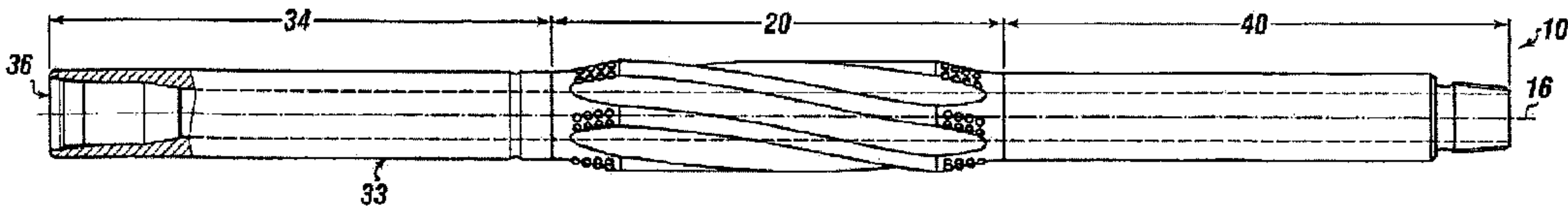




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(54) Titre : STABILISATEUR EXCENTRIQUE BIDIRECTIONNEL
(54) Title: BIDIRECTIONAL ECCENTRIC STABILIZER



(57) **Abrégé/Abstract:**
A drilling rig has a bidirectional eccentric stabilizer for use in a wellbore. The bidirectional eccentric stabilizer is coupled between a drill string and a bottom hole assembly. The bidirectional eccentric stabilizer has a shaft connected between a first shaft end and a second shaft end, an annulus formed longitudinally through the shaft and a cutting portion formed on an outer surface of the shaft. The cutting portion has a first cutting portion, a second cutting portion, a plurality of helical blades, a plurality of flutes, a plurality of cutting nodes, and a plurality of impact arrestors. The bidirectional eccentric stabilizer has a center of eccentric rotation which is offset from the longitudinal axis of the shaft, enabling the bidirectional eccentric stabilizer to form a larger wellbore than a drill bit on the bottom hole assembly and a larger diameter wellbore than originally drilled by the drill bit.

ABSTRACT OF DISCLOSURE

A drilling rig has a bidirectional eccentric stabilizer for use in a wellbore. The bidirectional eccentric stabilizer is coupled between a drill string and a bottom hole assembly. The bidirectional eccentric stabilizer has a shaft connected between a first shaft end and a second shaft end, an annulus formed longitudinally through the shaft and a cutting portion formed on an outer surface of the shaft. The cutting portion has a first cutting portion, a second cutting portion, a plurality of helical blades, a plurality of flutes, a plurality of cutting nodes, and a plurality of impact arrestors. The bidirectional eccentric stabilizer has a center of eccentric rotation which is offset from the longitudinal axis of the shaft, enabling the bidirectional eccentric stabilizer to form a larger wellbore than a drill bit on the bottom hole assembly and a larger diameter wellbore than originally drilled by the drill bit.

SPECIFICATION

BIDIRECTIONAL ECCENTRIC STABILIZER

FIELD

5 [0001] The present embodiments generally relate to a bidirectional eccentric stabilizer.

BACKGROUND

[0002] A need exists for a stabilizer for a drill string that can additionally smooth and improve quality of a wellbore bidirectionally.

10 [0003] The present embodiments meet this need.

BRIEF DESCRIPTION OF THE DRAWINGS

[0004] The detailed description can be better understood in conjunction with the accompanying drawings as follows:

15 [0005] Figure 1 depicts the side view of a bidirectional eccentric stabilizer according to one or more embodiments.

[0006] Figure 2 depicts an end portion of the bidirectional eccentric stabilizer according to one or more embodiments.

20 [0007] Figure 3A-3B depict a cutting portion of the bidirectional eccentric stabilizer according to one or more embodiments.

[0008] Figure 4 depicts a cut view of the cutting portion according to one or more embodiments.

- 5 [0009] Figure 5 depicts a detailed view of the surface of a blade according to one or more embodiments.
- [00010] Figure 6 shows a drill string in the wellbore according to one or more embodiments.
- [00011] Figure 7 depicts a drilling rig with the bidirectional eccentric stabilizer according to one or more embodiments.
- [00012] Figure 8 shows a bidirectional eccentric stabilizer with a slightly interrupted line of sight through the flutes between the blades for fluid flow according to one or more embodiments.
- 10 [00013] Figure 9 shows a bidirectional eccentric stabilizer with an uninterrupted line of sight through the flutes between the blades for fluid flow according to one or more embodiments.
- [00014] The present embodiments are detailed below with reference to the listed Figures.

DETAILED DESCRIPTION OF THE EMBODIMENTS

- 15 [00015] Before explaining the present apparatus in detail, it is understood that the apparatus is not limited to the particular embodiments and that it can be practiced or carried out in various ways.
- [00016] The embodiments generally relate to a bidirectional eccentric stabilizer that stabilizes a drill string while rotating into and out of a wellbore.
- 20 [00017] The embodiments generally relate to a drill string with at least one bidirectional eccentric stabilizer secured thereto. In the embodiments, the drill string can support up to 3 bidirectional stabilizers per drill string.
- [00018] The present embodiments generally relate to a bidirectional eccentric stabilizer that additionally increases a wellbore diameter and improves the quality of the wellbore while simultaneously stabilizing a drill string.
- 25

- [00019] The bidirectional eccentric stabilizer can be coupled on a first shaft end to the drill string and on a second shaft end to a bottom hole assembly or other downhole equipment. The bidirectional eccentric stabilizer can have the first shaft end and the second shaft end centered around a longitudinal axis.
- 5 [00020] The bidirectional eccentric stabilizer can have an annulus configured for maximum wellbore fluid flow. A cutting portion can be formed on a shaft with blades of a plurality of blades between the first and second shaft ends. The plurality of blades of the cutting portion can be on a first plane and a plurality of cutting nodes can be on a second plane, such as from 10 degrees to 30 degrees from the longitudinal axis of the
10 stabilizer.
- [00021] In the embodiments, two different bidirectional eccentric stabilizers can be used on the same drill string.
- [00022] The bidirectional eccentric stabilizer can improve safety at the well site by reducing the number of trips into a well to solve the problem of drift in the diameter of the
15 wellbore.
- [00023] The bidirectional eccentric stabilizer can be directed to an apparatus that simultaneously stabilizes the drill string while reaming a wellbore device, which in turn can save the environment by reducing the number of trips by a bottom hole assembly out of a wellbore.
- 20 [00024] The embodiments can also minimize the possibility that wellbore fluid and other material from drilling a wellbore can explode out of a wellbore by minimizing the number of trips from the wellbore.
- [00025] The bidirectional eccentric stabilizer can allow a wellbore that cannot be smooth to be smoothed out, which in turn can prevent damage to packers being sent down the
25 wellbore.
- [00026] This bidirectional eccentric stabilizer can be a device that allows a user to ream a wellbore without jeopardizing the integrity of the casing.

- [00027] The bidirectional eccentric stabilizer can connect to a drill string, a bit coupled to the drill string and/or a bottom hole assembly coupled to the drill string. The bidirectional eccentric stabilizer can be coupled to the drill string between the bottom hole assembly and tubulars that make up the drill string.
- 5 [00028] In the embodiments, the bidirectional eccentric stabilizer can be a 26 inch outer diameter bidirectional eccentric stabilizer or a 3 inch outer diameter bidirectional stabilizer.
- [00029] The bidirectional eccentric stabilizer can have a cutting portion with the plurality of blades extending radially from the shaft.
- 10 [00030] The cutting portion can have a plurality of cutting inserts installed adjacent the plurality of cutting nodes. In the embodiments, the plurality of cutting inserts can be tungsten carbide inserts, or other suitable materials used for drilling wellbores.
- [00031] In the embodiments, the plurality of cutting inserts can be in the shape of circles, rectangles, ellipses, or other suitable shapes as required by a specific application.
- 15 [00032] In the embodiments, the bidirectional eccentric stabilizer can have two cutting portions.
- [00033] Turning now to the Figures, Figure 1A depicts a side view of a bidirectional eccentric stabilizer according to one or more embodiments.
- [00034] The bidirectional eccentric stabilizer 10 can include a shaft 33 with a longitudinal axis 16. The longitudinal axis can be the axis of rotation of the shaft.
- 20 [00035] The bidirectional eccentric stabilizer can have a nose portion 40, an end portion 34 and a cutting portion 20. The end portion 34 can have a stab end for receiving a stab from the drill string. The nose portion can engage a bottom hole assembly, another drill pipe or tubular of a drill string, a drill bit, measurement while drilling equipment, or rotary steering downhole drilling motors.
- 25 [00036] In the embodiments, the nose portion can have an outer diameter ranging from 3

inches to 36 inches and an inner diameter that can be identical or substantially equivalent to the end portion. The inner diameter can be from 1 inch to 3 inches.

