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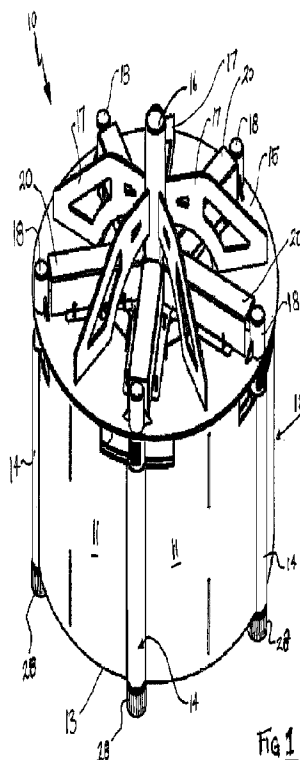


Fig 1

(57) **Abrégé/Abstract:**

There is disclosed a device for boring holes in a ground surface comprising: a core barrel having a barrel top and an open barrel bottom, the barrel top having a shaft mounted thereto for engaging with a rotary power source for rotating the core barrel; at least one cutting member mounted to the core barrel at the open barrel bottom; and a pressurised fluid source in fluid communication with the shaft for delivering a supply of pressurised fluid to the shaft; wherein the at least one cutting member is configured such that when it is mounted to the core barrel at the open barrel bottom, the pressurised fluid causes the at least one cutting member to perform a cutting motion to remove the ground surface.



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Abstract:

There is disclosed a device for boring holes in a ground surface comprising: a core barrel having a barrel top and an open barrel bottom, the barrel top having a shaft mounted thereto for engaging with a rotary power source for rotating the core barrel; at least one cutting member mounted to the core barrel at the open barrel bottom; and a pressurised fluid source in fluid communication with the shaft for delivering a supply of pressurised fluid to the shaft; wherein the at least one cutting member is configured such that when it is mounted to the core barrel at the open barrel bottom, the pressurised fluid causes the at least one cutting member to perform a cutting motion to remove the ground surface.

DRILLING ARRANGEMENTS

FIELD OF INVENTION

The present invention relates generally to drilling arrangements for drilling into a ground surface, and in particular, to earth drilling configurations for drilling
5 through a variety of surfaces for forming a hole therein.

BACKGROUND OF THE INVENTION

Earth drilling devices, such as augers, drills and the like, are well known. Such devices can be used across a variety of terrain to dig holes in the terrain for excavation or construction purposes. An auger typically comprises a rotating
10 helical screw blade that functions to break through the earth or soil and remove the drilled out soil by transporting the material from the leading cutting edge of the helical screw blade and along the helix and out of the resulting hole.

Augers and the like have proven successful in digging holes through a variety of different types of terrain, from soft earth through to hard rock. As the terrain
15 becomes harder to penetrate, the auger may lose cutting efficiency through the cutting edge becoming blunt or duller. This is typically addressed through treating the cutting edge with abrasives and the like which ensure that the auger is sufficiently sharp to perform its purpose.

In some applications it may be necessary to remove a core sample or create a
20 foundation hole at the drilling site, thus leaving behind a hole equivalent to the removed core. Core samples may be taken for geological assessment of the soil for mining purposes or for structural integrity purposes whilst foundation holes may be required to accommodate a foundation or support for a pole or the like, such as a support pole for a wind turbine.

Core or foundation holes are typically formed with a barrel cutter as the drill bit.
25 In this regard, the barrel cutter is attached to an excavator or similar machine that is capable of applying a rotational motion to the barrel cutter. A plurality of cutting teeth are typically provided around the lower edge opening of the barrel such that as the barrel rotates and is forced in a downward direction, the cutting
30 teeth function to cut through the ground surface. This is maintained until the barrel cutter achieves its desired depth after which time the excavator lifts the barrel cutter from the soil, thus leaving behind the core or foundation hole and removing the core, which is captured within the barrel or drum.

Whilst such devices have proven effective in achieving a core or foundation hole, it is not uncommon for conventional barrel cutters to require removal and servicing during the cutting operation, which can take time and requires the presence of skilled personnel to service the device as required during operation.

- 5 Thus, there is a need to provide an improved barrel cutter that addresses these issues.

The above references to and descriptions of prior proposals or products are not intended to be, and are not to be construed as, statements or admissions of common general knowledge in the art. In particular, the above prior art
10 discussion does not relate to what is commonly or well known by the person skilled in the art, but assists in the understanding of the inventive step of the present invention of which the identification of pertinent prior art proposals is but one part.

STATEMENT OF INVENTION

- 15 Accordingly, in one aspect of the invention there is provided a device for boring holes in a ground surface comprising:
- a core barrel having a barrel top and an open barrel bottom, the barrel top having a shaft mounted thereto for engaging with a rotary power source for rotating the core barrel;
 - 20 at least one cutting member mounted to the core barrel at the open barrel bottom; and
 - a pressurised fluid source in fluid communication with the shaft for delivering a supply of pressurised fluid to the shaft;
 - wherein the at least one cutting member is configured such that
 - 25 when it is mounted to the core barrel at the open barrel bottom, the pressurised fluid causes the at least one cutting member to perform a cutting motion to remove the ground surface.

Accordingly, in another aspect of the invention there is provided a device for boring holes in a ground surface comprising:

- 30 an auger having a pair of helical flights or removing cut material;
- a central recess extending centrally with respect to the pair of helical flights;
 - a pressurised fluid source in fluid communication with the central recess shaft for delivering a supply of pressurised fluid thereto; and
 - 35 a cutting member mounted to the a base of the auger;
 - wherein the at least one cutting member is configured such that

when it is mounted to the base of the auger, the pressurised fluid causes the at least one cutting member to perform a cutting action to remove the ground surface.

BRIEF DESCRIPTION OF THE DRAWINGS

- 5 The invention may be better understood from the following non-limiting description of preferred embodiments, in which:

Fig. 1 is a top perspective view of a barrel cutter in accordance with an embodiment of the present invention;

Fig. 2 is a side view of the barrel cutter of Fig. 1;

10 Fig. 3 is a bottom view of the barrel cutter of Fig. 1;

Fig. 4 is a top view of the barrel cutter of Fig. 1;

Fig. 5 is cross sectional side view of the barrel cutter of Fig. 1;

Figs. 6A and 6B are front and side views respectively of hammer members to be used with the barrel cutter of Fig. 1;

15 Fig. 7 is an enlarged cross-sectional view of barrel cutter of Fig. 1 showing the manner in which the hammer members engage with the cap members;

Fig. 8 is a side view of an auger assembly in accordance with another embodiment of the present invention;

20 Fig. 9 is an bottom view of a barrel cutter employing a core extraction tool in accordance with an embodiment of the present invention;

Fig. 10 is a cross sectional side view of the core extraction tool of Fig. 9 in action;

25 Fig. 11 is a side view of an adjustable auger in accordance with an embodiment of the present invention;

Fig. 12 – 14 show different embodiments of the manner in which the adjustable auger of Fig. 11 is adjusted;

Fig. 15 is a side cross-sectional view of a barrel cutter in accordance with another embodiment of the present invention;

Fig. 16 is an enlarged view showing the engagement of the cutter unit and the barrel cutter of Fig. 15;

Fig. 17 is an end view of the cutter unit of Fig. 16;

5 Fig. 18 is a side view of an auger assembly in accordance with another embodiment of the present invention; and

Fig. 19 is a plan view of the cutter unit of Fig. 18.

DETAILED DESCRIPTION OF THE DRAWINGS

Preferred features of the present invention will now be described with particular reference to the accompanying drawings. However, it is to be understood that the
10 features illustrated in and described with reference to the drawings are not to be construed as limiting on the scope of the invention.

The present invention will be described below in relation to its use in the creation of a core hole in a ground surface containing soil, rock and the like. However, it
15 will be appreciated that the system and device of the present invention may be used across a variety of different drilling environments where a core hole is to be formed.

Referring to Figs. 1 - 4, a first embodiment of a barrel or drum cutter 10 in accordance with the present invention, is depicted.

20 The barrel cutter 10 generally comprises a drum body 12 comprising a plurality of rolled plates 11 welded together to form a cylinder having an open lower end 13 which is configured to penetrate the ground surface. Each of the plates 11 are mounted to extend between pairs of substantially hollow tube members 14, which are regularly spaced about the perimeter of the drum body 12 in the manner as shown.

25 A circular end plate 15 is mounted to an upper end of the drum body 12. A hollow shaft member 16 is centrally mounted to the circular end plate and is supported in a vertical position by one or more struts 17, which are connected between an outer surface of the shaft member 16 and an upper surface of the end plate 15. Such a configuration ensures that the shaft member 16 is retained in a
30 substantially upright manner and is positioned concentric with the axis of the drum body 12. In this regard, the shaft member 16 is configured to engage with a Kelly bar or similar connector (not shown) attached to a excavating device which is capable of applying rotational motion to the drum body 12 to form the core

hole, in a manner as will be described in more detail below.

Cover members 18 are mounted to the surface of the end plate 15 such that they are aligned and concentric with each of the hollow tube members 14, as shown. The cover members 18 are tubular in configuration and each of the cover members 18 are in fluid communication with a pipe 19 that extends from the hollow shaft central member 16 to each cover member 18. A cover 20 extends over each of the pipes as shown, to protect the pipes 19, which are typically formed from a flexible plastic material. Each pipe 19 is configured to be attached to the central shaft member 16 so as to be in fluid communication with pressurised air delivered to a central bore of the central shaft member 16 from a remote pressurised air supply source. This remote pressurised air supply source may be an air compressor associated with an excavating device or the like, to deliver a supply of pressurised air to the associated cover member 18.

Each of the hollow tube members 14 are configured to receive a hammer member 25 as depicted on Figs 6A and 6B. The hammer member 25 has an elongate tubular body 26 having a frustoconical head portion 27 that is configured to be fittingly received within the cover 20 to communicate with the end of the pipe 19 in the manner as will be described further in relation to Fig. 7.

The body 26 of the hammer member 25 has a diameter that is less than the diameter of the hollow tube members 14 such that the hammer members 25 are able to extend therethrough. The distal end of the hammer member 25 terminates in a cutting member 28 that is free to rotate about the central axis of the hammer member 25. The cutting member 28 may be configured to take a variety of forms appropriate to cut through rock and soil, and the surface of the cutting member 28 may be coated with a tungsten or similar material to assist in cutting soil or rock when the cutting member 28 is caused to rotate, as is known in the art. The length of the hammer member 25 is such that the cutting member 28 projects from the open lower end of the hollow tubular member 14 to be located below the open end 13 of the drum body 12, as depicted in Fig. 2. This enables the cutting members 28 to project from each of the tubular bodies 16 to perform the cutting action to cut the soil/rock surface, as will be described in more detail below.

Referring again to Fig. 6A and 6B, each of the hammer members 25 has a central recess 29 extending from the head portion 27 to the cutting member 28. The cutting members 28 are mounted to the end of the tubular body 26 such that they are free to rotate about a central axis thereof. The cutting members 28 are also in fluid communication with the central recess 29 such that pressurised air flowing

through the central recess 29 of the hammer member 25 is directed towards the cutting member 28 so as to exit the hammer member 25 via the cutting member 28. The air outlets are configured such that as the air leaves the hammer member 25 it passes against a surface of the cutting members 28, thus generating a rotational movement of the cutting member 26 and in doing so causes the cutting member 28 to rotate. Such rotational action of the cutting member 28 further functions to cut the rock/soil as the barrel rotates.

