the line VI-VI in Fig. 3,

Fig. 7 shows the wrench in an illustration corresponding to Fig. 4, with a bolt head inserted in the jaw in a first rotational position,

Fig. 8 shows a perspective rear view of this,

Fig. 9 shows the wrench in the position illustrated in Fig. 3 with the jaw pushed in part onto the hexagon surfaces of a bolt head,

Fig. 10 is an illustration following on Fig. 9, with the hexagon shape inserted fully into the jaw,

Fig. 11 is an illustration corresponding to Fig. 8, in the second angular position,

Fig. 12 is an illustration corresponding to Fig. 2, of a second embodiment,

Fig. 13 is an illustration corresponding to Fig. 3, of a third embodiment,

Fig. 14 is an illustration corresponding to Fig. 1, of the third embodiment,

Fig. 15 is a illustration of a fourth embodiment in an illustration corresponding to Fig. 3,

Fig. 16 is a first perspective illustration of a fifth embodiment,

Fig. 17 is a second perspective illustration of the fifth embodiment,

Fig. 18 is a first perspective illustration of a sixth embodiment,

Fig. 19 is a second perspective illustration of the sixth embodiment,

Fig. 20 is a first perspective illustration of a seventh embodiment,

Fig. 21 is a second perspective illustration of the seventh embodiment,

Fig. 22 is a first perspective illustration of an eighth embodiment,

Fig. 23 is a second perspective illustration of the eighth embodiment,

Fig. 24 is a first perspective illustration of a ninth embodiment,

Fig. 25 is a second perspective illustration of the ninth embodiment,

Fig. 26 is a first perspective illustration of a tenth embodiment,

Fig. 27 is a second perspective illustration of the tenth embodiment,

Fig. 28 shows an eleventh embodiment in top view,

Fig. 29 shows the eleventh embodiment in side view, part cut away along the line XXIX-XXIX in Fig. 28, and

Fig. 30 is an enlargement of the extract XXX-XXX in Fig. 29.

Detailed Description

The tool shown in the drawings consists of a steel base body, which has a head 1 and an actuating arm 2 integrally connected to the head. The actuating arm 2 is shown only in part for clarity of illustration. One of the two wide sides of the head 1, which consists of a flat material, is provided with a profiled steel plate 12. While the steel base body can be forged from a steel with a hardness from 39 to 49 HRC, the steel plate 12 is a hardened plate. The profile opening can be produced, for example, by stamping or broaching. The steel plate shown in the drawings has a peripheral contour that runs on a circular arc and is enclosed in a recess in the wide side of the head 1. The steel plate may however also have a different peripheral shape, in order for example for it to be positively secured against twisting. It is conceivable for the steel plate to be connected to the steel base body by screws, for the steel plate 12 to be welded to the steel base body, or for it to be adhesively bonded thereto.

The opening 3 of the steel plate 12 has the shape of a partial section of an equilateral hexagon, the spacing of two mutually opposite marginal edges 7 defining the wrench dimension of the tool. The opening 3 located between the parallel cheeks 7 forms a mouth, which is open to one side. The opening 3' has substantially at least the width of the wrench dimension, thus the spacing between the two parallel cheeks 7.

The steel base body 1 has jaw portions 7', which run in alignment with the parallel cheeks 7. In the corner points 11, which are preferably formed as rounded portions in order to avoid notch stresses, the parallel cheeks 7 run into cheeks 10 which can enter into face-to-face engagement with the hexagon surfaces 14 of a bolt head 13, in the same way as the parallel cheeks 7, when a hexagon cross-section 13 is inserted into the mouth. The hexagon corners 15 of the bolt head 13 are then located in the region of the corners 11.

In this angular position, illustrated in Fig. 10, jaw surfaces 7' of the steel base body that are also aligned with the parallel cheeks 7 engage against the hexagon surfaces 14 of the bolt head 13. The same is the case for the jaw portions 10' of the steel base body that are aligned with the cheeks 10.

Approximately midway between the corner 11 and the opening 3' of the mouth 3, there is an angular recess between two jaw portions 7' of substantially the same size. This is defined by

two flanks 5, which meet in an apex line 6, and a further flank 4, which is formed by the underside of the steel plate 12. An angular recess of this kind is associated with each of the two diametrically opposed parallel cheeks 7.

Also an angular recess that is flanked by jaw portions 10' in the region of the steel base body is associated centrally with the two cheeks 10, each of which runs at an angle of 120º to the parallel cheeks. Each of the two angular recesses is formed in first instance by two flanks 8 that meet at an angle of 120º in an apex line 9, and which form zones for introducing torque in the same way as the flanks 5. A third flank is also formed here by the rear of the steel plate 12. In the same way as the flank 4, this flank 4' forms a stop for a wide side portion 16 of the end of the bolt head 13.

As can be gathered from Fig. 3, a rearward flank 5 is aligned with a flank 8. The flanks 5 and 8 of the angular recesses are in the region of the corners of an equilateral hexagon that has a spacing between its sides which corresponds to the spacing between the parallel cheeks 7.

The second embodiment shown in Fig. 12 differs from the first embodiment substantially in that the steel plate 12 extends over approximately half of the thickness of the material of the wrench head 1. Also in this embodiment, the steel plate 12 is inserted interchangeably in a recess in the wide side of the head 1. Securing is effected by screws, not shown, which establish a connection between the steel base body and the steel plate 12, from one of the two wide sides. Preferably the steel plate is enclosed in a recess in the head of the wrench. It is however also conceivable for the steel plate to extend over the entire wide side of the steel base body. In this case, the thickness of the material of the steel base body is preferably the same as the thickness of the material of the steel plate 12.

The thickness of the material of the steel plate 12 may however also be selected so that the axial extent of the parallel cheeks 7 is greater than the axial extent of the multi-point configuration 5, 8. Likewise the steel plate 12 may be configured so that the axial extent of the parallel cheeks 7 is less that the axial extent of the multi-point configuration 5, 8.

The wrench according to the invention has two zones for introduction of torque that are located beside one another in the axial direction, the first zone for introduction of torque, which is

formed by the multi-point configuration 5, 8, being produced on the basis of a twelve-point box-end wrench profile. The box-end wrench profile is provided with a ring opening, which is however larger than in the case of an open box-end wrench in accordance with DIN standards. The mouth opening has a width which corresponds to the width of an open-end wrench. The second zone for introduction of torque is formed by an open-end wrench profile. The two zones for introduction of torque are located one above the other in such a way that the two opposed parallel cheeks of the open-end wrench form abutments for end face portions of the hexagon cross-section of a nut or a bolt head.

In the case of the third embodiment shown in Figures 13 and 14, the two cheek surfaces of the mouth opening 3' that are opposite one another and run towards one another in the shape of a V are spaced from the opening 3' to a lesser extent than is the case in respect of the first embodiment shown in Fig. 3. This has the result that in an operating position in which two opposed flats of the bolt head engage in face-to-face manner on the parallel cheeks 7 and 7', two edge regions of the flat faces of steps 4", which are formed by the rear of the steel plate 12, are also overlaid. In an operating mode in which the corner regions of the bolt head 13 are enclosed in the jaw angles 5, 6, greater areas of the end face of the bolt head are overlaid than is the case for the first embodiment. Furthermore, the steps 4' also form stops against which the end face portion of the bolt head impacts, when the polygonal sides of the bolt head engage in face-to-face manner against the parallel cheeks 7.

For the fourth embodiment shown in Fig. 15, the flanks 5 of the multi-point arrangement of the steel base body run in each case into an arcuate portion 17, in an apex region 6. The two arcuate portions 17 merge at the apices 9 into a rearward jaw surface 8, which extends substantially at right angles to the direction of extent of the two parallel cheeks 7.

A bolt head 13 is shown in dashed lines in this embodiment, this engaging against the flanks 5 of the steel base body by way of two diametrically located corner regions. Since the two flanks 5 that are spaced apart from one another by the wrench width lie on lines which intersect one another in front of the mouth opening 3', these flanks 5 form radial retaining flanks. In opposition to the flanks 5, there runs the transverse flank 8 formed by the mouth base of the steel base body.

A bolt head 13 is shown chain-dashed in Fig 15, which engages against the parallel cheeks 7 of the steel plate 12 by way of two flats that face away from one another. An edge of the bolt head 13 facing the mouth base engages centrally against the transverse flank 8. The shape of the steel base plate 12 corresponds substantially to that of the first embodiment.

Furthermore, it may be provided that the polygonal jaw configuration is based on a 24-sided profile. In addition, the polygonal jaw surfaces 5, 8 and the parallel cheeks 7, 7' do not have to run in a straight line. These surfaces 5, 8, 7, 7' may also lie on arcuate lines with a large radius of curvature. Both jaw surface profiles that lie one above the other in the axial direction may be formed by a sequential arrangement of arcuate portions.

In addition, the parallel cheeks 7 may be formed to be rough. They may be ribbed. They may be provided with a diamond coating or another frictional coating. The surfaces 7 may furthermore also be toothed.

The manner of working of the tool is as follows:
A nut, as is illustrated in Fig. 8, has an axis about which it may be rotated. This nut may interact with the tool in two different angular positions which are displaced from one another by 30º. In a first angular position, which is shown in Figures 7 and 8, the nut 13 must be inserted in the axial direction from the side that faces away from the steel plate 12, between the surfaces 5, 8 of the jaw 3. In this way, there are altogether four corner regions 15 of the hexagonal profile 13 in the corner notches formed by the flanks 5 and 8. The corners 15 of the hexagonal profile 13 then correspond to the apices 6, 9 of the angle notches.

The axial insertion of the nut into the jaw 3 of the wrench or the axial placement of the jaw 3 onto the nut 13 is effected in a stop-limited manner. The underside portions 4, 4' of the steel plate 12 serve as a stop, these engaging on wide side portions 16 – as shown by Fig. 7.

In a second mode of operation of the tool, the jaw 3 – as is shown in Fig.9 – is pushed onto the hexagon surfaces 14 of the nut, in the radial direction with respect to the axis of rotation of the nut 13. In this way, not only the parallel cheeks 7, but also the jaw surface portions 7' that run aligned with the cheeks, slide along the hexagon surfaces 14 of the nut 13, until the end position

shown in Fig. 10 is reached, in which a total of four hexagon surfaces 14 engage against corresponding jaw surfaces 7, 10 and 7', 10'.

In an embodiment which is not illustrated, the further cheeks 10 and the angled jaw surface pairs 8 are left out. The portion opposite the opening 3' of the mouth 3, thus the base of the jaw, runs in this embodiment on an arcuate line through the points 9 and 11 shown in the drawings.

For the fifth embodiment shown in Figures 16 and 17, the open-end wrench profile formed by the steel plate 12 has the contour in plan view of a twelve-sided polygon. Here also the jaw cheeks run as surfaces 7 that extend parallel to one another. The cheeks 7 that run parallel to one another are however interrupted centrally. They form there two opposed angled openings, which are defined by two polygon surfaces 18 of the twelve. Also the portions 10 of a hexagonal profile that extend within the jaw base are in each case interrupted centrally by surfaces 19 of a twelve-sided profile.

The multi-point profile that is disposed axially displaced with respect to the open-end wrench profile has, in this embodiment, the shape in plan view of a 24-sided polygon.

The angle surfaces 5 provided with stops 4 are in the case of this embodiment neighbored by 24-edge jaw surfaces 20, which are in alignment with the twelve-side cheek surfaces 18 and 19 of the open-end wrench profile. In the case of this embodiment, a bolt head can be inserted radially into the jaw 3'. The wrench may however also be placed radially onto a nut or a screw head in a 30º-displaced position relative to this, with the polygon corners of the screw head profile entering into the angle portions 19, 18 and 20. In the case of this manner of gripping, the stops 4 do not come into play. The stops 4 in this case fulfill their stop function when the bolt head or the nut is inserted radially into the multi-point arrangement in a 15º-displaced position.

In the case of the seventh embodiment shown in Figures 18 and 19, the open-end wrench profile is once again a hexagonal profile, consisting of two parallel cheeks 7 that run parallel to one another and cheeks 10 adjoining these at an angle of 120º. The multi-point arrangement 5, 6 is based in this embodiment on a 24-edge profile. The additional jaw surfaces are indicated by the reference numeral 20. The 24-edge surfaces 20 are flanks of an angle notch whose third

flank is formed by the stop 4. Three angular positions of a bolt head profile are therefore possible, in each case displaced by 15º, in which an end face portion is supported on the stop surface 4.

In the case of the seventh embodiment shown in Figures 20 and 21, arcuate portions 17 lie between the jaw surfaces 5 and 8 of the multi-point arrangement.

The eighth embodiment shown in Figures 22 and 23 differs from the seventh embodiment shown in Figures 20 and 21 substantially in that the arcuate portions extend as far as the apices 6, so that the stop 4 runs in planar manner into the stop 4'.

In the case of the ninth embodiment shown in Figures 24 and 25, the jaw surfaces 5, 8 and 10' are rounded. The jaw surfaces do not run straight, but along rounded paths. The apices 6, 9 are also formed by radii. Surfaces and apices are here formed by peripheral curved regions.

In the case of the tenth embodiment shown in Figures 26 and 27, in addition to the ninth embodiment, the apices 11 between the cheeks 7 and 10 of the steel plate 12 are rounded. The cheeks 7, 10 may also run on arcuate lines with a large radius.

In the case of the eleventh embodiment shown in Figures 28 to 30, the central gripping portion of the actuating arm 2 has a profiled outward curvature. Near the head 1, there is a dished gripping region 21 for the thumb, in which the width of the wrench is indented. Within the dished gripping region 21 for the thumb, there are moreover still protrusions of material, in order to improve the surface feel.

The steel plate 21 is secured to the head 1 by means of a screw 23, the screw 23 being inserted into a countersunk screw-securing opening 22 of the steel plate 12 and being screwed into an internal screw thread of a fixing bore 24 of the head. The steel plate 12 is enclosed here in a recess in a wide side of the head. Compared with the previous embodiments, the steel plate 12 only has a different shape in plan view. The outer peripheral edge of the steel plate 12 has two edge portions 12', running substantially in a straight line, which are substantially at right angles to one another and merge into one another with a rounded apex being formed. In the region of this apex, there is the securing opening 22, through which the securing screw 23 passes.

At the end opposite from the jaw profile 3, the arm 1 carries a ratchet arrangement having a ring opening formed by a multiplicity of surfaces, the ring opening having the same width across the flats as the jaw 3. The free-running direction of the ratchet can be changed over by means of a pivot lever.

The scope of the claims appended hereto should not be limited by the preferred embodiments set forth in the present description, but should be given the broadest interpretation consistent with the description as a whole.

LIST OF REFERENCES

1	Head
2	Actuating arm
3	Opening
4	Stop
5	Angled jaw surfaces
6	Apex
7	Parallel cheek
8	Angled jaw surface
9	Apex
10	Jaw surface
11	Apex
12	Steel plate
13	Bolt head
14	Hexagon surface
15	Hexagon corner
16	Wide side portion
17	Arcuate portion
18	Twelve-sided jaws
19	Twelve-sided jaws
20	Twenty four-sided jaws
21	Apex
22	Screw securing opening
23	Screw
24	Fixing bore

WE CLAIM:

1. A wrench comprising:

a head having a first and a second opposite wide sides, the two wide sides being displaced axially from each other; and

an actuating arm being integrally connected to the head, both of the wide sides forming an opening having two cheeks running parallel and opposed to each other for torque transmitting engagement on two parallel opposed faces of a polygonal profile of a nut or a bolt head;

the two opposed cheeks forming two jaw cheeks on the first wide side and two jaw portions on the second wide side;

characterized in that the jaw portions of the second wide side are symmetrical and in alignment with the jaw cheeks of the first wide side;

wherein between the jaw portions of each of the two opposed cheeks an angular recess is located being defined by two flanks forming an angular notch and a third flank, the third flank being defined by a steel plate that forms at least part of the respective jaw cheek, the steel plate being fixedly connected to the first wide side of the head, the steel plate provides torque transmitting engagement on the nut or the bolt head; the two flanks forming a multi-point configuration for partially surrounding engagement in a torque transmitting manner on said polygonal profile; and

the third flank forming a stop for a portion of an end-face of said polygonal profile and is located on a boundary line between the first and the second wide sides.