[00037] In other embodiments, the nose portion and the end portion can have the same inner diameters for flow through of wellbore fluid.

5 [00038] In the embodiments, the cutting portion 20 can have an outer diameter that can be from 1 percent to 25 percent larger in diameter than the outer diameter of the nose portion or the outer diameter of the end portion.

[00039] In the embodiments, the outer diameter of the cutting portion 20 can be in a plane different from the outer diameter of the nose portion 40 or the outer diameter of the
10 end portion 34.

[00040] The cutting portion 20 can be between the nose portion 40 and the end portion 34.

[00041] The end portion 34 can have a stab end 36. The stab end 36 can be configured to receive components from the bottom hole assembly, such as a collar or the like, made of nickel alloys, primarily composed of nickel and copper, with small amounts of
15 iron, manganese, carbon, and silicon.

[00042] The bidirectional eccentric stabilizer can couple on an end portion 34 to a drill string and on a nose portion 20 to a bottom hole assembly.

[00043] The bidirectional eccentric stabilizer can have a center of eccentric rotation, which is offset from the longitudinal axis of the shaft, enabling the bidirectional eccentric
20 stabilizer to form a larger wellbore than a drill bit on the bottom hole assembly and a larger diameter wellbore than originally drilled by the drill bit.

[00044] Figure 1B depicts a cutting portion of the bidirectional eccentric stabilizer according to one or more embodiments.

[00045] The cutting portion 20 can have a first shaft end 12 and a second shaft end 14. In
25 embodiments, the first shaft end and the second shaft end can be threaded.

- [00046] An annulus can be formed longitudinally through the first shaft end 12 and the second shaft end 14. The annulus can be configured for maximum wellbore fluid flow.
- 5 [00047] A first cutting portion 22 can extend at a first cutting angle from the first shaft end 12. The first cutting angle can range from 10 degrees to 30 degrees from the longitudinal axis, forming a slightly larger outer diameter for the first cutting portion 22 as the first cutting portion 22 extends away from the first shaft end 12.
- 10 [00048] A second cutting portion 24 can extend at a second cutting angle from the second shaft end 14. The second cutting angle can range from 10 degrees to 30 degrees from the longitudinal axis, forming a slightly larger outer diameter for the second cutting portion as the second cutting portion extends away from the second shaft end 14.
- [00049] A plurality of impact arrestors 100a-100d are shown on the first cutting portion 22 and a plurality of impact arrestors 100e-100h are shown on the second cutting portion 24.
- 15 [00050] In embodiments, the plurality of impact arrestors can be mounted directly adjacent a cutting node on the first cutting portion 22, the second cutting portion 24 or both the first cutting portion and the second cutting portion.
- [00051] A plurality of cutting nodes 30a-30d are shown on the first cutting portion 22 and a plurality of cutting nodes 30e-30h are shown on the second cutting portion 24.
- 20 [00052] The plurality of cutting nodes 30a-30h can have a diameter ranging from 3/8 of an inch to 1 inch. In embodiment, the plurality of cutting nodes can extend from 0.1 inch to 0.5 inches from the surface of the first and second cutting portions. In embodiments, the plurality of cutting nodes can be polycrystalline diamond compacts or other suitable materials used for drilling wellbores.
- 25 [00053] A plurality of helical blades 46a, 46b, 50a and 50b can extend identically from the first shaft end, the second shaft end, or both in a flat plane for enhanced stability of the drill string, and can reducing wobble. Each blade can have a surface. Surface 26a is labelled.

- [00054] In embodiments, the plurality of helical blades 46a, 46b, 50a and 50b can be longitudinally connected eccentrically between the first and second cutting portions in a plane parallel to the longitudinal axis. Each helical blade of the plurality of helical blades can have a smooth blade surface.
- 5 [00055] In embodiments, a plurality of cutting inserts 104a-104ag can be mounted on a surface of the plurality of helical blades 46a, 46b, 50a and 50b. In embodiments, the plurality of cutting inserts 104a-104ag can be mounted on an edge of each helical blade 50a and 50b, cutting portions adjacent the plurality of cutting nodes 30a-30h, a surface of each helical blade 50a and 50b, or combinations thereof. The cutting
10 inserts can be mounted in parallel or installed in segments.
- [00056] In embodiments, a plurality of flutes can be used, here flutes 54a, 54b, 54c are labelled. Each flute of the plurality of flutes 54a – 54c can be formed between a pair of helical blades 50a and 50b of the plurality of helical blades. Each flute of the plurality of flutes 54a – 54c can be tapered on each end. The depth of each flute of the
15 plurality of flutes 54a – 54c can be from 10 percent to 50 percent of the outer diameter of the overall bidirectional stabilizer.
- [00057] For this type of drilling application, all of the drilling components can be made up with a high strength or premium connection. The bidirectional eccentric stabilizer can use a unique flute depth while still providing a strong high strength premium
20 connection.
- [00058] The flute depth can be as deep as possible to ensure a maximum flow of drill cuttings, without clogging, while simultaneously providing a high strength premium connection.
- [00059] Each flute 54a can be formed between a pair of helical blades 50a and 50b, flute 54b
25 can be formed between a different pair of helical blades 46b and 50b, flute 54c can be formed between a different pair of helical blades 46a and 50a.
- [00060] In embodiments, diamond enhanced hardfacing can be disposed on portions of each of the plurality of helical blades. Figure 1B shows diamond enhanced hardfacing

102a and 102b disposed on at least a portion of one of the plurality of helical blades.

[00061] In embodiments, the at least one diamond enhanced hardfacing 102a and 102b can be disposed on each helical blade 50a.

5 [00062] In embodiments, the at least one diamond enhanced hardfacing 102a can completely cover each helical blade 50a.

[00063] In embodiments, the at least one diamond enhanced hardfacing 102a and 102b can cover portions of the helical blades 46a, 46b, 50a and 50b.

10 [00064] In additional embodiments, the at least one diamond enhanced hardfacing 102a and 102b can be arranged in patterns, such as helical patterns to more quickly cut the wellbore in the direction the bidirectional eccentric stabilizer is being rotated.

[00065] In embodiments, at least one nozzle 601a and 601b can be used for diverting a portion of drilling fluid from the annulus to the plurality of flutes 54a – 54c at an angle from 0 degrees to 90 degrees from the longitudinal axis pointing downhole toward the second cutting portion.

15 [00066] The at least one nozzle 601a and 601b can be welded or otherwise fastened into the trough of a flute below the helical blade 46a, 46b, 50a and 50b smooth surface.

20 [00067] In embodiments, the bidirectional eccentric stabilizer can have from at least one nozzle to four nozzles. In embodiments, at least one nozzle can be mounted in each flute, which can divert a portion of drilling fluid from the annulus to the plurality of flutes at an angle from 0 degree to 90 degrees from the longitudinal axis.

[00068] Figure 2 depicts a side view of another embodiment of the dual bidirectional eccentric stabilizer 10 for use with the drilling rig according to one or more embodiments.

25 [00069] The bidirectional eccentric stabilizer can have a shaft 33 with a longitudinal axis 32, a first end 12, and a second end 16. The longitudinal axis 32 can be the axis of rotation of the shaft.

