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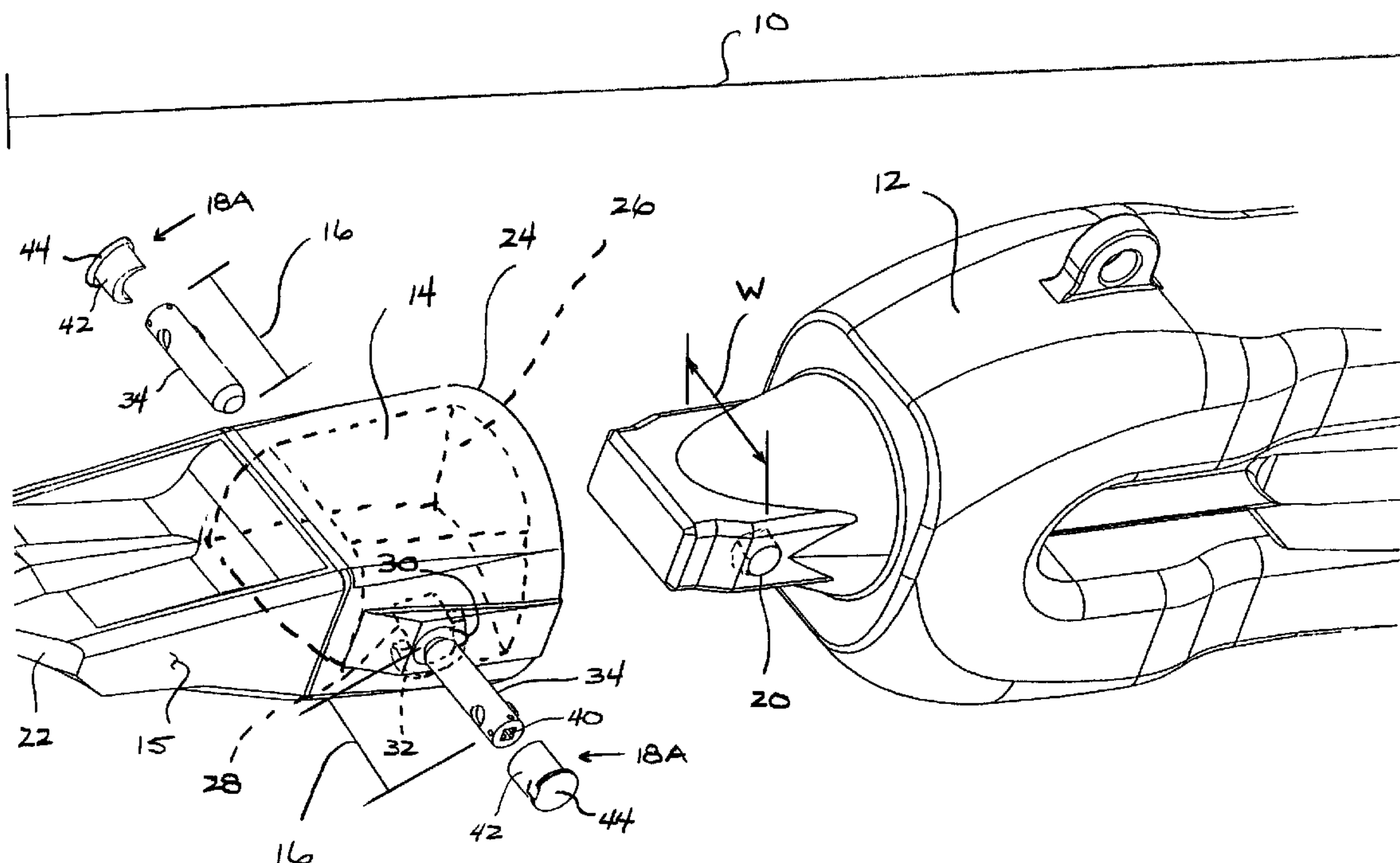
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(54) Title: TOOTH RETAINER WITH ROTARY CAMLOCK



(57) Abrégé/Abstract:

An excavation tooth removably connected to an adapter connected to a shovel dipper, the adapter defining a first passageway, the excavation tooth having a tooth body defining a second passageway, a first cam receiving recess adjacent to one end of the second passageway, and a cam access orifice adjacent to the first cam receiving recess, a pin received in the second passageway defined by the tooth body and a cam which extends in a direction away from the pin, wherein the cam is received in the first cam receiving recess defined by the excavation tooth to removably secure the excavation tooth to the adapter.

ABSTRACT OF THE DISCLOSURE

An excavation tooth removably connected to an adapter connected to a shovel
dipper, the adapter defining a first passageway, the excavation tooth having a
5 tooth body defining a second passageway, a first cam receiving recess adjacent
to one end of the second passageway, and a cam access orifice adjacent to the
first cam receiving recess, a pin received in the second passageway defined by
the tooth body and a cam which extends in a direction away from the pin,
wherein the cam is received in the first cam receiving recess defined by the
10 excavation tooth to removably secure the excavation tooth to the adapter .

TOOTH RETAINER WITH ROTARY CAMLOCK

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to excavating tools and, more particularly, a device for removably attaching excavation teeth to a shovel dipper.

2. Brief Description of the Prior Art

It is common to remove dirt, debris, or other material using heavy machinery such as backhoes, shovel dippers, or other similar devices. As shown in United States Patent No. 4,481,728 to Mulder et al., herein incorporated by reference in its entirety, shovel dippers often include adapters configured to receive replaceable excavation teeth to help loosen soil, clay, and rock. Each excavation tooth typically is attached to a corresponding adapter via a pin or wedge. Examples of removable teeth connected to an adapter with pins or wedges are illustrated in U.S. Patent Nos. 564,664, 3,256,622, 3,410,010, and 6,018,896.

The disadvantages of using wedges are discussed in U.S. Patent No. 6,018,896 to Adamic. One problem is that the wedges may be dislodged from the adapter during operation of the shovel dipper or other related equipment. A primary disadvantage for using pins is that the pins must be forcibly pounded into or out of a passageway connecting the tooth to the adapter. This is time consuming and sometimes physically difficult, especially if the pins develop a mushroom-shaped end from repeated pounding by a hammer or a specialized tool.

25 SUMMARY OF THE INVENTION

In order to help eliminate the disadvantages of the prior art, the present invention generally includes an excavation tooth for use with an adapter that defines a first passageway. The excavation tooth generally includes a tooth body defining a second passageway, a first or second cam receiving recess adjacent to one end of the second passageway, and a cam access orifice adjacent to the first or second cam receiving recess. A pin,

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having a cam which extends in a direction away from the pin,
is received in the second passageway defined by the tooth
body. The cam is received in the first or second cam
receiving recess defined by the excavation tooth to removably
5 secure the excavation tooth to the adapter.

The cam may be integrally formed with the pin or the
pin may define a cam receiving orifice, with the cam slideably
received in the cam receiving orifice. An elastomeric material
may be positioned in the cam receiving orifice between the cam
10 receiving orifice and the cam such that the cam exerts a force
on the elastomeric material, depending on the position of the
pin and the cam in the second cam receiving recess. In
another embodiment, the cam may define an internal cavity and
a compressible spring may be positioned in the internal cavity
15 defined by the cam such that such that the compressible spring
compresses and decompresses, depending on the position of the
pin and the cam in the second cam receiving recess. More than
one pin and more than one cam can be used to help hold the
excavation tooth on the adapter.