2. The wrench according to claim 1, wherein the jaw cheeks are parallel to one another and form the stop.

3. The wrench according to claim 1 or 2, wherein the material of the steel plate is a hardened steel having a hardness of at least 50 HRC, wherein the hardness of the material of the steel base body that forms the rest of the head and the actuating arm is 35 to 49 HRC.

4. The wrench according to any one of claims 1 to 3, wherein the polygonal profile is a hexagonal profile, wherein the surfaces of the multi-point configuration are in the form of angled surfaces, each of the angled surfaces being located approximately midway along the jaw

cheeks that run inclined at an angle of 120º with respect to the jaw cheeks, the jaw cheeks forming respective third flanks as stop for a portion of an end face of the hexagonal profile.

5. The wrench according to claim 4, wherein the jaw cheeks running inclined at an angle of 30º with respect to the angled surfaces.

6. The wrench according to claim 4, wherein the jaw cheeks that are located opposite the jaw opening form the stop for contact with substantially an entire edge portion of an end face of a polygonal profile.

7. The wrench according to any one of claims 1 to 6, wherein the steel plate is set into a recess in the wide side of the head.

8. The wrench according to any one of claims 1 to 7, wherein the steel plate is connected to the head by way of a force fit, by a positive connection, or by bonding.

9. The wrench according to claim 8, wherein the steel plate is connected to the head by way of a push fit, a screw connection, a riveted connection, an adhesive bond, or welding.

10. The wrench according to any one of claims 1 to 9, wherein the steel plate is interchangeably associated with the wide side of the head.

11. The wrench according to any one of claims 1 to 10, wherein the steel plate has a material thickness that equates to approximately one-half of the thickness of the material of the head.

12. The wrench according to any one of claims 1 to 11, wherein the two angular notches that lie diametrically opposite one another each form just one contact flank.

13. The wrench according to any one of claims 1 to 12, wherein the surfaces of the multi-point configuration that is located opposite the jaw opening forms a contact edge surface, the contact edge surface running substantially at right angles to the direction of extent of the jaw cheeks and making contact with substantially a complete polygon face of the polygonal profile.

14. The wrench according to any one of claims 1 to 13, wherein the surface of the steel plate that is located opposite to the jaw opening, extends substantially at right angles to the extent of the jaw cheeks, merges into arcuate portions, the arcuate portions merging into the surfaces of the multi-point configuration that are located substantially close to the jaw cheeks.

15. The wrench according to any one of claims 1 to 14, wherein the jaw cheeks and/or the surfaces of the multi-point configuration are provided with a roughened configuration to increase their gripping capability.

16. The wrench according to claim 15, wherein the jaw cheeks and /or surfaces of the multi-point configuration are fluted, provided with a coating of frictional material, or toothed.

17. The wrench according to any one of claims 1 to 16, wherein the jaw cheeks are interrupted by surfaces of a 12-sided polygon.

18. The wrench according to any one of claims 1 to 17, wherein the two angular notches are substantially diametrically opposite to one another such that the nut can be radially secured in the head.

19. The wrench according to any one of claims 1 to 18, wherein the opening formed by each of the two wide sides has a symmetrical configuration.

20. The wrench according to any one of claims 1 to 19, wherein the jaw cheeks formed by the steel plate provides torque transmitting engagement on two parallel opposed faces of a polygonal profile of a nut or a bolt head.

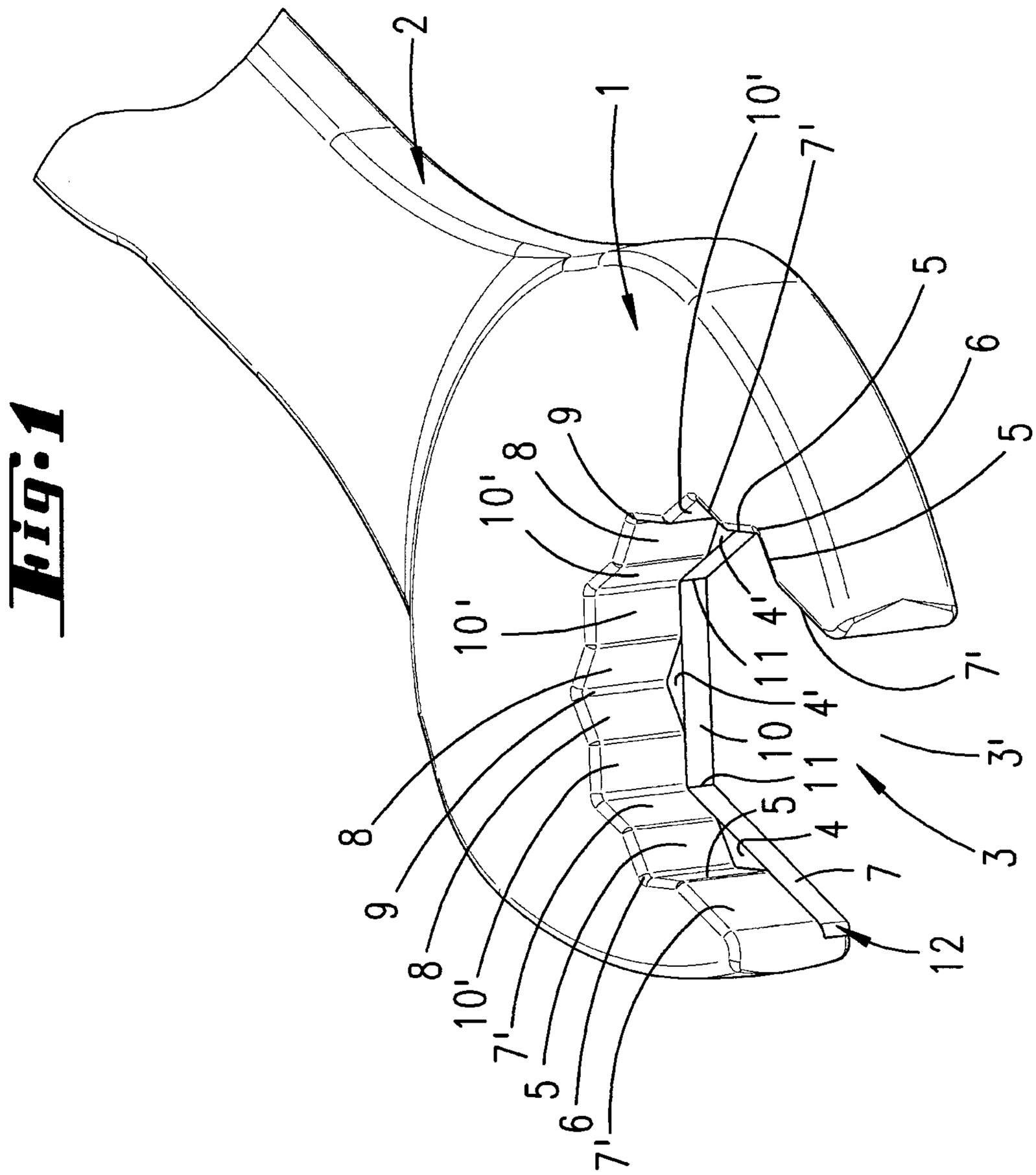


Fig:1

Fig:2

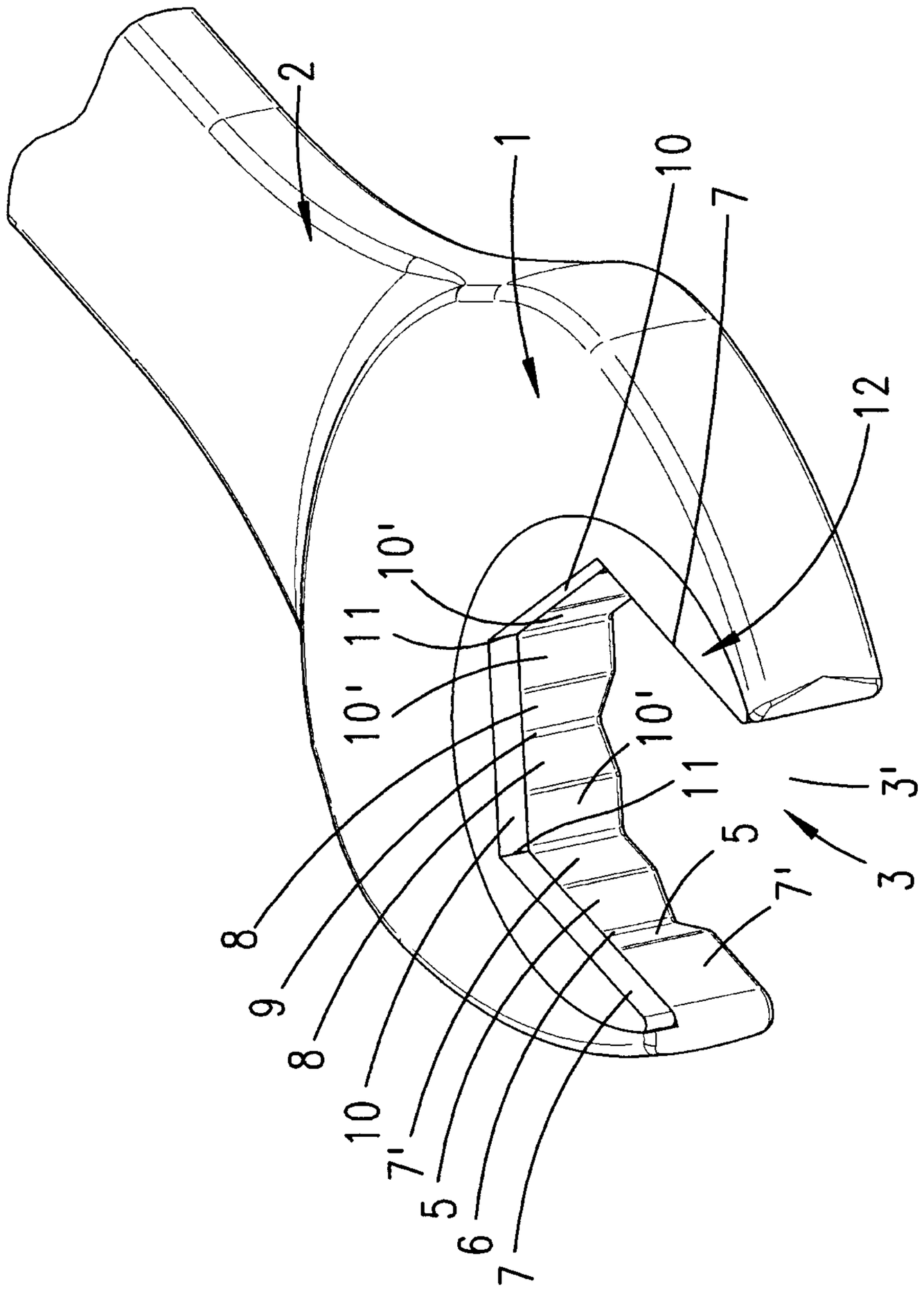
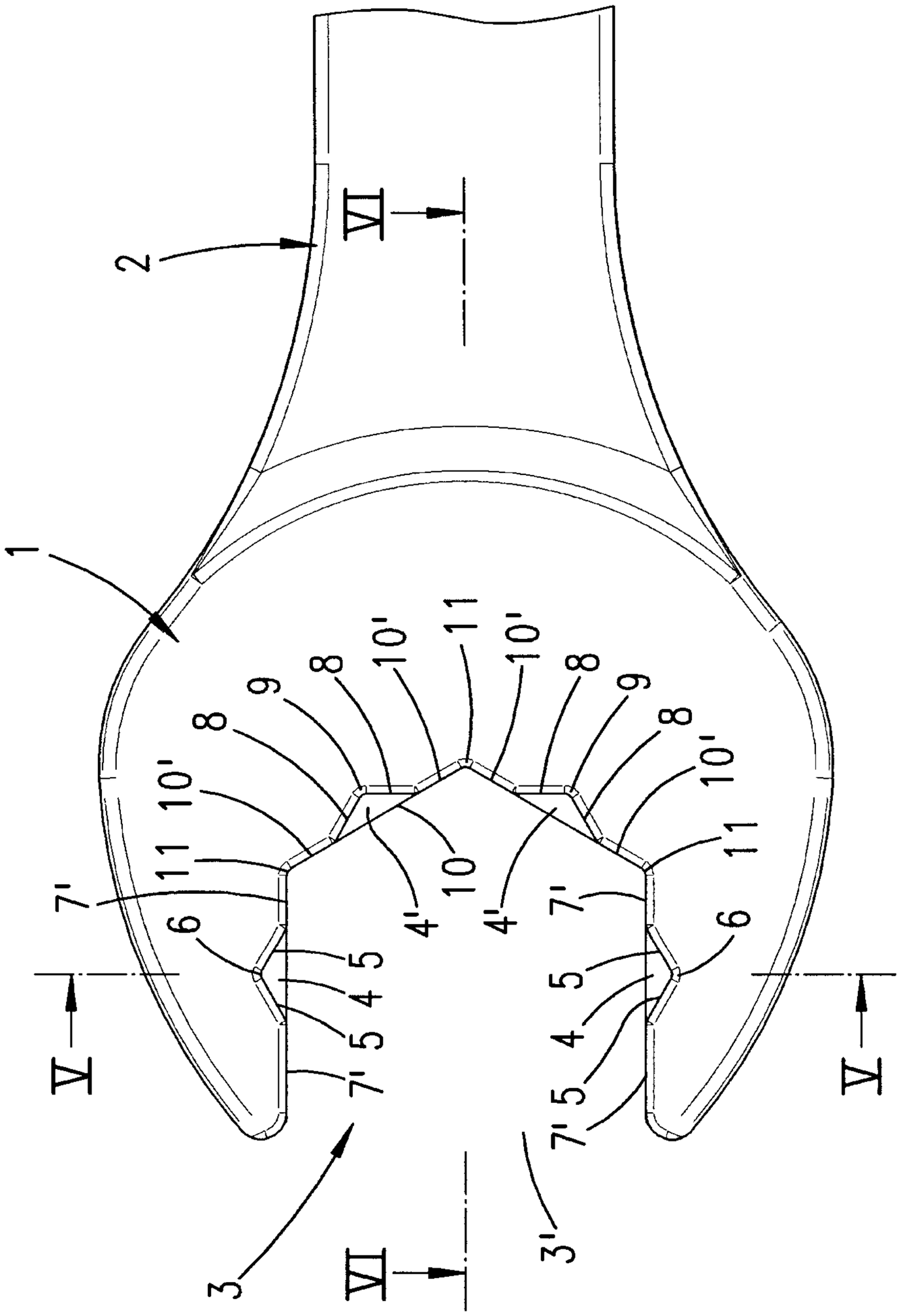