- [00070] The shaft 33 can have an annulus, not shown in this Figure, for allowing fluid flow along the bidirectional eccentric stabilizer's longitudinal axis 16.
- 5 [00071] The bidirectional eccentric stabilizer can have a first shaft portion 136, connected to a first neck 140. The first shaft portion 136 can have a first diameter 38 that can range from 2 inches to 9 inches in embodiments.
- [00072] The first neck 140 can be a narrowed portion of the shaft 33. The first neck portion can have a first neck diameter 42 which can be less than the first diameter 38 of the first shaft portion.
- 10 [00073] In embodiments, the first neck diameter 42 can be at least ten percent less than the first diameter. In embodiments, the first neck 140 can have a first neck diameter 42 that ranges from 3.5 inches to 7 inches.
- [00074] The first neck 140 can have a shoulder at a 30 degree angle reducing the diameter of the shaft for the neck from the first shaft portion 136.
- 15 [00075] The first neck 140 can be contiguous with the first cutting section 44. The first cutting section 44 can be integrally connected to the first neck 140. The first neck can range from 1 inch to 6 inches in length.
- [00076] A second shaft portion 60 can connect to the first cutting portion 44. The second shaft portion can have a second diameter 62 which can range from 2 inches to 9 inches.
- [00077] A second cutting section 64 can be connected to the second shaft portion 60.
- 20 [00078] The second cutting section 64 is contiguous with the second shaft portion 60.
- [00079] The second cutting section 64 can be substantially identical to the first cutting section 44 in structure, or have a different structure, such as comprise two blades when the first cutting section comprises four blades.
- 25 [00080] The second cutting section 64 can be contiguous with a second neck 67. The second neck 67 can have a second neck diameter 66 which can be less than the first diameter

42.

- [00081] In embodiments, the second neck diameter 66 can be at least ten percent less than the first diameter 42. The second neck diameter 66 need not be the same as the first neck diameter 42.
- 5 [00082] The second neck 67 can be contiguous with a third shaft portion 68. In embodiments, the third shaft portion 68 can have a third diameter 72, which can be equivalent to the first diameter 38 of the first shaft portion 136.
- [00083] The bidirectional eccentric stabilizer can be shown with a plurality of helical blades one helical blade 46a, is labelled.
- 10 [00084] The bidirectional eccentric stabilizer is depicted with a plurality of flutes, one flute 54a is shown located between two helical blades.
- [00085] In embodiments, the second cutting section 64 can be rotationally offset in relation to the first cutting section 44 such that the first helical blade 46a and the second helical blade 50a of the first cutting portion 44 are not aligned with the first helical blade and the second helical blade of the second cutting portion 64 respectively as viewed along the longitudinal axis 32 of the shaft 33.
- 15 [00086] The second cutting section 64 has two flutes wherein the depth of each flute is labelled 29a and 29b.
- [00087] The plurality of flutes can be cut to have the deepest part identified as a flute troughs 29a-29d which can be formed in the tool at least 50% into the tool wall, and up to 80% through the tool wall. The flutes can have a depth from 1 to 4 inches for very large tools that have diameters of 12 1/8 inches.
- 20 [00088] Figures 3A-3B depicts a cut view of the cutting portion according to one or more embodiments.
- [00089] The bidirectional eccentric stabilizer can have a shaft 33 connected between the first shaft end and the second shaft end.
- 25

- [00090] The cutting portion is shown with a plurality of helical blades 46a, 46b, 50a and 50b.
- [00091] In embodiments, helical blades 46a and 46b are shown as the same size and helical blades 50a and 50b are shown as the same size. In embodiments, the helical blades can have different thicknesses.
- 5 [00092] The plurality of helical blades 46a, 46b, 50a and 50b can be formed on the outer surface of the shaft 33.
- [00093] The shaft 33 can have an outer diameter with the first shaft end and the second shaft end. In embodiments, the shaft can then be centered around an annulus 18 formed longitudinally through the shaft in which the annulus is configured for maximum
10 wellbore fluid flow.
- [00094] In embodiments, when the plurality of helical blades 46a, 46b, 50a and 50b are used, the plurality of helical blades 46a-46b can have identical sizes.
- [00095] Additionally, in embodiments, the plurality of helical blades 50a-50b can have different thicknesses. As measured from the outer surface of the shaft, the thickness
15 52 of the second helical blade 50a can be larger than the thickness 48 of the first helical blade 46a.
- [00096] In embodiments, the thickness 52 of the second helical blade can be at least thirty percent greater than the thickness 48 of the first helical blade 46a as measured from the outer surface of the shaft.
- 20 [00097] In other embodiments, the bidirectional eccentric stabilizer does not need the plurality of helical blades to operate.
- [00098] The plurality of flutes 54a-54d can be located between pairs of the plurality of helical blades 50a-50b.
- [00099] In embodiments, a plurality of impact arrestors can be used, such as from 20 to 400
25 impact arrestors. Each impact arrestor can be mounted uniquely. Impact arrestors 100a and 100b are shown.

- [000100] Impact arrestor 100a is shown extending from the surface of the helical blade in Figure 2. Impact arrestor 100b is shown embedded in the helical blade in a flush fit, which can form a smooth surface with the helical blade shown in Figure 1B.
- 5 [000101] The impact arrestor 100b can be flush mounted in the cutting portion, and the impact arrestor 100a can be slightly raised above a surface of the cutting portion. It should be noted that the raised impact arrestors can have a height less than the height of the cutting nodes.
- 10 [000102] In embodiments, from one impact arrestor to sixty impact arrestors can be used. Each impact arrestor can be configured to simultaneously perform as a shock dampener and as a cutting insert.
- [000103] In embodiments, each impact arrestor can be cylindrical in shape and identical to the diameter of the cutting nodes. Each impact arrestor can extend from the surface less than the cutting nodes, such as ten percent less than the adjacent cutting nodes.
- 15 [000104] In embodiments, the plurality of cutting inserts, two cutting inserts are labelled 104a and 104d can be viewed mounted on an edge of the helical blades 54a-54d.
- [000105] In embodiments, the cutting portion can have at least one communication conduit 501a for flowing well fluid down the bidirectional eccentric stabilizer in a flow direction parallel to fluid flowing through the annulus 18, which can include but is not limited to substances, such as drilling mud.
- 20 [000106] In embodiments, the communication conduit 501a can be used for flowing well fluid in the same direction as fluid flowing through the annulus.
- [000107] In embodiments, a communication wire 503 can also be disposed or installed in the communication conduit 501a to communicate with bottomhole assemblies or other downhole equipment.
- 25 [000108] In embodiments, the communication conduit 501a can be a conduit that is offset from the annulus 18.

- [000109] In embodiments, the communication conduit 501a can be separated and without fluid communication with the annulus 18. In embodiments, the communication conduit 501a can be fluidly connected to the annulus 18. The communication conduit can be located anywhere on the tool, and is not limited to a particular location.
- 5 [000110] In embodiments, two communication conduits 501a and 501b can be used on opposite sides of the annulus 18 to provide a balanced tool during rotation.
- [000111] In embodiments, the communication conduit can flow from two percent to twenty percent of a volume of fluid that is flowing through the annulus.
- 10 [000112] The center of eccentric rotation 70 can be offset from the longitudinal axis 32 of the shaft, which can also be the axis of rotation of the shaft. This allows the bidirectional eccentric stabilizer to drill a larger bore than the actual bidirectional eccentric stabilizer diameter, as well as a larger diameter wellbore than originally drilled with a drill bit.
- 15 [000113] Figure 4 depicts a detail cut view of a helical blade for one of the embodiments of the bidirectional eccentric stabilizer for a drilling rig.
- [000114] In this embodiment, a cutting node 30a, 30b is shown disposed on the second helical blade 50a.
- [000115] In embodiments, the each blade of the plurality of helical blades can have cutting formed on the blades.
- 20 [000116] Figure 5 depicts a detailed view of a surface of an embodiment of a blade of the plurality of blades according to one or more embodiments.
- [000117] In embodiments, the helical blade 50a of the plurality of blades can have a plurality of cutting inserts 104a and 104b disposed thereon. The plurality of cutting inserts in this embodiment are shown as a circular shape.
- 25 [000118] In embodiments, the plurality of cutting inserts can be arranged on the blade of the plurality of blades in an alternating arrangement. While the plurality of cutting inserts

are shown as circular, other embodiments can make use of any suitable shape for the plurality of cutting inserts.

