

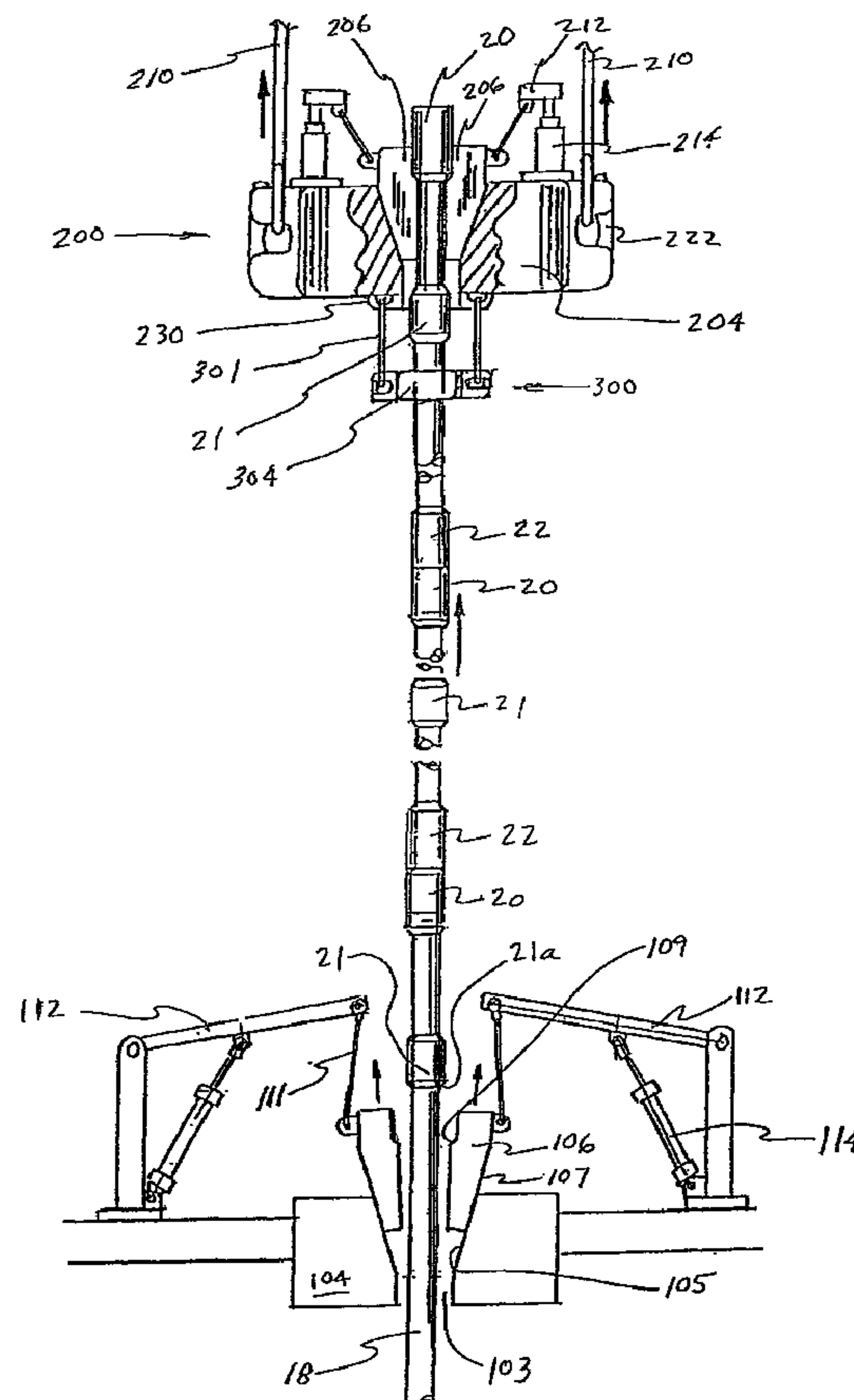


(86) Date de dépôt PCT/PCT Filing Date: 2001/04/24
(87) Date publication PCT/PCT Publication Date: 2001/12/13
(45) Date de délivrance/Issue Date: 2008/07/08
(85) Entrée phase nationale/National Entry: 2002/11/28
(86) N° demande PCT/PCT Application No.: US 2001/013145
(87) N° publication PCT/PCT Publication No.: 2001/094737
(30) Priorités/Priorities: 2000/06/02 (US09/586,239);
2000/06/02 (US09/586,233); 2000/06/02 (US09/586,232)

(51) Cl.Int./Int.Cl. *E21B 19/07* (2006.01),
E21B 15/02 (2006.01), *E21B 19/00* (2006.01),
E21B 19/06 (2006.01), *E21B 19/16* (2006.01)
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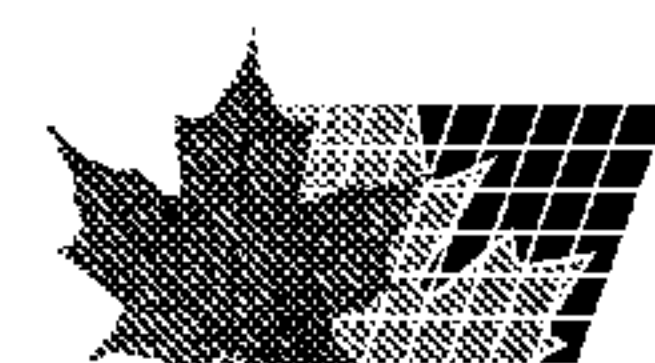
(54) Titre : DISPOSITIF POUR MANUTENTION DE TUYAUX ET TECHNIQUE DE DESCENTE DE PIECES DANS UN
PUITS

(54) Title: PIPE HANDLING APPARATUS AND METHOD OF LANDING ITEMS AT A WELL LOCATION



(57) Abrégé/Abstract:

A drill pipe (18) and drill pipe handling apparatus for oil and gas drilling rigs, the drill pipe (18) having an enlarged diameter section (21) positioned between the ends of the drill pipe (18). The enlarged diameter section (21) of drill pipe (18) has a shoulder (21a and



(57) **Abrégé(suite)/Abstract(continued):**

b) which corresponds with and is engaged by a shoulder (109 or 209) located on wedge members (106 or 206) of a holder (100 or 200) on a drilling rig (10) for supporting the drill pipe (18) without crushing or otherwise damaging the drill pipe (18) during and after addition or removal of joints of drill pipe (18). A method of lowering items from a drilling rig (10) to a well (14) located below it through the use of a landing string (19) comprised of drill pipe (18) having an enlarged diameter section (21) with a shoulder (21a and b), in combination with upper and lower holders (100 and 200) having wedge members (106 and 206) with shoulders (109 and 209) that engage and support the drill pipe (18) at the shoulder (21a and b) of the enlarged diameter section (21).

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
13 December 2001 (13.12.2001)

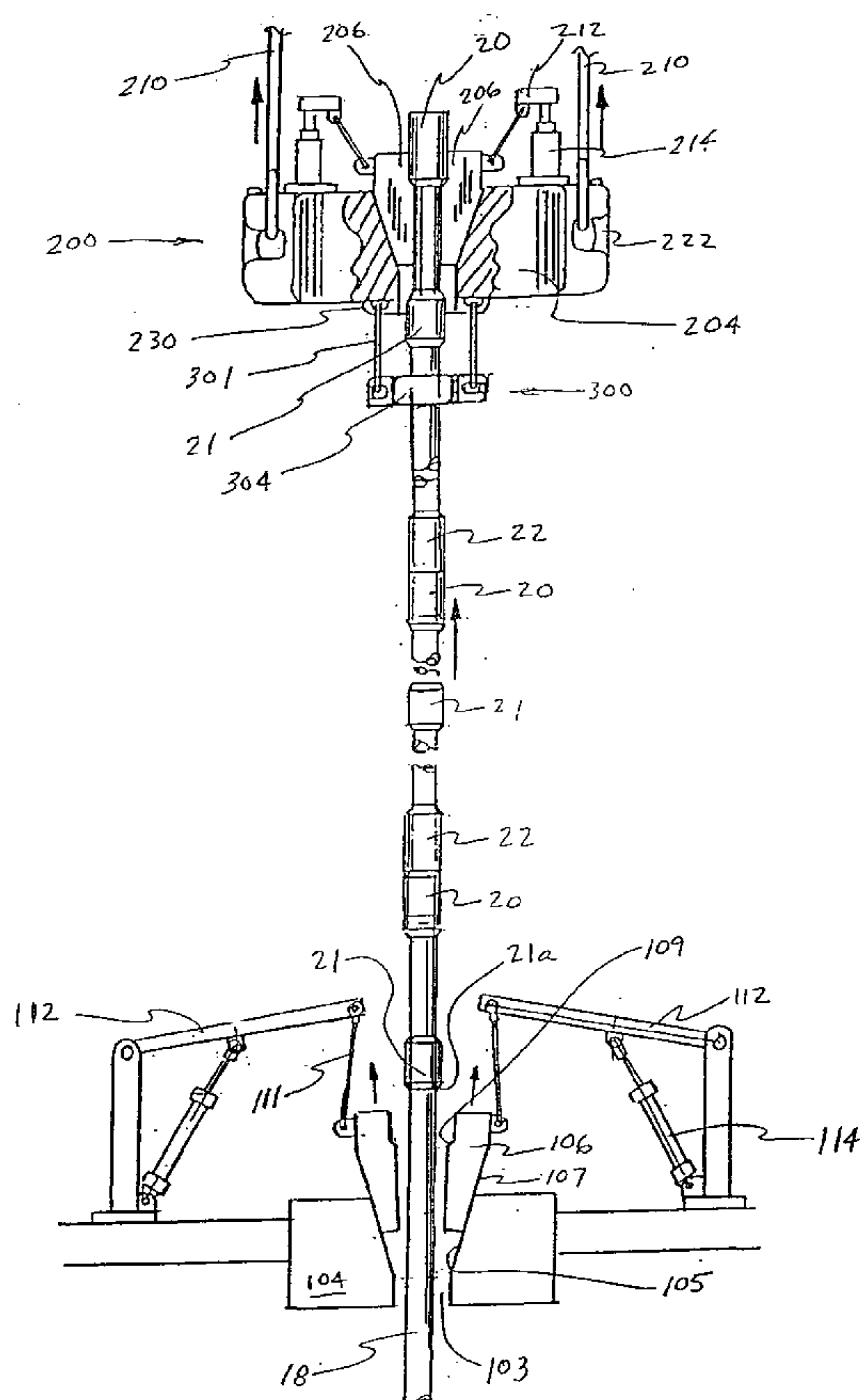
PCT

(10) International Publication Number
WO 01/94737 A1

- (51) International Patent Classification⁷: **E21B 7/12**, 15/02, 19/06, 19/07, 19/16, 33/035
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- (21) International Application Number: PCT/US01/13145
- (22) International Filing Date: 24 April 2001 (24.04.2001)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
09/586,232 2 June 2000 (02.06.2000) US
09/586,233 2 June 2000 (02.06.2000) US
09/586,239 2 June 2000 (02.06.2000) US
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- (81) Designated States (*national*): AE, AG, AL, AM, AT, AT (utility model), AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, CZ (utility model), DE, DE (utility model), DK, DK (utility model), DM, DZ, EE, EE (utility model), ES, FI, FI (utility model), GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (utility model), SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.
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[Continued on next page]

(54) Title: PIPE HANDLING APPARATUS AND METHOD OF LANDING ITEMS AT A WELL LOCATION



(57) Abstract: A drill pipe (18) and drill pipe handling apparatus for oil and gas drilling rigs, the drill pipe (18) having an enlarged diameter section (21) positioned between the ends of the drill pipe (18). The enlarged diameter section (21) of drill pipe (18) has a shoulder (21a and b) which corresponds with and is engaged by a shoulder (109 or 209) located on wedge members (106 or 206) of a holder (100 or 200) on a drilling rig (10) for supporting the drill pipe (18) without crushing or otherwise damaging the drill pipe (18) during and after addition or removal of joints of drill pipe (18). A method of lowering items from a drilling rig (10) to a well (14) located below it through the use of a landing string (19) comprised of drill pipe (18) having an enlarged diameter section (21) with a shoulder (21a and b), in combination with upper and lower holders (100 and 200) having wedge members (106 and 206) with shoulders (109 and 209) that engage and support the drill pipe (18) at the shoulder (21a and b) of the enlarged diameter section (21).