Fig.3



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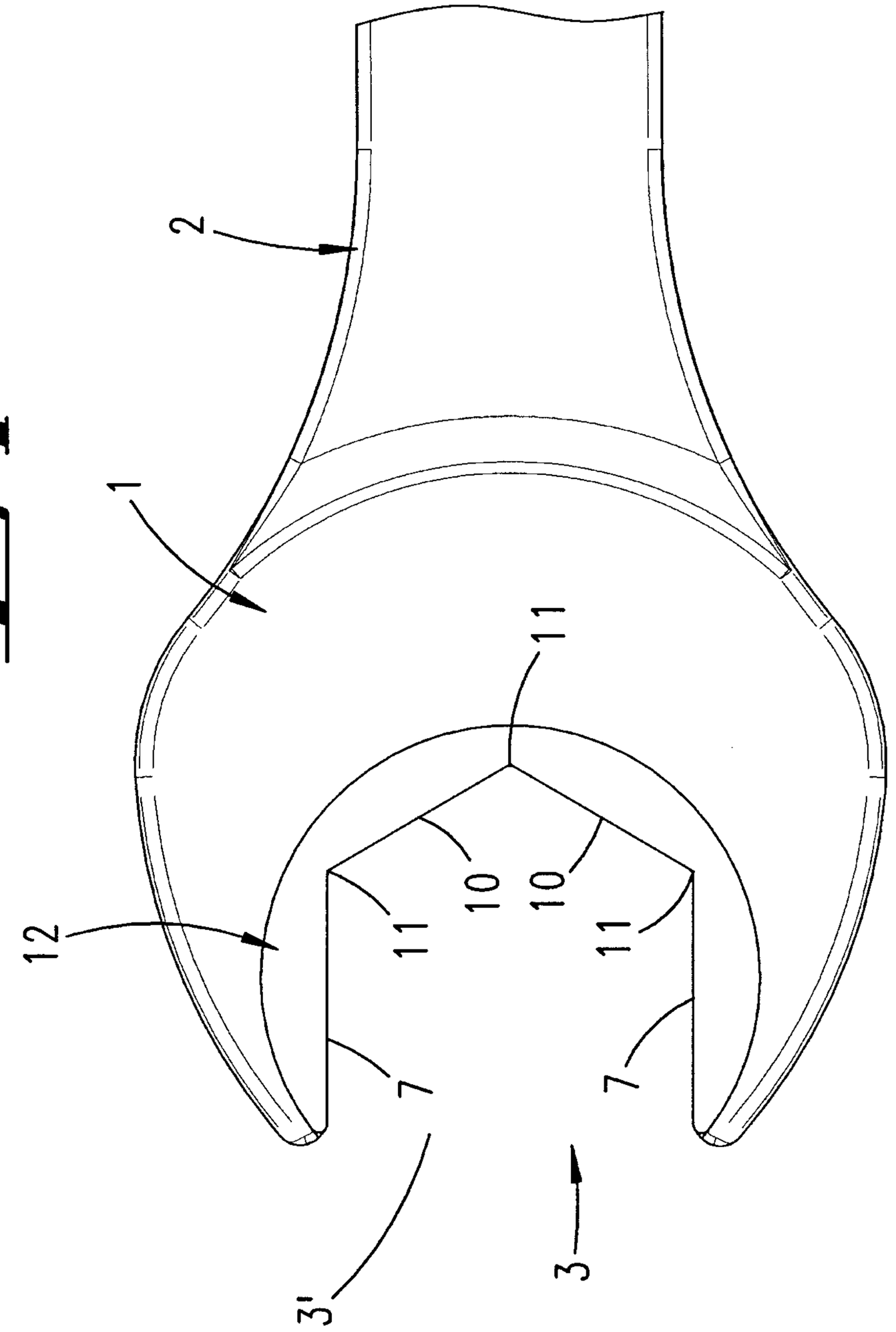

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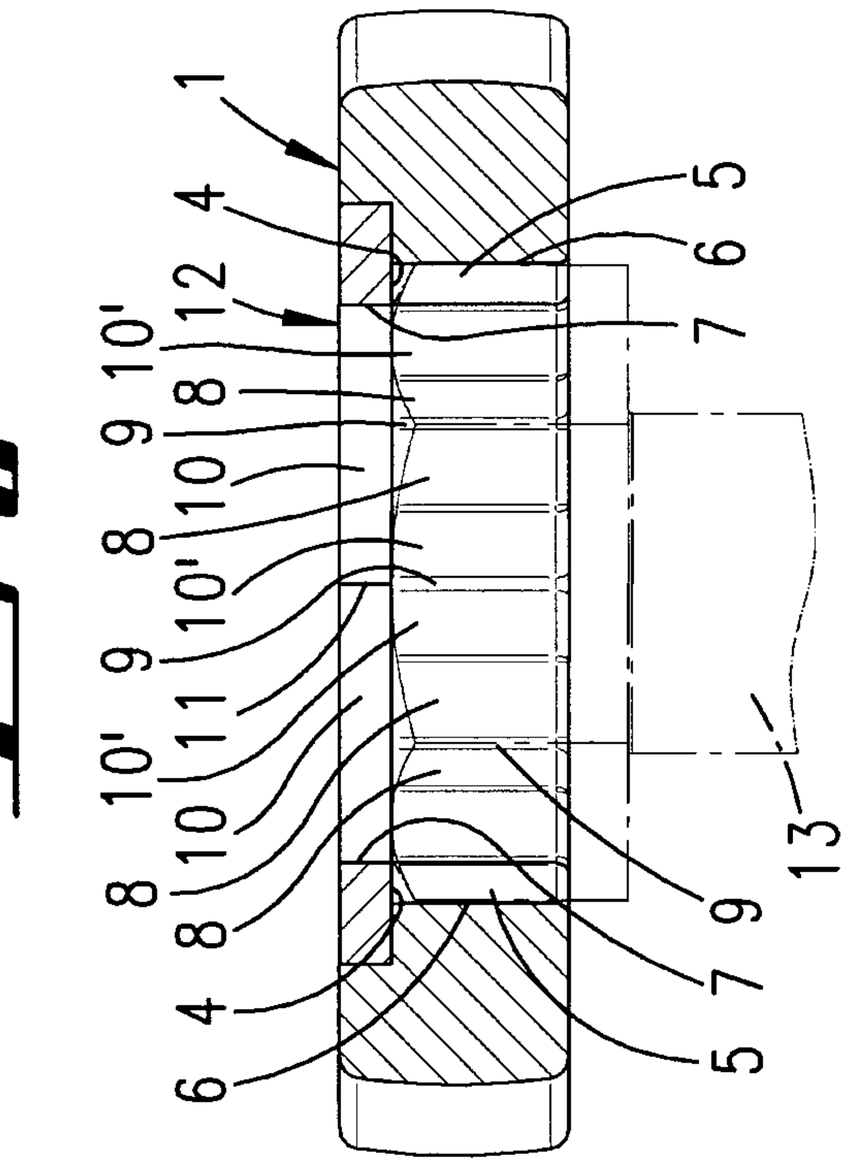
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Fig:6

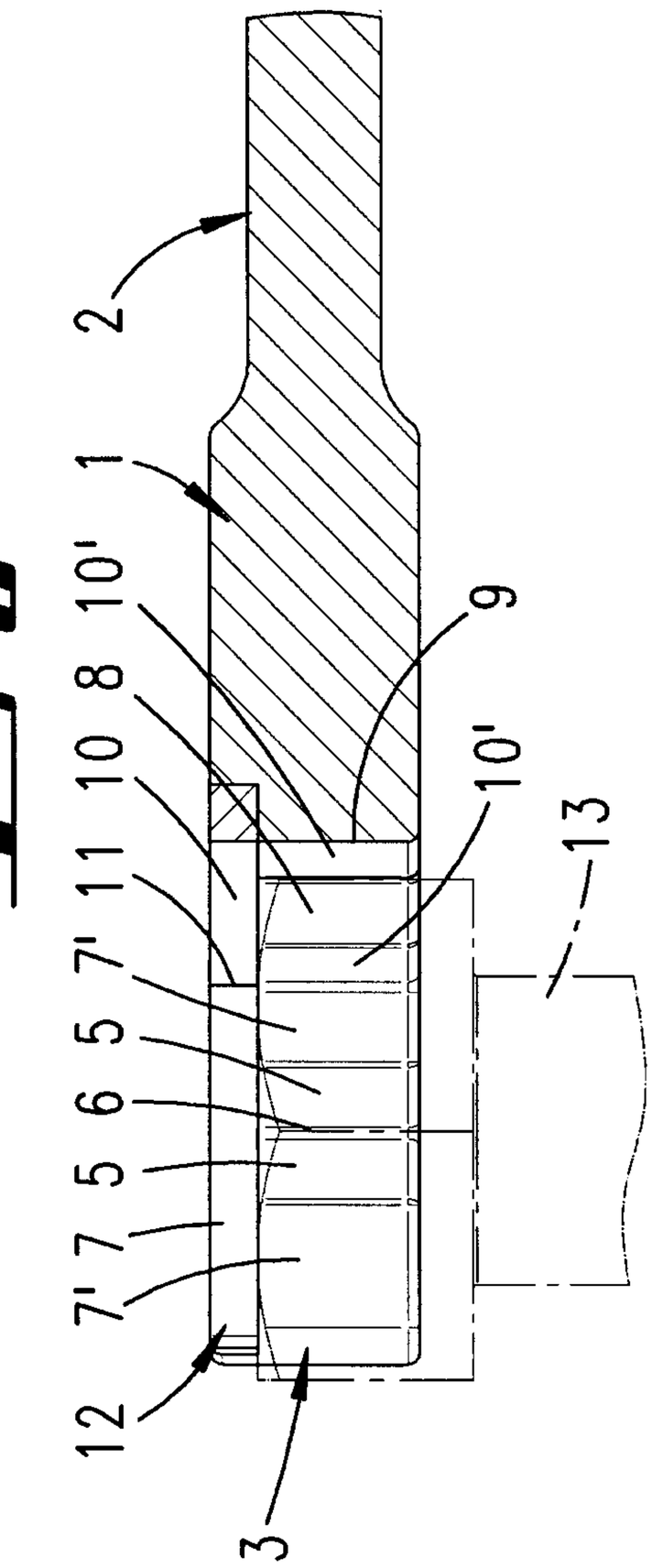
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Fig:1

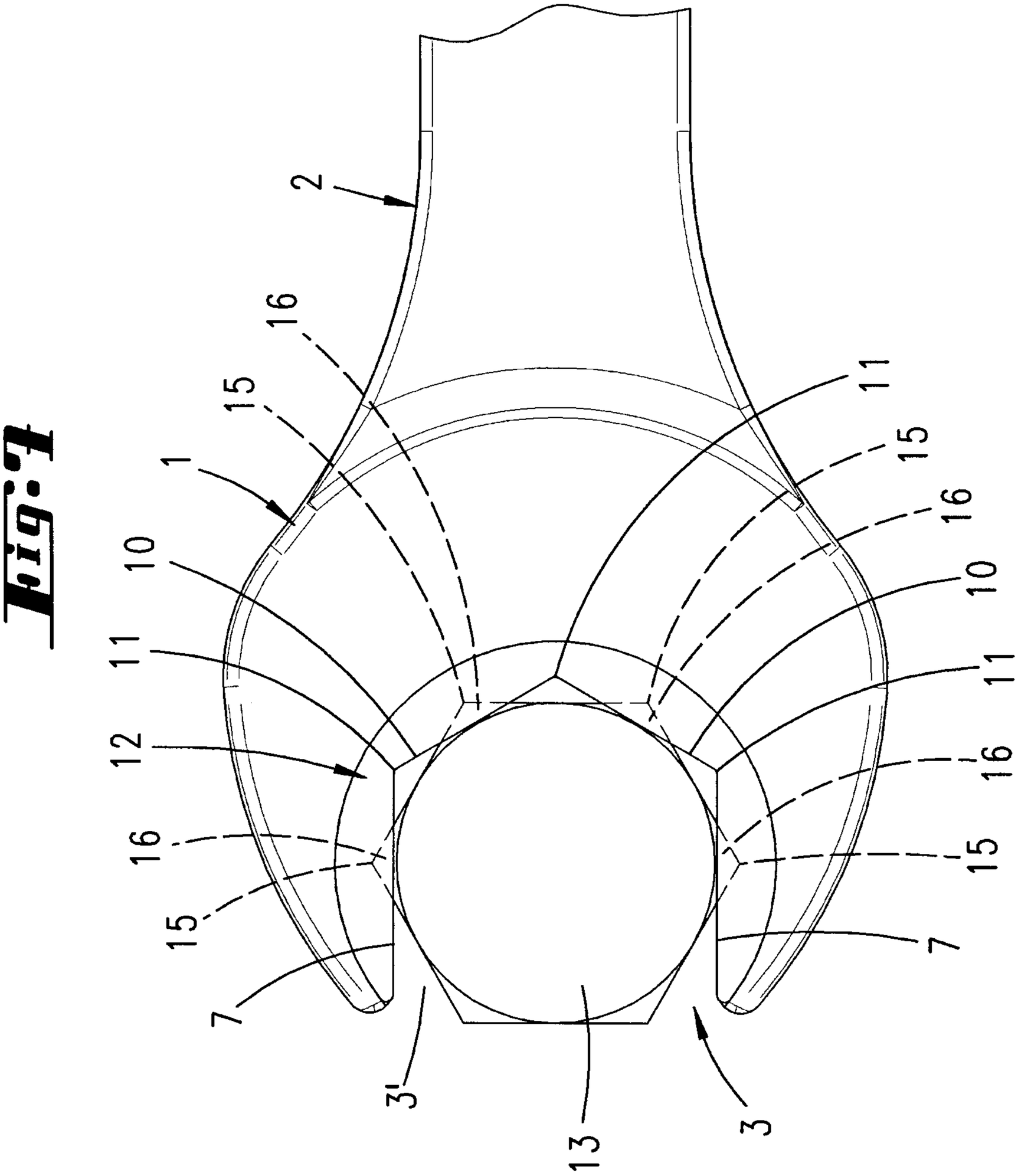


Fig. 8

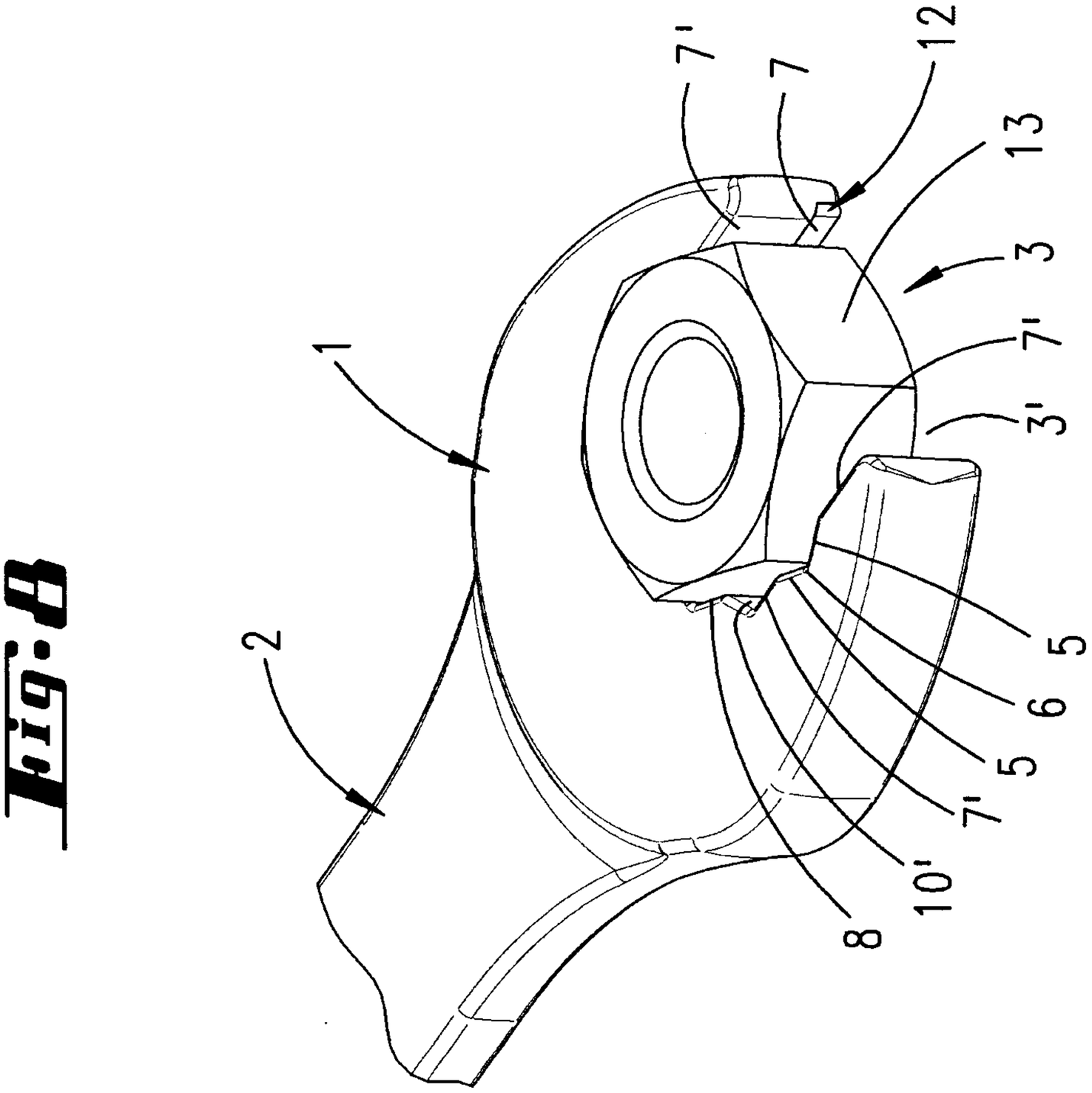
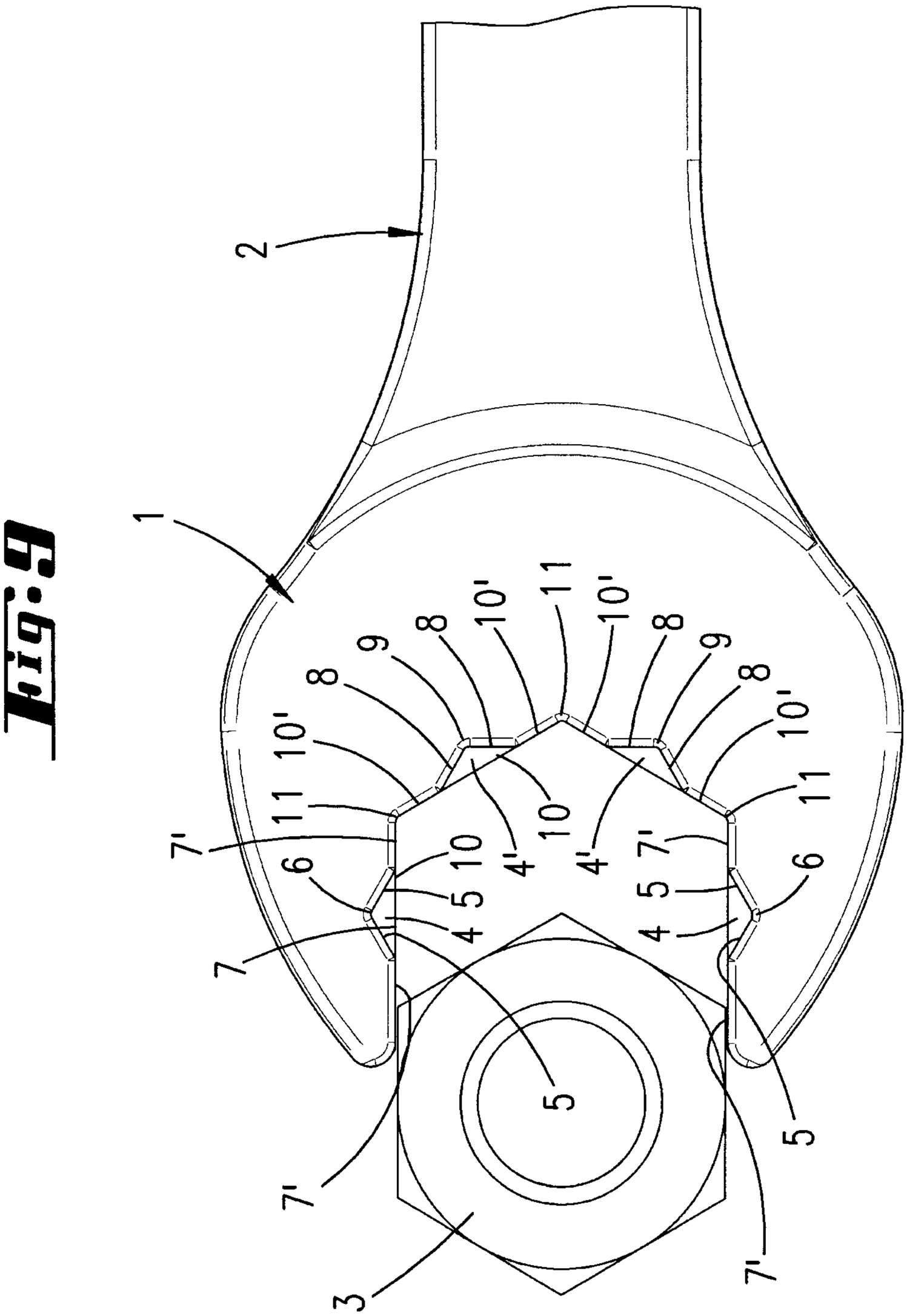