Referring to Fig. 7, the manner upon which the hammer member 25 is fitted in position within the barrel cutter is depicted. The head portion 27 of each hammer member 25 tapers inwardly to represented a truncated cone shape that substantially matches the internal space of the cover member 18. When fitted in this manner, the head portion 27 of the hammer member 25 is securely captured in position to form an airtight seal with the cover member 18. Such an arrangement ensures that pressurised air delivered to the cover member 18 from the pipe 19 is directed down the central recess 29 of the hammer member 25 to exit the hammer member 25 at the cutting member 26, thus causing the cutting member 26 to rotate.

It will be appreciate that the barrel cutter 10 will be rotated in a clockwise direction with the cutting members 28 also configured to rotate in a clockwise direction under action of the compressed air, to enhance the cutting action of the barrel cutter 10. By supplying the compressed air to the barrel cutter 10 as the barrel cutter 10 is rotated, a core sample is able to be taken from rock and/or soil in an improved manner over existing barrel cutting devices.

An alternative embodiment of a barrel cutter of the present invention is show in Fig. 15. In this embodiment the barrel cutter 100 is also configured to receive pressurised air or hydraulic oil to perform the cutting operation.

The barrel cutter 100 comprises a drum body 105 comprises has a that kelly box 102 or similar connector (not shown) for attachment to a excavating device which is capable of applying rotational motion to the drum body 105 to form the core hole, in a manner as will be described in more detail below. A swivel member 104 is mounted to the kelly box 102 and is connected to a pipe 103 that delivers pressurised air or hydraulic oil to the drum body as depicted by the arrows. The swivel member 104 enables the drum body 105 and kelly box 102 to rotate whilst maintaining the connection with the pipe 103 relatively stable such that the pipe will not be wound under rotation

The drum body 105 is configured to receive the pressurised air or hydraulic fluid

and to deliver the pressurised air or hydraulic fluid to the open lower end of the drum body 105 as depicted. This is achieved through the provision of open channels 106 in the wall of the drum body 105.

5 A cutting unit 110 is configured to be mounted to the open lower end of the drum body 105 to engage therewith. The cutting unit has a plurality of sets of cutting teeth 112 mounted about a lower periphery thereof, and when mounted to the drum body 105 the pressurised air or hydraulic fluid is able to enter the cutting unit and is directed in a manner that facilitates rotation of the cutting unit 110 to perform cutting of the core hole.

10 The manner in which the cutting unit 110 is mounted to the drum body 105 is depicted in Fig. 16. In this embodiment, the underside of the drum body 105 has shaped recesses 106 formed therein. The upper rim of the cutting unit has tabs 116 extending therefrom which are shaped to be received in the recesses 106 of the drum body 105. The tabs 116 have a head portion 116a that is able to extend
15 into the recesses 106 and grip a ledge portion 106a thereof when the cutting unit 110 is rotated in a forward direction with respect to the drum body 105. This forward direction is opposite to the direction of cutting to ensure that the cutting unit is in continual engagement with the drum body during use.

Referring to Fig. 17, the manner in which the cutting teeth 112 of the cutting unit
20 110 are positioned is shown. The cutting teeth 112 comprise four individual cutting members 113 that are offset from each other so as to overlap. The cutting teeth 112 are mounted to the underside of the cutting unit in an angular manner, typically at a 75° to a tangent of the cutting unit. This orientation is such that as the cutting unit 110 rotates in the direction of the arrows, the cutting teeth
25 function to cut the earth material at a greater width than the diameter of the cutting unit to help reduce friction and to obtain a cutting edge for the following cutting teeth. In the embodiment as depicted, the four sets of cutting teeth are located at 90° intervals about the circumference of the underside of the cutting unit 110.

30 It will be appreciated that in many instances, particularly in drilling rock and the like, it is difficult to remove the core from the ground surface. In many cases, it is often necessary for the operator of the machinery to manoeuvre the barrel cutter by rocking it side-to-side, in order to break-off the core for removal from the ground. Further to this, in instances of particular rocky ground or tight soil, it
35 may be difficult to release the removed core from the barrel cutter without the operator having to hit the barrel against the ground or another hard surface to free

the core. In both of these instances, the ability to perform the task is often reliant on skilled operators of the machines and is time consuming and can cause damage to the equipment and the cutters.

To address this issue a core extraction system 70 as depicted in Figs 9 and 10 has been developed. The core extraction tool 70 is configured to be mounted within the wall of a barrel cutter 10, 100 such as that described in relation to Figures 1 – 7 and Figs 15 – 17, as well as more conventional barrel cutters. In the embodiment as depicted in Fig. 9 five core extraction tool members 70 are mounted within the wall of the barrel cutter 10, however the number of core extract tool members 70 can vary.

Referring to Fig. 10, the tool members 70 generally comprise a hydraulically driven press ram 72 that is activated to extend from the barrel wall of the barrel cutter 10 and contact the face of the cut core by way of a grip member 74. The hydraulic press ram 72 is activated to move the grip member 74 against the wall of the core to apply a significant force thereto. As there are multiple grip members located around the barrel, the core becomes firmly gripped by the tool members 70 and is under compression. The operator can then cause the barrel cutter to rotate to cause a fracture in the base of the core such that the core can be removed from the hole. As the core is removed from the hole, the pressure applied by the grip members 74 is maintained until such time as the core is to be released. To release the core the hydraulic press rams 72 are released, allowing the core to become released from the barrel of the barrel cutter with minimum effort.

It will be appreciated that such a core extraction system provides a simple and effective means of handling the core cut from the ground surface, which minimises operator time and skill required to perform the task.

Referring to Fig. 8, an alternative embodiment of a cutting device is depicted. This cutting device is in the form of an earth drilling auger assembly 40 of the twin helix type, having twin helical auger flighting 42, 43 for removing earth material during drilling. The auger assembly 40 has a central shaft 45 around which the auger flighting 42, 43 is arranged. A drive kelly 46 is provided for engagement by an appropriate machine capable of gripping the drive kelly 46 and applying a downward weight against the auger assembly 40 and rotational motion to the central shaft 45 to facilitate the drilling action.

As is shown, the central shaft 45 has at least one internal air duct 48 extending therethrough. The air duct(s) 48 are engineered and fabricated into the shaft 45

to provide a passage for compressed air to travel from the upper region of the shaft 45 to the distal end of the shaft 45.

A swivel member 50 is machined onto the upper end of the shaft 45, which is in connection with a pipe 49 that is in fluid communication with a compressor (not shown). The compressor supplies compressed air of a predetermined pressure, approximately 300 CFM, to the swivel member 50 that distributes the compressed air to the one or more air ducts 48 formed in the shaft 45.

The cutting tip of the auger assembly 40 is fitted with cutting heads 52, which extend across the width of the auger assembly. The cutting heads 52 act as pilots to perform the initial cutting action when the auger assembly is introduced into the ground surface. In the embodiment as depicted in Fig. 8, two cutting heads 52 are provided which extend either side of the central shaft 45. The cutting heads 52 are surface treated with appropriate cutting teeth formed thereon and are free to rotate about their central axis, in a direction perpendicular to the shaft 45. A central cutting head 53 may also be provided in the form of a spherical body having cutting teeth formed thereon, which is also free to rotate about a central axis parallel with the shaft 45.

To apply the rotational motion to the cutting heads 52, 53, the compressed air travelling in the air ducts 48 is directed to pass over the cutting heads as it exits the air ducts 48. As the air passes through the cutting heads 42, 43 the cutting heads rotate and apply a cutting motion which acts to provide additional cutting action together with the rotation of the auger assembly 40.

An alternative embodiment of the cutting device depicted in Fig. 8 is shown as cutting device 120 in Figs. 18 and 19.

The cutting device 120 also has twin helical auger flighting 122, 123 for removing earth material during drilling. The auger assembly 120 has a central portion 125 around which the auger flighting 122, 123 is arranged. A drive kelly (not shown) may be provided for engagement by an appropriate machine capable of gripping the drive kelly 46 and applying a downward weight against the auger assembly 120 and rotational motion to the central portion 45 to facilitate the drilling action.

The cutting device 120 is also configured to receive pressurised air or hydraulic fluid from a source and to deliver the pressurised air or hydraulic fluid to the bottom of the device 120 via a hollow channel 126 formed in the central portion 125.

The bottom of the central portion 125 is configured to engage with a cutting unit 130, as depicted more clearly in Fig. 19. The cutting unit 130 comprises a substantially linear body having a central threaded recess 132 that threadingly engages with a threaded end 127 formed at the end of the central portion 125 of the cutting device 120. This connection ensures that the supply of pressurised air or hydraulic fluid flows into the cutting unit 130.

The cutting unit 130 is substantially linear and has a plurality of hammer pistons 135 mounted on opposing sides of the central threaded recess 132. The hammer pistons 135 on each side of the central threaded recess 132 are orientated in opposing directions such as the cutting unit 130 rotates they will all face in the same direction. Each of the hammer pistons 135 are mounted to the cutting unit 130 to have a degree of linear movement as depicted by the arrows. In this regard, as the pressurised air or hydraulic fluid is supplied to the cutting portion 130 it is directed to the hammer pistons 135 causing the hammer pistons 135 to project outwards. As the hammer pistons 135 have teeth 136 formed at their periphery, the teeth 136 impact and break away rock as the cutting device 120 rotates. As they hammer pistons 135 project out from the body under pressure of the supplied pressurised fluid, a gap is formed between the teeth 136 that allows pressurised fluid to escape. This will then cause a drop in pressure enabling the hammer pistons 135 to return to their internal position under a bias, such as a spring. In this position, the gap between adjacent teeth will close thereby causing the pressurised fluid inside the cutting unit to build at which point the hammer pistons will be forced outward again to contact the rock. This will continue as the cutting device is used to provide an enhanced cutting action and improved penetration of the cutting device into the rock or ground surface.

It will be appreciated that by providing such additional pneumatic cutting tools working in combination with the rotational cutting motion of the auger assembly, rock and stiff soils are able to be more easily drilled with the cut soil being removed via the auger flighting in a conventional manner.

In accordance with another embodiment of the present invention, an adjustable auger assembly 80 of Figs. 11 – 14 is proposed. This auger system 80 is configured to provide an auger assembly that can be adjustable to change diameters to suit different tasks, as required by a user.

Referring to Fig. 11, a primary auger assembly 80 is depicted having a central shaft 82 around which the auger flighting 84, 86 is arranged. An adjustable flight 90 is initially placed over the primary auger assembly 80 such that in the initial

stage of use, the primary auger 80 and the adjustable flight 90 determines the size/diameter of the auger. However, to increase the size of the primary auger 80, the adjustable flight 90 is caused to extend from the primary auger 80 in the manner as shown in Fig 11, to increase the diameter of the overall arrangement to
5 become a secondary auger 80'.

The manner in which this is achieved is depicted broadly in Fig. 12. The adjustable flight 90 is initially mounted over the primary auger 80 such that together they define the diameter of the primary auger 80. To increase the diameter of the working auger the adjustable flight 90 is caused to extend from
10 the primary auger 80 to extend the primary auger 80 in the manner as shown. Two embodiment depicting the manner in which this extension is controlled are shown in Figs. 13 and 14.

In Fig. 13 a grub screw 95 is fixed within the adjustable flight 90 and extends through a hole at the end of the adjustable flight 90 and into the end of the
15 primary auger 80. By rotating the grub screw 95 the grub screw is caused to move in and out of the end of the primary auger thereby providing a means for extending the adjustable flight 90 in the manner as shown. By having multiple adjustment points along the primary auger 80 this extension can be uniformly achieved.

