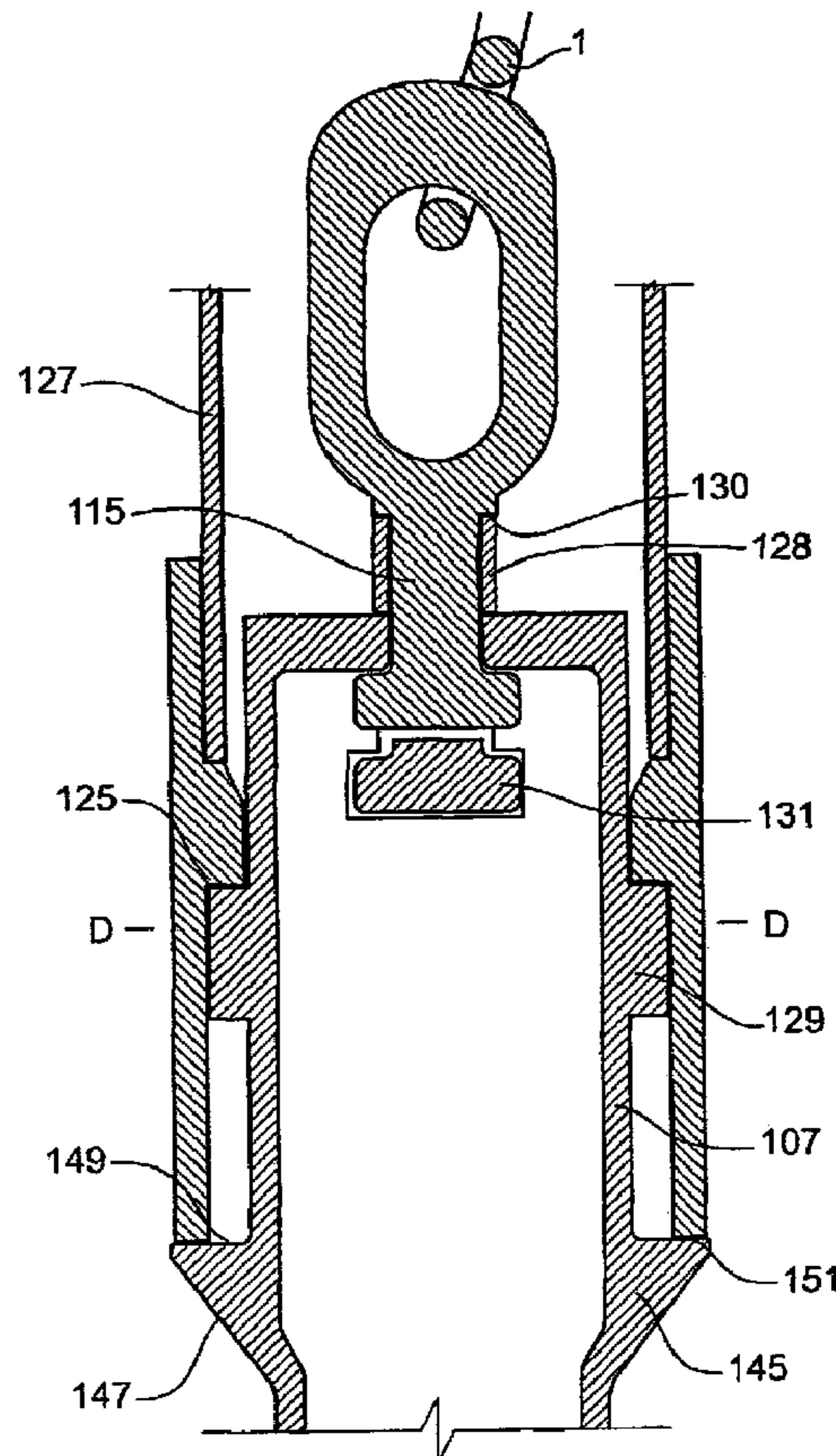




(86) **Date de dépôt PCT/PCT Filing Date:** 2011/05/12
 (87) **Date publication PCT/PCT Publication Date:** 2011/11/24
 (45) **Date de délivrance/Issue Date:** 2018/08/28
 (85) **Entrée phase nationale/National Entry:** 2012/11/20
 (86) **N° demande PCT/PCT Application No.:** NZ 2011/000074
 (87) **N° publication PCT/PCT Publication No.:** 2011/145951
 (30) **Priorité/Priority:** 2010/05/21 (NZ585545)

(51) **Cl.Int./Int.Cl. E02D 5/56** (2006.01),
B63B 21/38 (2006.01), **E02D 5/80** (2006.01)
 (72) **Inventeur/Inventor:**
BAKER, MICHAEL ARTHUR KEITH, NZ
 (73) **Propriétaires/Owners:**
BAKER, MICHAEL ARTHUR KEITH, NZ;
BAKER, DONNA ANN, NZ;
NEW ZEALAND TRUSTEE SERVICES LIMITED, NZ
 (74) **Agent:** NEXUS LAW GROUP LLP

(54) **Titre : ANCRAGES**
 (54) **Title: ANCHORS**



(57) **Abrégé/Abstract:**

An anchor (100) for subsurface installation in a ground surface has an anchor body (101) and a helical member (103) for engaging with a ground surface. The anchor has a swivel (113) for receiving a line. One of the anchor body (101) or the swivel (113) has a

(57) Abrégé(suite)/Abstract(continued):

contact part and the other has a complementary slot for receiving the contact part. The swivel (113) can be releasably engaged with the anchor body (101) by moving the swivel relative to the anchor in a first direction so that the contact part passes through the slot and then in a second direction that is transverse to the first direction to an engagement position in which the swivel is rotatable relative to the anchor body.

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau(43) International Publication Date
24 November 2011 (24.11.2011)(10) International Publication Number
WO 2011/145951 A1(51) International Patent Classification:
E02D 5/56 (2006.01) *B63B 21/38* (2006.01)
E02D 5/80 (2006.01)(74) Agent: PIETRAS, Anthony, Josef; AJ. Pietras & Co,
Level 2, Gibson Sheat Centre, 1 Margaret Street, (PO Box
30173), Lower Hutt 5010 (NZ).(21) International Application Number:
PCT/NZ2011/000074(81) Designated States (unless otherwise indicated, for every
kind of national protection available): AE, AG, AL, AM,
AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ,
CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO,
DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT,
HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP,
KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD,
ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI,
NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD,
SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR,
TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.(22) International Filing Date:
12 May 2011 (12.05.2011)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
585545 21 May 2010 (21.05.2010) NZ(71) Applicants (for all designated States except US): BAK-
ER, Donna, Ann [NZ/NZ]; 12 Kent Street, Picton 7220
(NZ). NEW ZEALAND TRUSTEE SERVICES LIM-
ITED [NZ/NZ]; Unit 1, 142 Ferry Road, Christchurch
8011 (NZ).(84) Designated States (unless otherwise indicated, for every
kind of regional protection available): ARIPO (BW, GH,
GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG,
ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ,
TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK,
EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU,
LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK,

(72) Inventor; and

(71) Applicant : BAKER, Michael, Arthur, Keith [NZ/NZ];
12 Kent Street, Picton 7220 (NZ).

[Continued on next page]

(54) Title: ANCHORS

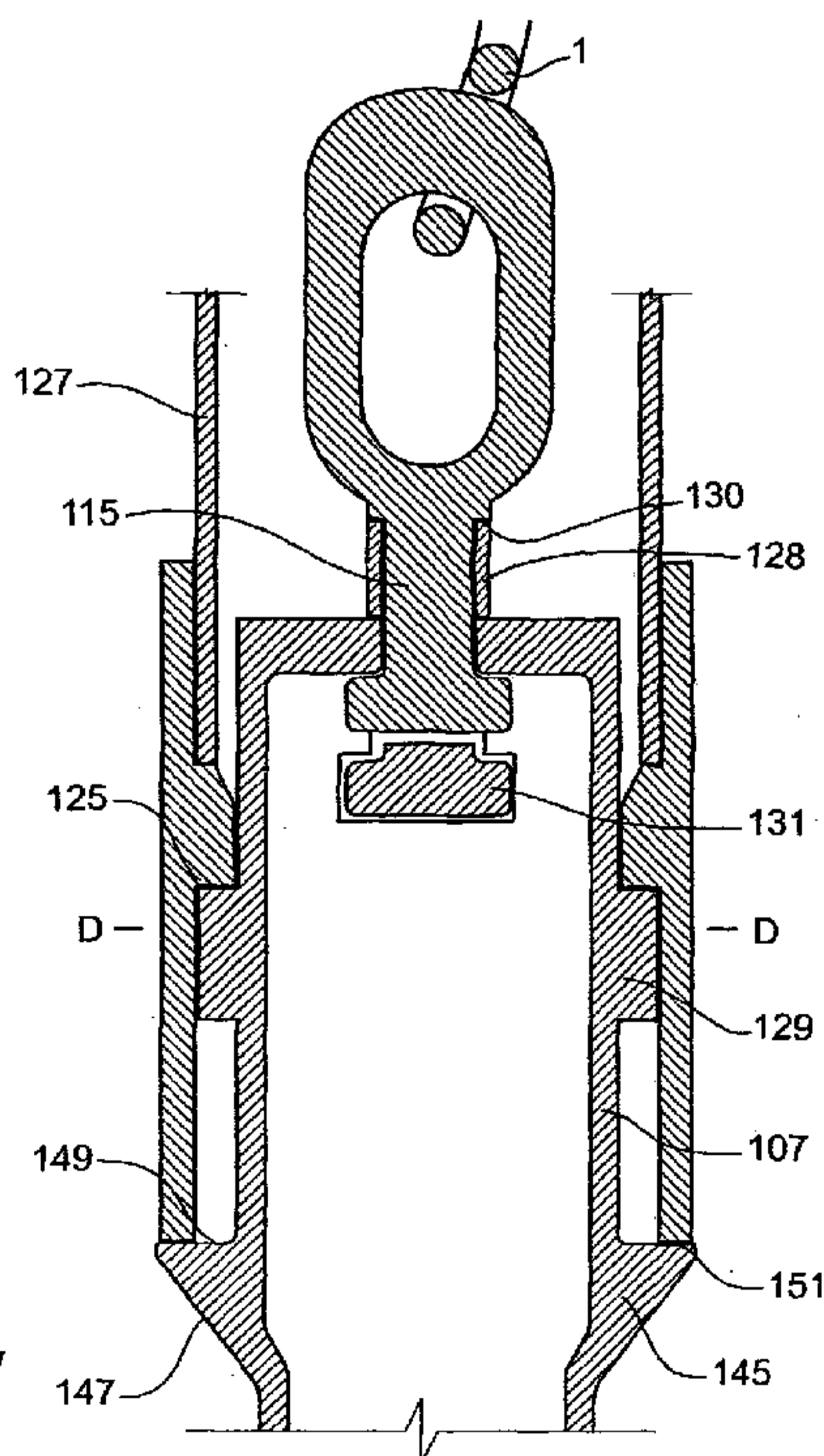


FIGURE 7

(57) Abstract: An anchor (100) for subsurface installation
in a ground surface has an anchor body (101) and a helical
member (103) for engaging with a ground surface. The an-
chor has a swivel (113) for receiving a line. One of the an-
chor body (101) or the swivel (113) has a contact part and
the other has a complementary slot for receiving the con-
tact part. The swivel (113) can be releasably engaged with
the anchor body (101) by moving the swivel relative to the
anchor in a first direction so that the contact part passes
through the slot and then in a second direction that is tran-
sverse to the first direction to an engagement position in
which the swivel is rotatable relative to the anchor body.

