

(12) UK Patent

(19) GB

(11) 2539636

(13) B

(45) Date of B Publication

25.11.2020

(54) Title of the Invention: **A protection system**

(51) INT CL: **E05B 65/00** (2006.01) **E05B 63/14** (2006.01) **E05C 19/18** (2006.01) **E21B 33/037** (2006.01)

(21) Application No: **1508137.5**

(22) Date of Filing: **13.05.2015**

(43) Date of A Publication **28.12.2016**

(72) Inventor(s):
Simon Eves

(73) Proprietor(s):
PIPEX LIMITED
Pipex House, Devon Enterprise Facility,
1 Belliver Way, Roborough, Plymouth, Devon,
PL6 7BP, United Kingdom

(74) Agent and/or Address for Service:
Bryers LLP
7 Gay Street, BATH, BA1 2PH, United Kingdom

(56) Documents Cited:

GB 2485817 A **FR 002693500 A1**
US 3863470 A **US 3071957 A**

(58) Field of Search:

As for published application 2539636 A viz:
INT CL **E05B, E05C, E21B**
Other: **Online: EPODOC WPI**
updated as appropriate

Additional Fields
Other: **None**

GB 2539636 B

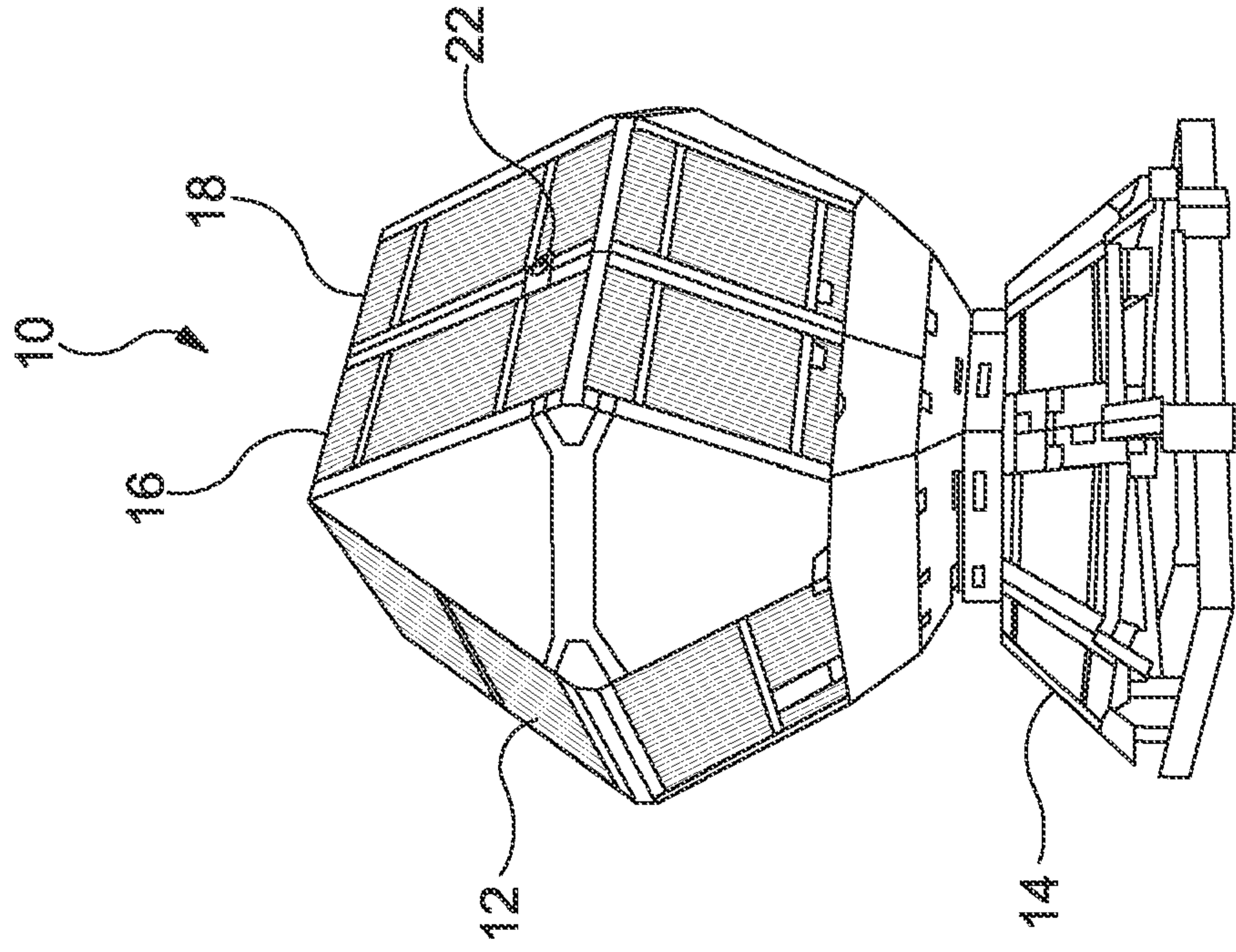


Figure 1