20 In Fig. 14, a hexagonal screw 96 is fixed within the adjustable flight 90 and extends through a hole at the end of the adjustable flight 90 and into the end of the primary auger 80. By using an hexagonal tool to rotating the hexagonal screw 96, the screw 96 is caused to move in and out of the end of the primary auger 80 thereby providing a means for extending the adjustable flight 90 in the manner as
25 shown. By having multiple adjustment points along the primary auger 80 this extension can be uniformly achieved.

In each of the embodiments of Fig. 13 and Fig. 14, the diameter of the auger assembly can be altered between two sizes, the primary auger diameter 80 and the fully extended secondary auger diameter 80'.

30 It will be appreciated by those skilled in the art that many modifications and variations may be made to the methods of the invention described herein without departing from the spirit and scope of the invention.

The claims defining the invention are as follows:

1. A device for boring holes in a ground surface comprising:
a core barrel having a barrel top and an open barrel bottom, the
barrel top having a shaft mounted thereto for engaging with a rotary power
source for rotating the core barrel;
5 at least one cutting member mounted to the core barrel at the open
barrel bottom; and
a pressurised fluid source in fluid communication with the shaft for
delivering a supply of pressurised fluid to the shaft;
10 wherein the at least one cutting member is configured such that
when it is mounted to the core barrel at the open barrel bottom, the
pressurised fluid causes the at least one cutting member to perform a
cutting motion to remove the ground surface.
- 15 2. A device according to claim 1, wherein the at least one cutting member is
a substantially circular body mounted to engage with the open barrel
bottom so as to extend across the open barrel bottom.
3. A device according to claim 2, wherein the substantially circular body has
20 a plurality of cutting teeth mounted about a periphery thereof.
4. A device according to claim 3, wherein the plurality of cutting teeth are
equispaced about the periphery of the substantially circular body and
comprise multiple tooth members.
- 25 5. A device according to claim 4, wherein the multiple tooth members extend
angularly across the periphery of the substantially circular body.
6. A device according to any one of claims 2 – 5, wherein the substantially
30 circular body is rotated under action of the pressurised fluid.
7. A device for boring holes in a ground surface comprising:
an auger having a pair of helical flights or removing cut material;
a central recess extending centrally with respect to the pair of
35 helical flights;

a pressurised fluid source in fluid communication with the central recess shaft for delivering a supply of pressurised fluid thereto; and a cutting member mounted to the a base of the auger;

5 wherein the at least one cutting member is configured such that when it is mounted to the base of the auger, the pressurised fluid causes the at least one cutting member to perform a cutting action to remove the ground surface.

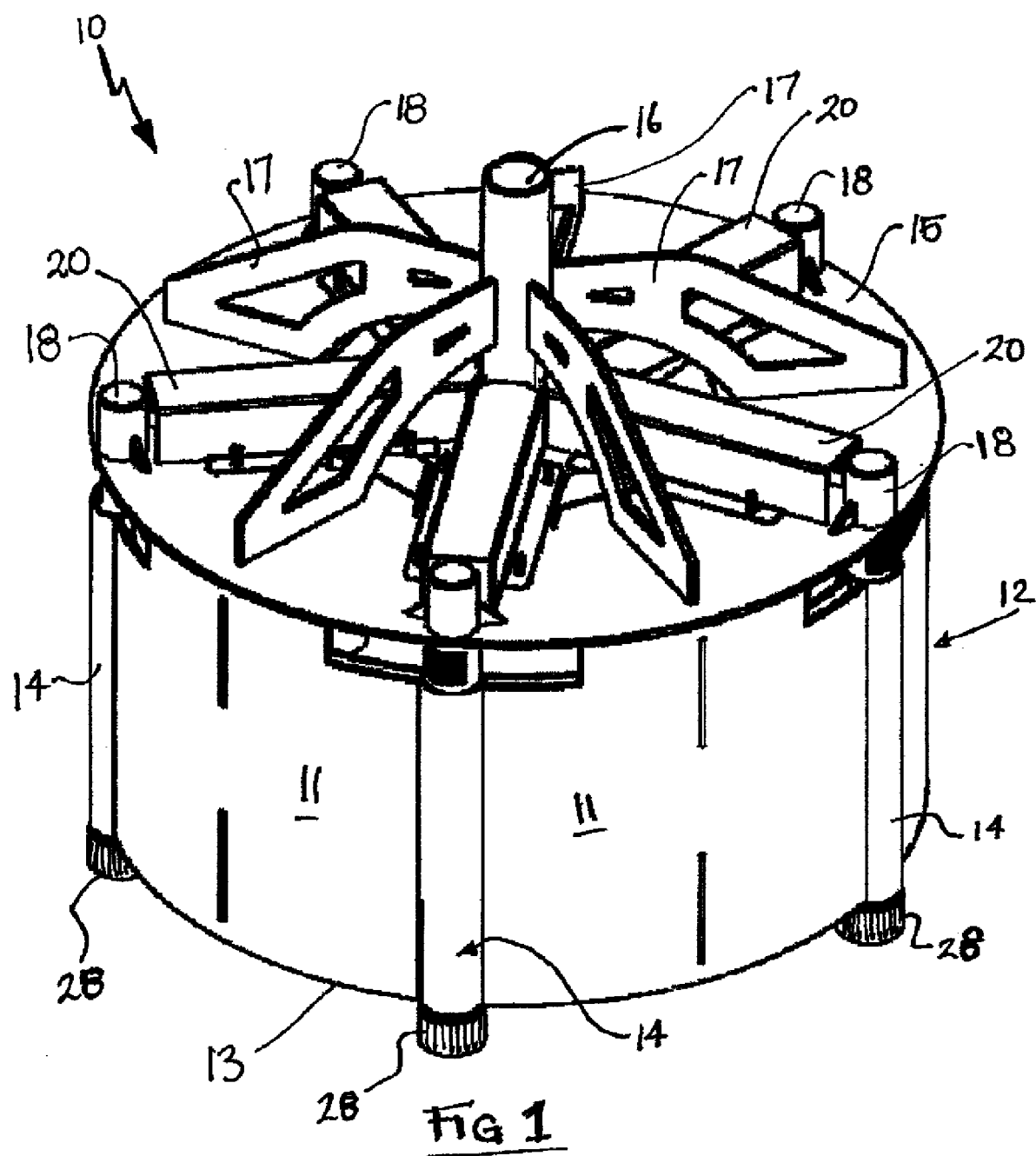
8. A device according to claim 7, wherein the cutting member comprises a plurality of hammer pistons that project outwards with respect to the cutting member under action of the pressurised fluid to impact the ground surface to remove material therefrom.

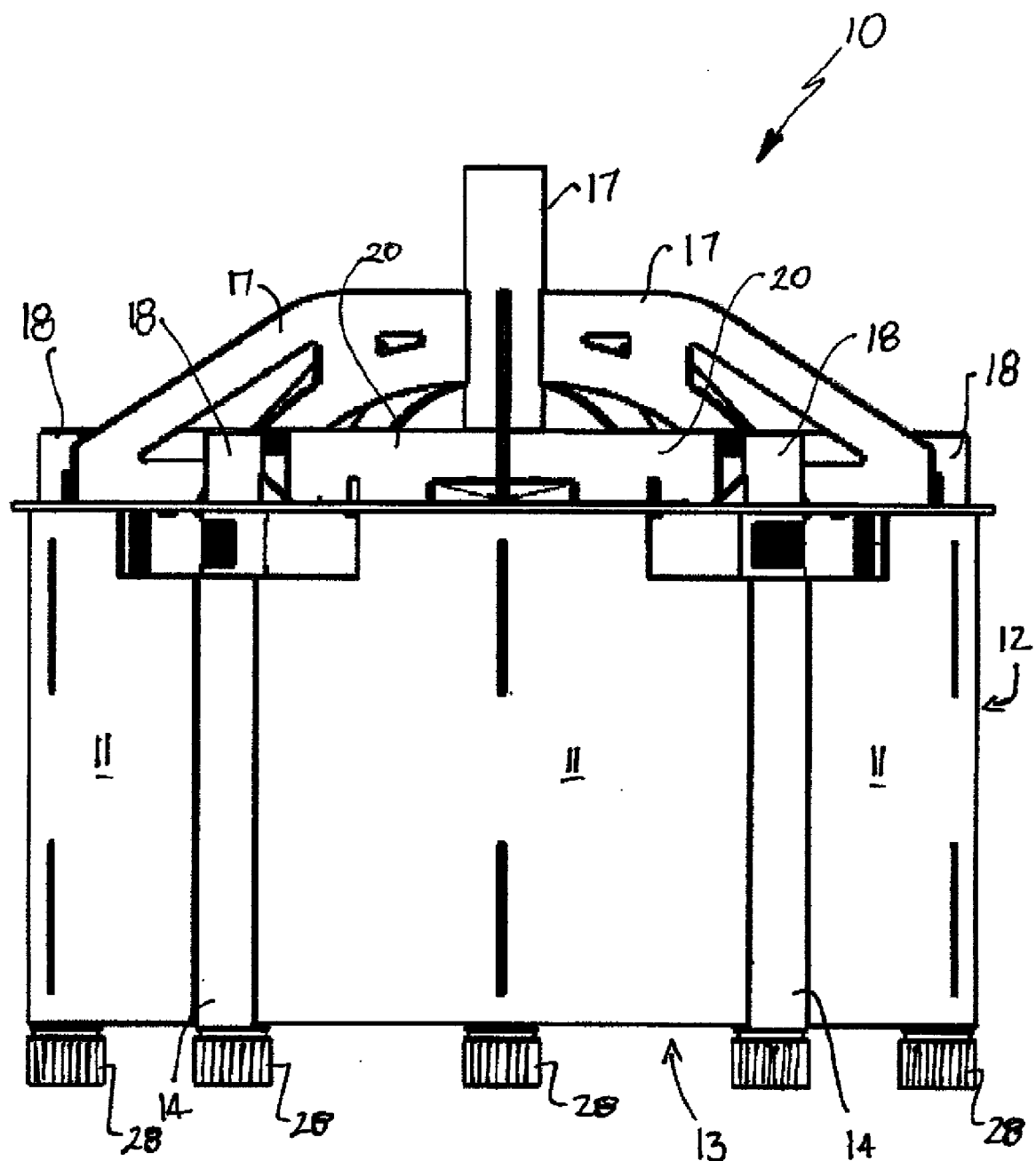
9. A device according to claim 8, wherein the hammer pistons have cutting teeth formed thereon for impacting the ground surface.

10. A device according to claim 8 or claim 9, wherein the cutting member has an internal thread that engages with an external thread provided on the base of the auger to facilitate mounting of the cutting member to the auger.

