

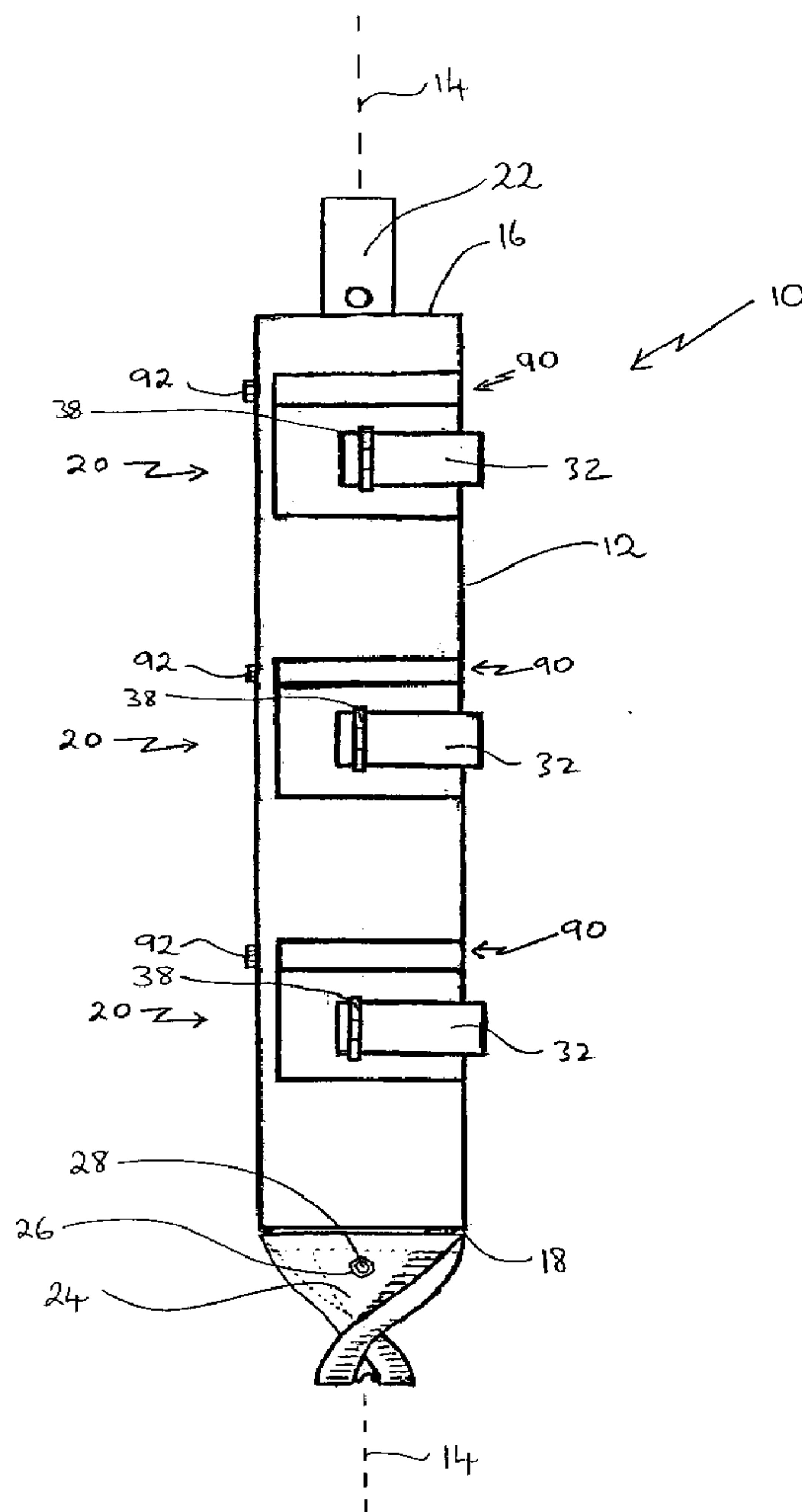


(72) FRENCH, Robert Dale, CA  
(72) JACKSON, Neil Russell, CA  
(71) FRENCH, Robert Dale, CA  
(71) JACKSON, Neil Russell, CA

(51) Int.Cl.<sup>6</sup> E21B 49/02, E21B 25/00

(54) **METHODE DE PRELEVEMENT D'ECHANTILLONS DE SOLS  
ET APPAREIL D'ECHANTILLONNAGE DE SOLS**

(54) **A METHOD OF TAKING SOIL SAMPLES AND A SOIL  
SAMPLING APPARATUS**



(57) A soil sampling apparatus and method of soil sampling. The soil sampling apparatus has several soil sampling compartments, each of which has a closure with an open position and a closed position. Upon rotation in one direction, a second edge of the closure engages a borehole to move the closure to the closed position. Upon rotation in another direction, the second edge of the closure engages the borehole to move the closure to the open position and scrape cuttings into the compartment.



UNITED STATES/CANADA

**ABSTRACT OF THE DISCLOSURE**

A soil sampling apparatus and method of soil sampling.  
5 The soil sampling apparatus has several soil sampling  
compartments, each of which has a closure with an open position  
and a closed position. Upon rotation in one direction, a  
second edge of the closure engages a borehole to move the  
closure to the closed position. Upon rotation in another  
10 direction, the second edge of the closure engages the borehole  
to move the closure to the open position and scrape cuttings  
into the compartment.