- 5 **[000119]** The plurality of cutting inserts can range in diameter, if circular from 1/8 inch to 1 inch. In embodiments, from 1 to 150 cutting inserts can be installed on the blade of the plurality of blades.
- [000120]** A portion of the plurality of cutting inserts can be installed adjacent the plurality of cutting nodes at the ends of the blades of the plurality of blades.
- [000121]** In other embodiments, the plurality of cutting inserts can range from 15 cutting inserts per inch to 50 cutting inserts per inch.
- 10 **[000122]** The plurality of cutting inserts can be rectangular in shape and arranged in an alternating configuration on the blade of the plurality of blades.
- [000123]** The plurality of cutting inserts in this embodiment are shown as a rectangular shape and configured in an alternating arrangement. The cutting inserts can be trapezoidal or triangular or square in shape.
- 15 **[000124]** The plurality of cutting inserts can be arranged in parallel rows with a first row offset from a second row.
- [000125]** This figure shows that the plurality of cutting inserts can have a shape other than a circular shape, such as a rectangular shape, and be arranged in an alternating configuration on the blade of the plurality of blades.
- 20 **[000126]** In embodiments, the bidirectional eccentric stabilizer can be made from either steel or a non-magnetic material.
- [000127]** In embodiments, the plurality of cutting inserts can be installed on at least one edge of at least one blade of the plurality of blades. In embodiments, at least one cutting insert to 30 cutting inserts per blade can be used.
- 25 **[000128]** In embodiments, the bidirectional eccentric stabilizer can be modular.

- [000129] In embodiments, the bidirectional eccentric stabilizer excluding the plurality of cutting nodes can be an integral one piece bidirectional eccentric stabilizer formed from a single piece of metal.
- 5 [000130] In embodiments, the plurality of blades can be formed from a material harder than material used to form the first shaft end, the shaft and the second shaft end.
- [000131] In embodiments, the plurality of blades can be pretreated with nitride to improve hardness and create a more durable bidirectional stabilizer.
- 10 [000132] The hardfacing material shown in Figure 1B can be a material that can be applied at low temperature and has high corrosion resistance. In embodiments, the hardfacing material is non-magnet with the entire tool being steel and non-magnetic.
- [000133] In a different embodiment, the hardfacing material can be magnet and have tolerances above API tolerances for drill collars such as a Durmat™ hardfacing material NIFD.
- [000134] Figure 6 shows a downhole drill string in the wellbore according to one or more embodiments.
- 15 [000135] Figure 6 depicts the bidirectional stabilizers connected to the first and second drill pipe segments forming the drill string that protects the drill pipe.
- [000136] The downhole drill string can have at least one bidirectional eccentric stabilizer 10a mounted between a bottom hole assembly 304 and a first drill pipe segment 300.
- 20 [000137] In this embodiment, the downhole drill string is shown with a first bidirectional eccentric stabilizer 10a and an additional bidirectional eccentric stabilizer 10b mounted between the first drill pipe segment 300 and a second drill pipe segment 302
- [000138] The downhole drill string is shown in the wellbore surrounding a formation 305.
- 25 [000139] In embodiments, the bidirectional eccentric stabilizer can be a 60 inch long bidirectional eccentric stabilizer or a 15 inch long bidirectional stabilizer, or a 20 inch long bidirectional stabilizer. When the bidirectional eccentric stabilizer is of a short

length, the bidirectional eccentric stabilizer can be installed every 100 feet of drill pipe. When such short versions of the bidirectional eccentric stabilizer are used, 3 to 20 bidirectional stabilizers can be used, and a few can even be stacked through the bottomhole assembly.

5 [000140] With a slightly larger outer diameter, the formation can rub on the bidirectional eccentric stabilizer and not on the drill pipe.

[000141] In long wells, ranging from 1 mile to 20 miles in length, the bidirectional eccentric stabilizer can simultaneously perform as a sacrificial node while centralizing the drill string and protecting the more expensive drill pipe.

10 [000142] Figure 7 shows a drilling rig with the bidirectional eccentric stabilizer according to one or more embodiments.

15 [000143] The bidirectional eccentric stabilizer 10 can be configured to simultaneously smooth a wellbore, centralize the downhole components from wear and damage and flow drilling fluid to at least one downhole component or at least one operating component while allowing wellbore fluid to flow to a surface unimpeded.

[000144] The drilling rig 290 can have a tower 289 and a crown 288 with a plurality of sheaves 160. In embodiments, the tower can be a derrick.

[000145] The tower can have a rig floor 90 and a rig floor substructure 91.

20 [000146] The drilling rig 290 can have a drawworks 162 connected with a drawworks motor 164, which can be connected to a power supply 166.

[000147] A cable 158 can extend from the drawworks 162 through the plurality of sheaves 160 over the crown 288. A lifting block 212 can be connected to the cable 158.

[000148] A hydraulic pump 271 can be fluidly connected to a tank 270 to allow flowing fluid into the wellbore as drill pipe is turned into the wellbore.

25 [000149] A rotating means 210 can be used for turning drill pipe into the wellbore. The rotating

means 210 can be a top drive, a power swivel mounted to the lifting block, or another device known in the industry that can be used for turning drill pipe.

[000150] In embodiments, the rotating means can be a rotary table mounted to the rig floor for rotating drill pipe into a wellbore.

5 [000151] A blowout preventer 352 can be connected between the rotating means and the wellbore for receiving drill pipe.

[000152] The bidirectional eccentric stabilizer 10 can be mounted between the first drill pipe segment 300 and the second drill pipe segment 302.

10 [000153] A drill bit 119 is shown attached to the first drill pipe segment 300 and a bottom hole assembly 121 is shown connected between the drill bit 119 and the first drill pipe segment 300.

[000154] The bidirectional eccentric stabilizer can be mounted in drill pipe segments as the drill pipe is run into the wellbore. This can allow the drilling rig to save measurement while drilling equipment and bottomhole components as they are lowered downhole.

15 [000155] Figure 8 shows a bidirectional eccentric stabilizer with a helical blade with a slightly interrupted line of sight through the plurality of flutes between the plurality of blades for fluid flow.

20 [000156] Figure 9 shows a straight blade version of another bidirectional eccentric stabilizer with an uninterrupted line of sight through the flutes between the blades for fluid flow.

[000157] In embodiments, the bidirectional eccentric stabilizer 10 can have the helical blades 50a and 50b, helical blade 50a can extend at a first cutting angle 201 from a first apex 401a to a second apex 403a on the same blade.

25 [000158] The second helical blade 50b can extend at a second cutting angle from a first apex 401b (not shown) to a second apex 403b.

- [000159] The first apex and the second apex can have a flat surface or a rounded surface, and the apex is not limited to a certain shape.
- [000160] In embodiments, first and second cutting angles can range from 20 degrees to 55 degrees from the longitudinal axis 16 of the bidirectional eccentric stabilizer.
- 5 [000161] The plurality of flutes 210a and 210b can create a first area for fluid flow, referred to herein as a first bypass area, which can be sized to be greater than or equal to thirty-five percent of a bit diameter for bits having an outer diameter of 10 inches 5/8 of an inch or greater, and a second area for fluid flow, referred to herein as a second bypass area, which can be greater than or equal to twenty-five percent of a bit diameter for
10 bits having an outer diameter less than 10 and 5/8 of an inch. Each bypass area can be formed around the longitudinal axis 16 of the bidirectional eccentric stabilizer 10.
- [000162] This embodiment depicts an eccentric helical blade height 306.
- [000163] Each helical blade can have a smooth blade surface with a wrap angle 301 forming a particle flow path between pairs of helical blades without intersecting more than
15 thirty percent of any one helical blade and configured with a line of sight 307 parallel to the longitudinal axis 16.
- [000164] Figure 9 shows a straight blade embodiment, wherein the straight blades 405a and 405b. A first flute 210b is depicted between a pair of straight blades and a second flute 210a is depicted between another pair of straight blades.
- 20 [000165] The first straight blade 405a has a first apex 401a to a second apex 403a.
- [000166] In embodiments, two cutting angles can be used, cutting angle 201 is shown that can range from 20 degrees to 55 degrees from the longitudinal axis 16 of the bidirectional eccentric stabilizer.
- [000167] Angle 203 is labelled as the angle of the shoulder of the blade.
- 25 [000168] Each straight blade can be configured with a line of sight 307 parallel to the longitudinal axis 16.