20

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FIG. 2

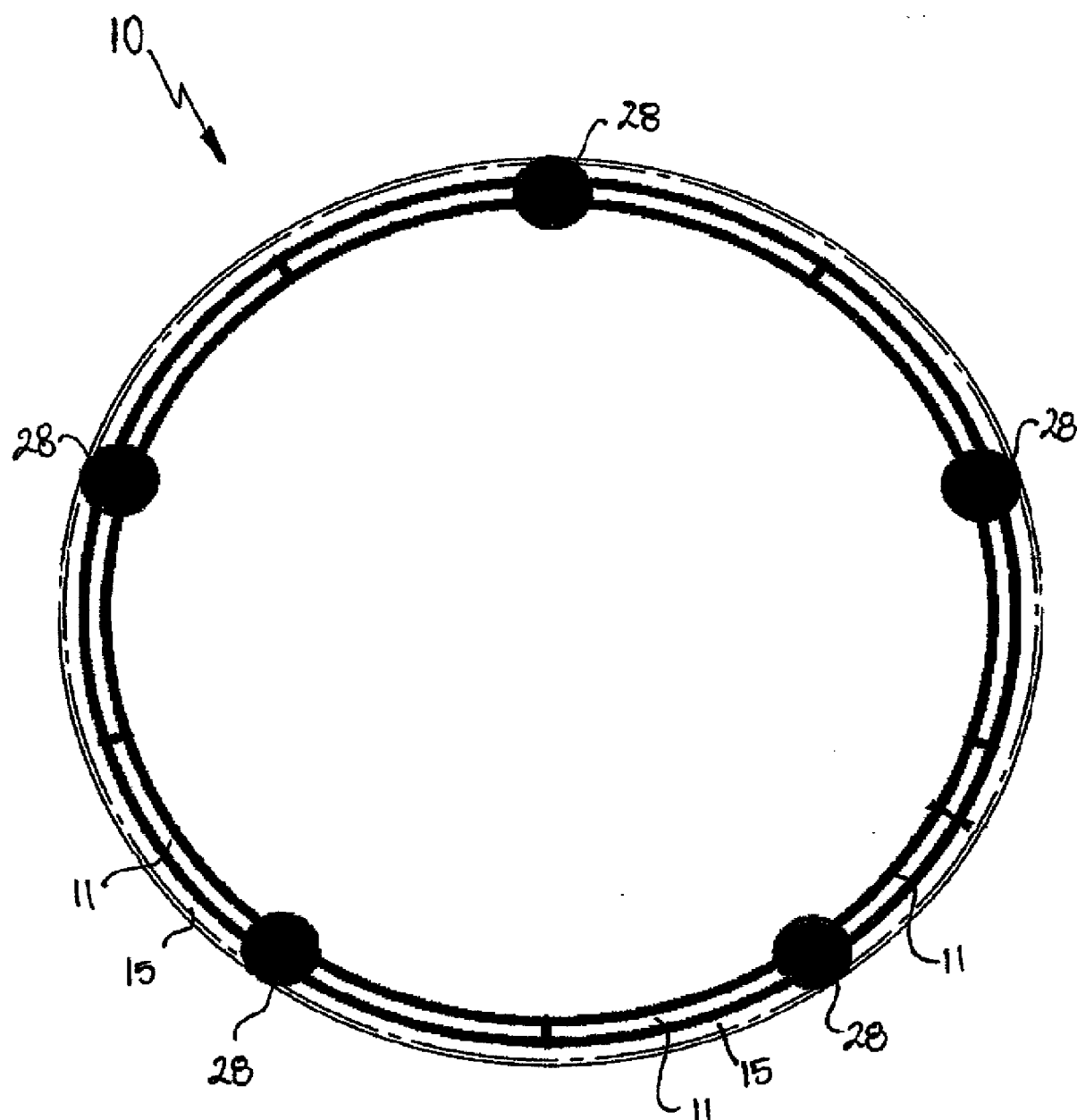
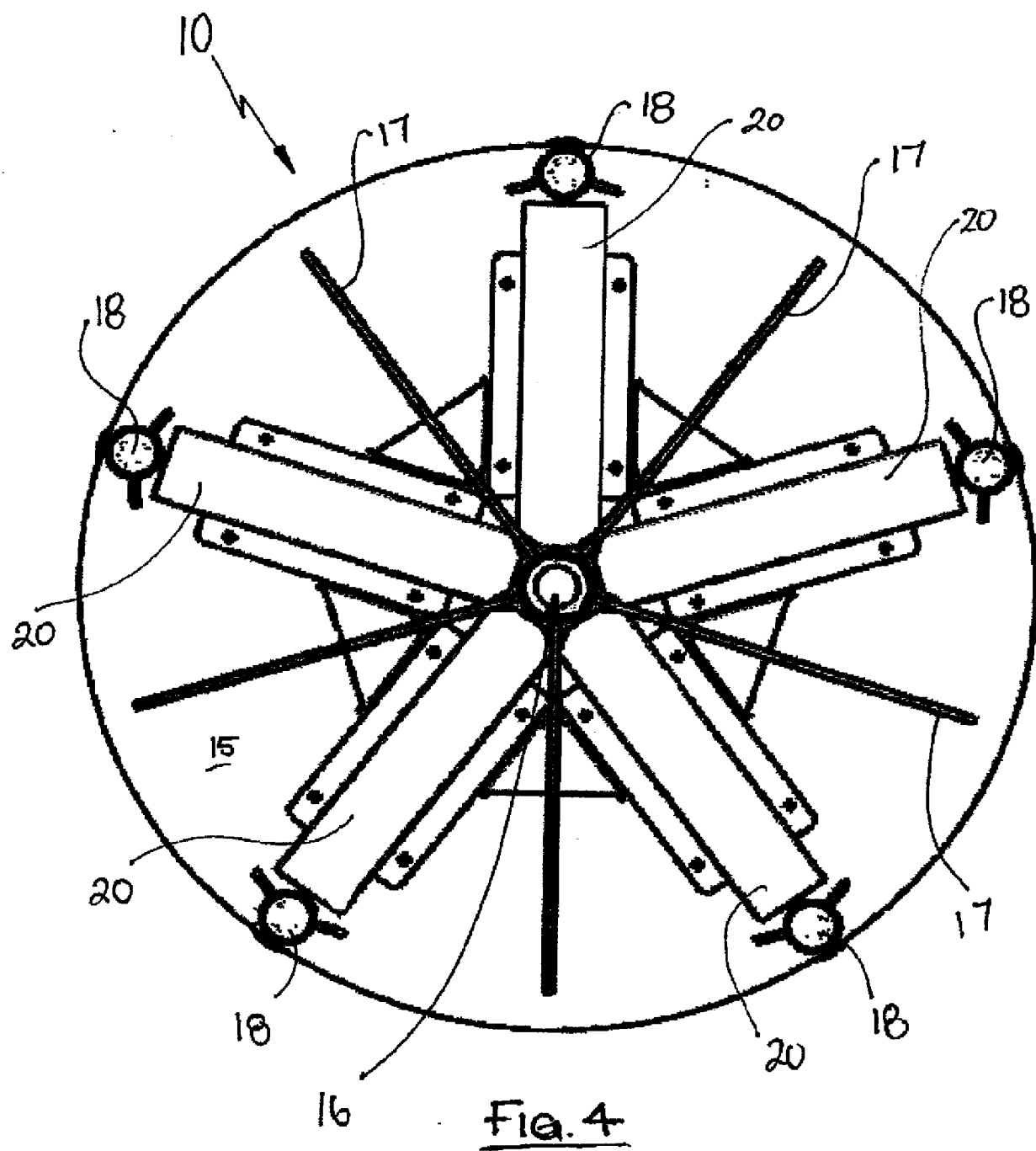
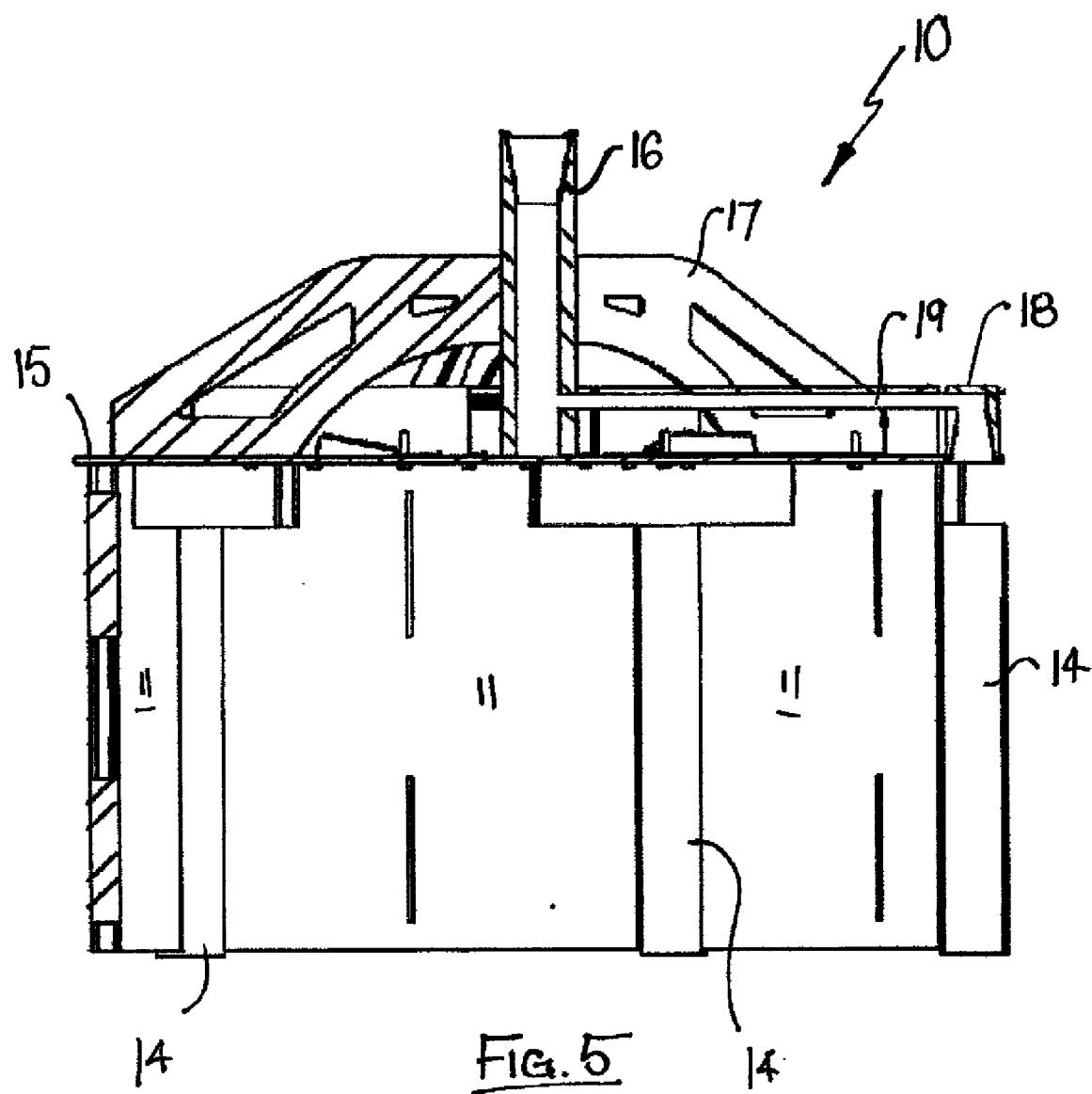
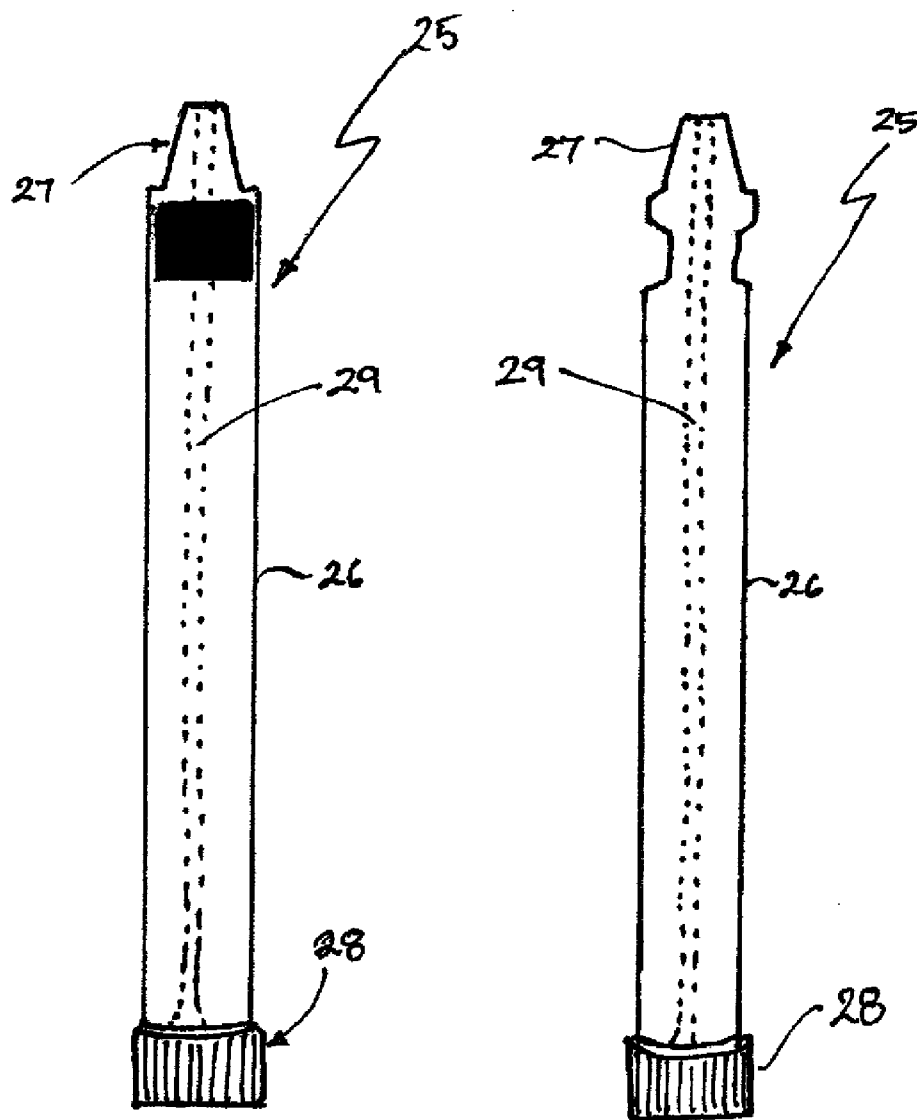