**TITLE OF THE INVENTION:**

A Method Of Taking Soil Samples And A Soil Sampling Apparatus

**5 NAME(S) OF INVENTOR(S):**

Robert Dale French  
Neil Russell Jackson

**FIELD OF THE INVENTION**

10 The present invention relates to a method of taking soil samples and a soil sampling apparatus.

**BACKGROUND OF THE INVENTION**

There are many applications in which soil samples must be  
15 taken at varying depths. One example of such an application, is where soil samples are taken to determine the suitability of a property as a building site. Another example of such an application, is where soil samples are taken to check for environmental contamination of a site.

20

Earth boring drills with helical external flights are used to avoid making a major excavation when taking subsurface soil samples. As the earth boring drill bores a hole, soil cuttings are carried to surface by the helical flights.  
25 Unfortunately, a certain amount of mixing of the soil cuttings unavoidably occurs as the soil cuttings are carried up the helical flights. It is, therefore, impossible to tell with precision the start and end of soil stratum.

**30 SUMMARY OF THE INVENTION**

What is required is a more accurate method of taking soil samples and a soil sampling apparatus that will enable more accurate taking of soil samples in accordance with the teachings of the method.

35

According to one aspect of the present invention there is provided a soil sampling apparatus which includes a tubular

body having a longitudinal axis, a first end and second end. A coupling is provided at the first end of the tubular body by means of which the tubular body is rotated in one of a clockwise and a counterclockwise direction about the  
5 longitudinal axis. Several soil sampling compartments are provided in the tubular body spaced at intervals axially along the tubular body between the first end and the second end. Each of the sampling compartments has a closure with an open position and a closed position. Each closure has a first edge  
10 and a second edge, with a hinge positioned along the first edge pivotally mounting each closure for movement about a secondary axis parallel to the longitudinal axis. The second edge of each closure protrudes tangentially past the tubular body. Upon rotation in one of the clockwise and the counterclockwise  
15 directions the second edge of the closure engages a borehole to move the closure to the closed position. Upon rotation in another of the clockwise and the counterclockwise directions the second edge of the closure engages the borehole to move the closure to the open position and scrape cuttings into the  
20 compartment.

Although beneficial results may be obtained through the use of the soil sampling apparatus, as described above, in order to use the apparatus a borehole would have to be drilled  
25 by a separate drill. Even more beneficial results may, therefore, be obtained when an earth boring tip is positioned at the second end of the tubular body. This enables the soil sampling apparatus to function as a drill. The tubular body does not have helical flights, however. Cuttings are not  
30 carried to surface, they are merely compressed into the sidewalls of the borehole.

Although beneficial results may be obtained through the use of the soil sampling apparatus, as described above, it is  
35 sometimes difficult to remove and clean soil cuttings from the compartments in preparation for the next soil sampling. Even more beneficial results may, therefore, be obtained when

containers are detachably secured in each of the sampling compartments. This enables soil to be gathered in containers, that are then removed after sampling is completed. Once removed, clean and uncontaminated containers can be used for  
5 the next soil sampling. The full containers can then be emptied and cleaned at the users convenience. The removal of the containers makes them more accessible for cleaning.

According to another aspect of the present invention there  
10 is provided a method of taking soil samples. A soil sampling apparatus is provided substantially as described above. The tubular body is rotated in one of the clockwise and the counterclockwise directions during entry into the borehole to cause the second edge of the closure to engage a borehole  
15 created by the earth boring tip to move the closure to the closed position, thereby precluding soil cuttings from entering the soil sampling compartments. The tubular body is then rotated in another of the clockwise and the counterclockwise directions while sampling to cause the second edge of the  
20 closure to engage the borehole to move the closure to the open position and scrape cuttings into the compartment. The tubular body is then rotated in one of the clockwise and the counterclockwise directions while withdrawing the tubular body from the borehole to cause the second edge of the closure to  
25 engage the borehole to move the closure to the closed position.

It will be appreciated that with the method, as described above, the drilling operation and the sampling operations of the apparatus are isolated. When the apparatus is rotating in  
30 a first direction, it is in a drilling mode. In the drilling mode, the closure of the sampling compartment is pushed to a closed position precluding the entry of soil cuttings. Once a borehole has been drilled, the apparatus is rotated in a second direction, to assume a sampling mode. In the sampling  
35 mode, the closure of the sampling compartment is forced into an open position and soil is scraped into the sampling compartment. The apparatus is again rotated in the first

direction as the apparatus is withdrawn from the borehole to move the closure to the closed position and avoid contamination of the samples.

5 **BRIEF DESCRIPTION OF THE DRAWINGS**

These and other features of the invention will become more apparent from the following description in which reference is made to the appended drawings, wherein:

10 **FIGURE 1** is a side elevation view of a soil sampling apparatus constructed in accordance with the teachings of the present invention.

**FIGURE 2** is a top plan view of the soil sampling apparatus illustrated in **FIGURE 1** being rotated in a clockwise direction.