20 One method of removably attaching an excavation
tooth to an adapter is also provided. The excavation tooth
preferably defines a first passageway and the excavation tooth
defining a second passageway, a first or second cam receiving
recess adjacent to one end of the second passageway, and a cam
25 access orifice adjacent to the first or second cam receiving
recess, with the first passageway defined by the adapter and
the second passageway defined by the excavation tooth aligned
with one another. The steps may include: (a) inserting a pin
into the first passageway defined by the adapter and the
30 second passageway defined by the excavation tooth, the pin
having a cam which extends in a direction away from the pin;
(b) orienting the pin so that the cam can be received in the
cam access orifice and the first or second cam receiving
recess defined adjacent to one end of the second passageway
35 defined by the excavation tooth; (c) rotating the pin in a
first direction with respect to the excavation tooth so that
the cam engages in the first or second cam receiving

recess and the excavation tooth is removably secured to the adapter; (d) rotating the pin in a second direction with respect to the excavation tooth until the cam is aligned with the cam access orifice; (e) removing the pin from the first passageway defined by the adapter and the second passageway defined by the excavation tooth; and (f) removing the excavation tooth from the adapter.

The present invention provides an easy and expeditious way to remove a worn excavation tooth from an adapter, replace the worn excavation tooth, and re-secure a new excavation tooth to the adapter. Due to the cam mechanism, the pins do not need to be pounded through the aligned passageways defined by the adapter and the excavation tooth. Instead, the pins can be inserted into the aligned passageway and rotated in a first direction for installation and rotated in a second direction for removal. The rotation can be done with customary tools such as a ratchet and socket, helping to eliminate the possibility of the pins becoming bent, mangled, or otherwise mutilated.

These and other advantages of the present invention will be clarified in the description of the preferred embodiment taken together with the attached drawings in which like reference numerals represent like elements throughout.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a top perspective exploded view of a portion of an adapter, a portion of an excavation tooth, a first embodiment pin and cam combination, and dust covers according to the present invention;

Fig. 2 is a side view of the first embodiment pin and cam combination shown in Fig. 1;

Fig. 3 is a top sectional view of a portion of the adapter, the excavation tooth, the first embodiment pin and cam combination shown in Figs. 1 and 2, and the dust covers shown in Fig. 1 in an installation configuration;

Fig. 4 is a top perspective partial sectional view of a portion the adapter, the excavation tooth, the first embodiment pin and cam combination shown in Figs. 1-3, and the dust covers shown in Fig. 3;

Fig. 5 is a partial sectional side view of the excavation tooth shown in Figs. 1-3 defining a cam access recess and a first embodiment cam receiving orifice configured to receive the first embodiment pin and cam combination;

Fig. 6 is a perspective, partial sectional view of a second embodiment pin and cam combination;

Fig. 7 is a sectional side view of an excavation tooth defining a cam access recess and a second embodiment cam receiving orifice configured to receive the second embodiment pin and cam combination shown in Fig. 6;

Fig. 8 is a is a perspective, partial sectional view of a third embodiment pin and cam combination; and

Fig. 9 is a schematic side view of a movable work vehicle having a shovel dipper configured with an adapter, an excavation tooth, and a pin and cam combination according to any embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Fig. 1 generally shows an excavation tool 10 having an adapter 12, a removable excavation tooth 14 having a tooth body 15, a first embodiment pin and cam combination 16, and dust covers 18A.

The adapter 12 defines a first passageway 20 extending at least partially through a width W of one end of the adapter 12. The adapter 12 is configured to removably receive the excavation tooth 14. The adapter 12 is preferably made from steel or other suitable material.

The excavation tooth 14 has a cutting end 22 and an adapter end 24. The excavation tooth 14 further defines an internal cavity 26 configured to receive the adapter 12, a second passageway 28 extending at least partially through the excavation tooth 14, a cam access orifice 30 positioned adjacent to the second passageway 28, and a first cam receiving recess 32, shown in

greater detail in Fig. 5, positioned adjacent to the second passageway 28 and the cam access orifice 30. The excavation tooth 14 is preferably made from steel or other suitable material.

With continuing reference to Fig. 1, Fig. 2 shows the first
5 embodiment pin and cam combination 16 in more detail. The first embodiment pin and cam combination 16 includes a generally elongated cylindrically-shaped pin 34 and a cam 36. The cam 36 is any object which protrudes or extends away from an external surface 38 of the pin 34. The pin 34 and the cam 36 are preferably positioned adjacent to a rotational drive recess 40, with
10 the cam 36 integrally formed with the pin 34 in this embodiment. The drive recess 40 is at one end of the pin 34 and is configured to receive a drive tool (not shown). The drive recess 40 can be square shaped, as shown in Figs. 1 and 2, or define another suitable shape. Moreover, instead of forming a drive recess 40, the pin 34 can define one or more drive points which protrude in a
15 direction away from an end of the pin 34, with the drive points configured to be received by a hollow socket. One or more pin and cam combinations 16 may be used. Both the pin 34 and the cam 36 are preferably made from steel or other suitable material.

Referring again to Fig. 1, the dust covers 18A preferably have a
20 main body 42, preferably semi-circular or other suitable shape and an endcap 44, preferably circular or other suitable shape. Each dust cover 18A is positioned adjacent to the drive recess 40 defined by a corresponding pin 34. The dust covers 18A preferably are made from plastic, rubber, steel, or other suitable material. In particular, it is preferred that the main body 42 be made
25 from metal and the endcap 44 be made from rubber or other suitable material. An elastomeric O-ring may also circumscribe the endcap 44.

Figs. 3 and 4 show the adapter 12 connected to the excavation tooth 14 by the first embodiment pin and cam combination 16, with the dust covers 18A added to help protect the pins 34. This configuration is
30 accomplished by aligning the first passageway 20 defined by the adapter 12

with the second passageway 28 defined by the excavation tooth 14. The pin 34 is inserted into the aligned first and second passageways 20, 28, and oriented so that the cam 36 can be moved through the cam access orifice 30 defined by the excavation tooth 14 and be aligned with and received in the first cam receiving recess 32 defined by the excavation tooth 14, shown in greater detail in Fig. 5. As shown in Fig 3, once the cam 36 has been aligned with the first cam receiving recess 32, the pin 34 is rotated about a longitudinal axis L, in a first direction, shown by arrow A1 in Fig. 5. As the first embodiment pin 34 is rotated in the first direction A1, the cam 36 is received in the first cam receiving recess 32 and follows the first cam receiving recess 32, shown in Figs. 3-5, removably locking the excavating tooth 14 to the adapter 12. The dust covers 18A shown in Figs. 1, 3 and 4 then are added to help keep dirt and debris out of the second passageway 28 and the cam access orifice 30.