Fig. 3





FIG. 6AFIG. 6B

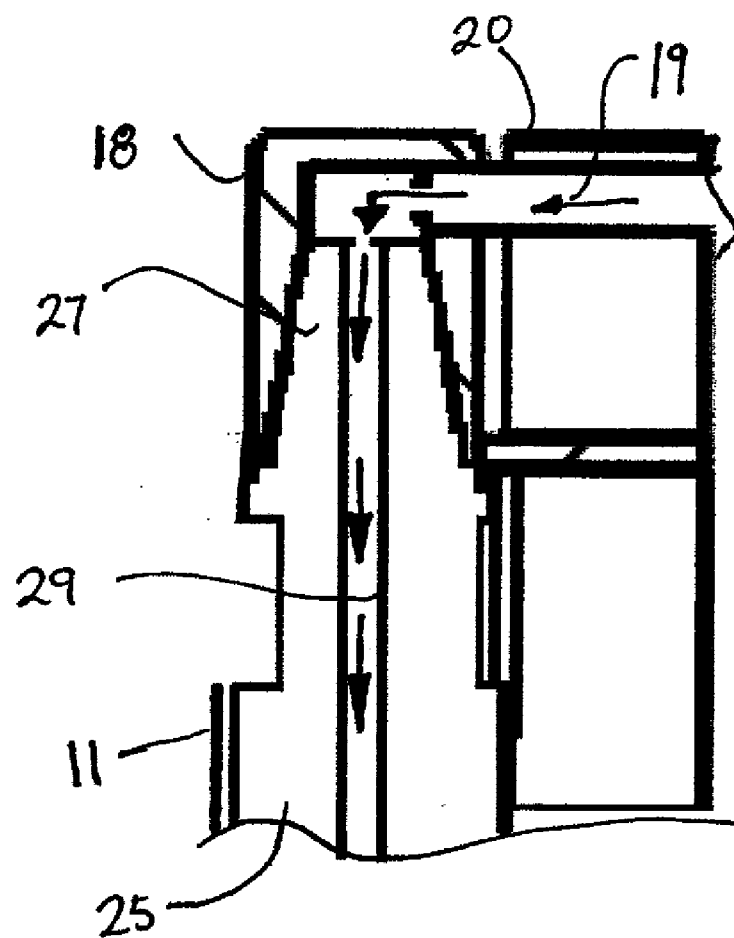


Fig. 7

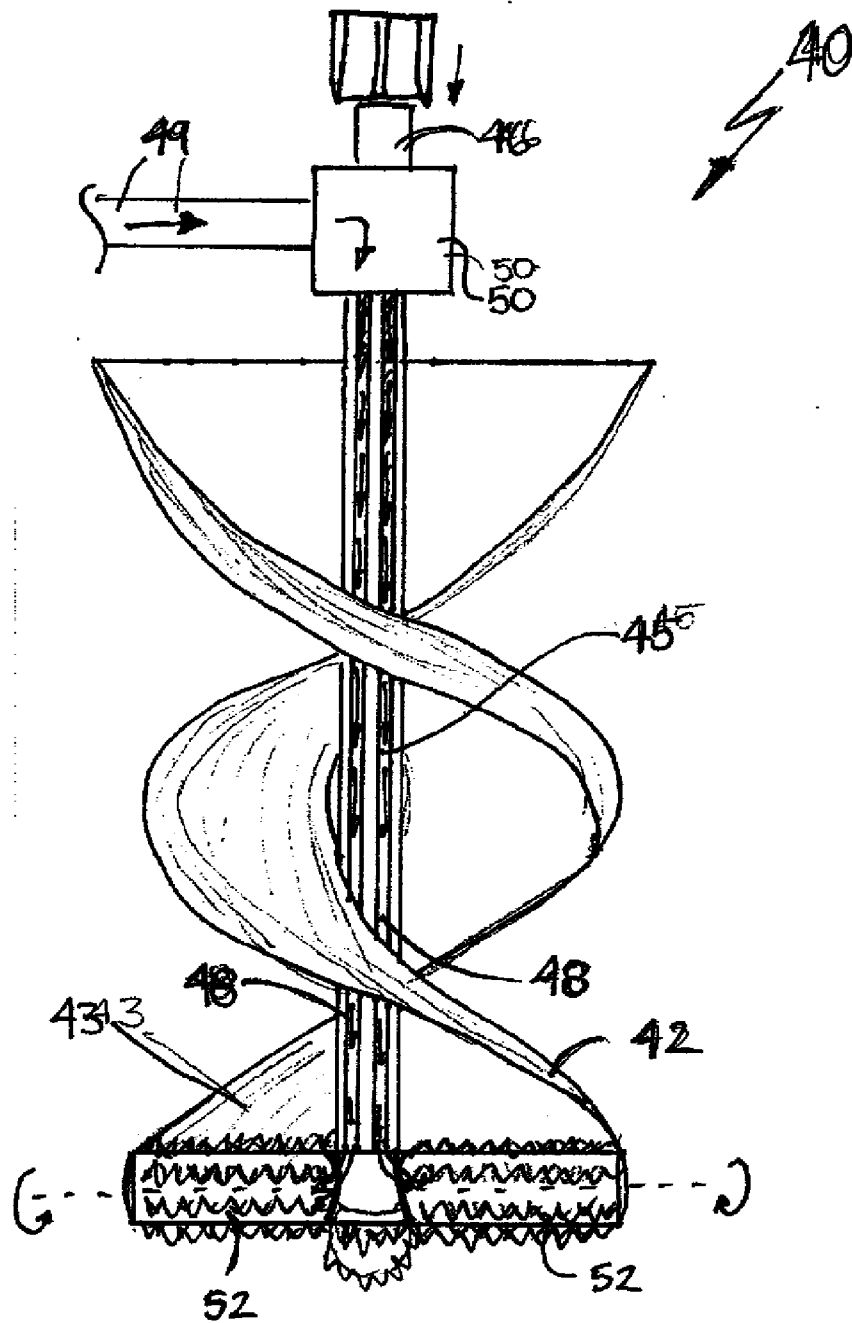
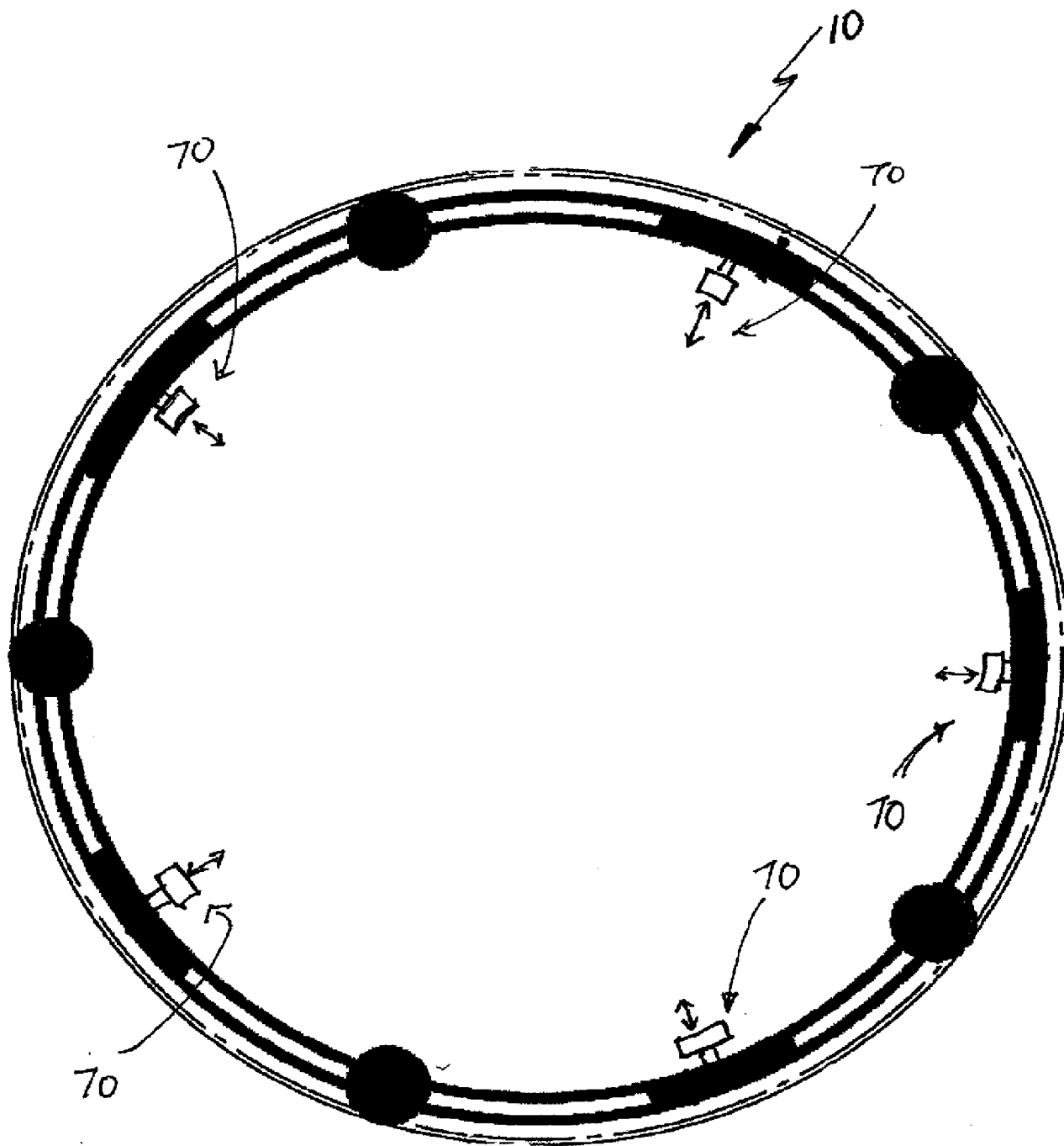