Fig. 9



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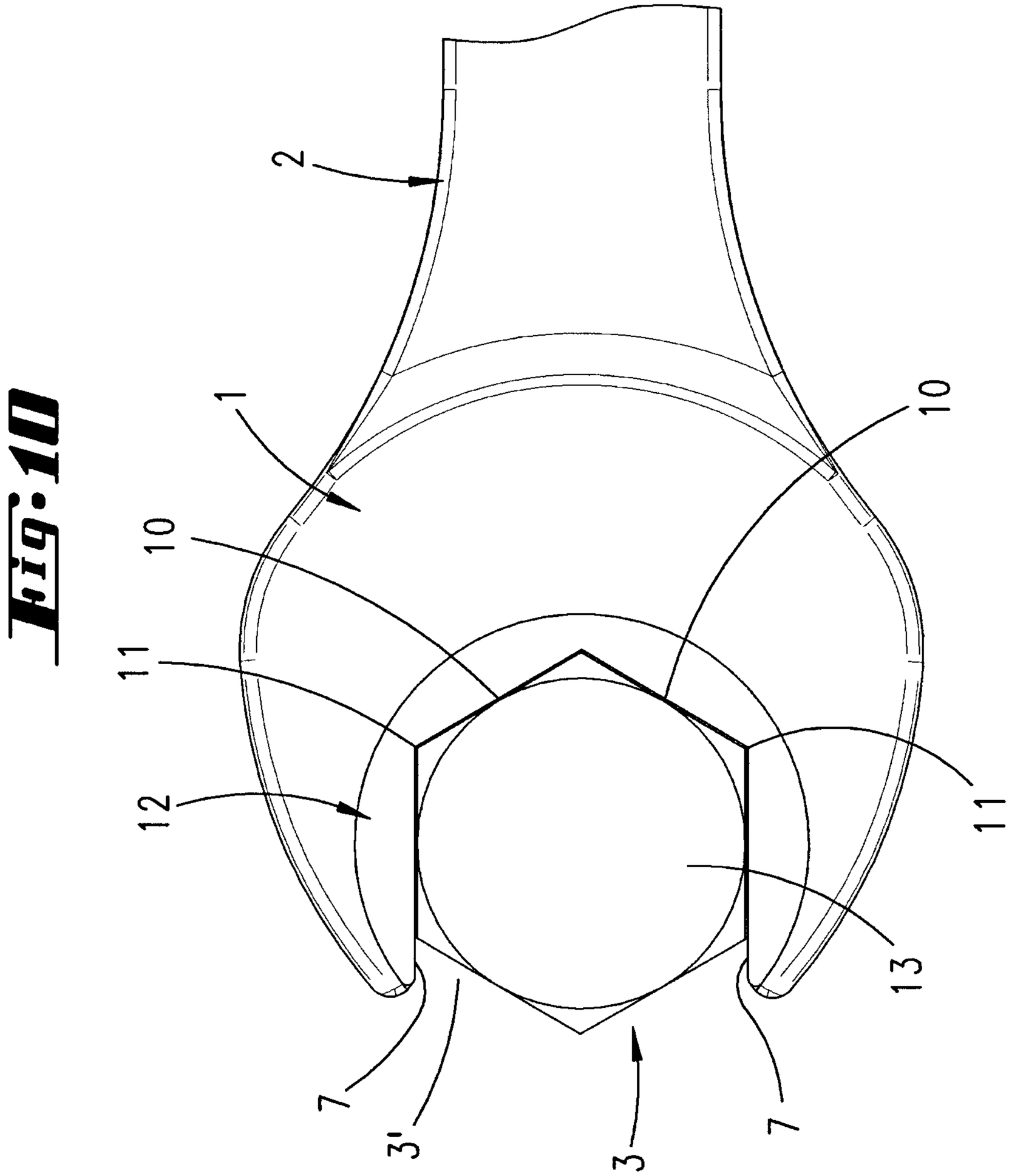

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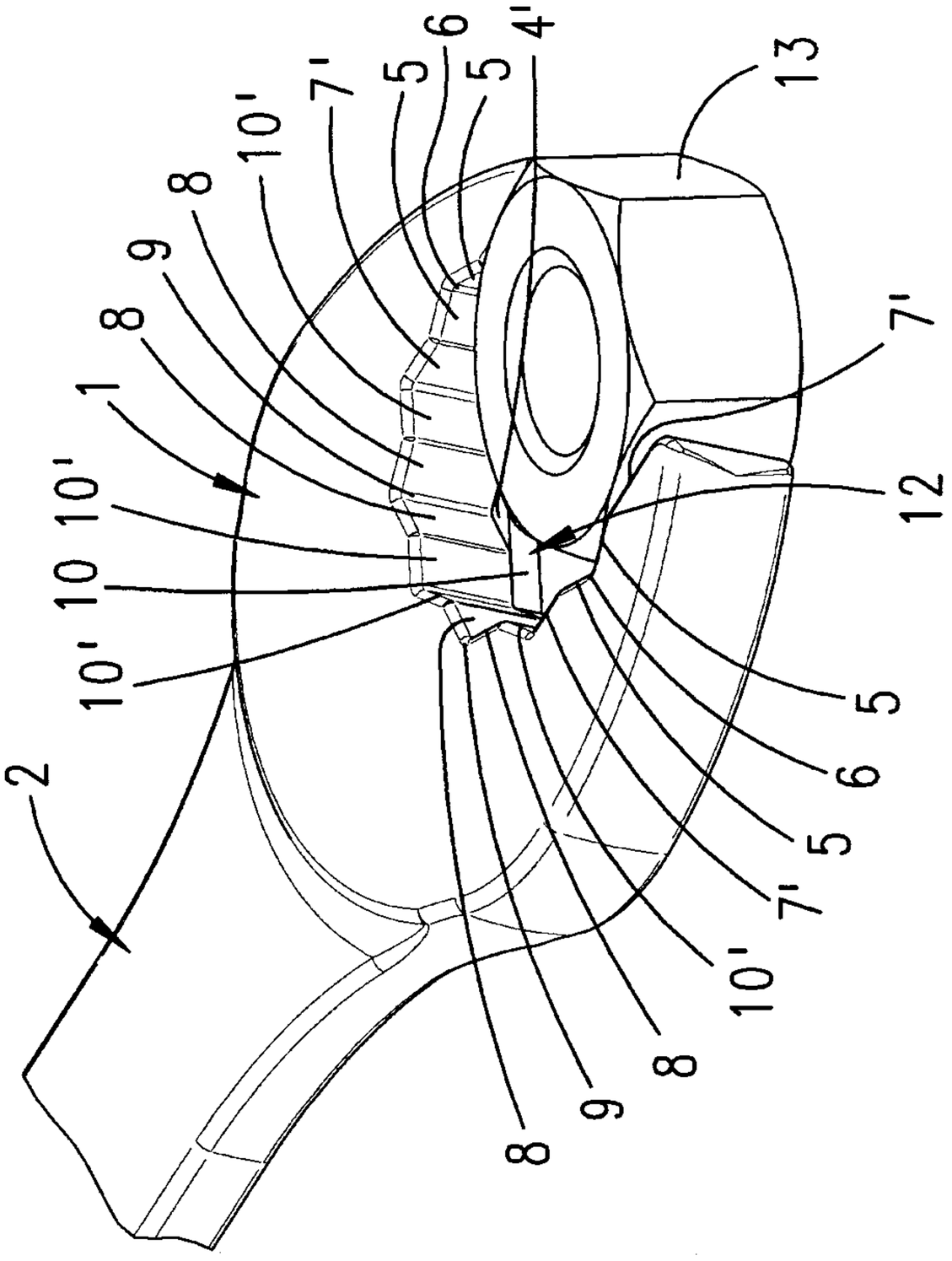

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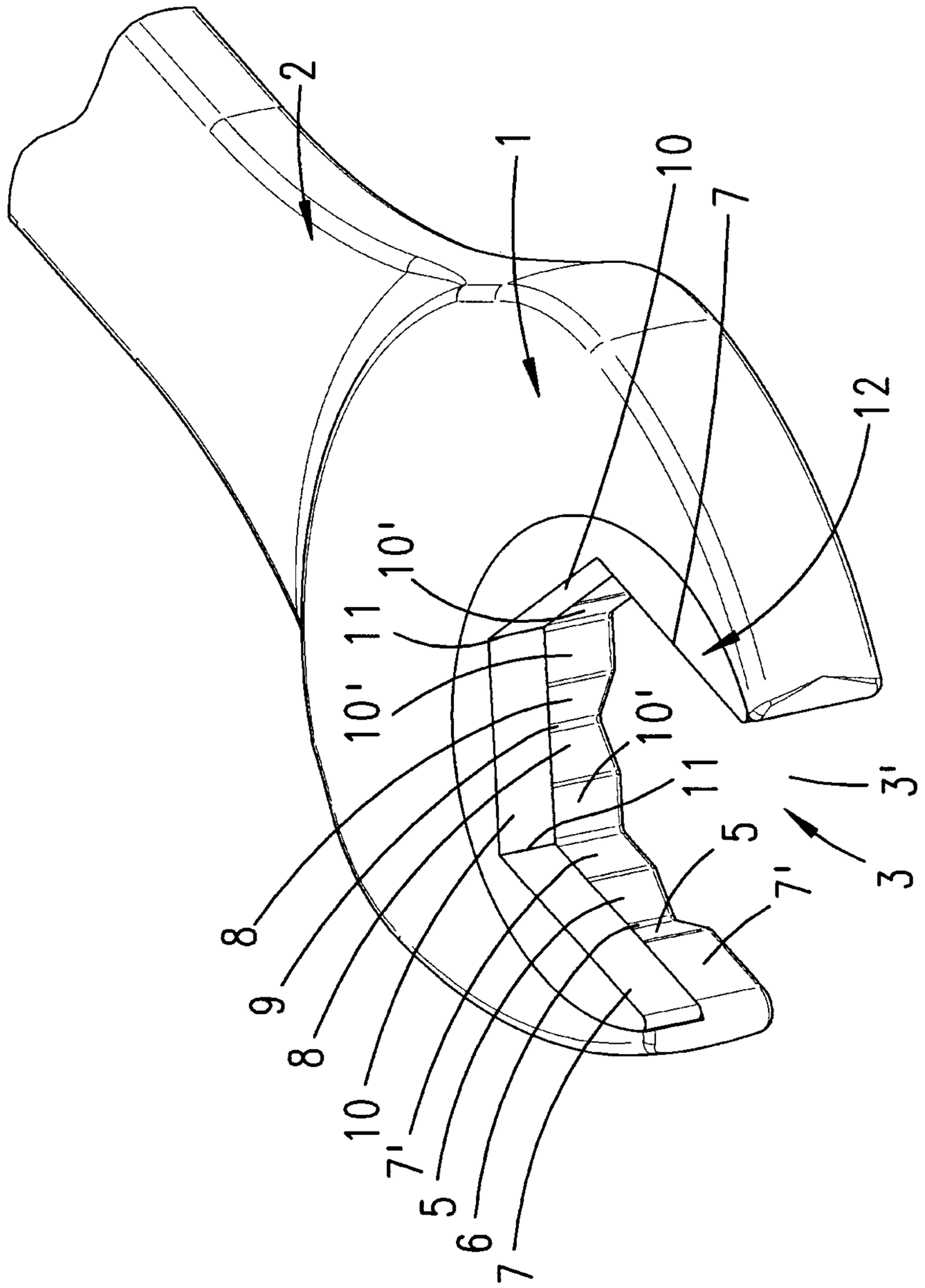