WO 2011/145951 A1



SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

Published:

— *with international search report (Art. 21(3))*

Anchors

FIELD OF THE INVENTION

5 A preferred form of this invention relates to an anchor for subsurface installation in a ground surface. In a particular embodiment, the invention relates to an anchor for installation in an underwater environment and, in another embodiment, for subsurface installation on land.

10 BACKGROUND

It is well known to use anchors to attach other objects to the ground. For example, anchors are used to attach boats or buoys floating on the sea surface to the seabed via a line. Anchors can be temporary anchors, for use when the boat or buoy is intended to be temporarily secured. Alternatively, anchors can be permanent, for use
15 when the boat or buoy is intended to be permanently secured.

One type of permanent anchor is a drag or gravity anchor. The anchor is typically a large concrete block that is secured relative to the seabed by its sheer weight. A buoy or boat is attached to the block via a line. Drag anchors require a large amount of
20 surface area to function correctly. The buoy and anchor are spaced apart from each other in a horizontal direction and the line will extend between the buoy and the anchor in a generally catenary shape. In normal conditions, the horizontal distance is about three times the sea depth. When a drag anchor is used to anchor a buoy in a marine farm, the horizontal distance required between the anchor and the buoy reduces the
25 usable surface area of the farm. Concrete block anchors are often unsuitable for anchoring to steep or sloping sea beds because they tend to move down the slope. Another problem with drag anchors is that they may move on the seabed during storms or rough seas.

30 Another type of permanent anchor is a screw anchor. Screw anchors have an anchor body with a helical member. The screw anchor is screwed into the sea bed by divers or a remote controlled system using a drilling tool. Screw anchors may require less horizontal space than gravity anchors. For example, it is possible to use a screw anchor and have horizontal distance about 1.2 times the sea depth.

35

Screw anchors may reduce the environmental impact to the seabed compared to gravity anchors that can drag across the seabed. However, when installed in the seabed, the shaft of known screw anchors protrudes out from the seabed, which can have adverse environmental affects.

Conventionally, screw anchors are manufactured by separately forming each of the parts of the anchor and then welding them together to form the anchor. For example, an anchor is manufactured by welding a steel helical member to a steel tubular member. During the welding process, the helical member or tubular can become heat affected, which can weaken the anchor. The heat affected areas are prone to breaking when the anchor is drilled into the ground. Additionally, the welding process can be expensive.

A helical member is conventionally formed by cutting a generally oval annular-shaped piece from a sheet of steel. The annular-shaped piece of steel is then stretched to form a helical member. When the helical member is formed and then welded to the tubular member, it is common for the helical member to extend at an angle that is not 90° to the axis of the tubular member. Accordingly, when the anchor is drilled into the ground, voids can form in the surrounding ground above the helical member. Additionally, the ground above the helical member can become compressed.

When conventional screw anchors are used, the line is attached to the anchor prior to the anchor being inserted into the seabed. That increases the boat time required to assemble and install the screw anchors, which increases the cost to assemble and install the screw anchors.

It is an object of some preferred embodiments of the present invention to provide a useful alternative to known anchors.

The term "comprising" or derivatives thereof, for example "comprises", if and when used in relation to a feature or combination of features, should not be interpreted to exclude the presence of a possible unspecified additional feature or features.

SUMMARY OF THE INVENTION

According to one aspect of the invention there is provided an anchor assembly for subsurface installation in a ground surface comprising:

- an anchor body having an anchoring feature for engaging with a ground
- 5 surface; and
- a swivel having means for receiving a line;
- one of the anchor body or the swivel having a contact part and the other of the anchor body or the swivel having a complementary slot for receiving the contact part,
- the swivel being arranged to be releasably engaged with the anchor body by
- 10 moving the swivel relative to the anchor in a first direction so that the contact part passes through the slot and then in a second direction that is transverse to the first direction to an engagement position in which the swivel is rotatable relative to the anchor body and substantially secured in a longitudinal direction.

15 Optionally the means for receiving a line comprises an eye.

Optionally the contact part comprises a tab.

20 Optionally the means for receiving a line comprises an eye and at the same time the contact part comprises a tab.

Optionally one of the anchor body or the swivel has a shank and the tab extends at an angle from the shank.

25 Optionally the slot comprises a main portion complementary to the shank and a transverse portion complementary to the tab.

30 Optionally the anchor assembly comprises a retainer for substantially securing the swivel relative to the anchor body in the engagement position while simultaneously allowing rotational movement of the swivel relative to the anchor body.

Optionally the retainer comprises a ring.

Optionally the retainer comprises a plug.

35

Optionally the plug is substantially wedge shaped.

Optionally the anchor body is elongate.

5 Optionally the anchor body is tubular.

Optionally the swivel is releasably engageable with the anchor body at or near an attachment end of the anchor body.

10 Optionally the anchoring feature is positioned at or near an insertion end of the anchor body.

Optionally the anchoring feature for engaging with a ground surface comprises a helical member.

15

Optionally the anchoring feature for engaging with a ground surface is integrally formed with the anchor body.

20 Optionally the anchoring feature for engaging with a ground surface comprises a separate component that is releasably attachable to the anchor body.

Optionally the anchor assembly is suitable to be installed in an underwater environment.

25 Optionally the anchor assembly is suitable to be fully submerged in the ground surface.

According to a further aspect of the invention there is provided an anchor for subsurface installation in a ground surface comprising:

30 an anchor body having an anchoring feature for engaging with a ground surface;
engagement features for engaging with complementary engagement features of a drive head; and

an outwardly extending flange;

the flange and engagement features being arranged such that when the engagement features of the anchor are engaged with the engagement features of the drive head,
35 matter is substantially inhibited from entering between the engagement features of the anchor and the engagement features of the drive head.

Optionally the flange comprises a tapered deflection surface that extends at an acute angle relative to the anchor body.

- 5 According to a further aspect of the invention there is provided an anchor assembly for subsurface installation in a ground surface comprising:
- a tubular anchor body having a helical element;
 - a separate anchoring element for engaging with a ground surface, the anchoring element having a helical ground engaging member;
- 10 the helical element of the anchor body and the helical ground engaging member of the anchoring element being engageable to form an anchor.

Optionally the helical ground engaging member comprises a tapered helical ground engaging member having a radius that increases from a first insertion end towards an
15 opposite end of the helical member.

According to a further aspect of the invention there is provided an anchor for subsurface installation in a ground surface comprising a generally tubular anchor body;

- an anchoring feature for engaging with a ground surface; and

20 engagement features for engaging with complementary engagement features of a drive head;

- the anchor body, anchoring feature and engagement features being integrally formed as a single component.

- 25 Optionally the anchoring feature for engaging with a ground surface comprises a helical member.

Optionally the helical member comprises a tapered helical member.

30 BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will now be described by way of example only and with reference to the accompanying drawings in which:

- Figure 1** is a front view of a first embodiment of the anchor;
- 35 **Figure 2** is a vertical cross-sectional view of the anchor of Figure 1;
- Figure 3** is an end view of the anchor of Figure 1, with the flange and helical

- member not shown for clarity;
- Figure 4** is a partial cross-sectional view of the anchor of Figure 3 taken through line B-B of Figure 3:
- Figure 5** is a front view of a swivel;
- 5 **Figure 6** is a bottom view of the swivel of Figure 5;
- Figure 7** is a partial vertical cross-sectional view of the anchor of Figure 1 together with a swivel, a drive head, and a drill string;
- Figure 8** is a perspective view of a retainer ring;
- Figure 9** is a bottom view of the drive head;
- 10 **Figure 10** is a cross-sectional view taken through line C-C of Figure 9;
- Figure 11** is a cross-sectional view of the drive head engaged with the drive shaft of Figure 7 taken through line D-D of Figure 7;
- Figure 12** is a cross-sectional view of the drive head disengaged from the drive shaft of Figure 7 taken through line D-D of Figure 7;
- 15 **Figure 13** is a front view of an anchor body and anchor cone, prior to attachment;
- Figure 14** is a partial cross sectional view of the anchor body and cone of Figure 13, with the cone attached;
- Figure 15** is a front view of an anchor body and plate, prior to attachment;
- Figure 16** shows a number of separate plates that may be attached to the anchor
20 body; and
- Figure 17** shows the first embodiment of the anchor installed in a ground surface.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

Figures 1 to 4 show a first embodiment of an anchor 100. The anchor 100 is adapted
25 to engage with a ground surface to secure the anchor in a ground surface. The anchor is used to attach other objects to the ground surface. The ground may be in an underwater environment, such as a seabed, river bed, or lake bed for example, as shown in Figure 17. Alternatively, the ground may be dry land. The ground may be substantially flat, sloping or substantially vertical. For example, the anchor may be
30 inserted into the seabed and attached to a boat, buoy or other object on the sea surface via a line 1. The line may be rope, cable, cord, catenaries, chain, or the like. When installed in the seabed, the anchor may be fully submerged in the ground surface, as shown in Figure 17. Alternatively, a major portion of the anchor body may be buried in the ground surface so that only a minor part of the anchor body protrudes
35 therefrom. Both alternatives are intended to be "subsurface installation".

The anchor 100 has an anchor body 101 and an anchoring element in the form of a helical member 103. The body 101 is an elongate, substantially tubular component having an insertion end 105 and a line attachment end 107. The helical member 103 is positioned at or near the insertion end and is integrally formed with the anchor body
5 101.

The helical member 103 engages with a ground surface to secure the anchor 100 in therein. In the embodiment shown, the helical member 103 is a tapered helical member in which the radius R increases from a tip 109 of the helical member towards the second end 111 of the helical member. The helical member 103 extends outwardly
10 from the anchor body 101 at about 90 degrees relative to a longitudinal axis of the anchor body. When the anchor is inserted into the ground, the helical member can drill into the ground without working against itself or churning the ground as it is drilled. In addition, the anchor is unlikely to form voids above or below the helical member or
15 compress the ground above or below the helical member.

With reference to Figures 5 and 6, the anchor assembly has a swivel 113 for attaching the line to the anchor. In the embodiment shown, the swivel has an eye 114 for receiving the line. The swivel is releasably engageable with the anchor body 101 at or
20 near the attachment end 107 of the anchor body. The swivel 113 is arranged to be engaged with the anchor body 101 by moving the swivel relative to the anchor in a first direction D1 transverse to the longitudinal direction of the anchor (see Figure 3) and then in a second direction D2 (see Figure 4) that is transverse to the first direction to an engagement position.
25

One of the anchor body 101 or the swivel has a shank with a tab extending at an angle from the shank. The other of the anchor body or the swivel has a complementary slot for receiving the shank and the tab. In the embodiment shown, the swivel 113 has the shank 115 and the tab 117 and the anchor body 101 has the complementary slot 119.
30 The tab is preferably disc shaped, as shown in Figure 6.

The slot 119 has a main portion 121 complementary to the shank of the swivel and a transverse portion 123 complementary to the tab of the swivel. The transverse portion extends outwardly from the main portion in a first direction and a second opposite
35 direction, as shown in Figure 4, corresponding to the shape of the tab. The swivel 113 is arranged to be engaged with the anchor body by moving the swivel relative to the

anchor in the first direction D through the slot 121 and then in the second direction D2 that is transverse to the slot. In the embodiment shown, the second direction corresponds with the longitudinal axis of the anchor. In the engagement position, the swivel is rotatable relative to the anchor body 101 when engaged with the anchor body.

5

Figure 7 is a cross-sectional view of the anchor and swivel in an engaged position, together with a drive head 125 and drill string 127. The anchor assembly also has a retainer for securing the swivel 113 relative to the anchor body 101 while simultaneously allowing rotational movement of the swivel relative to the anchor body.

10 With reference to Figure 8, the retainer may comprise a split-ring 128 that is adapted to extend around the shank 115 of the swivel. The ring 128 prevents the swivel from being moved in towards the anchor (ie in a direction opposite to D2) and released from engagement from the anchor body. The swivel has a shoulder or ledge 130, which the split ring can sit substantially flush against. That reduces the risk of the arc surface of
15 the swivel causing wear to the ring, which may otherwise cause the ring to split and fail.