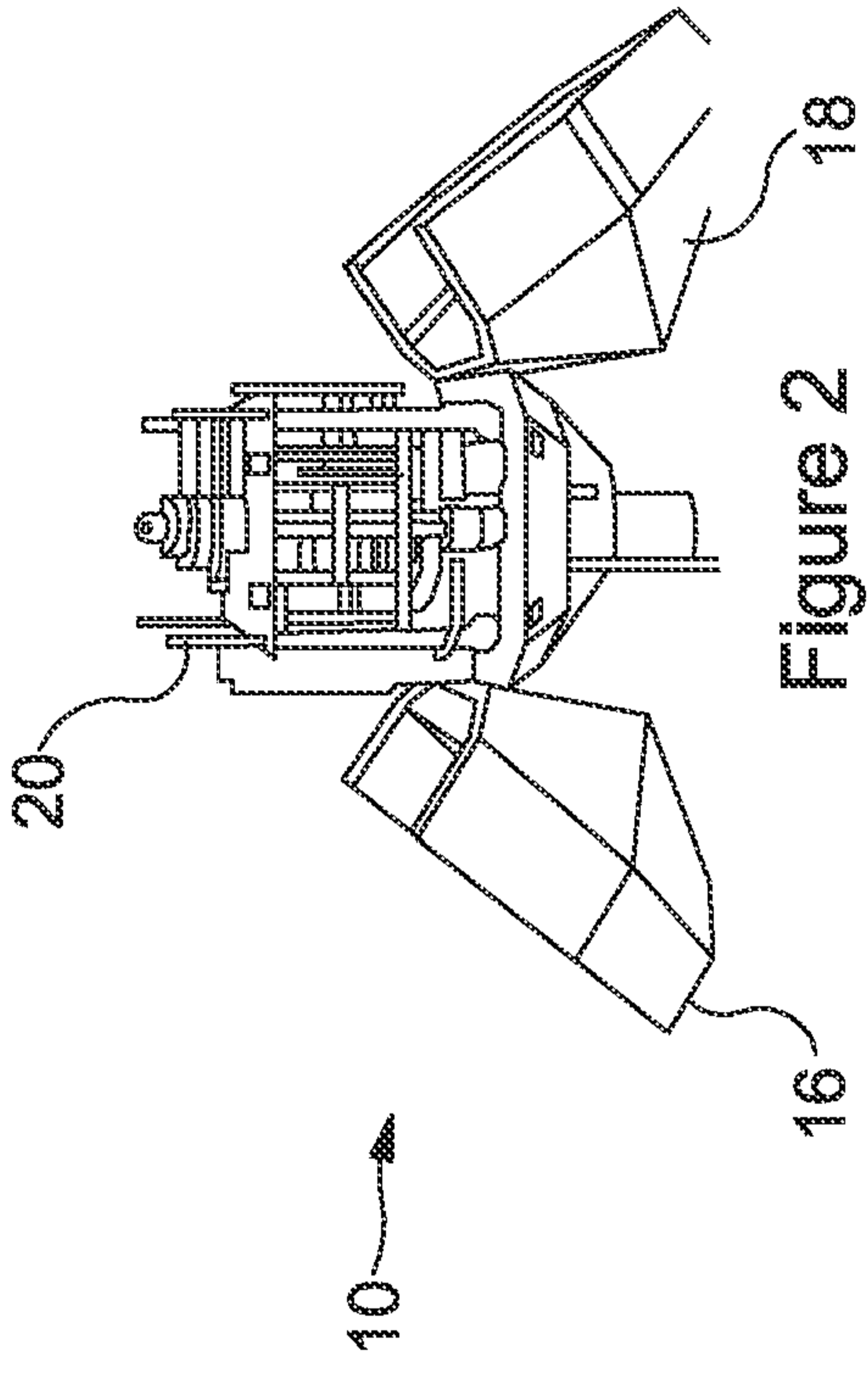


Figure 2

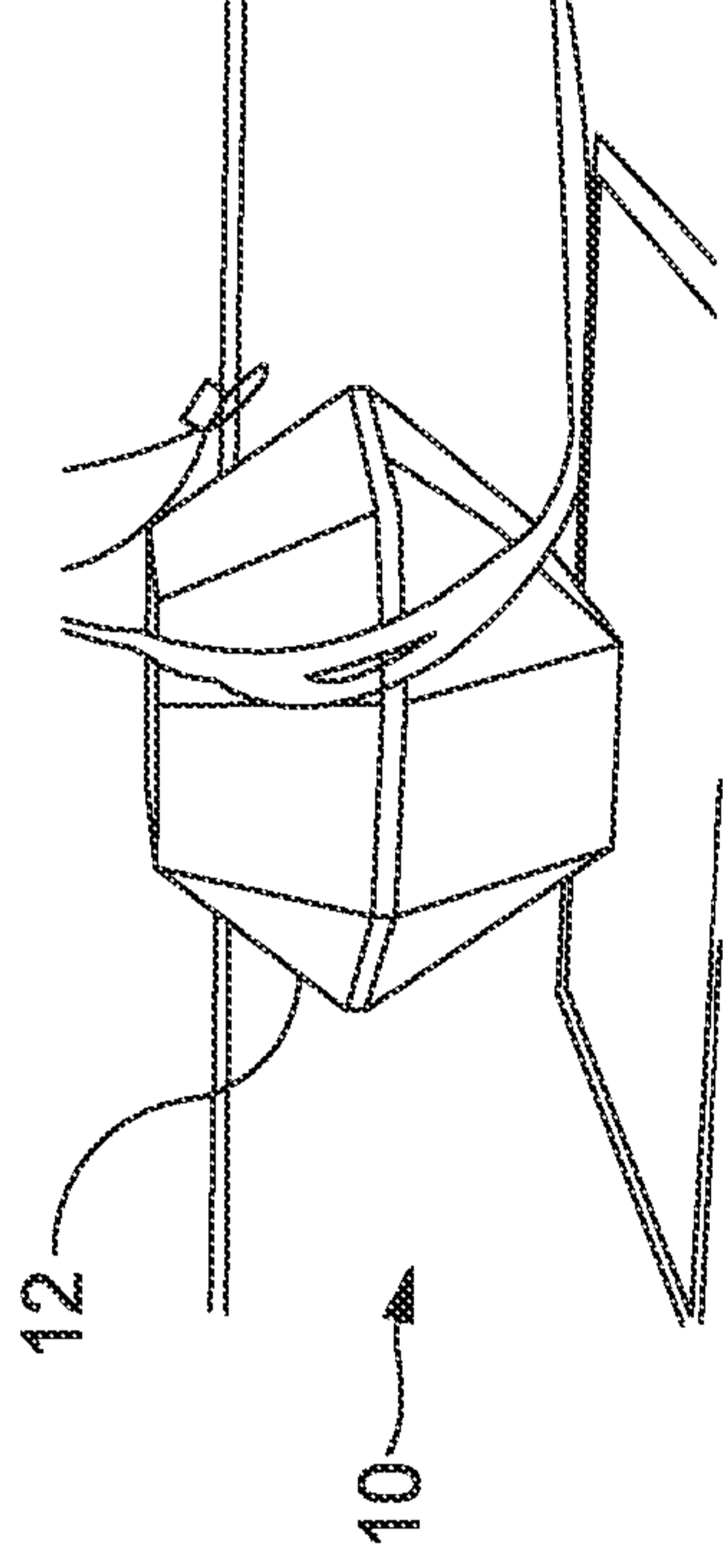


Figure 3

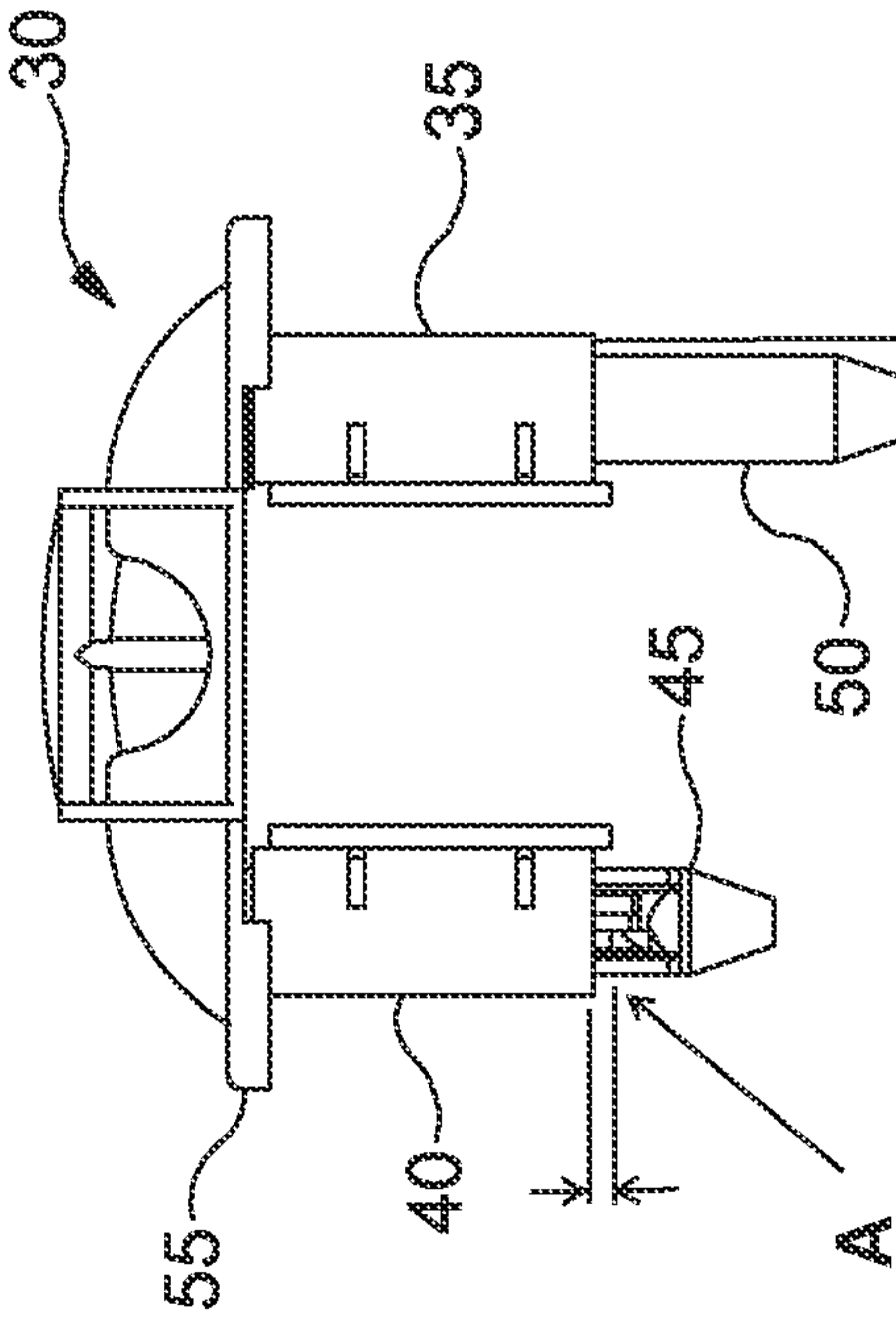


Figure 4

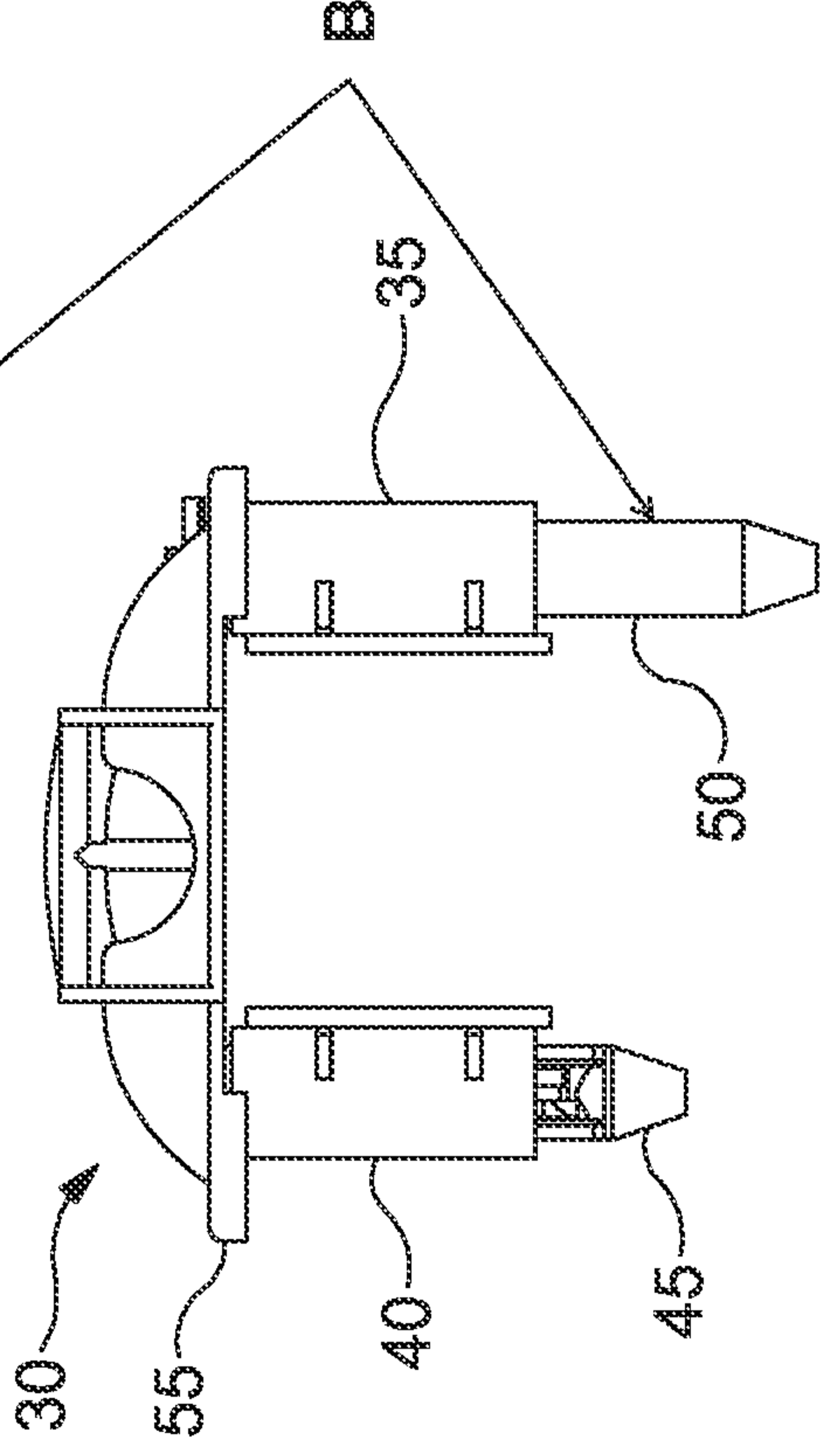


Figure 5

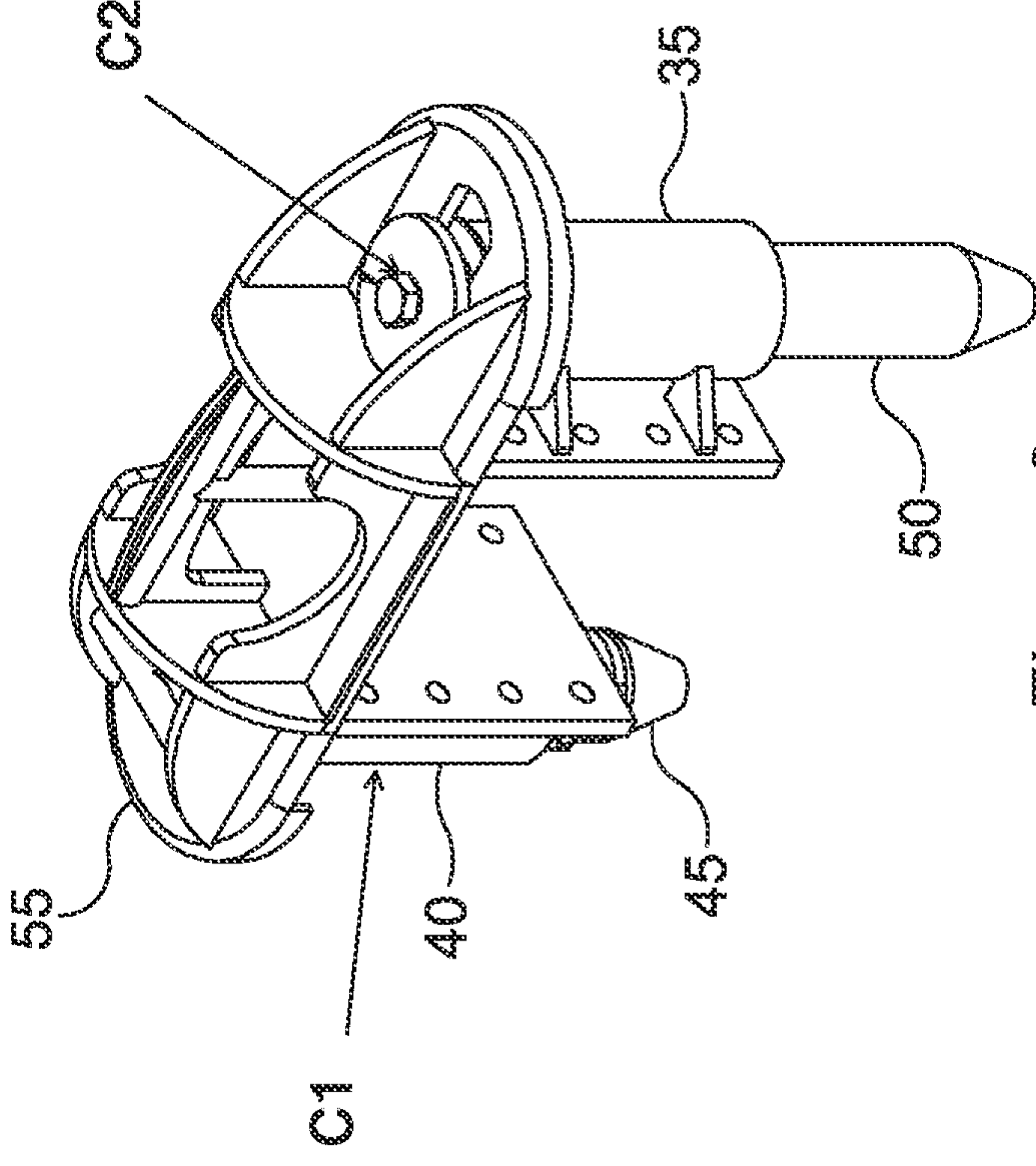


Figure 6

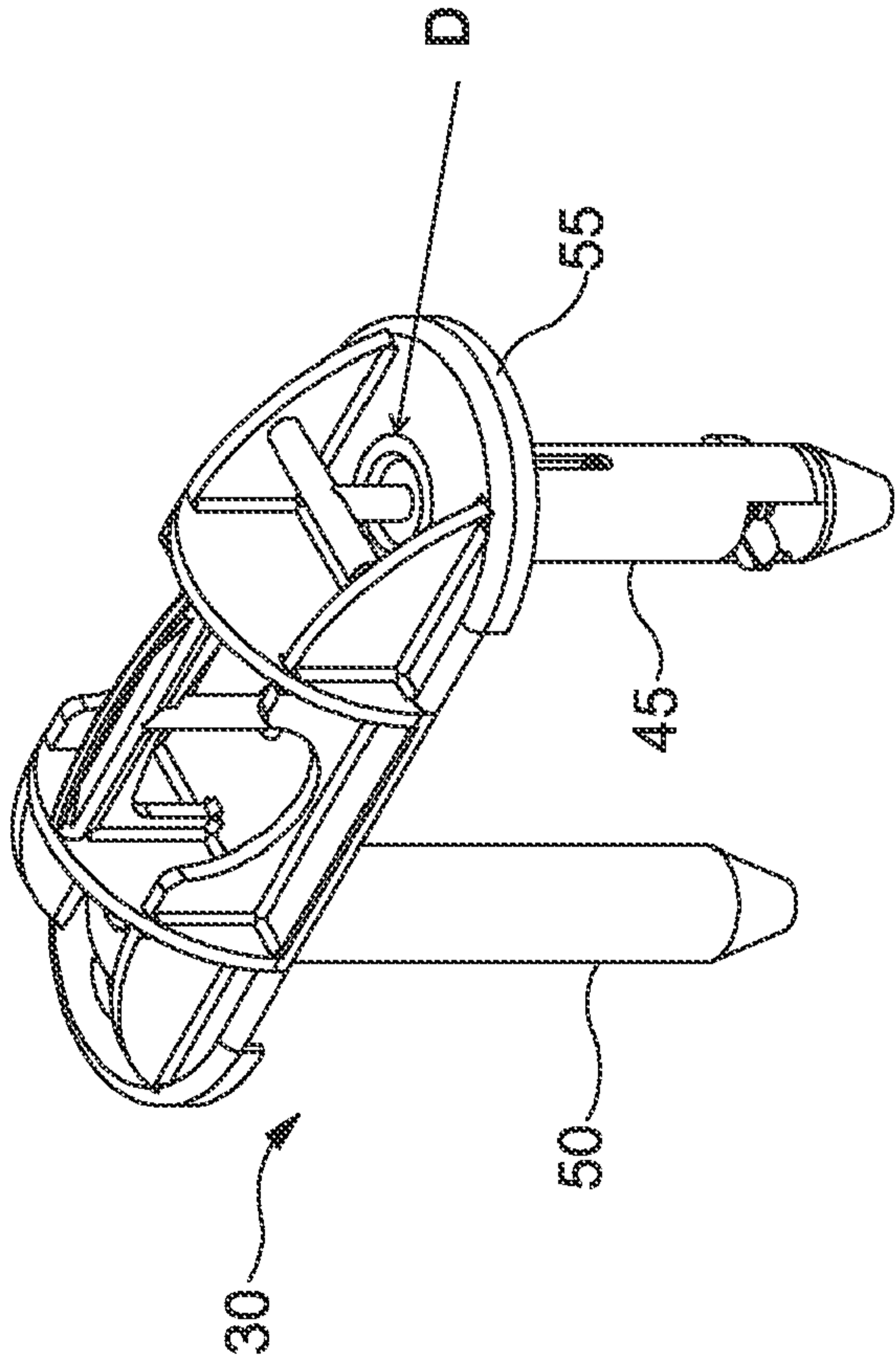


Figure 7

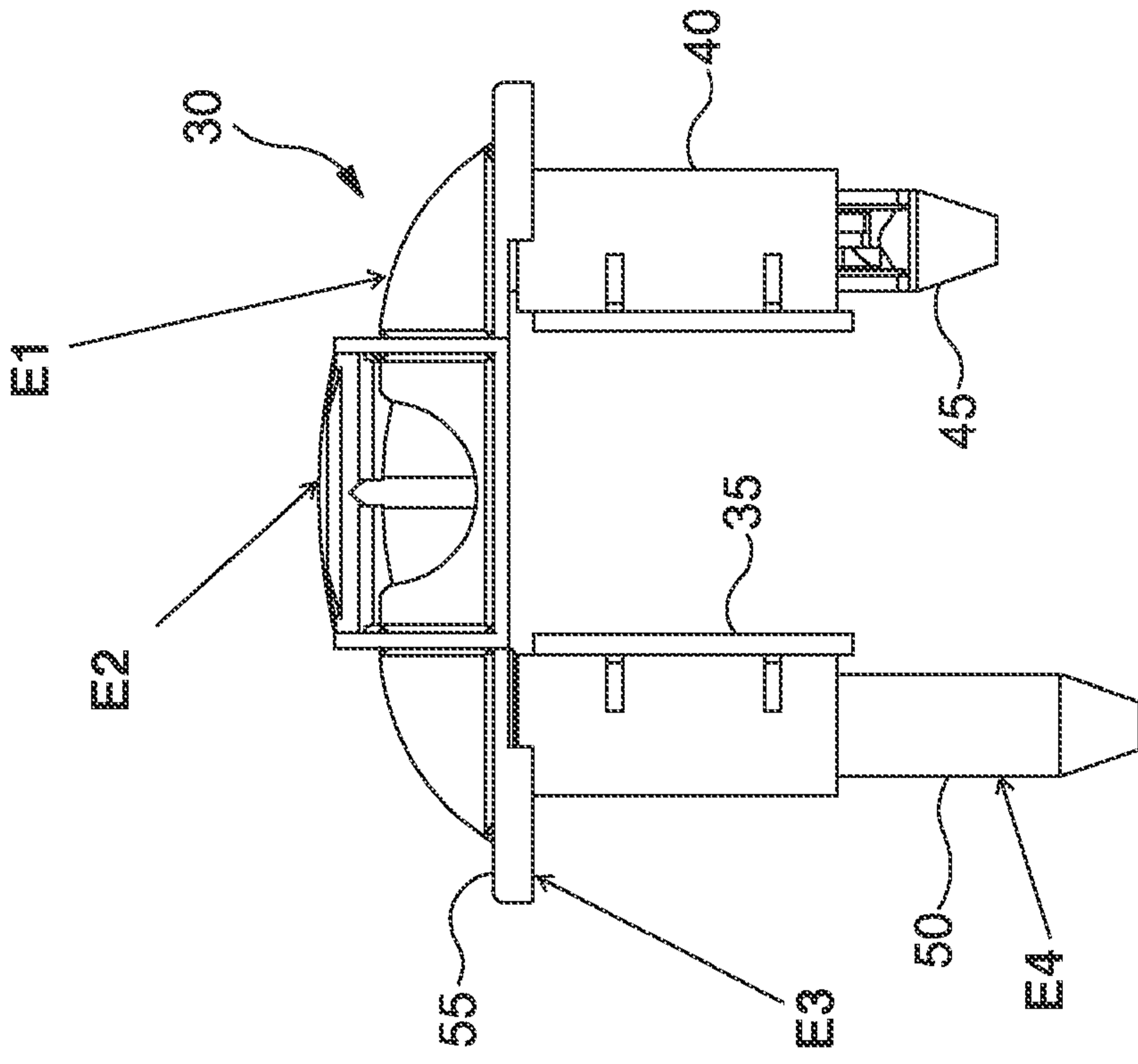


Figure 8

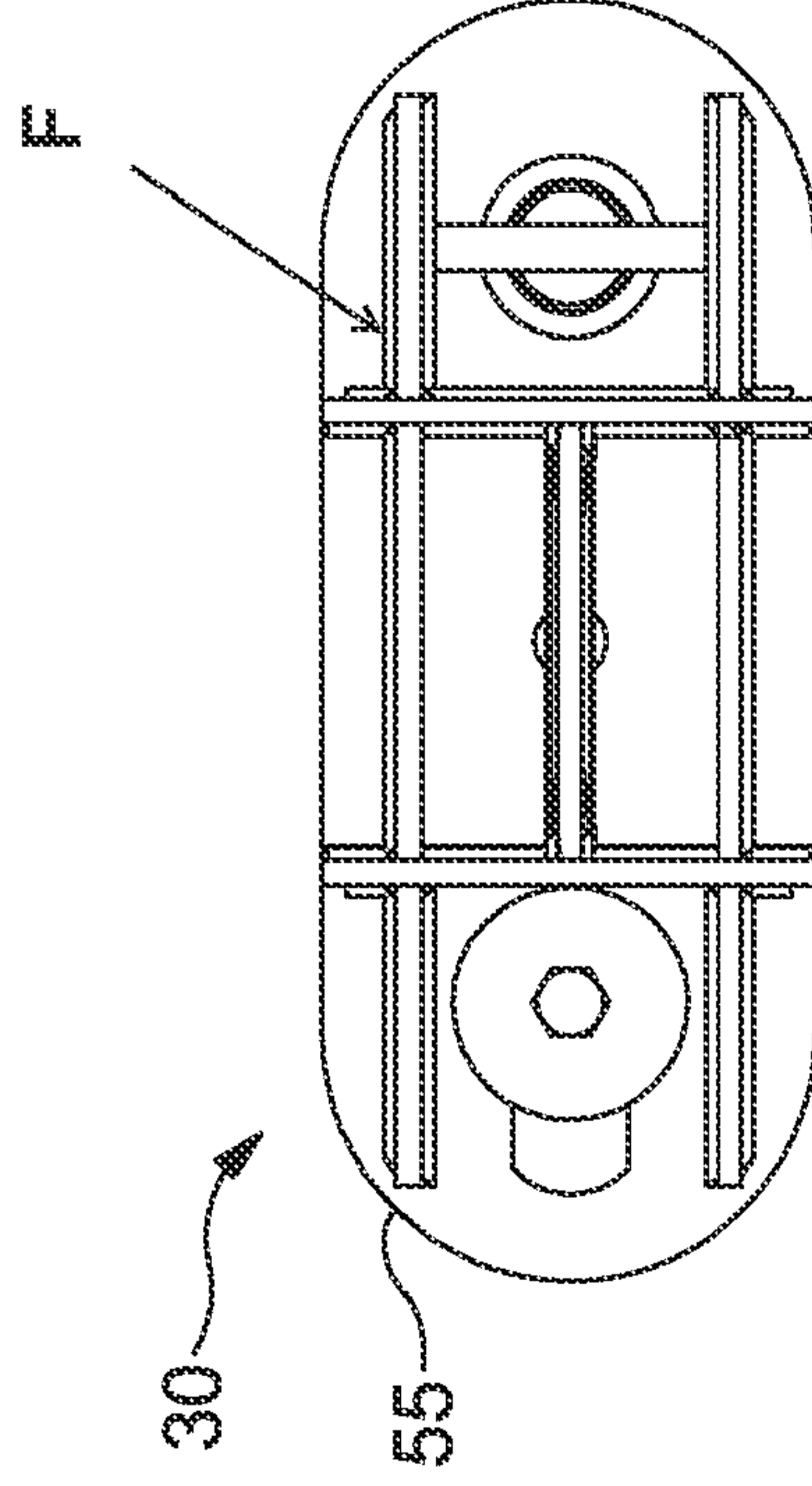


Figure 9

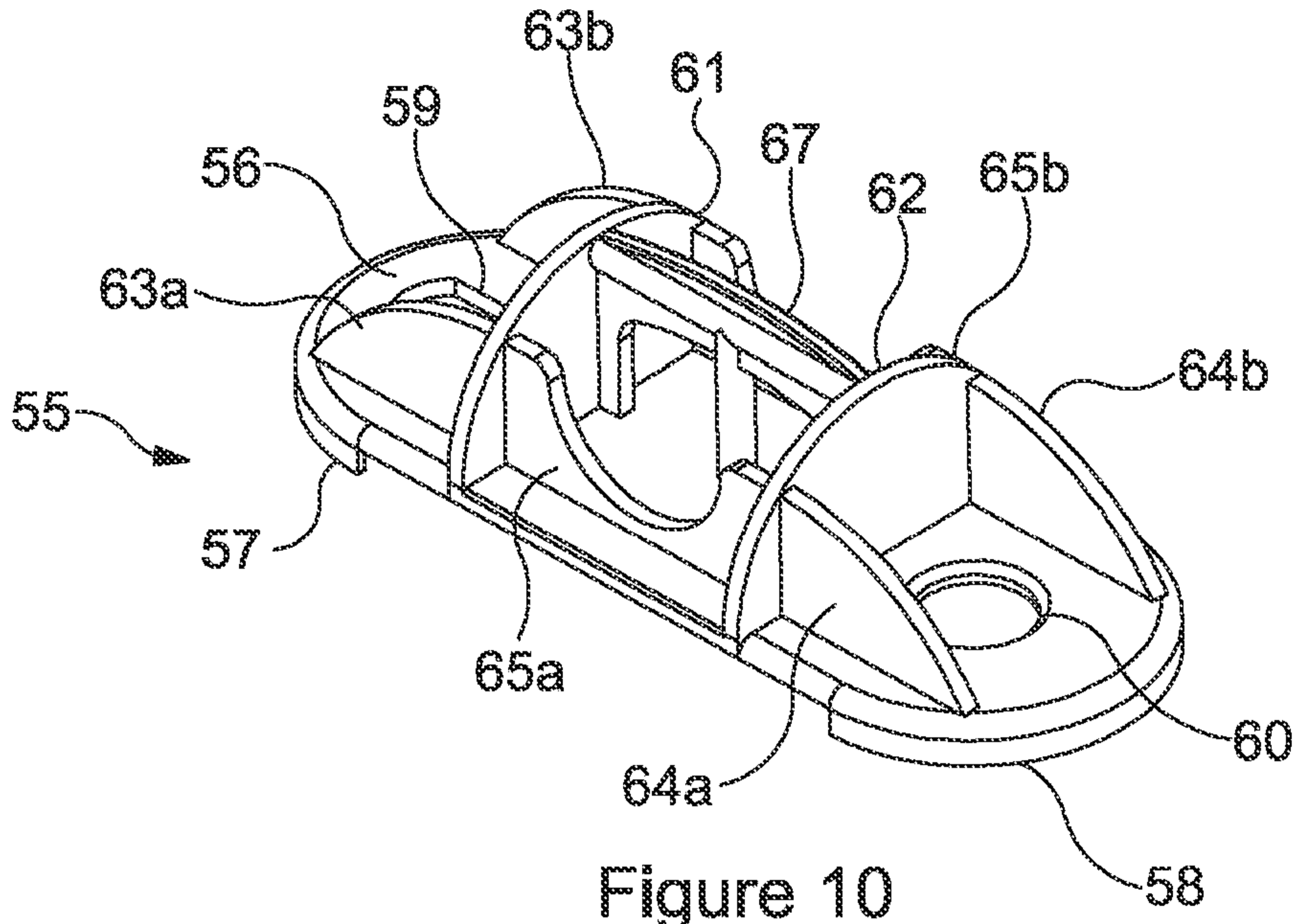


Figure 10