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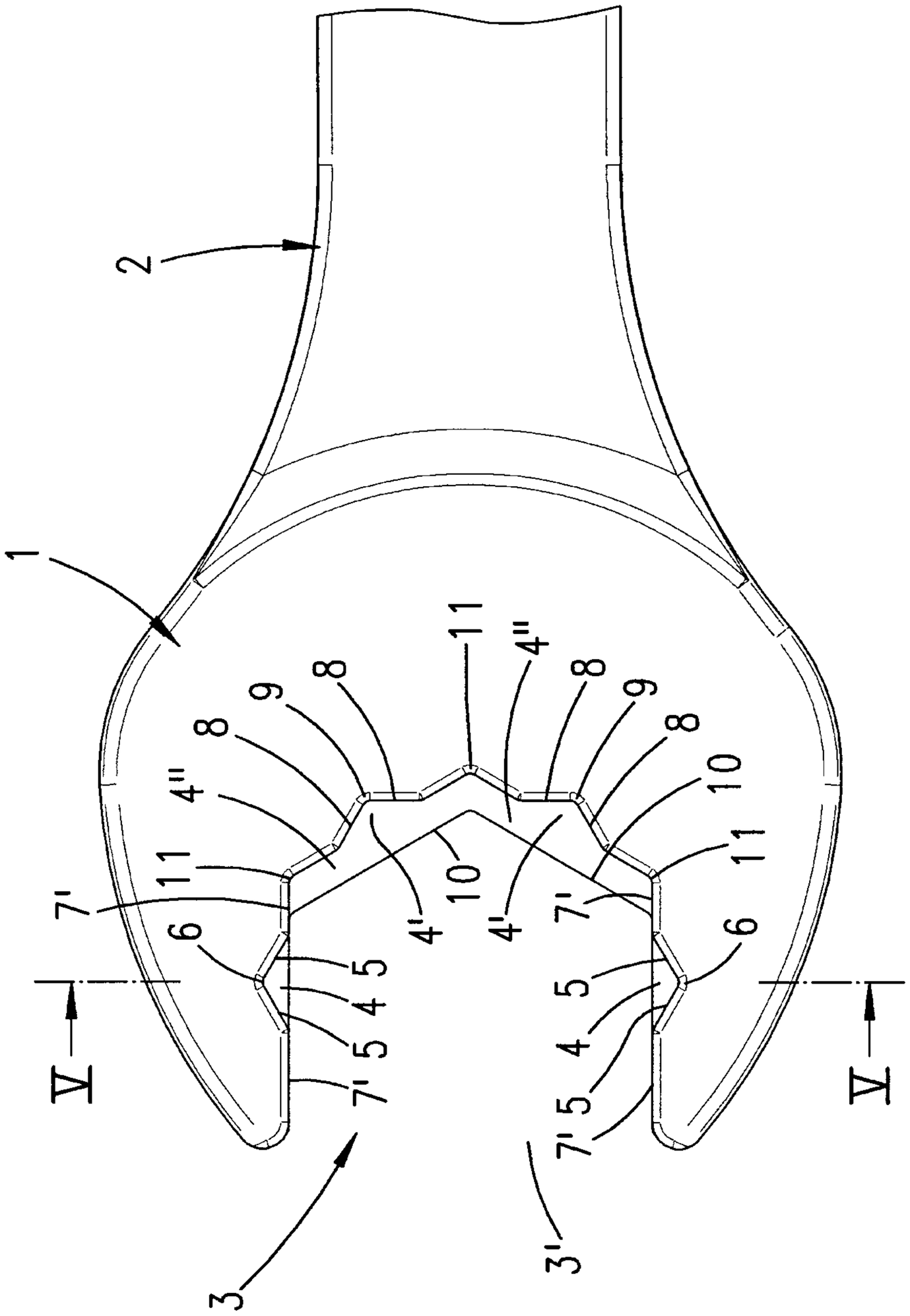


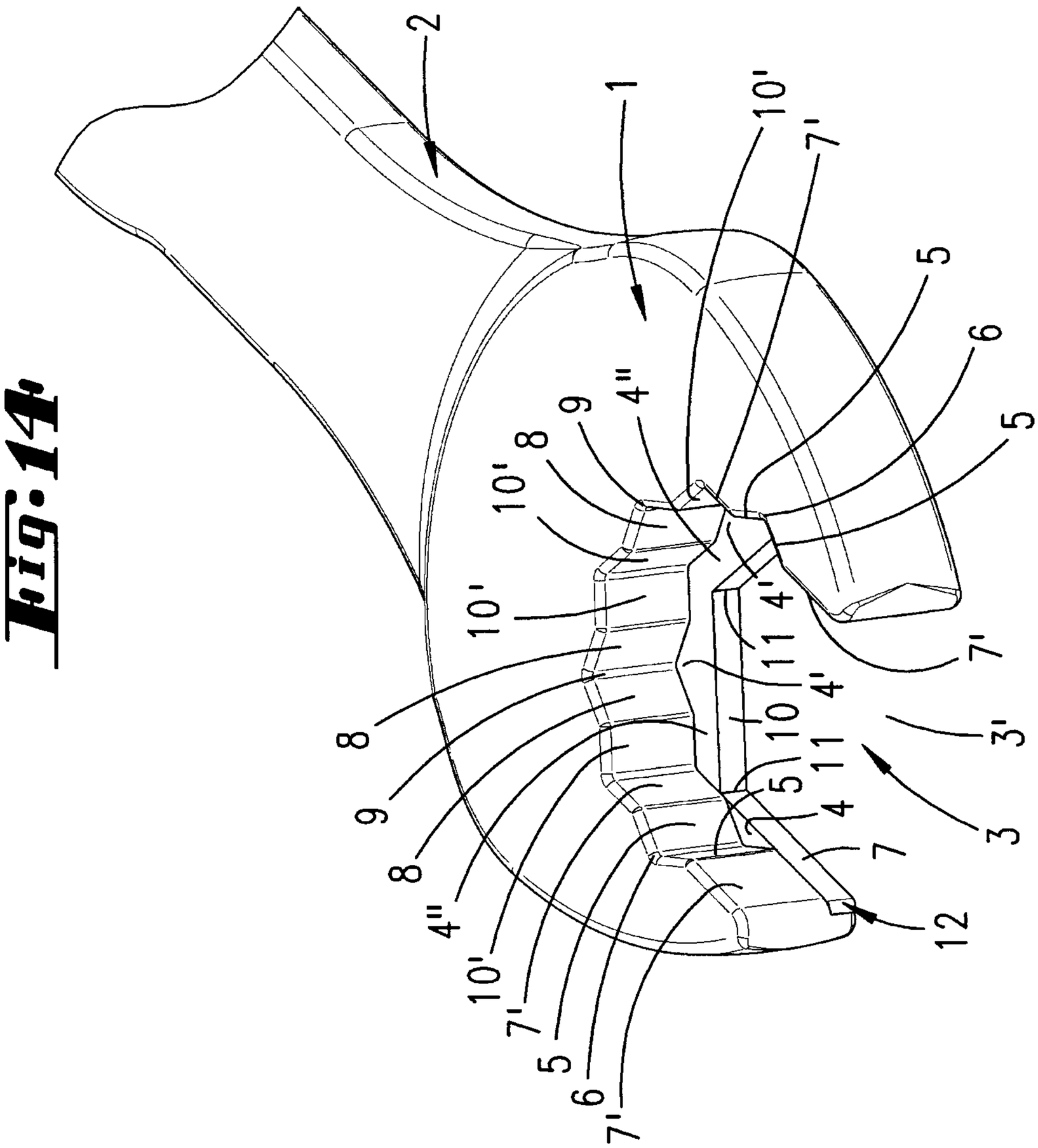
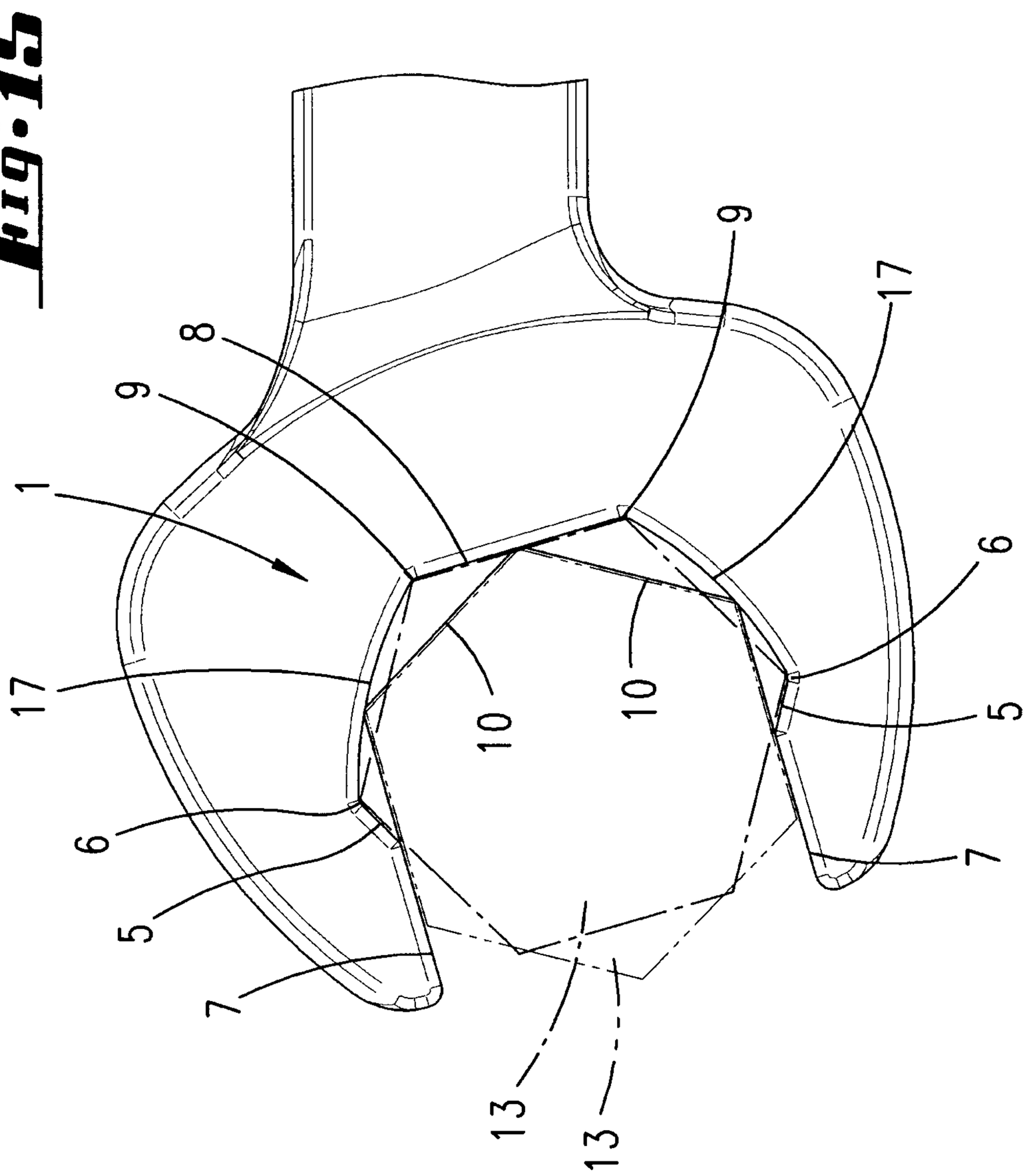


Fig: 14

Fig.15



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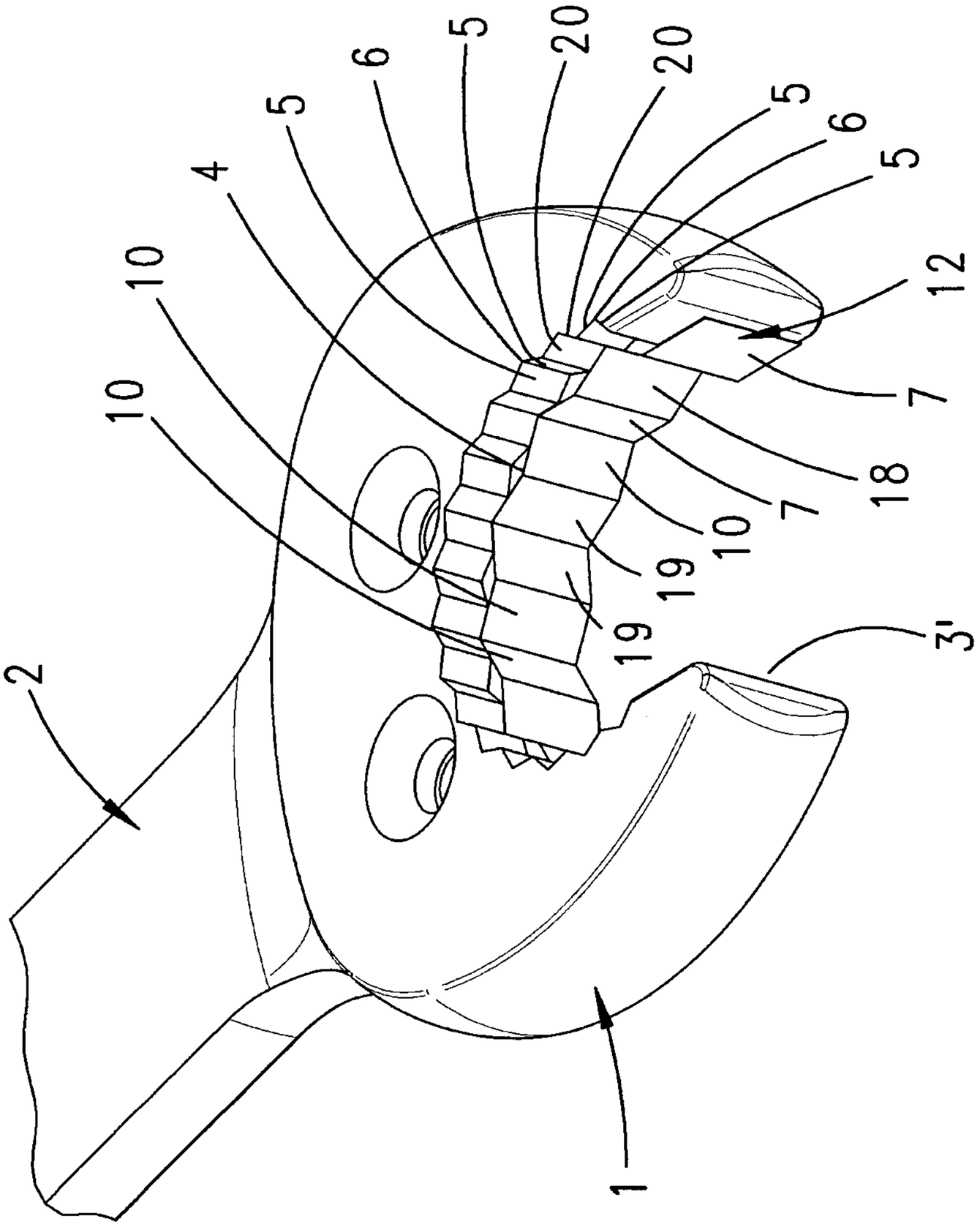

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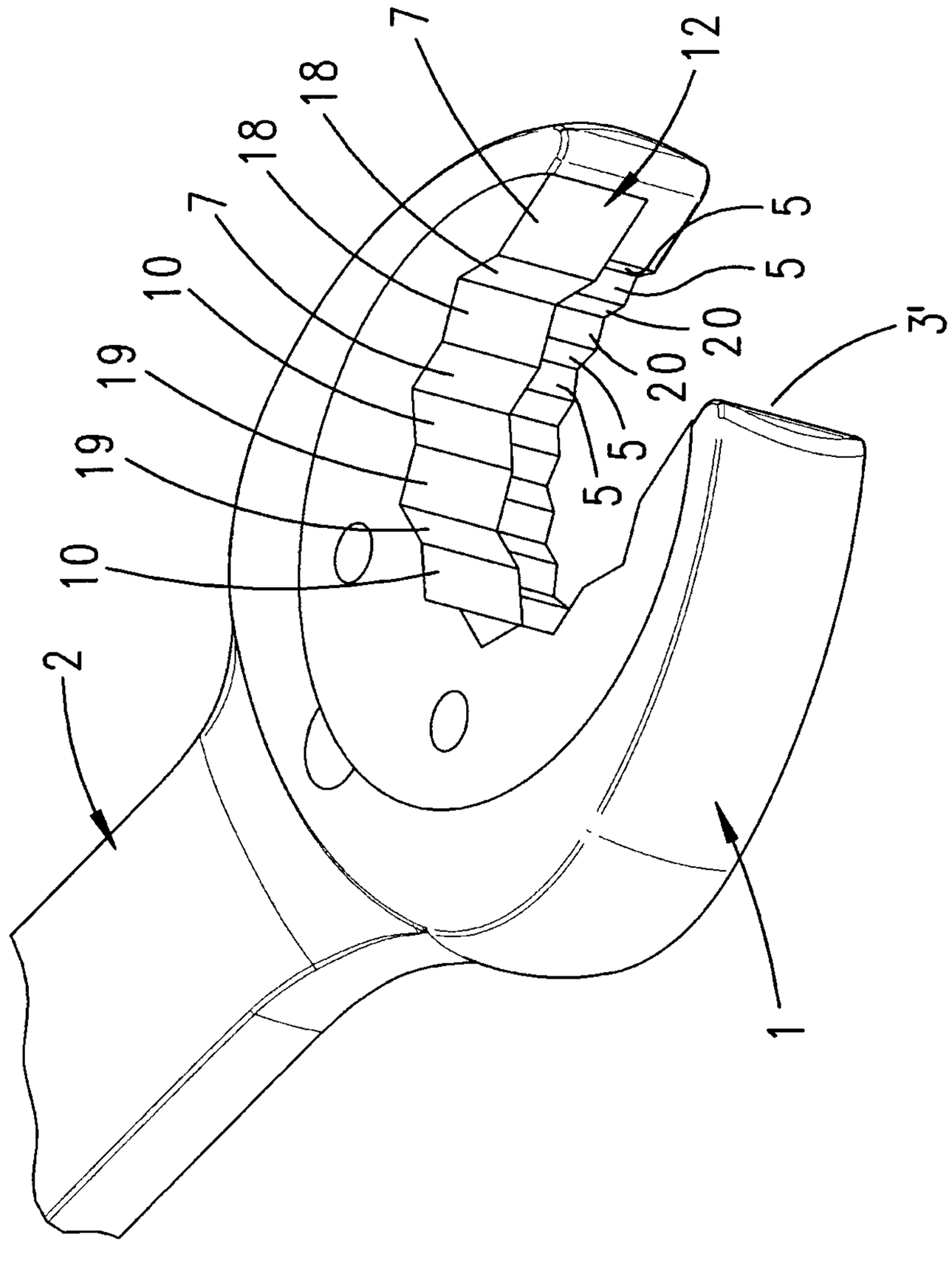