Alternatively, the retainer may comprise a substantially wedge shaped plug that is adapted to be inserted into the transverse portion 123 of the slot. The plug 131
20 prevents the swivel from being inadvertently moved in towards the anchor (ie in a direction opposite to D2) and released from engagement from the anchor body 101. If a wedge plug is used, the anchor assembly may have an internal annular member with a ledge that the plug can sit against.

25 The anchor is inserted into the ground using the drill string 127 and a drive head 125. The anchor has engagement features for engaging with complementary engagement features of the drive head. The engagement features comprise protrusions extending outwardly from the anchor body 101 near the attachment end of the anchor. In the embodiment shown, the engagement features comprise rectangular shaped teeth 129.
30 The teeth extend radially outwards from the anchor body and are evenly spaced around the circumference of the anchor body. The engagement features are integrally formed with the anchor body 101.

With reference to figures 10 to 12, the drive head 125 has complementary engagement
35 features 20. In the embodiment shown, the engagement features comprise generally rectangular shaped teeth 132. The teeth 132 extend radially inwardly from the drive

head 125 and are evenly spaced around an internal surface 133 of the drive head. The engagement features are integrally formed with the drive head.

5 The drive head 125 has a plurality of slots 135 that are complementary to the anchor engagement features that allow the attachment end of the anchor to be inserted into the drive head. Each of the slots has a narrow neck 137 that leads into a wider portion 139 of the slot. The neck 137 has a width that generally corresponds to the width of the anchor tooth 129. When the anchor is engaged with the drive head, the teeth of the anchor are received by part of the wider portion 139 of the slot.

10

With reference to figures 11 and 12, when each drive head tooth 132 is engaged with an anchor tooth 129 on one side, there is a free space 141 between the drive head tooth and the anchor tooth on the other side. That allows the drive head 125 to rotate in a first drilling direction D3 to insert the anchor into a ground surface and then
15 disengage by rotating in an opposite direction D4 without rotating the anchor in the opposite direction.

When the drive head and the anchor are engaged, a shear pin 143 extends between the drive head and the anchor through an aperture 144. The shear pin is inserted to sit
20 in the position shown in broken lines in Figure 11. The shear pin holds the drive head and anchor in engagement as they are moved through water and into the ground. During drilling, the shear pin does not have any load applied to it. The shear pin breaks when a specific load is applied to the shear pin, for example, when the drive head is rotated in the direction D3.

25

With reference to Figure 7, the anchor has a flange 145 extending around the anchor body 101 and radially outwards from the anchor body. As the anchor is being drilled into the seabed, the drive head and attachment end of the anchor will become submerged in the seabed until the anchor is substantially fully submerged in the
30 seabed. The flange prevents or at least substantially inhibits matter entering between the engagement features of the anchor and the engagement features 129 of the drive head, when engaged. The flange 145 is integrally formed with the anchor body 101. The flange 145 has a tapered deflection surface 147 that extends at an acute angle relative to the anchor body 101 and an abutment surface 149 for contacting a lead
35 surface 151 of the drive head. The flange and engagement features are arranged such that when the engagement features of the anchor are engaged with the

engagement features of the drive head, matter is substantially inhibited from entering between the engagement features of the anchor and the engagement features of the drive head. The deflection surface 147 deflects matter that is expelled from the ground as the anchor is drilled into the ground. The abutment surface contacts a lower
5 surface of the drive head. The abutment surface and lower surface of the drive head interact to prevent or at least substantially inhibit matter entering between the engagement members.

The anchor is an integrally formed component in which the anchor body 101, helical
10 member 103, tapered flange 145, and engagement features 129 are integrally formed as one piece. Accordingly, the anchor does not have any areas that have been adversely heat affected by welding, which could weaken the anchor. By integrally forming the helical member 103 and the anchor body 101 as a single piece, the helical member 103 extends outwardly from the anchor body 101 at about 90 degrees relative
15 to a longitudinal axis of the anchor body. By extending at about 90 degrees, when the anchor is inserted into the ground, the helical member will drill into the ground without working against itself or churning the ground as it is drilled into the ground. Integrally forming the parts as one piece removes the costs involved with assembly, including welding costs.

20
By integrally forming the tapered flange 145 and engagement features 129 as a single piece, the location and distance between those parts of the anchor can be defined more precisely than when those parts are manufactured and attached separately. The precise locations of those parts of the anchor help inhibit matter entering between the
25 engagement members as the anchor is drilled into the ground.

Integrally forming the parts as one piece ensures that the anchor body 101, helical member 103, tapered flange 145, and engagement features 129 are formed from the same material. There are no areas that are formed from different materials. When the
30 parts are welded together, the welding material is typically a different material to the base material of the anchor, which can cause corrosion. By integrally forming the anchor body 101, helical member 103, tapered flange 145, and engagement features 129 as a single part, the risk of corrosion is reduced.

35 With reference to figures 13 and 14, in an embodiment of the anchor assembly, the anchoring feature for engaging with a ground surface comprises a separate component

in the form of an anchor cone 200, which is releasably attachable to an anchor body 201. The anchor body 201 comprises a tubular anchor body having a helical connector element 203 at an insertion end. The anchor cone 200 has a ground engaging member in the form of a helical member 207. The helical element of the anchor body and the
5 helical ground engaging member of the anchoring element are engageable to form an anchor. The anchor cone and anchor body each have corresponding apertures 206 for receiving fasteners 208.

The body of the anchor cone is a substantially conical component and the helical
10 member 207 is a corresponding tapered helical member. The cone and helical member are integrally formed. The radius R2 of the tapered helical member increases from a tip 209 of the helical member towards the other end 213 of the cone. The helical member 207 extends outwardly from the anchor body 101 at about 90 degrees relative to a longitudinal axis of the anchor body.

15

With reference to Figure 16, in an embodiment the anchor assembly has separate plates 301a—301e that are releasably attachable to the anchor body. The plates have a number of different diameters, shown in Figure 16. The plates and the anchor body have complementary apertures 303 for receiving fasteners. The plate is mounted on
20 the anchor in the direction of the arrows shown in Figure 15. The outer diameter of the plate will be chosen depending on the intended use of the anchor. For example, depending on the expected load that will be applied to the anchor and/or the expected hardness of the ground surface.

25

A method of assembling the anchor assembly will now be described. The line 1 is attached to the swivel 113 at an earlier convenient time to reduce the amount of boat time required to assemble and insert the anchor. The swivel 113 is then attached to the anchor body 101 by moving the swivel relative to the anchor in the first direction D through the slot and then in the second direction D2 that is transverse to the slot so
30 that the swivel is in an engagement position. In the engagement position, a portion of the swivel shank 115 extends outwardly from the anchor body 101 and the lower portion 123 of the slot is open. The swivel 113 is secured in the engagement position by either placing the retainer ring 128 or the wedge 131 plug in position. If a ring is used, it is placed around the shank of the swivel that extends outwardly from the
35 anchor body. If a wedge plug is used, it is inserted into the lower, open portion of the slot. The swivel is then prevented from being inadvertently disengaged from the anchor

body 101.

If a separate cone 200 is being used, it can be assembled to the anchor body 201 prior to installation, or at an earlier time. Additionally, if a separate plate is being used, it can
5 also be assembled to the anchor prior to installation, or at an earlier time.

The attachment end 107 of the anchor is inserted into the drive head 125 so that the teeth 29 slide along the narrow portion of the slots 137 in the drive head. The anchor body 101 is rotated relative to the drive head to the engaged position in Figure 11. The shear pin 143 is inserted through the aperture 144. A shoulder 140, together with the
10 shear pin 143, prevents the drive head 125 and anchor from being disengaged. The drive head and anchor are taken to an installation site. The drill string 127 and drive head 125 are operated to drill the anchor into the ground. Once installed, the drive head 125 is operated in a reverse direction D4, to break the shear pin 143 and disengage the teeth of the drive head 125 from the teeth 129 of the anchor.

15 The drive head 125 is moved to the position relative to the anchor shown in Figure 12. In that position, the teeth 132 are aligned with the narrow portion 137 of the slots. The drive head can then be pulled away from the anchor, leaving the anchor and swivel installed in the ground, as shown in Figure 17.

20 Each of the components is preferably formed from a material that will not cause, or will at least substantially inhibit, electrolysis or corrosion between the components. The anchor body 101 and swivel are preferably formed from the same material.

Alternatively, the anchor body and swivel may be formed from different materials, but
25 which substantially inhibit, electrolysis or corrosion between the components.

The separate plate and cone are preferably also formed from the same materials as the anchor body and swivel. The separate plate and cone may also be formed from different materials, but which substantially inhibit, electrolysis or corrosion between the
30 components.

In an embodiment, the anchor body, swivel, plate and cone are formed from stainless steel. Alternatively, the anchor body, swivel, plate or cone may be formed from other metallic materials. The parts of the anchor assembly may be galvanized or painted to
35 substantially inhibit electrolysis or corrosion. In other alternatives, the anchor body, swivel, plate or cone may be formed from carbon fiber or reinforced polymeric

materials.

The retainer ring and retainer wedge plug are each preferably formed from a suitable inert material. The shear pin is also preferably formed from a suitable inert material.

5 For example, each of those components may be formed from a polymeric material, such as nylon. Alternatively, each of those components may be formed from any other suitable polymeric material such as polyvinyl chloride (PVC) or rubber, for example.

10 The anchor is lighter to transport than previously known anchors, which can reduce transportation costs of the anchors and makes installation easier.

Preferred embodiments of the invention have been described by way of example only and modifications may be made thereto without departing from the scope of the invention. For example, the swivel has been described as having a tab and the anchor
15 body has been described as having a complementary slot. However, it will be appreciated that the anchor may have a tab and the swivel may have a complementary slot. The helical member has been described as a single helical member however it will be appreciated that the anchor may have a series of helical members.

20 The anchor has been particularly described for subsurface installation in an underwater environment. However, it will be appreciated that the anchor may be used on the land, for example to attach or secure other objects to the land via a line.

25

30

35

CLAIMS

1. An anchor assembly for subsurface installation in a ground surface comprising:
an anchor body having an anchoring feature for engaging with a ground surface; and
a swivel having means for receiving a line,
5 one of the anchor body or the swivel having a contact part and the other of the anchor
body or the swivel having a complementary slot for receiving the contact part,
the swivel being arranged to be releasably engaged with the anchor body by moving the
swivel relative to the anchor in a first direction so that the contact part passes through the slot
and then in a second direction that is transverse to the first direction to an engagement position
10 in which the swivel is rotatable relative to the anchor body and substantially secured in a
longitudinal direction.
2. An anchor assembly according to claim 1, wherein the means for receiving a line
comprises an eye.
3. An anchor assembly according to claim 1 or 2, wherein the contact part comprises a tab.
- 15 4. An anchor assembly according to claim 1 wherein the means for receiving a line
comprises an eye and at the same time the contact part comprises a tab.
5. An anchor assembly according to claim 4, wherein one of the anchor body or the swivel
has a shank and the tab extends at an angle from the shank.
6. An anchor assembly according to claim 5, wherein the slot comprises a main portion
20 complementary to the shank and a transverse portion complementary to the tab.
7. An anchor assembly according to any one of claims 1 to 6, further comprising a retainer
for substantially securing the swivel relative to the anchor body in the engagement position
while simultaneously allowing rotational movement of the swivel relative to the anchor body.