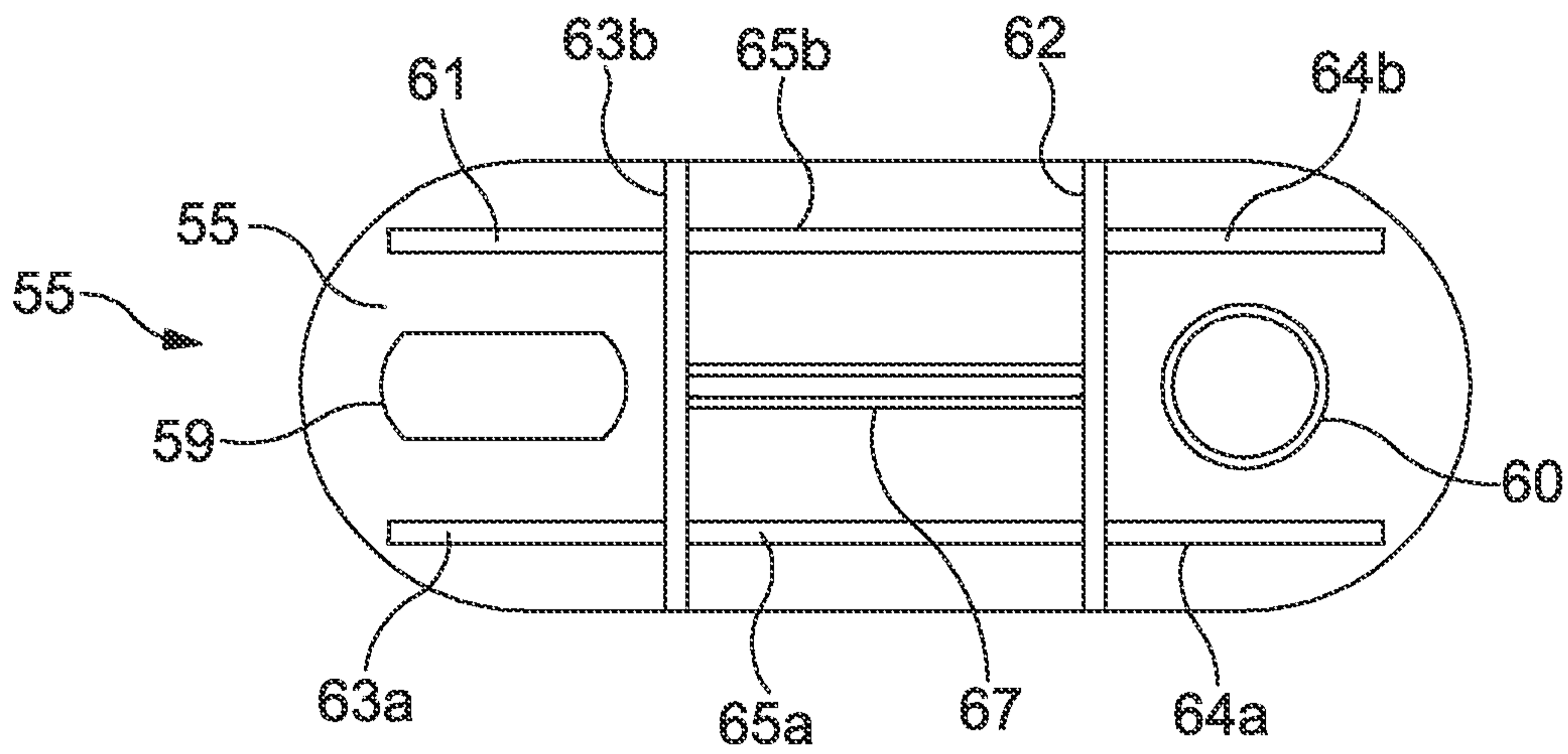


Figure 11

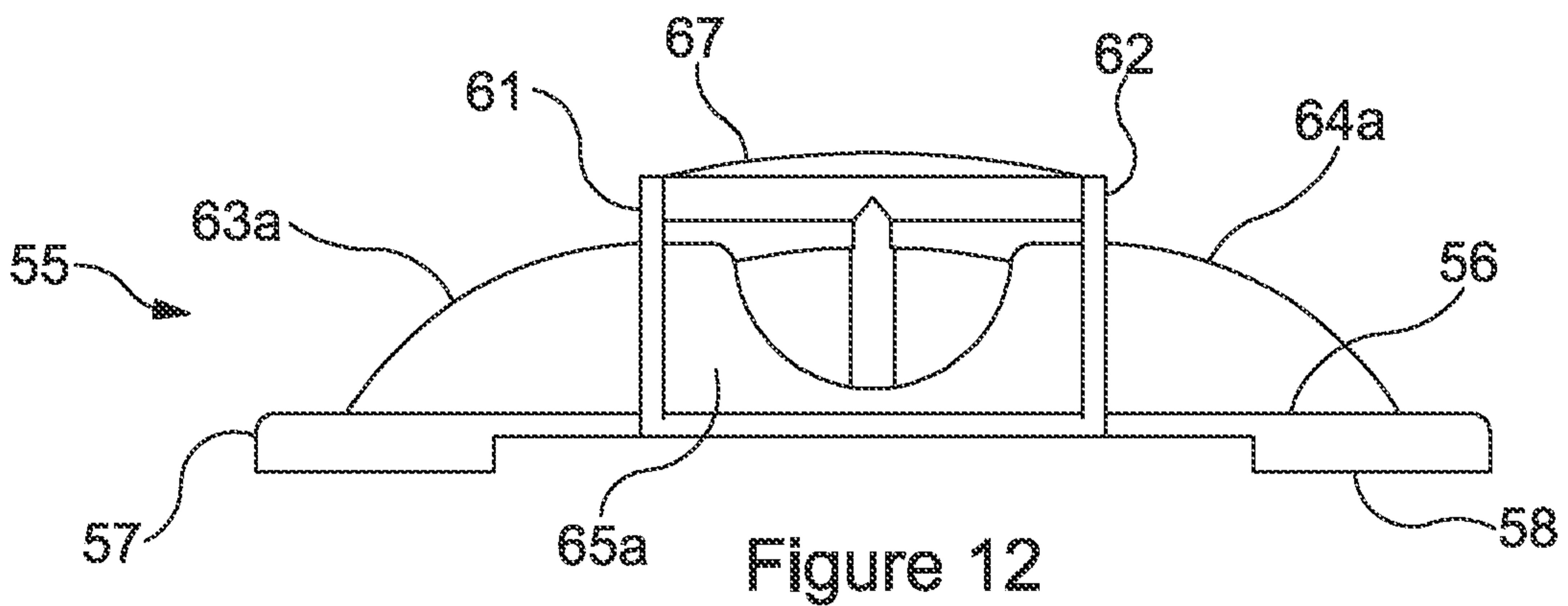


Figure 12

21 11 16

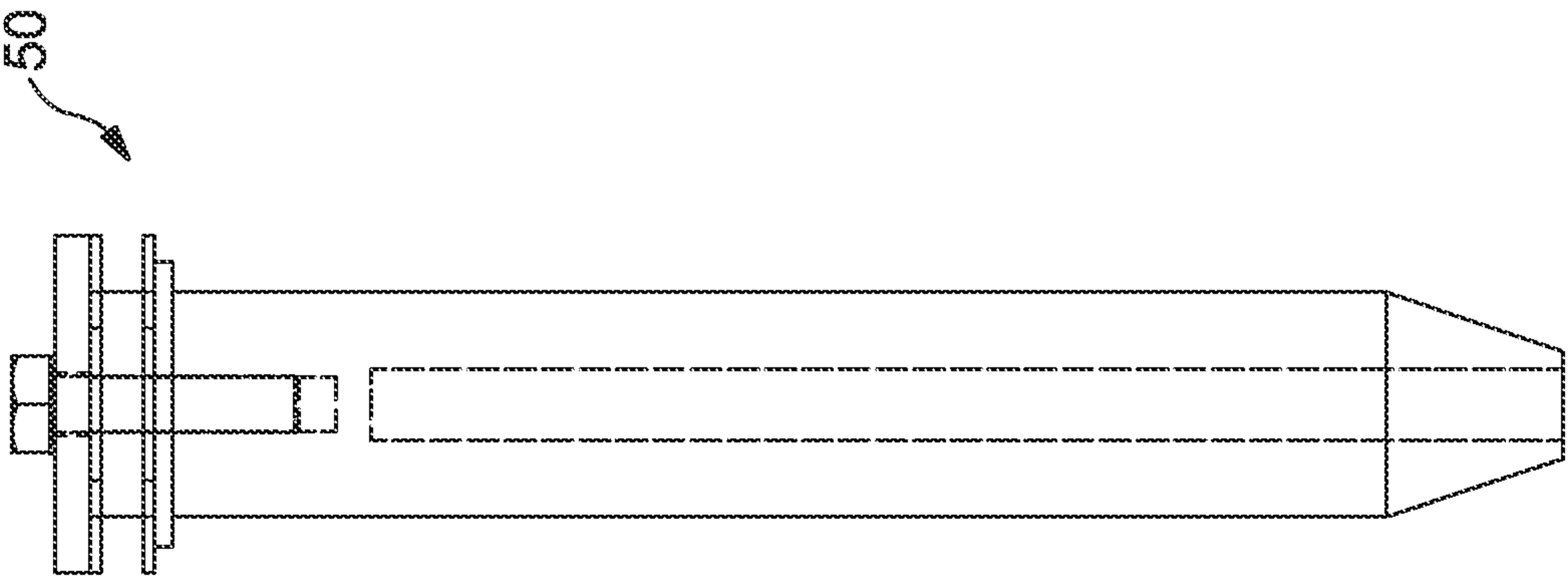


Figure 13

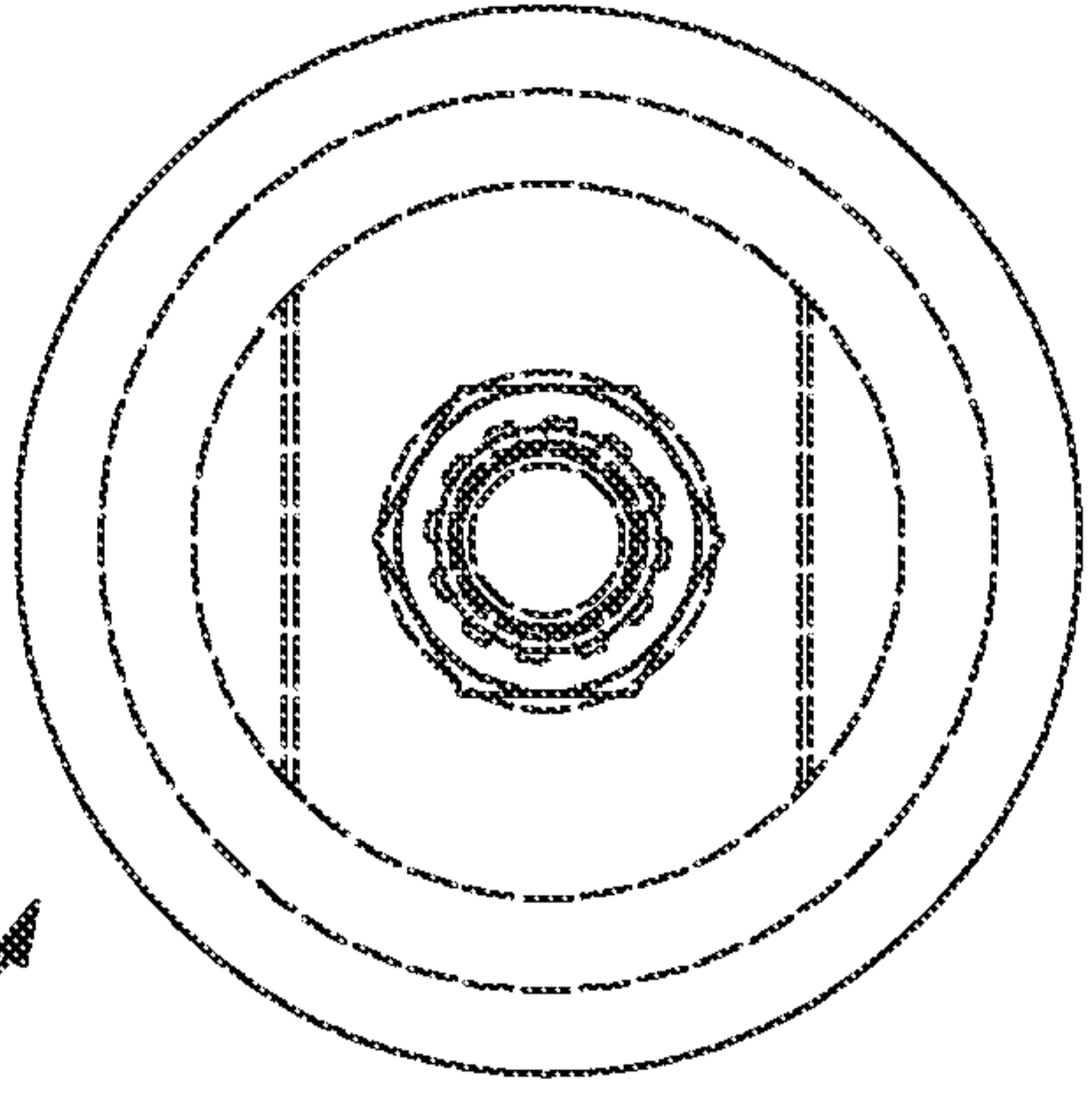


Figure 14

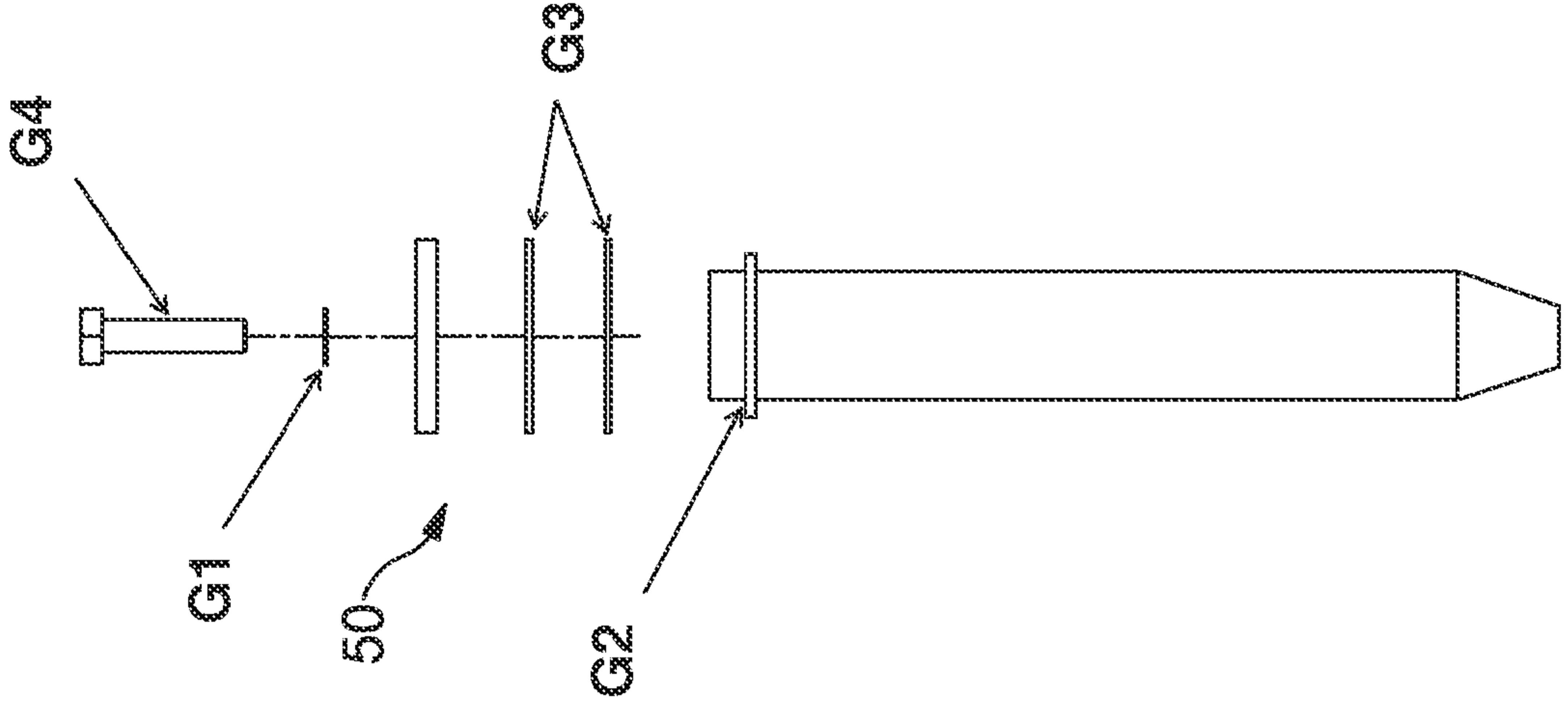


Figure 15

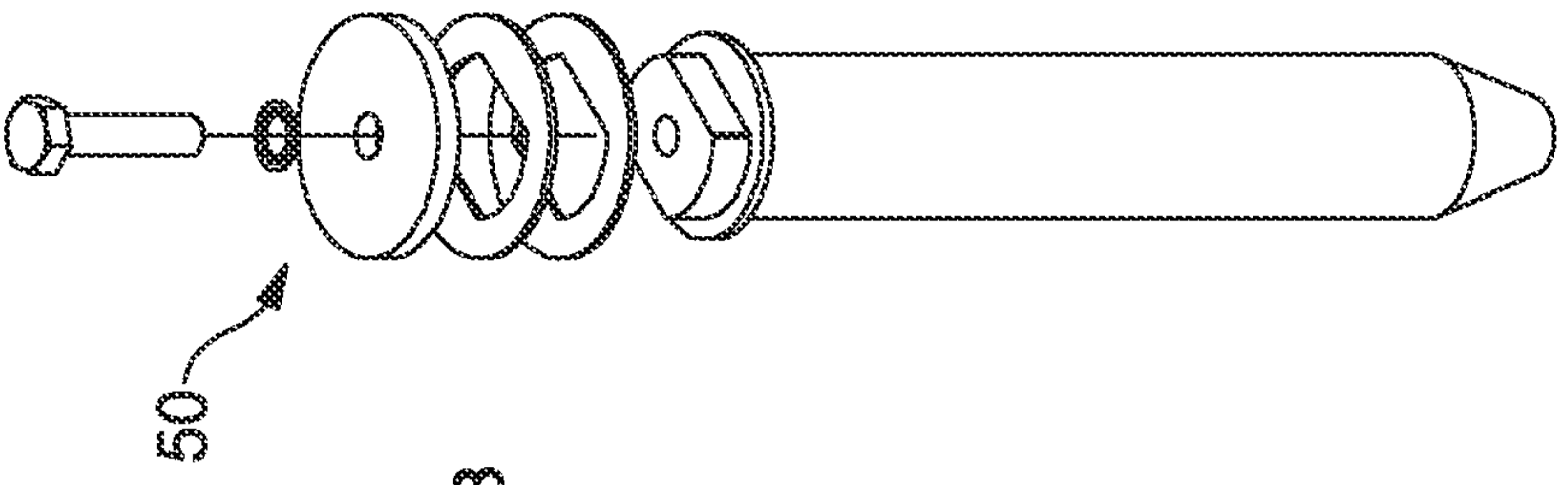


Figure 16

AU-AU

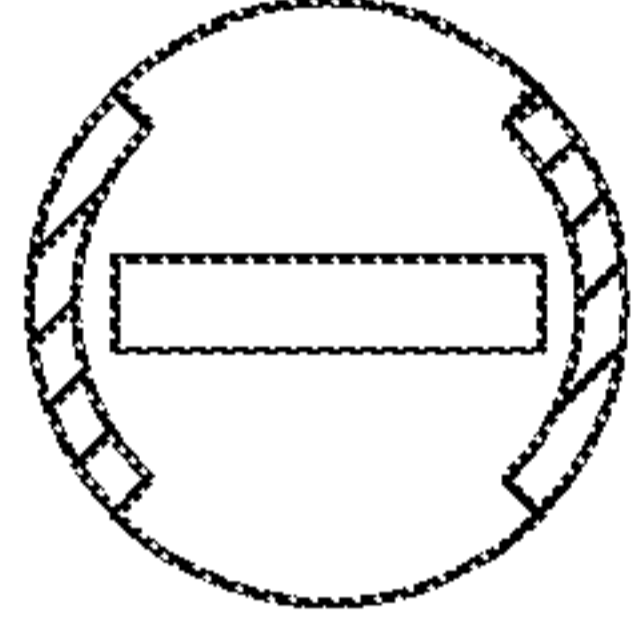


Figure 19

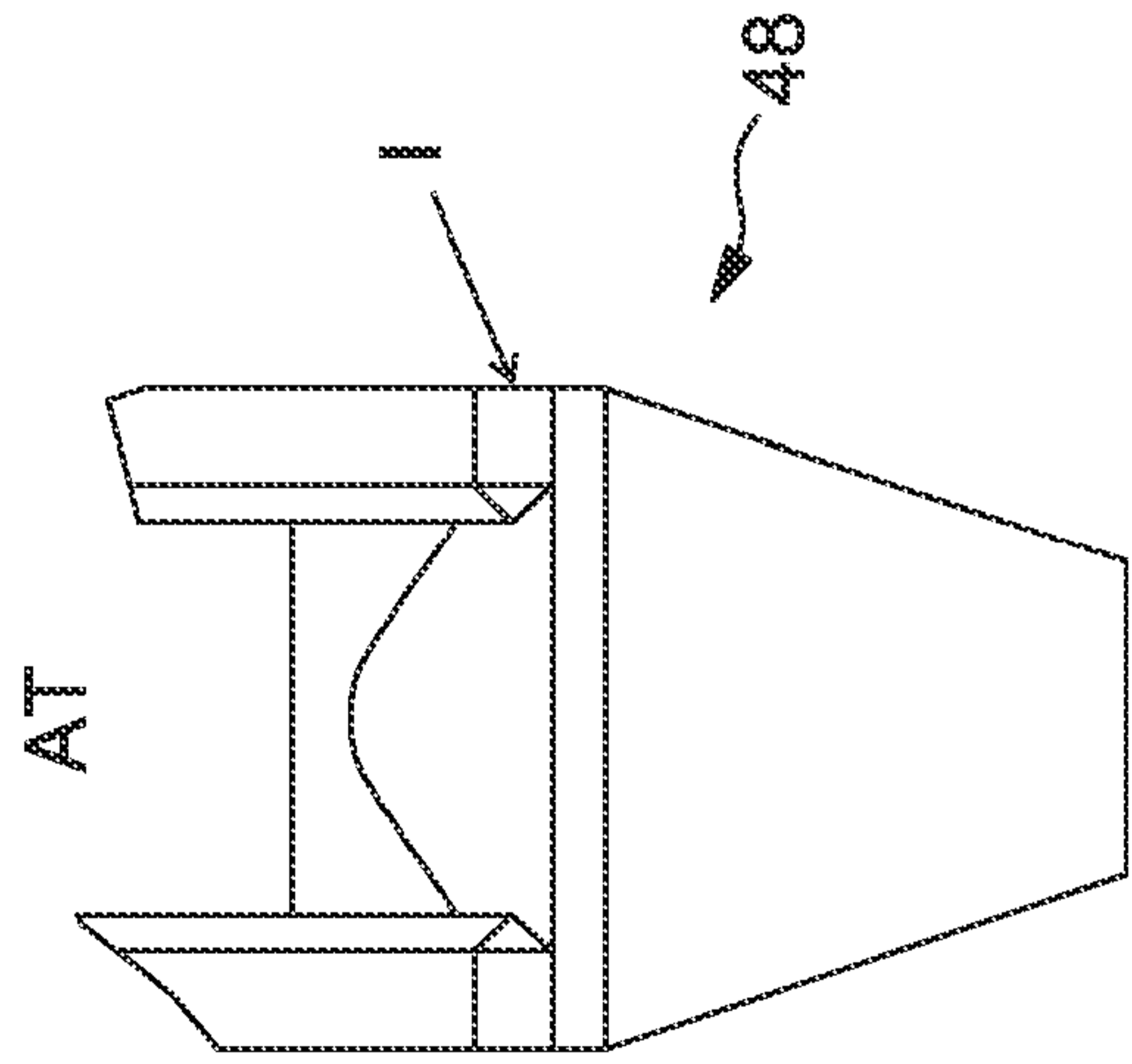


Figure 20

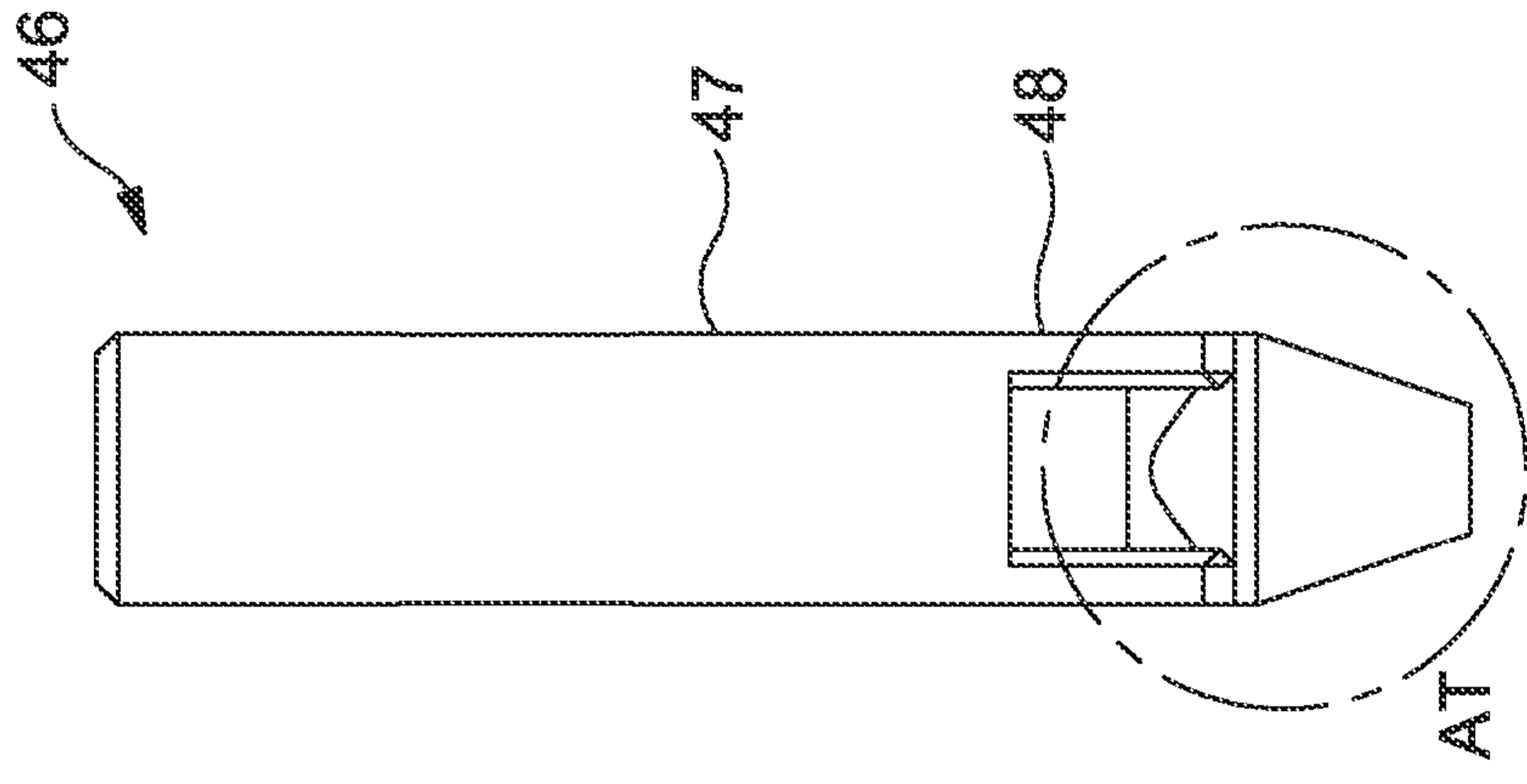


Figure 17