Fig: 1B

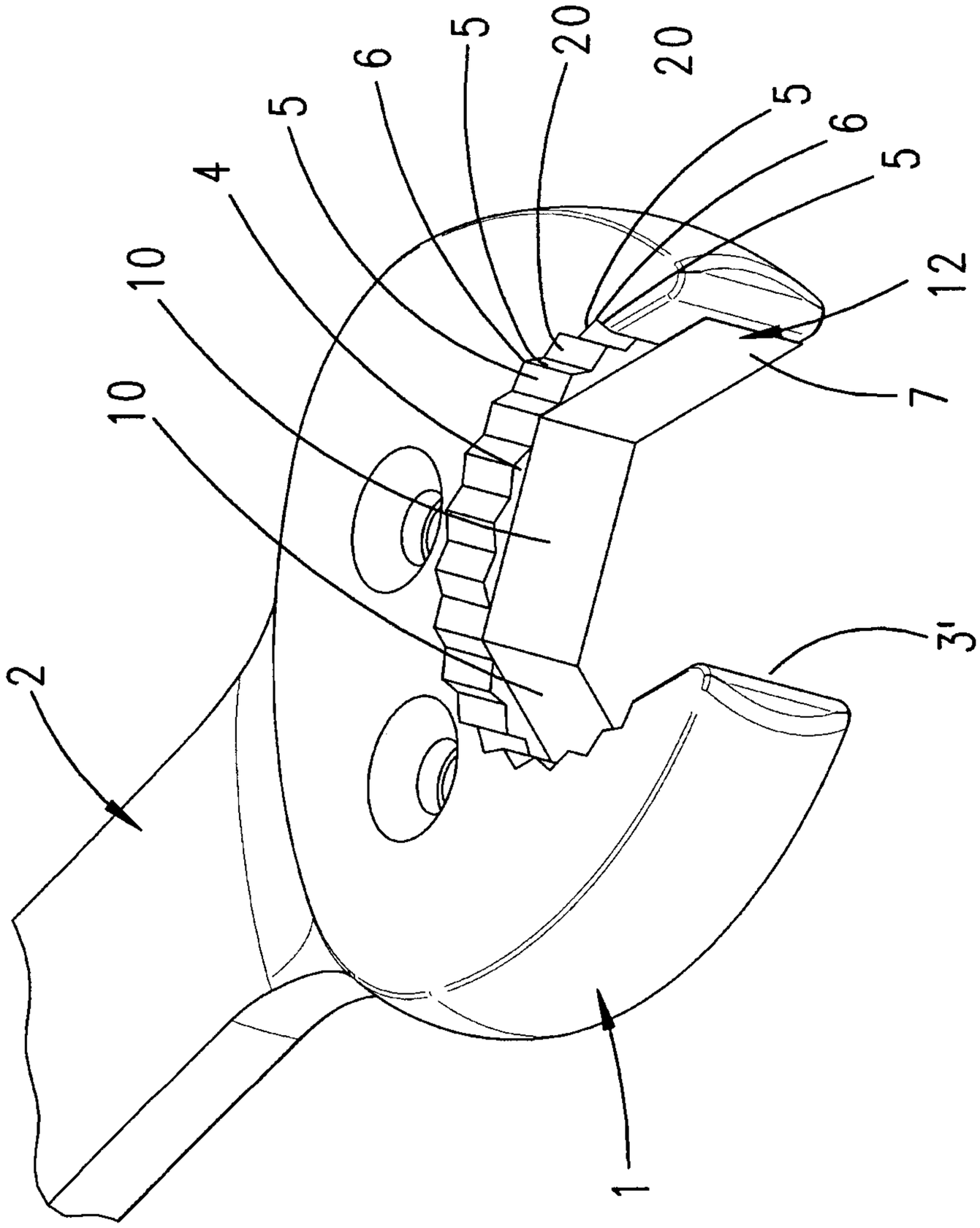


Fig: 19

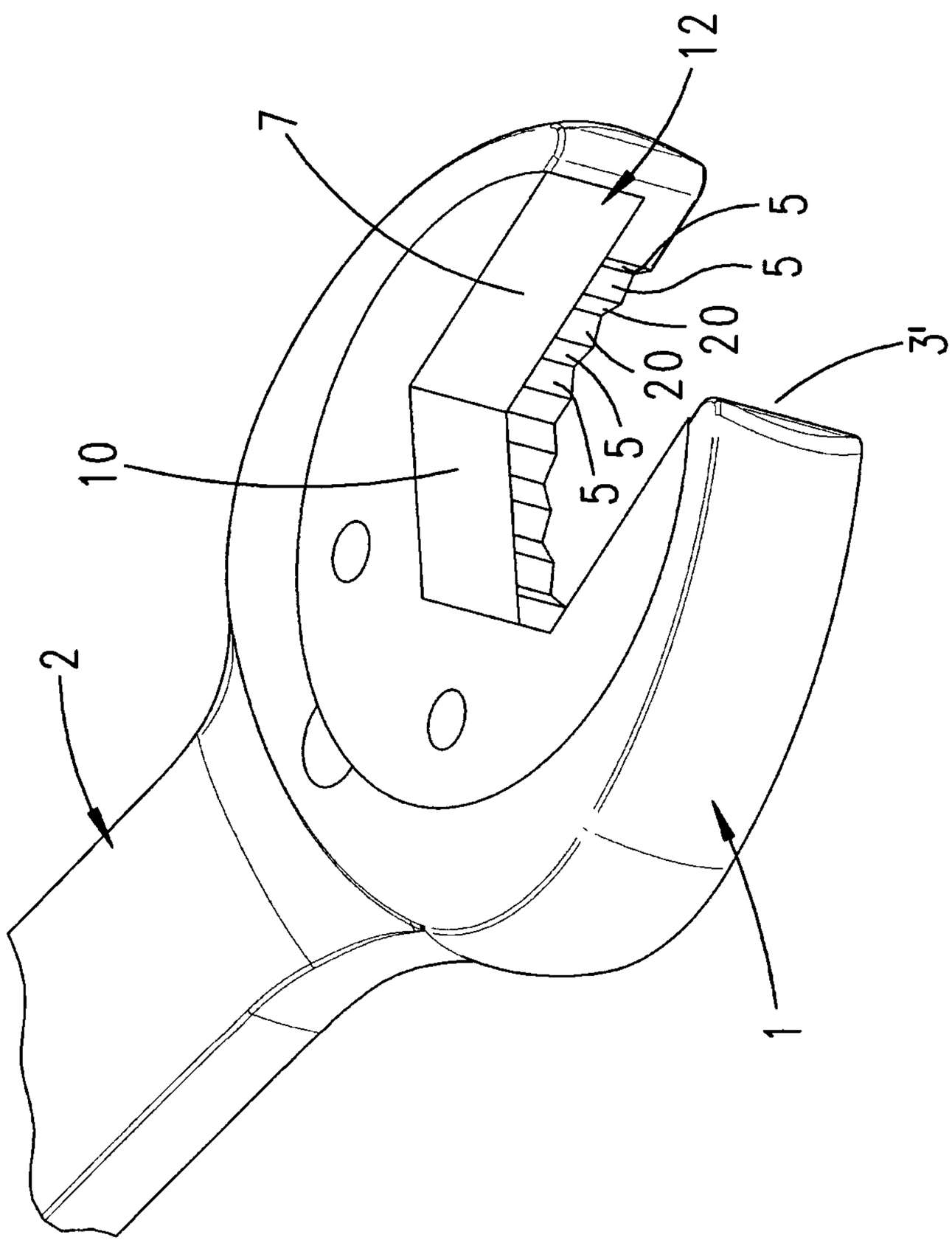
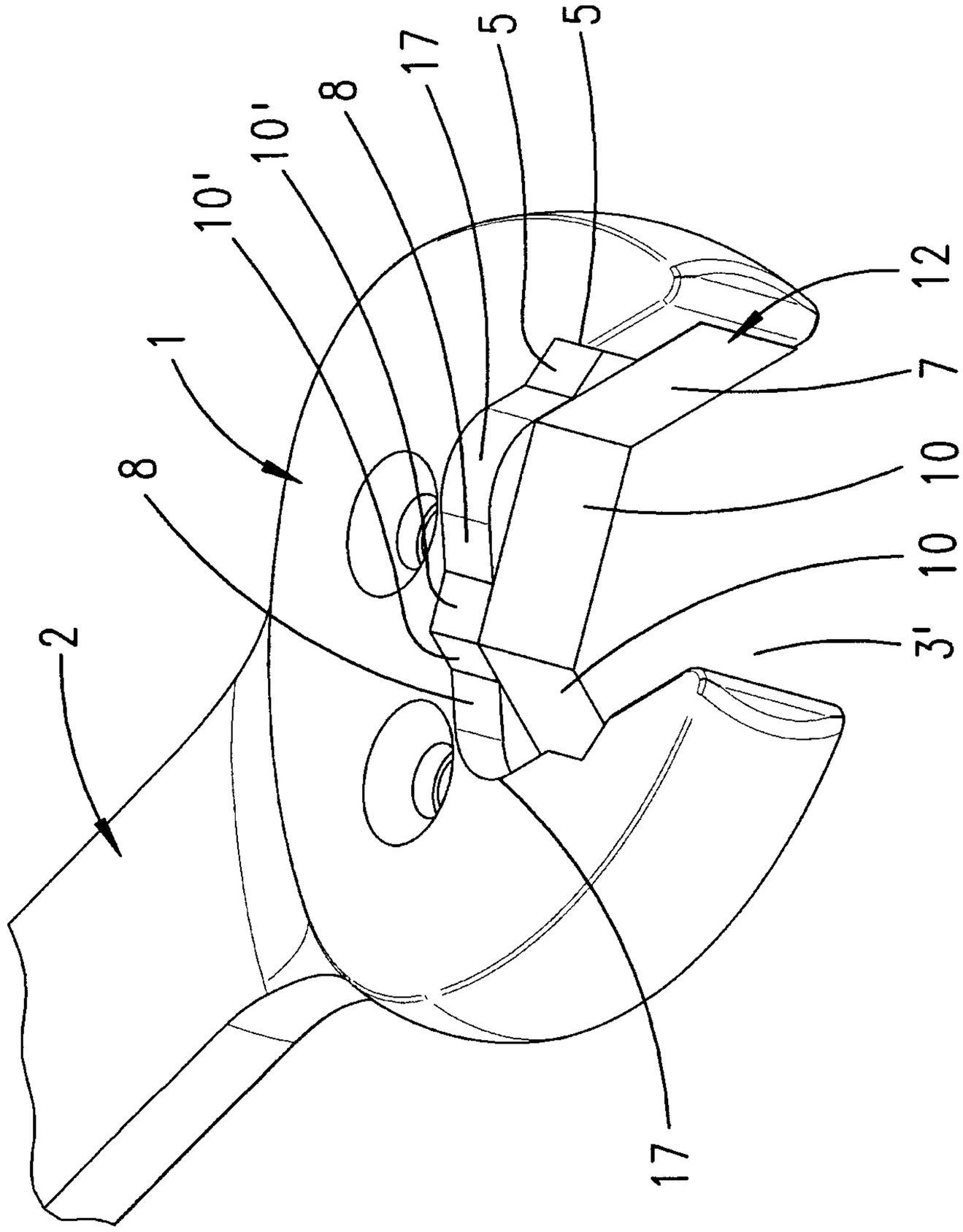


Fig. 20



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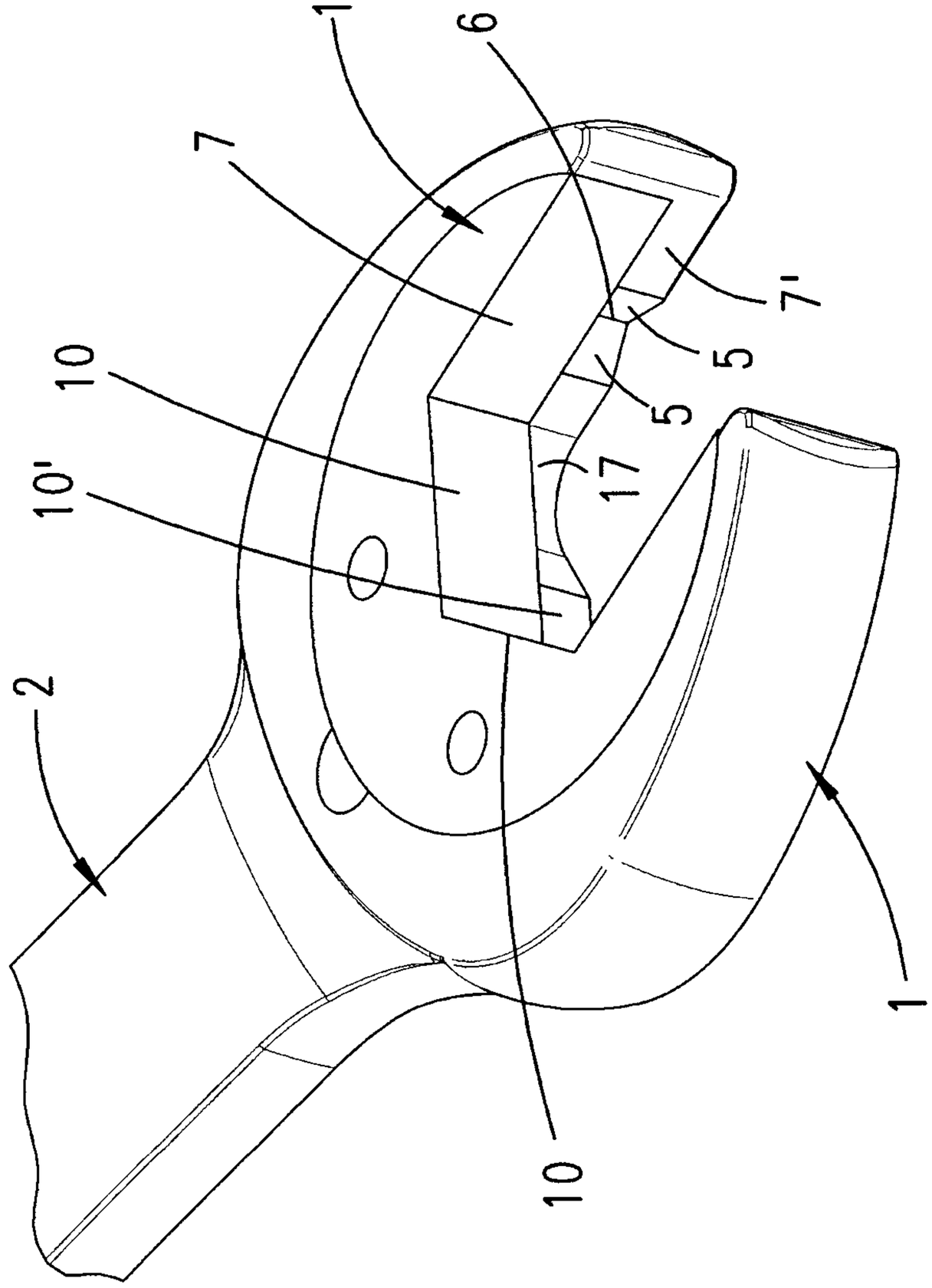