- [000169] Each straight blade can have a smooth blade surface with the flute forming a particle flow path between pairs of helical blades without intersecting more than thirty percent of any one helical blade and configured with a line of sight 307 parallel to the longitudinal axis 16.
- 5 [000170] The cutting portion forms a transition radius shown as an inner radius 204 of the cutting portion, wherein the inner radius 204 of the cutting portion 20 can be greater than or equal to $\frac{1}{8}$ of an inch of each blade height 303 as measured from the flute trough to reduce stress on the bottom hole assembly of the drill string to which the bidirectional eccentric stabilizer is secured.
- 10 [000171] The cutting portion forms a transition radius shown as an outer radius 202 of the cutting portion, wherein the outer radius 202 of the cutting portion 20 can be greater than or equal to $\frac{1}{4}$ of an inch of each blade height 303 as measured from the flute trough to reduce hang-up in a wellbore during operation.
- 15 [000172] While these embodiments have been described with emphasis on the embodiments, it can be understood that within the scope of the appended claims, the embodiments might be practiced other than as specifically described herein.

CLAIMS

What is claimed is:

1. A drilling rig having a bidirectional eccentric stabilizer for use in a wellbore, wherein the bidirectional eccentric stabilizer is coupled between a drill string and a bottom hole assembly, comprising:
 - a. the drilling rig comprising:
 - i. a tower having a crown with sheaves;
 - ii. a drawworks connected to a drawworks motor and connected to a power supply;
 - 10 iii. a cable extending from the drawworks through the sheaves over the crown;
 - iv. a lifting block connected to the cable;
 - v. a hydraulic pump connected to a tank for flowing fluid into the wellbore as a drill pipe is turned into the wellbore;
 - 15 vi. a rotating means for turning the drill pipe into the wellbore, the rotating means comprising at least one of: a top drive or a power swivel mounted to the lifting block or a rotary table mounted to a rig floor for rotating the drill pipe into the wellbore;
 - 20 vii. a blowout preventer connected between the rotating means and the wellbore for receiving the drill pipe;
 - b. the bidirectional eccentric stabilizer comprising:
 - i. a shaft connected between a first shaft end and a second shaft end, wherein the shaft comprises an outer diameter with the first shaft end and the second shaft end centered around a longitudinal axis;

ii. an annulus formed longitudinally through the shaft, wherein the annulus is configured for maximum wellbore fluid flow; and

iii. a cutting portion formed on an outer surface of the shaft, the cutting portion comprising:

5 (a) a first cutting portion extending at a first angle from the first shaft end;

(b) a second cutting portion extending at a second angle from the second shaft end, the second cutting portion forming a slightly larger outer diameter for the second cutting portion as the second cutting portion extends away from the second shaft end;

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(c) a plurality of helical blades longitudinally connected eccentrically between the first cutting portion and the second cutting portion, each helical blade of the plurality of helical blades existing in a plane parallel to the longitudinal axis, and each helical blade of the plurality of helical blades comprising a smooth blade surface;

15

(d) a plurality of flutes formed between pairs of helical blades of the plurality of helical blades;

(e) a plurality of cutting nodes installed on at least one edge of the first cutting portion, on at least one edge of the second cutting portion, or on at least one edge of the first cutting portion and on at least one edge of the second cutting portion; and

20

(f) a plurality of impact arrestors, each impact arrestor of the plurality of impact arrestors mounted in a location either directly adjacent each cutting node of the plurality of cutting nodes on the first cutting portion, directly adjacent each cutting node of the plurality of cutting nodes on the second cutting portion or in both locations; and

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wherein the bidirectional eccentric stabilizer couples on an end portion to a drill string and on a nose portion to a bottom hole assembly and the bidirectional eccentric stabilizer has a center of eccentric rotation which is offset from the longitudinal axis of the shaft, enabling the bidirectional eccentric stabilizer to form a larger wellbore than a drill bit on the bottom hole assembly and a larger diameter wellbore than originally drilled by the drill bit.

2. The drilling rig having a bidirectional eccentric stabilizer for use in a wellbore of claim 1, wherein the bidirectional eccentric stabilizer is a dual eccentric bidirectional stabilizer.

3. The drilling rig having a bidirectional eccentric stabilizer for use in a wellbore of claim 1, wherein the plurality of helical blades comprise multiple helical blades each with each helical blade of the plurality of helical blades having an identical longitudinal length along the shaft.

4. The drilling rig having a bidirectional eccentric stabilizer for use in a wellbore of claim 1, wherein the plurality of helical blades comprise 4 to 16 helical blades each extended longitudinal length along the shaft.

5. The drilling rig having a bidirectional eccentric stabilizer for use in a wellbore of claim 1, wherein the plurality of helical blades comprise multiple helical blades with each helical blade of the plurality of helical blades having an identical thickness.

6. The drilling rig having a bidirectional eccentric stabilizer for use in a wellbore of claim 1, wherein the plurality of helical blades comprise multiple helical blades with each helical blade of the plurality of helical blades having alternating thicknesses.

7. The drilling rig having a bidirectional eccentric stabilizer for use in a wellbore of claim 1, wherein the end portion and the nose portion range in length from 25 percent to 35 percent of a total length of the bidirectional eccentric stabilizer.

8. The drilling rig having a bidirectional eccentric stabilizer for use in a wellbore of claim 1, wherein the plurality of impact arrestors comprises at least one of: a tungsten carbide arrestor, a ceramic impact arrestor, a polycrystalline diamond impact arrestor, and a

diamond impregnated impact arrestor.

9. The drilling rig having a bidirectional eccentric stabilizer for use in a wellbore of claim 1, comprising a plurality of cutting elements, wherein the plurality of cutting elements comprises at least one of: a diamond impregnated cutting element and a polycrystalline diamond cutting element, and wherein the plurality of cutting elements are mounted either directly on a face of the plurality of helical blades or on at least one edge of the plurality of helical blades.
10. The drilling rig having a bidirectional eccentric stabilizer for use in a wellbore of claim 1, comprising at least one diamond enhanced hardfacing disposed on least one of: a portion of each helical blade, an entire helical blade, and an area surrounding each impact arrestor.
11. The drilling rig having a bidirectional eccentric stabilizer for use in a wellbore of claim 1, comprising from 1 impact arrestor to 60 impact arrestors per bidirectional stabilizer, each impact arrestor of the plurality of impact arrestors configured to simultaneously perform as a shock dampener and as a cutting element.
12. The drilling rig having a bidirectional eccentric stabilizer for use in a wellbore of claim 1, wherein each impact arrestor of the plurality of impact arrestors is either flush mounted in the cutting portion or slightly raised above a surface of the cutting portion or the plurality of helical blades and extend from the surface less than the plurality of cutting nodes extend from the surface.
13. The drilling rig having a bidirectional eccentric stabilizer for use in a wellbore of claim 1, further comprising a plurality of cutting buttons mounted on at least one of: an edge of each helical blade, cutting portions adjacent the plurality of cutting nodes, and a surface of each helical blade.
14. The drilling rig having a bidirectional eccentric stabilizer for use in a wellbore of claim 1, comprising: a first cutting portion extending at a first cutting angle to a first apex from a first shaft end; a second cutting portion extending at a second cutting angle to a second apex from a second shaft end, the second cutting portion forming a slightly larger outer

diameter as the second cutting portion extends away from the second shaft end, wherein the first cutting portion and the second cutting portion are installed at the first cutting angle and the second cutting angle ranging from 20 degrees to 55 degrees from the longitudinal axis of the bidirectional stabilizer.