15 **FIGURE 3** is a top plan view of the soil sampling apparatus illustrated in **FIGURE 1** being rotated in a counterclockwise direction.

**FIGURE 4** is a detailed side elevation view, in section, of a container positioned in a sampling compartment of the soil sampling apparatus illustrated in **FIGURE 1**.

20 **FIGURE 5** is an exploded perspective view of removal of the container illustrated in **FIGURE 4**, from the sampling compartment of the soil sampling apparatus illustrated in **FIGURE 1**.

25 **DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT**

The preferred embodiment, a soil sampling drill generally identified by reference numeral 10, will now be described with reference to **FIGURES 1** through 5.

30 Referring to **FIGURE 1**, soil sampling drill 10 includes a tubular body 12 having sidewalls 13, a longitudinal axis indicated by dashed lines 14, a first end 16 and a second end 18. Several soil sampling compartments are provided in the form of containers 20 that are removably secured within tubular  
35 body 12 at spaced intervals axially along tubular body 12 between first end 16 and second end 18. Tubular body 12 is rotated in one of a clockwise and counterclockwise direction

about longitudinal axis 14 by means of a coupling 22 at first end 16 of tubular body 12. An earth boring tip 24 is detachably secured by means of a nut 26 and a bolt 28 at second end 18 of tubular body 12. Referring to **FIGURE 5**, sidewalls 13 of tubular body 12 have an interior surface 52 defining an interior and an exterior surface 54. Containers 20 are inserted through an opening 80 in sidewalls 13 into cavities 53 in tubular body 12. Sleeves 82 are rigidly secured to interior surface 52 of sidewalls 13 above and below opening 80. Each sleeve 82 has a first end 84 and a second end 86. Each container 20 has a bottom 62 and peripheral sidewalls 64. Peripheral sidewalls 64 have an outer surface 66 and an inside surface 68 that defines an interior 72. When container 20 is inserted through opening 80 into one of cavities 53, bottom 62 of container 20 adjacent peripheral sidewalls 64 is supported from below by second end 86 of a sleeve 82. Referring to **FIGURES 2** through **4**, an arcuate opening 70 extends through sidewall 64 of container 20 providing access to interior 72. Each arcuate opening 70 of container 20 has an arcuate closure 32 having a first edge 34 and a second edge 36. A hinge pin 38 is positioned along first edge 34 thereby pivotally mounting closure 32 to container 20 for movement about a secondary axis defined by hinge pin 38 parallel to longitudinal axis 14. Referring to **FIGURE 2**, second edge 36 of each closure 32 protrudes tangentially past sidewalls 13 of tubular body 12. Closure 32 has a closed position, illustrated in **FIGURE 2**, in which closure 32 completely covers arcuate opening 70 to preclude entry of soil into interior 72 of container 20; and an open position, illustrated in **FIGURE 3**.

30

Referring to **FIGURE 3**, a stop 46 is rigidly attached to an interior surface 47 of closure 32. Referring to **FIGURE 4**, stop 46 is "T" shaped with a radial portion 48 and a longitudinal portion 50. Longitudinal portion 50 of "T" shaped stop 46 has a length that is greater than a height of opening 70 of container 20. Referring to **FIGURE 3**, an extent by which closure 32 can be moved to the open position is limited by

35

longitudinal portion 50 of "T" shaped stop 46 engaging interior surface 68 of sidewalls 64 surrounding opening 70 of container 20.

5 Referring to **FIGURES 4** and **5**, container 20 is precluded from inadvertent removal from cavities 53 of tubular body 12 by a disk form spacer member 90. Spacer disk 90 is secured in position by a screw 92 which extends through sidewall 13 of tubular housing 12. Each spacer disk 90 has a circular body  
10 93 with a top face 94, a bottom face 96, a first side 98 and a second side 100. A diameter of circular body 93 fits closely within diameter of interior surface 52 of sidewalls 13 of tubular body 12. Referring to **FIGURE 5**, a cavity 102 at first side 98 of circular body 93 is threaded to matingly receive  
15 screw 92. A semicircular wall member 104 of spacer member 90 depends from perimeter surface 106 at second side 100 of circular body 93. Referring to **FIGURE 4**, when spacer member 90 is secured in place above container 20, container 20 is secured between bottom face 96 of spacer member 90 and second  
20 end 86 of sleeve 82 below said container 20. Container 20 is constrained from moving laterally through opening 80 in sidewalls 13 and thereby being inadvertently removed from tubular body 12 by engagement of sidewall 64 at top 60 of container 20 with wall member 104 of spacer member 90.

25

Referring to **FIGURE 2**, upon rotation of tubular body 12 a clockwise direction, as indicated by curved arrow 42, second edge 36 of closure 32 engages a borehole (not shown) created by earth boring tip 24 to move closure 32 to the closed  
30 position. In the illustrated embodiment, the clockwise direction indicated by curved arrow 42 would be the same direction of rotation of tubular body 12 as is required for use of earth boring tip 24, illustrated in **FIGURE 1**, to drill a borehole. Referring to **FIGURE 3**, upon rotation in the  
35 counterclockwise directions, as indicated by curved arrow 44, second edge 36 of closure 32 engages the borehole to move closure 32 to the open position and scrape cuttings (not shown)



through opening 70 into interior 72 of container 20.

