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(54) **LOW IMPEDANCE GROUNDING ELECTRODE WITH UNIVERSAL CONNECTIONS AND RAPID ACCESS CAP**

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H05K 5/02 (2006.01)

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(58) **Field of Classification Search** **174/6, 7, 174/40 CC, 51, 78; 439/92, 98, 426, 100; 361/753, 799**

See application file for complete search history.

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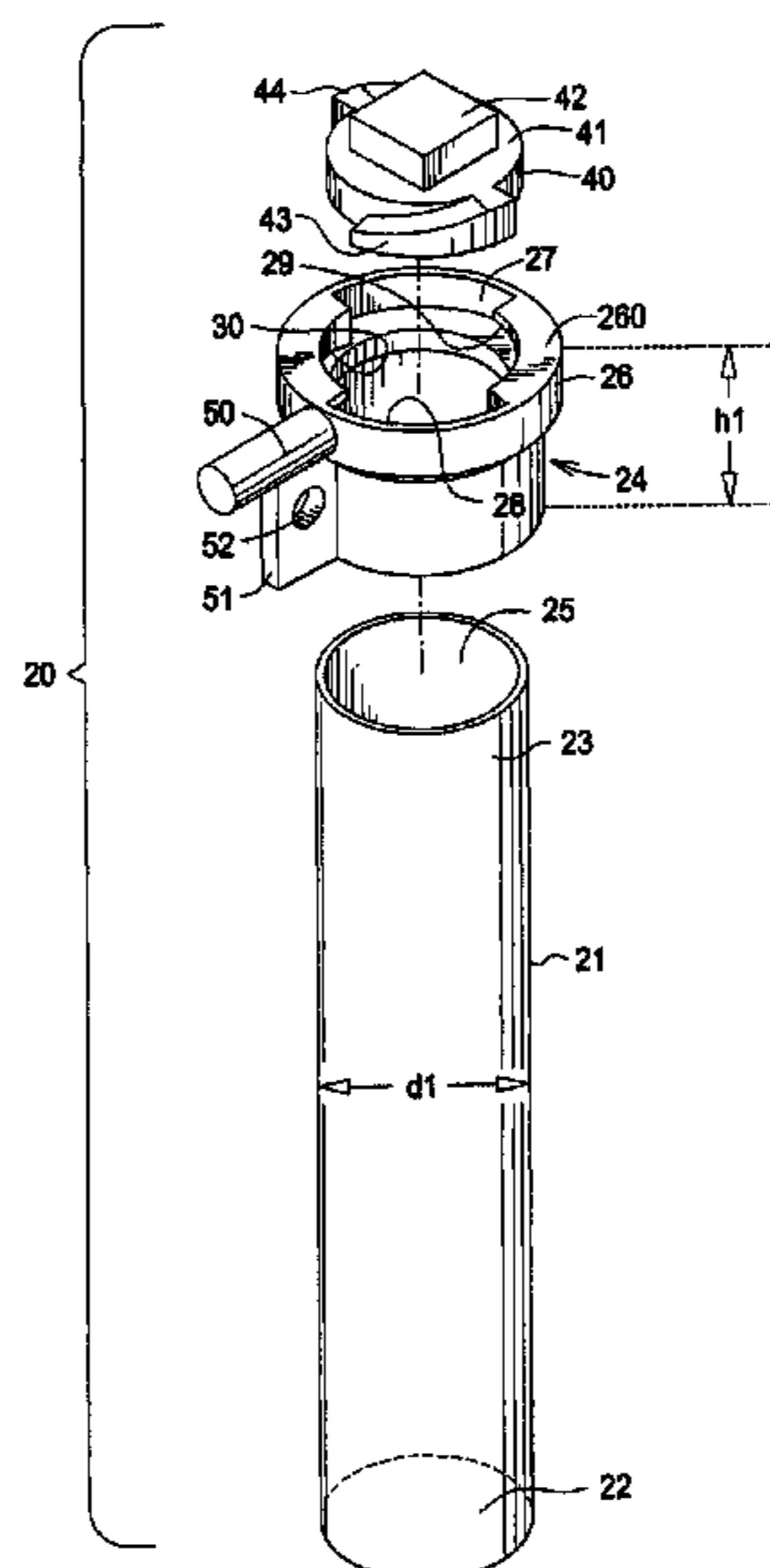
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(57) **ABSTRACT**

An all stainless steel grounding electrode uses a coating of stainless steel for an upper collar which has a dual purpose cable connector. The cable connector can accommodate a cable lug and bolt connection or a cad weld connection. A cap for the collar has a one quarter turn dual heavy duty thread set to prevent corrosion from locking up the cap. An osmotic material is placed and replaced in the grounding electrode via the cap.

26 Claims, 7 Drawing Sheets



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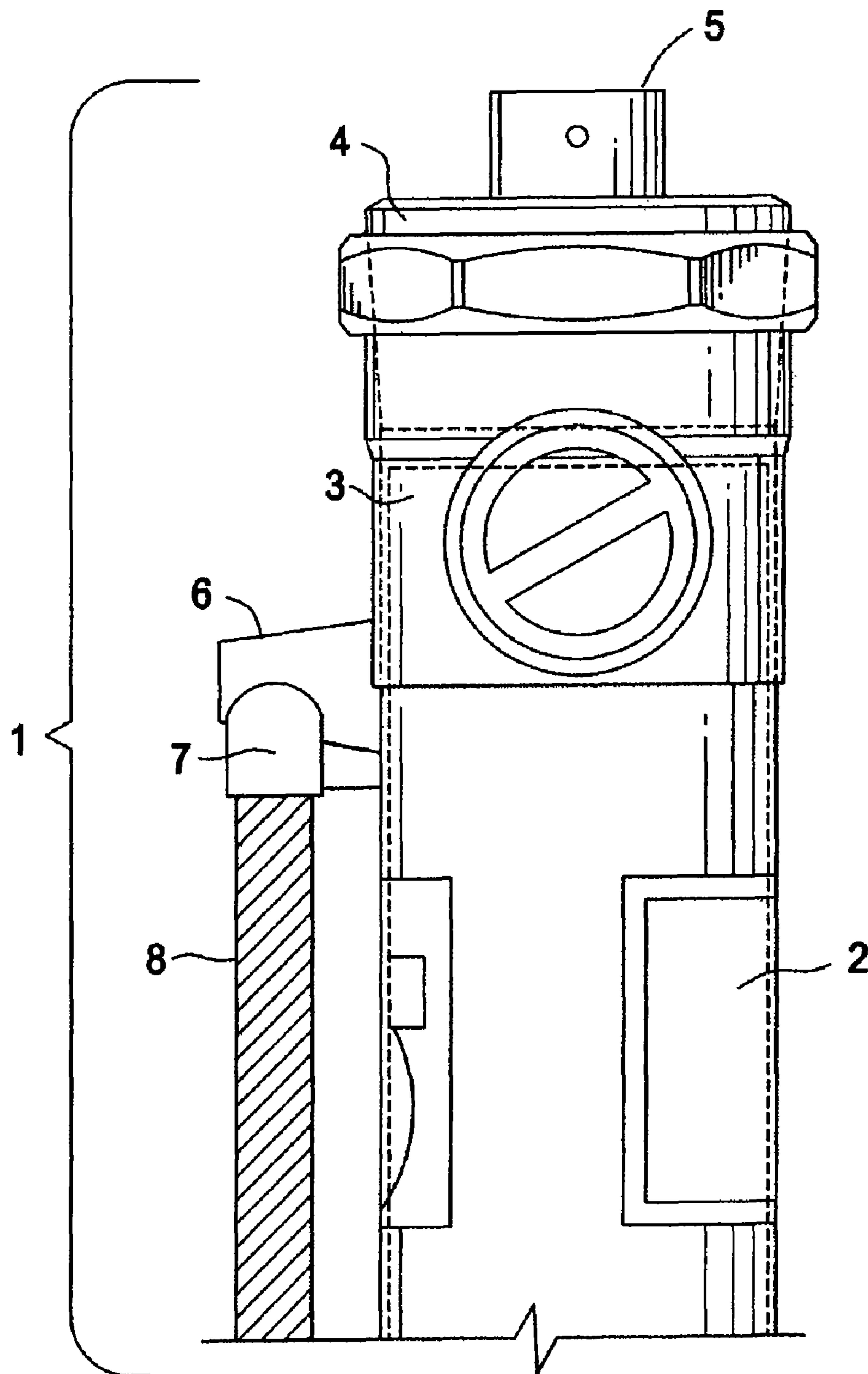


FIG. 1
(PRIOR ART)