8. An anchor assembly according to claim 7, wherein the retainer comprises a ring.
9. An anchor assembly according to claim 7, wherein the retainer comprises a plug.
10. An anchor assembly according to claim 9, wherein the plug is substantially wedge shaped.
- 5 11. An anchor assembly according to any one of claims 1 - 10, wherein the anchor body is elongate.
12. An anchor assembly according to any one of claims 1 to 11, wherein the anchor body is tubular.
13. An anchor assembly according to any one of claims 1 to 12, wherein the swivel is
- 10 releasably engageable with the anchor body at or near an attachment end of the anchor body.
14. An anchor assembly according to any one of claims 1 to 13, wherein the anchoring feature is positioned at or near an insertion end of the anchor body.
15. An anchor assembly according to any one of claims 1 to 14, wherein the anchoring feature for engaging with a ground surface comprises a helical member.
- 15 16. An anchor assembly according to any one of claims 1 to 15, wherein the anchoring feature for engaging with a ground surface is integrally formed with the anchor body.
17. An anchor assembly according to any one of claims 1 to 15, wherein the anchoring feature for engaging with a ground surface comprises a separate component that is releasably attachable to the anchor body.
- 20 18. An anchor assembly according to any one of claims 1 - 17, wherein the anchor assembly is suitable to be installed in an underwater environment.

19. An anchor assembly according to any one of claims 1 - 18, wherein the anchor assembly is suitable to be fully submerged in the ground surface.