A method of taking soil samples will now be described with reference to **FIGURES 1** through **5**, using soil sampling drill 10. Tubular body 12 is rotated in the clockwise direction so that earth boring tip 24 drills a borehole. As the borehole is being drilled, second edge 36 of closure 32 engages the borehole created by earth boring tip 24 and moves closure 32 to the closed position, illustrated in **FIGURE 2**, thereby precluding soil cuttings from entering soil sampling containers 20. When the borehole has been drilled to a selected depth, in tubular body 12 is rotated in the counterclockwise directions. As tubular body 12 rotates counterclockwise, second edge 36 of closure 32 engages the borehole to move closure 32 to the open position, as illustrated in **FIGURE 3**. Cuttings are scraped into interior 72 of containers 20. Each compartment 20 is at a different depth below the surface and therefore receiving a different sample of the earth being scraped. Tubular body 12 is then rotated in the clockwise directions, thereby again moving closure 32 to the closed position illustrated in **FIGURE 2**. While tubular body 12 is rotated in the counterclockwise directions, tubular body 12 is withdrawn from the borehole. Once soil sampling drill 10 is back at surface, screws 92 are unscrewed from spacing members 90 and spacing members 90 are withdrawn from tubular body 12. Containers 20 containing the samples of soil collected during the above operations are removed to recover said soil samples. If another borehole must be drilled to take further samples, this is done using uncontaminated containers 20.

30

It will be apparent to one skilled in the art that instead of removable containers 20, permanent compartments could be built into tubular body 12. This would not be as convenient to clean after use, but would be a workable embodiment in accordance with the teachings of the present invention.

35

It will also be apparent to one skilled in the art that other modifications may be made to the illustrated embodiment without

departing from the spirit and scope of the invention as hereinafter defined in the Claims.

**THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:**

- 5 1. A soil sampling apparatus, comprising:  
a tubular body having a longitudinal axis, a first end and  
a second end;  
a coupling at the first end of the tubular body by means  
of which the tubular body is rotated in one of a clockwise and  
10 a counterclockwise direction about the longitudinal axis;  
several soil sampling compartments in the tubular body  
spaced at intervals axially along the tubular body between the  
first end and the second end;  
each of the sampling compartments having a closure with  
15 an open position and a closed position, each closure having a  
first edge and a second edge with a hinge positioned along the  
first edge pivotally mounting each closure for movement about  
a secondary axis parallel to the longitudinal axis, the second  
edge of each closure protruding tangentially past the tubular  
20 body, such that upon rotation in one of the clockwise and the  
counterclockwise directions the second edge of the closure  
engages a borehole to move the closure to the closed position  
and upon rotation in another of the clockwise and the  
counterclockwise directions the second edge of the closure  
25 engages the borehole to move the closure to the open position  
and scrape cuttings into the compartment.
2. The soil sampling apparatus as defined in Claim 1, wherein  
an earth boring tip is positioned at the second end of the  
30 tubular body.
3. The soil sampling apparatus as defined in claim 1, wherein  
the soil sampling compartments are in the form of removable  
containers.
- 35 4. The soil sampling apparatus as defined in Claim 3, wherein  
the closures are pivotally secured to the containers.

5. The soil sampling apparatus as defined in Claim 3, wherein the containers are held in position by spacer members.

6. The soil sampling apparatus as defined in Claim 5, wherein  
5 the spacer members are disks.

7. The soil sampling apparatus as defined in Claim 6, wherein the spacer members are secured in place by screws which extend through the tubular housing.

8. A soil sampling drill, comprising:

a tubular body having a longitudinal axis, a first end and second end, several soil sampling compartments in the tubular  
5 body spaced at intervals axially along the tubular body between the first end and the second end;

a coupling at the first end of the tubular body by means of which the tubular body is rotated in one of a clockwise and counterclockwise direction about the longitudinal axis;

10 an earth boring tip at the second end of the tubular body;

the sampling compartments being in the form of containers detachably secured within cavities in the tubular housing, each of the containers having a closure with an open position and a closed position, each closure having a first edge and a  
15 second edge with a hinge positioned along the first edge pivotally mounting each closure to the container for movement about a secondary axis parallel to the longitudinal axis, the second edge of each closure protruding tangentially past the tubular body, such that upon rotation in one of the clockwise  
20 and the counterclockwise directions the second edge of the closure engages a borehole created by the earth boring tip to move the closure to the closed position and upon rotation in another of the clockwise and the counterclockwise directions the second edge of the closure engages the borehole to move the  
25 closure to the open position and scrape cuttings into the container.

9. The soil sampling drill as defined in Claim 7, wherein the containers are smaller than the cavities in the tubular body,  
30 the containers being precluded from removal from the cavities by disk form spacer members which are secured in position by screws which extend through the tubular housing.