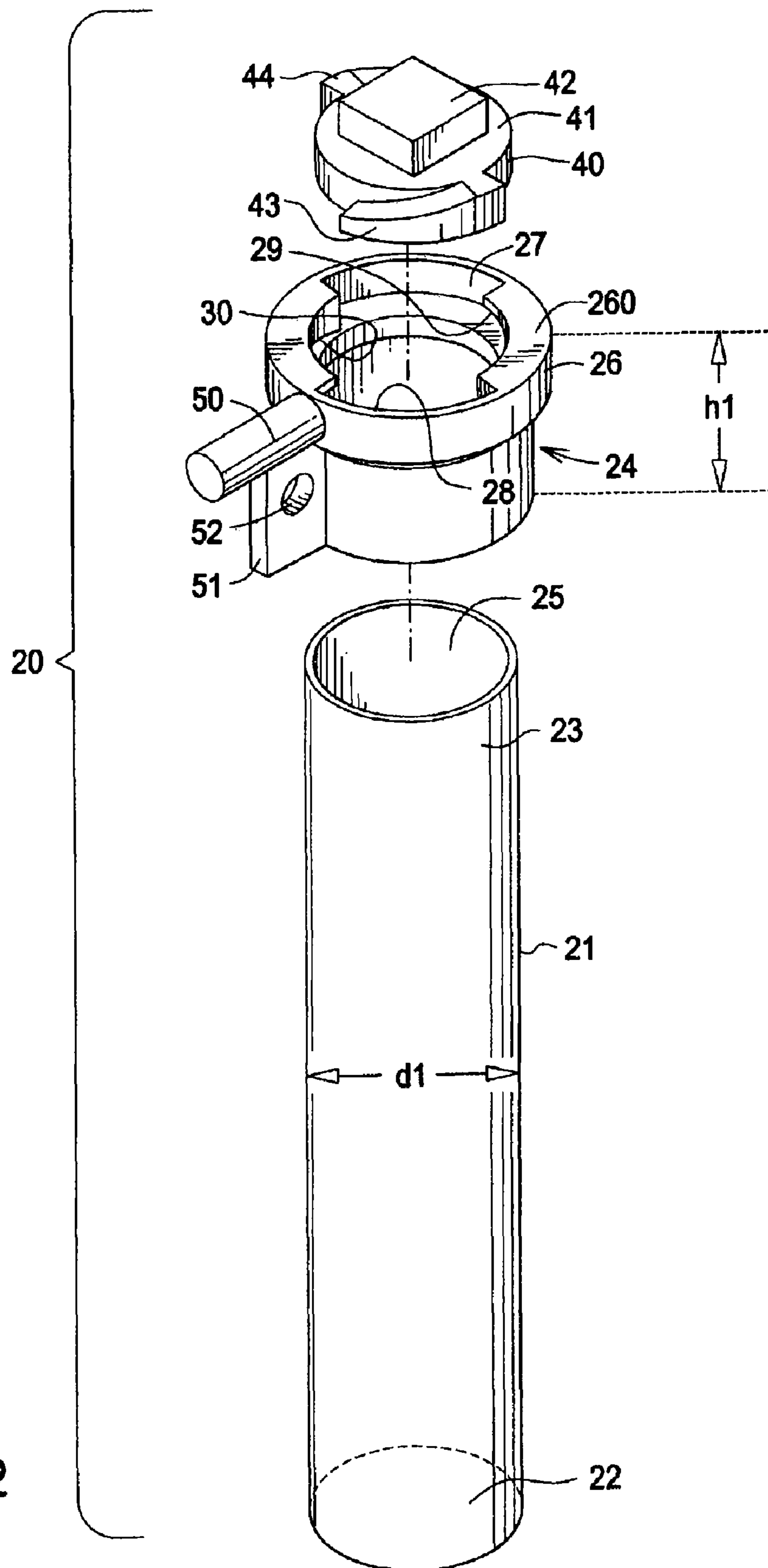


FIG.2

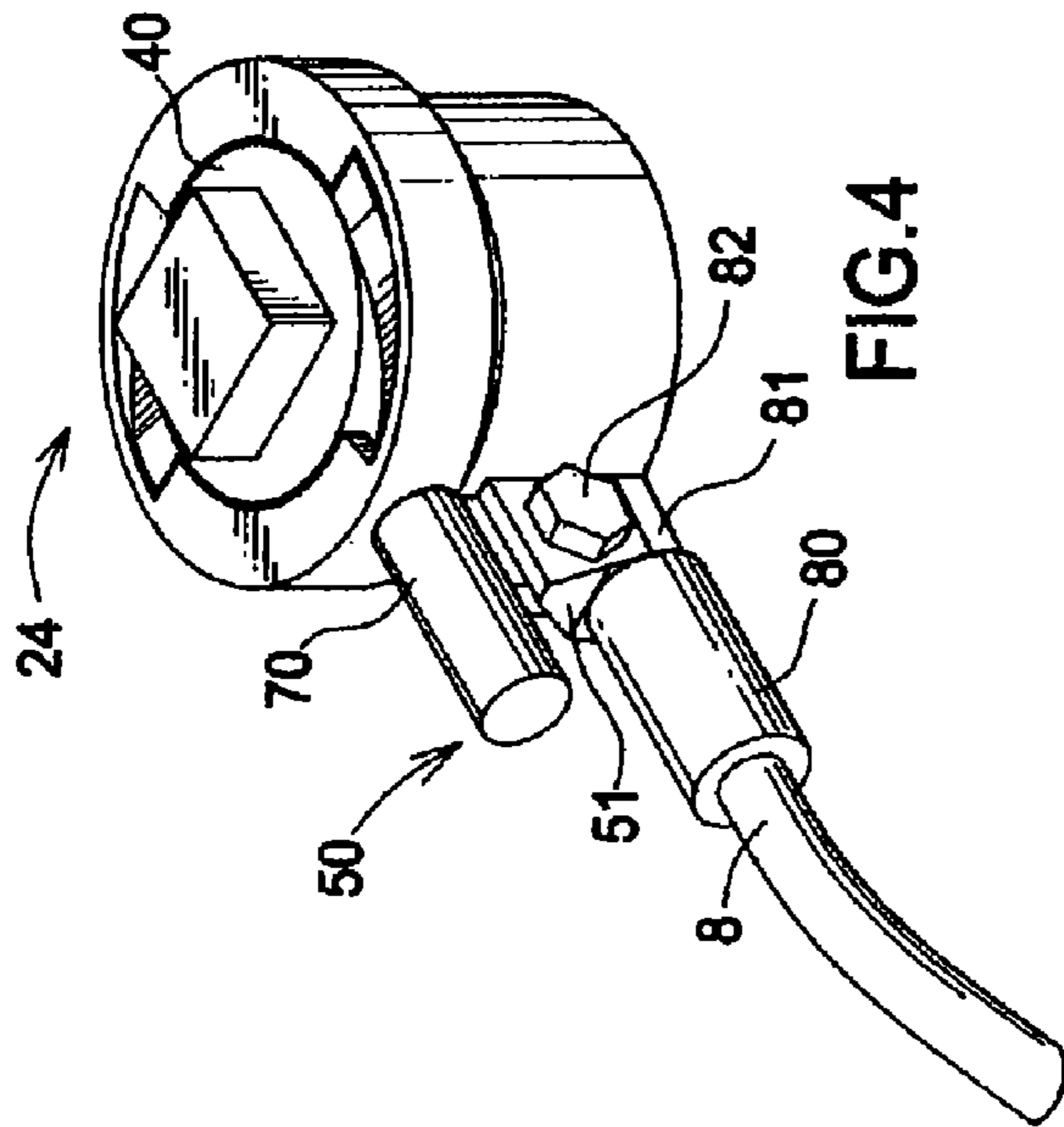


FIG. 4

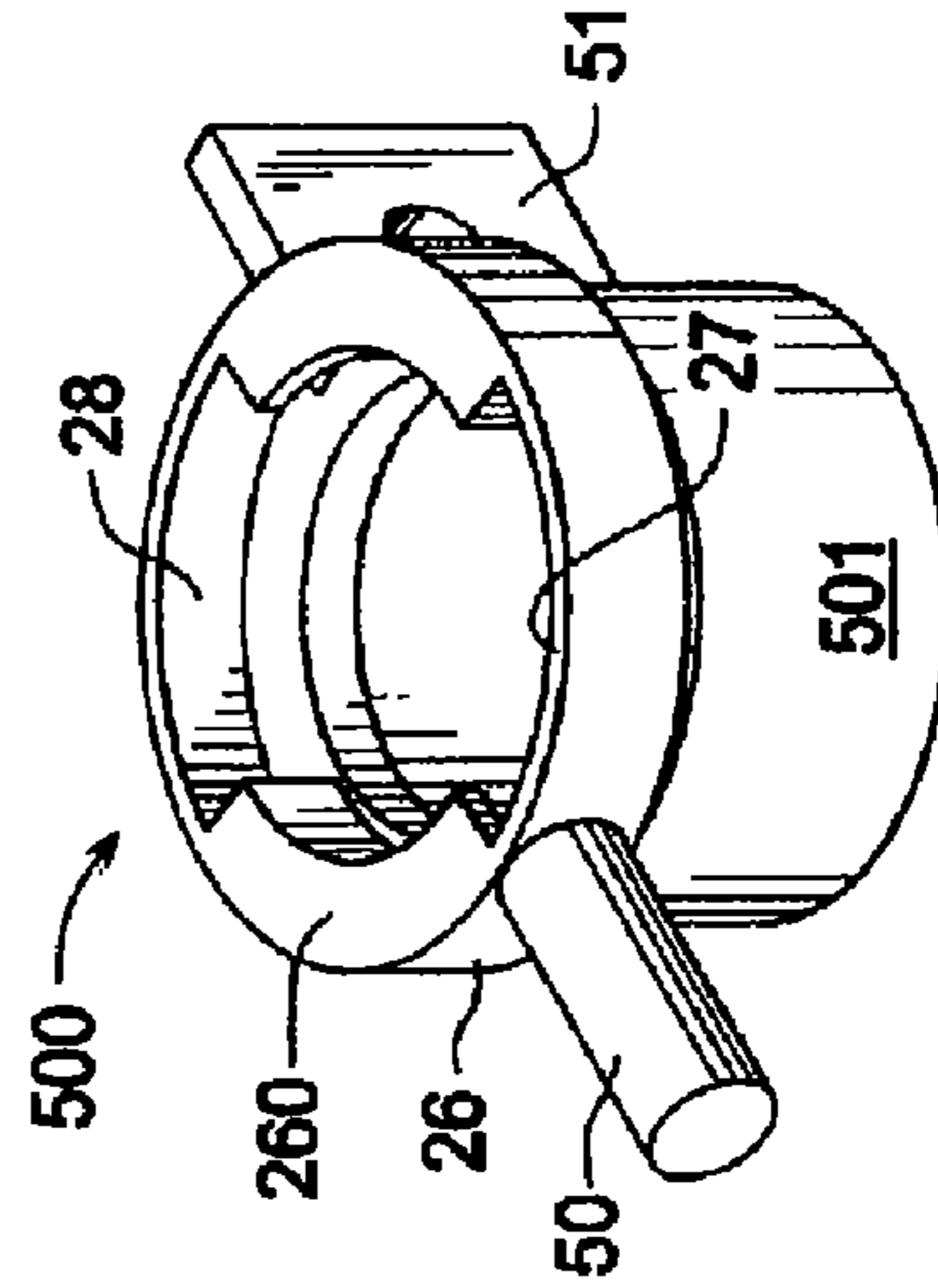