Fig. 8

Fig. 9

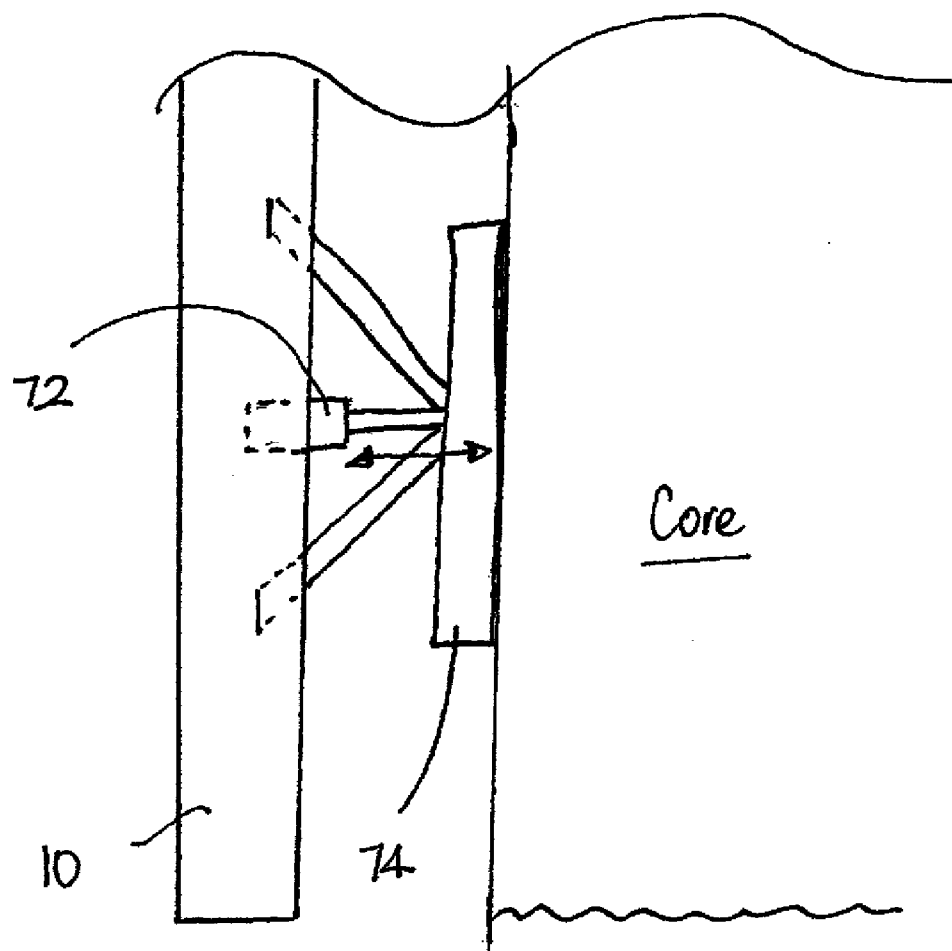
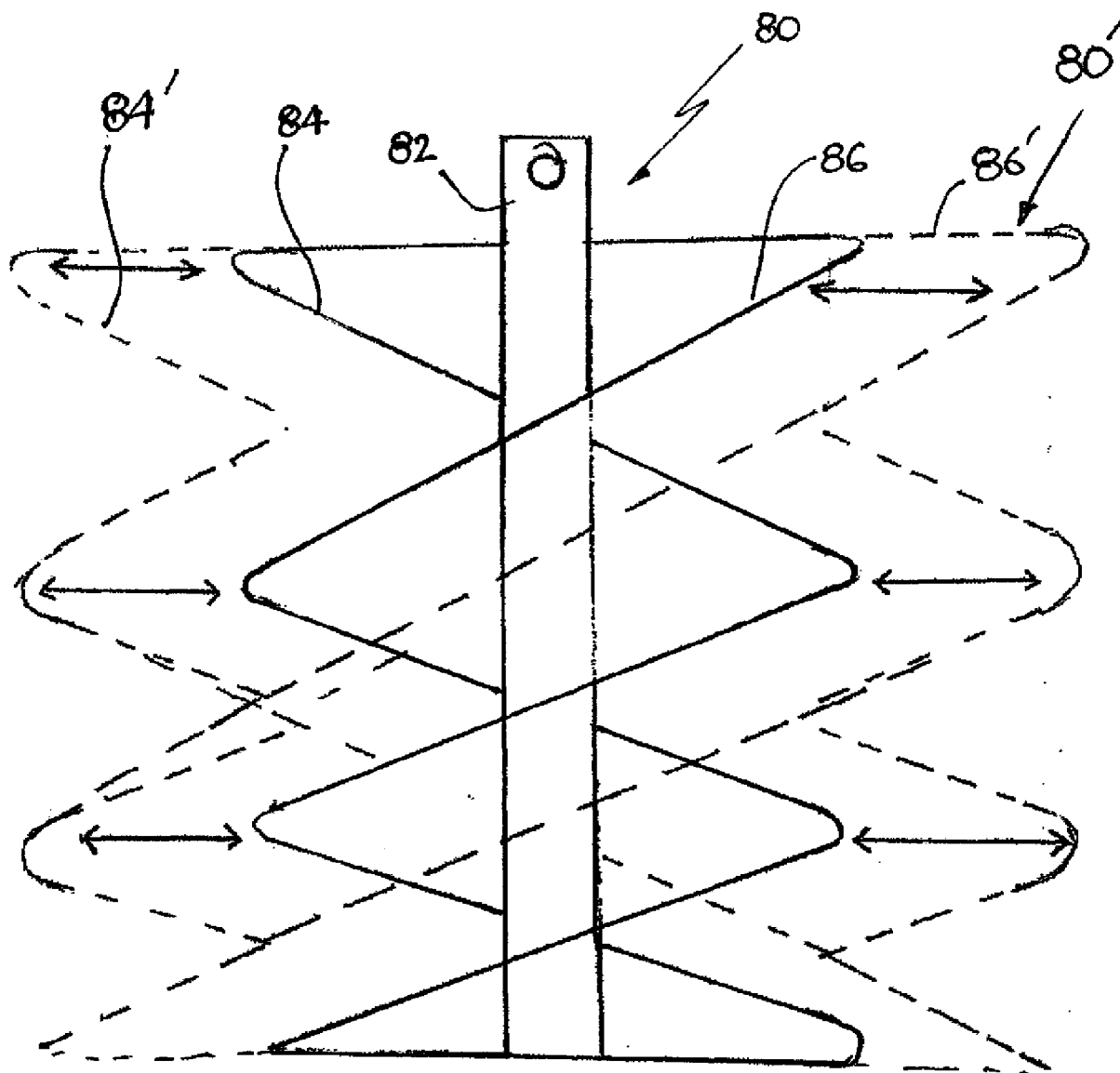