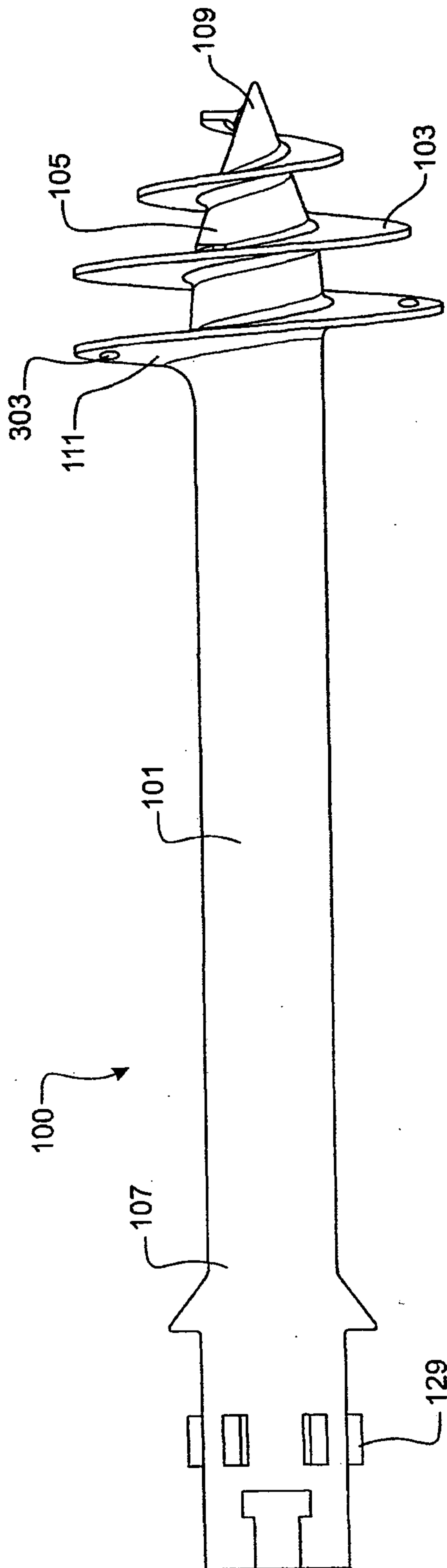


FIGURE 1

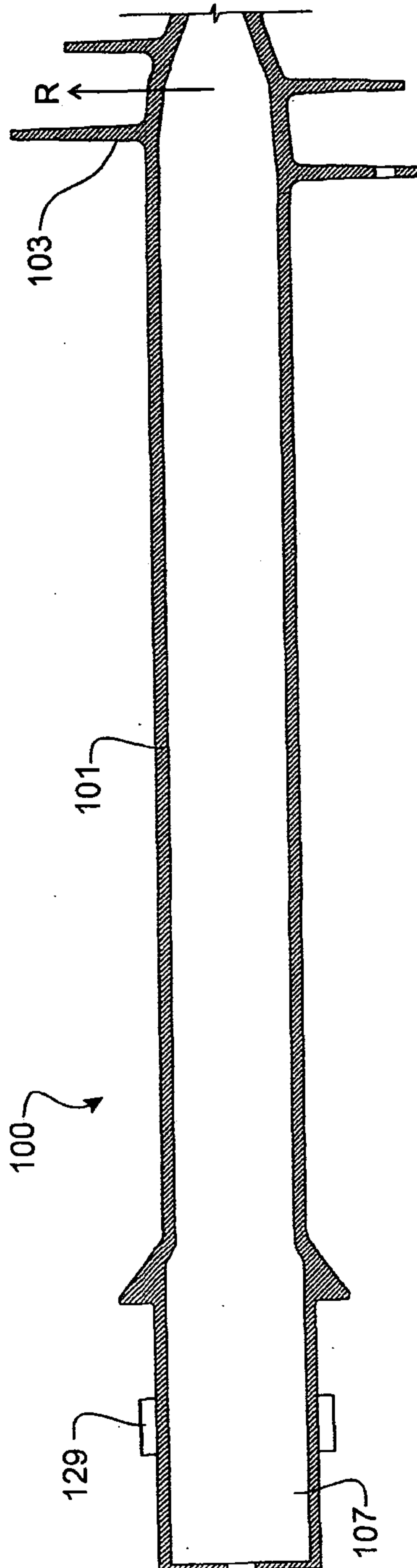


FIGURE 2

2/9

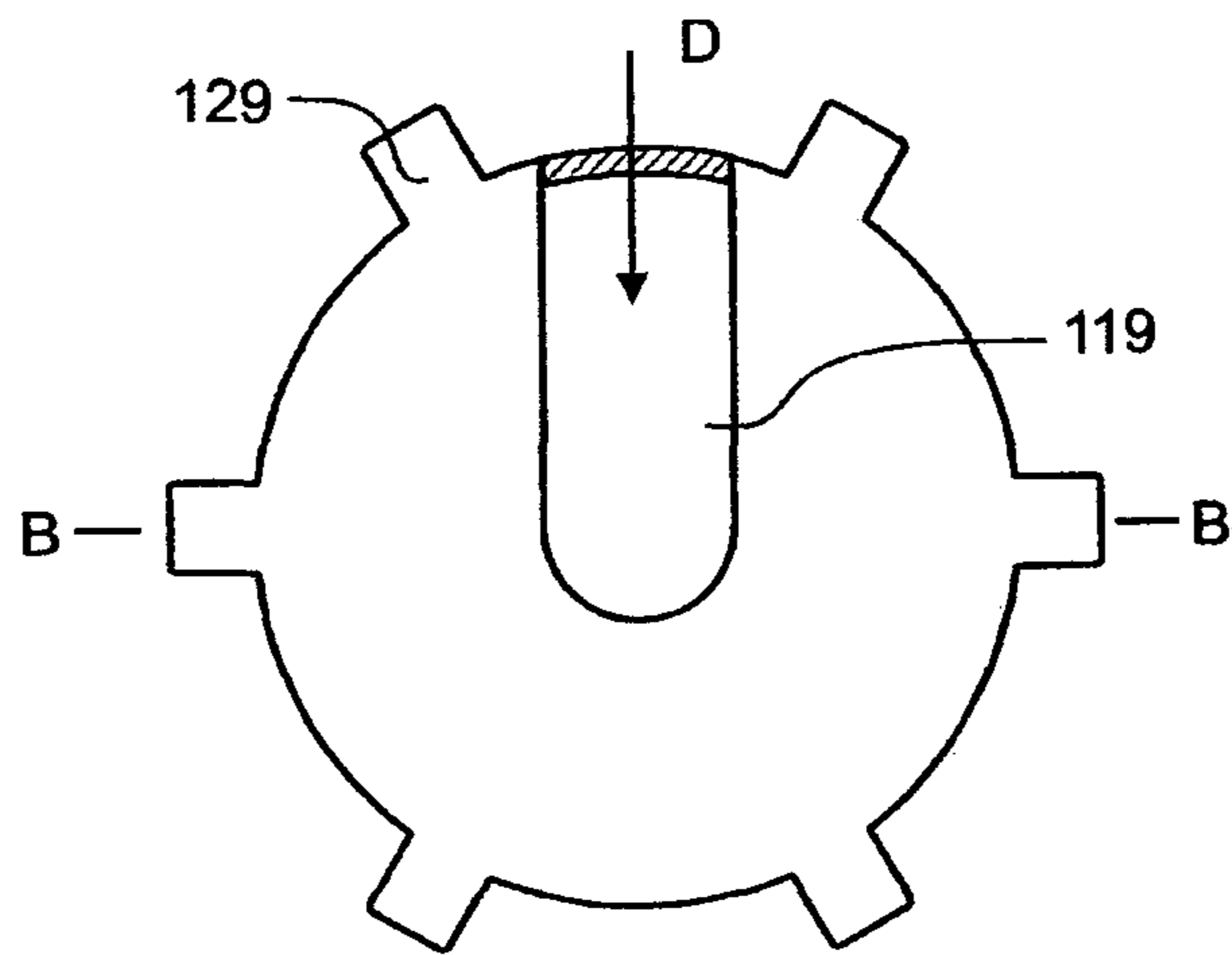


FIGURE 3

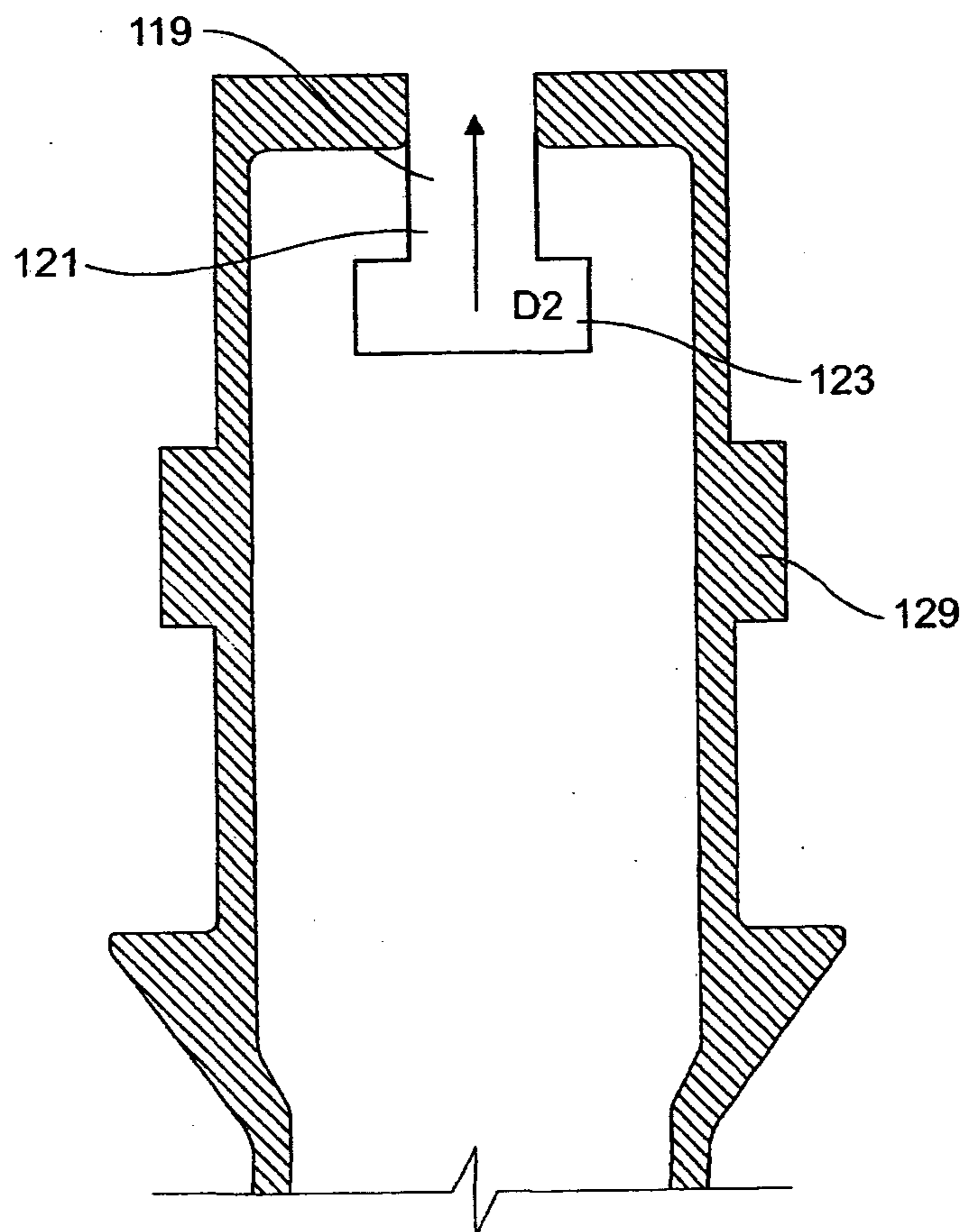


FIGURE 4

3/9