FIG. 6

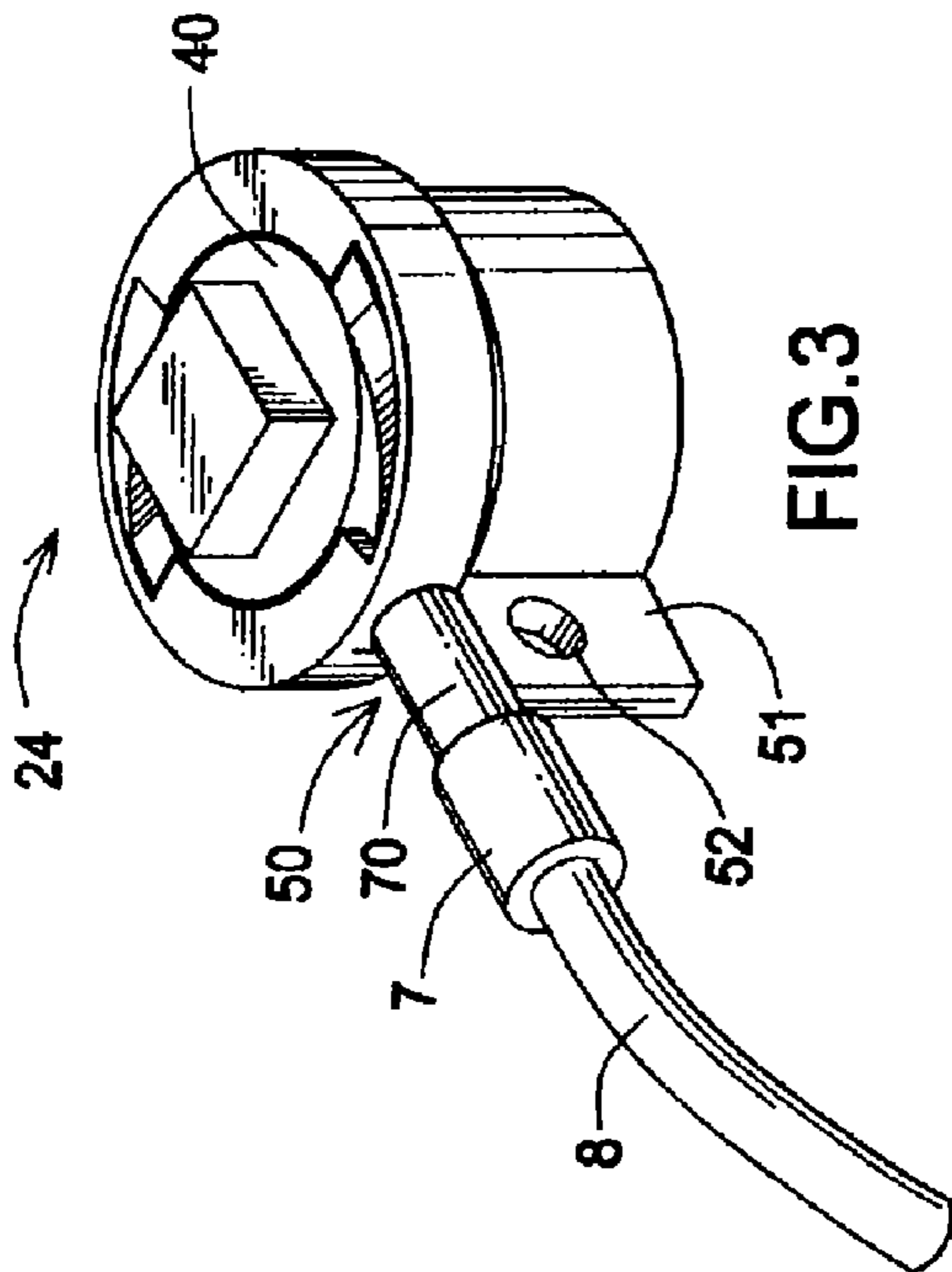


FIG. 3

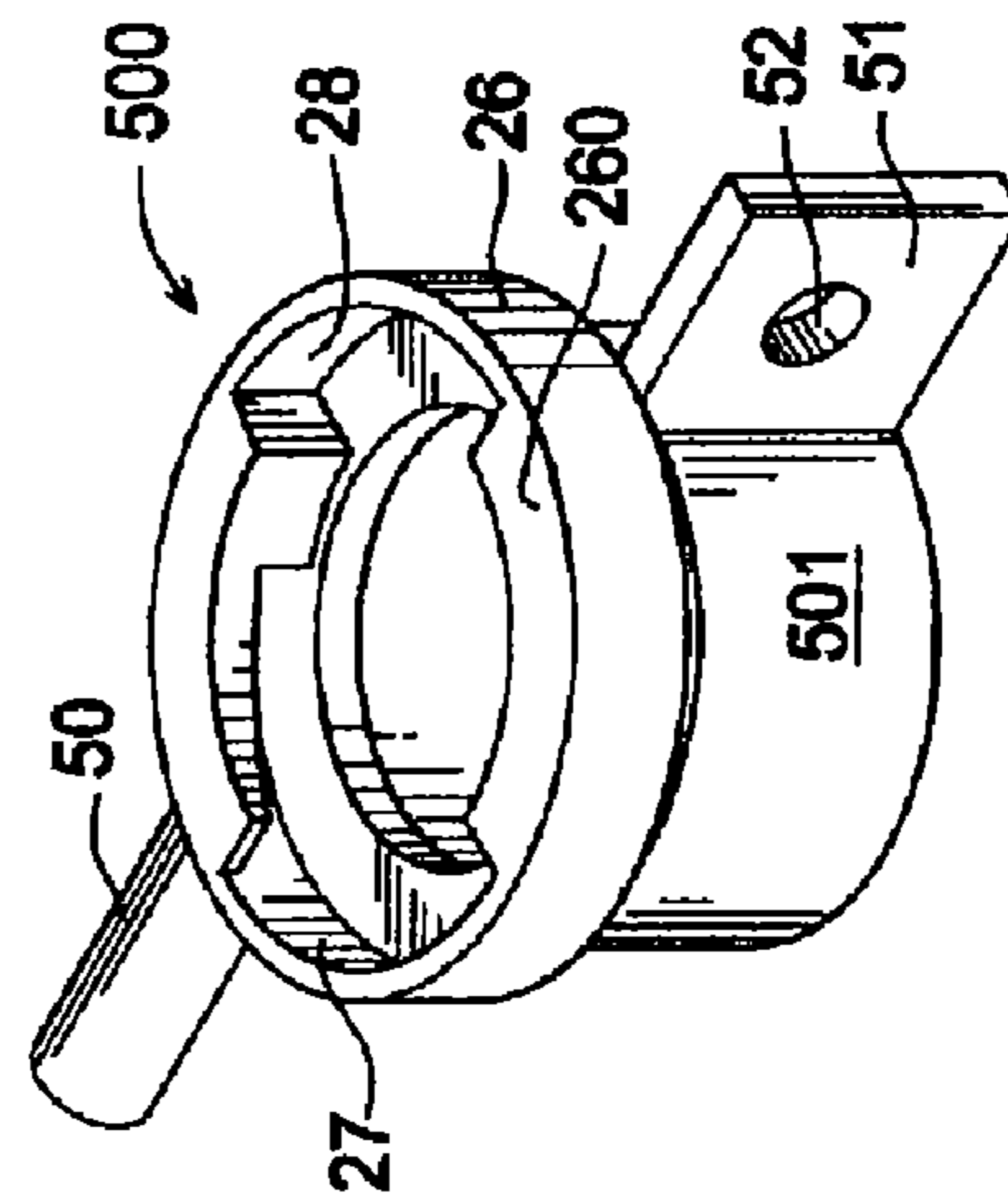


FIG. 5