WO 01/94737 A1

WO 01/94737 A1

(84) Designated States (regional): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

PIPE HANDLING APPARATUS AND METHOD OF LANDING ITEMS AT A WELL LOCATION

BACKGROUND OF THE INVENTION

1. Field of the invention

The present invention relates to a drill pipe and drill pipe holder used in the oil and gas well drilling industry. More particularly, the present invention relates to a drill pipe holder that holds a joint of drill pipe in a landing string during the addition or removal of a joint of drill pipe to or from the landing string, wherein the holder and the joint of drill pipe held by the holder are
5 configured to support the load of the landing string with correspondingly shaped shoulders that engage when the holder holds the joint of drill pipe.

2. General Background of the Invention

Oil and gas well drilling and production operations involve the use of generally cylindrical tubes commonly known in the industry as "casing" which line the generally cylindrical
10 wall of the borehole which has been drilled in the earth. Casing is typically comprised of steel pipe in lengths of approximately 40 feet, each such length being commonly referred to as a "joint" of casing. In use, joints of casing are attached end-to-end to create a continuous conduit. In a completed well, the casing generally extends the entire length of the borehole and conducts oil and gas from the producing formation to the top of the borehole, where one or more blowout
15 preventors may be located on the sea floor.

Casing is generally installed or "run" into the borehole in phases as the borehole is being drilled. The casing in the uppermost portion of the borehole, commonly referred to as "surface casing," may be several hundred to several thousand feet in length, depending upon numerous factors including the nature of the earthen formation being drilled and the desired final depth of
20 the borehole.

After the surface casing is cemented into position in the borehole, further drilling operations are conducted through the interior of surface casing as the borehole is drilled deeper and deeper. When the borehole reaches a certain depth below the level of the surface casing, depending again on a number of factors such as the nature of the formation and the desired final

depth of the borehole, drilling operations are temporarily halted so that the next phase of casing installation, commonly known as intermediate casing, may take place.

Intermediate casing, which may be thousands of feet in total length, is typically made of "joints" of steel pipe, each joint typically being in the range of about 38 to 42 feet in length (11.58
5 to 12.80 meters). The joints of intermediate casing are attached end-to-end, typically through the use of threaded male and female connectors located at the respective ends of each joint of casing.

In the process of installing the intermediate casing, joints of intermediate casing are lowered longitudinally through the floor of the drilling rig. The length of the column of intermediate casing grows as successive joints of casing are added, generally one at a time, by
10 drill hands and/or automated handling equipment located on the floor of the drilling rig.

When the last intermediate casing joint has been added, the entire column of intermediate casing, commonly referred to as the intermediate "casing string", must be lowered further into its proper place in the borehole. The task of lowering the casing string into its final position in the borehole is accomplished by adding joints of drill pipe to the top of the casing string. The
15 additional joints of drill pipe are added, end-to-end, by personnel and/or automated handling equipment located on the drilling rig, thereby creating a column of drill pipe known as the "landing string." With the addition of each successive joint of drill pipe to the landing string, the casing string is lowered further and further.

During this process as practiced in the prior art, when an additional joint of drill pipe is
20 being added to the landing string, the landing string and casing string hang from the floor of the drilling rig, suspended there by a holder or gripping device commonly referred to in the prior art as "slips." When in use, the slips generally surround an opening in the rig floor through which the upper end of the uppermost joint of drill pipe protrudes, holding it there a few feet above the surface of the rig floor so that rig personnel and/or automated handling equipment can attach the

next joint(s) of drill pipe.

The inner surface of the prior art slips has teeth-like grippers and is curved such that it corresponds with the outer surface of the drill pipe. The outer surface of prior art slips is tapered such that it corresponds with the tapered inner or "bowl" face of the master bushing in which the slips sit.

When in use, the inside surface of the prior art slips is pressed against and "grips" the outer surface of the drill pipe which is surrounded by the slips. The tapered outer surface of the slips, in combination with the corresponding tapered inner face of the master bushing in which the slips sit, cause the slips to tighten around the gripped drill pipe such that the greater the load being carried by that gripped drill pipe, the greater the gripping force of the slips being applied around that gripped drill pipe. Accordingly, the weight of the casing string, and the weight of the landing string being used to "run" or "land" the casing string into the borehole, affects the gripping force being applied by the slips, i.e., the greater the weight the greater the gripping force and crushing effect.

As the world's supply of easy-to-reach oil and gas formations is being depleted, a significant amount of oil and gas exploration has shifted to more challenging and difficult-to-reach locations such as deep-water drilling sites located in thousands of feet of water. In some of the deepest undersea wells drilled to date, wells may be drilled from a rig situated on the ocean surface some 5,000 to 10,000 feet (1.524 to 3.048 kilometers) above the sea floor, and such wells may be drilled some 15,000 to 20,000 feet (4.572 to 6.096 kilometers) below the sea floor. It is envisioned that as time goes on, oil and gas exploration will involve the drilling of even deeper holes in even deeper water.

For many reasons, including the nature of the geological formations in which unusually deep drilling takes place and is expected to take place in the future, the casing strings required for such wells must be unusually long and must have unusually thick walls, which means that

such casing strings are unusually heavy and can be expected in the future to be even heavier. Moreover, the landing string needed to land the casing strings in such extremely deep wells must be unusually long and strong, hence unusually heavy in comparison to landing strings required in more typical wells.

5 For example, a typical well drilled in an offshore location today may be located in about 300 to 2000 feet (91.44 to 609.6 meters) of water, and may be drilled 15,000 to 20,000 feet (4.572 to 6.096 kilometers) into the sea floor. Typical casing for such a typical well may involve landing a casing string between 15,000 to 20,000 feet (4.572 to 6.096 kilometers) in length, weighing 40 to 60 pounds per linear foot (59.52 to 89.28 kilograms per meter), resulting in a
10 typical casing string having a total weight of between 600,000 to 1,200,000 pounds (272,160 to 544,320 kilograms). The landing string required to land such a typical casing string may be 300 to 2000 feet (91.44 to 609.6 meters) long which, at about 35 pounds per linear foot (52.08 kilograms per meter) of landing string, results in a total landing string weight of 10,500 to 70,000 pounds (4,762.8 to 31,752 kilograms). Hence, prior art slips in typical wells have typically
15 supported combined landing string and casing string weight in the range of between about 610,500 to 1,270,000 pounds (276,922.8 to 576,072 kilograms).

By way of contrast, extremely deep undersea wells located in 5,000 to 10,000 (1.524 to 3.048 kilometers) feet of water, uncommon today but expected to be more common in the future, may involve landing a casing string 15,000 to 20,000 feet (4.572 to 6.096 kilometers) in length,
20 weighing 40 to 80 pounds per linear foot (59.52 to 119.04 kilograms per meter), resulting in a total casing string weight of 600,000 to 1,600,000 pounds (272,160 to 725,760 kilograms). The landing string required to land such casing strings in such extremely deep wells may be 5,000 to 10,000 feet (1,524 to 3,048 meters) long which, at 70 pounds per linear foot (104.16 kilograms per meter), results in a total landing string weight of about 350,000 to 700,000 pounds (158,760
25 to 317,520 kilograms). Hence, the combined landing string and casing string weight for

extremely deep undersea wells may be in the range of 950,000 to 2,300,000 pounds (430,920 to 1,043,280 kilograms), instead of the 610,500 to 1,270,000 pound (276,696 to 576,072 kilograms) range generally applicable to more typical wells. In the future, as deeper wells are drilled in deeper water, the combined landing string and casing string weight can be expected to increase, perhaps up to as much as 4,000,000 pounds (1,814,400 kilograms) or more.

Under certain circumstances, prior art slips have been able to support the combined landing string and casing string weight of 610,500 to 1,270,000 pounds (276,696 to 576,072 kilograms) associated with typical wells, depending upon the size, weight and grade of the pipe being held by the slips. In contrast, prior art slips cannot effectively and consistently support the combined landing string and casing string weight of 950,000 to 2,300,000 pounds (430,920 to 1,043,280 kilograms) associated with extremely deep wells, because of numerous problems which occur at such extremely heavy weights.

For example, prior art slips used to support combined landing string and casing string weight above the range of about 610,500 to 1,270,000 pounds (276,696 to 576,072 kilograms) have been known to apply such tremendous gripping force that (a) the gripped pipe has been crushed or otherwise deformed and thereby rendered defective, (b) the gripped pipe has been excessively scored and thereby damaged due to the teeth-like grippers on the inside surface of the prior art slips being pressed too deeply into the gripped drill pipe and/or (c) the prior art slips have experienced damage rendering them inoperable.

A related problem involves the uneven distribution of force applied by the prior art slips to the gripped pipe joint. If the tapered outer wall of the slips is not substantially parallel to and aligned with the tapered inner wall of the master bushing, that can create a situation where the gripping force of the slips is concentrated in a relatively small portion of the inside wall of the slips rather than being evenly distributed throughout the entire inside wall of the slips. Such concentration of gripping force in such a relatively small portion of the inner wall of the slips can

(a) crush or otherwise deform the gripped drill pipe, (b) result in excessive and harmful strain or elongation of the drill pipe below the point where it is gripped and (c) cause damage to the slips rendering them inoperable.

This uneven distribution of gripping force is not an uncommon problem, as the rough and tumble nature of oil and gas well drilling operations cause the slips and/or master bushing to be knocked about, resulting in misalignment and/or irregularities in the tapered interface between the slips and the master bushing. This problem is exacerbated as the weight supported by the slips is increased, which is the case for extremely deep wells as discussed above.

BRIEF SUMMARY OF INVENTION

The present invention does away with prior art slips and provides for a drill pipe holder which supports the drill pipe without crushing, deforming, scoring or causing elongation of the drill pipe being held. The holder of the present invention includes wedge members which can be raised out of and lowered into the holder.

The holder is used in combination with an enlarged diameter section of the drill pipe which is spaced apart from the ends of the drill pipe. The enlarged diameter section has a tapered shoulder which corresponds to a tapered shoulder on the movable wedge members of the holder, and the engagement of such shoulders provides support for the drill pipe being held without any of the problems associated with the prior art slips, regardless of the weight of the landing string and casing string.

Certain exemplary embodiment may provide a drilling rig, pipe, and pipe support apparatus, comprising: a) a drilling rig having a floor; b) a landing string comprised of a number of joints of drill pipe connected end to end extending from the rig; c) a drill pipe holder, located at the rig floor, that holds a joint of drill pipe in the landing string and supports the landing string during the addition or removal of a joint of drill pipe to or from the landing string; d) wherein the holder and the joint of drill pipe that is held by the holder

are configured to support the load of the landing string with correspondingly shaped annular shoulders that engage when the holder holds the joint of drill pipe; e) the holder including a main body and a plurality of wedge members, the wedge members forming an interface between the body and the joint of drill pipe being held by the holder.

5 Certain other exemplary embodiment may provide a drill pipe support apparatus comprising: a) a landing string comprised of a number of joints of drill pipe connected end to end, each joint of pipe having pin and box end portions and an enlarged diameter section spaced in between the pin and box end, but closer to the box end portion; b) a drill pipe holder that holds a joint of drill pipe in the landing string and supports the landing string at
10 the enlarged diameter section during the addition or removal of a joint of drill pipe to or from the landing string; c) wherein the holder and the joint of drill pipe that is held by the holder are configured to support the load of the landing string with correspondingly shaped annular shoulders that engage when the holder holds the joint of drill pipe; and d) the holder including a main body and a plurality of wedge members, the wedge members forming an
15 interface between the body and the joint of drill pipe being held by the holder.

Certain exemplary embodiment may provide a drilling rig, pipe, and pipe support apparatus, comprising: a) a drill platform having a floor with a work area; b) a landing string comprised of a number of joints of drill pipe connected end to end, each joint having enlarged, pin and box end portions, an enlarged diameter section that is positioned between
20 the pin and box end portions, the majority of each joint of drill pipe being of a smaller, generally uniform diameter; c) the floor having a drill pipe holder that supports the landing string during the addition or removal of a joint of drill pipe to or from the landing string; d) wherein the holder and an uppermost joint of drill pipe that is supported by the holder are configured to support the load of the landing string at the enlarged diameter section with
25 correspondingly shaped tapered annular shoulders that engage when the holder supports the

uppermost joint of drill pipe at the enlarged diameter section; e) the holder including a main body and a plurality of wedge members that form an interface between the body and the uppermost joint of drill pipe at the engaged annular shoulder.