- 5 15. The drilling rig having a bidirectional eccentric stabilizer for use in a wellbore of claim 1, wherein, each helical blade of the plurality of helical blades comprising a smooth blade surface has a wrap angle forming a particle flow path between pairs of helical blades of the plurality of helical blades without intersecting more than thirty percent of any one helical blade and configured with a line of sight parallel to the longitudinal axis.
- 10 16. The drilling rig having a bidirectional eccentric stabilizer for use in a wellbore of claim 1, wherein an outer radius of the cutting portion is greater than or equal to $\frac{1}{4}$ of an inch of a blade depth as measured from a flute trough to reduce hang-up in a wellbore; and an inner radius of the cutting portion greater than or equal to $\frac{1}{8}$ of an inch of the blade depth as measured from the flute trough to reduce stress on a bottom hole assembly of a drill
- 15 string to which the bidirectional eccentric stabilizer is secured.
17. The drilling rig having a bidirectional eccentric stabilizer for use in a wellbore of claim 1, comprising: a plurality of flutes formed between pairs of the plurality of helical blades, the plurality of flutes configured with a first bypass area greater than or equal to thirty-five percent of a bit diameter for bits having an outer diameter of 10 and $\frac{5}{8}$ inches or
- 20 greater or a second bypass area greater than or equal to twenty five percent of a bit diameter for bits having an outer diameter less than 10 and $\frac{5}{8}$ inches;
18. The drilling rig having a bidirectional eccentric stabilizer for use in a wellbore of claim 1, comprising: a plurality of cutting inserts mounted on at least one of: an edge of each helical blade of the plurality of helical blades, cutting portions adjacent the plurality of
- 25 cutting nodes, and a surface of each helical blade of the plurality of helical blades and wherein the plurality of cutting inserts are disposed on the smooth blade surface without extending from the smooth blade surface more than 0.5 percent of a blade depth.
19. The drilling rig having a bidirectional eccentric stabilizer for use in a wellbore of claim 1,

comprising: a communication conduit for flowing well fluid in the same direction as fluid flowing in the annulus.

20. The drilling rig having a bidirectional eccentric stabilizer for use in a wellbore of claim 19, comprising a communication wire disposed in the communication conduit.

5 21. The drilling rig having a bidirectional eccentric stabilizer for use in a wellbore of claim 17, comprising: at least one nozzle diverting a portion of drilling fluid from the annulus to the plurality of flutes, the at least one nozzle oriented at an angle from 0 degrees to 90 degrees from the longitudinal axis.