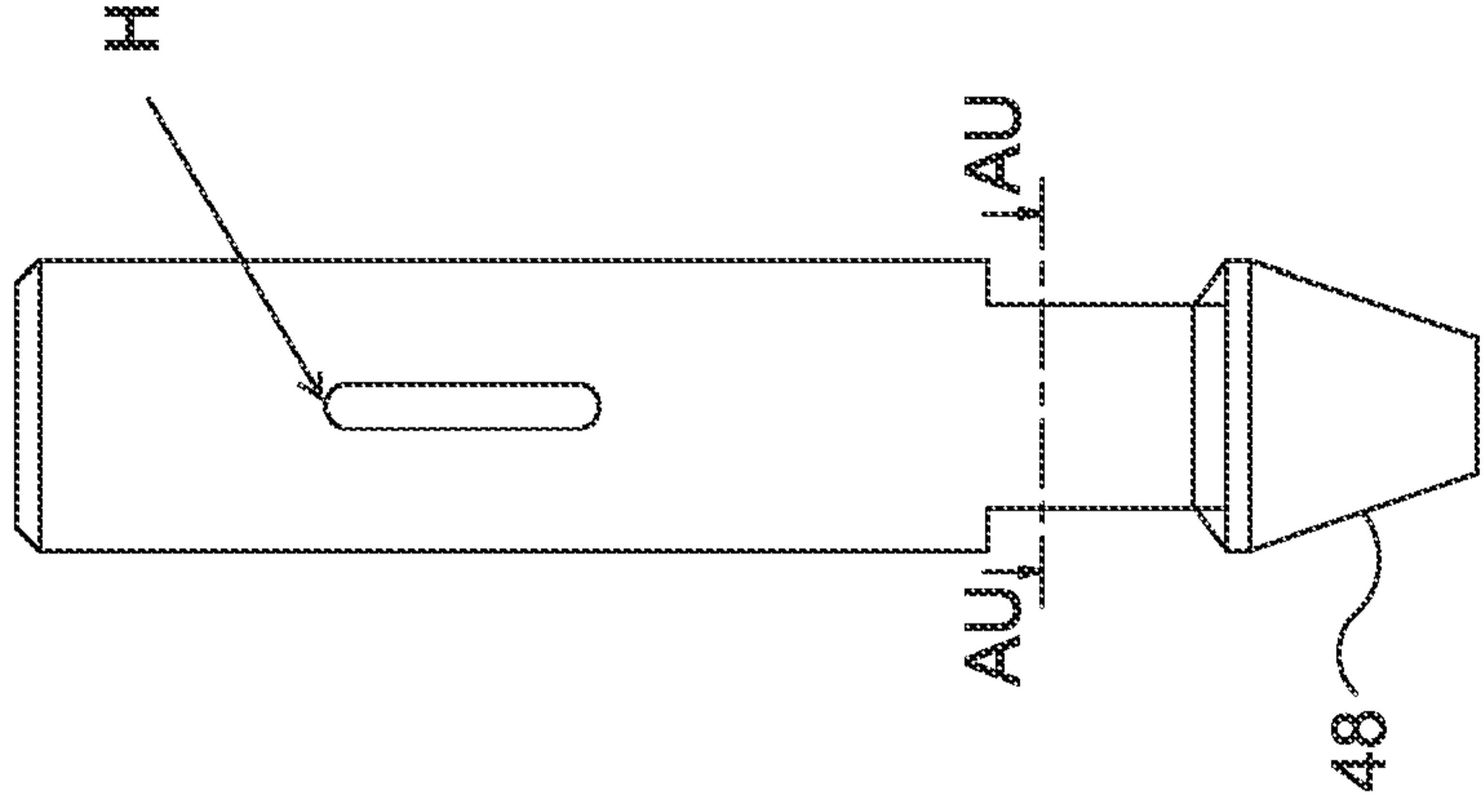


Figure 18

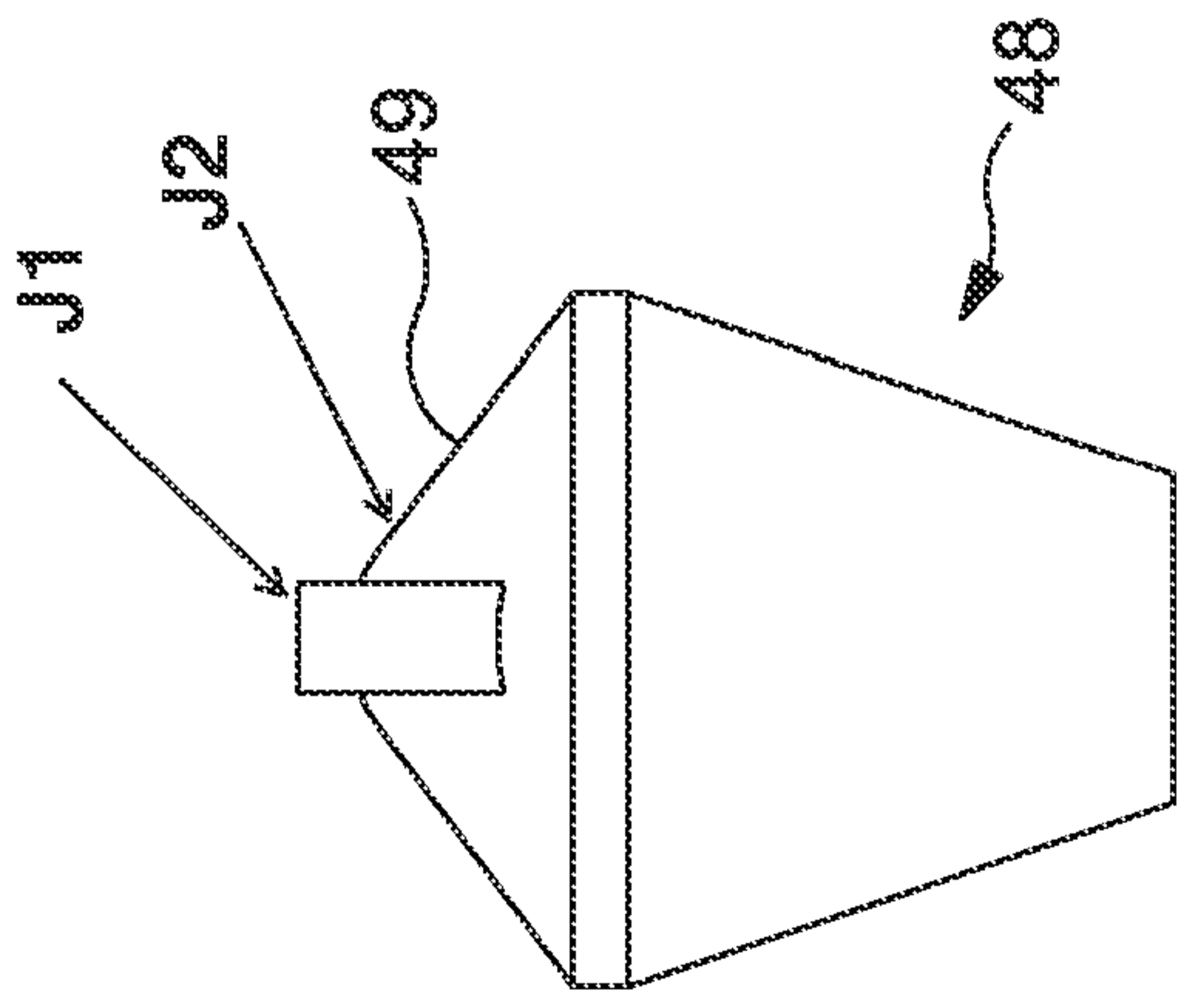


Figure 21

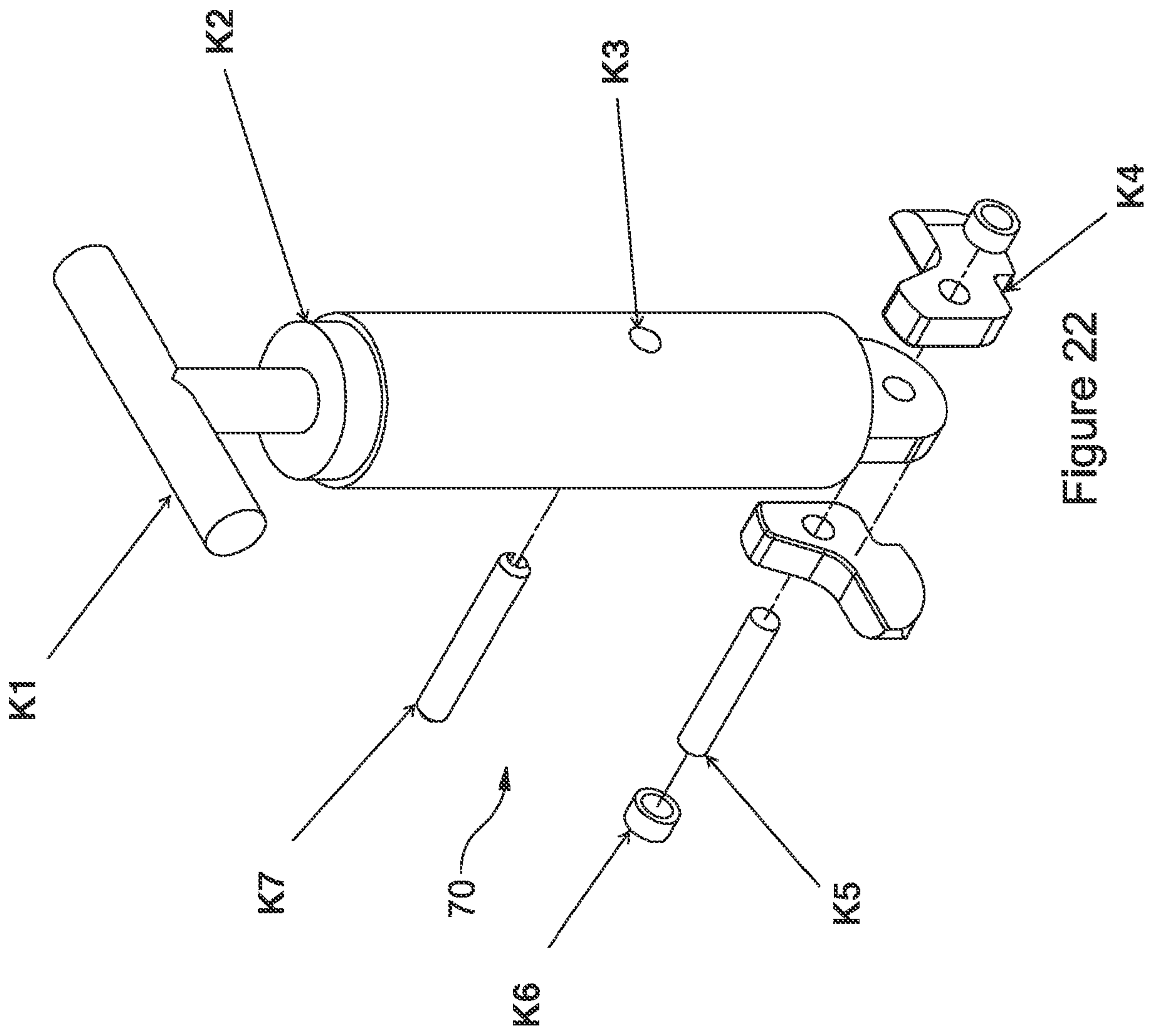


Figure 22

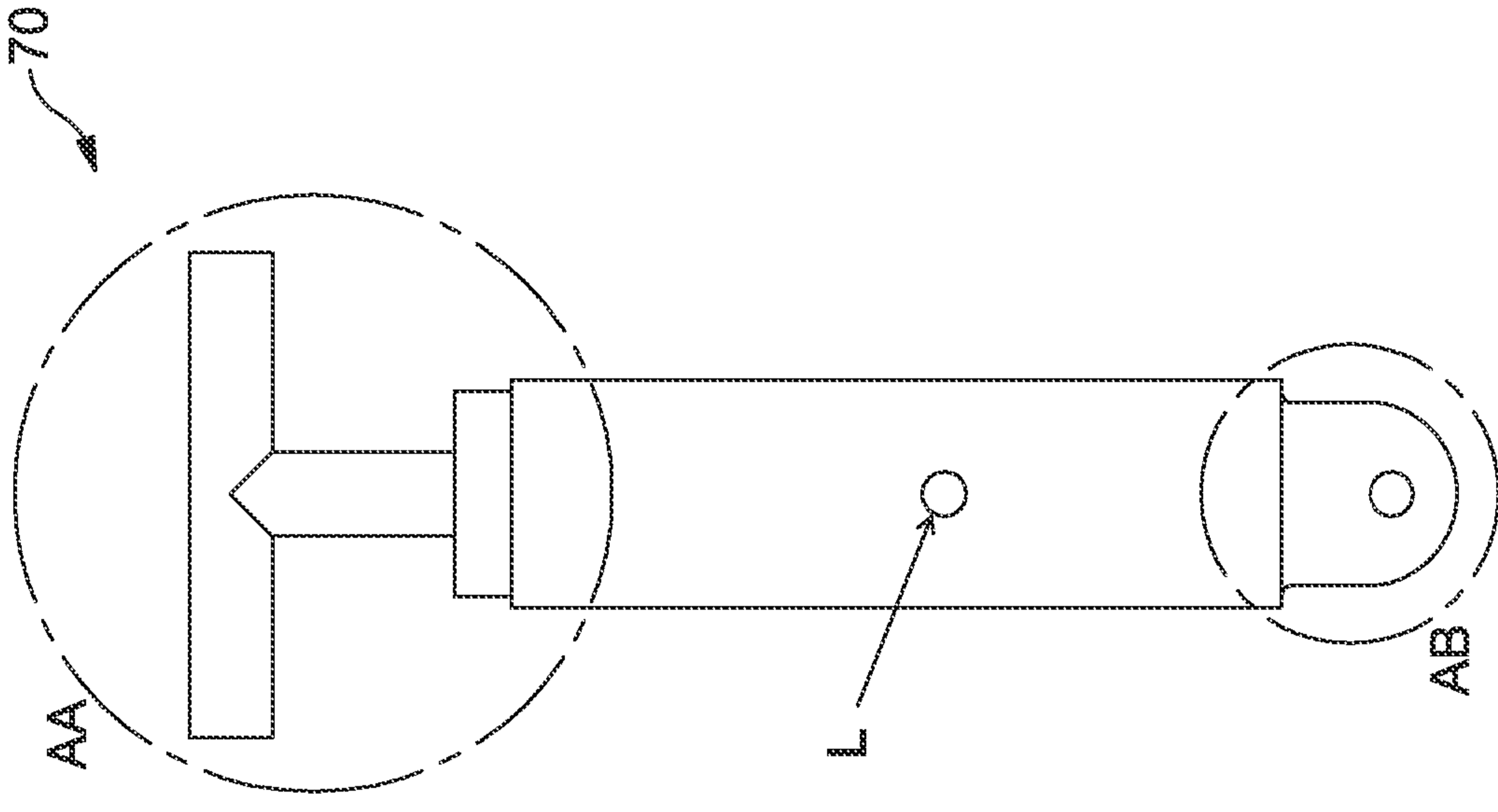


Figure 23

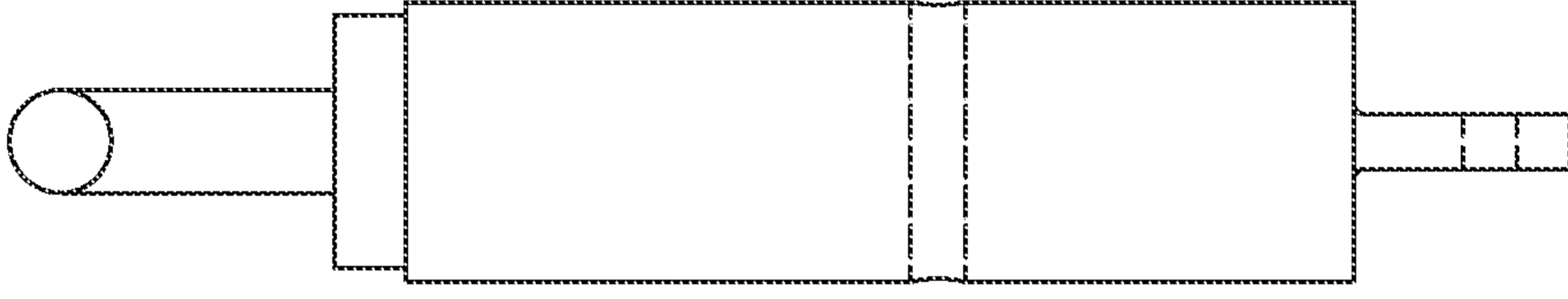


Figure 24

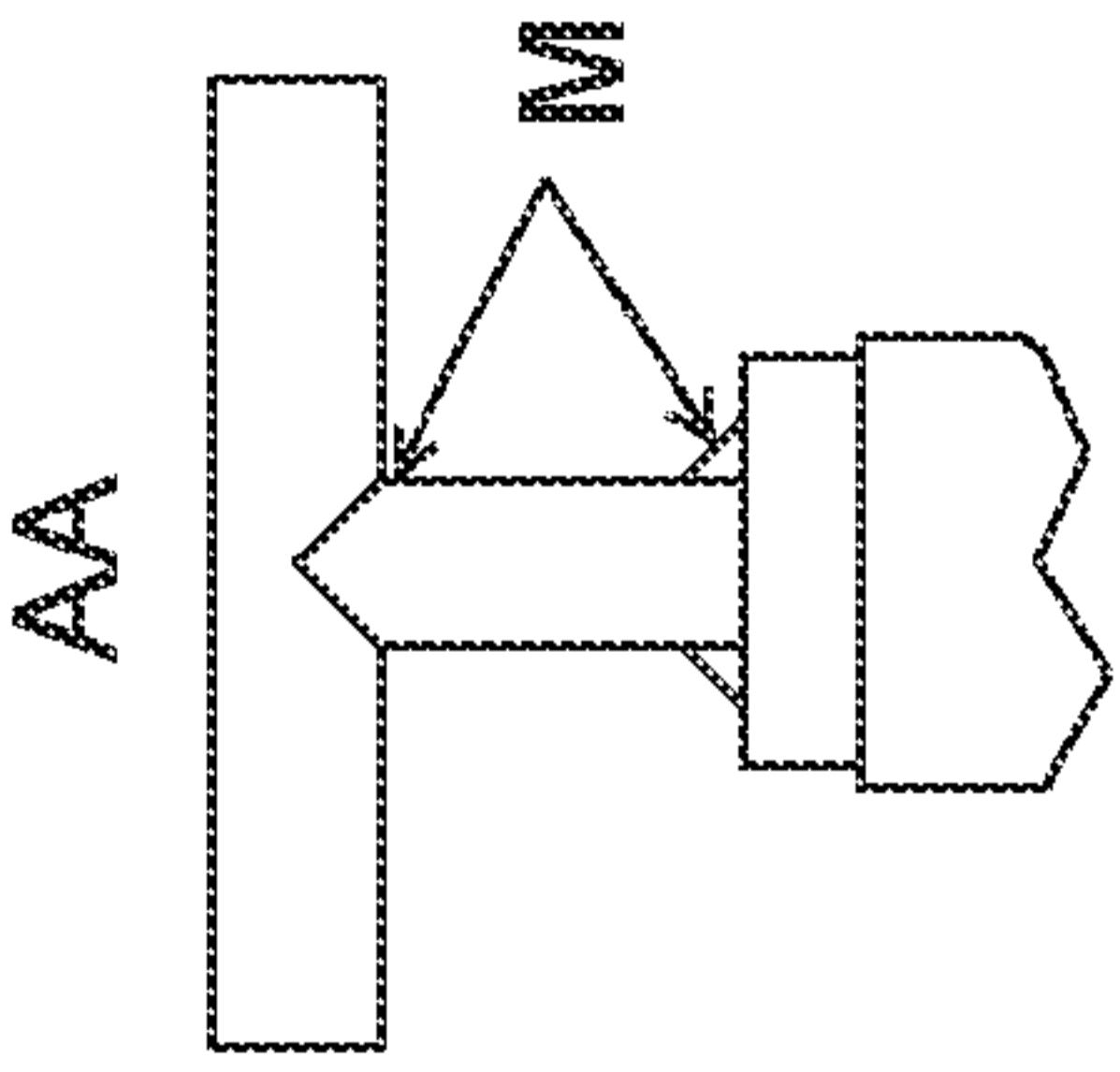


Figure 25

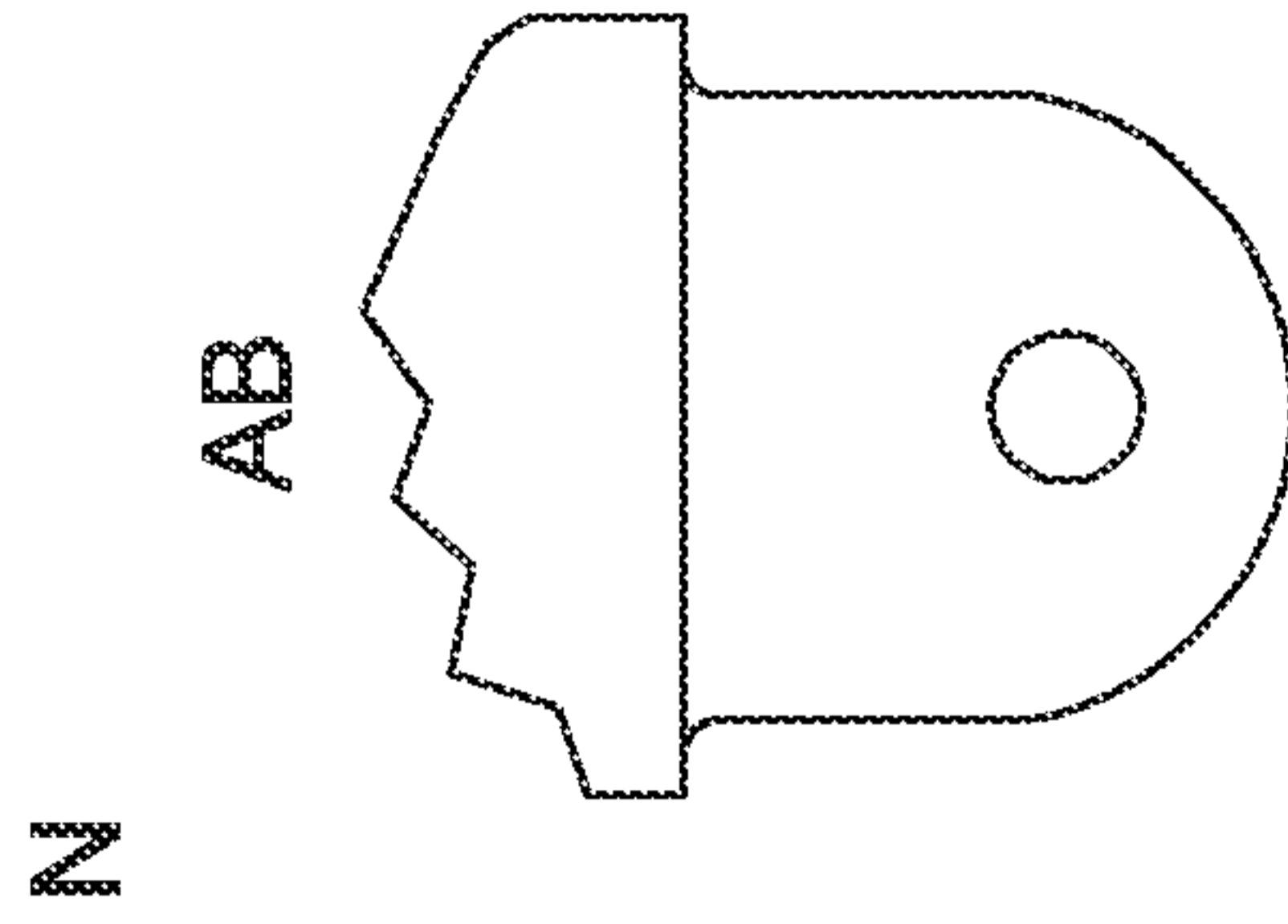


Figure 26

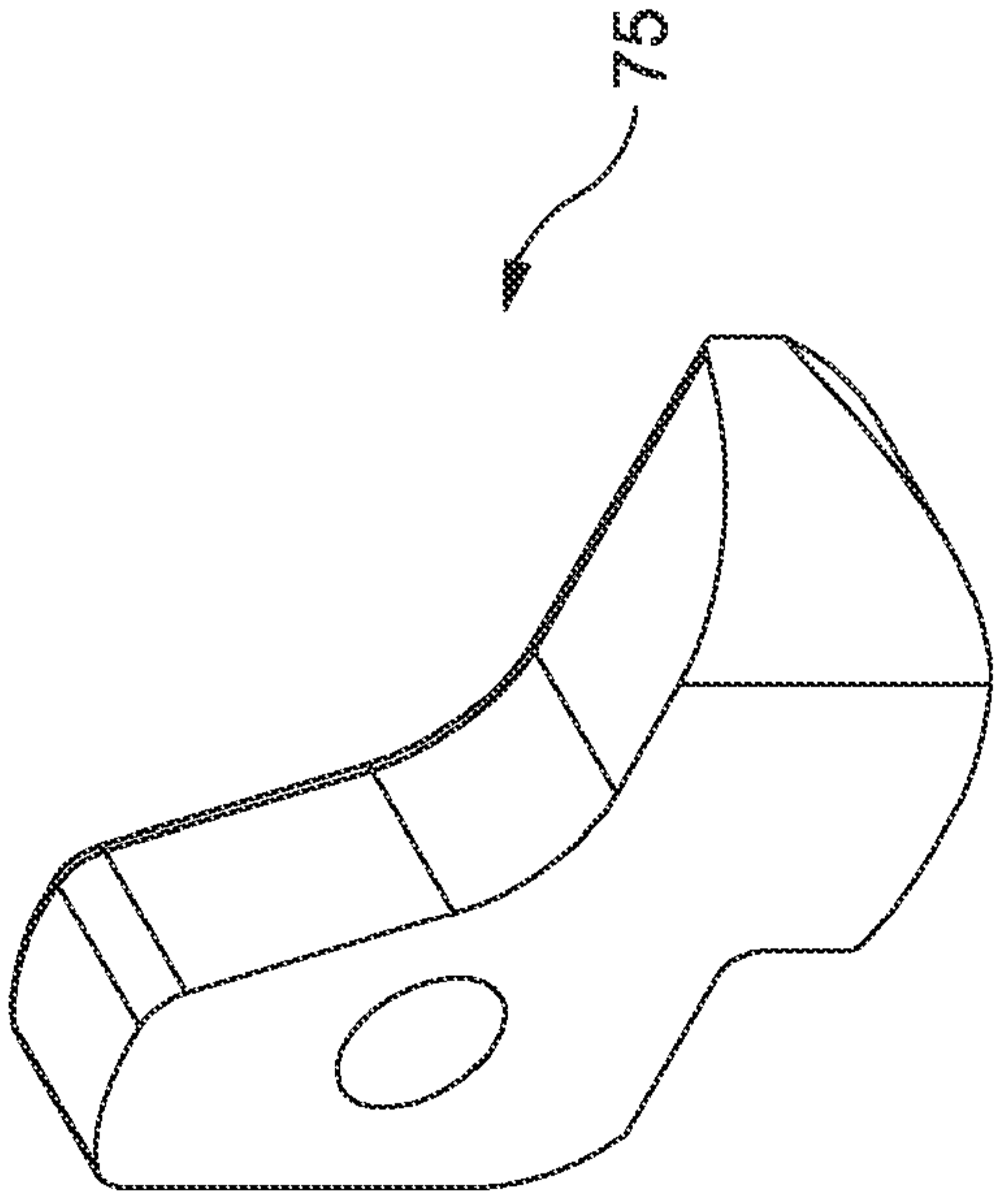


Figure 27

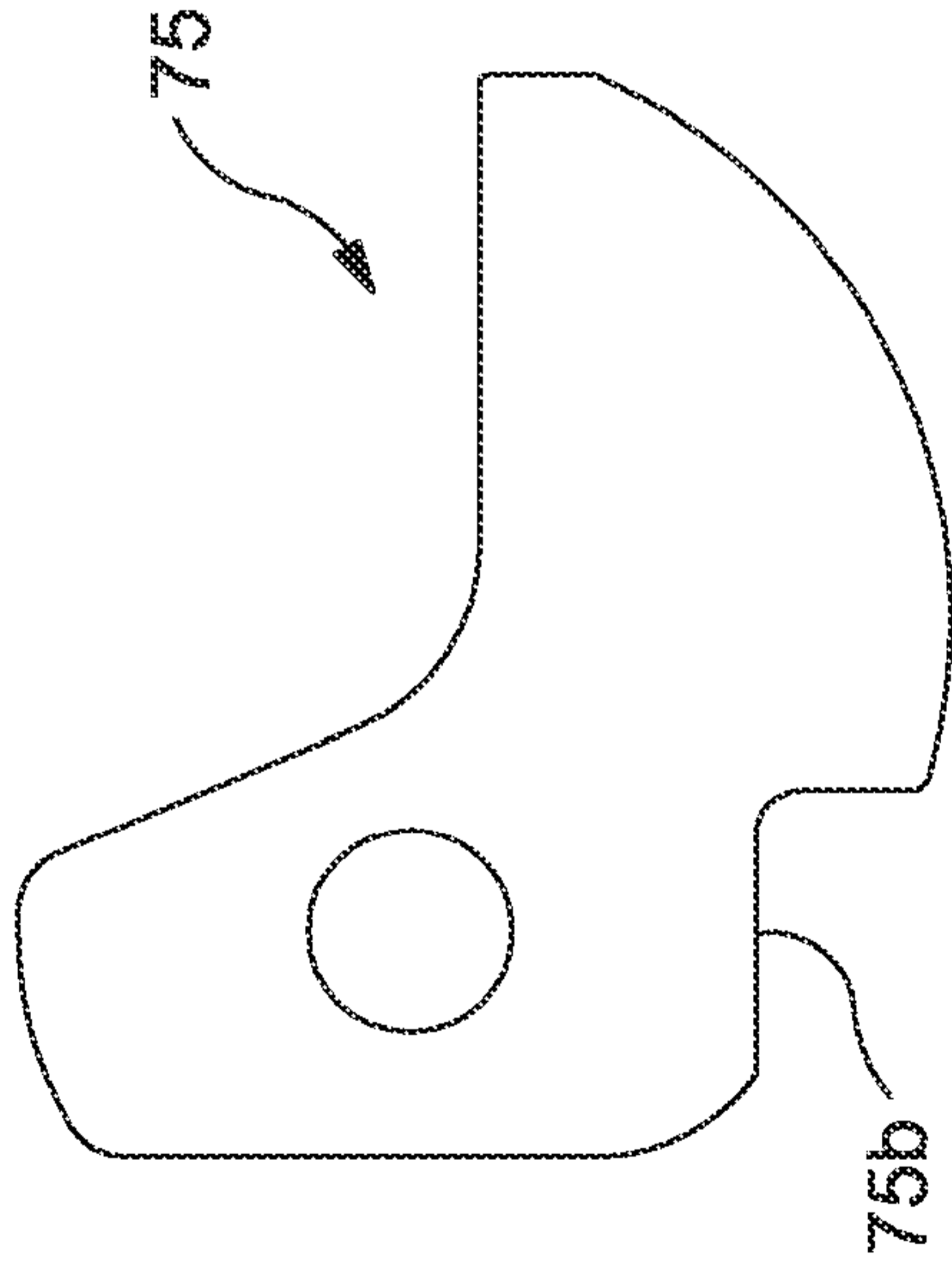


Figure 27