Referring again to Figs. 3 and 4, when the excavation tooth 14 needs to be removed due to wear or for any other reason, the dust covers 18A are removed from the second passageway 28, the pin 34 is rotated in a second direction A2, shown by arrow A2 in Fig. 5, and the pin 34 is removed from the aligned passageways 20, 28. An excavation tooth 14 then can be removed and a new excavation tooth 14 installed by inserting the adapter 12 into the internal cavity 26 defined by the excavation tooth 14, aligning the first and second passageways, 20, 28, inserting the first embodiment pin and cam combination 16 into the aligned first and second passageways 20, 28, rotating the first embodiment pin and cam combination 16 in a first direction A2 so that the cam 36 is received in or engages the first cam receiving recess 32, and inserting the dust covers 18A into a respective end of the second passageway 28.

Fig. 6 shows a second embodiment pin and cam combination 46. In this embodiment, which is similar to the first embodiment pin and cam combination 16, the pin 34A defines a cam receiving orifice 48A which receives a cam 36A, or an elastomeric material 50 and a cam 36A. The cam 36A is slideably received in the cam receiving orifice 48A. The elastomeric

material 50 is preferably rubber or other suitable material that is compressible. As with the second embodiment pin and cam combination 46, the cam 36A and pin 34A of the second embodiment pin and cam combination 46 are preferably made from steel or other suitable material. The second embodiment pin and cam combination 46, including the elastomeric material 50 preferably is used in conjunction with a second cam receiving recess 52, shown in Fig. 7. The second cam receiving recess 52, differs from the first cam receiving recess 32, shown in Fig. 5, because the second cam receiving recess 52 tapers in the first direction A1. With reference to Fig. 6, the taper of the second cam receiving recess 52 compresses the cam 36A into the elastomeric material 50 as the cam 36A is rotated in the first direction A1, and the cam 36A exerts a restoring force on the elastomeric material 50 which helps to hold the cam 36A removably secure in the second cam receiving recess 52.

Fig. 8 shows a third embodiment pin and cam combination 54, which is similar to the second embodiment pin and cam combination 46 shown in Fig. 6. In this third embodiment, the cam receiving orifice 48B defined by the pin 34B is tapered T at one end 56. A cam 36B, also having a taper 58 and defining an internal cavity 60, is slideably received in the cam receiving orifice 48B. The taper 58 of the cam 36B is biased against a receiving surface 62 defined by the cam receiving orifice 48B, preferably by a compressible spring 64. The compressible spring 64 is preferably received in the internal cavity 60 defined by the cam 36B and may be positioned between the cam 36B and a second embodiment dustcover 18B made from metal, a combination of metal and an elastomeric material, or other suitable material or materials. The dustcover 18B is held in place when the pin 34B is inserted into the excavation tooth 14, such as the excavation tooth 14 shown in Fig. 7. Alternatively, the dustcover 18B may be integrally formed with the pin 34B or attached to the pin 34B by welding or other suitable attachment method. As with the first and second embodiment pin and cam combinations 16, 46, the cam 36B and pin 34B of the third embodiment pin and cam combination 54 are preferably made

from steel or other suitable material. Moreover, as with the second embodiment pin and cam combination 46, the third embodiment pin and cam combination 54 is preferably used in conjunction with the second cam receiving recess 52, shown in Fig. 7.

5 Fig. 9 shows an excavation machine 66 including a movable work vehicle 68 such as the depicted shovel or a dragline bucket, end loader, hydraulic shovel, or other suitable movable work vehicle 68 with a shovel dipper 70 or other suitable device attached thereto. Attached to the shovel dipper 70 is the adapter 12. Attached to the adapter 12, via either the first
10 embodiment pin and cam combination 16, the second embodiment pin and cam combination 46, or the third embodiment pin and cam combination 54 is an excavation tooth 14.

As is evident from the preceding discussion, it is clear that the present invention provides a quick and easy method and apparatus for
15 removing an excavation tooth from an adapter and for reinstalling an excavation tooth onto an adapter. The present invention uses an easy cam operating mechanism to hold the pin in place. The present invention reduces the need to pound pins through openings defined by the excavation tooth and the adapter, an operation which is particularly difficult if the pins are mangled,
20 bent or have a mushroom-shaped first end or second end. Moreover, the cam of any embodiment of the present invention helps to prevent the pins from being dislodged from the excavation tooth.

The invention has been described with reference to the preferred embodiment. Obvious modifications and alterations will occur to others upon
25 reading and understanding the preceding detailed description.

We claim:

An excavation tooth for use with an adapter, the adapter defining a first passageway, the excavation tooth comprising:

5 a tooth body defining a second passageway, a cam receiving recess adjacent to one end of the second passageway, and a cam access orifice adjacent to the cam receiving recess;

a pin which is received in the second passageway defined by the tooth body; and

10 a cam which extends in a direction away from the pin, wherein the cam is received in the cam receiving recess defined by the excavation tooth to removably secure the excavation tooth to the adapter.

2. The device as claimed in claim 1 wherein the cam is integrally formed with the pin and the cam receiving recess is a first cam receiving recess.

3. The device as claimed in claim 1 wherein the pin defines a cam receiving orifice and the cam is slideably received in the cam receiving orifice.

4. The device as claimed in claim 3 further comprising an elastomeric material positioned in the cam receiving orifice between the cam receiving orifice and the cam and wherein the cam receiving recess is a second cam receiving recess, such that the cam exerts a restoring force on the elastomeric material, depending on the position of the cam in the second cam receiving recess.

5. The device as claimed in claim 3 wherein the cam defines an internal cavity.

6. The device as claimed in claim 5 further comprising a compressible spring positioned in the internal cavity defined by the cam and wherein the cam receiving recess is a second cam receiving recess, such that
5 the compressible spring compresses and decompresses, depending on the position of the pin and the cam in the second cam receiving recess.

7. The device as claimed in claim 6 further comprising an end cap, wherein the compressible spring is positioned between the end cap and the
10 cam.

8. A method of removably attaching an excavation tooth to an adapter, the adapter defining a first passageway and the excavation tooth defining a second passageway, a cam receiving recess adjacent to one end of
15 the second passageway, and a cam access orifice adjacent to the cam receiving recess, with the first passageway defined by the adapter and the second passageway defined by the excavation tooth aligned with one another, comprising the steps of:

(a) inserting a pin into the first passageway defined by the
20 adapter and the second passageway defined by the excavation tooth, the pin having a cam which extends in a direction away from the pin;

(b) orienting the pin so that the cam can be received in the cam access orifice and the cam receiving recess defined adjacent to one end of the second passageway defined by the excavation tooth; and

25 (c) rotating the pin in a first direction with respect to the excavation tooth so that the cam engages the cam receiving recess and the excavation tooth is removably secured to the adapter.

9. The method as claimed in claim 8 further comprising the steps
30 of:

(d) rotating the pin in a second direction with respect to the excavation tooth until the cam is aligned with the cam access orifice; and

(e) removing the pin from the first passageway defined by the adapter and the second passageway defined by the excavation tooth.

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10. The method as claimed in claim 9 further comprising the step of:

(f) removing the excavation tooth from the adapter.

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11. An excavating tool comprising:

a moveable work vehicle:

a shovel dipper attached to the moveable work vehicle;

an adapter attached to the shovel dipper, the adapter defining a first passageway;

15

and an excavation tooth removably attached to the adapter, the excavation tooth defining a second passageway, a cam receiving recess adjacent to one end of the second passageway, and a cam access orifice adjacent to the cam receiving recess, with the first passageway defined by the adapter and the second passageway defined by the excavation tooth aligned with one another;

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a pin removably received in the first passageway defined by the adapter and the second passageway defined by the excavation tooth; and

a cam which extends in a direction away from the pin and is received in the cam receiving recess defined adjacent to one end of the second passageway defined by the excavation tooth,

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wherein rotation of the pin and cam in a first direction with respect to the excavation tooth causes the cam to engage the cam receiving recess and prevents the pin and cam from being removed from the first passageway defined by the adapter and the second passageway defined by the excavation tooth.