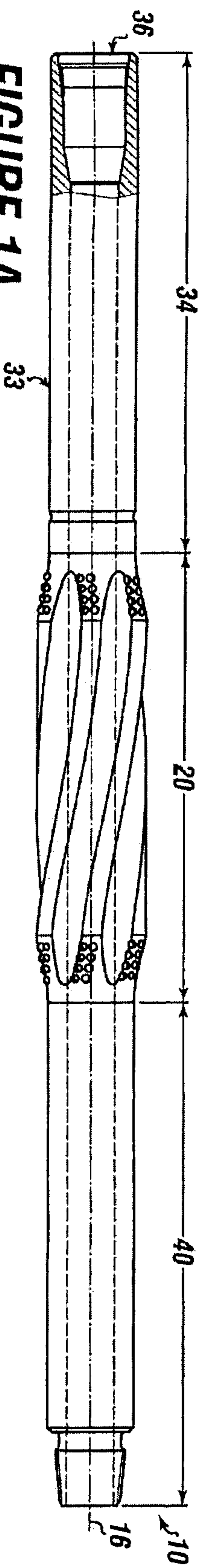


FIGURE 1A

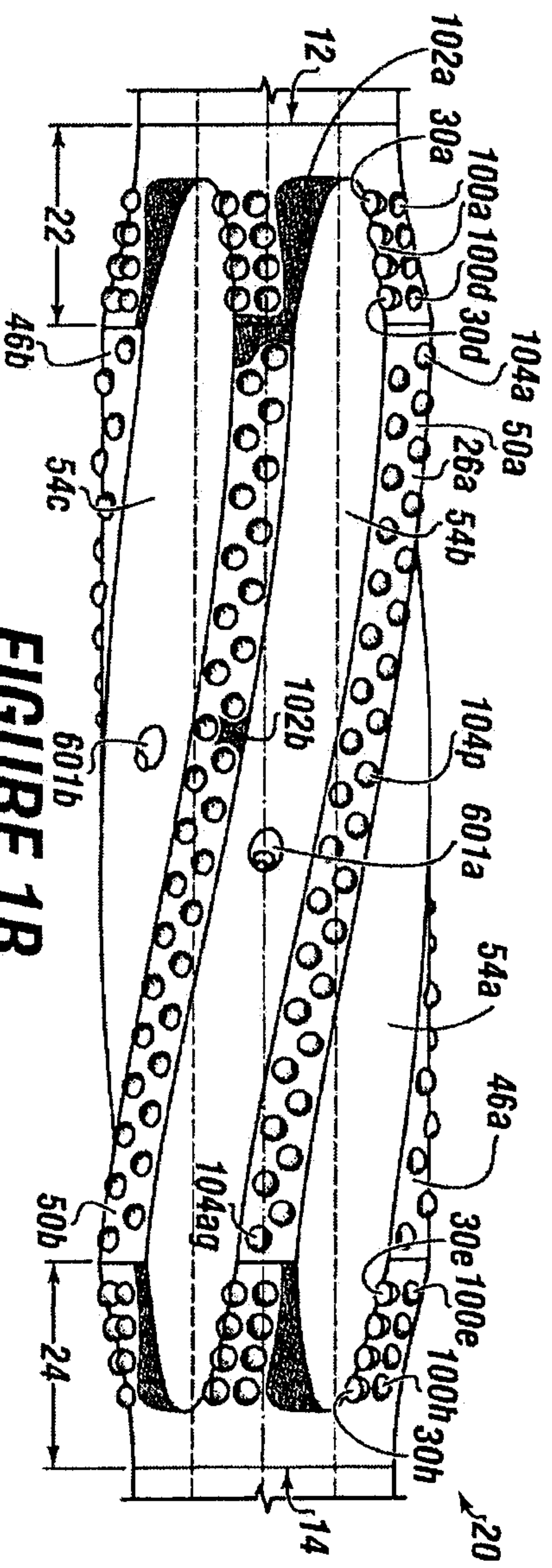


FIGURE 1B

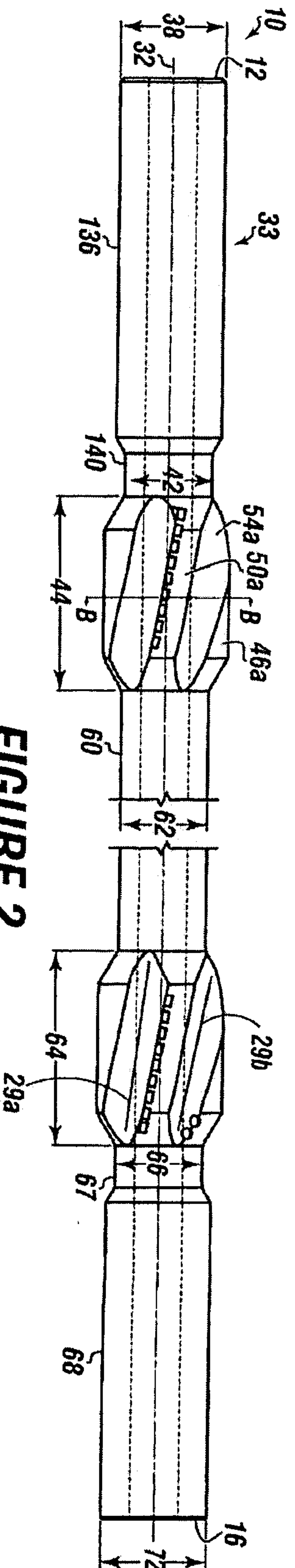
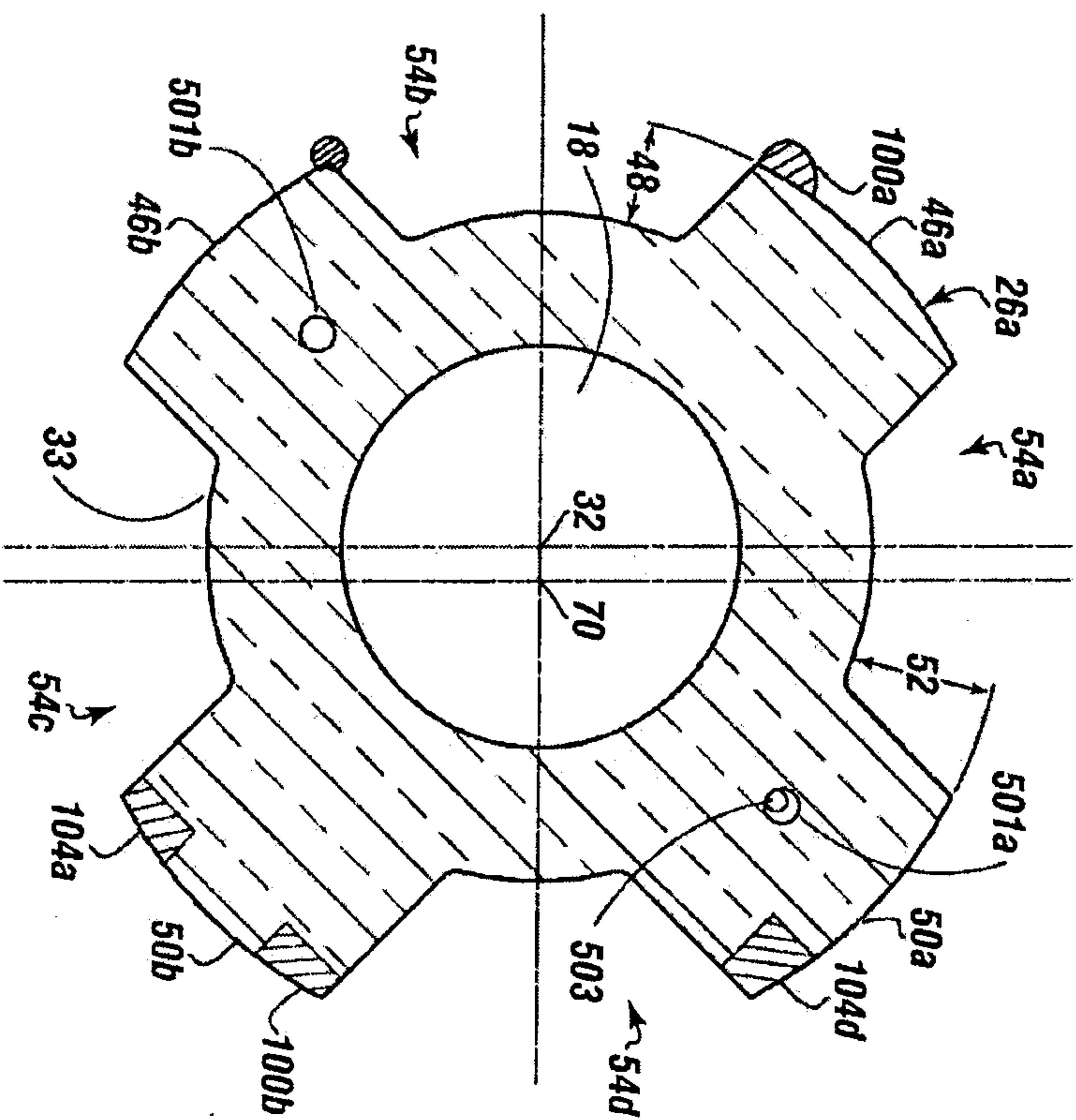
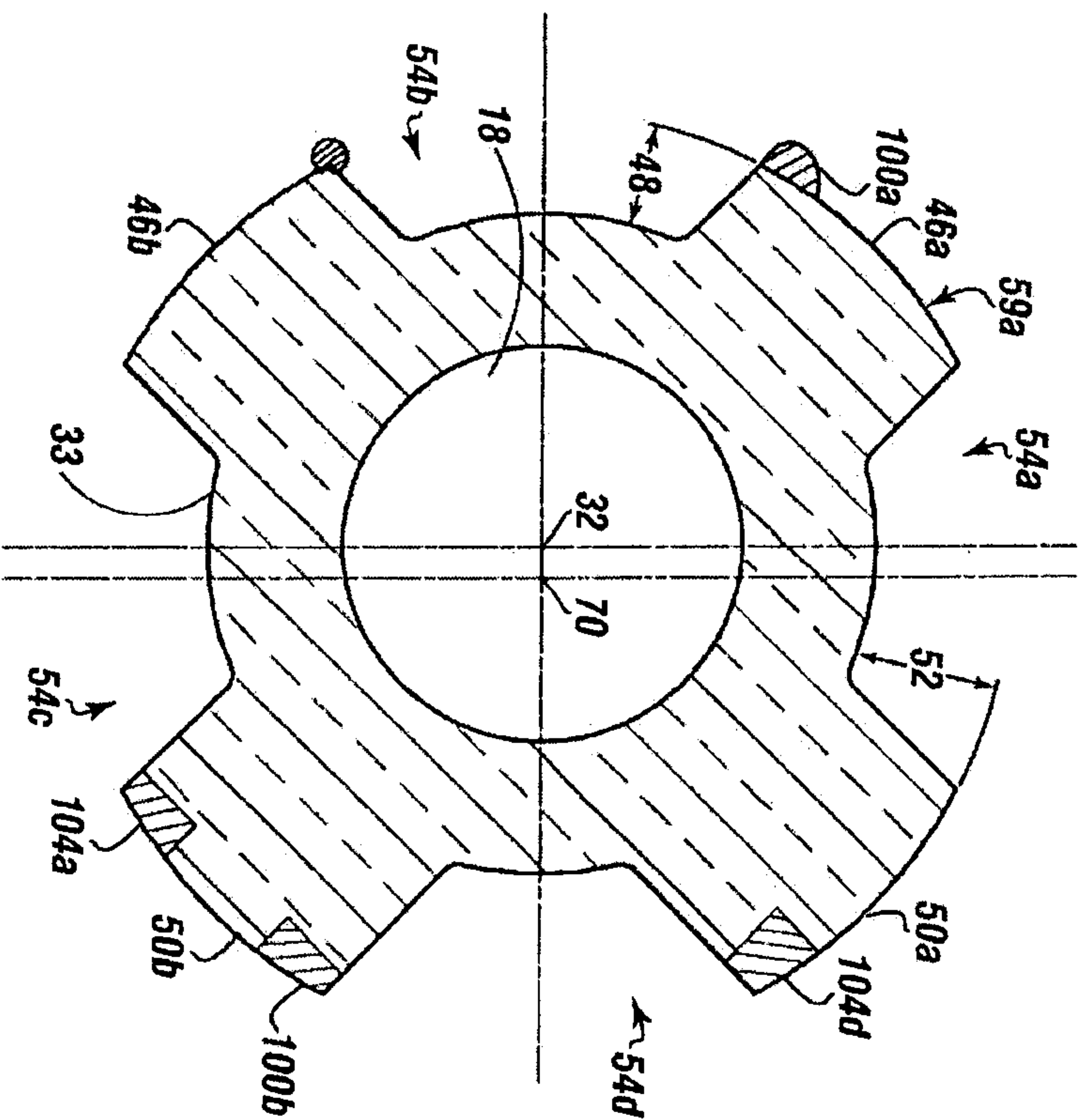
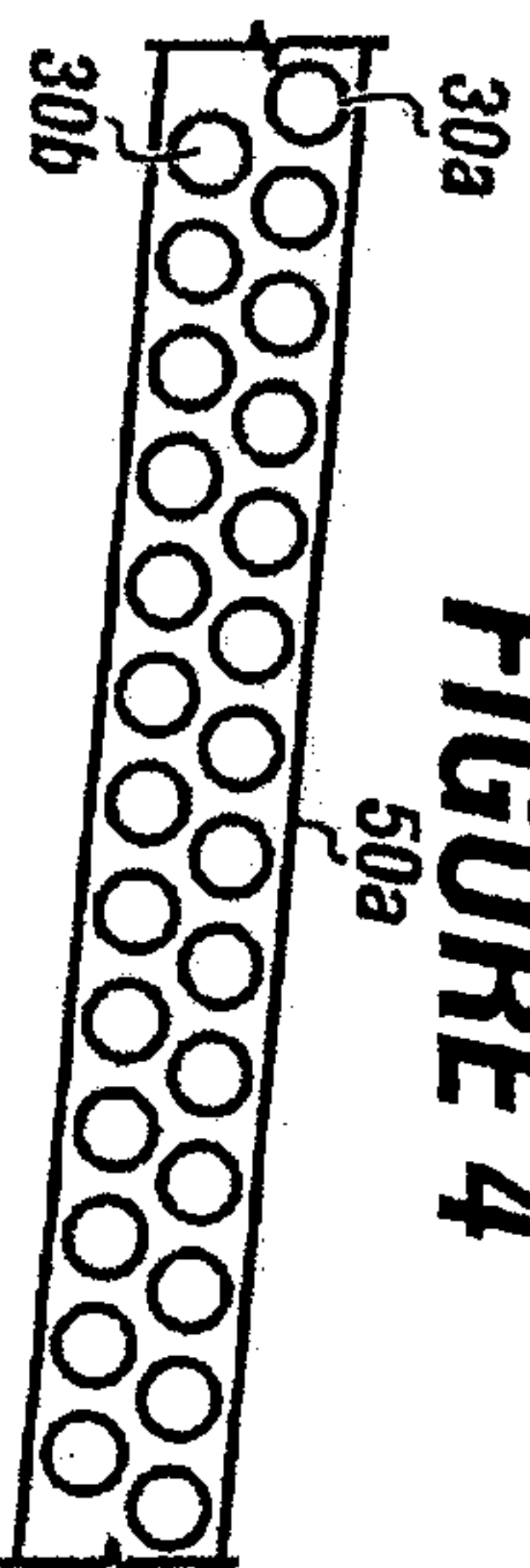
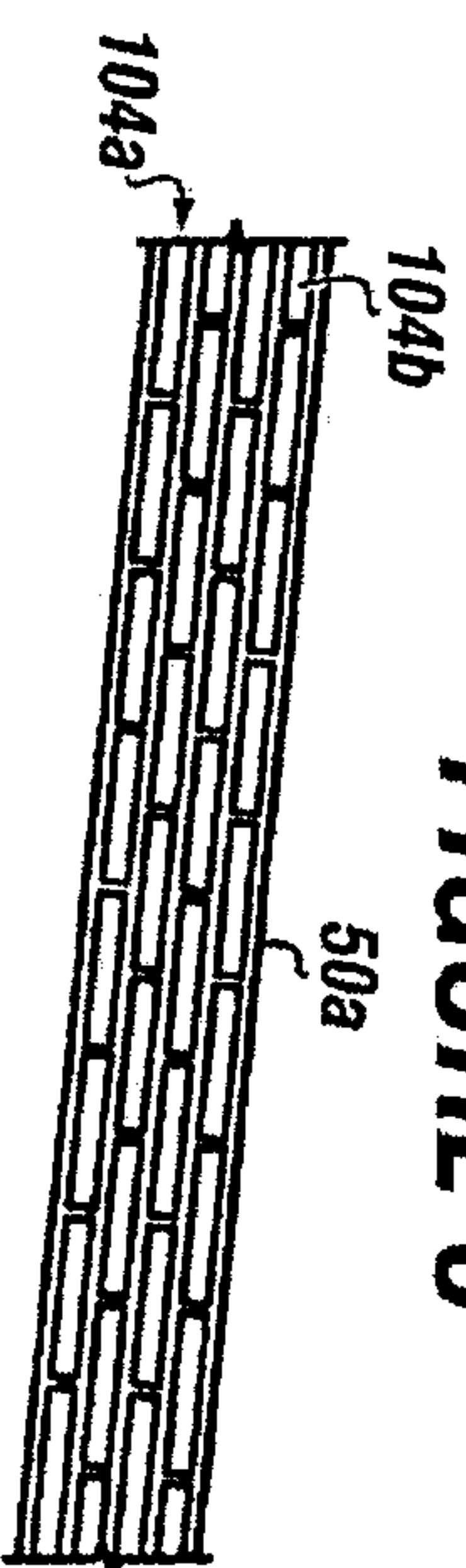