10. A method of taking soil samples, comprising the steps of:  
providing a soil sampling drill, including:
- 5 a tubular body having a longitudinal axis, a first end and second end;
  - a coupling at the first end of the tubular body by means of which the tubular body is rotated in one of a clockwise and counterclockwise direction about the longitudinal axis;
  - 10 an earth boring tip at the second end of the tubular body;
  - several soil sampling compartments in the tubular body spaced at intervals axially along the tubular body between the first end and the second end;
  - 15 each of the sampling compartments having a closure with an open position and a closed position, each closure having a first edge and a second edge with a hinge positioned along the first edge pivotally mounting each closure for movement about a secondary axis parallel to the longitudinal axis, the second edge of each closure protruding tangentially past the tubular body;
  - 20 rotating the tubular body in one of the clockwise and the counterclockwise directions while drilling to cause the second edge of the closure to engage a borehole created by the earth boring tip to move the closure to the closed position, thereby precluding soil cuttings from entering the soil sampling compartments;
  - rotating the tubular body in another of the clockwise and the counterclockwise directions while sampling to cause the 30 second edge of the closure to engage the borehole to move the closure to the open position and scrape cuttings into the compartment; and
  - rotating the tubular body in one of the clockwise and the counterclockwise directions while withdrawing the tubular body 35 form the borehole to cause the second edge of the closure to engage the borehole to move the closure to the closed position.