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12. The excavating tool as claimed in claim 11 wherein the cam is integrally formed with the pin and the cam receiving recess is a first cam receiving recess.

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13. The excavating tool as claimed in claim 11 wherein the pin defines a cam receiving orifice and the cam is slideably received in the cam receiving orifice.

10

14. The excavating tool as claimed in claim 13 further comprising an elastomeric material positioned in the cam receiving orifice between the cam receiving orifice and the cam and wherein the cam receiving recess is a second cam receiving recess, such that the cam exerts a restoring force on the elastomeric material, depending on the position of the cam in the

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15. The excavating tool as claimed in claim 13 wherein the cam defines an internal cavity.

20

16. The excavating tool as claimed in claim 15 further comprising a compressible spring positioned in the internal cavity defined by the cam and wherein the cam receiving recess is a second cam receiving recess, such that such that the compressible spring compresses and decompresses, depending on the position of the pin and the cam in the second cam receiving

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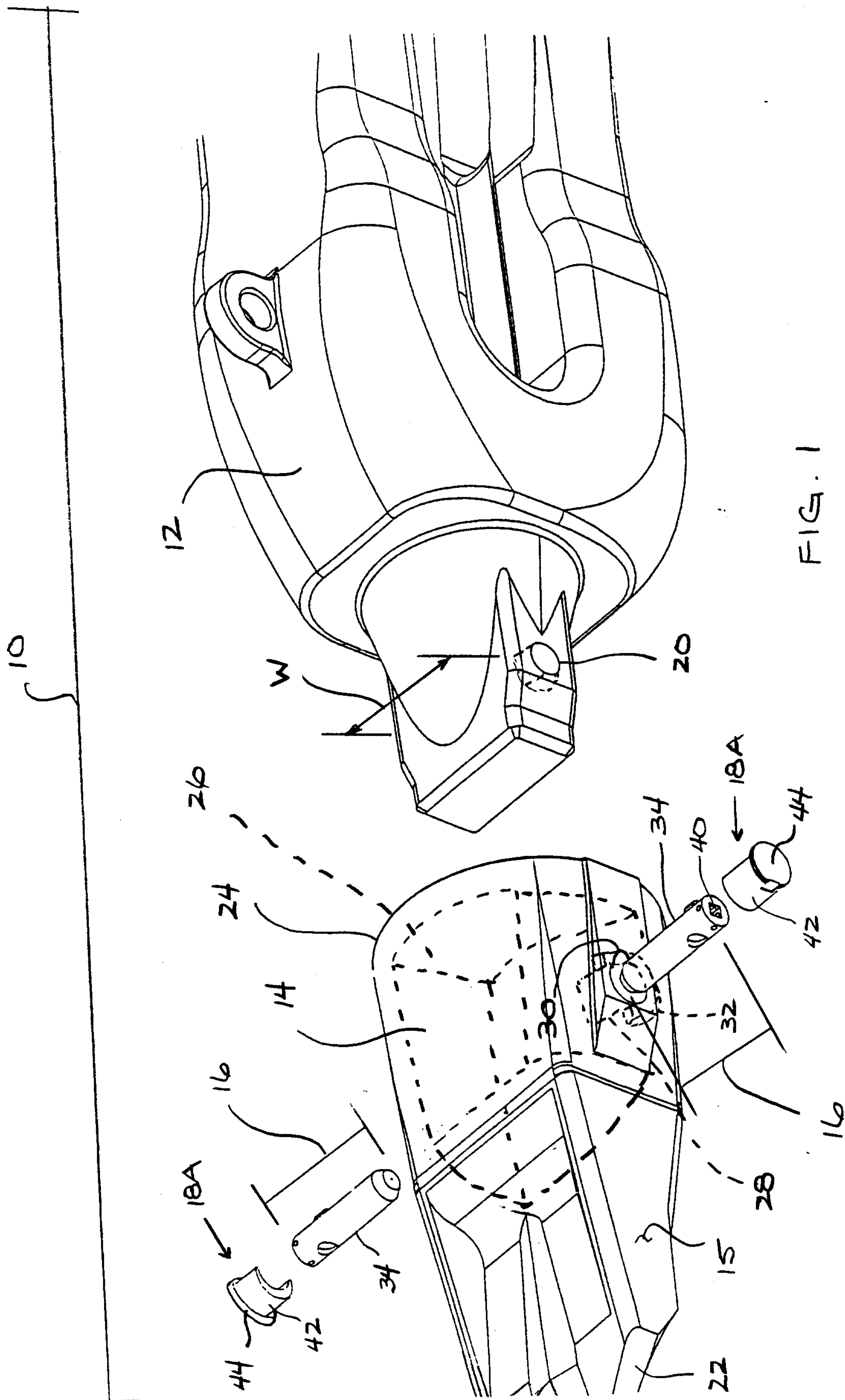