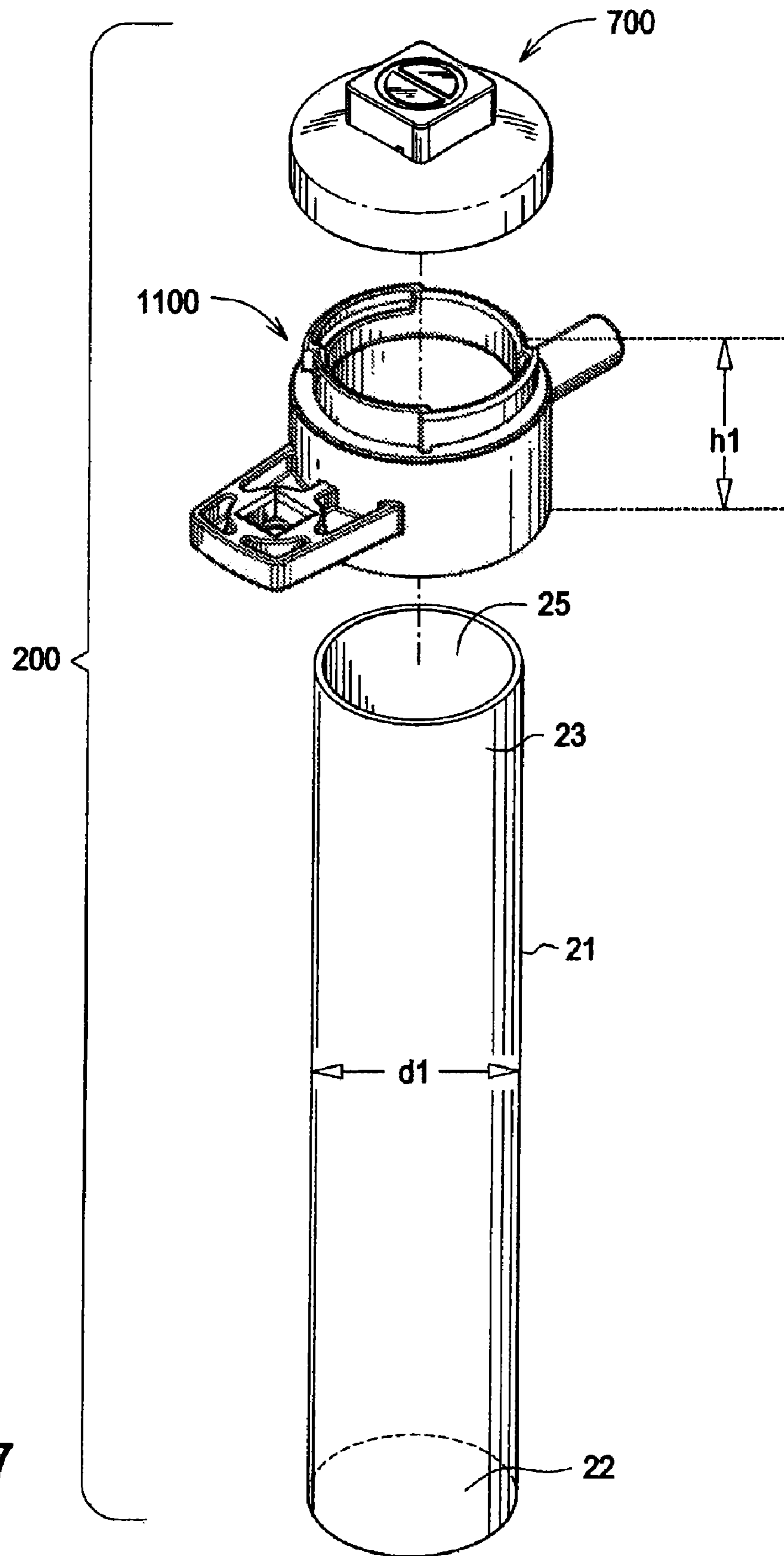


FIG.7

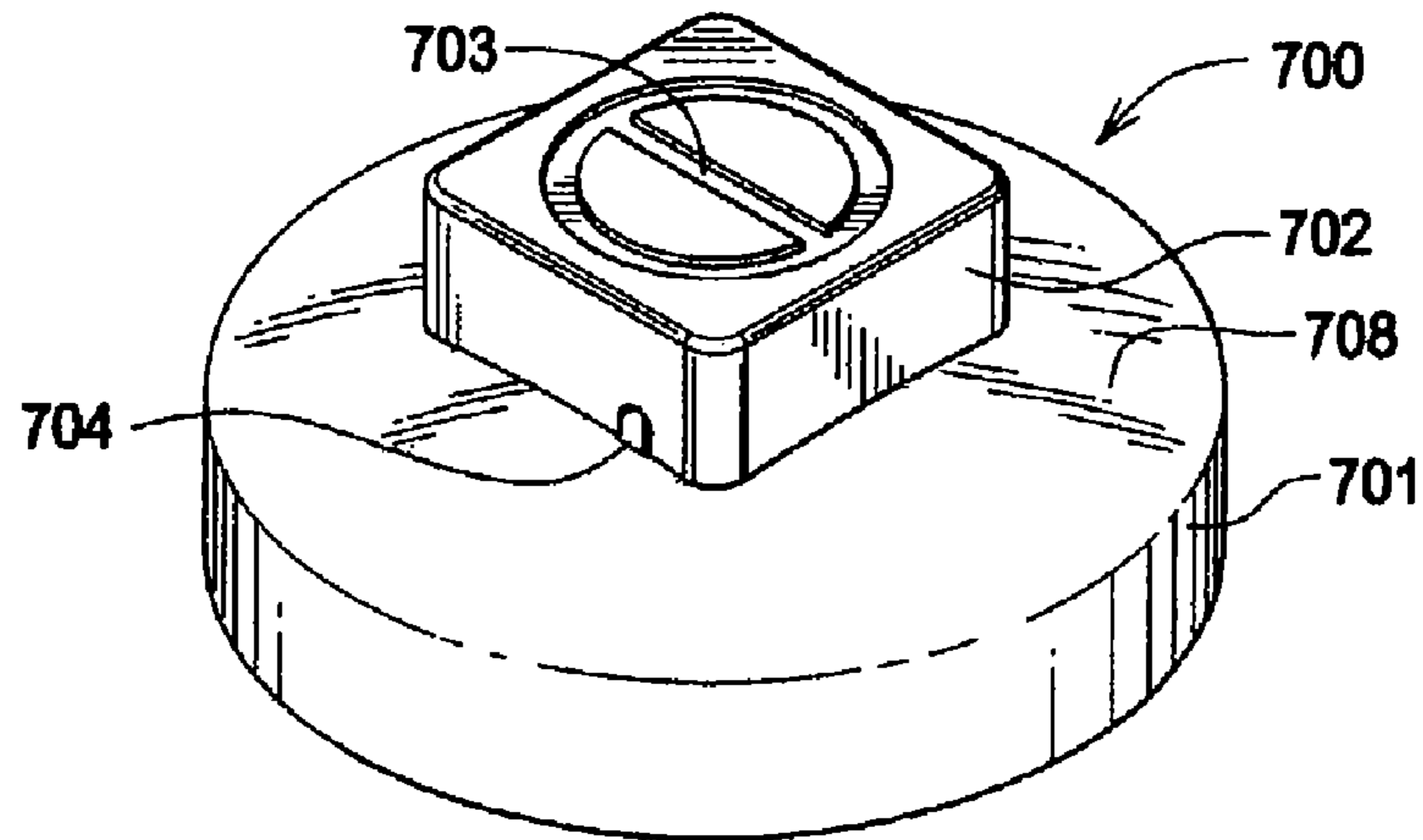


FIG. 8

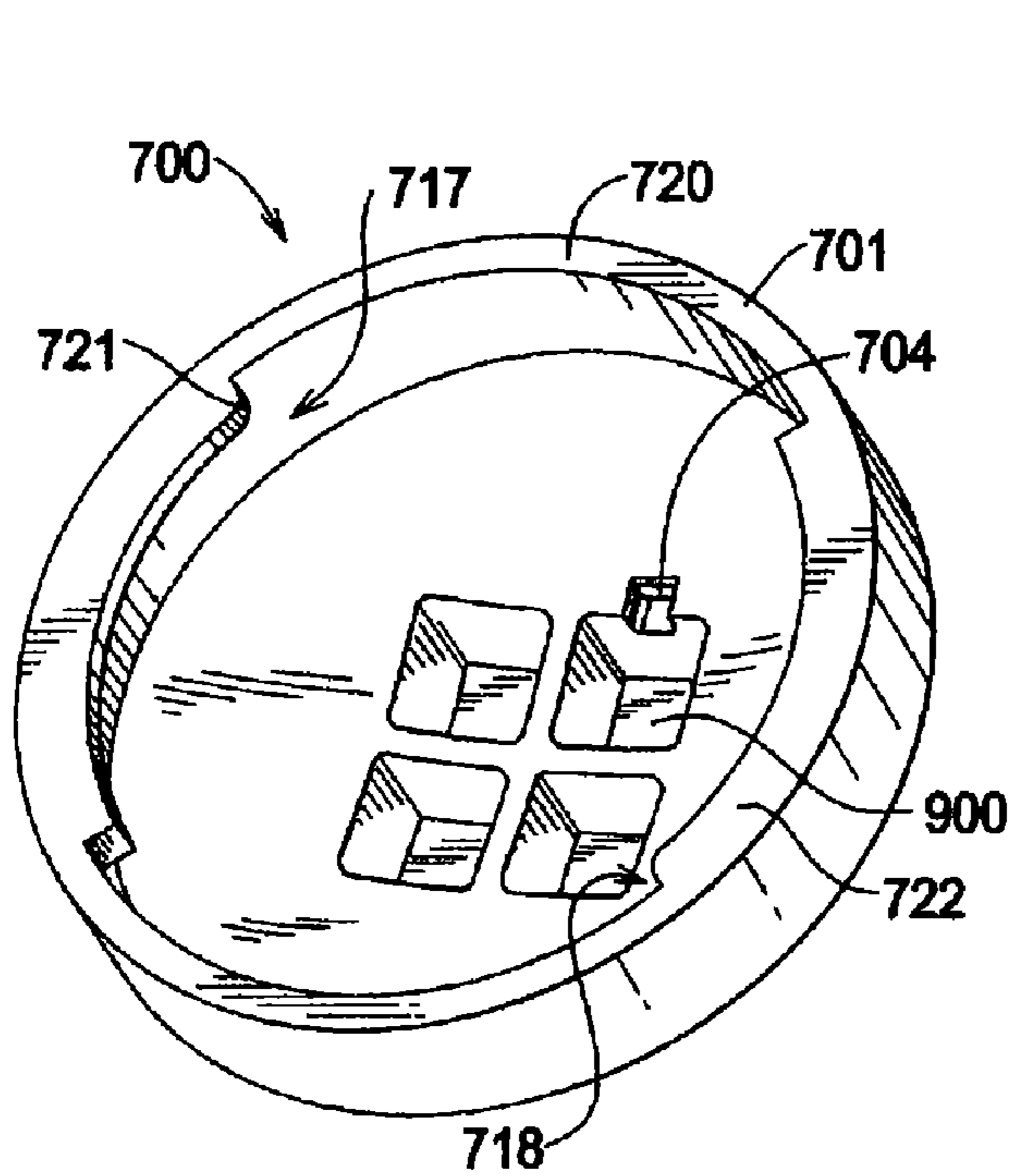