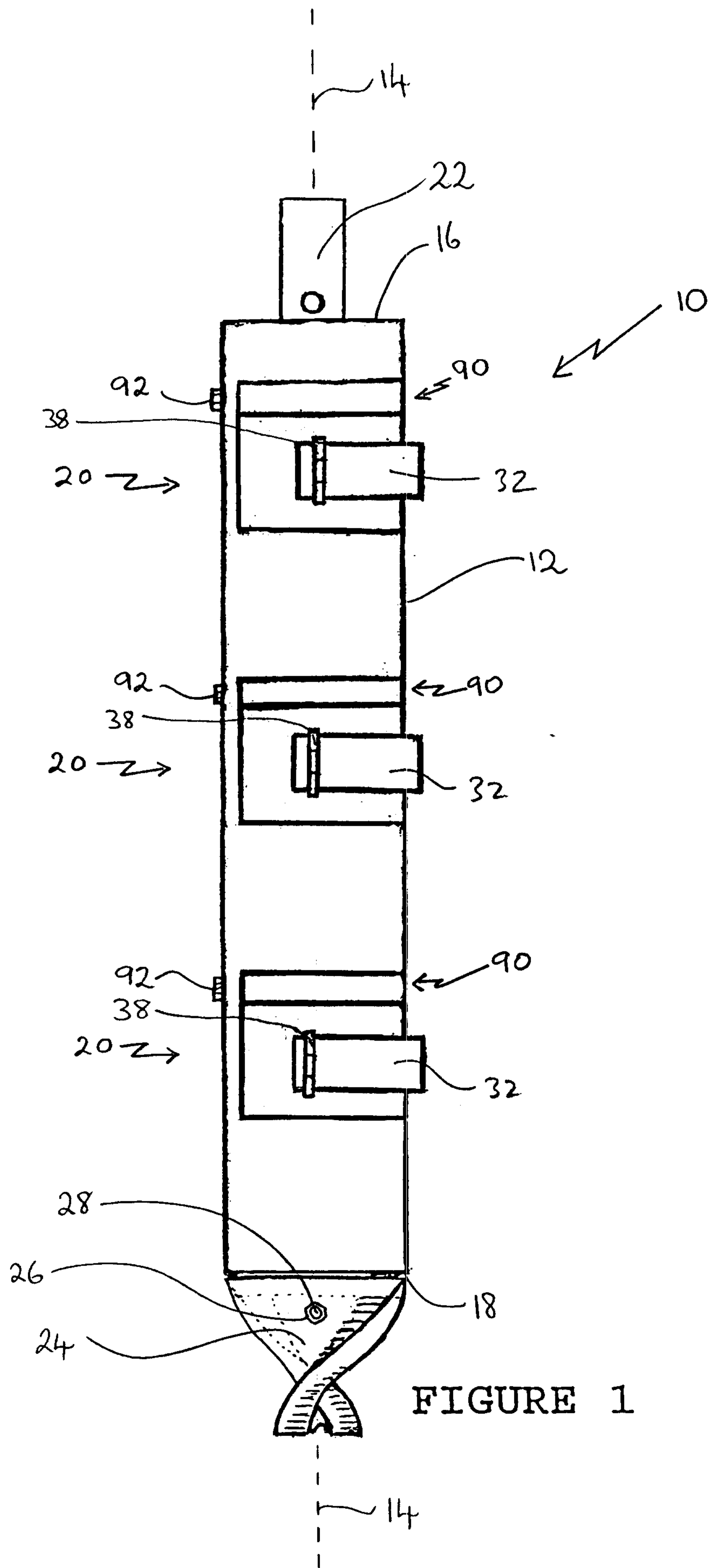


FIGURE 1

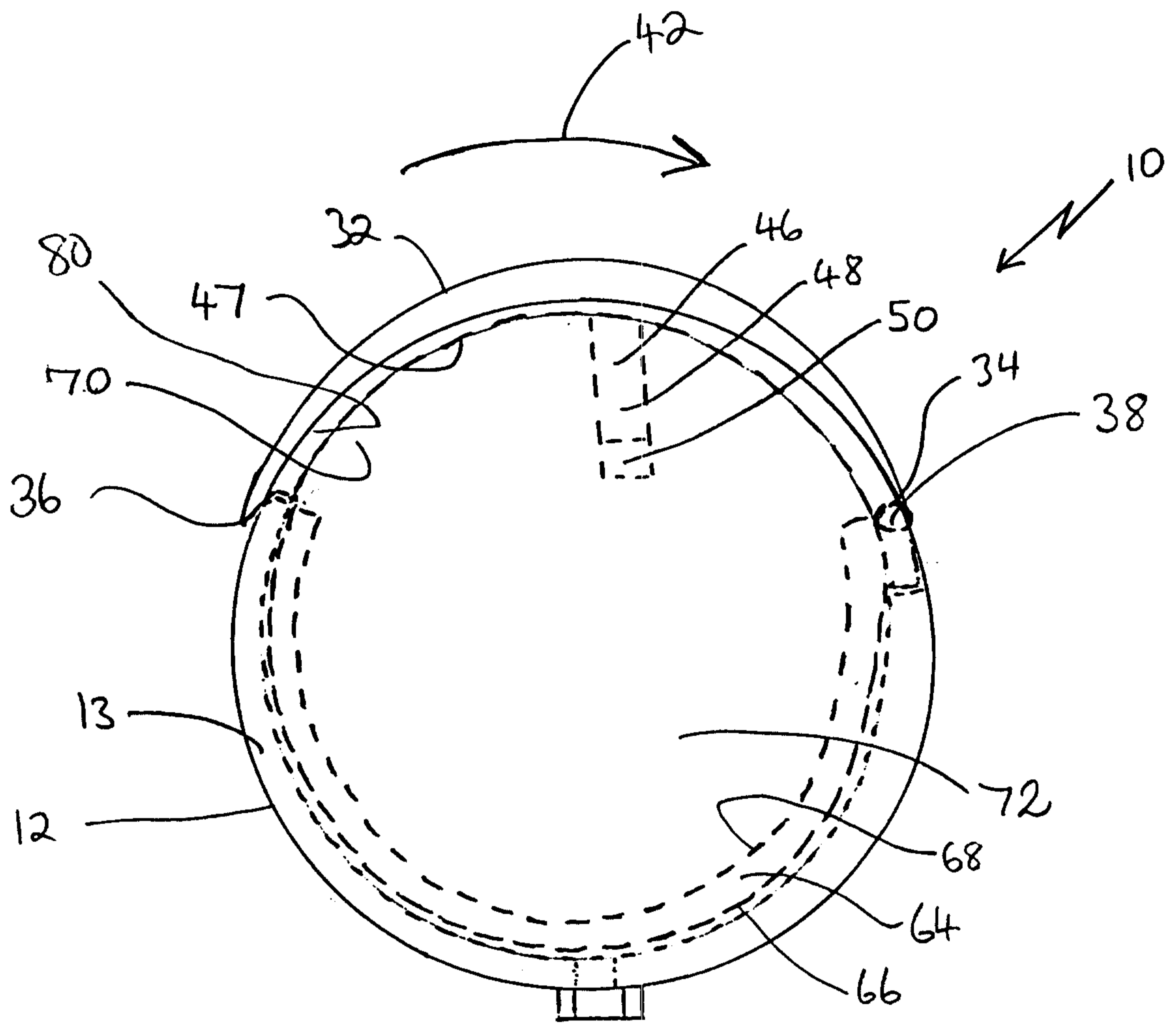