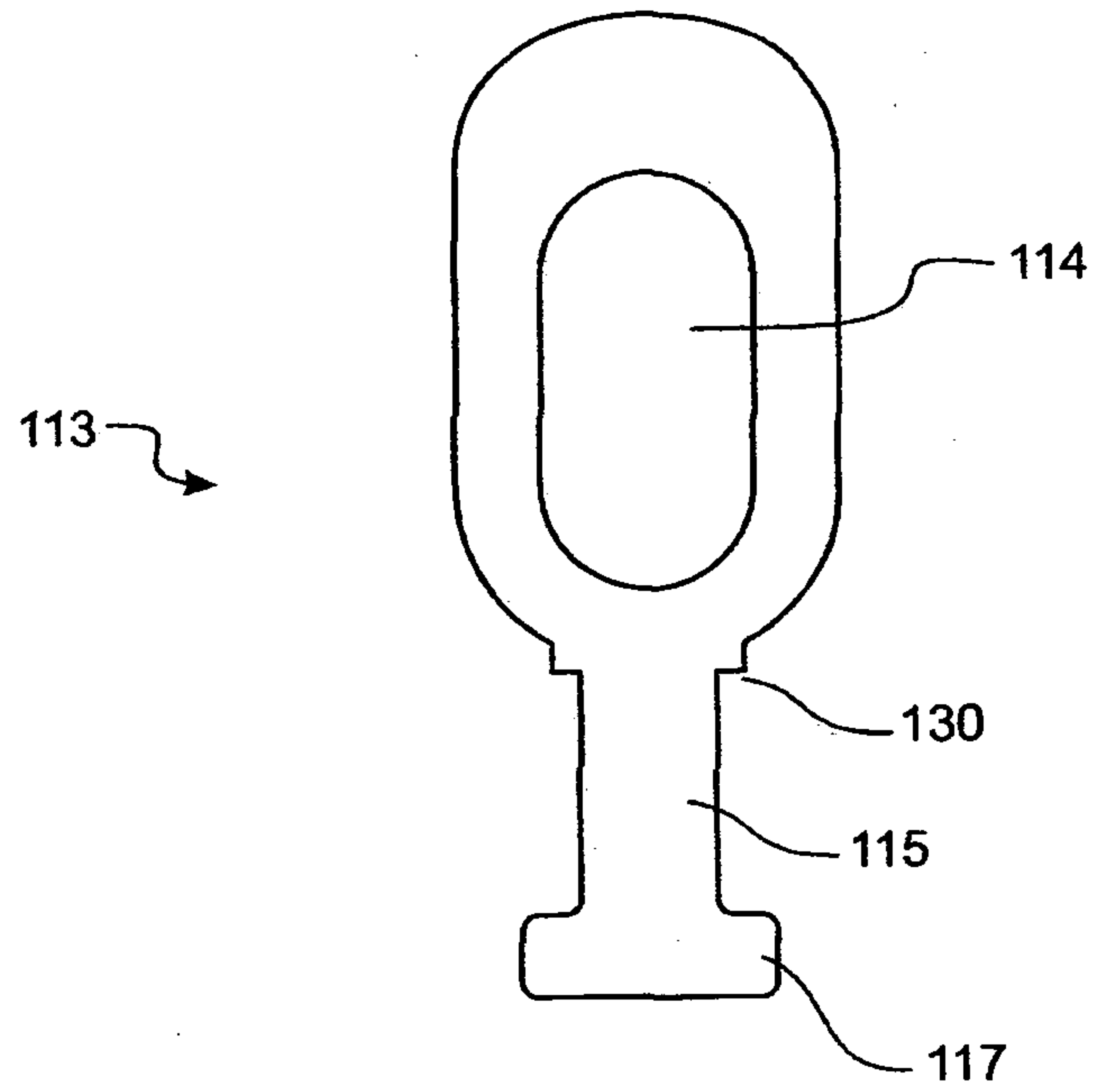


FIGURE 5

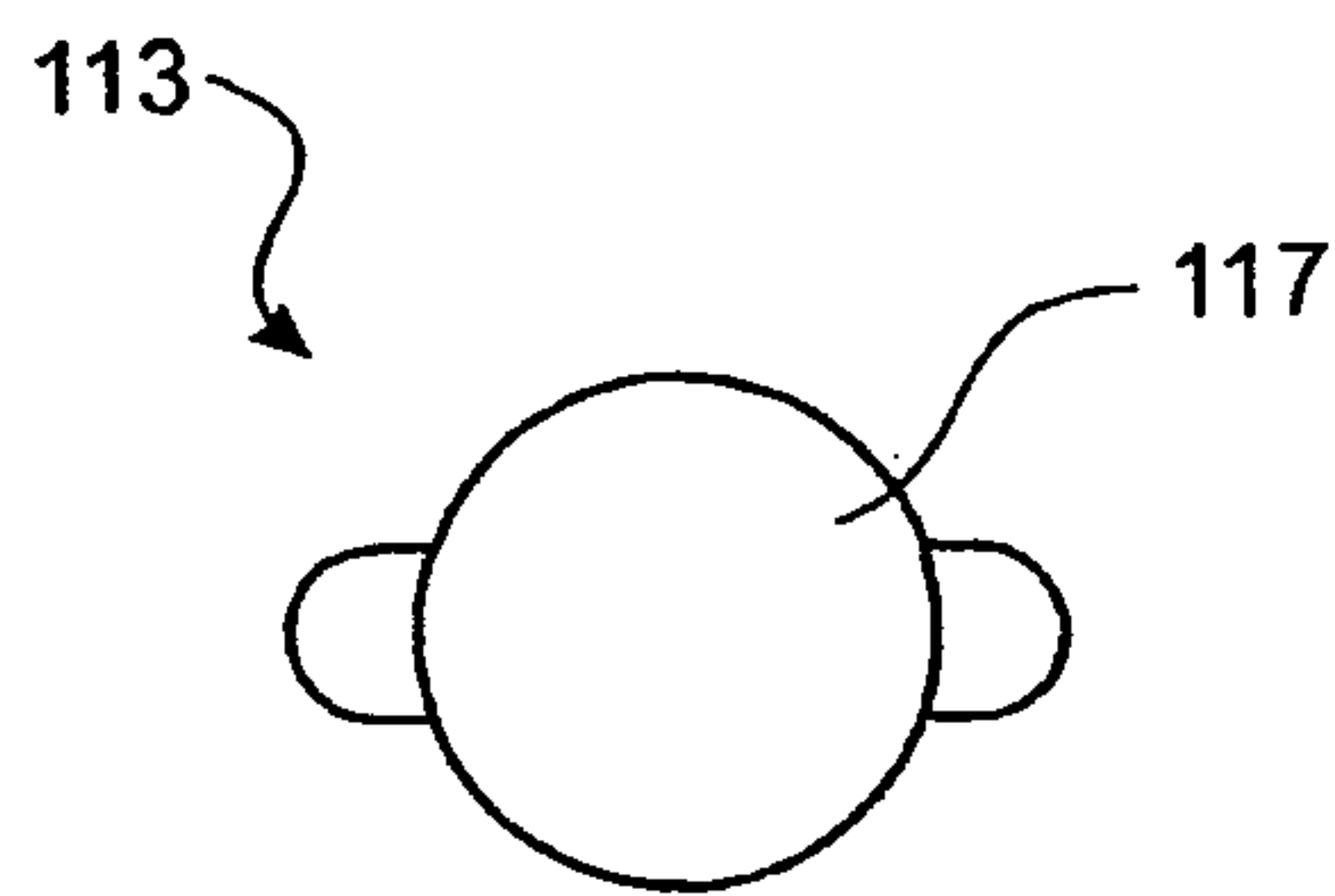


FIGURE 6

4/9

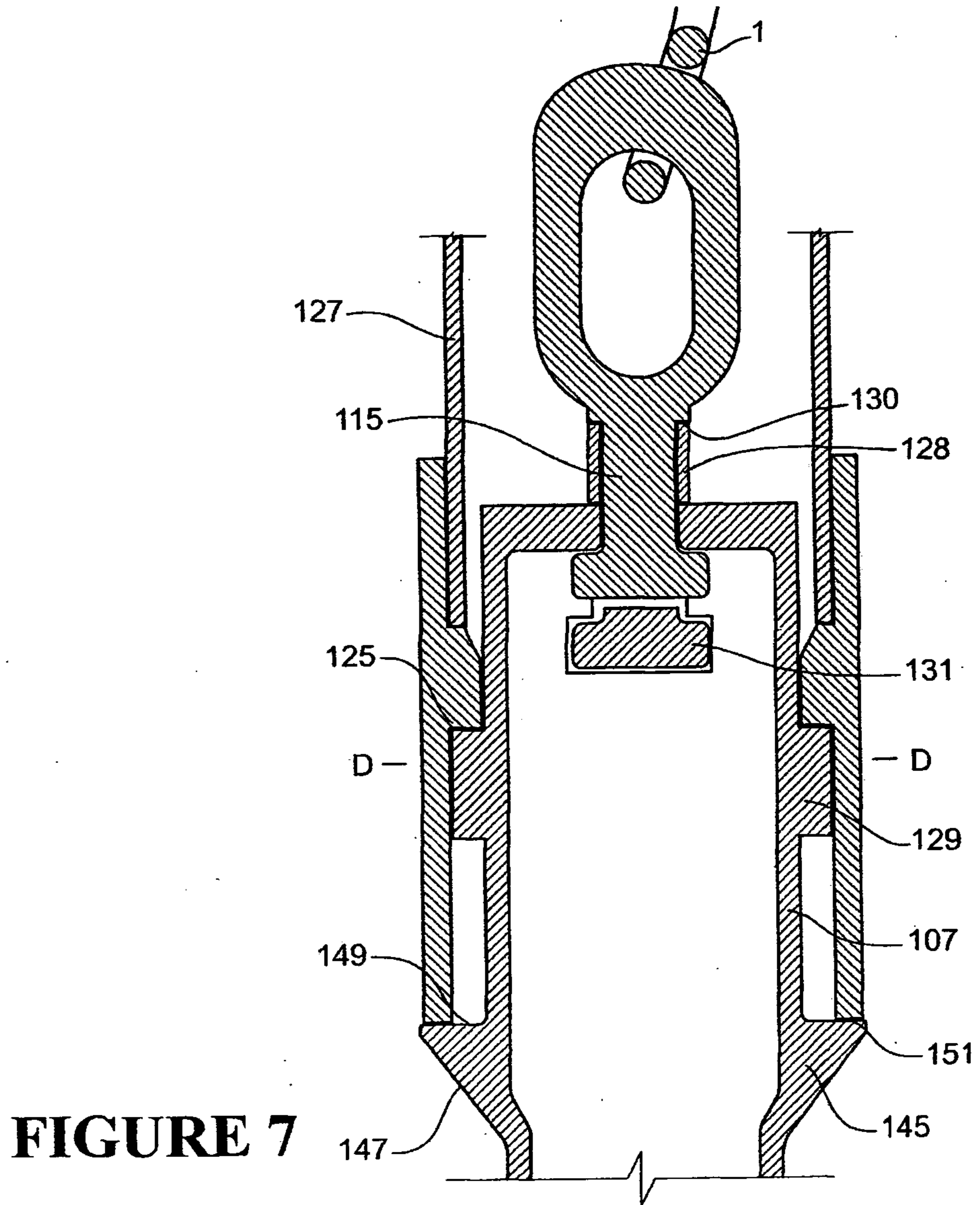


FIGURE 7

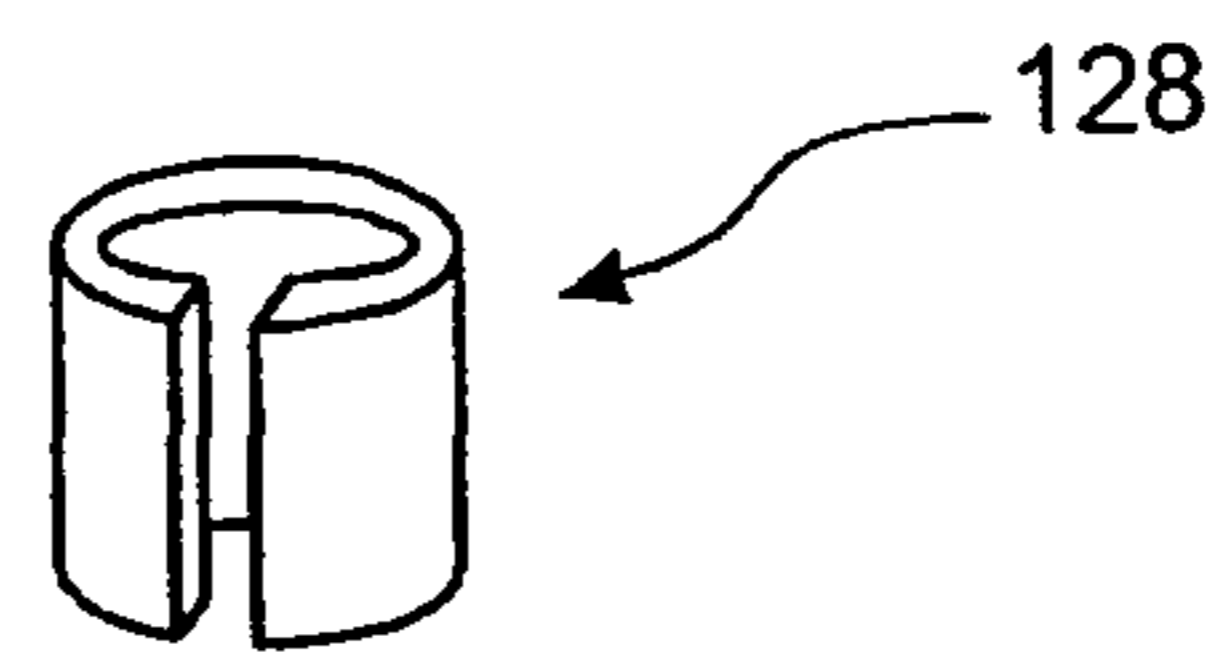


FIGURE 8

5/9

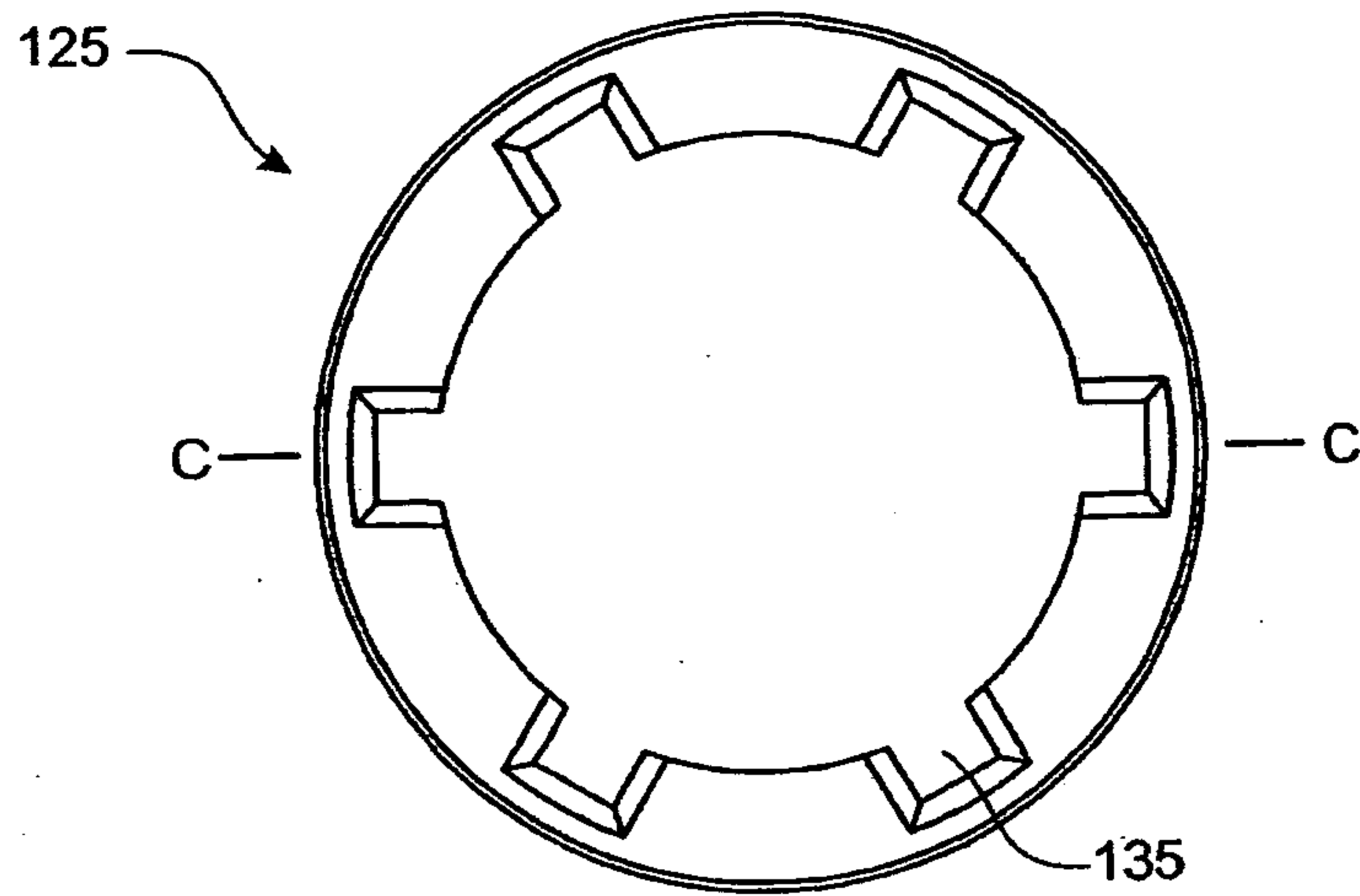