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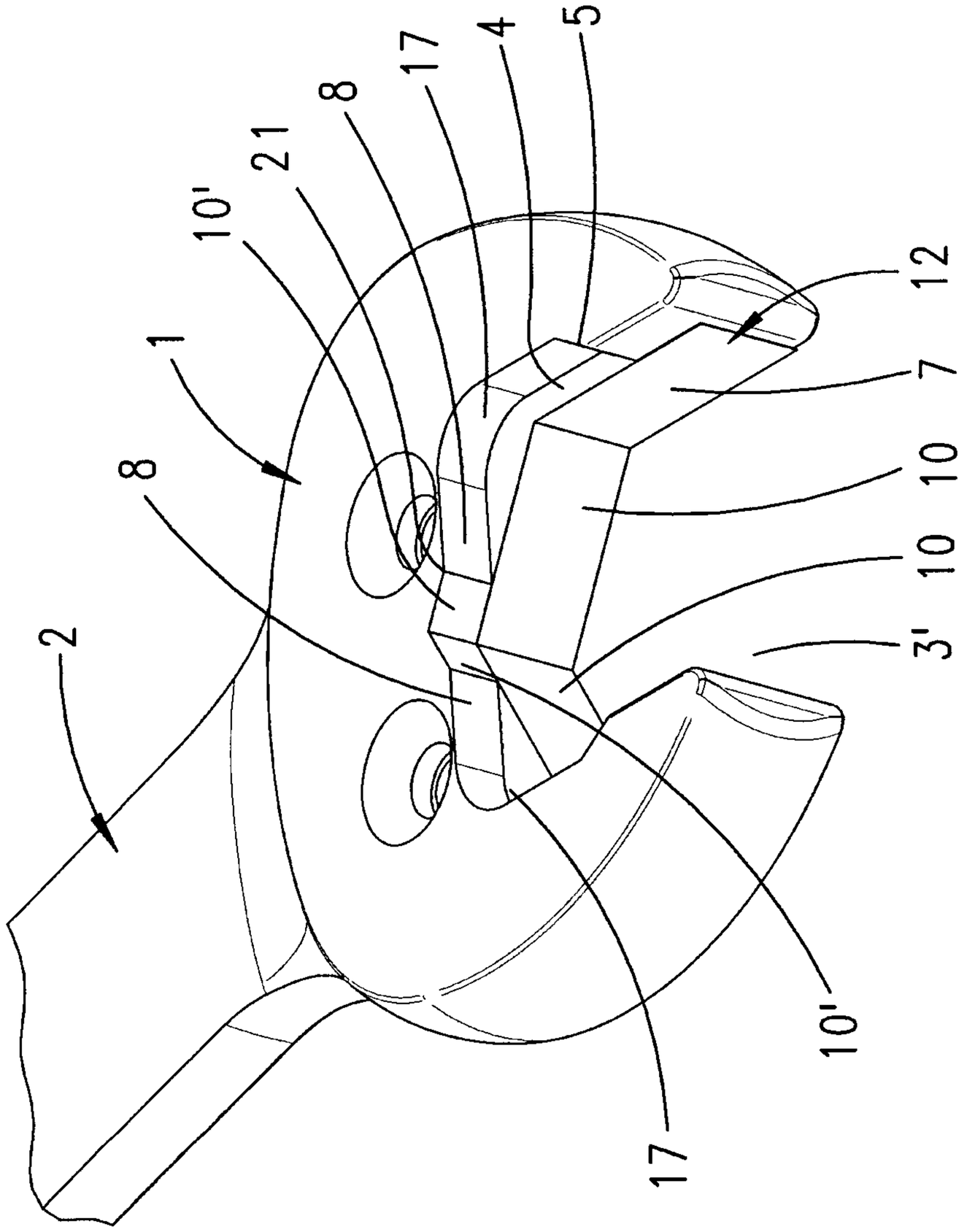
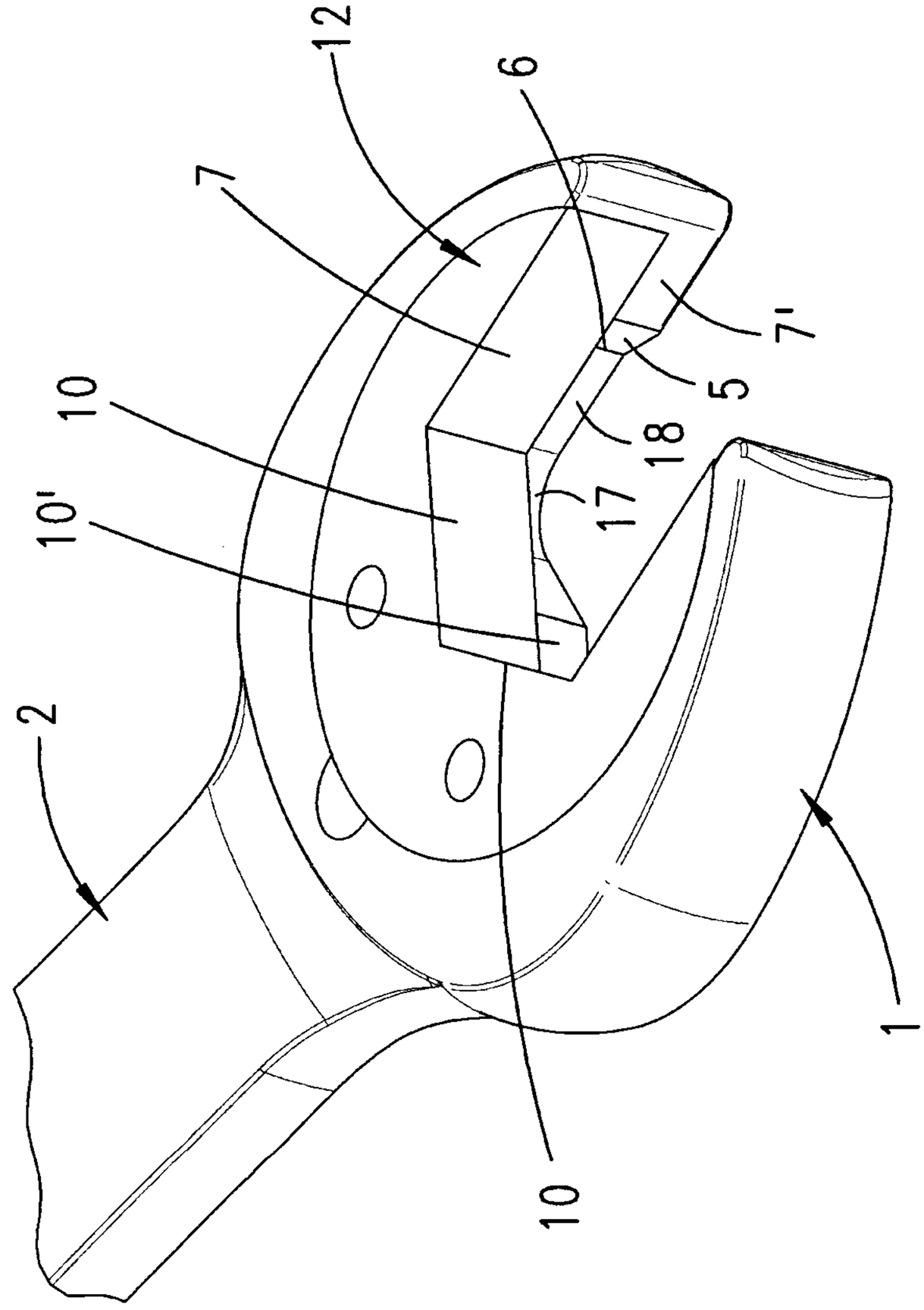


Fig. 23



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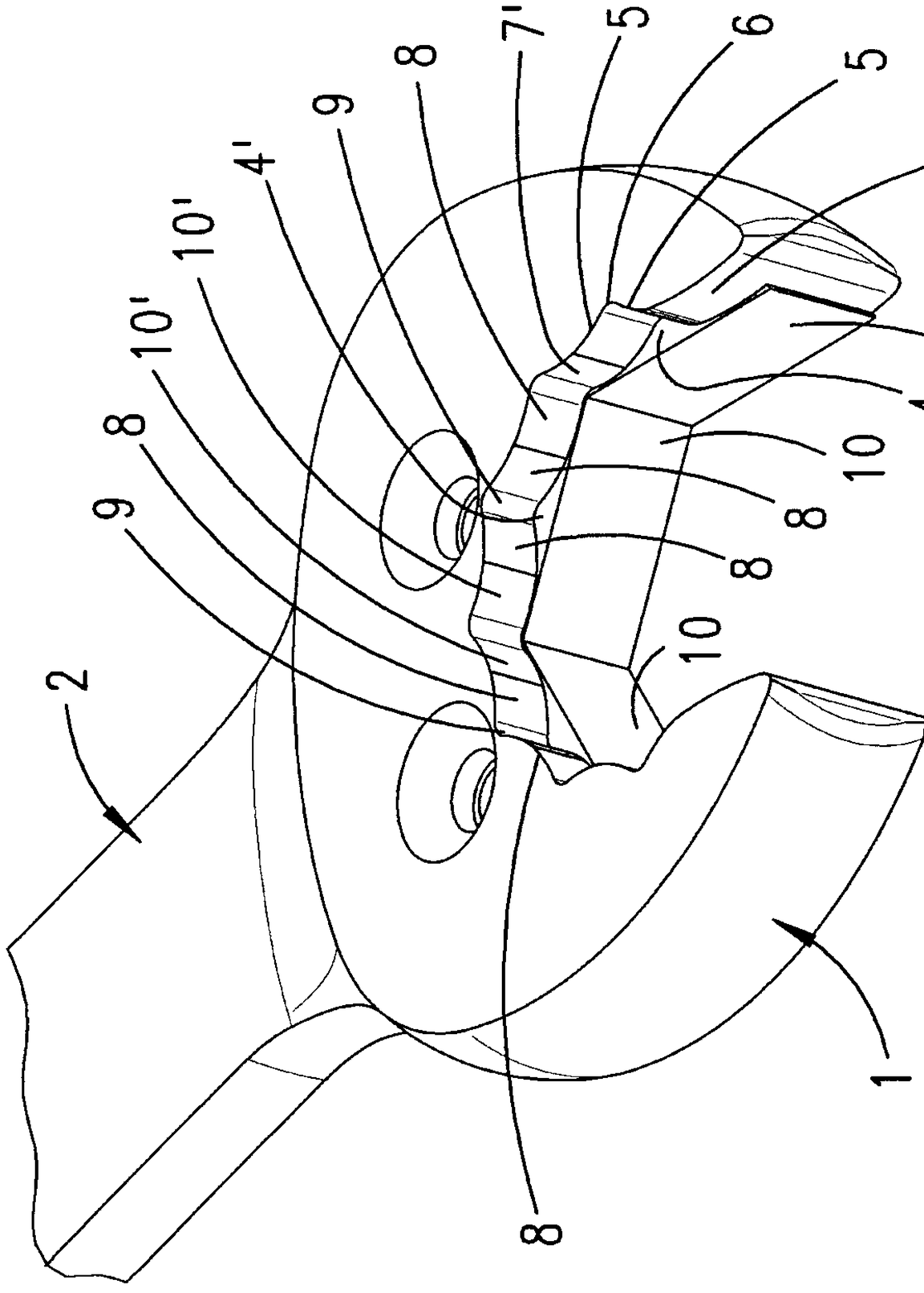

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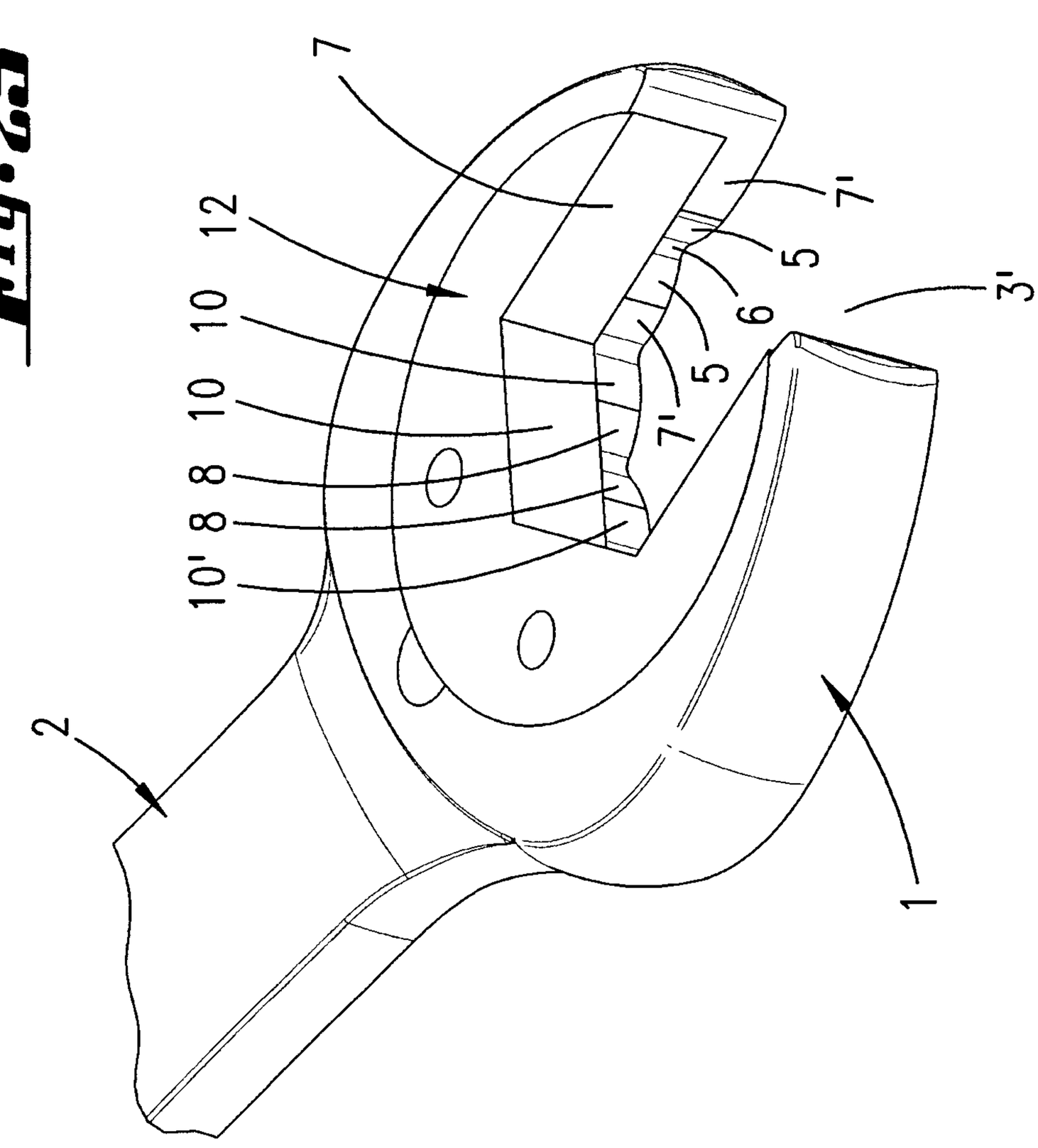