FIGURE 2



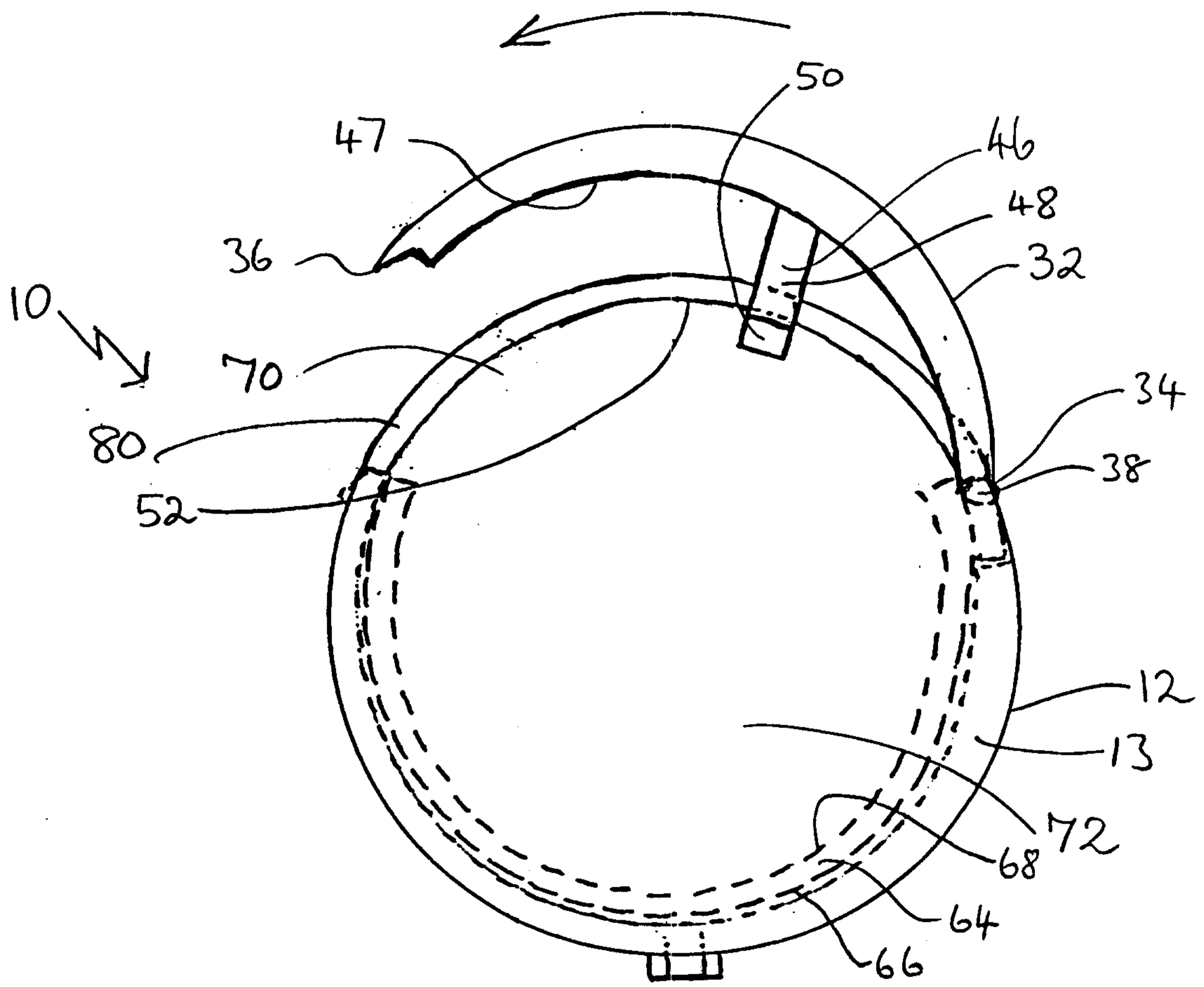


FIGURE 3