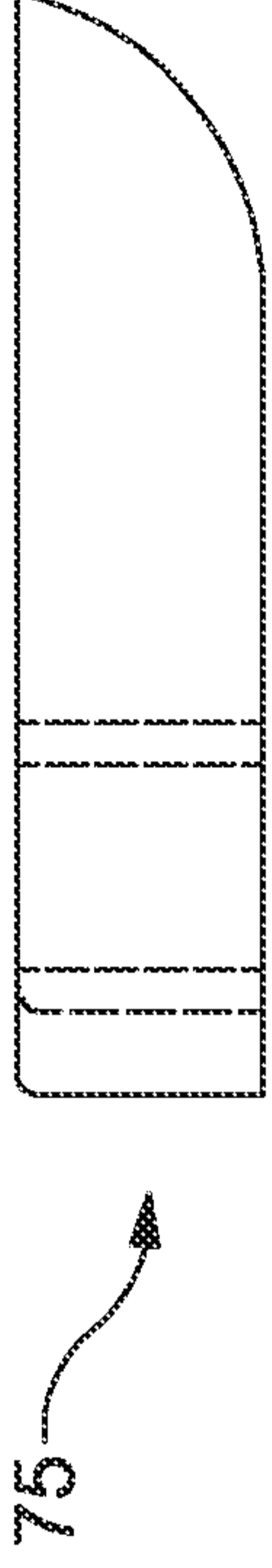


Figure 29

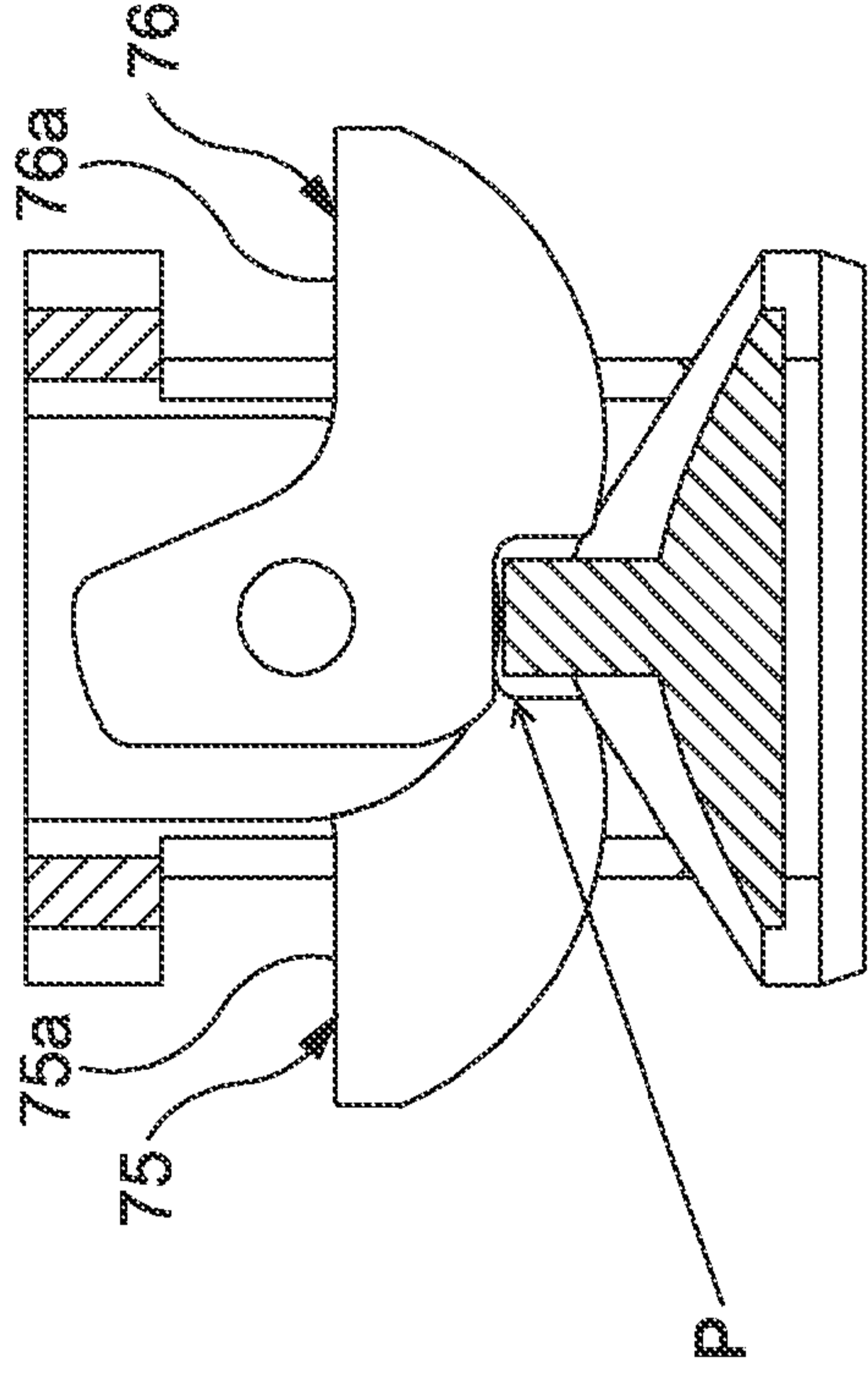
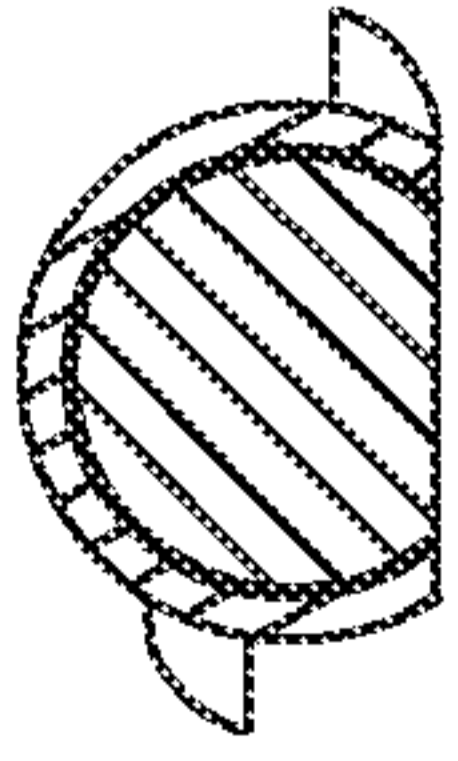
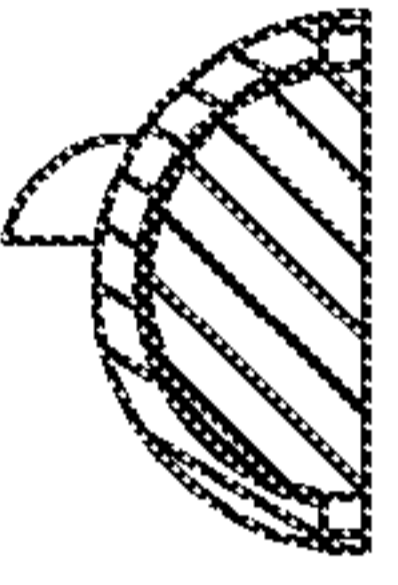


Figure 30

AC-AC



AF-AF



AG-AG

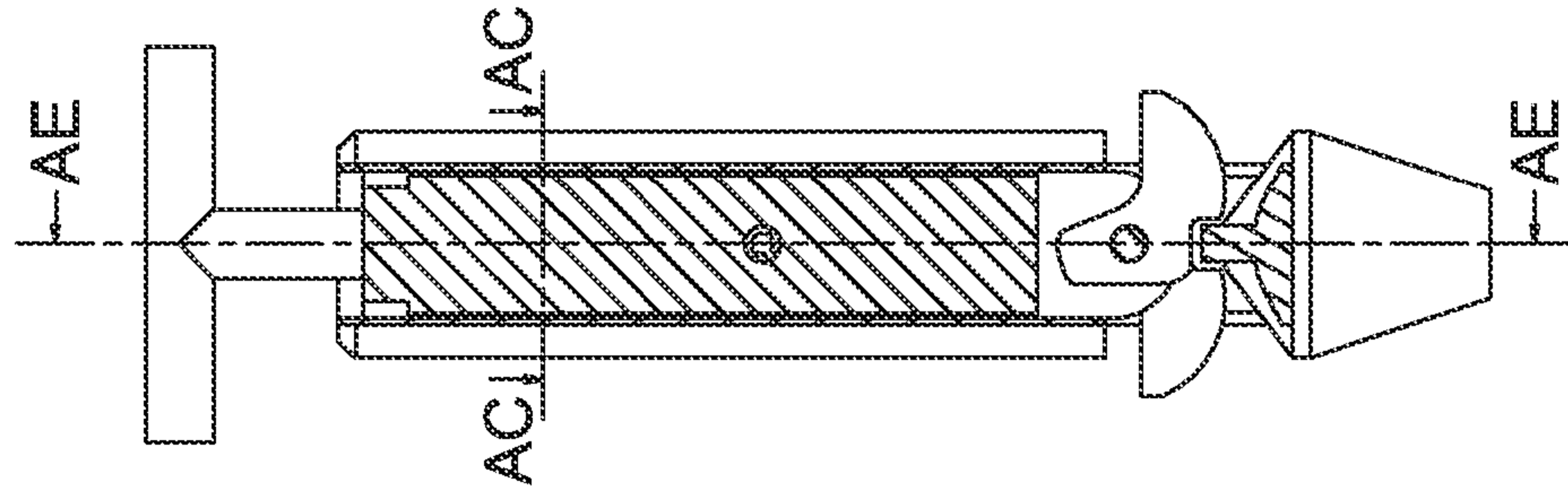
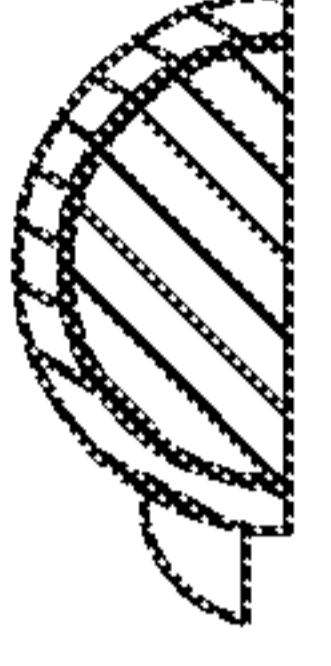


Figure 31A

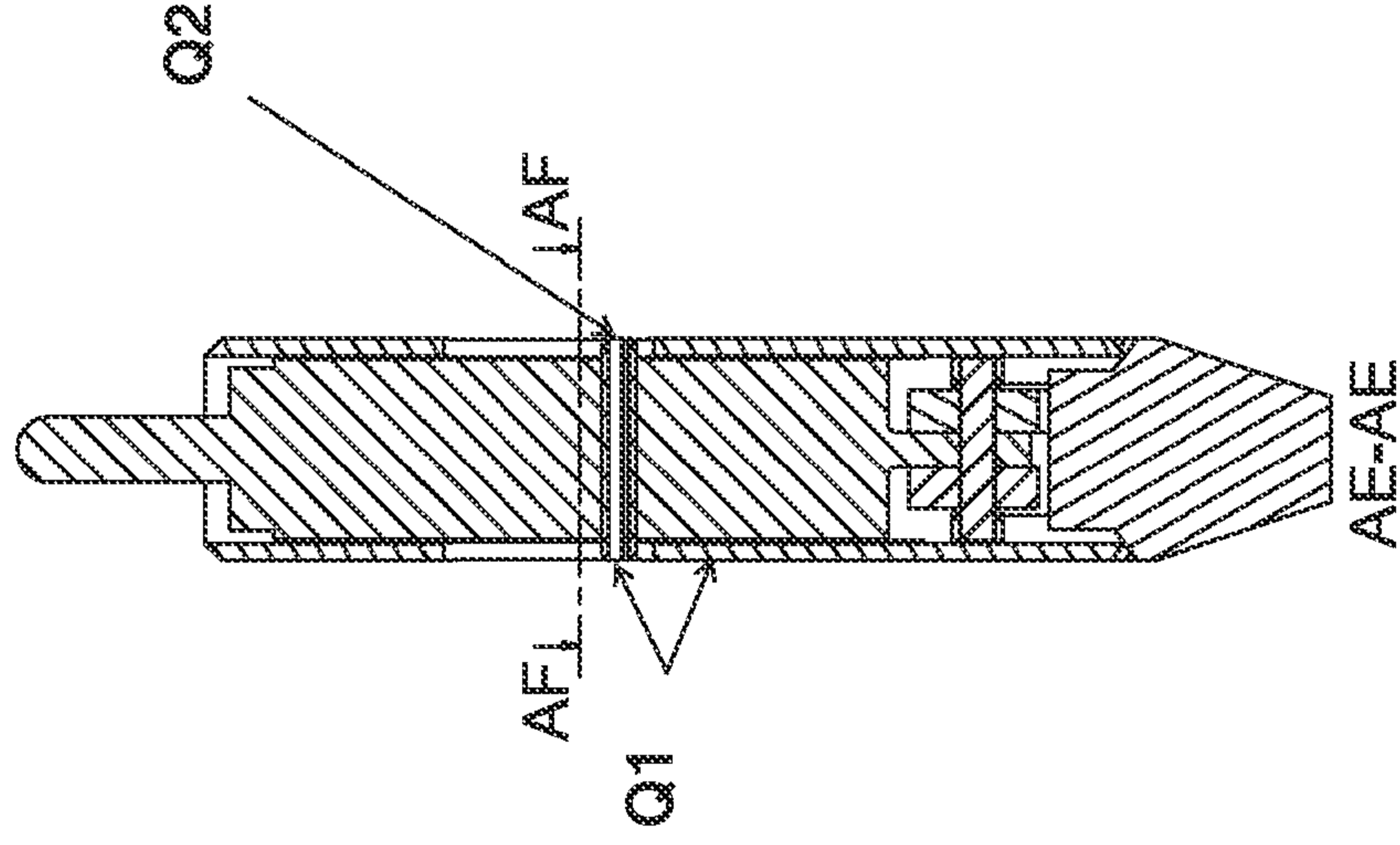


Figure 31B

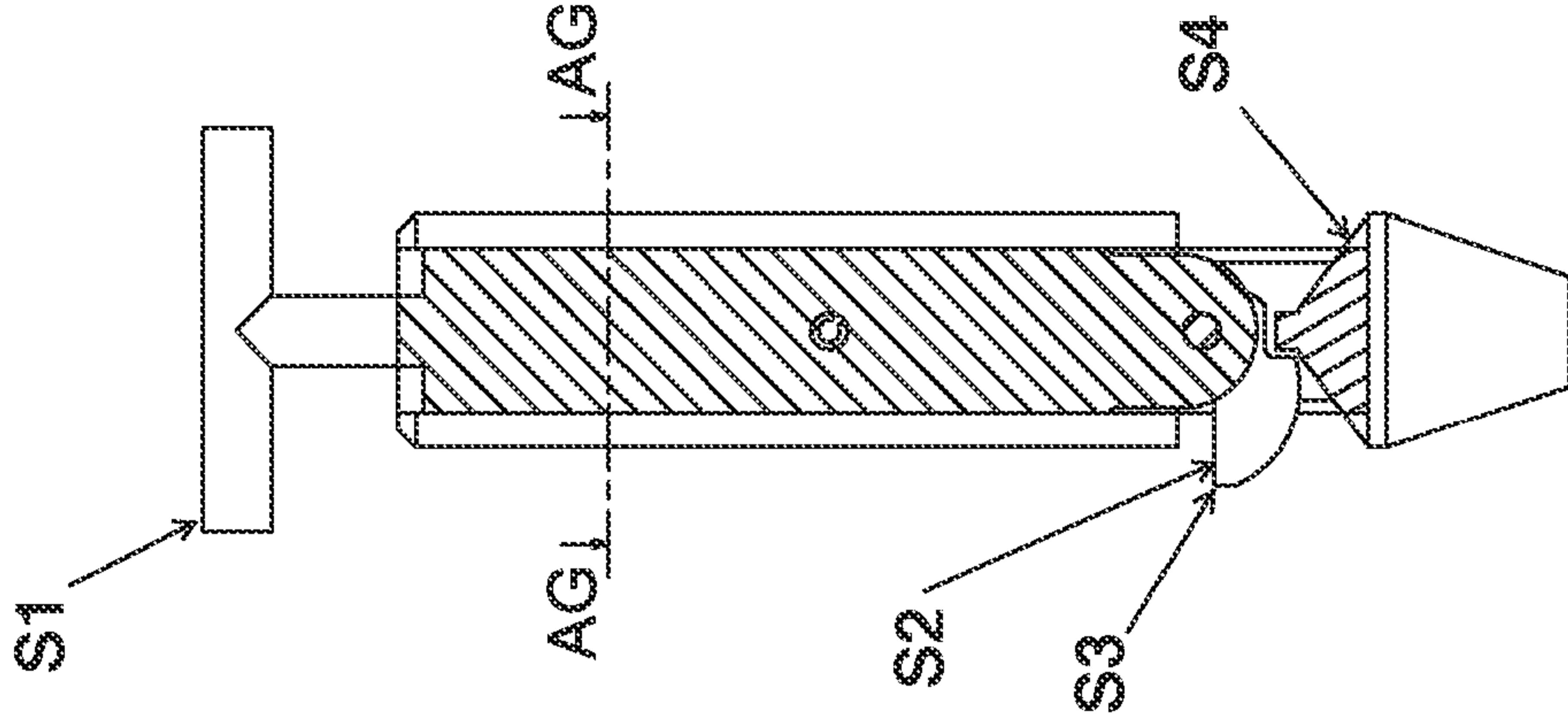
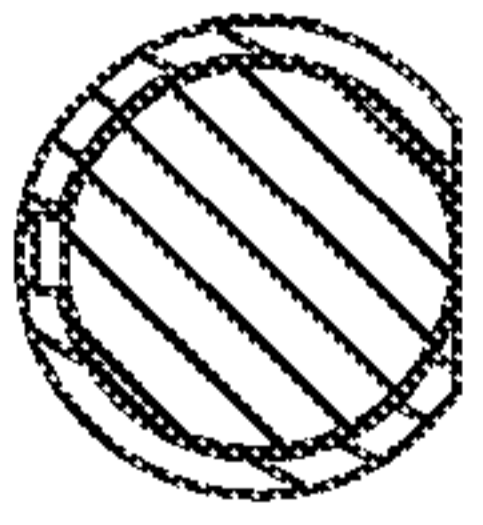
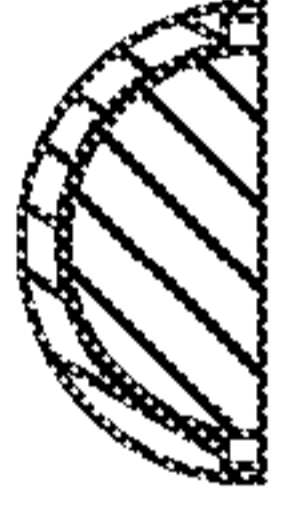