Certain exemplary embodiment may provide a drill pipe support apparatus
5 comprising: a) a landing string comprised of a number of joints of drill pipe connected end to end, each joint of pipe having enlarged diameter pin and box end portions and an enlarged diameter section spaced in between the pin and box end portions, but closer to the box end portion; b) a drill pipe holder that supports the landing string at the enlarged diameter section during the addition or removal of a joint of drill pipe to or from the landing string; c) wherein
10 the holder and an uppermost joint of drill pipe that is supported by the holder are configured to support the load of the landing string with correspondingly shaped tapered annular shoulders that engage when the holder supports the uppermost joint of drill pipe; and d) the holder including a main body, and a plurality of wedge members that form an interface between the body and the uppermost joint of drill pipe.

15 Certain exemplary embodiment may provide a drill pipe support apparatus comprising: a) a landing string comprised of a member of joints of drill pipe connected end to end, wherein a number of joints of the drill pipe in the landing string have an enlarged diameter section and wherein the enlarged diameter section is spaced apart from the ends of the drill pipe, but closer to one end than the other; b) a drill pipe holder that supports the
20 enlarged diameter section of drill pipe in the landing string during the addition or removal of a joint of drill pipe to or from the landing string; c) wherein the holder and the joint of drill pipe that is held by the holder are configured to support the load of the landing string with correspondingly shaped shoulders that engage when the holder holds the joint of pipe, wherein the shoulders are rotatable with respect to each other regardless of the distance
25 between said shoulders; d) the holder including a main body and a plurality of

wedge members, the wedge member forming an interface between the body and the joint of drill pipe being held by the holder.

Certain exemplary embodiment may provide a drill pipe handling apparatus, comprising: a) a drilling rig with a floor; b) a landing string comprised of a number of joints
5 of drill pipe connected end to end, at least a plurality of the joints of pipe having an enlarged diameter section with a shoulder that is spaced apart from either end of the pipe; c) first and second holders that provide support for the landing string; d) wherein the first holder is a lower holder positioned near the rig floor that holds a joint of drill pipe in the landing string and supports the landing string during the addition or removal of a joint of drill pipe to or
10 from the landing string, and a second holder that is an upper holder that holds a joint of drill pipe in the landing string and supports the landing string after a joint of drill pipe has been added to or removed from the landing string; e) each of the holders including a main body and a plurality of wedge members, the wedge members forming an interface between the body and the joint of drill pipe being held by the holder, each wedge member having a
15 shoulder that corresponds in shape to the shoulder at the enlarged diameter section, wherein the shoulders are rotatable with respect to each other regardless of the distance between said shoulders.

Certain exemplary embodiment may provide a pipe handling apparatus comprising:
a) a landing string comprised of a number of joints of drill pipe connected end to end, each
20 joint of pipe having generally cylindrically shaped pin and box end portions, a generally cylindrically shaped smaller diameter portion that extends over a majority of the length of each joint, and an enlarged diameter generally cylindrically shaped section spaced in between the pin and box end portions; b) a pair of vertically spaced apart drill pipe holders that each enable the landing string to be supported; c) wherein each holder and a joint of drill pipe in

the landing string that is held by a holder are configured to support the load of the landing string with correspondingly shaped shoulders that engage when the holder holds the joint of drill pipe, wherein the shoulders are rotatable with respect to each other regardless of the distance between said shoulders; and d) each holder including a main body and a plurality of wedge members, the wedge members forming an interface between the body and the joint of drill pipe being held by the holder.

Certain exemplary embodiment may provide a pipe handling apparatus comprising:

a) a landing string comprised of a number of joints of drill pipe connected end to end, each joint of pipe having generally cylindrically shaped pin and box end portions, a generally cylindrically shaped smaller diameter portion that extends over a majority of the length of each joint, and a generally cylindrically shaped enlarged diameter section spaced in between the pin and box end portions; b) a pair of vertically spaced apart drill pipe holders that each enable the landing string to be supported; c) wherein each holder and a joint of drill pipe in the landing string that is held by the holder are configured to support the load of the landing string with correspondingly shaped annular shoulders that engage when the holder holds the joint of drill pipe; and d) each holder including a main body, a plurality of wedges that are movable between engaged and disengaged positions, said wedges defining an interface between the body and the joint of pipe being held by the holder, and wherein one of the holders has a body that is movable in a vertical direction during use.

Certain exemplary embodiment may provide a method of landing items at a well location, comprising the steps of: a) positioning a drilling rig above a well location, the drilling rig having a landing string that is comprised of a number of joints of drill pipe, and a holder that holds a joint of drill pipe in the landing string for supporting the landing string; b) attaching an item to the lower end of the landing string and lowering the landing string such that it spans the distance between the drilling rig and the well location; c) wherein the holder,

and the joint of drill pipe that is held by the holder, are configured to support the load of the landing string with correspondingly shaped shoulders that engage when the holder holds the joint of drill pipe, wherein the shoulders are rotatable with respect to each other regardless of the distance between said shoulders.

5 Certain exemplary embodiment may provide a method of well casing placement comprising the steps of: a) positioning a drilling rig above a well location, the drilling rig having a landing string that is comprised of a number of joints of drill pipe, and a holder that holds a joint of drill pipe in the landing string for supporting the landing string; b) lowering a plurality of connected joints of casing to the well, said plurality of connected joints of casing
10 defining a casing string, the casing string being supported by the landing string; c) configuring the combination of landing string and casing string so that the overall combined length of the landing string and casing string spans the distance between the drilling rig and the well location, and wherein the combined weight of landing string and casing string is between about 430,000 and 1,050,000 kilograms; d) wherein the holder, and the joint of drill
15 pipe that is held by the holder, are configured to support the load of step "c" with correspondingly shaped shoulders that engage when the holder holds the joint of drill pipe, wherein the shoulders are rotatable with respect to each other regardless of the distance between said shoulders.

 Certain exemplary embodiment may provide a method of landing casing string for use
20 in water depths of at least about 90 meters, comprising the steps of: a) positioning a drilling rig above an undersea well location, the drilling rig having a landing string that is comprised of a number of joints of drill pipe, and a holder for supporting the landing string when one or more pipe joints is to be added to or removed from the landing string; b) lowering a plurality of connected joints of casing to the undersea well, said plurality of connected joints of casing
25 defining a casing string, wherein the landing string in step "a" has upper and lower end

portions, the casing string being supported by the lower end portion of the landing string; c) configuring the combination of landing string and casing string so that the overall, combined length of the landing string and casing string spans at least a majority of the distance between the drilling rig and the undersea well location at the seabed, and wherein the combined weight of landing string and casing string is between about 430,000 and 1,050,000 kilograms; d) wherein the holder, and an uppermost joint of drill pipe that is supported by the holder, are configured to support the load of step "c", wherein the uppermost joint of drill pipe is rotatable with respect to the holder regardless of the distance between the uppermost joint of drill pipe and the holder.

Certain exemplary embodiment may provide a method of deep sea well casing placement for use in water depths of at least about 90 meters, comprising the steps of: a) positioning a drilling rig above an undersea well location, the drilling rig having a landing string that is comprised of a number of joints of drill pipe, and a holder for supporting the landing string when one or more pipe joints is to be added to or removed from the landing string; b) lowering a plurality of connected joints of casing to the undersea well, said plurality of connected joints of casing defining a casing string, wherein the landing string in step "a" has upper and lower end portions, the casing string being supported by the lower end portion of the landing string; c) configuring the combination of landing string and casing string so that the overall, combined length of the landing string and casing string spans the distance between the drilling rig and the undersea well location at the seabed, and wherein the combined weight of landing string and casing string is between about 430,000 and 1,050,000 kilograms; d) wherein the holder, and an uppermost joint of drill pipe that is supported by the holder, are configured to support the load of step "c" with correspondingly shaped tapered annular shoulders that engage when the holder supports the uppermost joint of drill pipe.

Certain exemplary embodiment may provide a method of well casing placement comprising the steps of: a) positioning a drilling rig above an undersea well location, the drilling rig having a lifting device, a landing string that is comprised of a number of joints of drill pipe, and a holder for supporting the landing string when one or more pipe joints is to be
5 added to or removed from the landing string; b) supporting the landing string with the lifting device; c) lowering a plurality of connected joints of casing to the undersea well, said plurality of connected joints of casing defining a casing string, wherein the landing string in step "a" has upper and lower end portions, the casing string being supported by the lower end portion of the landing string; d) configuring the combination of landing string and casing
10 string so that the overall, combined length of the landing string and casing string spans at least a majority of the distance between the drilling rig and the undersea well location at the seabed, and wherein the combined weight of landing string and casing string is between about 430,000 and 1,050,000 kilograms; e) wherein the holder, and an uppermost joint of drill pipe that is supported by the holder, are configured to support the load of step "d",
15 wherein the uppermost joint of drill pipe is rotatable with respect to the holder regardless of the distance between the uppermost joint of drill pipe and the holder.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is an overall elevational view of a drilling rig situated on a floating drill ship, said drilling rig supporting a landing string and casing string extending therefrom in accordance
20 with the present invention toward the borehole that has been drilled into the sea floor.

Figure 2 is an elevational view of drill pipe in accordance with the present invention.

Figures 3 and 4 are fragmentary, sectional, elevational views of drill pipe in accordance

with the present invention.

Figure 5 is a perspective view of the wedge members of the lower and upper holders of the present invention, hinged together and closed.

Figure 6 is a cross sectional view taken along lines 6 - 6 in figure 5.

5 Figure 7 is a perspective view of the individual, unconnected wedge members of the lower and upper holders of the present invention.

Figure 8 is a perspective view of the wedge members of the lower and upper holders of the present invention hinged together in an open position.

10 Figure 9 is a fragmentary, sectional, elevational view of an alternative embodiment of drill pipe in accordance with the present invention, along with a side view of a wedge member used with the alternative embodiment in both the upper and lower holders of the present invention.

Figure 10 is an elevational view of the drill pipe and upper and lower holders in accordance with the present invention, in which the lower holder is supporting the landing string
15 extending from the drilling rig, and the auxiliary upper holder is supporting the weight of the joints of drill pipe being added to or removed from the landing string.

Figure 11 is an elevational view of the drill pipe and holders in accordance with the present invention, wherein the landing string is being supported by the lower holder, and wherein additional joints of drill pipe have either been just added to or are about to be removed from the
20 landing string being held by the lower holder.

Figure 12 is an elevational view of the drill pipe and holders in accordance with the present invention, wherein the landing string is supported by the upper holder, and wherein the upper holder and the wedges of the lower holder are being raised slightly so as to clear the wedge members of the lower holder from around the drill pipe prior to lowering the joints of drill pipe
25 which have been added, or, alternatively, where the upper holder has just been used to pull

several joints of landing string up as in "tripping out" of the hole.

Figure 13 is a perspective view showing the upper holder without its wedge members and without the auxiliary upper holder.

Figure 14 is a cross sectional view taken along lines 14 - 14 of figure 13.

5 Figure 15 is an elevational view of the drill pipe and upper and lower holders of the present invention wherein the upper holder has just lowered the drill pipes that were added and wherein the weight of the landing string is about to be transferred from the upper holder to the lower holder.

10 Figure 16 is an elevational view of the drill pipe and upper and lower holders of the present invention wherein the lower holder is supporting the weight of the landing string and wherein the upper holder is about to be hoisted up so that additional joints of drill pipe may be added to the landing string or, alternatively, wherein the upper holder is about to engage and support the landing string in preparation for "tripping out" of the hole.

15 Figure 17 is an elevational view of an alternative embodiment of the drill pipe in accordance with the present invention.

Figure 18 is a cross sectional view taken along lines 18 - 18 of figure 17.

Figure 19 is an elevational view of an alternative embodiment of drill pipe in accordance with the present invention.

Figure 19A is a cross sectional view taken along lines 19A-19A of figure 19.

20 Figure 20 is an elevational view of an alternative embodiment of the present invention in which the joints are run with the female end down and the male end up.

Figure 21 is an elevational view of another alternative embodiment of drill pipe in accordance with the present invention.