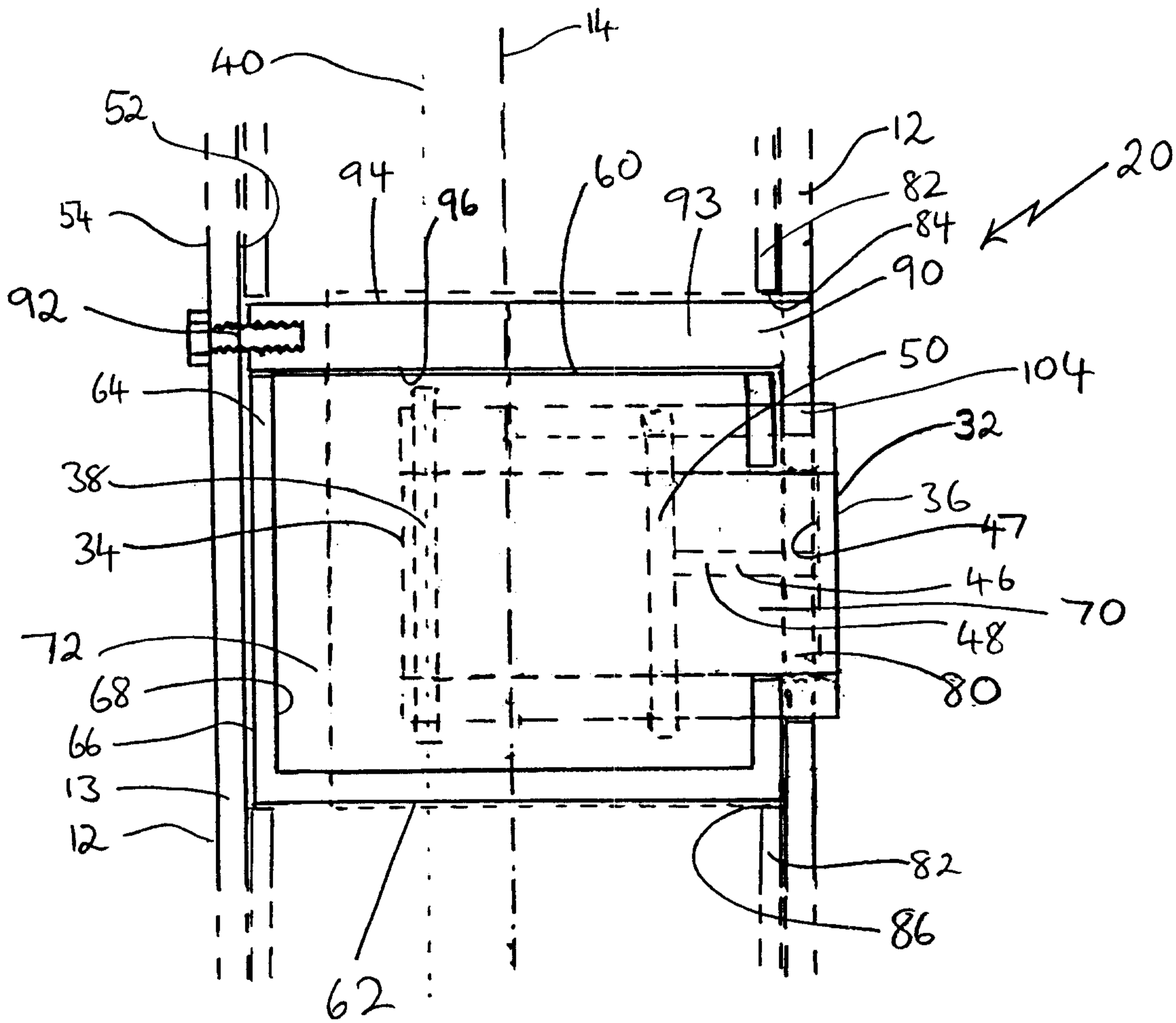


FIGURE 4

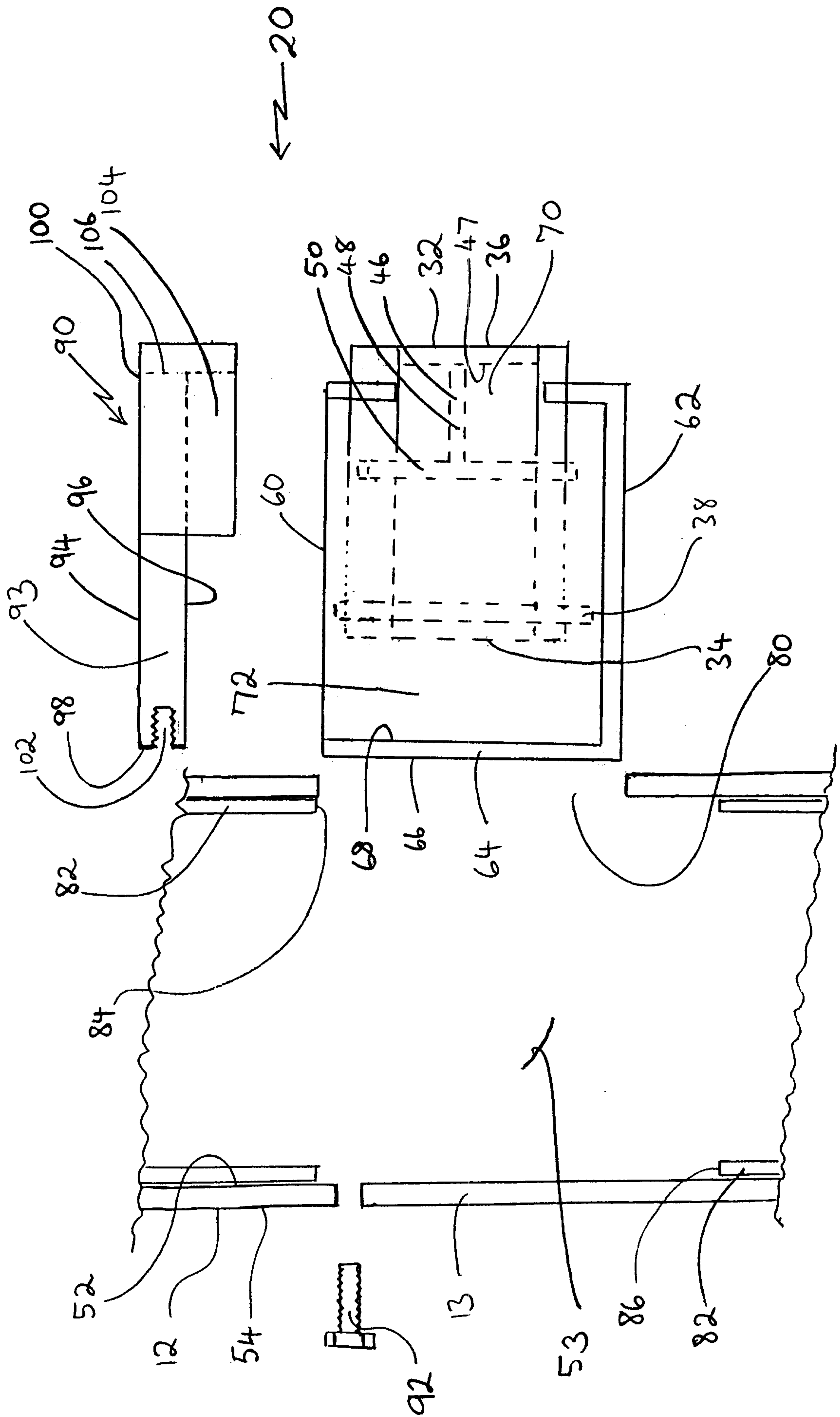


FIGURE 5