FIG. 1

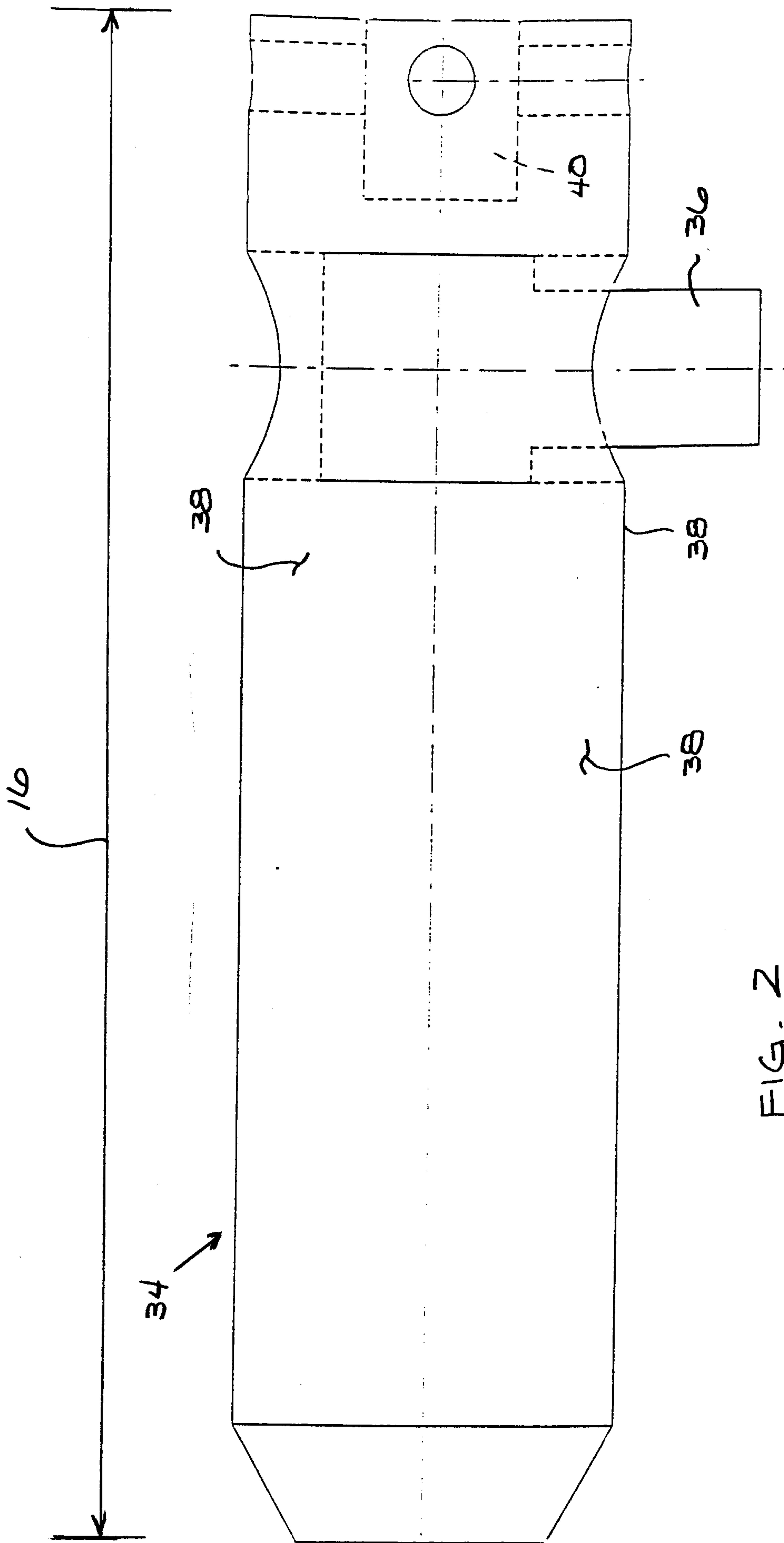
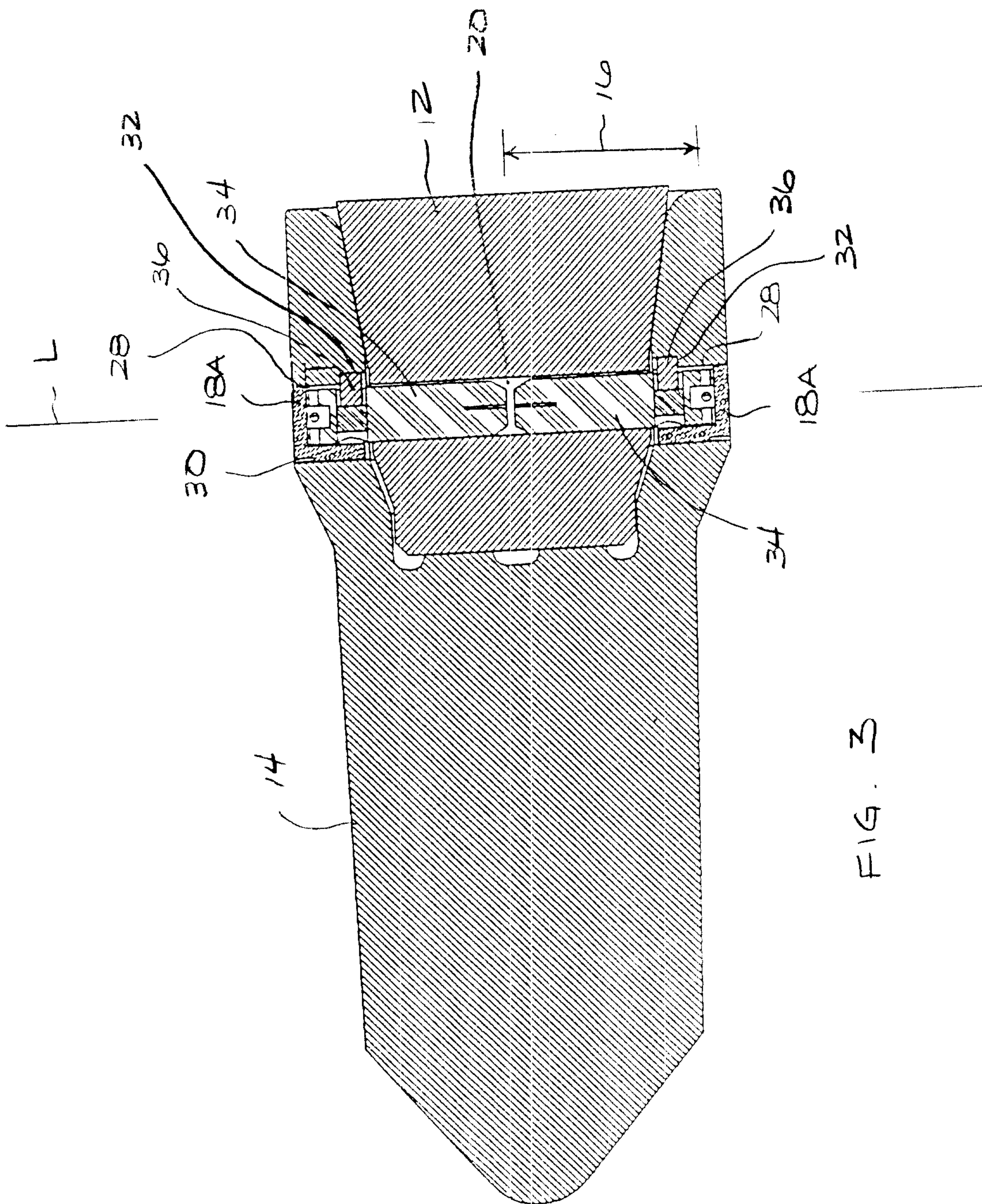
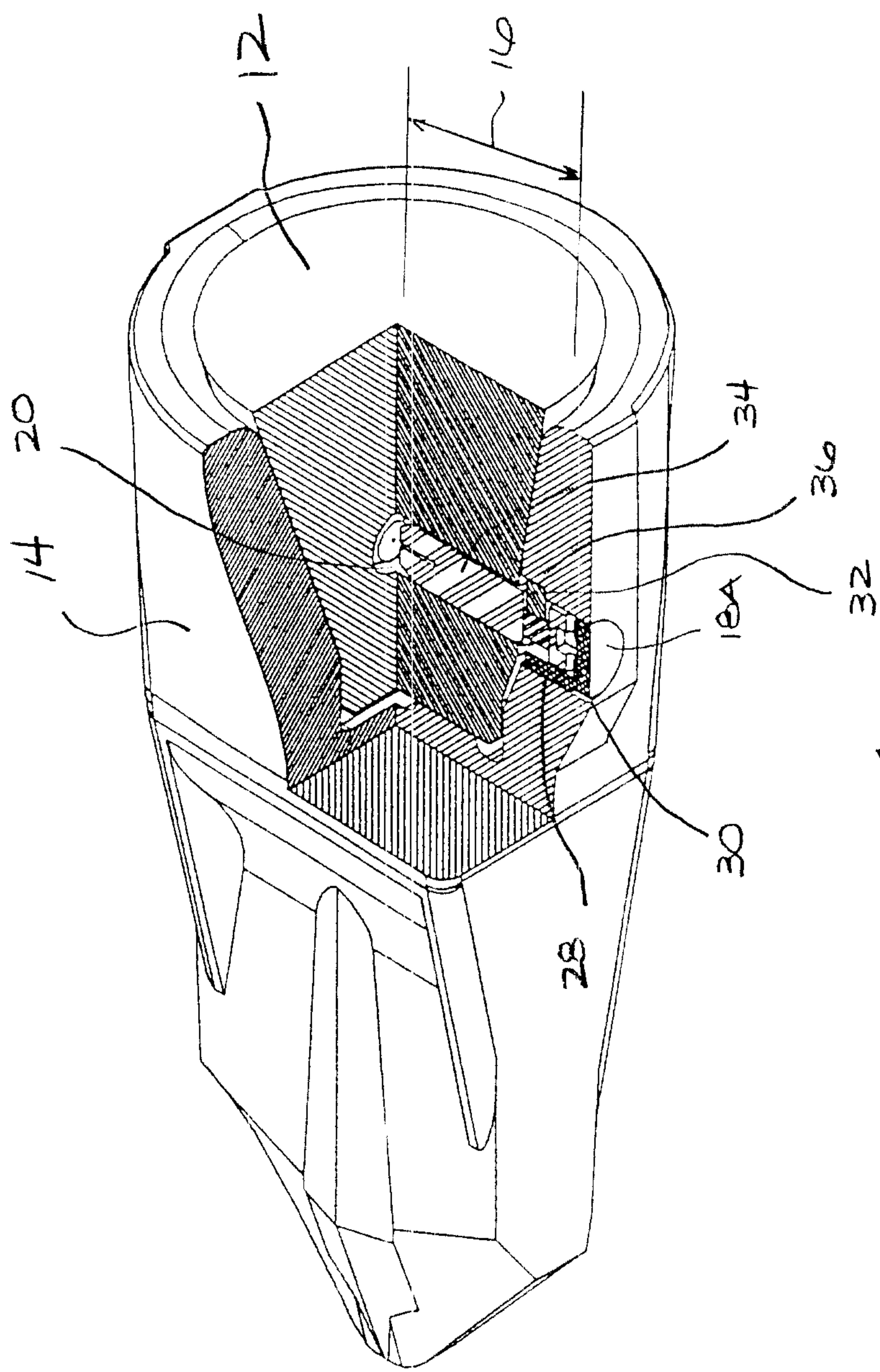