Fig. 10

FIG. 11

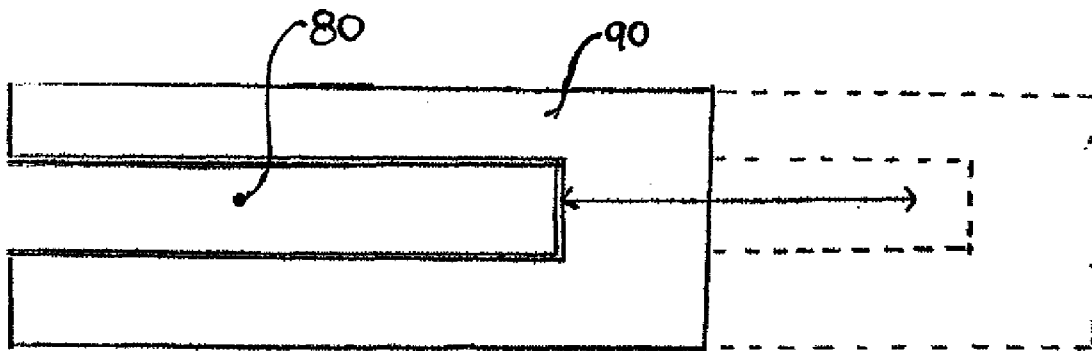


Fig. 12

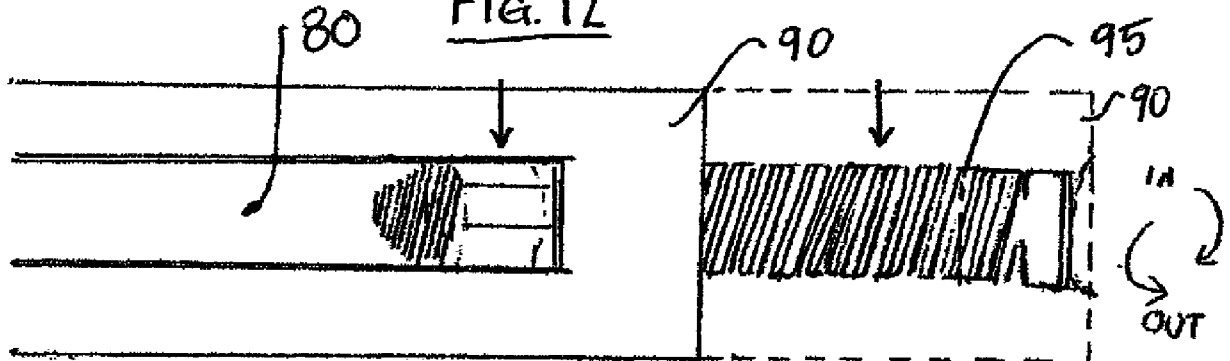


Fig. 13

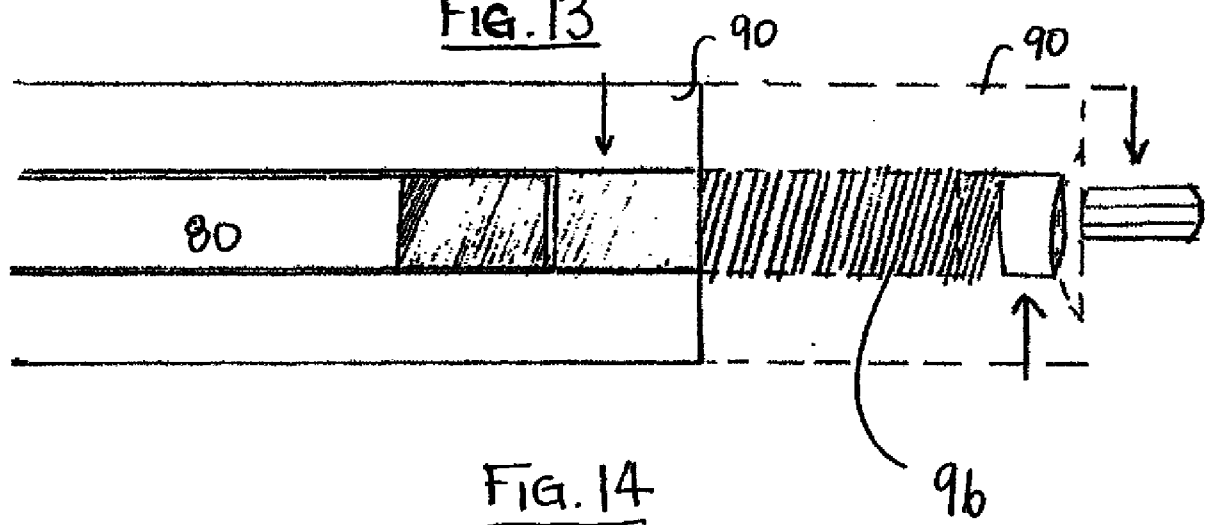
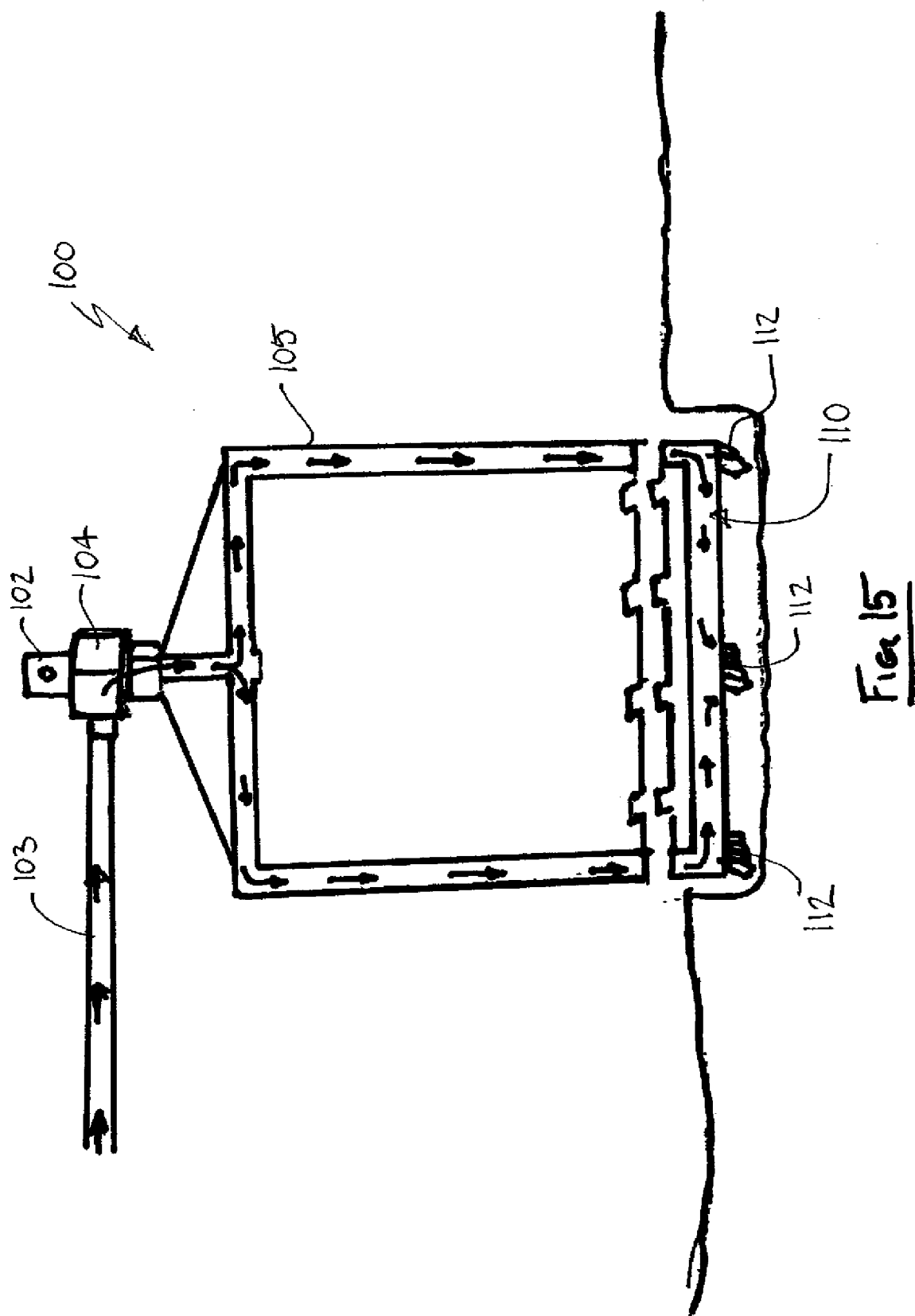
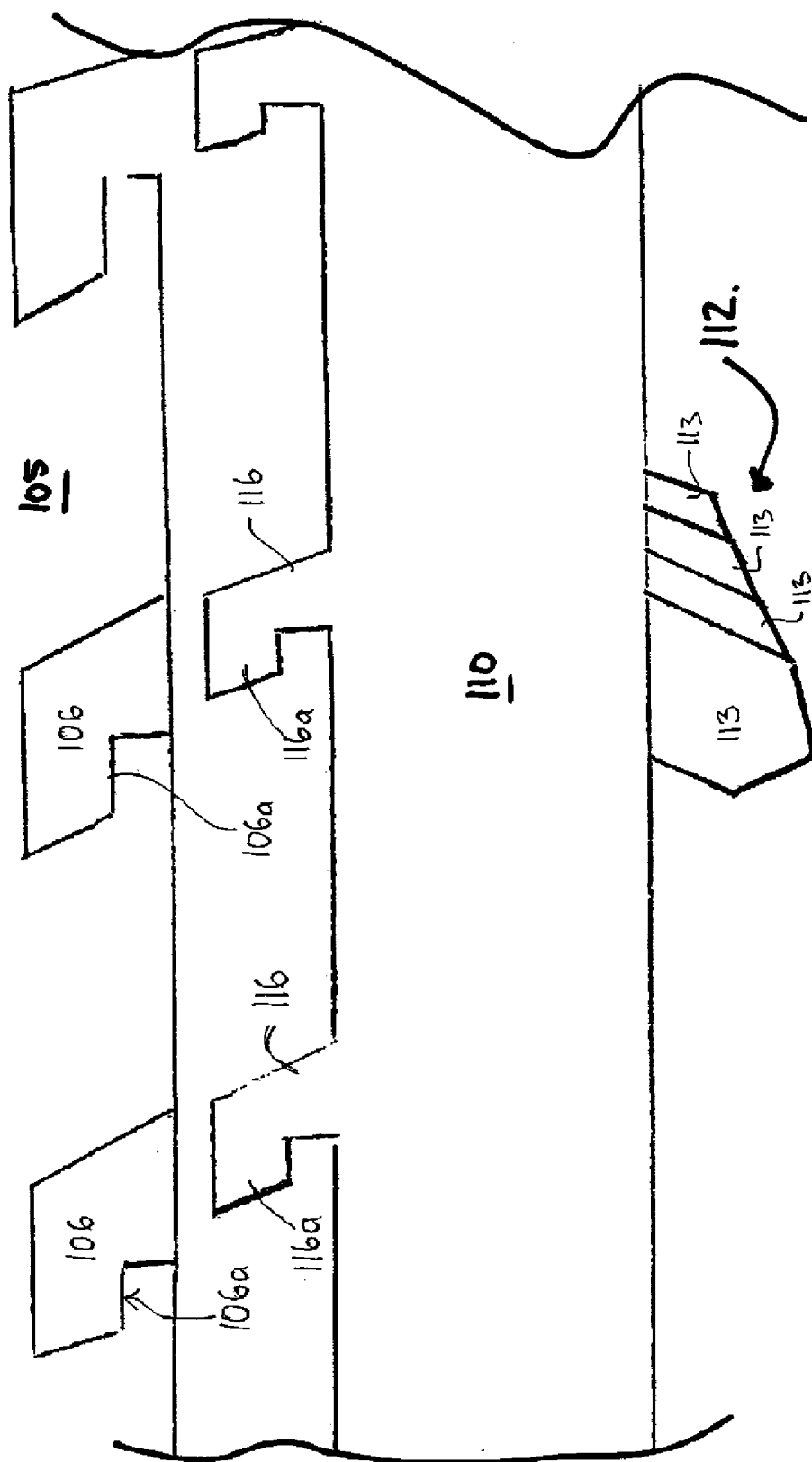