FIG. 9

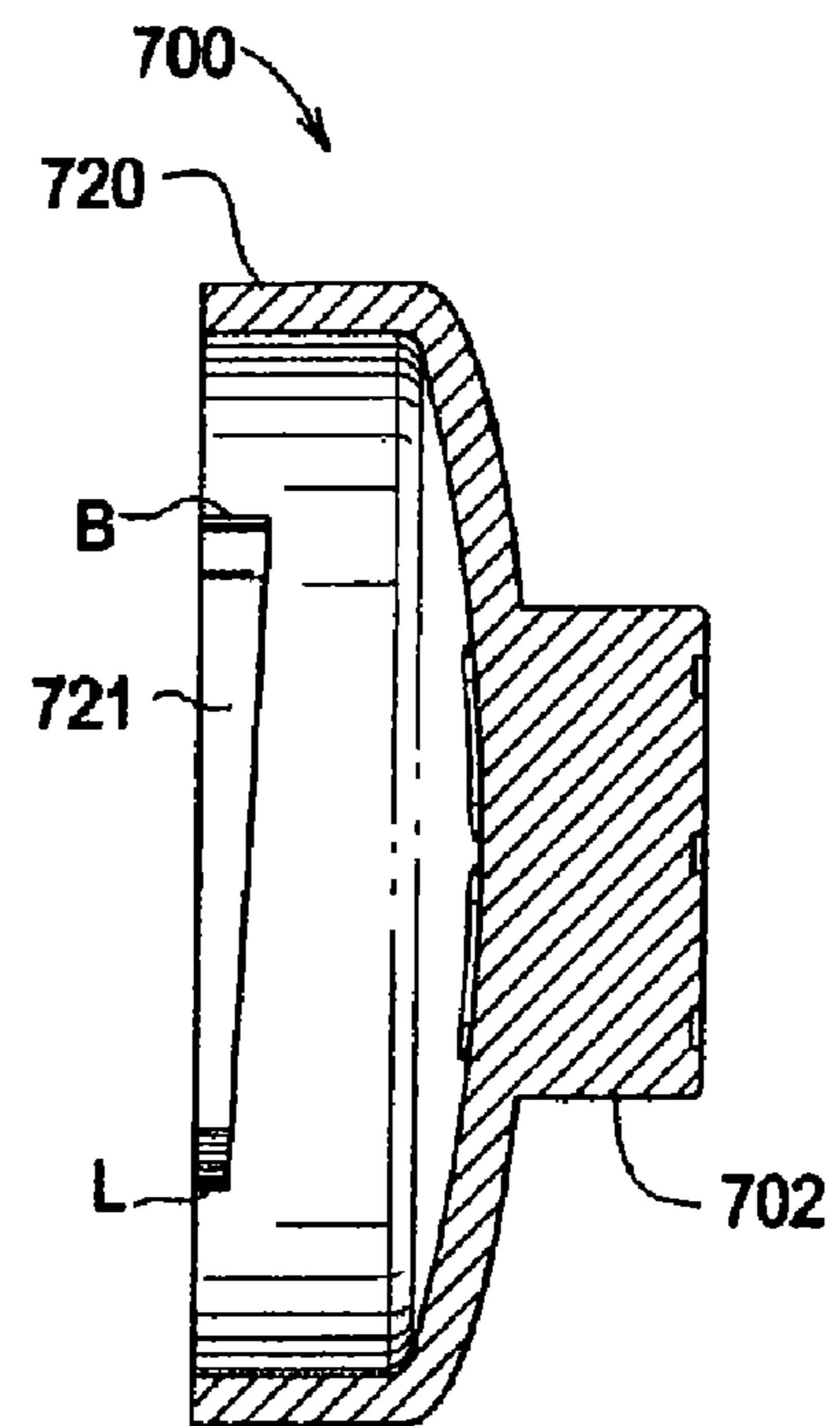


FIG. 10

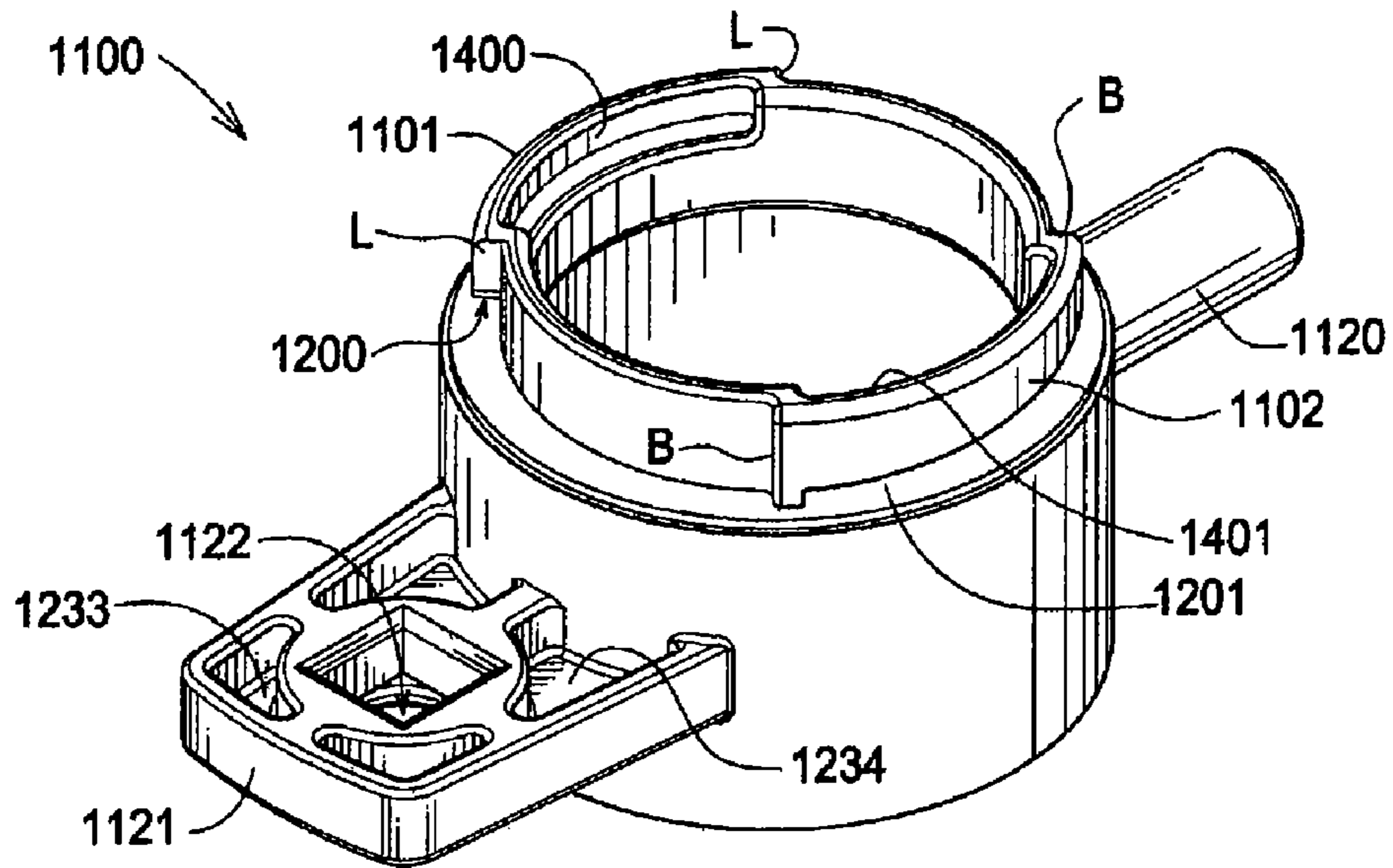


FIG. 11