Figure 21A is a cross sectional view taken along lines 21A-21A of figure 21.

25 Figure 22 is an elevational view of yet another alternative embodiment of the present

invention.

Figure 23 is an elevational side view of a further alternative embodiment of wedge members in accordance with the present invention.

For a further understanding of the nature, objects and advantages of the present invention, reference should be had to the following detailed description, read in conjunction with the following drawings, wherein like reference numerals denote like elements and wherein:

DETAILED DESCRIPTION OF THE INVENTION

Figure 1 depicts generally the present invention 5 in overview. As shown in figure 1, drilling rig 8 is situated above ocean surface 12 over the location of undersea well 14 that is drilled below sea floor 16. Numerous lengths or "joints" of drill pipe 18 in accordance with the present invention, attached end-to-end and collectively known as "landing string" 19, extend from rig 8. Numerous lengths or "joints" of casing 34, attached end-to-end and collectively known as "casing string" 35, extend below landing string 19 and are attached to landing string 19 via crossover connection 36. The landing string 19, crossover connection 36 and casing string 35 are situated longitudinally within riser 17 which extends from the rig 8 to undersea well 14.

Figure 2 shows a drill pipe 18 in accordance with the present invention. In addition to a female or "box" end 20 and a male or "pin" end 22, drill pipe 18 of the present invention also has an enlarged diameter section 21 which is spaced apart from box end 20 and pin end 22. Enlarged diameter section 21 has a shoulder 21a which is preferably tapered as shown in figures 2 and 3. Shoulder 21a surrounds at least a part and preferably all of the circumferential perimeter of drill pipe 18.

Also in accordance with the present invention, figure 10 shows drill pipe lower holder 100 for supporting the landing string 19 during the addition or removal of one or more joints of drill pipe 18 to or from landing string 19. Lower holder 100 is preferably located at the drilling rig floor 9, where it may be situated in or adjacent to the floor.

As also shown in figure 10, lower holder 100 includes main body 104 which generally surrounds an opening 11 in rig floor 9 through which landing string 19 protrudes. Main body 104 has an opening 103 and a tapered inner face 105 which defines a tapered bowl generally surrounding landing string 19 which protrudes therethrough.

5 Lower holder 100 also includes one or more wedge members 106, as depicted in figures 10, 11 and 12. As shown in figure 7, the wedge members 106 of the present invention are preferably three in number and are preferably connected by hinges 108 as shown in figures 5 and 8. Wedge members 106 have a tapered outer face 107, as shown in figures 5 and 7, which corresponds with the tapered inner face 105 of main body 104, as shown in figures 11 and 12.

10 The tapered bowl in main body 104 which is defined by its tapered inner face 105 receives wedge members 106 as best depicted in figures 10 and 11.

As shown in figures 6 and 7, the inner side of wedge member 106 has a tapered shoulder 109. Tapered shoulder 109 corresponds with tapered shoulder 21a of enlarged diameter section 21 of drill pipe 18, as best shown in figures 12 and 11. Tapered shoulder 109 of wedge member

15 106 is curved, as shown in figures 7 and 8, to correspond with the curved, circumferential shape of shoulder 21a of enlarged diameter section 21. The inner side of wedge member 106 also has a curved surface 106a, as best shown in figures 7 and 8, which corresponds with and accommodates the curved outer surface 18a of drill pipe 18. The inner side of wedge member 106 also has curved surface 106b, as best shown in figures 7 and 8, which corresponds with and

20 accommodates the curved outer surface 21b of enlarged diameter section 21 of drill pipe 18.

When wedge members 106 are in place in main body 104, as shown in figures 10 and 11, the wedge members form an interface between body 104 and the joint of drill pipe 18 being held by holder 100, the engagement between shoulder 109 of wedge member 106 and shoulder 21a of enlarged diameter section 21 providing support for the drill pipe 18 being held by the holder

25 100.

It should be understood that lower holder 100 of the present invention provides support for landing string 19 by the engagement of shoulder 109 of wedge member 106 with shoulder 21a of enlarged diameter section 21 of drill pipe 18. Accordingly, unlike prior art slips, it is not necessary for the curved inner surface 106a of wedge member 106 to have teeth-like grippers or bear against the drill pipe 18 being supported by the holder. Hence, the present invention overcomes the problems associated with crushing, deformation, scoring and uneven distribution of gripping force associated with prior art slips.

It should be understood that drill pipe 18 depicted in figure 10 as being supported by lower holder 100 is the uppermost length or "joint" of drill pipe in landing string 19 depicted in figure 1. It should also be understood that lower holder 100 of the present invention supports not only drill pipe 18 which appears in figure 10, but also the entire attached landing string 19 and casing string 35 extending from rig 8, as best shown in figure 1. In extremely deep wells drilled in extremely deep water for which the present invention is particularly suited, the combined weight of landing string 19 and casing string 35 may range from 950,000 to 2,300,000 pounds. In the future, as deeper wells are drilled in deeper water, it is expected that the present invention may be supporting combined landing string and casing string weight of 4,000,000 pounds or more.

Figure 1 depicts the installation or "running" of intermediate casing string 35, which will be lowered longitudinally, through blowout preventors 15 and surface casing 32, into position in borehole 24. Although figure 1 shows surface casing 32 already cemented into position in borehole 24, it should be understood that the present invention may not only be used to run intermediate casing, but surface and production casing as well. It should also be understood that the present invention, in addition to being used to land casing strings, may also be used to land any other items on or below the sea floor such as blow out preventors, subsea production facilities, subsea wellheads, production strings, drill pipe and drill bits. It should be specifically

understood that drill pipe 18 of the present invention may be used in the drilling operation, with drilling fluid being circulated through the lumen 23 of drill pipe 18.

In order to lower casing string 35 from the position shown in figure 1 into borehole 24, additional joints of drill pipe 18 are added, usually 1 to 4 at a time, above the joint of drill pipe 18 being held by holder 100, as shown in figure 10. Figure 10 shows three additional joints of drill pipe 18 about to be added, although it should be understood that the number of joints of drill pipe added at a time may vary.

After the additional joint or joints of drill pipe 18 have been attached, as shown in figure 11, landing string 19 and attached casing string 35 may be lowered by a distance roughly equivalent to the length of the newly added joints of drill pipe. This is accomplished via upper holder 200 of the present invention, as depicted in figure 11. Upper holder 200 is supported by elevator bails or "links" 210 which in turn are attached to the rig lifting system (not shown). Upper holder 200 includes a main body 204 having an opening 203 which may accommodate the passage of drill pipe 18 therethrough. The opening 203 of main body 204 has a tapered inner face 205 which defines a tapered bowl, as best shown in figure 13.

Upper holder 200 also includes one or more wedge members 206 having a tapered outer face 207 which corresponds with the tapered inner face 205 of main body 204. The tapered bowl in main body 204 defined by its tapered inner face 205 receives wedge members 206 as shown in figures 11 and 12. Wedge members 206 of the present invention are preferably three in number and are preferably connected by hinges, similar to wedge members 106 as depicted in figures 5 and 7.

Wedge members 206 of upper holder 200 are preferably shaped and configured similar to wedge members 106 of lower holder 100, although there may be slight variations in size and/or dimensions between wedge members 106 and 206. Similar to tapered shoulder 109 of wedge member 106 as depicted in figures 6 through 8, the inner side of wedge member 206 has a

tapered shoulder 209. As shown in fig. 11, tapered shoulder 209 of wedge member 206 corresponds with tapered shoulder 20a of box end 20 of drill pipe 18. Similar to tapered shoulder 109 of wedge member 106, tapered shoulder 209 of wedge member 206 is curved to correspond with and accommodate the curved, circumferential shape of shoulder 20a of box end 20.

5 When wedge members 206 are in place in main body 204, as shown in figure 12, the engagement between shoulder 209 of wedge member 206 and shoulder 20a of box end 20 of drill pipe 18 being held by holder 200 provides support for said drill pipe 18 being held by holder 200.

 Similar to curved surface 106a on the inner side of wedge member 106 as shown in figures 7 and 8, the inner side of wedge member 206 also has a curved surface 206a which
10 corresponds with and accommodates the curved outer surface 18a of drill pipe 18. Similar to curved surface 106b on the inner side of wedge member 106 as best shown in figures 7 and 8, the inner side of wedge member 206 also has a curved surface 206b which corresponds with and accommodates the curved outer surface 20b of box end 20 of drill pipe 18.

 When wedge members 206 are in place in main body 204 of upper holder 200, as shown
15 in figure 12, said wedge members form an interface between body 204 and the joint of drill pipe 18 being held by holder 200. In that position, as depicted in figure 12, the rig lifting system (not shown) can be used to slightly lift upper holder 200. When that happens, upper holder 200 is supporting the entire load including the landing string 19 and casing string 35, thereby taking the load off wedge members 106 of lower holder 100. Wedge members 106 can then be disengaged,
20 i.e., wholly or partially moved up and away from drill pipe 18, providing sufficient clearance for the landing string 19 to pass unimpeded through the opening 103 in main body 104 of lower holder 100.

 The rig lifting system may then be used to lower upper holder 200, along with the landing string and casing string it is supporting, by a distance roughly equivalent to the length of the
25 newly added joints of drill pipe. More specifically, upper holder 200 is lowered until the

uppermost enlarged diameter section 21 of newly added drill pipe 18 is located a distance above main body 104 of holder 100 sufficient to provide the vertical clearance needed for reinsertion of wedge members 106 in main body 104, as shown in fig. 15. At that point, wedge members 106 of lower holder 100 may be placed back into position in main body 104 of holder 100.

5 Upper holder 200 may then be slightly lowered further so as to bring into supporting engagement shoulder 109 of wedge members 106 with shoulder 21a of the uppermost enlarged diameter section 21 of newly added drill pipe 19, as shown in fig. 16. In this fashion, the entire load including the landing string and the casing string is transferred from upper holder 200 to lower holder 100.

10 Upper holder 200 can then be cleared away from the uppermost end of the landing string. This is accomplished by lowering holder 200 slightly such that wedge members 206 can be disengaged, i.e., moved up and away from box end 20 that was previously being held by holder 200, as shown in fig. 16. Holder 200 can then be hoisted up by the rig lifting system, permitting clearance for yet additional joints of drill pipe to be added to the upper end of the landing string.

15 As this process is repeated over and over again, casing string 35 is lowered further and further. This process continues until such time as casing string 35 reaches its proper location in borehole 24, at which point the overall length of landing string 19 spans the distance between rig 8 and undersea well 14.

20 It should be understood that the rig lifting system referenced herein may be a conventional system available in the industry, such as a National Oilwell 2040-UDBE drawworks, a Dreco model "872TB-1250" traveling block and a Varco-BJ "DYNAPLEX™" hook, model 51000, said system being capable of handling in excess of 2,000,000 pounds (907,200 kilograms).

Some rigs have specialized equipment to hold aloft additional joints of drill pipe as they
25 are being added to the landing string. However, for those rigs that do not have such specialized

equipment, the present invention provides for auxiliary upper holder 300, as shown in figures 10 and 11. Auxiliary holder 300 is suspended below upper holder 200 by connectors 301. Connectors 301 may be cables, links, bails, slings or other mechanical devices which serve to connect auxiliary holder 300 to upper holder 200.

5 Auxiliary holder 300 has a main body 304 which can be moved from an opened to a closed position, allowing it to capture and hold aloft the joints of drill pipe 18 to be added to the pipe string, as shown in fig. 10. The inner surface of main body 304 includes a tapered shoulder which corresponds with tapered shoulder 21a. The inner surface of main body 304 is sized to accommodate drill pipe 18 such that when main body 304 is in its closed position and supporting
10 the joints of drill pipe to be added, as shown in figure 10, the tapered shoulder of main body 304 engages tapered shoulder 21a, providing support for the joints of drill pipe being added. When upper holder 200 is to be used to lower the entire load to the position shown in figure 15, auxiliary holder 300 can be swung back, up and out of the way, so that it does not interfere with lower holder 100. Because the combined weight of the relatively few joints of drill pipe being
15 added at any one time is significantly less than the combined weight of the landing string and the casing string extending below the rig, the size and strength of auxiliary upper holder 300 may be substantially less than that of upper holder 200. Auxiliary holder 300 may be a conventional elevator available in the industry, such as the 25-ton model "MG" manufactured by Access Oil Tools.