FIGURE 9

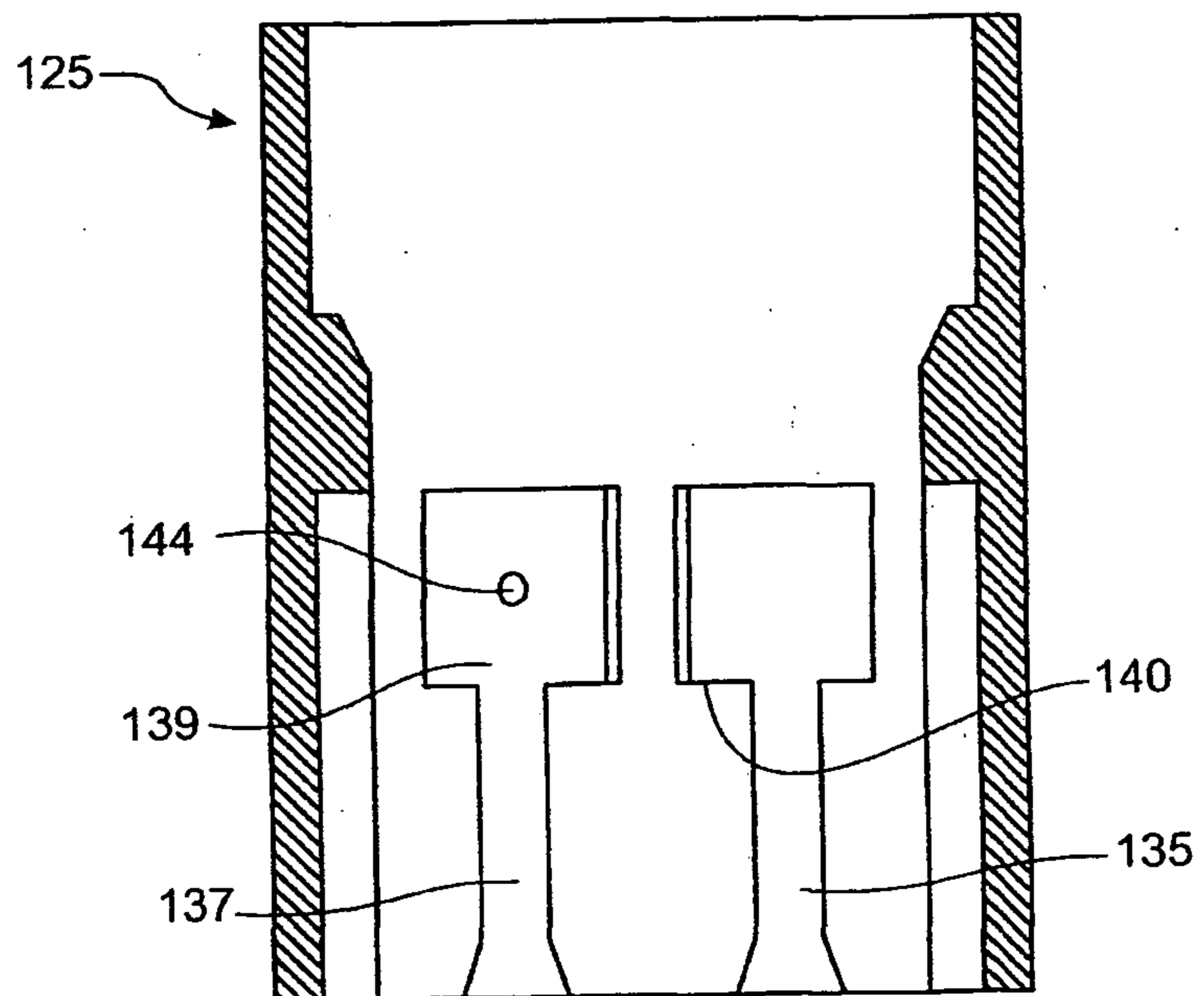


FIGURE 10

6/9

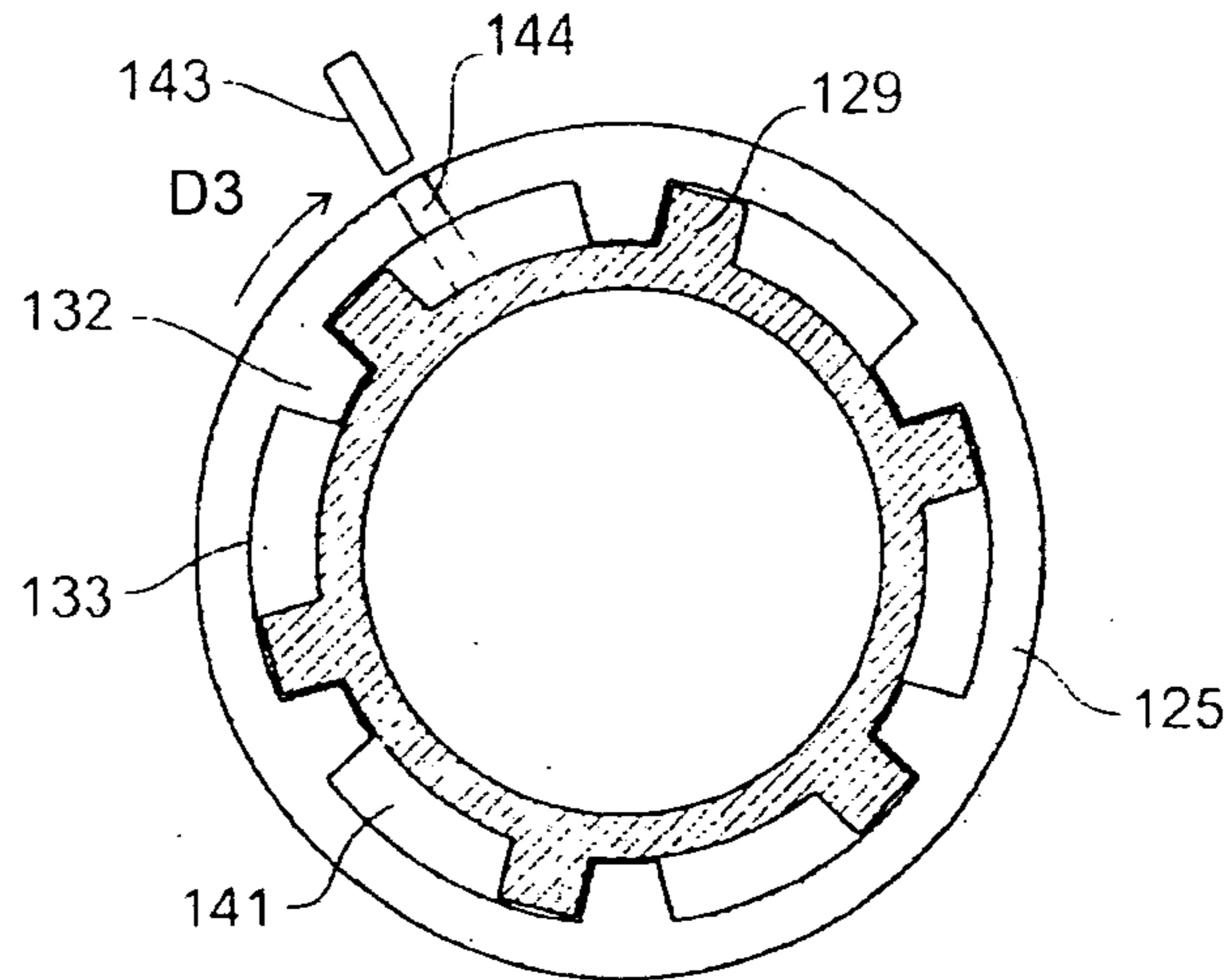


FIGURE 11

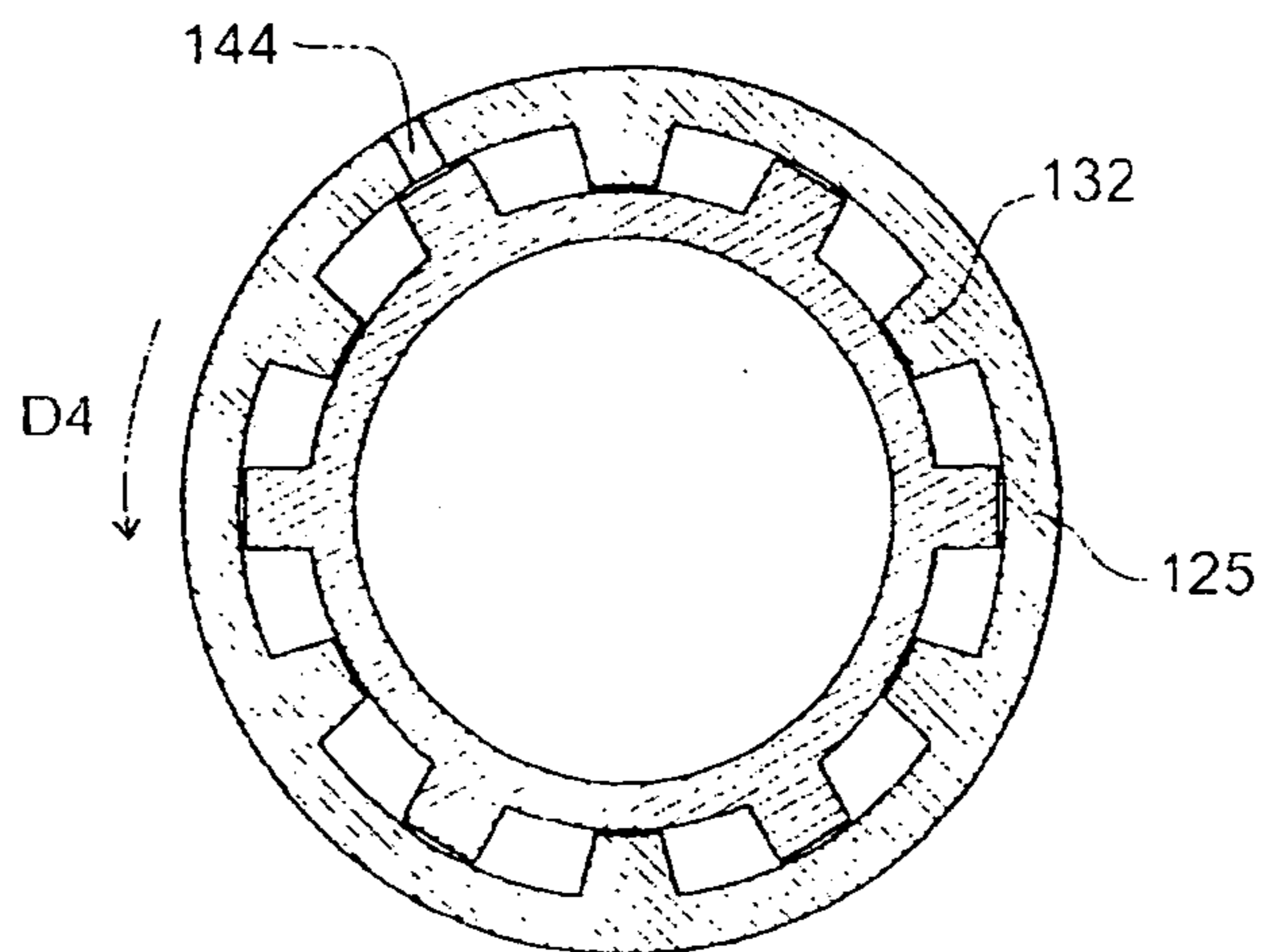


FIGURE 12

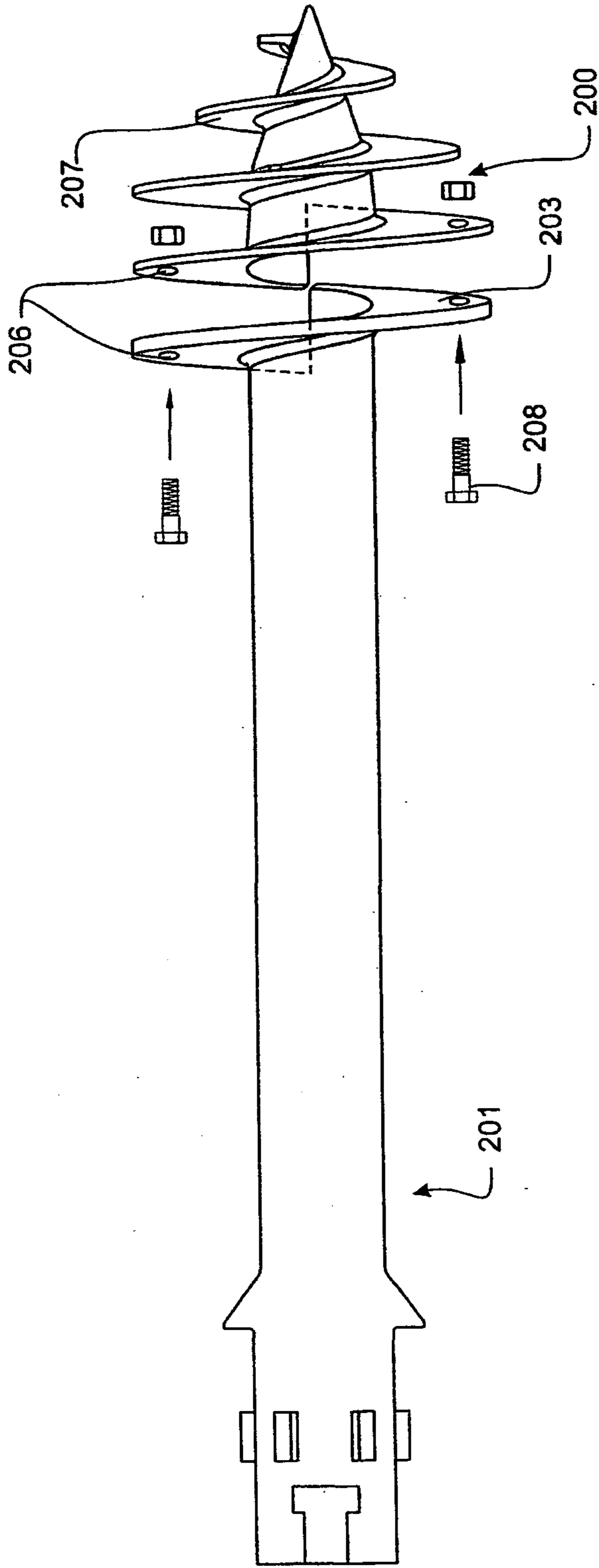