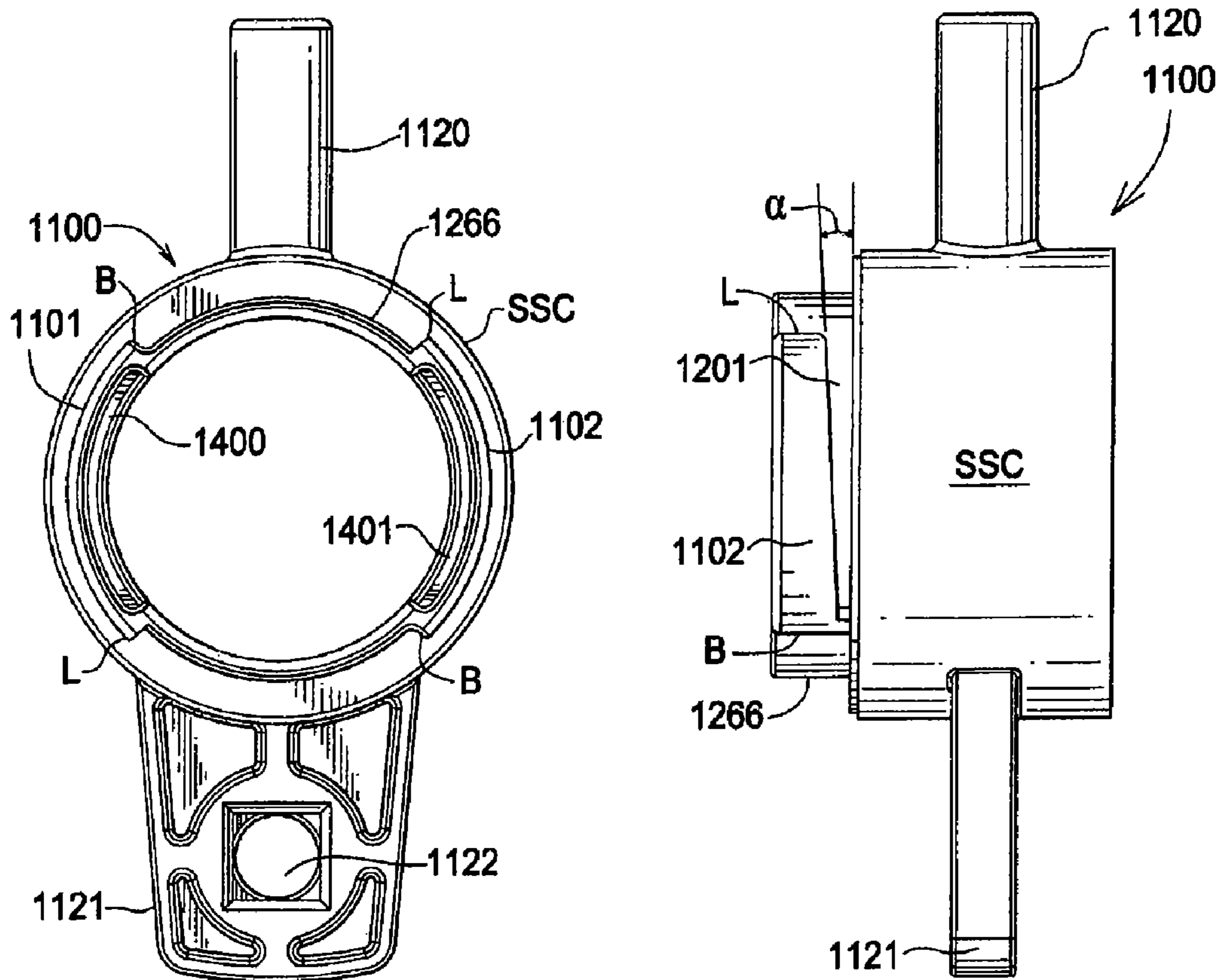
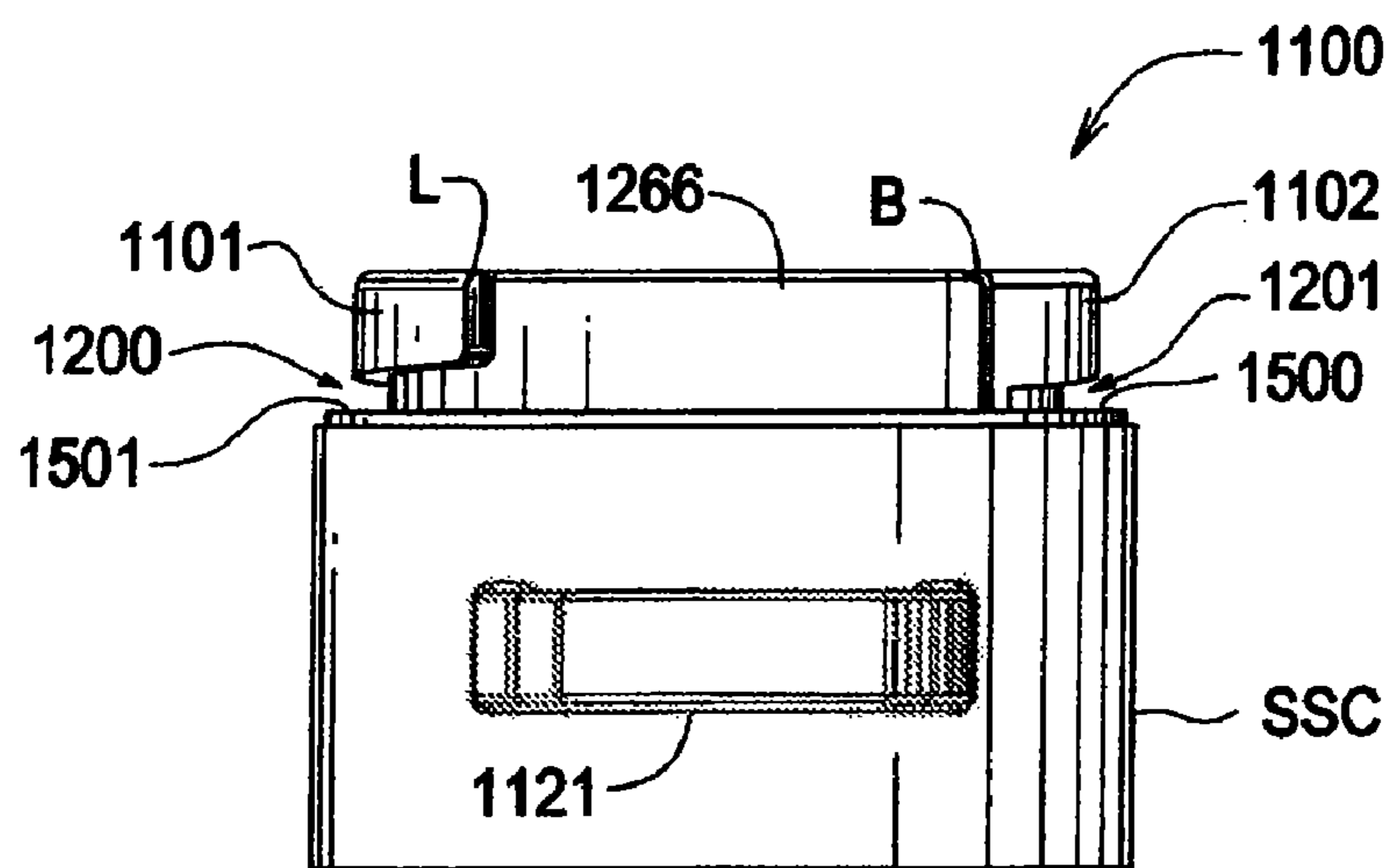
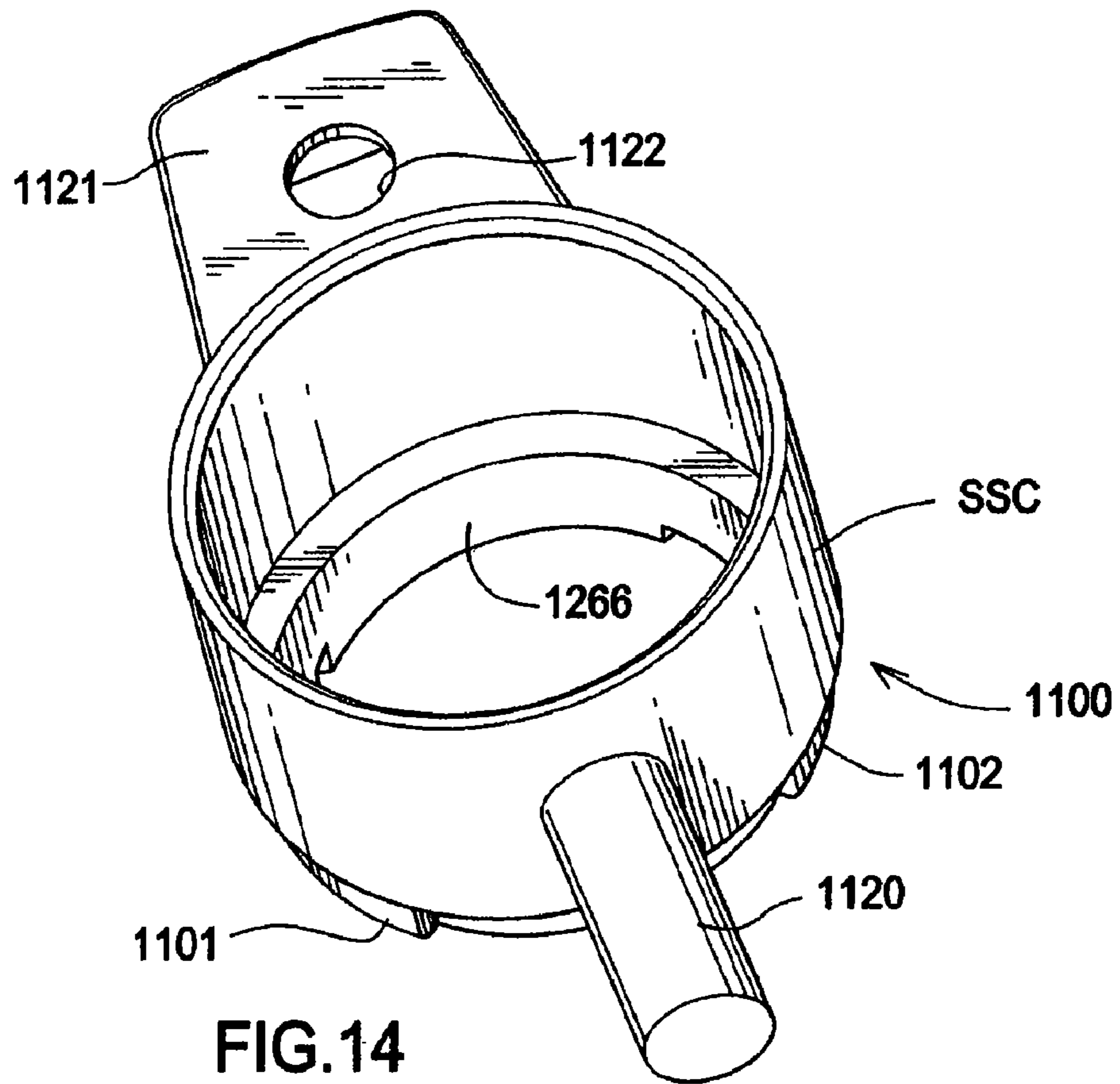