FIGURE 2

FIGURE 3A**FIGURE 3B****FIGURE 4****FIGURE 5**

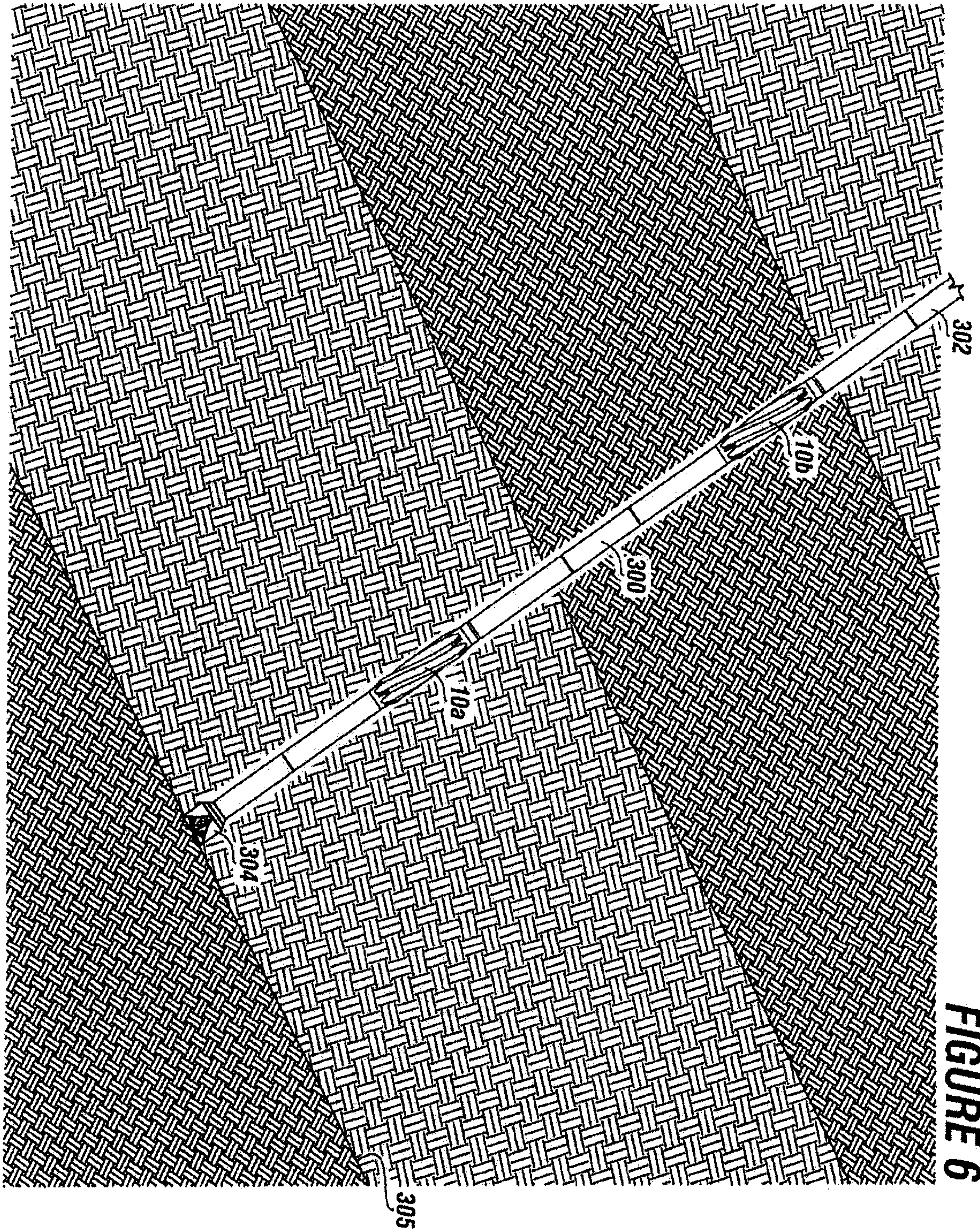


FIGURE 6

FIGURE 7