FIGURE 13

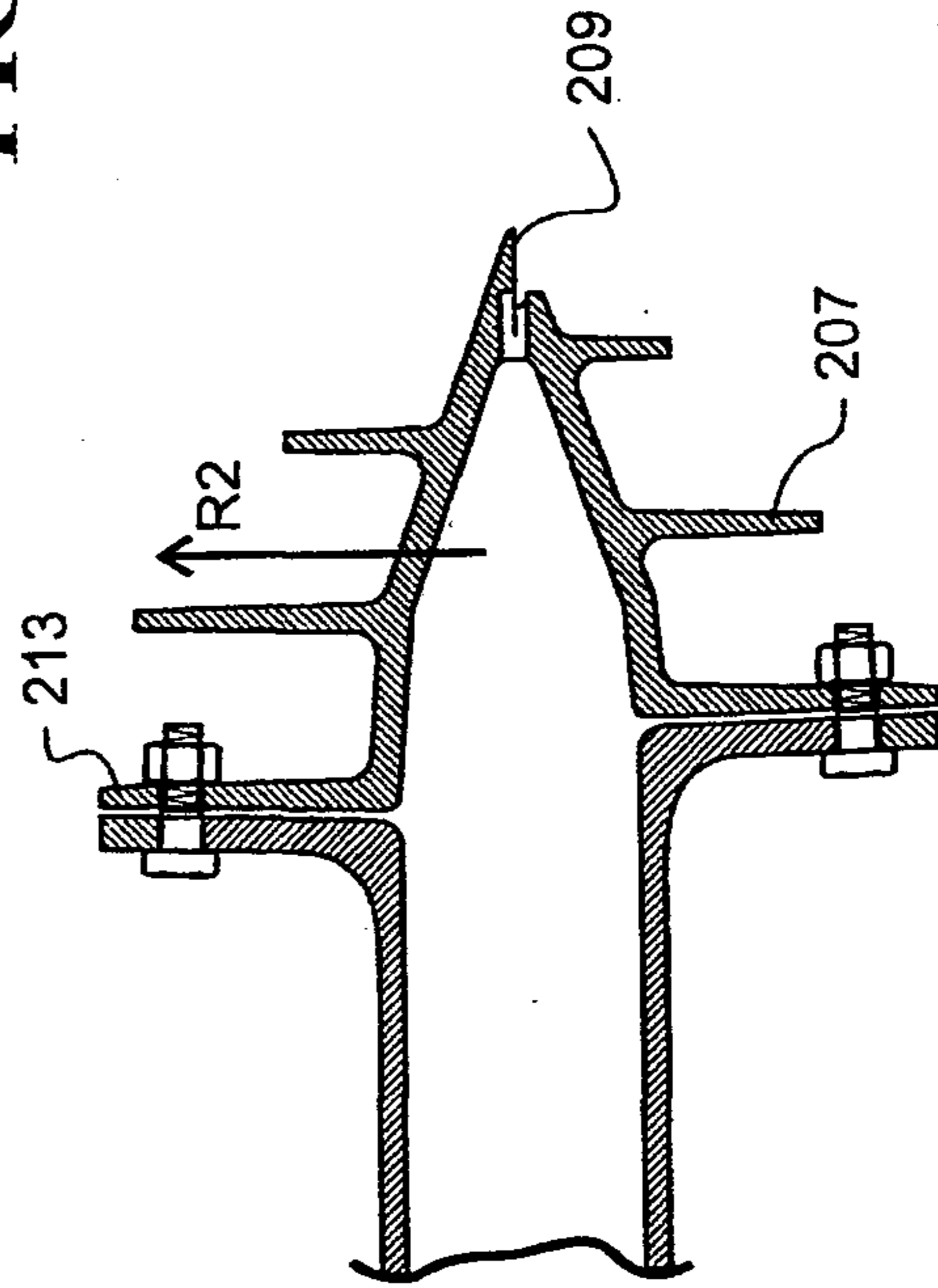


FIGURE 14

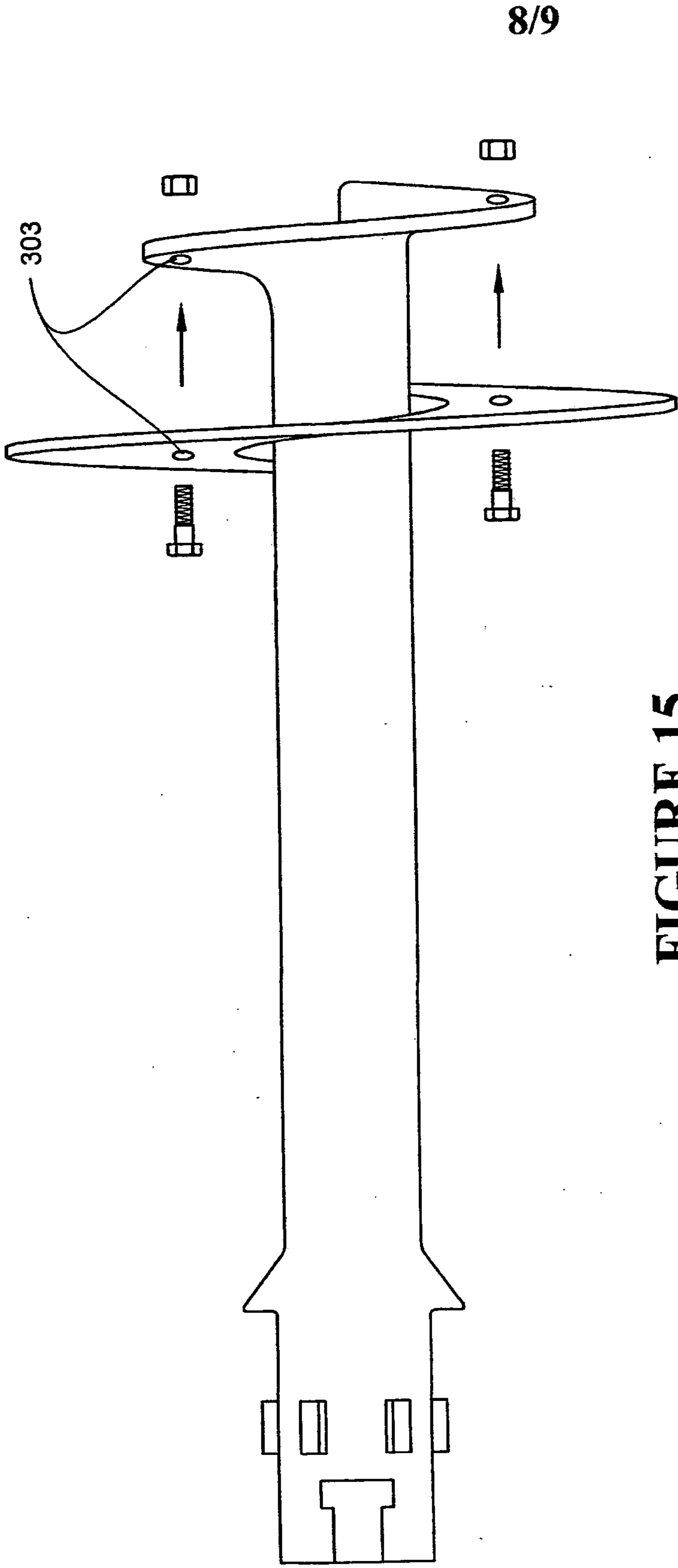


FIGURE 15

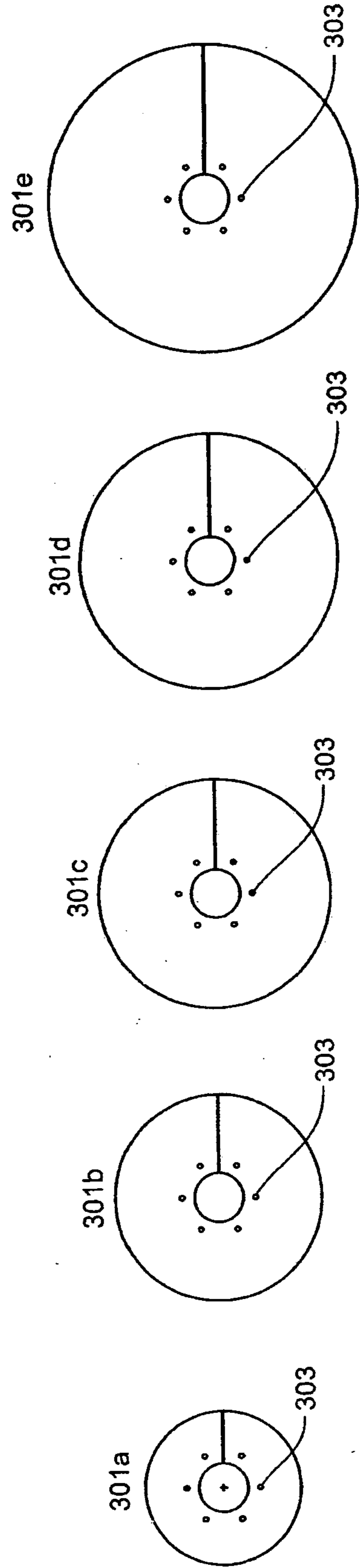


FIGURE 16

9/9

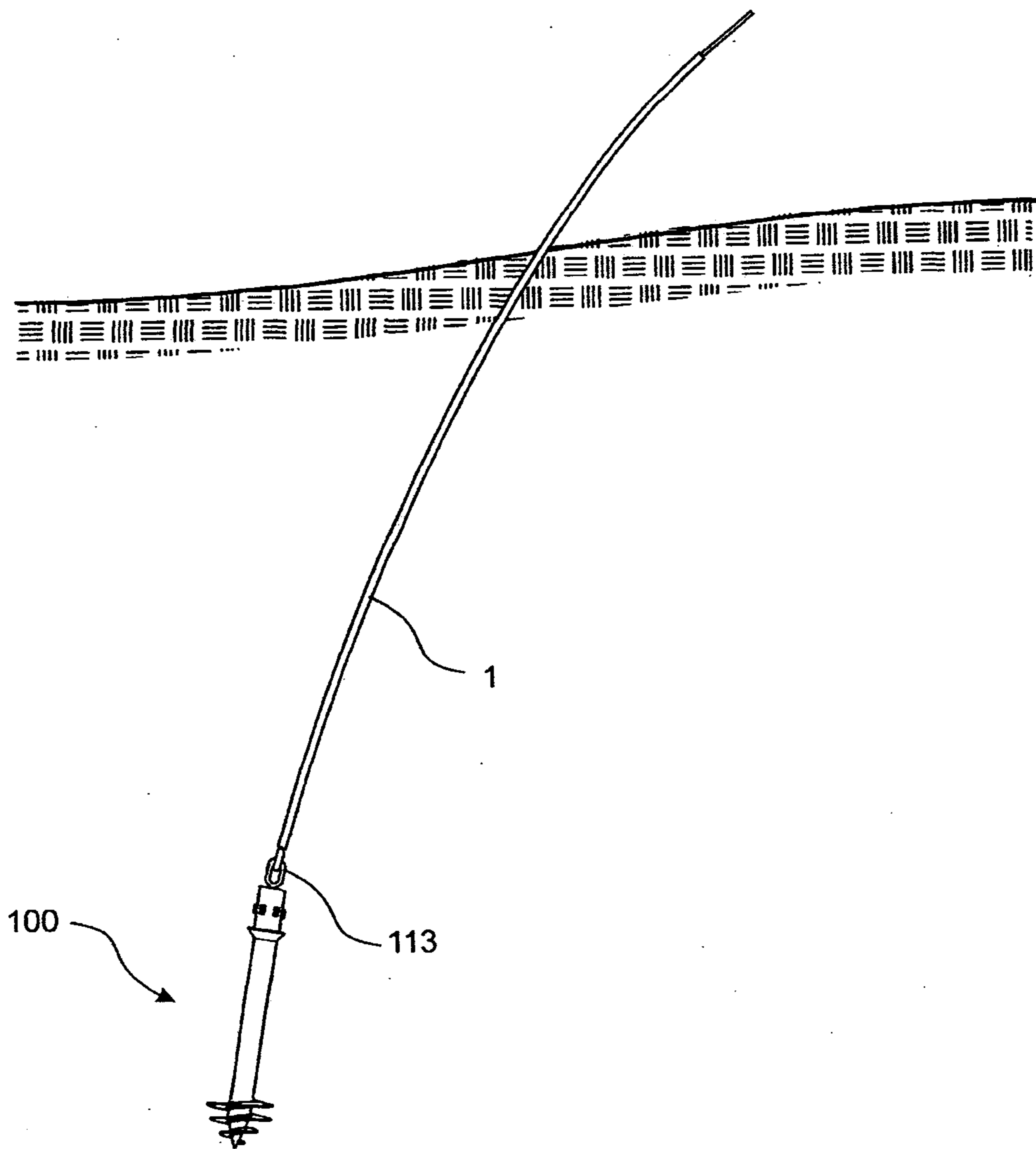


FIGURE 17