FIG. 2



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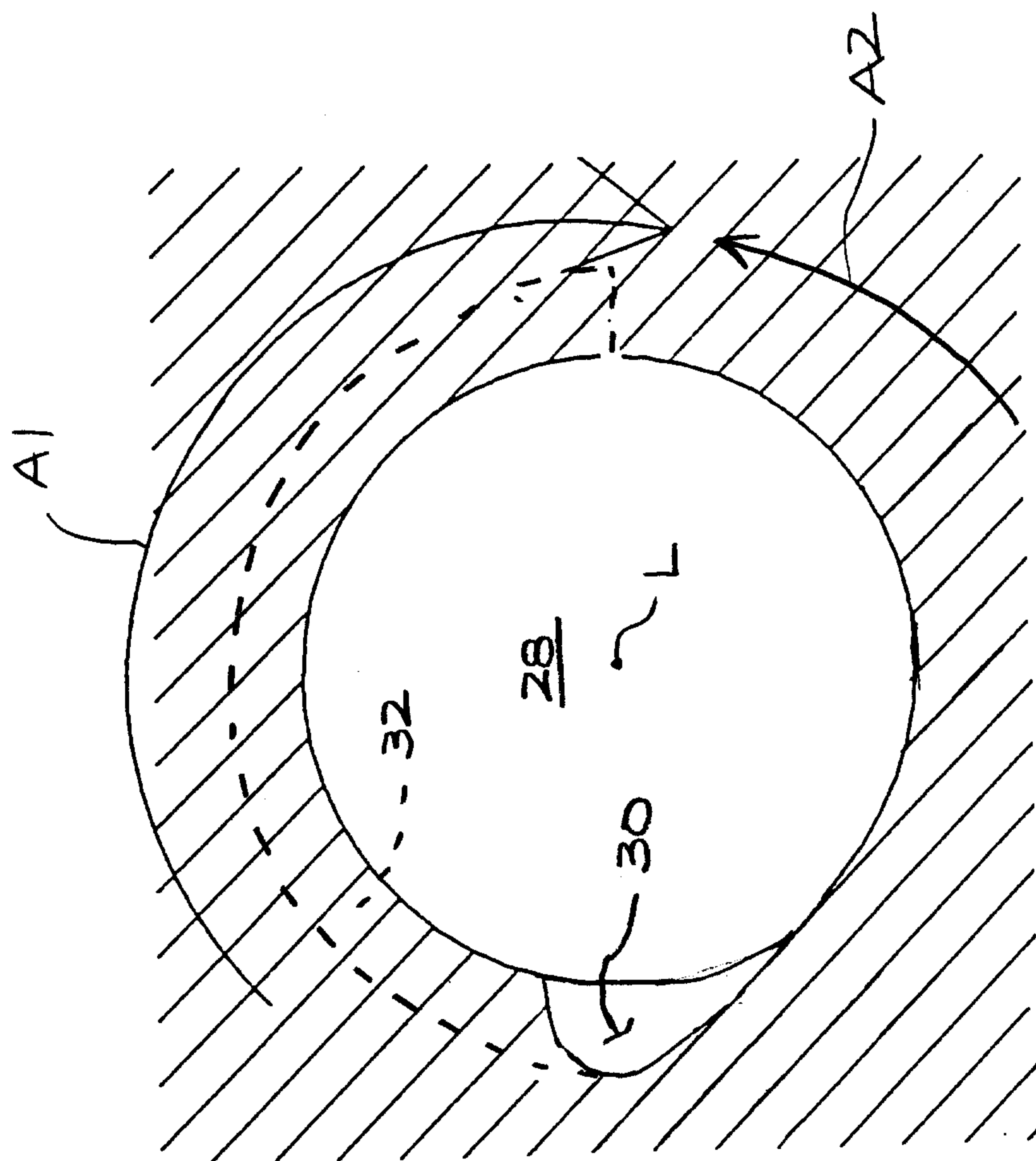