Figure 31C

AN-AN



AP-AP



AR-AR

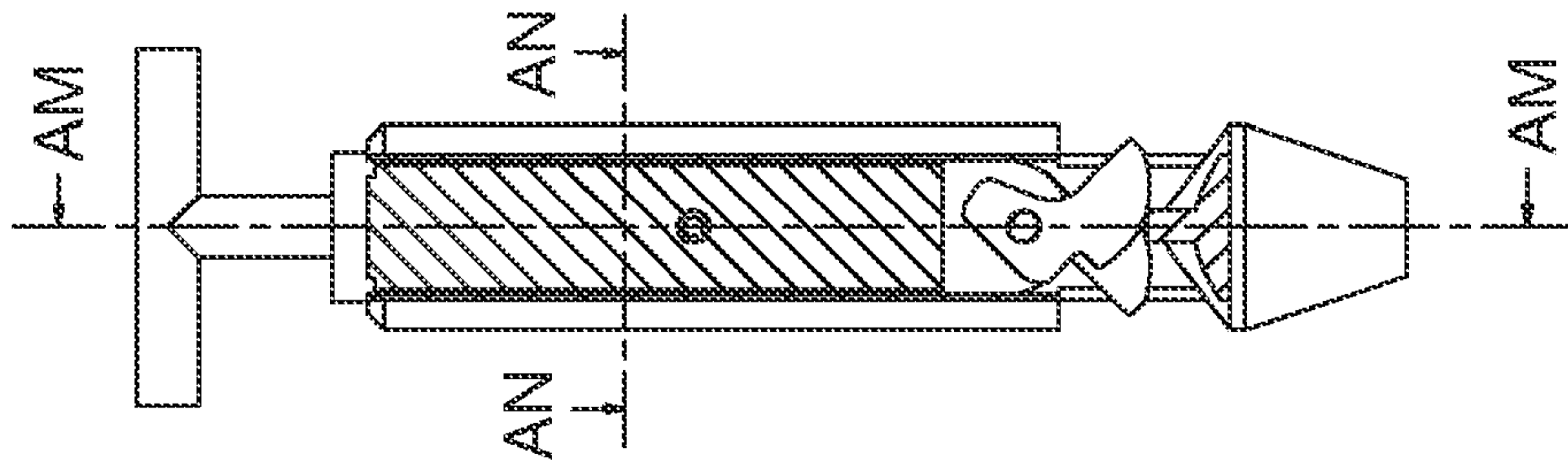
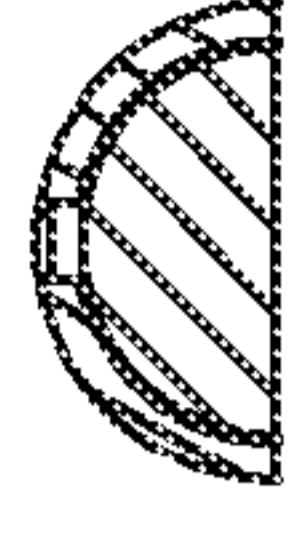


Figure 32A

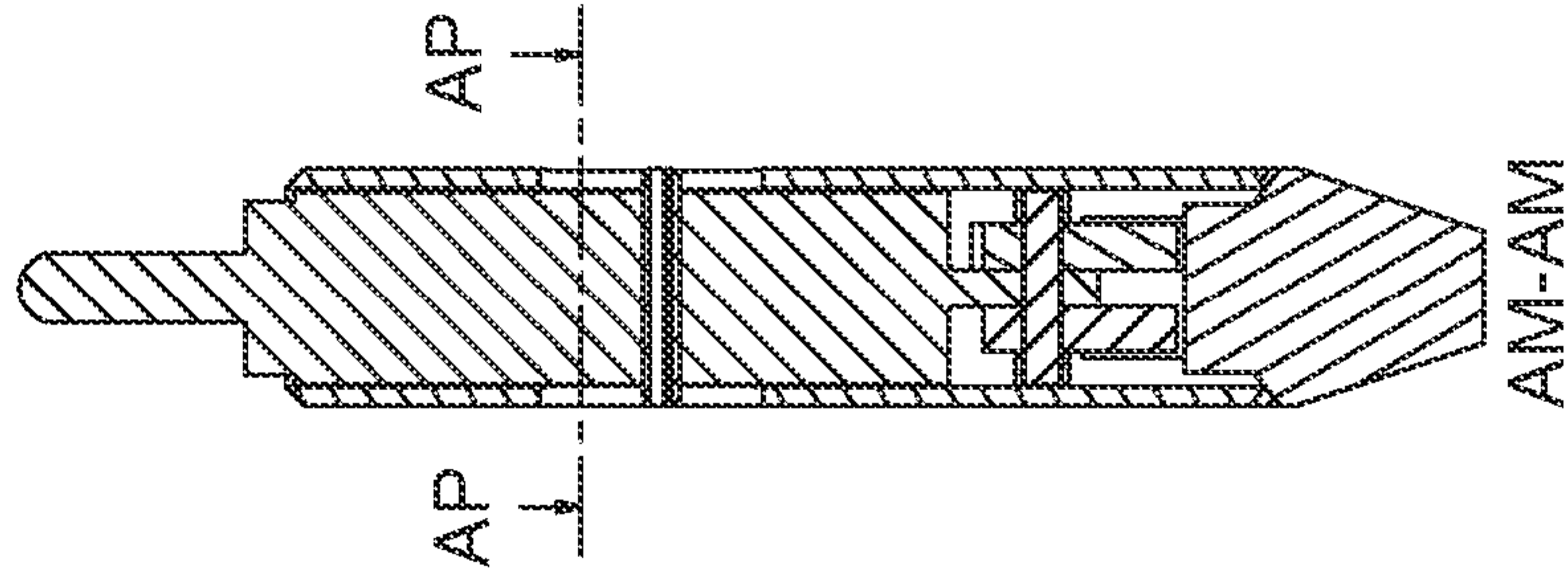


Figure 32B

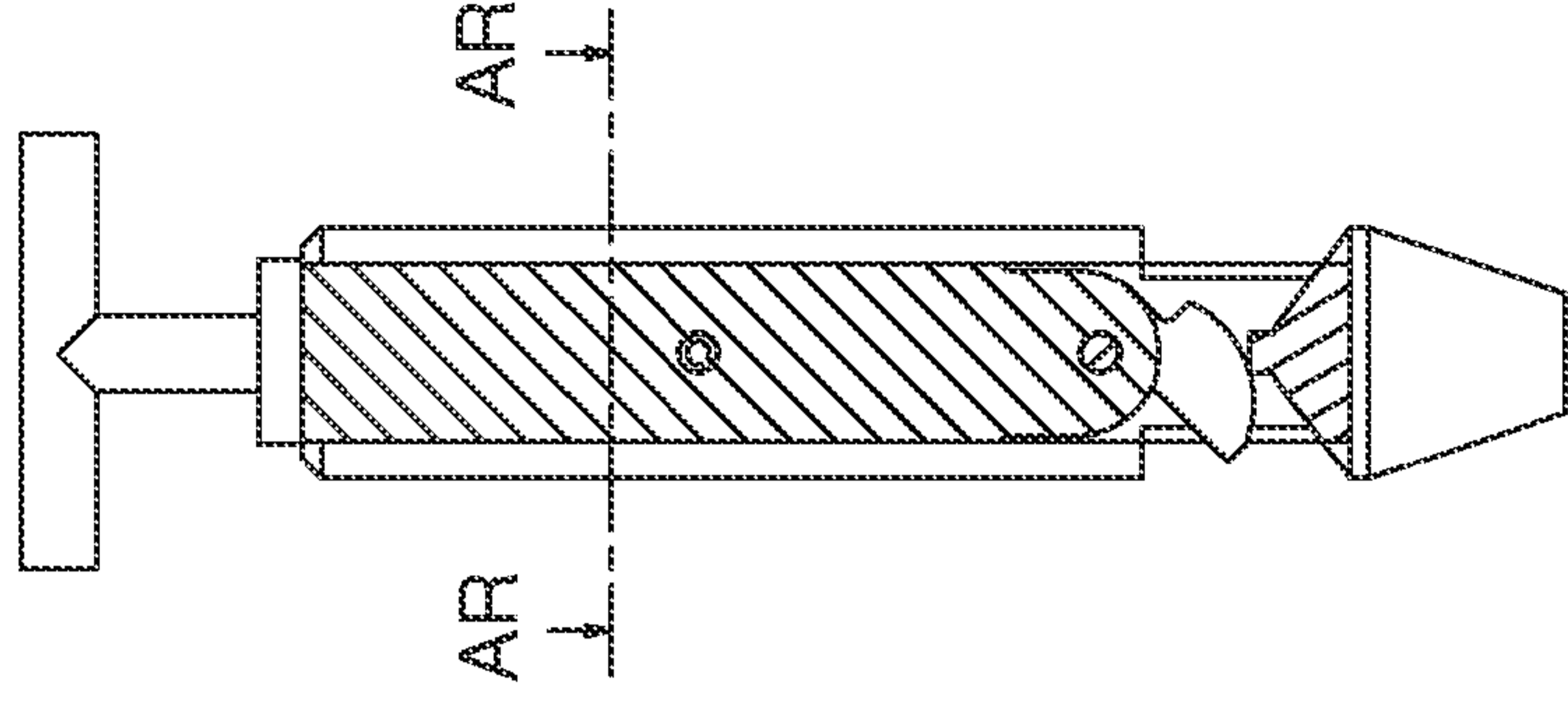


Figure 32C

AJ-AJ

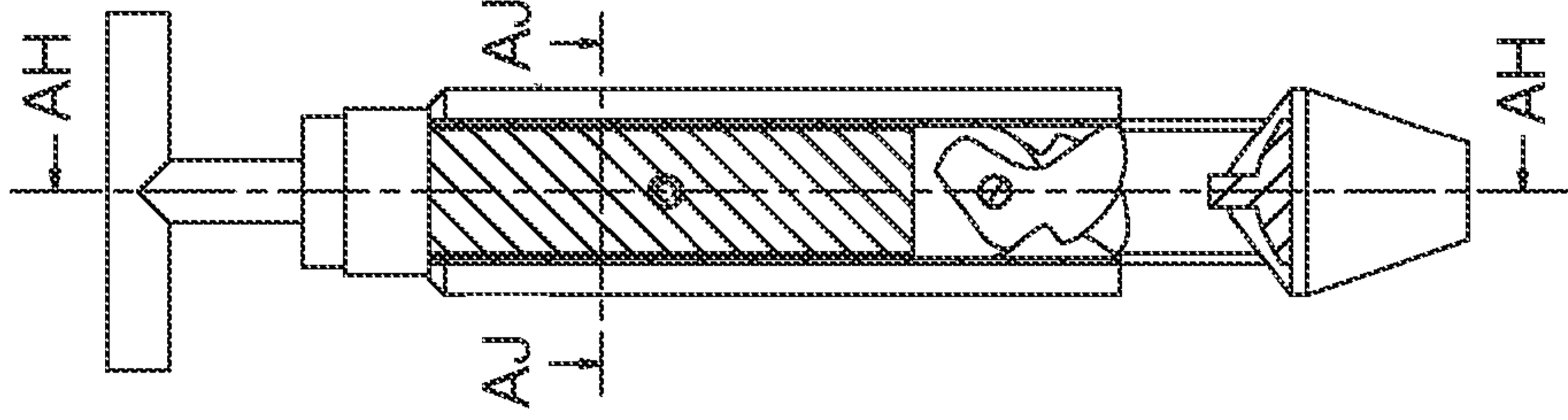
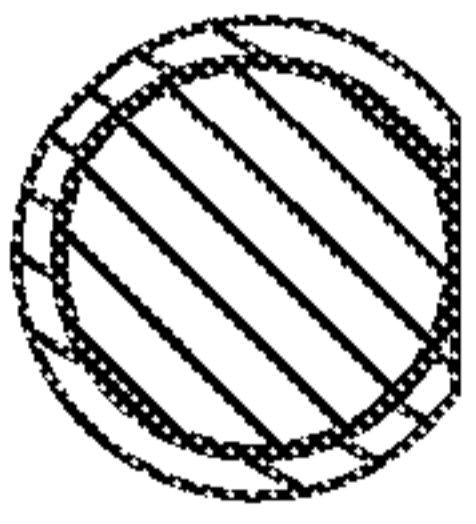


Figure 33A

AK-AK

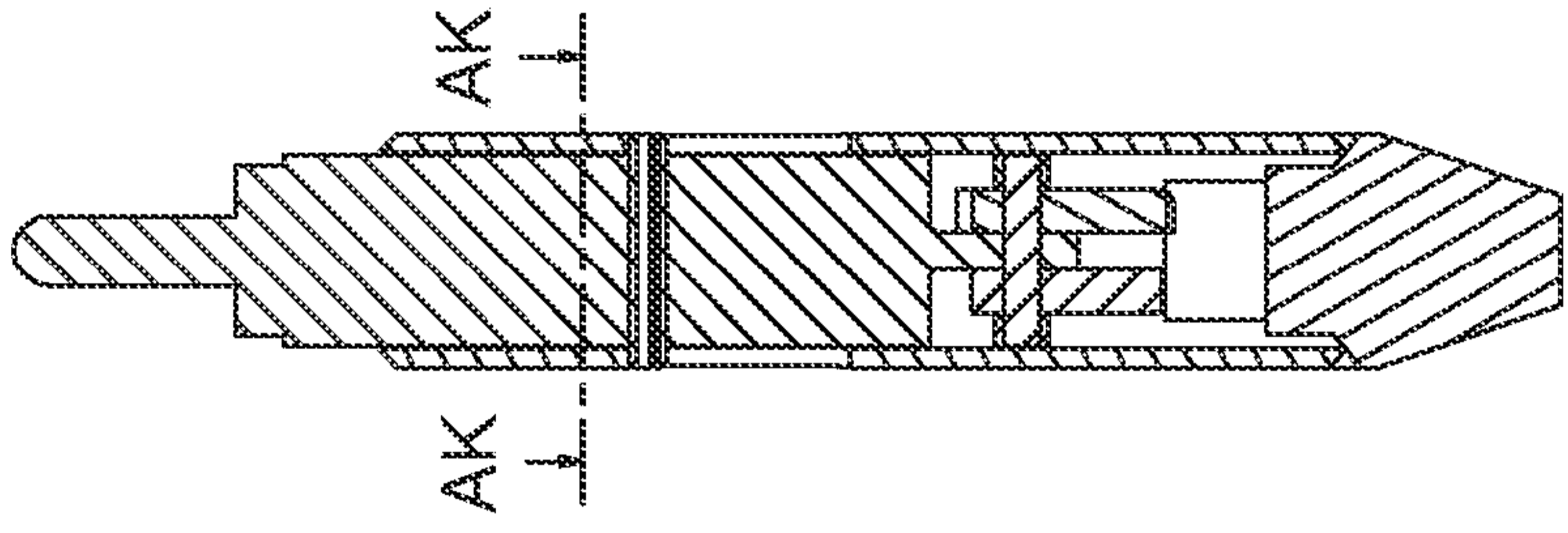
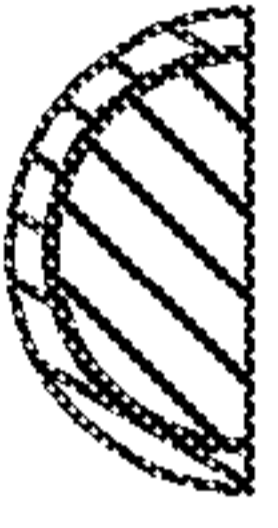


Figure 33B

AL-AL

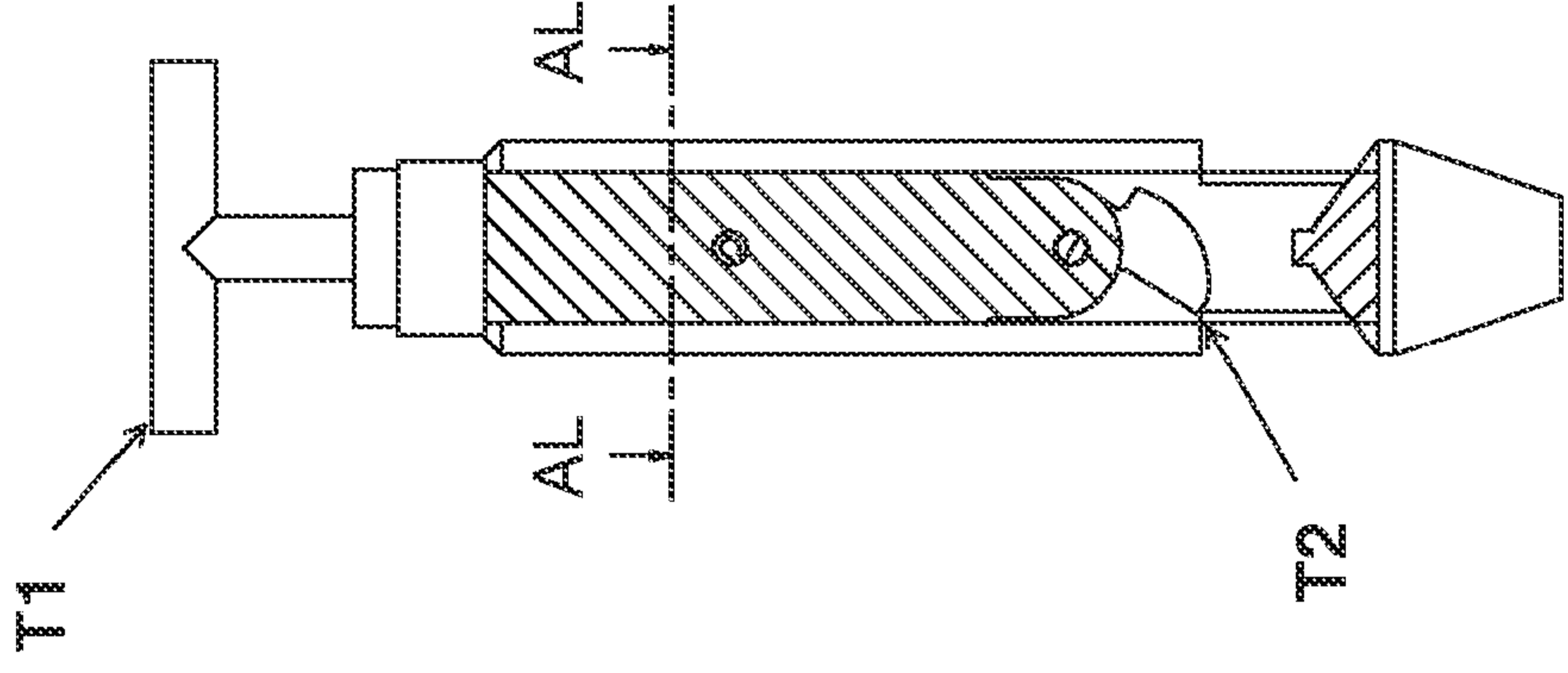
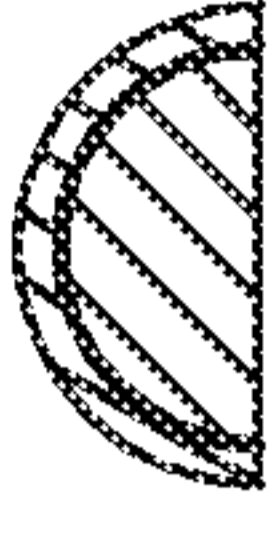


Figure 33C

A PROTECTION SYSTEM

The present invention relates generally to a protection system and particularly to a protection system with a locking mechanism for preventing two parts from separating.