20 It should be understood that while the present invention is particularly useful for landing casing strings and other items, the invention may also be used to retrieve items. For example, the invention may be employed to retrieve the landing string and any items attached thereto, such as a drill bit, in an operation commonly referred to as "tripping out of the hole," wherein the operations described hereinabove are essentially reversed. While the landing string is being
25 supported by lower holder 100, as shown in figure 16, upper holder 200 is lowered to the position

shown in figure 16. Wedge members 206 may then be lowered into main body 204 of upper holder 200 so that shoulder 209 of wedge member 206 is brought into supporting engagement with shoulder 20a of box end 20.

At that point, the rig lifting system may be used to lift holder 200, thereby transferring the landing string load from lower holder 100 to upper holder 200. This allows wedge members 106 of lower holder 100 to be wholly or partially moved up and away from drill pipe 18, providing sufficient clearance for pipe string 19 to pass unimpeded through the opening 103 in main body 104.

When tripping out of the hole, it is common practice to pull up two or more joints at a time, as would be the case shown in figure 12. The landing string would be pulled up by upper holder 200 such that the enlarged diameter section 21 of the drill pipe to be held by lower holder 100 is slightly above wedge members 106, as is shown in figure 12. At that point, wedge members 106 would be lowered into position in main body 104. Upper holder 200 may then be slightly lowered further so as to bring into supporting engagement shoulder 109 of wedge member 106 with shoulder 21a of enlarged diameter section 21 of the drill pipe being held in holder 100. In this fashion, the entire load is transferred to lower holder 100, permitting the drill pipe that has been pulled up above holder 100 to be detached from the landing string, as would appear in figure 10. The removed joints of drill pipe would then be cleared from the upper holder and placed on the drilling rig, permitting upper holder 200 to be lowered again so that more joints of drill pipe could be pulled up, as this process is repeated over and over again until all of the landing string and the items attached thereto have been retrieved.

As shown in figures 2 - 4, drill pipe 18 of the present invention has the following exemplary dimensions:

The end outside diameter (E.O.D.) of pin end 22 and box end 20 is preferably in the range between about 6 ½ to 9 7/8 inches (16.51 to 25.0825 centimeters), and most preferably between

7 1/2 and 8 inches (19.05 to 20.32 centimeters).

The end wall thickness (E.W.T.) of pin end 22 and box end 20 is preferably in the range between about 1 1/2 to 3 inches (3.81 to 7.62 centimeters), and most preferably between 2 1/4 and 2 3/8 inches (5.715 to 6.0325 centimeters).

5 The pipe inside diameter (P.I.D.), i.e., the diameter of the uniform bore or lumen 23 extending throughout the length of drill pipe 18, is preferably in the range between about 2 to 6 inches (5.08 to 15.24 centimeters), and most preferably between 2 1/3 and 3 1/2 inches (5.9267 to 8.89 centimeters).

10 The pipe wall thickness (P.W.T.), i.e., the thickness of the pipe wall throughout the length of drill pipe 18, except at the ends and at the enlarged diameter section, is preferably in the range between about 5/8 to 2 inches (1.5875 to 5.08 centimeters), and most preferably between 1 and 1 1/2 inches (2.54 to 3.81 centimeters).

15 The pipe outside diameter (P.O.D.), i.e., the outside diameter of drill pipe 18 throughout its length, except at the ends and at enlarged diameter section 21, is preferably in the range between about 4 1/2 to 7 5/8 inches (11.43 to 19.3675 centimeters), and most preferably between 5 and 6 5/8 inches (12.7 to 16.8275 centimeters).

20 The enlarged diameter wall thickness (E.D.W.T.), i.e., the thickness of the pipe wall at enlarged diameter section 21, is preferably in the range between about 1 1/2 to 3 inches (3.81 to 7.62 centimeters), and most preferably between 2 1/4 and 2 3/8 inches (5.715 to 6.0325 centimeters).

The length "L" of drill pipe 18 is preferably in the range between about 28 to 45 feet (8.5344 to 13.716 meters), and most preferably between 28 and 32 feet (8.5344 to 9.7536 meters). It should be understood that length "L" may be any length that can be accommodated by the vertical distance between the rig floor and the highest point of the rig.

25 The length of the enlarged diameter section (L. E.) is preferably in the range between

about 1 to 60 inches (2.54 to 152.4 centimeters), and most preferably between 6 and 12 inches (15.24 to 30.48 centimeters).

The distance "D" between shoulder 21a and shoulder 20a is preferably in the range between about 2 to 11 feet (0.6096 to 3.3528 meters) , most preferably between 3 to 5 feet (0.9144 to 1.524 meters). The design criteria for distance "D" include the following: (a) the distance "D" should be sufficient to provide adequate clearance, and thereby avoid entanglement, between the bottom of holder 200 and the top of holder 100 when said holders are in the position depicted in fig. 16; (b) the distance "D" should also be sufficient to permit insertion and removal of wedge members 206 into and out of the tapered bowl of upper holder 200; and (c) the distance "D" should preferably be such that the uppermost end of the drill pipe being supported by lower holder 100 is a reasonable working height (R.W.H.) above rig floor 9, as shown in fig. 10, so as to permit rig personnel and/or automated handling equipment to assist in attaching or removing joints of drill pipe to or from said uppermost end.

The angle of taper "A" of shoulders 21a, 20a and 22a, which appear in figures 3 and 4, can be any angle greater than 0° and less than 180°, preferably between 10 degrees and 45 degrees, and most preferably 18 degrees. The same angle "A" applies to the angle of taper of shoulder 109 of wedge member 106 and shoulder 209 of wedge member 206, as shown in fig. 6.

As shown in figures 6 and 7, wedge members 106 and 206 of the present invention have the following exemplary dimensions:

The height ("H-1") of the wedge members is preferably in the range of about 5 to 20 inches (12.7 to 50.8 centimeters), and most preferably between 8 and 16 inches (20.32 to 40.64 centimeters).

The distance ("H-2") between the top of the wedge members and shoulders 109, 209 is preferably in the range of about 2 to 10 inches (5.08 to 25.4 centimeters), and most preferably

between 3 and 8 inches (7.62 to 20.32 centimeters).

The distance ("H-3") between the bottom of the wedge members and shoulders 109, 209 is preferably in the range of about 3 to 10 inches (7.62 to 25.4 centimeters), and most preferably between 5 and 8 inches (12.7 to 20.32 centimeters).

5 The top thickness ("T-1") of the wedge members is preferably in the range of about 1 to 8 inches (2.54 to 20.32 centimeters), and most preferably between 2 and 6 inches (5.08 to 15.24 centimeters).

10 The thickness ("T-2") of the wedge members at shoulders 109, 209 is preferably in the range of about 1 1/2 to 8 1/2 inches (3.81 to 21.59 centimeters), and most preferably between 2 1/2 and 6 1/2 inches (6.35 to 16.51 centimeters).

The bottom thickness ("T-3") of the wedge members is preferably in the range of about 1/2 to 6 inches (1.27 to 15.24 centimeters), and most preferably between 1 and 4 inches (2.54 to 10.16 centimeters).

15 The angle of taper ("A.T.") of outer face 107, 207 of the wedge members can be any angle greater than 0° and less than 180°, preferably between 10 degrees and 45 degrees.

As shown in figure 14, upper holder 200 of the present invention has the following exemplary dimensions:

20 The height of holder 200 ("H.H.") is preferably in the range of about 18 to 72 inches (45.72 to 182.88 centimeters), and most preferably between 24 and 48 inches (60.96 to 121.92 centimeters).

The width of holder 200 ("W-1") is preferably in the range of about 24 to 72 inches (60.96 to 182.88 centimeters), and most preferably between 36 and 60 inches (91.44 to 152.4 centimeters).

25 The width of the top of opening 203 ("W-2") of holder 200 is preferably in the range of about 12 to 24 inches (30.48 to 60.96 centimeters), and most preferably between 16 and 21

inches (40.64 to 53.34 centimeters).

The width of the bottom of opening 203 ("W-3") of holder 200 is preferably in the range of about 6 to 18 inches (15.24 to 45.72 centimeters), and most preferably between 9 and 15 inches (22.86 to 38.1 centimeters).

5 Figure 9 depicts an alternative embodiment of the present invention wherein the shoulders, for example shoulders 21a and 20a, are square, i.e., wherein angle "A" measures 90 degrees. In that alternative embodiment as depicted in figure 9, the shoulders 109 and 209, respectively, of wedge members 106 and 206, respectively, are also square.

10 In the preferred embodiment of the invention as depicted in figure 12, wedge members 106 are lifted out of position by a lifting apparatus which includes lifting arms 112. Lifting arms 112 may be raised and lowered by way of an actuator 114, preferably a pneumatic or hydraulic piston-cylinder arrangement. Lifting arms 112 may be attached directly to wedge members 106 or via connectors 111 as shown in figure 12. Connectors 111 may be cables, links, bails, slings or other mechanical devices which serve to connect lifting arms 112 to wedge members 106.

15 Wedge members 106 preferably include lifting eye 115 to facilitate the connection to lifting arms 112. It should be understood that the raising and lowering wedges 106 out of and into position in body 104 can be accomplished in a variety of ways, including manual handling by rig personnel. It should also be understood that the lifting apparatus for raising and lowering wedge members 106 must be sized and configured so as to permit sufficient clearance for upper holder

20 200 when it is in the position shown in figures 15 and 16.

As depicted in figures 11 and 12, upper holder 200 preferably includes a lifting apparatus for raising and lowering wedge members 206 out of and into position in main body 204. In the preferred embodiment of the invention as depicted in figure 12, the lifting apparatus includes lifting arms 212. Lifting arms 212 may be moved up and down by actuator 214, preferably a

25 hydraulic or pneumatic piston-cylinder arrangement. Lifting arms 212 may be attached directly

to wedge members 206 or via connectors 211. Connector 211 may be cables, links, bails, slings or other mechanical devices which serve to connect lifting arms 212 to wedge members 206. Wedge members 206 preferably include lifting eyes 215 to facilitate the connection to lifting arms 212.

5 In the preferred embodiment of the invention as shown in figure 13, upper holder 200 is removably attached to elevator links 210. Main body 204 of upper holder 200 is preferably comprised of steel having recessed areas 220 to accommodate therein placement of elevator link eyes 221. Elevator link eyes 221 are retained in the position shown in figures 13 and 14 by link retainers 222. Link retainers 222 may be moved from the closed position shown in figure 14 to
10 an open position by lifting release pins 224, thereby permitting retainer links 222 to pivot about hinge pin 225 to an open position, thus permitting removal of upper holder 200 from elevator links 210. As best depicted in figure 12, upper holder 200 is also provided with lifting eyes 230 to which connectors 301 may be attached.

Figures 17 and 18 depict an alternative embodiment of the present invention in which
15 enlarged diameter section 21 is not enlarged completely around the circumference of drill pipe 18. In this alternative embodiment of enlarged diameter section 21, shown in cross section in figure 18, there may be one or more cross sectional gaps in section 21 where the diameter is not enlarged.

In the preferred embodiment of the invention, drill pipe 18, including box end 20,
20 enlarged diameter section 21 and pin end 22, is made from a single piece of pipe of uniform wall thickness having the dimension E.W.T. in figure 4, said thickness being reduced at intervals along the pipe by milling between box end 20 and enlarged diameter section 21, and by milling between pin end 22 and enlarged diameter section 21. It should be understood that in such preferred embodiment of the invention, box and pin ends 20 and 22 and enlarged diameter
25 section 21 are integral with the pipe, i.e., box end 20 and pin end 22 are not created by welding

or otherwise attaching said ends to drill pipe 18, nor is enlarged diameter section 21 created through welding or other means of attachment. In the preferred embodiment of the invention, each joint of drill pipe 18 is made of steel and weighs between 800 to 5,000 pounds (362.88 to 2,268 kilograms), most preferably between 1,000 to 2,000 pounds (453.6 to 907.2 kilograms),
5 or approximately 29 to 110 pounds per linear foot (43.152 to 163.68 kilogram per meter), most preferably 32 to 75 pounds per linear foot (47.616 to 111.6 kilograms per meter).