Fig. 26

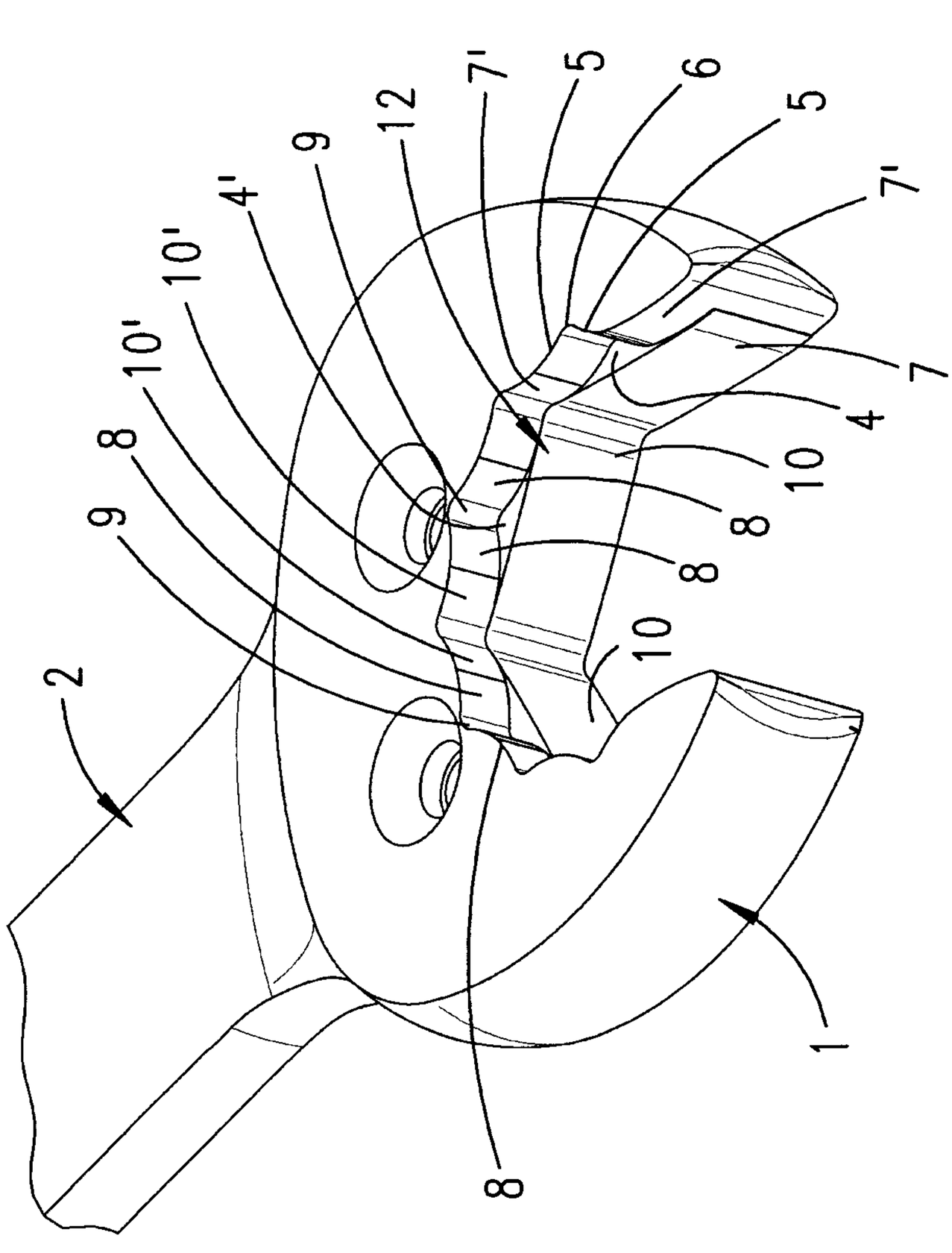
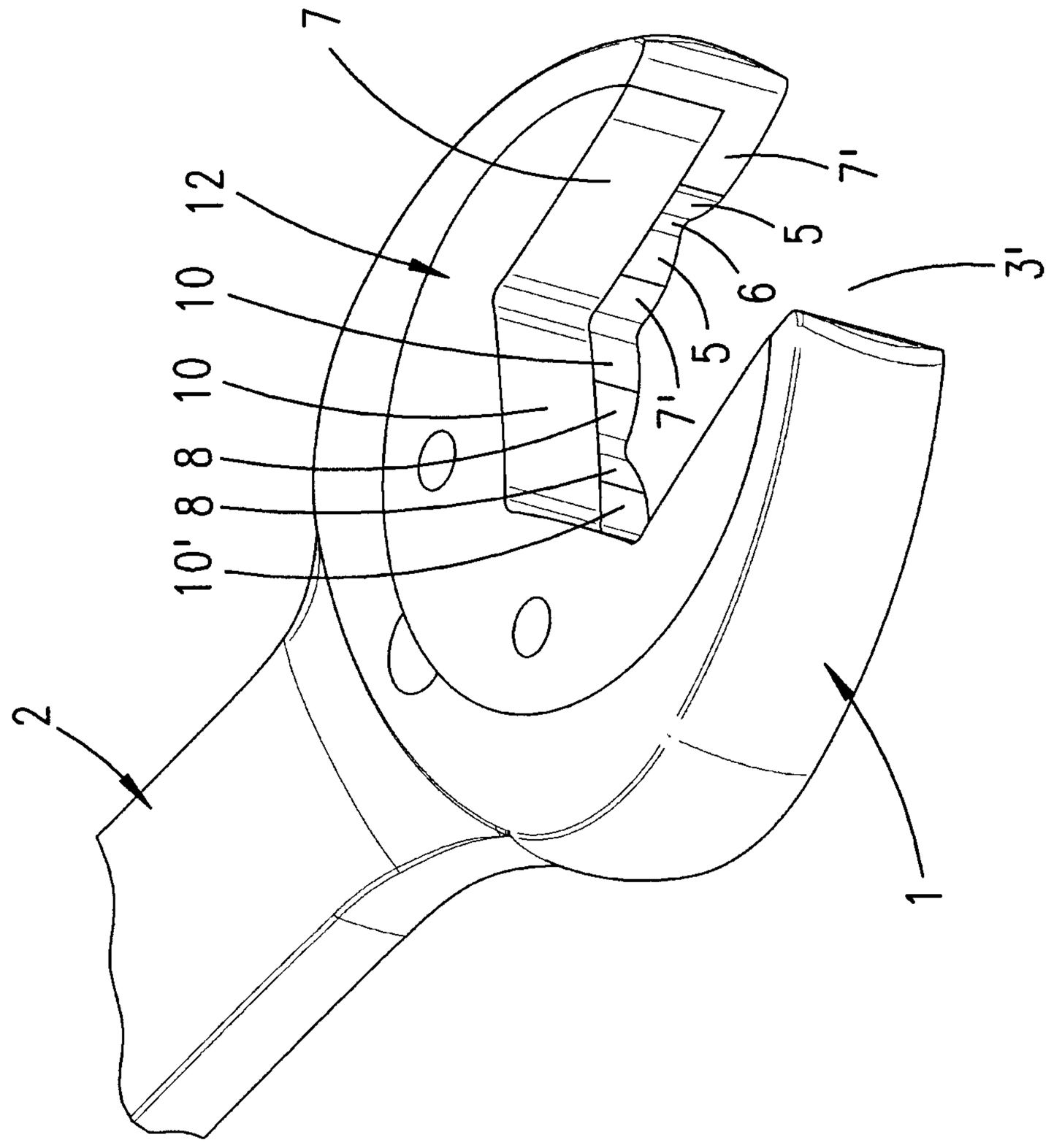
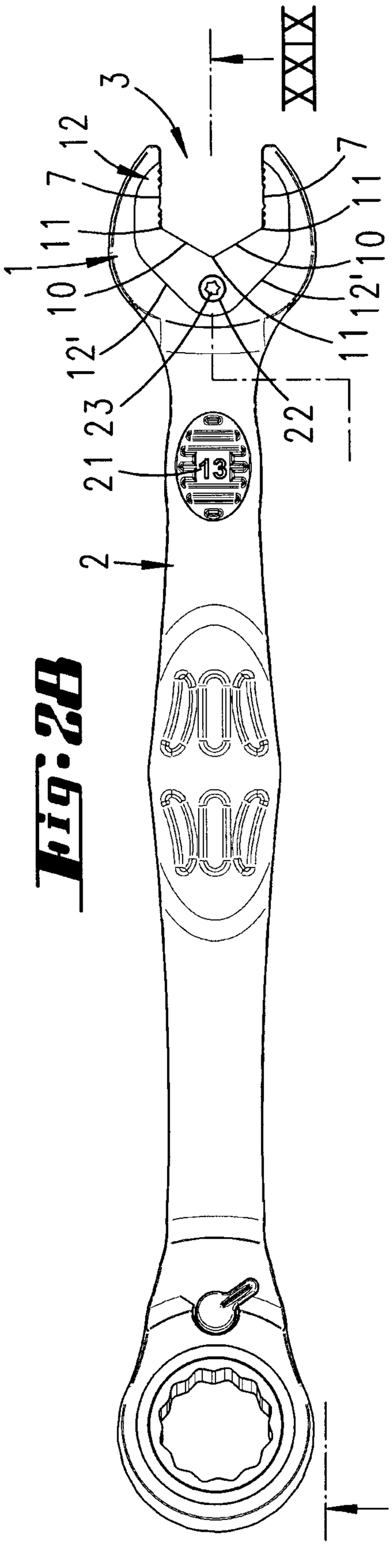


Fig.27





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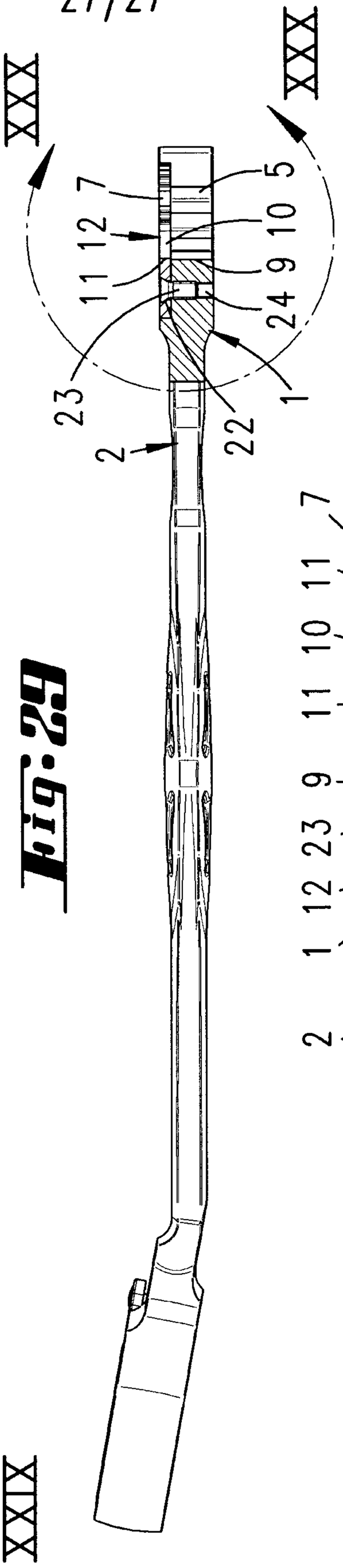

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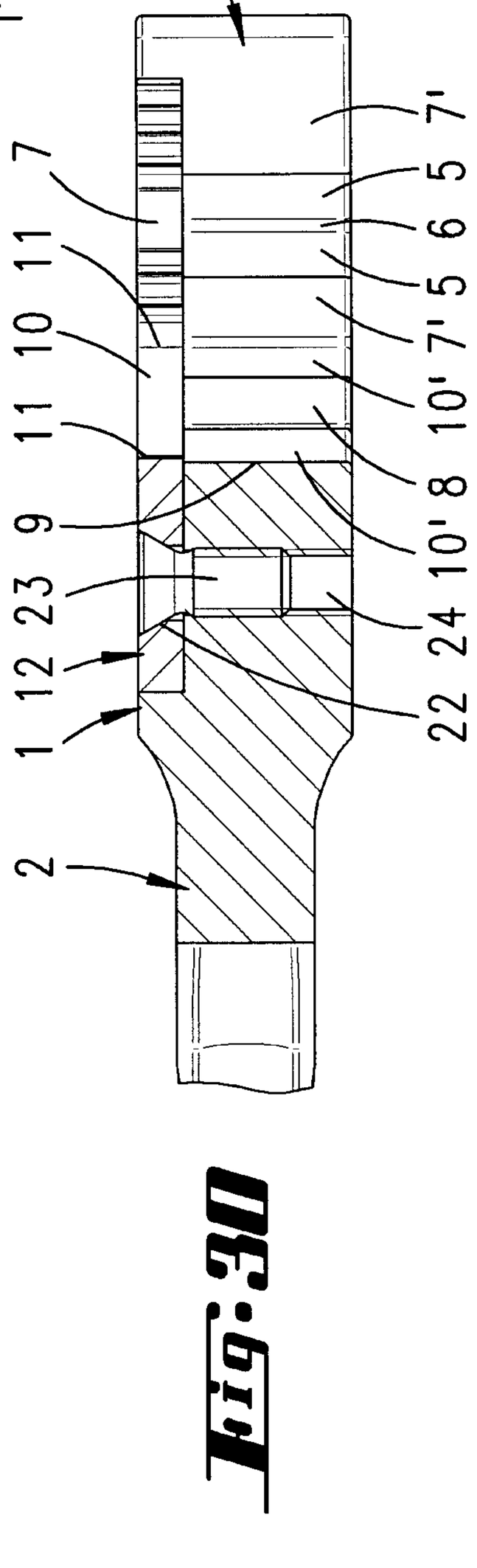

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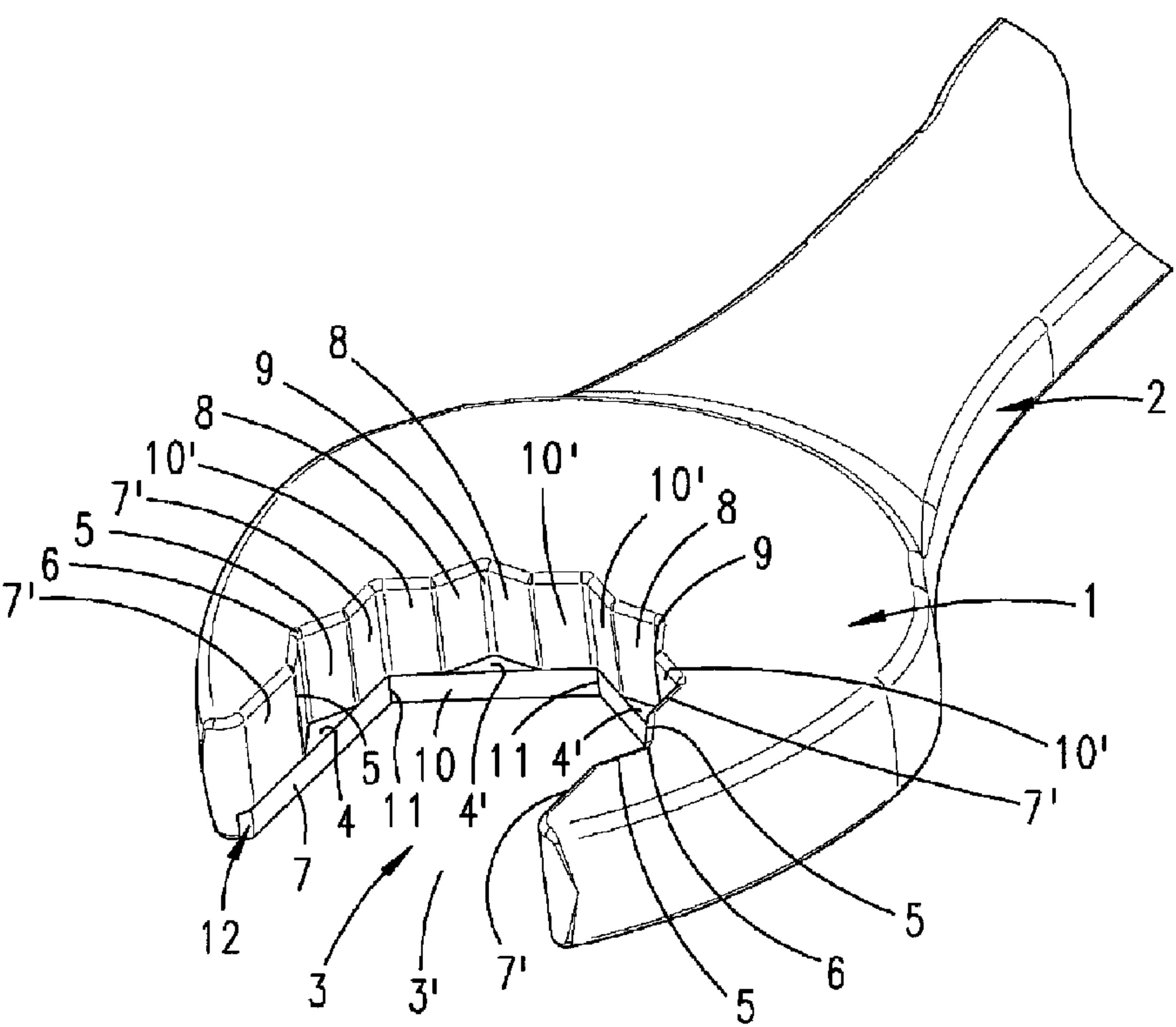
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