FIG. 13

FIG. 12



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**LOW IMPEDANCE GROUNDING
ELECTRODE WITH UNIVERSAL
CONNECTIONS AND RAPID ACCESS CAP**

Matter enclosed in heavy brackets [] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue.

FIELD OF INVENTION

The present invention relates to chemically activated grounding electrodes that provide a low resistance connection to earth.

BACKGROUND OF THE INVENTION

U.S. Pat. No. 6,515,220 B1 (2003) to Carpenter, Jr. discloses a chemically activated grounding electrode constructed from a copper cylinder, a copper upper collar and a copper screw on cap. The copper cylinder has a lug onto which a grounding cable may be exothermically welded. During manufacturing the upper collar is exothermically welded to the cylinder, and the lug is welded to the cylinder.

An osmotic conductor is poured into the cylinder, and then the electrode is buried in the earth with the cap accessible at or above the earth's surface. The threads for the cap are traditional 360° threads. In the field the traditional 360° threads become galvanically corroded. When this happens, the osmotic conductor inside the cylinder cannot be checked or replaced. Copper was found to deteriorate over time, and some applications required zinc or tin coatings on the copper cylinder. When this is done, corrosion from dissimilar metals occurs at joints. The end user could not bolt on a grounding cable of his own choice since the exothermic welded grounding cable was shipped with the grounding electrode.

What is needed is a corrosion resistant construction for the cylinder, a single mold construction for the collar and the attachment lug, a one metal construction to avoid corrosion at joints, a non-corroding cap attachment means, and a multi-purpose lug connector for the grounding wire.

The present invention is made of all stainless steel construction. A multi-purpose connector provides for either an exothermic weld connection and/or a wire through stud connection using a bolt to the grounding wire. The cap has a pair of thick ramp type threads which lock with a 90° turn of the cap. Thus, a longer life grounding electrode is provided that can perform in all soil conditions without a costly coating procedure for the cylinder.

SUMMARY OF THE INVENTION

An aspect of the present invention is to provide a corrosion resistant cap for a ground electrode, said cap having a 90° corrosion resistant thread.

Another aspect of the present invention is to provide a multi-purpose connector for a grounding wire affixed to the grounding electrode.

Another aspect of the present invention is to provide an all stainless steel construction.

Another aspect of the present invention is to provide a single mold construction for the collar and the attachment lug.

Other aspects of this invention will appear from the following description and appended claims, reference being made to

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the accompanying drawings forming a part of this specification wherein like reference characters designate corresponding parts in the several views.

The present invention uses a stainless steel tube with a bottom. On the upper part of the tube is placed a collar cast from stainless steel. The collar has two female thread segments that run one quarter turn on the outside of the collar. The cap has two male one quarter turn twin threads that mate with the collar's threads. A large bolt head is located on the top of the cap to enable a large wrench to open the cap.

The collar has a multi-purpose lug that includes a stud for an exothermic weld connection and a plate with a bolt hole for a wire to lug connection.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 (prior art) is a front plan view of a copper grounding electrode with an exothermic weld connection to a grounding wire.

FIG. 2 is an exploded view of the preferred embodiment. FIG. 3 is a top perspective view of a grounding cable welded to the attachment lug.

FIG. 4 is a top perspective view of a grounding cable bolted to the attachment lug.

FIG. 5 is a top perspective view of an alternate embodiment collar.

FIG. 6 is a top perspective view of the collar shown in FIG. 5.

FIG. 7 is an exploded view of an alternate embodiment grounding electrode labeled 200.

FIG. 8 is a top perspective view of the top shown in FIG. 7.

FIG. 9 is a bottom perspective view of the top for grounding electrode 200.

FIG. 10 is a cross sectional view of the top shown in FIG. 8.

FIG. 11 is a top perspective view of the collar shown in FIG. 7.

FIG. 12 is side plan view of the collar shown in FIG. 11.

FIG. 13 is a top plan view of the collar shown in FIG. 11.

FIG. 14 is a bottom perspective view of the collar shown in FIG. 11.

FIG. 15 is a side plan view of the collar shown in FIG. 11.

Before explaining the disclosed embodiment of the present invention in detail, it is to be understood that the invention is not limited in its application to the details of the particular arrangement shown, since the invention is capable of other embodiments. Also, the terminology used herein is for the purpose of description and not of limitation.

DETAILED DESCRIPTION OF THE DRAWINGS

Referring first to FIG. 1 a prior art grounding electrode 1 is made of a copper tube 2 with a bottom not shown. A copper collar 3 is welded onto the tube 2. The cap 4 is copper. The cap 4 has 360° male threads that mate with the 360° female threads of the collar, not shown. A bolt head 5 allows a large wrench to remove the cap 4 if the threads are not corroded.

A lug 6 projects from the tube 2. It is a part of an exothermic weld for the end cap 7 of the grounding cable 8. The lug 6 is welded to the tube 2 during manufacturing. The grounding cable 8 is generally welded to the lug 6 in the factory or in the field.

In FIG. 2 the grounding electrode 20 has a stainless steel tube 21 with a bottom 22 and an upper segment 23. Osmotic material can be placed into hollow 25. A collar 24 is made as a single stainless steel mold along with the lug 50. The collar 24 is made as a stainless steel casting. It is welded to tube 21.