Alternatively, drill pipe 18 of the present invention may be made of a piece of pipe of uniform thickness, referenced as P.W.T. in fig. 4, with attached box and pin ends, and with an attached enlarged diameter section 21. In this alternative embodiment, the box end, pin end and
10 enlarged diameter section may be attached to the pipe by welding, bolting or other means.

In a further alternative embodiment of the present invention, drill pipe 18 may be made from titanium or from a carbon graphite composite.

Figures 19 and 21 show further alternative embodiments of the present invention in which drill pipe 18, having a length "L", is comprised of two separate drill pipes, 18S and 18L, the
15 former being shorter than the latter, each one having a female end 20 and a male end 22. As shown in figures 19 and 21, 18S is attached end-to-end with 18L. In the alternative embodiment depicted in fig. 19, the mated male end 22 and female end 20 combine to form enlarged diameter section 21, having a tapered shoulder 21a defined by the tapered shoulder of mated female end 20. In the alternative embodiment depicted in figure 21, the mated female end 20 serves as
20 enlarged diameter section 21, with the shoulder of said mated female end serving as shoulder 21a.

In yet a further alternative embodiment of the present invention shown in figure 22, an extra tapered shoulder 25 is provided on drill pipe 18 between enlarged diameter section 21 and the end of the drill pipe. In this embodiment of the invention, extra tapered shoulder 25 has an
25 angle of taper "A" that corresponds with and is engaged by shoulder 209 of wedge members 206,

WO 01/94737

PCT/US01/13145

thereby providing support for the drill pipe being held by upper holder 200. In this embodiment, "D" is the distance between shoulder 21a and shoulder 25.

5 The distance "D", the angle "A" and the length "L" in the alternative embodiment shown in figures 17, 19, 21 and 22 are comparable to those of the preferred embodiment as shown in figure 3.

Figure 23 depicts a further alternative embodiment of wedge members 106, 206 in accordance with the present invention. The dimensions H-1, H-2, H-3, T-1, T-2 and T-3, and the angles A and A.T. in the alternative embodiment shown in figure 23 are comparable to those of the embodiment as shown in figure 6.

10 It should be understood that in an alternative embodiment of the present invention, the drill pipe may be run with the male or pin end 22 up and the female or box end 20 down, as depicted in fig. 20. In this alternative embodiment of the invention, tapered shoulder 209 of wedge member 206 corresponds with tapered shoulder 22a of pin end 22 of drill pipe 18; shoulder 209 is curved to correspond with and accommodate the curved, circumferential shape
15 of shoulder 22a; and curved surface 206b of wedge member 206 corresponds with and accommodates the curved outer surface 22b of drill pipe 18.

Crossover connection 36 depicted in figure 1 may include an "SB" Casing Hanger Running Tool in conjunction with an "SB" Casing Hanger, all manufactured by Kvaerner National Oilfield Products.

20 It can be clearly observed in the figures that owing to the corresponding shapes of the shoulder 21a,b of the enlarged diameter section 21 and the shoulder 109, 209 of the wedge members 106, 206, the shoulders 21a,b and 109, 209 are rotatable with respect to each other regardless of the distance between the shoulders 21a,b and 109, 209. That is, given that the holders 100, 200 containing the wedge members 106, 206 are configured to allow the landing string 18 containing the enlarged diameter section 21 to be inserted therein so that the

shoulders 21a,b and 109, 209 engage only when the landing string 18 is positioned in the holders 100, 200, it is clear that the shoulders 21a,b and 109, 209 are rotatable with respect to each other when the shoulders 21a,b and 109, 209 have a large distance between them. However, as a result of the corresponding configuration of the shoulders 21 a,b and 109, 209
5 as shown in the figures, the shoulders 21a,b and 109, 209 are also rotatable with respect to each other when the distance between them is small.

It should be understood that drilling rig 8 includes a drill platform having floor 9 with a work area for the rig personnel who assist in the various operations described herein. Although figure 1 shows drilling rig 8 situated on a drill ship 10, it should
10 be understood that the present invention may be used on drilling rigs situated on platforms that are permanently affixed to the sea floor, or on semi-submersible and other types of deep water rigs. Moreover, although the invention is particularly useful for rigs drilling in deep water, the invention may also be used with

shallow-water rigs and with rigs drilling on land.

The following table lists the part numbers and part descriptions as used herein and in the drawings attached hereto:

PARTS LIST

5	PART NUMBER	DESCRIPTION
	5	invention in general overview
	8	drilling rig
	9	drilling rig floor
	10	drill ship
10	11	opening in drilling rig floor
	12	surface of ocean
	14	undersea well
	15	blowout preventors
	16	sea floor
15	17	riser
	18	drill pipe
	18a	curved outer surface of drill pipe
	18S	shorter joint of drill pipe of alternative embodiment
	18L	longer joint of drill pipe of alternative embodiment
20	19	landing string
	20	box (female) end of drill pipe
	20a	tapered shoulder of box end
	20b	curved outer surface of box end
	21	enlarged diameter section of drill pipe
25	21a	supporting shoulder of enlarged diameter section

	21b	curved outer surface of enlarged diameter section
	22	pin (male) end of drill pipe
	22a	tapered shoulder of pin end
	22b	curved outer surface of pin end
5	23	lumen of drill pipe 18
	24	borehole
	25	extra tapered shoulder
	26	earthen formation
	28	wall of borehole
10	32	surface casing
	34	intermediate casing
	35	casing string
	36	crossover connection
	100	lower holder
15	103	opening in main body 104
	104	main body of lower holder
	105	tapered inner face of main body 104
	106	wedge members of lower holder
	106a	curved inner surface of wedge member 106 accommodating drill pipe
20	106b	curved inner surface of wedge member 106 accommodating enlarged diameter section 21
	107	tapered outer face of wedge members 106
	108	hinges connecting wedge members
	109	tapered shoulder of wedge members 106
25	111	connectors between wedge members 106 and lifting arms 112

112	lifting arms for lifting wedge members 106
114	actuator for moving lifting arm 112
115	lifting eye on wedge member 106
200	upper holder
5 203	opening in main body of upper holder
204	main body of upper holder
205	tapered inner face of main body 204
206	wedge members of upper holder
206a	curved inner surface of wedge member 206 accommodating drill pipe
10 206b	curved inner surface of wedge member 206 accommodating end of drill pipe
207	tapered outer face of wedge member 206
209	tapered shoulder of wedge member 206
210	elevator links
15 211	connectors between wedge member 206 and lifting arms 212
212	lifting arm for lifting wedge member 206
214	actuator for moving lifting arm 212
215	lifting eye on wedge member 206
220	recessed area of upper holder
20 221	eye of elevator link
222	elevator link retainer
224	release pin
225	hinge
230	lifting eyes to support auxiliary upper holder
25 300	auxiliary upper holder

- 301 connectors for auxiliary holder 300
- 304 main body of holder 300

The following table lists and describes the dimensions used herein and in the drawings

5 attached hereto:

DIMENSION LIST

<u>DIMENSION</u>	<u>DESCRIPTION</u>
E.O.D.	end outside diameter of pin end and box end of drill pipe
E.W.T.	end wall thickness of pin end and box end of drill pipe
10 P.I.D.	pipe inside diameter
P.W.T.	pipe wall thickness
P.O.D.	pipe outside diameter
E.D.W.T.	enlarged diameter wall thickness
R.W.H.	reasonable working height of box end above rig floor
15 L	length of drill pipe
D	distance between supporting shoulders
A	angle of shoulder taper
LE	length of enlarged diameter section
T-1	top thickness of the wedge member
20 T-2	thickness of the wedge member at the shoulder
T-3	bottom thickness of the wedge member
H-1	height of the wedge member
H-2	distance between the top of the wedge member and the shoulder
H-3	distance between the bottom of the wedge member and the shoulder
25 A.T.	Angle of taper of the outer face of the wedge member

H.H.	Height of upper holder
W-1	width of upper holder
W-2	width of top of opening of upper holder
W-3	width of bottom of opening of upper holder

5 The foregoing embodiments are presented by way of example only; the scope of the present invention is to be limited only by the following claims:

CLAIMS

1. A drilling rig, pipe, and pipe support apparatus, comprising:
 - a) a drilling rig having a floor;
 - b) a landing string comprised of a number of joints of drill pipe connected end to end
5 extending from the rig;
 - c) a drill pipe holder, located at the rig floor, that holds a joint of drill pipe in the landing string and supports the landing string during the addition or removal of a joint of drill pipe to or from the landing string;
 - d) wherein the holder and the joint of drill pipe that is held by the holder are
10 configured to support the load of the landing string with correspondingly shaped annular shoulders that engage when the holder holds the joint of drill pipe;
 - e) the holder including a main body and a plurality of wedge members, the wedge members forming an interface between the body and the joint of drill pipe being held by the holder.
- 15 2. The drilling rig, pipe, and pipe support apparatus of claim 1 wherein the holder has a substantially uniform surface.
3. The drilling rig, pipe, and pipe support apparatus of claim 1 further comprising a casing string supported by the landing string.
4. The drilling rig, pipe, and pipe support apparatus of claim 1 wherein the landing
20 string and casing string are configured so that the overall combined length of the landing string and casing string spans the distance between the drilling rig and the well location.
5. The drilling rig, pipe, and pipe support apparatus of claim 4 wherein the combined weight of the landing string and casing string is between about 430,000 and 1,050,000 kilograms.
6. The drilling rig, pipe, and pipe support apparatus of claim 4 wherein the combined weight of the landing string and casing string is between about 360,000 and 1,820,000 kilograms.

WO 01/94737

PCT/US01/13145

7. The drilling rig, pipe, and pipe support apparatus of claim 1 wherein the wedge members are configured to provide substantially uniform contact with a surface of the drill pipe across an entire inner surface of the wedge such that the surface of the drill pipe is maintained.

8. The drilling rig, pipe, and pipe support apparatus of claim 1 wherein each joint
5 of pipe has a pin end and a box end, and wherein the holder has a tapered bowl that receives the wedge members and each of the wedge member has an interior surface with a curved shoulder that engages a correspondingly shaped curved shoulder on the drill pipe being held by the holder at a position spaced apart from the box or pin end of the drill pipe.

9. The drilling rig, pipe, and pipe support apparatus of claim 1 wherein each wedge
10 member has a shoulder, the shoulders of the wedge members engaging the shoulder of the drill pipe being held by the holder.

10. The drilling rig, pipe, and pipe support apparatus of claim 1 wherein each pipe joint has a pin end and a box end and an enlarged diameter section, and wherein the enlarged diameter section is spaced between 30 and 250 centimeters from the box or pin ends.

11. The drilling rig, pipe, and pipe support apparatus of claim 10 wherein at least one
15 of the ends of the pipe joint and the enlarged diameter section have correspondingly shaped shoulders.

12. The drilling rig, pipe, and pipe support apparatus of claim 10 wherein both of the ends of the pipe joint and the enlarged diameter section have correspondingly shaped shoulders.

13. The drilling rig, pipe, and pipe support apparatus of claim 1 wherein each joint
20 of pipe has a weight of between about 43 and 164 kilograms per linear meter.

14. The drilling rig, pipe, and pipe support apparatus of claim 3 wherein the combined weight of the landing string and casing string is between about 430,000 and 1,050,000 kilograms.

15. The drilling rig, pipe, and pipe support apparatus of claim 1 wherein the shoulders form an angle of between about 10 and 45 degrees with the central longitudinal axis of each joint of pipe.

16. A drill pipe support apparatus comprising:

- 5 a) a landing string comprised of a number of joints of drill pipe connected end to end, each joint of pipe having pin and box end portions and an enlarged diameter section spaced in between the pin and box end, but closer to the box end portion;
- b) a drill pipe holder that holds a joint of drill pipe in the landing string and supports the landing string at the enlarged diameter section during the addition or removal of a joint of
10 drill pipe to or from the landing string;
- c) wherein the holder and the joint of drill pipe that is held by the holder are configured to support the load of the landing string with correspondingly shaped annular shoulders that engage when the holder holds the joint of drill pipe; and
- d) the holder including a main body and a plurality of wedge members, the wedge
15 members forming an interface between the body and the joint of drill pipe being held by the holder.