5

According to an aspect of the present invention there is provided a protection system for use in a subsea environment, the system comprising a cocoon formed in a clamshell configuration and comprising two parts which allows it to move from a closed, protective, position to an open position, in which the system includes a primary locking mechanism and a secondary locking device, acting as a backup to the primary locking mechanism, for preventing two parts from separating, the locking device comprising a first locking pin and a second locking pin, the pins being receivable in receptacles in the parts, the device further comprising a bridge portion, the pins being provided on or by the bridge portion.

10
15

The pins may be the same or different axial lengths.

In some aspects and embodiments the secondary locking device is retrofittable to an existing cocoon. In some embodiments the pins may be receivable into pre-existing receptacles, for example ball grab receptacles.

20

The bridge portion may comprise a handle.

24 08 20

The relative position of the pins may be variable. For example relative separation and approach of the pins may be possible to accommodate different tolerances.

5 In some embodiments either or both of the pins may be slidably adjustable with respect to the bridge portion.

One of the pins may include a latching mechanism for retaining it in a receptacle. The latching pin may comprise a plunger. The latching mechanism may be generally linear.

10 The latch mechanism may be releasable by a deliberate axial withdrawal of the latching pin.

The latching pin may include a latch handle to allow it to be engaged/disengaged by a user and/or a remotely operate vehicle (ROV).

15 The latching mechanism may resist withdrawal of the pin when a load is applied to the bridge by the item. In other words, if the two parts of the item start to move relative to each other and apply a consequential load to the bridge, the bridge does not disengage the latch.

20 The latching pin may be shorter than the other pin. This allows the device to be easily fitted to the item.

The latch mechanism may comprise a pair of latch dogs. The latch dogs may be movable between a retracted position in which the pin can be withdrawn and a splayed position in which they prevent withdrawal of the pin.

- 5 The latch mechanism may include a generally conical shape for causing the latch dogs to splay when the pin is fully inserted in the receptacles.

The latch dogs may be symmetrically opposed.

- 10 The latch dogs may be rotatable relative to each other and to the pin.

The latching dogs and the conical shape may be shaped such that when the dogs are in the splayed position they are locked.

- 15 The latch pin may include means for indicating if it is in a latched or unlatched position. For example the latch pin may include a collar which is visible in the unlatched position and not visible in the latched position.

- The bridge portion may include one or more deflector plates for preventing snagging
20 on the pins.

The present invention also provides a subsea oilfield wellhead protection system comprising a system as described herein.

25

Different aspects and embodiments of the invention may be used separately or together.

Further particular and preferred aspects of the present invention are set out in the
5 accompanying independent and dependent claims. Features of the dependent claims may be combined with the features of the independent claims as appropriate, and in combination other than those explicitly set out in the claims.

The present invention will now be more particularly described, by way of example,
10 with reference to the accompanying drawings, in which:

Figure 1 is a perspective view of a subsea protection system to which locking devices formed in accordance with the present invention are applicable;

15 Figure 2 is a schematic representation of a system of the type shown in Figure 1 and shown in an open position;

Figure 3 is a schematic representation of the system of Figure 2 shown in a closed position;

20

Figure 4 is a side view of a locking mechanism formed in accordance with the present invention;

Figure 5 is a side view of the mechanism of Figure 4 shown with a sliding locking pin
25 moved with respect to a base compared to Figure 4;

Figure 6 is a perspective view of the mechanism of Figure 4;

Figure 7 is a perspective view of the mechanism of Figure 6 turned 180 degrees;

5

Figure 8 is a side view of the mechanism of Figure 7;

Figure 9 is a plan view of the mechanism of Figure 7;

10 Figure 10 is a perspective view of a bridge or base plate component forming part of the mechanism of Figures 4 to 9;

Figure 11 is a plan view of the bridge of Figure 10;

15 Figure 12 is a side view of the bridge of Figure 10;

Figure 13 is a side view of a sliding pin forming part of the mechanism of Figures 4 to 9;

Figure 14 is a plan view of the pin of Figure 13;

20

Figure 15 is an exploded side view of the sliding pin of Figure 13;

Figure 16 is a perspective view of the pin of Figure 15;

Figure 17 is a side view of a latching pin housing forming part of the latching pin of the mechanism of Figures 4 to 9;

Figure 18 is a side view showing the pin of Figure 17 rotated 90 degrees;

5

Figure 19 is a section taken along line AU of Figure 17;

Figure 20 is a magnified view of the region AT of Figure 18;

10 Figure 21 is a magnified view of the lower end of the pin of Figure 17 shown removed for clarity;

Figure 22 is an exploded view of a latching assembly forming part of the latching pin of the mechanism of Figures 4 to 9;

15

Figure 23 is a side view of a latching pin handle assembly forming part of the latching assembly of Figure 22;

Figure 24 is a side view showing the assembly of Figure 23 rotated 90 degrees;

20

Figure 25 is a magnified view of the region AA of Figure 25;

Figure 26 is a magnified view of the region AB of Figure 25;

Figure 27 is a perspective view of a latching dog forming part of the assembly of Figure 22;

Figure 28 is a side view of the dog of Figure 27;

5

Figure 29 is a plan view of the dog of Figure 27;

Figure 30 shows a pair of dogs of the type shown in Figures 27 to 29 in use;

10 Figure 31A, B and C show the latching assembly in a fully engaged position;

Figure 32A, B and C show the latching assembly in a partially engaged position; and

Figure 33A, B and C show the latching assembly in a disengaged position.

15

Example embodiments are described below in sufficient detail to enable those of ordinary skill in the art to embody and implement the systems and processes herein described. It is important to understand that embodiments can be provided in many alternate forms and should not be construed as limited to the examples set forth herein.

20

Accordingly, while embodiments can be modified in various ways and take on various alternative forms, specific embodiments thereof are shown in the drawings and described in detail below as examples. There is no intent to limit to the particular forms disclosed and as well as individual embodiments the invention is intended to

25

cover combinations of those embodiments as well. On the contrary, all modifications, equivalents, and alternatives falling within the scope of the appended claims should be included. Elements of the example embodiments are consistently denoted by the same reference numerals throughout the drawings and detailed description where
5 appropriate.

The terminology used herein to describe embodiments is not intended to limit the scope. The articles “a,” “an,” and “the” are singular in that they have a single referent; however, the use of the singular form in the present document should not preclude
10 the presence of more than one referent. In other words, elements referred to in the singular can number one or more, unless the context clearly indicates otherwise. It will be further understood that the terms “comprises,” “comprising,” “includes,” and/or “including,” when used herein, specify the presence of stated features, items, steps, operations, elements, and/or components, but do not preclude the presence or
15 addition of one or more other features, items, steps, operations, elements, components, and/or groups thereof.

Unless otherwise defined, all terms (including technical and scientific terms) used herein are to be interpreted as is customary in the art. It will be further understood
20 that terms in common usage should also be interpreted as is customary in the relevant art and not in an idealized or overly formal sense unless expressly so defined herein.

Figures 1 to 3 illustrate a protection system 10 for use in a subsea environment to protect oilfield equipment. Subsea wellheads are vulnerable to fishing net systems and
25 dropped objects from oilfield vessels working overhead. Fishing nets caught on

wellheads can cause significant damage, danger and potential harm to life and the environment.

5 Manufactured from advanced FRP building materials, the system is lightweight, ensuring simple offshore installation and through life intervention. It is highly corrosion resistant, making it ideal for harsh marine environments.

10 An upper part 12, or cocoon, of the system is designed as a skeletal “clam” with a smooth external surface ensuring fishing gear is deflected or easily released if snagged. A lower part 14, or shroud, forms the base of the structure, penetrating the seabed.

15 The system is placed over wellheads providing complete protection from trawler net incidents and safety of the marine environment. The system can deflect nets and shields wellheads.

The upper part 12 is formed in a clamshell configuration, and comprises two parts 16, 18 which allows it to move from a closed, protective, position (Figure 3) to an open position (Figure 2) to allow access to the wellhead 20.

20 The upper part 12 is provided with equatorial latch pins 22 which, when in the closed position, provide restraint against relative movement of the halves 16, 18 in the vertical direction (one half to another) and horizontal direction (perpendicular to the hinged opening direction).

In some embodiments the present invention provides a secondary latching mechanism to supplement the equator pins and, for example, to provide restraint against the halves being pulled directly apart.

5 Figures 4 to 9 show a locking device generally indicated 30. In Figures 4, 5, 6 and 8 the device 30 is shown engaged in ball grab receptacles 35, 40. In Figures 7 the device 30 is shown removed from the receptacles for clarity.

The receptacles 35, 40 are in this embodiment existing mechanical fixing points
10 provided on a structure. In other embodiments the receptacles may be purpose-fitted.

A device 30 comprises a first, shorter pin 45 and a second, longer pin 50. The pins 45, 50 are carried on a handle 55 which is also shown in Figures 10 to 12 separated from the remainder of the device for clarity.

15 The handle 55 comprises a generally oval plate 56 having at each arm its curved ends a depending semi-circular skirt 57, 58. The end of the plate with the skirt 57 includes an elongated slot 59 which receives the pin 50. The end of the plate having the skirt 58 includes a circular hole 60 for receiving the pin 45.

20 The semi-circle section of the plate 56 comprises a pair of spaced upstanding transverse walls 61, 62. At each end of the plate, beyond the walls 61, 62 a pair of spaced upstanding curved walls 63a, 63b, 64a, 64b extend either side of the slot 59 and the slot 60 respectively.

25

Within the semi-circle section of the plate a pair of upturned arch-shaped plates 65a, 65b, are upstanding and extend between the walls 61, 62.

5 A pull handle 67 extends longitudinally between the plates 61, 62 and is flanked by the plates 65a, 65b.

The configuration of the plate 30 is such that in use the heads of the pins are shielded to prevent snagging of fishing nets and the like.

10 Figures 13 to 16 show the longer, fixed pin 50. The pin 50 is slide able in the slot 59 to allow the device to take up tolerances in distances between the receptacles 40, 35.

Figures 17 to 20 show a latching pin housing 46 forming part of the latch pin 45. The housing 46 comprises a generally tubular main body 47 having at one end a pair of depending legs 48 which carry a domed pin 48 the purpose of which is described in more detail below. Figures 22 to 26 show a latching pin handle assembly 70 which fits within the housing 46.

Figures 27 to 30 show the latching dogs which form part of the assembly 70. The dogs 75, 76 are shown engaged in Figure 30 having been splayed outwardly due to the domed section 49 of the pin 48. This causes an axial latching and means that if a load is applied on the plate 55 due to relative movement of shell halves carrying the ball grab receptacles 35, 40, or by action of a fishing net or similar, the upper surfaces 75a, 76a of the dogs 75, 76 engage the end of the receptacle 40 to prevent axial withdrawal. This locked state is shown in Figures 31a to 31c.

25

In order to release the latch mechanism a deliberate and straight axial lift of the handle assembly 70 must be affected by a user. This causes the assembly 70 to be lifted through the housing 46 because the dogs 75, 76 lift off the surface 49 and rotate as shown in Figures 32a to 32c and 33a to 33c.

5

The symmetrically opposed dogs can rotate relative to each other and to the pin. If the handle 70 is pushed down the dogs are pushed onto the conical dome section which forces them out. The dogs include cut out sections which engage on a central raised sections at the centre of the dome to ensure that the latching mechanism can only be
10 disengaged by vertical movement of the latching pin.

15

Although illustrative embodiments of the invention have been disclosed in detail herein, with reference to the accompanying drawings, it is understood that the invention is not limited to the precise embodiments shown and that various changes and modifications can be effected therein by one skilled in the art without departing from the scope of the invention as defined by the appended claims and their equivalents.

KEY

Figure 4

A: ± 10 MM VERTICAL TOLERANCE

5

Figure 5

B: SLIDING PIN ALLOWS FOR 0-46mm HORIZONTAL TOLERANCES

Figure 6

10 C1: SECONDARY LOCKING MECHANISM TO BE INSERTED INTO EXISTING
BALL GRAB RECEPTACLES

C2: ANTI-VIBRATION WASHER TO PROVIDE RESISTANCE TO VIBRATION AND
LOOSENING. BOLT CAN BE REMOVED IN THE EVENT OF JAMMING
PROVIDING EMERGENCY RELEASE FEATURE.

15

Figure 7

D: LATCHING PIN TO BE WELDED TO TOP FACE OF BASE PLATE

Figure 8

20 E1: CURVED FAIRINGS TO ENSURE SLM IS OVER TRAWLABLE

E2: SLM HANDLE EASILY ACCESSIBLE BY ROV MANIPULATOR AND DIVER

E3: SKIRTS TO ENSURE SLM IS NON SNAGABLE BY PRIMARY WARPS WHILST
ENABLING ± 10 mm VERTICAL TOLERANCE

E4: SLIDING PIN LONGER THAN LATCHING PIN TO FACILITATE EASY

25 LOCATING OF SLM INTO BALL GRAB RECEPTACLES

Figure 9

F: BASE PLATE TO BE WELDED AS SHOWN. 7MM WELD SIZE

5 Figure 15

G1: ANTI-VIBRATION WASHER

G2: SHOULDER TO PREVENT PIN FALLING INTO COCOON IN THE EVENT OF AN EMERGENCY RELEASE

G3: HDPE WASHERS TO ASSIST IN SMOOTH PIN SLIDING

10 G4: M16 BOLT

Figure 18

H: SLOT MACHINED IN LATCHING PIN HOUSING FOR CENTRALISATION OF LATCHING PIN

15

Figure 20

I: 7MM X 7MM WELD

Figure 21

20 J1: RAISED SECTION TO SECURE LATCHING DOGS IN THE EVENT OF UPLIFT FORCES, THIS ENSURES LATCHING MECHANISM CAN ONLY BE RELEASED BY VERTICAL MOVEMENT OF HANDLE

J2: DOMED SECTION TO ENSURE LATCHING DOGS ENGAGE OUTWARDS

25

Figure 22

K1: 19MM ROUND BAR TO ENSURE LATCHING PIN HANDLE IS ROV ACCESSIBLE

5 K2: 5mm THINNER TURNED AND COLOURED SECTION TO INDICATE ENGAGED POSITION

K3: DRILLED HOLE FOR COTTER PIN ASSEMBLY

K4: CUT OUT SECTION IN LOCKING DOGS TO ENSURE ONLY VERTICAL MOVEMENT OF HANDLE CAN DISENGAGE THE LATCHING MECHANISM

10 K5: LOOSE FIT ON PIN TO ENABLE SMOOTH ENGAGEMENT OF LOCKING DOGS

K6: HDPE WASHER ON EITHER SIDE OF PIN TO ENSURE DOGS REMAIN CENTRED

K7: DUPLEX COTTER PIN TO ENSURE CENTRALISATION OF LATCHING PIN

15 Figure 23

L: HOLE TO BE DRILLED FOR COTTER PIN, THIS ENSURES CENTRALISATION OF LATCHING PIN

Figure 25

20 M: 5mm WELDS

Figure 26

N: LATCHING PIN TO BE MANUFACTURED FROM SOLIDA STEEL, 9.5mm ROUND BAR TO BE WELDED

25

Figure 30

P: CUT OUT SECTIONS TO ENSURE LATCHING MECHANISM CAN ONLY BE DISENGAGED BY VERTICAL MOVEMENT OF THE LATCHING PIN

5 Figure 31B

Q1: COTTER PIN TO BE FLUSH WITH PIN HOUSING TO PREVENT SNAGGING ON BALL GRAB RECEPTACLES

Q2: COTTER PIN PREVENTS LATCHING PIN FROM TRAVELLING BELOW DESIRED POINT OF COMING OUT OF PIN HOUSING

10

Figure 31C

S1: LATCHING MECHANISM ENGAGED USING ROV COMPATIBLE HANDLE

S2: CURVED LOCKING DOGS TO ALLOW FOR SMOOTH ENGAGING AND DISENGAGING

15 S3: LOCKING DOGS SHAPE ENSURES DOGS CAN ONLY OPEN IN DESIRED DIRECTION

S4: DOMED PIN TO ENSURE LOCKING DOGS ENGAGE OUTWARD

Figure 33c

20 T1: LATCHING PIN IN DISENGAGED POSITION

T2: LOCKING DOGS EASILY ABLE TO FIT INSIDE LATCHING TUBE

CLAIMS

1. A protection system for use in a subsea environment, the system comprising a cocoon formed in a clamshell configuration and comprising two parts which
5 allows it to move from a closed, protective, position to an open position, in which the system includes a primary locking mechanism and a secondary locking device, acting as a backup to the primary locking mechanism, for preventing the two parts from separating, the locking device comprising a first locking pin and a second locking pin, the pins being receivable in receptacles in
10 the parts, the device further comprising a bridge portion, the pins being provided on or by the bridge portion.
2. A system as claimed in claim 1, in which the pins are different axial lengths.
- 15 3. A system as claimed in any preceding claim, in which the pins are receivable in ball grab receptacles.
4. A system as claimed in any preceding claim, in which the bridge portion comprises a handle.
- 20 5. A system as claimed in any preceding claim, in which the relative position of the pins is variable.
- 25 6. A system as claimed in claim 5, in which either or both of the pins is slidably adjustable with respect to the bridge portion.

7. A system as claimed in any preceding claim, in which one of the pins includes a latching mechanism for retaining it in a receptacle.
- 5 8. A system as claimed in claim 7, in which the latching pin comprises a plunger.
9. A system as claimed in claim 7 or claim 8, in which the latching mechanism is generally linear.
- 10 10. A system as claimed in any of claims 7 to 9, in which the latch mechanism is releasable by a deliberate axial withdrawal of the latching pin.
11. A system as claimed in any of claims 7 to 10 in which the latching pin includes a latch handle.
- 15 12. A system as claimed in any of claims 7 to 11, in which the latching pin is shorter than the other pin.
13. A system as claimed in any of claims 7 to 12, in which the latch mechanism
- 20 comprises a pair of latch dogs.
14. A system as claimed in 13, in which the latch dogs are movable between a retracted position in which the pin can be withdrawn and a splayed position in which they prevent withdrawal of the pin.

25

15. A system as claimed in claim 14, in which the latch mechanism includes a generally conical shape for causing the latch dogs to splay when the pin is fully inserted in the receptacles.
- 5 16. A system as claimed in any of claims 13 to 15, in which the latch dogs are symmetrically opposed.
17. A system as claimed in any of claims 13 to 16, in which the latch dogs are rotatable relative to each other and to the latch pin.
- 10 18. A system as claimed in any of claims 13 to 17, in which the latching dog and the conical shape are shaped such that when the dogs are in the splayed position they are locked.
- 15 19. A system as claimed in any of claims 7 to 18, in which the latch pin includes means for indicating if it is in a latched or unlatched position.
20. A system as claimed in claim 19, in which the latch pin includes a collar which is visible in the unlatched position and not visible in the latched position.
- 20 21. A system as claimed in any preceding claim, in which the bridge portion includes one or more deflector plates for preventing snagging on the pins.
22. A system as claimed in any preceding claim, in which the cocoon comprises an upper part and the system further comprises a lower part.
- 25

23. A subsea oilfield wellhead protection system comprising a system as claimed in any preceding claim.

5

10

24 08 20