FIG. 5

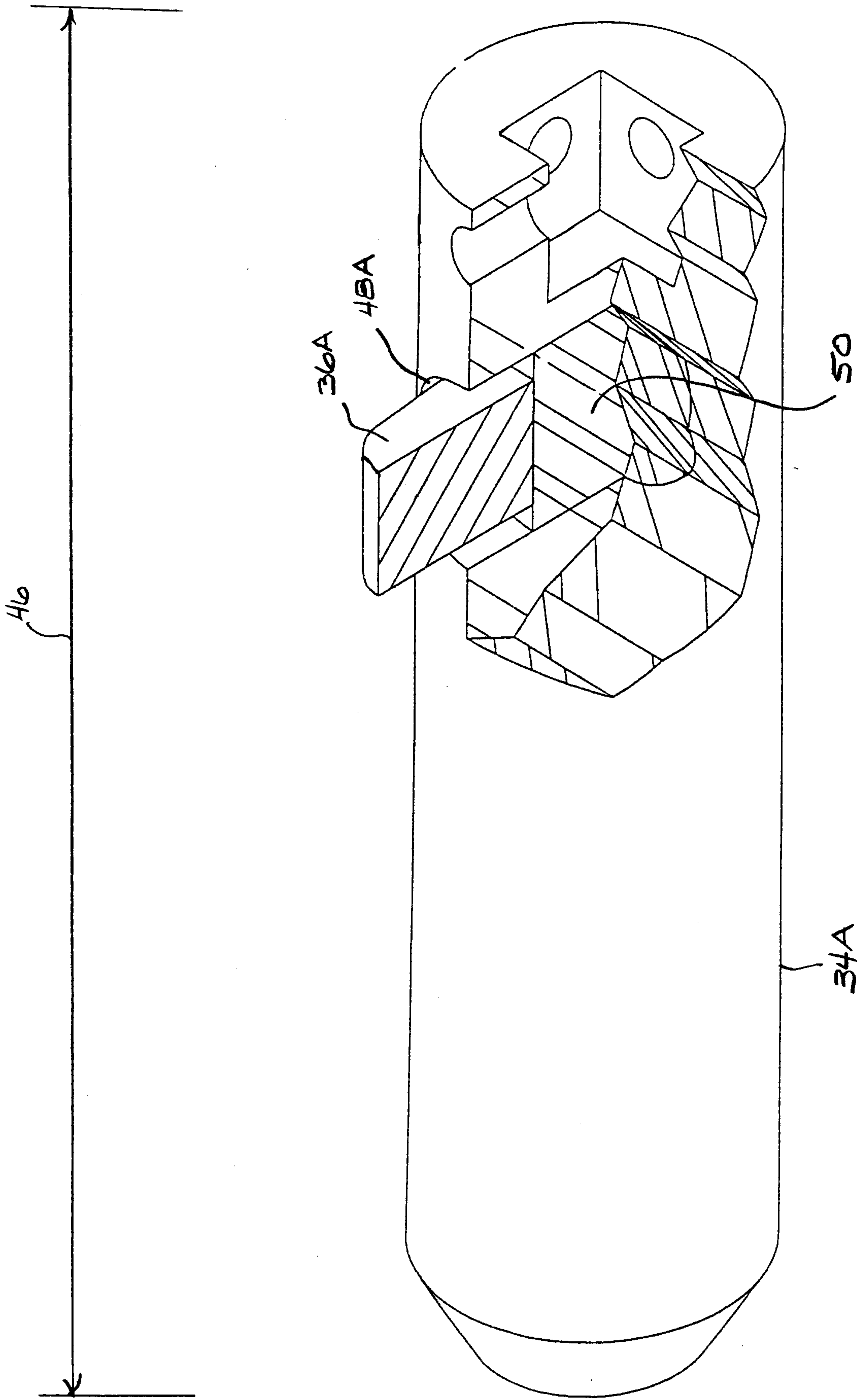


FIG. 6

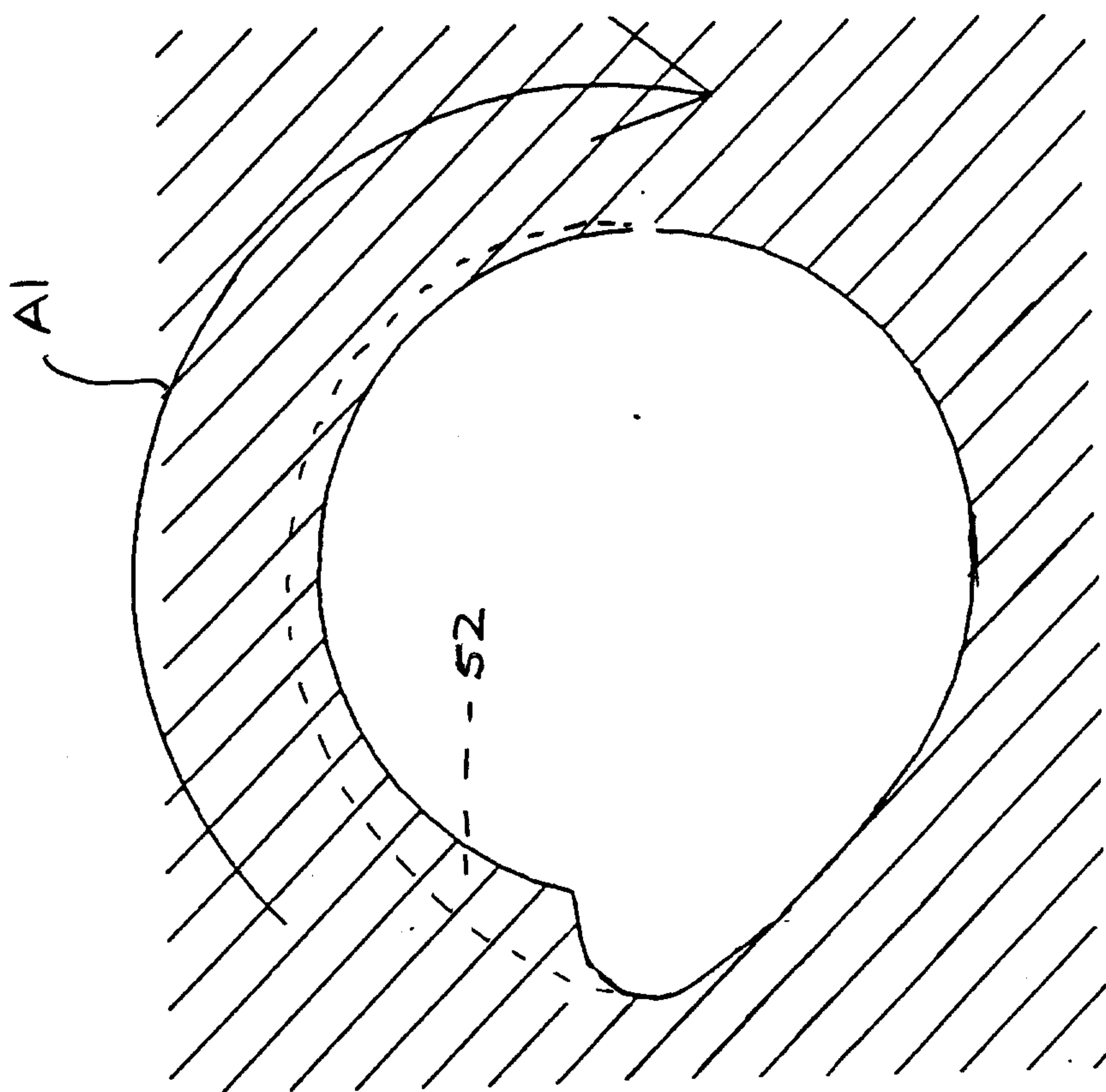
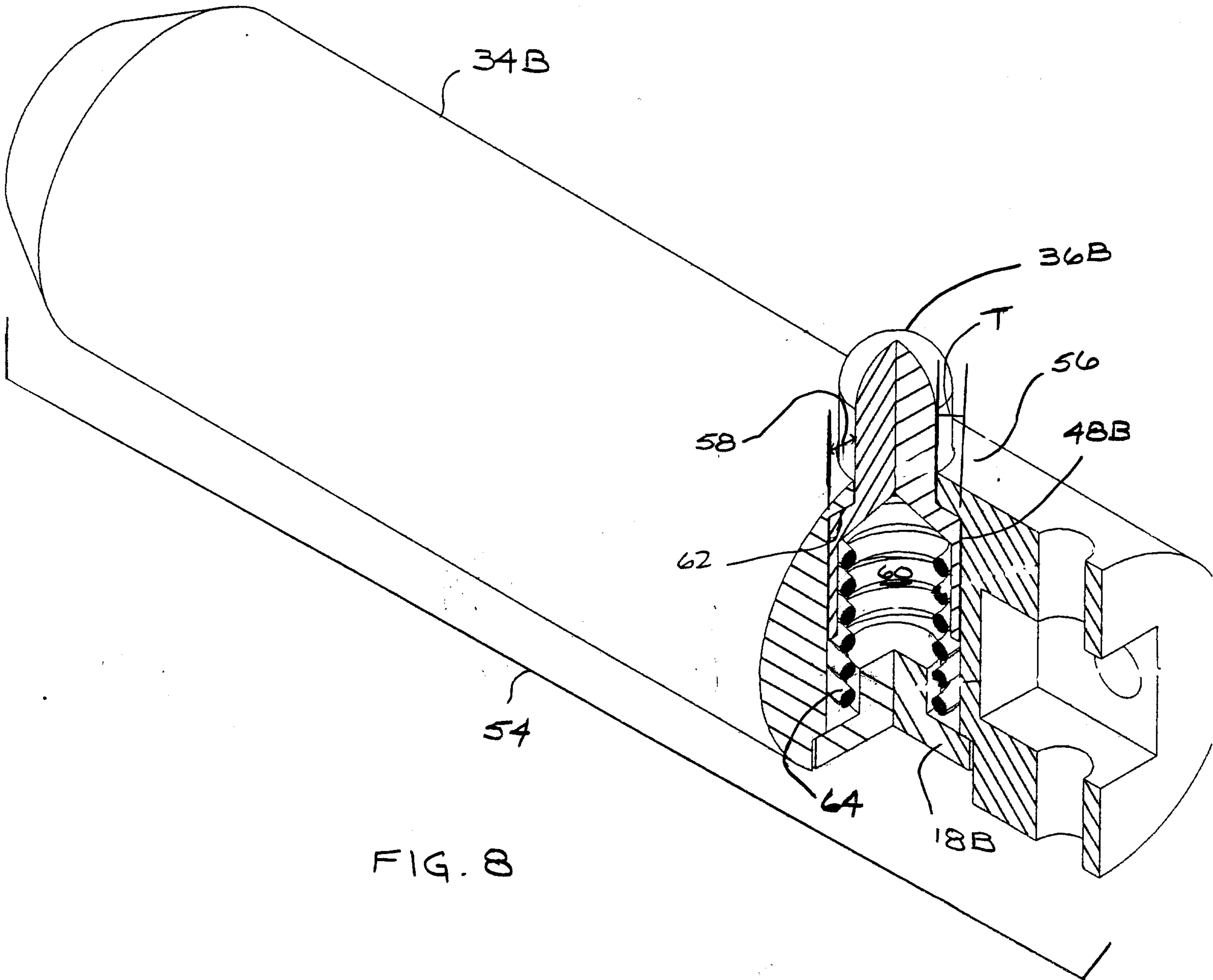