Fig. 14





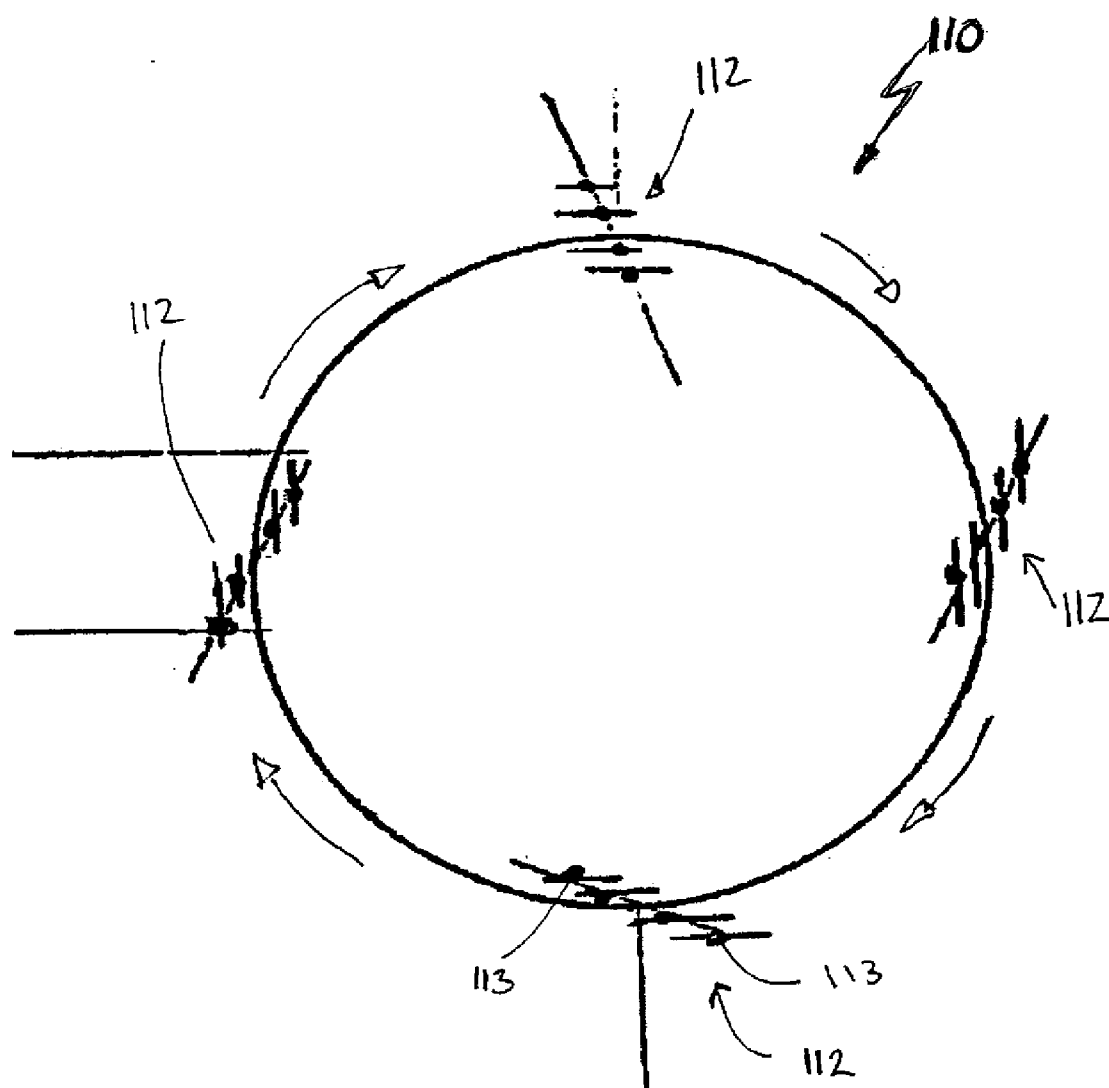
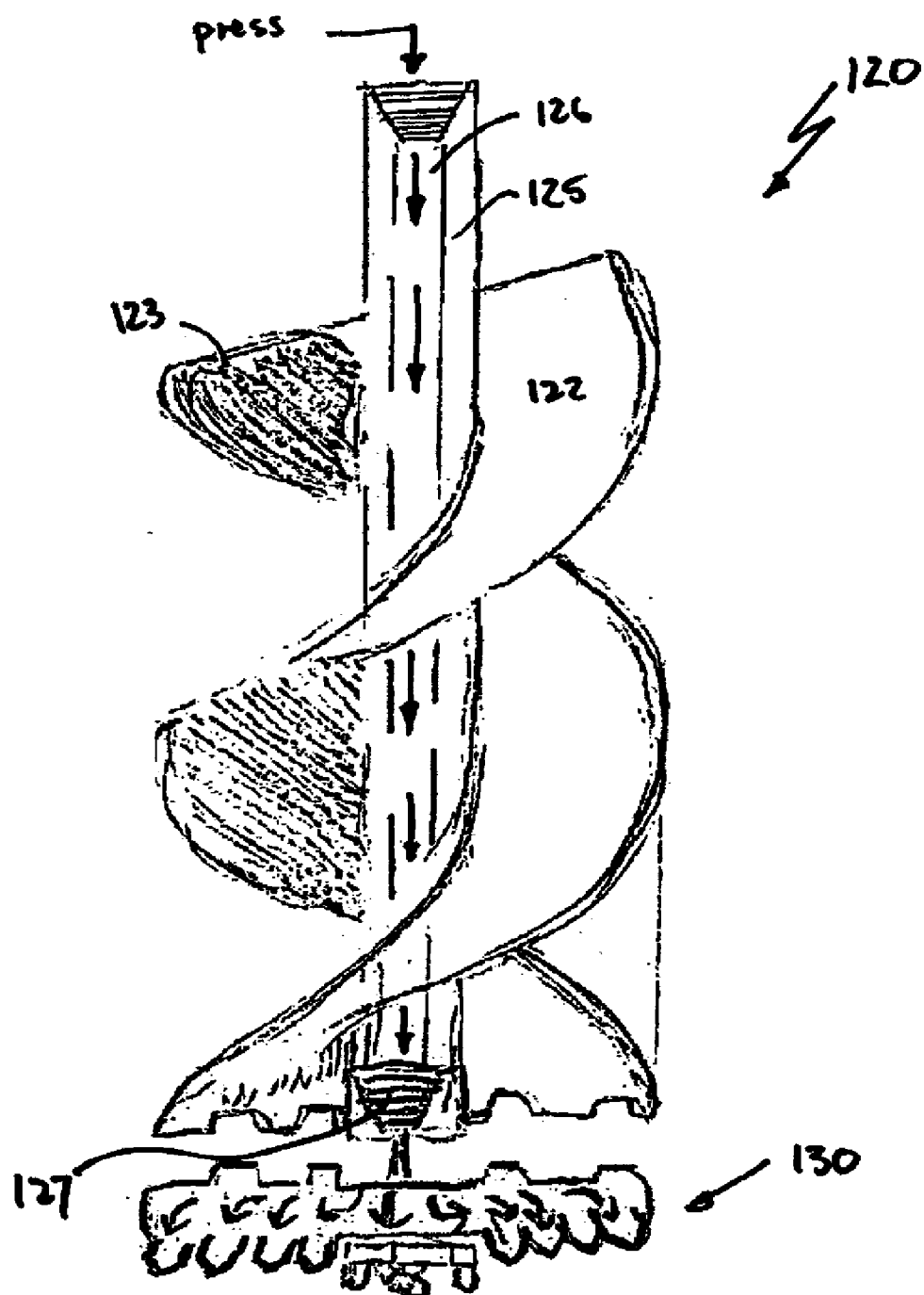


FIG. 17

FIG. 18

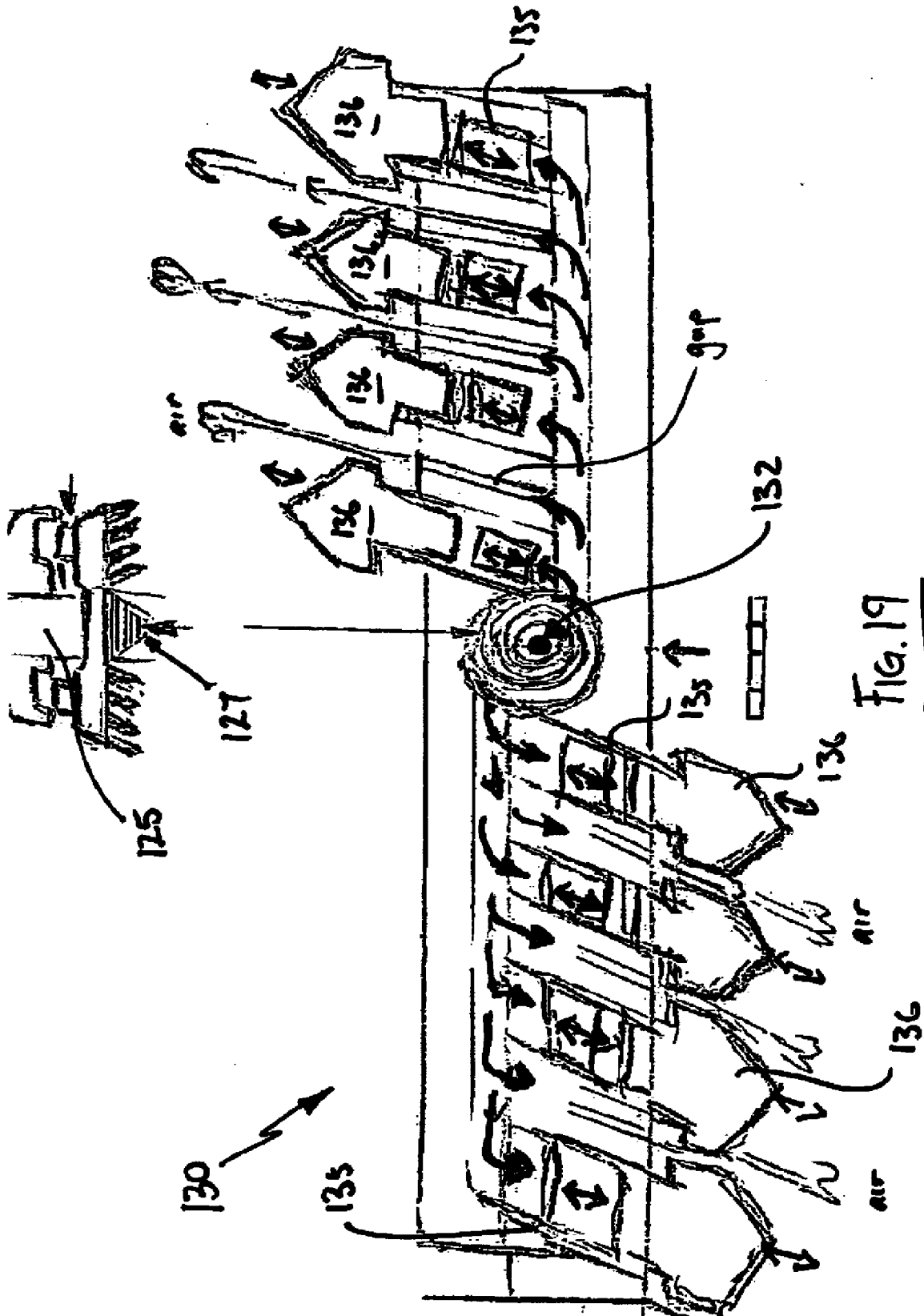


Fig. 19

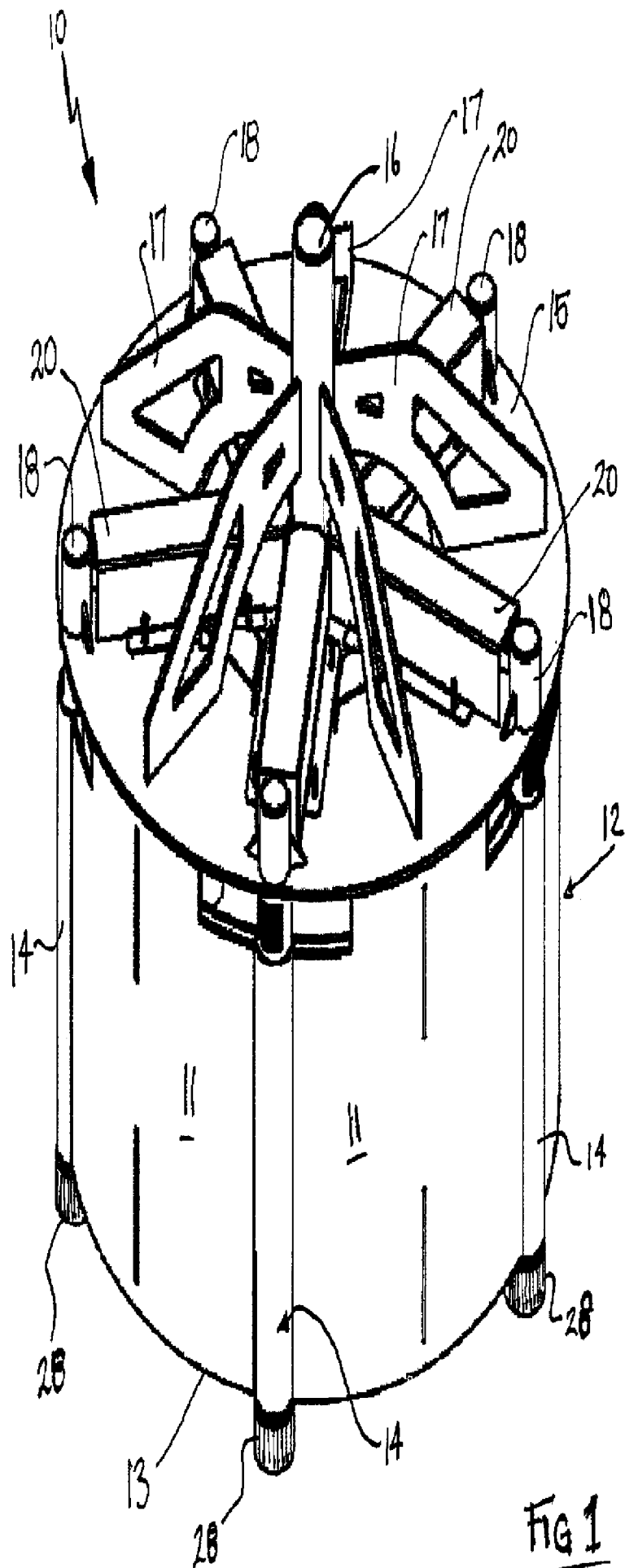


Fig 1