17. A drilling rig, pipe, and pipe support apparatus, comprising:

- a) a drill platform having a floor with a work area;
- b) a landing string comprised of a number of joints of drill pipe connected end to
20 end, each joint having enlarged, pin and box end portions, an enlarged diameter section that is positioned between the pin and box end portions, the majority of each joint of drill pipe being of a smaller, generally uniform diameter;
- c) the floor having a drill pipe holder that supports the landing string during the addition or removal of a joint of drill pipe to or from the landing string;

WO 01/94737

PCT/US01/13145

d) wherein the holder and an uppermost joint of drill pipe that is supported by the holder are configured to support the load of the landing string at the enlarged diameter section with correspondingly shaped tapered annular shoulders that engage when the holder supports the uppermost joint of drill pipe at the enlarged diameter section;

5 e) the holder including a main body and a plurality of wedge members that form an interface between the body and the uppermost joint of drill pipe at the engaged annular shoulder.

18. The drilling rig, pipe, and pipe support apparatus of claim 17 wherein the drill pipe has a weight of between 43 and 164 kilograms per linear meter.

10 19. The drilling rig, pipe, and pipe support apparatus of claim 17 further comprising a casing string supported by the landing string.

20. The drilling rig, pipe, and pipe support apparatus of claim 17 wherein the drilling rig is a drill ship and the combination of landing string and casing string are configured so that at least a majority of the combined overall length of the landing string and casing string spans the distance between the drill ship and the undersea well location at the seabed during use.

15 21. The drilling rig, pipe, and pipe support apparatus of claim 20 wherein the combined weight of landing string and casing string is between about 430,000 and 1,050,000 kilograms.

22. The drilling rig, pipe, and pipe support apparatus of claim 17 wherein the wedge members are configured to provide substantially uniform contact with a surface of the drill pipe across an entire inner surface of the wedge such that the surface of the drill pipe is maintained.

20 23. The drilling rig, pipe, and pipe support apparatus of claim 17 wherein the holder has a tapered bowl that receives the wedge members and each of the wedge member has an interior surface with a curved surface that engages a correspondingly shaped curved shoulder on the drill pipe at a position spaced away from the box or pin end of the drill pipe.

24. The drilling rig, pipe, and pipe support apparatus of claim 17 wherein the holder

WO 01/94737

PCT/US01/13145

includes a main body, and a plurality of wedge members that form an interface between the body and the uppermost joint of drill pipe, each wedge member having a curved, tapered shoulder, the tapered shoulders of the wedge members engaging the tapered annular shoulder of the supported drill pipe.

5 25. The drilling rig, pipe, and pipe support apparatus of claim 17 wherein the enlarged diameter section is spaced between about 30 and 92 centimeters from one of the pin or box end portions.

 26. The drilling rig, pipe, and pipe support apparatus of claim 25 wherein at least one of the one end portions and the annular enlarged diameter section have correspondingly shaped
10 annular tapered shoulders.

 27. The drilling rig, pipe, and pipe support apparatus of claim 17 wherein at least one of the pin or box end portions and the annular enlarged diameter section have correspondingly shaped annular tapered shoulders.

 28. The drilling rig, pipe, and pipe support apparatus of claim 17 wherein each joint
15 of pipe has a pipe outside diameter of between about 11 and 20 centimeters.

 29. The drilling rig, pipe, and pipe support apparatus of claim 19 wherein the combined weight of the landing string and casing string is between about 430,000 and 1,050,000 kilograms.

 30. The drilling rig, pipe, and pipe support apparatus of claim 17 wherein the tapered
20 shoulders form an angle of between about 10 and 45 degrees with the central longitudinal axis of its pipe joint.

 31. A drill pipe support apparatus comprising:
 a) a landing string comprised of a number of joints of drill pipe connected end to end, each joint of pipe having enlarged diameter pin and box end portions and an enlarged

diameter section spaced in between the pin and box end portions, but closer to the box end portion;

b) a drill pipe holder that supports the landing string at the enlarged diameter section during the addition or removal of a joint of drill pipe to or from the landing string;

5 c) wherein the holder and an uppermost joint of drill pipe that is supported by the holder are configured to support the load of the landing string with correspondingly shaped tapered annular shoulders that engage when the holder supports the uppermost joint of drill pipe; and

d) the holder including a main body, and a plurality of wedge members that form an interface between the body and the uppermost joint of drill pipe.

10 32. The drilling rig, pipe, and pipe support apparatus of claim 24 wherein the pipe has a weight of between 43 and 164 kilograms per linear meter.

33. The drilling rig, pipe, and pipe support apparatus of claim 24 further comprising a casing string supported by the landing string.

15 34. The drilling rig, pipe, and pipe support apparatus of claim 24 wherein the drilling rig is a drill ship and the combination of landing string and casing string are configured so that at least a majority of the combined overall length of the landing string and casing string spans the distance between the drill ship and the undersea well location at the seabed during use.

20 35. The drilling rig, pipe, and pipe support apparatus of claim 24 wherein the combined weight of landing string and casing string is between about 430,000 and 1,050,000 kilograms.

36. The drilling rig, pipe, and pipe support apparatus of claim 24 wherein the wedge members are configured to provide substantially uniform contact with a surface of the drill pipe across an entire inner surface of the wedge such that the surface of the drill pipe is maintained.

37. The drilling rig, pipe, and pipe support apparatus of claim 24 wherein the holder has a tapered bowl that receives the wedge members and each of the wedge members has an

interior surface with a curved surface that engages a correspondingly shaped curved shoulder on the drill pipe at a position spaced away from the box or pin end of the drill pipe.

38. The drilling rig, pipe, and pipe support apparatus of claim 24 wherein the enlarged diameter section is spaced between about 30 and 92 centimeters from one of the pin or box end portions.

39. A drill pipe support apparatus comprising:

a) a landing string comprised of a member of joints of drill pipe connected end to end, wherein a number of joints of the drill pipe in the landing string have an enlarged diameter section and wherein the enlarged diameter section is spaced apart from the ends of the drill pipe, but closer to one end than the other;

b) a drill pipe holder that supports the enlarged diameter section of drill pipe in the landing string during the addition or removal of a joint of drill pipe to or from the landing string;

c) wherein the holder and the joint of drill pipe that is held by the holder are configured to support the load of the landing string with correspondingly shaped shoulders that engage when the holder holds the joint of pipe, wherein the shoulders are rotatable with respect to each other regardless of the distance between said shoulders;

d) the holder including a main body and a plurality of wedge members, the wedge member forming an interface between the body and the joint of drill pipe being held by the holder.

40. A drill pipe handling apparatus, comprising:

a) a drilling rig with a floor;

b) a landing string comprised of a number of joints of drill pipe connected end to end, at least a plurality of the joints of pipe having an enlarged diameter section with a shoulder that is spaced apart from either end of the pipe;

c) first and second holders that provide support for the landing string;

d) wherein the first holder is a lower holder positioned near the rig floor that holds a joint of drill pipe in the landing string and supports the landing string during the addition or removal of a joint of drill pipe to or from the landing string, and a second holder that is an upper holder that holds a joint of drill pipe in the landing string and supports the landing string after a joint of drill pipe has been added to or removed from the landing string;

5 e) each of the holders including a main body and a plurality of wedge members, the wedge members forming an interface between the body and the joint of drill pipe being held by the holder, each wedge member having a shoulder that corresponds in shape to the shoulder at the enlarged diameter section, wherein the shoulders are rotatable with respect to each other regardless of the distance between said shoulders.

10 41. The drill pipe handling apparatus of claim 40 further comprising a casing string supported by the landing string.

42. The drill pipe handling apparatus of claim 41 wherein the combined weight of the landing string and the casing string is between about 430,000 and 1,050,000 kilograms.

15 43. The pipe handling apparatus of claim 1 wherein the wedge members are configured to provide substantially uniform contact with a surface of the drill pipe across an entire inner surface of the wedge such that the surface of the drill pipe is maintained.

44. The pipe handling apparatus of claim 40 wherein each joint of pipe has a pin end and a box end, and wherein at least one of the holders has a tapered bowl that receives the wedge members, and wherein each of the wedge members so received has an interior surface that engages a correspondingly shaped shoulder on the drill pipe at a position spaced apart from the
20 box or pin end of the drill pipe.

45. The pipe handling apparatus of claim 40 wherein each joint of drill pipe has a pin end and a box end and an enlarged diameter section, and wherein the enlarged diameter section is spaced away from the pin end and the box end.

46. The pipe handling apparatus of claim 45 wherein the enlarged diameter section

WO 01/94737

PCT/US01/13145

is spaced between 30 and 92 centimeters from one of the ends of the drill pipe.

47. The pipe handling apparatus of claim 45 wherein at least one of the ends of the drill pipe and the enlarged diameter section have correspondingly shaped shoulders.

48. The pipe handling apparatus of claim 46 wherein at least one of the ends of the drill pipe and the enlarged diameter section have correspondingly shaped shoulders.

49. The pipe handling apparatus of claim 40 wherein each joint of pipe in the landing string has a weight of between about 43 and 164 kilograms per linear meter.

50. The pipe handling apparatus of claim 40 wherein the combined mass of the landing string and the casing string exceeds 450,000 kilograms.

51. The pipe handling apparatus of claim 40 wherein the shoulders on the wedge members form an angle of between about 10 and 45 degrees with the central longitudinal axis of the joint of a pipe being held by the holder.

52. The pipe handling apparatus of claim 40 wherein the shoulders on the enlarged diameter sections form an angle of between about 10 and 45 degrees with the central longitudinal axis of the joints of a pipe.

53. A pipe handling apparatus comprising:

a) a landing string comprised of a number of joints of drill pipe connected end to end, each joint of pipe having generally cylindrically shaped pin and box end portions, a generally cylindrically shaped smaller diameter portion that extends over a majority of the length of each joint, and an enlarged diameter generally cylindrically shaped section spaced in between the pin and box end portions;

b) a pair of vertically spaced apart drill pipe holders that each enable the landing string to be supported;

c) wherein each holder and a joint of drill pipe in the landing string that is held by

a holder are configured to support the load of the landing string with correspondingly shaped shoulders that engage when the holder holds the joint of drill pipe, wherein the shoulders are rotatable with respect to each other regardless of the distance between said shoulders; and

d) each holder including a main body and a plurality of wedge members, the wedge members forming an interface between the body and the joint of drill pipe being held by the holder.

54. The pipe handling apparatus of claim 53, further comprising a casing string supported by the landing string.

55. The drill pipe handling apparatus of claim 54 wherein the combined weight of the landing string and the casing string is between about 430,000 and 1,050,000 kilograms.

56. The pipe handling apparatus of claim 53 wherein the wedge members are configured to provide substantially uniform contact with a surface of the drill pipe across an entire inner surface of the wedge such that the surface of the drill pipe is maintained.

57. The pipe handling apparatus of claim 53 wherein at least one of the holders has a tapered bowl that receives the wedge members, and wherein each of the wedge members so received has an interior surface that engages a correspondingly shaped curved shoulder on the drill pipe at a position spaced apart from the box or pin end of the drill pipe.

58. The pipe handling apparatus of claim 53 wherein the enlarged diameter section is spaced apart from the pin end portion and the box end portion.

59. The pipe handling apparatus of claim 53 wherein the enlarged diameter section is spaced between 30 and 92 centimeters from the box or pin end portions.

60. The pipe handling apparatus of claim 53 wherein at least one of the end portions and the enlarged diameter section have correspondingly shaped tapered shoulders.

61. The pipe handling apparatus of claim 54 wherein at least one of the end portions and the enlarged diameter section have correspondingly shaped tapered shoulders.

62. The pipe handling apparatus of claim 53 wherein each joint of pipe in the landing

string has a weight of between about 43 and 164 kilograms per linear meter.

63. The pipe handling apparatus of claim 54 wherein the combined mass of the landing string and casing string exceeds 450,000 kilograms.

64. The pipe handling apparatus of claim 53 wherein the shoulders on the wedge members form an angle of between about 10 and 45 degrees with the central longitudinal axis of the joint of pipe being held by the holder.

65. The pipe handling apparatus of claim 53 wherein the shoulders on the enlarged diameter sections form an angle of between about 10 and 45 degrees with the central longitudinal axis of the joints of pipe.