The collar **24** has an upper flange **26** which has an upper shelf **260**. The upper shelf **260** has a first recess **27** and a second recess **28**. Recess **27** transitions into a quarter turn female thread **29**. Recess **28** transitions into a quarter turn female thread **30**.

The cap **40** is stainless steel. It has a top shelf **41** which has a square bolt head **42** for a wrench. Male thread **43** is about $\frac{1}{2}$ " thick at the start of its taper, and $\frac{3}{16}$ " thick at the end of its taper. It fits into recess **28**, and thread **44** fits into recess **27**. A quarter turn (90°) clockwise will lock the cap **40** to the collar **24**.

The collar **24** has a lug **50** for an exothermic weld connection to a grounding cable **8** using end cap **7** as seen in FIG. **3**. The user can also bolt a cable lug to plate **51** via hole **52**. Nominal dimensions are $h_1=2\frac{1}{2}$ ", $d_1=2\frac{1}{2}$ ".

Referring next to FIG. **3** the lug **50** has a rod **70** for welding the end cap **7** thereto.

In FIG. **4** the cable **8** has an end cap **80** crimped to it. The end cap **80** has a bracket **81** with a hole to align with hole **52** of plate **51**. The bolt **82** (and nut not shown) join the bracket **81** to the plate **51**.

Referring next to FIGS. **5**, **6** a collar **500** is made from a single stainless steel casting. The upper flange **26** and upper shelf **260** are the same as collar **24** of FIG. **2**. Recesses **27**, **28** receive the same cap **40** as shown in FIG. **2**. The lug **50** protrudes from upper flange **26**. The plate **51** protrudes from the body **501** of the collar about 180 degrees to the opposite side of the cap as the lug **50**. This arrangement facilitates placing a bolt connection in hole **52**.

Referring next to FIG. **7** an exploded view of grounding electrode **200** is shown. The stainless steel tube **21** is the same as embodiment **20**. The collar **1100** and the top **700** are new. A primary difference is the male part of the thread **1101**, **1102** is integral with the collar **1100**. The female recesses of the thread **717**, **718** are housed in the top **700**. The collar **1100** has a lug **1120** for a cad weld connection to a grounding cable **8** using end cap **7** shown in FIG. **3**. The user can also bolt a cable lug to horizontal flange **1121** via hole **1122**.

FIG. **8** shows the top **700** to have a smooth top surface **708** with a central top shelf **702** having a square bolt head for a wrench. A screwdriver slot **703** could be provided. A small vent hole **704** is also provided. The sides **701** are smooth.

In FIG. **9** recesses **900** extend into the stainless steel top shelf **702** as part of a preferred lost wax method of mold making and manufacture. A lower ridge **720** is circular, but thread members **721**, **722** extend inward from the outer periphery of the ridge **720**. These thread members **721**, **722** are tapered to form tapered recesses **717**, **718** respectively. FIG. **10** shows thread member **721** having a first end B tapering to second end L.

Referring next to FIG. **11** a stainless steel collar **1100** has a flange **1121** oriented 180° from a lug **1120**. The male thread members **1101**, **1102** taper from a big width B to a smaller width L. Thus, the recesses **1200**, **1201** are tapered to lock with thread members **721**, **722** with a 90° twist of the top **700**. Recesses **1233**, **1234** facilitate the one piece molding operation used to form collar **1100**.

FIG. **12** shows the stainless steel cylindrical body SSC of the collar **1100**, with a preferred angle ANG of 3° . An upper ring **1266** supports the male thread members **1101**, **1102**.

FIG. **13** illustrates the slots **1400**, **1401** formed between body SSC and ring **1266** which is covered by the top **700**.

In FIG. **15** best illustrates the recesses **1200**, **1201**. The thread members **721**, **722** rest on ledges **1500**, **1501** on top of the body SSC and lock into recesses **1200**, **1201**.

Although the present invention has been described with reference to preferred embodiments, numerous modifications

and variations can be made and still the result will come within the scope of the invention. No limitation with respect to the specific embodiments disclosed herein is intended or should be inferred. Each apparatus embodiment described herein has numerous equivalents.

We claim:

1. A grounding electrode comprising:

a cylindrical stainless steel tube having a bottom and having a top segment;

a stainless steel collar attached to the top segment of the stainless steel tube;

said stainless steel collar having an attachment lug with a rod to provide a weld connection to a cable end, and having a plate with a mounting hole to receive a bolt for [a] the cable end with a bracket connector;

said stainless steel collar having a stainless steel top with at least two recesses to receive in each recess a male thread segment of a stainless steel cap; and

wherein a one quarter turn of the cap locks each male thread segment into a respective female thread segment of the stainless steel collar.

2. The grounding electrode of claim 1, wherein the cap further comprises a square bolt head lug for accepting a wrench.

3. The grounding electrode of claim 1, wherein the cylindrical stainless steel tube is filled with an osmotic material.

4. The grounding electrode of claim 1, wherein the lug rod is connected to the plate.

5. The grounding electrode of claim 4, wherein the plate is aligned in a vertical plane below the rod.

6. The grounding electrode of claim 1, wherein the collar and the lug are made in a one piece mold.

7. The grounding electrode of claim 6, wherein the collar is attached to the top segment of the stainless steel tube by means of a weld.

8. The grounding electrode of claim 1, wherein the plate is located on an opposite side of the collar from the lug rod.

9. An all stainless steel grounding electrode comprising: a cylindrical tube having a bottom to contain [and] an osmotic material;

a collar welded to a top segment of the tube;

said collar having a dual purpose lug for connection to a grounding cable;

wherein a rod projects from the collar for a purpose of welding a cable end thereto;

wherein a plate having a mounting hole projects from the collar for a purpose of bolting a bracket end of [a] the cable thereto;

said collar having at least two recesses integrated into at least two female threads;

a cap having at least two male threads designed to lock into a respective female thread of the collar; and

wherein the male threads lock into the female threads with a one quarter turn of the cap.

10. The grounding electrode of claim 9, wherein the plate is connected to the rod and extends from the collar below the rod.

11. The grounding electrode of claim 9, wherein the plate is located on an opposite side of the collar from the rod.

12. A grounding electrode comprising:

a hollow cylindrical container with a closed bottom and an open top;

a collar connected to the top;

said collar having a mounting flange with a hole and having a mounting lug oriented about 180° from the mounting flange;

said collar having a top ledge supporting a support ring;

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said support ring having a first male thread member projecting outbound from the support ring and having a taper, wherein a first tapered recess is formed between the top ledge and the first male thread member;
 said support ring having a second male thread member oriented about 180° from the first male thread member; wherein a second recess is formed having [a] an image of the first recess;
 a top having a smooth outside edge with [the] a lower ridge; said lower ridge having a first thread member projecting inbound designed to be received in the first recess, and a second thread member projecting inbound designed to be received in the second recess;
 said top having a bolt head tightening fixture; and wherein a one quarter turn of the top locks the first and second male thread members into their respective first and second recess of the top.

13. The apparatus of claim 12, wherein the container, collar and top are all made of stainless steel.

14. The apparatus of claim 13, wherein the top further comprises a vent hole.

15. *A grounding electrode comprising:
 a cylindrical tube having a bottom and having a top segment;*

*a collar attached to the top segment of the tube;
 said collar having an attachment lug with a rod to provide a weld connection to a cable end, and having a plate with a mounting hole to receive a bolt for the cable end with a bracket connector;*

said collar having a top with at least two recesses to receive in each recess a male thread segment of a cap; and wherein a one-quarter turn of the cap locks each male thread segment into a respective female thread segment of the collar.

16. *The grounding electrode of claim 15, wherein the cap further comprises a square bolt head lug for accepting a wrench.*

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17. *The grounding electrode of claim 15, wherein the cylindrical tube is filled with an osmotic material.*

18. *The grounding electrode of claim 15, wherein the lug rod is connected to the plate.*

19. *The grounding electrode of claim 18, wherein the plate is aligned in a vertical plane below the rod.*

20. *The grounding electrode of claim 15, wherein the collar and the lug are made in a one piece mold.*

21. *The grounding electrode of claim 20, wherein the collar is attached to the top segment of the tube by means of a weld.*

22. *The grounding electrode of claim 15, wherein the plate is located on an opposite side of the collar from the lug rod.*

23. *The grounding electrode of claim 15, wherein said turn of the cap is a one quarter turn.*

24. *A grounding electrode comprising:
 a cylindrical tube having a bottom to contain an osmotic material;*

*a collar connected to a top segment of the tube;
 said collar having a lug for connection to a grounding cable;*

wherein a rod projects from the collar for a purpose of welding a cable end thereto;

wherein a plate having a mounting hole projects from the collar for a purpose of bolting a bracket end of the cable thereto;

said collar having at least two recesses integrated into at least two female threads;

a cap having at least two male threads designed to lock into a respective female thread of the collar; and

wherein the male threads lock into the female threads with a one-quarter turn of the cap.

25. *The grounding electrode of claim 24, wherein the plate is connected to the rod and extends from the collar below the rod.*

26. *The grounding electrode of claim 24, wherein the plate is located on an opposite side of the collar from the rod.*

* * * * *