FIG. 7



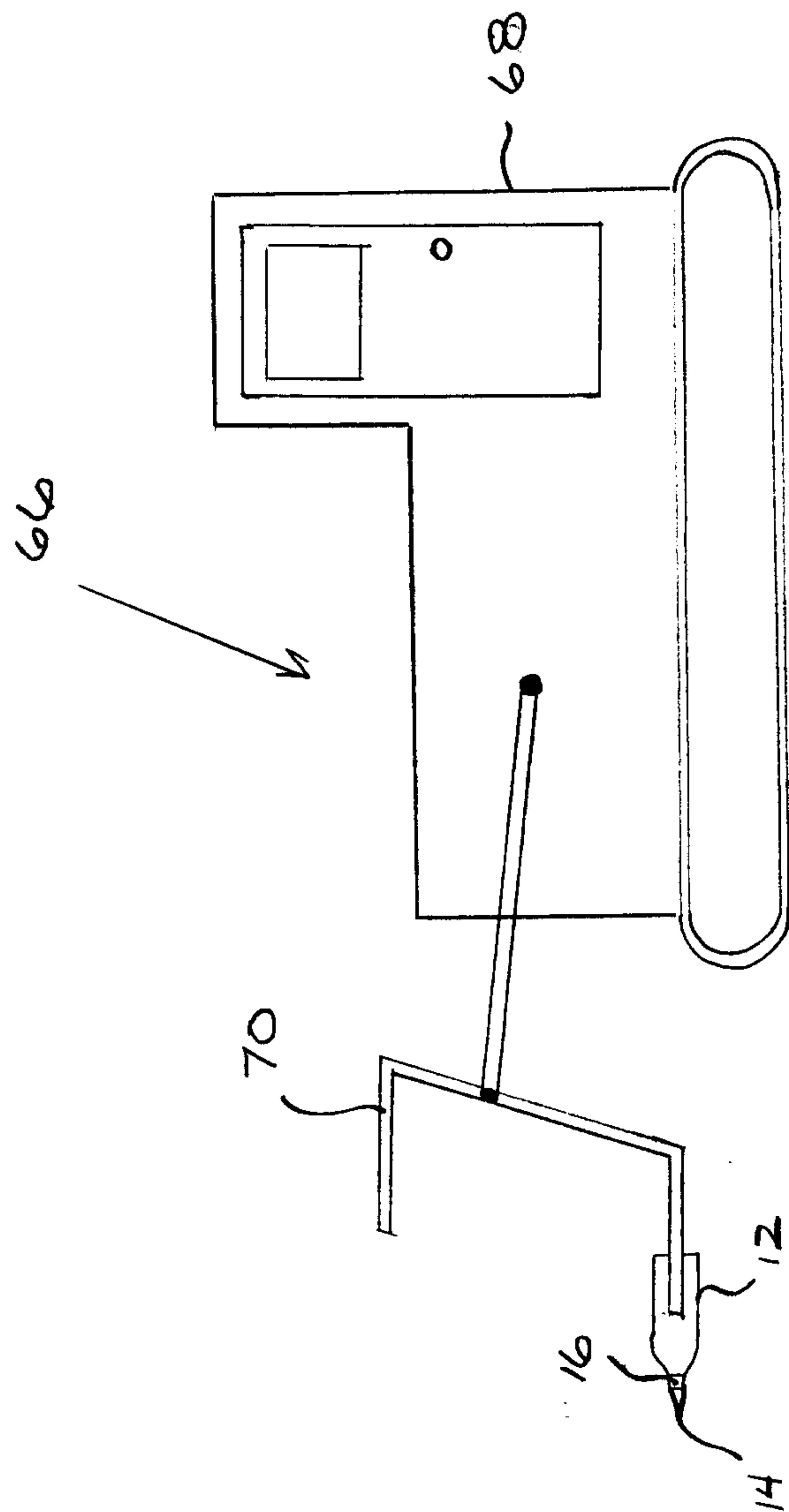


FIG. 9