10 66. A pipe handling apparatus comprising:

a) a landing string comprised of a number of joints of drill pipe connected end to end, each joint of pipe having generally cylindrically shaped pin and box end portions, a generally cylindrically shaped smaller diameter portion that extends over a majority of the length of each joint, and a generally cylindrically shaped enlarged diameter section spaced in between the pin and box end portions;

b) a pair of vertically spaced apart drill pipe holders that each enable the landing string to be supported;

c) wherein each holder and a joint of drill pipe in the landing string that is held by the holder are configured to support the load of the landing string with correspondingly shaped annular shoulders that engage when the holder holds the joint of drill pipe; and

d) each holder including a main body, a plurality of wedges that are movable between engaged and disengaged positions, said wedges defining an interface between the body and the joint of pipe being held by the holder, and wherein one of the holders has a body that is movable in a vertical direction during use.

WO 01/94737

PCT/US01/13145

67. The pipe handling apparatus of claim 66 further comprising a drilling rig that has a rig floor and a rig lifting system, and wherein the lower holder is located at the rig floor and the upper holder is supported by the rig lifting system.

5 68. The pipe handling apparatus of claim 66 wherein the upper holder has a lifting apparatus for moving the wedges relative to the main body of the holder.

69. The pipe handling apparatus of claim 66 wherein the lower holder has a lifting apparatus for moving the wedges relative to the main body of the holder.

70. The pipe handling apparatus of claim 68 wherein the lifting apparatus is powered with pressurized fluid.

10 71. The pipe handling apparatus of claim 69 wherein the lifting apparatus is powered with pressurized fluid.

72. The pipe handling apparatus of claim 66 wherein the shoulders form an angle of between 10 and 45 degrees with the central longitudinal axis of a drill pipe joint that is supported by the lower holder.

15 73. The pipe handling apparatus of claim 66 wherein the shoulders form an angle of between 10 and 45 degrees with the central longitudinal axis of a drill pipe joint that is supported by the upper holder.

20 74. The pipe handling apparatus of claim 66 wherein each wedge member has an inner curved surface that corresponds with and accommodates the outer curved surface of the drill pipe being held by the holder.

75. The pipe handling apparatus of claim 66 wherein the plurality of wedges in an engaged position define a shape that corresponds with and accommodates the shape of the enlarged diameter section of the drill pipe being held by the holder.

76. The pipe handling apparatus of claim 75 wherein the plurality of wedges in an

engaged position define a shape that corresponds with and accommodates the shape of the held drill pipe below the enlarged diameter section.

77. The pipe handling apparatus of claim 66 wherein there are three wedges included with each holder.

5 78. The pipe handling apparatus of claim 66 wherein the drill pipe wall thickness is between about 1.5 and 5.1 centimeters.

79. The pipe handling apparatus of claim 66 wherein the enlarged diameter wall thickness is between about 3.8 and 7.7 centimeters.

10 80. The pipe handling apparatus of claim 78 wherein the enlarged diameter wall thickness is between 3.3 and 7.7 centimeters.

81. The pipe handling apparatus of claim 66 wherein the upper holder has a main body that has an opening through which a joint of the drill pipe can pass when the wedge members are disengaged.

82. A method of landing items at a well location, comprising the steps of:

15 a) positioning a drilling rig above a well location, the drilling rig having a landing string that is comprised of a number of joints of drill pipe, and a holder that holds a joint of drill pipe in the landing string for supporting the landing string;

b) attaching an item to the lower end of the landing string and lowering the landing string such that it spans the distance between the drilling rig and the well location;

20 c) wherein the holder, and the joint of drill pipe that is held by the holder, are configured to support the load of the landing string with correspondingly shaped shoulders that engage when the holder holds the joint of drill pipe, wherein the shoulders are rotatable with respect to each other regardless of the distance between said shoulders.

83. The method of claim 82 wherein in steps "a" and "c" the holder has a substantially uniform surface.

WO 01/94737

PCT/US01/13145

84. The method of claim 82 wherein in steps "a" and "c" the holder is configured to provide substantially uniform contact with a surface of the drill pipe across an entire inner surface of the holder such that the surface of the drill pipe is maintained.

85. The method of claim 82 wherein in steps "a" and "c" the holder includes a main body and a plurality of wedge members, the wedge members forming an interface between the
5 body and the joint of drill pipe being held by the holder

86. The method of claim 82 wherein in steps "a" and "c" the holder includes a main body and a plurality of wedge members, the wedge members forming an interface between the body and the joint of drill pipe being held by the holder, each wedge member having a shoulder, the shoulders of the wedge members engaging the shoulder of the drill pipe being held by the
10 holder.

87. The method of claim 82 wherein in steps "a" and "c" each joint of drill pipe has a pin end and a box end and an enlarged diameter section, and wherein the enlarged diameter section is spaced between 30 and 245 centimeters from the box or pin ends.

88. The method of claim 87 wherein in steps "a" and "c" at least one of the ends of
15 the drill pipe and the enlarged diameter section have correspondingly shaped shoulders.

89. The method of claim 88 wherein in steps "a" and "c" each joint of pipe has a weight of between about 43 and 164 kilograms per linear meter.

90. The method of claim 82 wherein in steps "a" and "c" each joint of pipe has pin and box end portions, each with a shoulder, and the enlarged diameter section is positioned between
20 about 30 and 245 centimeters from the box and pin end portions.

91. A method of well casing placement comprising the steps of:

a) positioning a drilling rig above a well location, the drilling rig having a landing string that is comprised of a number of joints of drill pipe, and a holder that holds a joint of drill pipe in the landing string for supporting the landing string;

b) lowering a plurality of connected joints of casing to the well, said plurality of connected joints of casing defining a casing string, the casing string being supported by the landing string;

c) configuring the combination of landing string and casing string so that the overall combined length of the landing string and casing string spans the distance between the drilling rig and the well location, and wherein the combined weight of landing string and casing string is between about 430,000 and 1,050,000 kilograms;

d) wherein the holder, and the joint of drill pipe that is held by the holder, are configured to support the load of step "c" with correspondingly shaped shoulders that engage when the holder holds the joint of drill pipe, wherein the shoulders are rotatable with respect to each other regardless of the distance between said shoulders.

92. The method of claim 91 wherein in steps "a" and "d" the holder includes a main body and a plurality of wedge members, the wedge members forming an interface between the body and the joint of drill pipe being held by the holder.

93. The method of claim 91 wherein in steps "a" and "d" the holder includes a main body, and a plurality of wedge members, the wedge members forming an interface between the body and the joint of drill pipe being held by the holder, each wedge member having a shoulder, the shoulders of the wedge members engaging the shoulder of the drill pipe being held by the holder.

94. The method of claim 93 wherein in steps "a" and "d" each joint of drill pipe has a pin end and a box end and an enlarged diameter section, and wherein the enlarged diameter section is spaced between 30 and 245 centimeters from the box or pin ends.

95. The method of claim 94 wherein in steps "a" and "d" at least one of the ends of the drill pipe and the enlarged diameter section have correspondingly shaped shoulders.

96. The method of claim 91 wherein in steps "a", "c" and "d" each joint of pipe has

WO 01/94737

PCT/US01/13145

a weight of between about 43 and 164 kilograms per linear meter.

97. The method of claim 91 wherein in steps "a" and "d" each joint of pipe has pin and box end portions, each with a shoulder, and an enlarged diameter section that is positioned between about 30 and 245 centimeters from the box and pin end portions.

5 98. The method of claim 91 wherein in steps "a" and "d" each joint of pipe has pin and box end portions, each with a shoulder, and an enlarged diameter section that is positioned between about 61 and 92 centimeters from the box and pin end portions.

99. The method of claim 97 wherein in steps "a" and "d" the shoulder forms an angle of between 10 and 45 degrees with the central longitudinal axis of its joint of pipe.

10 100. The method of claim 98 wherein in steps "a" and "d" the shoulder forms an angle of between 10 and 45 degrees with the central longitudinal axis of its joint of pipe.

101. A method of landing casing string for use in water depths of at least about 90 meters, comprising the steps of:

15 a) positioning a drilling rig above an undersea well location, the drilling rig having a landing string that is comprised of a number of joints of drill pipe, and a holder for supporting the landing string when one or more pipe joints is to be added to or removed from the landing string;

b) lowering a plurality of connected joints of casing to the undersea well, said plurality of connected joints of casing defining a casing string, wherein the landing string in step 20 "a" has upper and lower end portions, the casing string being supported by the lower end portion of the landing string;

c) configuring the combination of landing string and casing string so that the overall, combined length of the landing string and casing string spans at least a majority of the distance between the drilling rig and the undersea well location at the seabed, and wherein the combined

weight of landing string and casing string is between about 430,000 and 1,050,000 kilograms;

d) wherein the holder, and an uppermost joint of drill pipe that is supported by the holder, are configured to support the load of step "c", wherein the uppermost joint of drill pipe is rotatable with respect to the holder regardless of the distance between the uppermost joint of drill pipe and the holder.

102. The method of claim 101 wherein in step "a" the pipe joints each have a weight
5 of at least about 43 kilograms per meter.

103. The method of claim 101 wherein in steps "a" and "d" the holder is configured to provide substantially uniform contact with a surface of the drill pipe across an entire inner surface of the holder such that the surface of the drill pipe is maintained.

104. The method of claim 101 wherein in steps "a" and "d" the holder includes a main
10 body and a plurality of wedge members movably connectable to the main body, the wedge members forming an interface between the body and the uppermost joint of drill pipe.

105. The method of claim 101 wherein in steps "a" and "d" the holder includes a main
body and a plurality of wedge members that form an interface between the body and the
uppermost joint of drill pipe, each wedge member and the holder having an annular tapered
shoulder, the tapered shoulders of the wedge members engaging the tapered annular shoulder of
15 the main body when supporting the landing string.

106. The method of claim 101 wherein each pipe joint has a pin end portion and a box
end portion and an annular enlarged diameter section spaced between about 30 and 92
centimeters from one of the box or pin end portions.

107. The method of claim 106 wherein at least one of the one end portions and the
20 annular enlarged diameter section have correspondingly shaped tapered shoulders.

108. The method of claim 107 wherein each joint of pipe has a weight of between
about 43 and 164 kilograms per linear meter.

109. The method of claim 108 wherein each joint of pipe has pin and box end portions,
each with a tapered annular shoulder, and the annular enlarged diameter section is positioned

WO 01/94737

PCT/US01/13145

between about 30 and 183 centimeters from the box end portion.

110. A method of deep sea well casing placement for use in water depths of at least about 90 meters, comprising the steps of:

- a) positioning a drilling rig above an undersea well location, the drilling rig having
5 a landing string that is comprised of a number of joints of drill pipe, and a holder for supporting the landing string when one or more pipe joints is to be added to or removed from the landing string;
- b) lowering a plurality of connected joints of casing to the undersea well, said plurality of connected joints of casing defining a casing string, wherein the landing string in step
10 "a" has upper and lower end portions, the casing string being supported by the lower end portion of the landing string;
- c) configuring the combination of landing string and casing string so that the overall, combined length of the landing string and casing string spans the distance between the drilling rig and the undersea well location at the seabed, and wherein the combined weight of landing
15 string and casing string is between about 430,000 and 1,050,000 kilograms;
- d) wherein the holder, and an uppermost joint of drill pipe that is supported by the holder, are configured to support the load of step "c" with correspondingly shaped tapered annular shoulders that engage when the holder supports the uppermost joint of drill pipe.

111. The method of claim 110 wherein the holder includes a main body, and a plurality
20 of wedge members that form an interface between the body and the uppermost joint of drill pipe.

112. The method of claim 110 wherein the holder includes a main body, and a plurality of wedge members that form an interface between the body and the uppermost joint of drill pipe, each wedge member and the holder having an annular tapered shoulder, the tapered shoulders of the wedge members engaging the tapered annular shoulder of the main body when supporting

WO 01/94737

PCT/US01/13145

the landing string.

113. The method of claim 112 wherein each pipe joint has a pin end portion and a box end portion and an annular enlarged diameter section spaced between 30 and 305 centimeters from one of the box or pin end portions.

5 114. The method of claim 113 wherein at least one of the one end portions and the annular enlarged diameter section have correspondingly shaped annular tapered shoulders.

115. The method of claim 110 wherein each joint of pipe has a weight of between about 43 and 164 kilograms per linear meter.

10 116. The method of claim 110 wherein in step "a" each joint of pipe has pin and box end portions, each with a tapered annular shoulder, and the annular enlarged diameter section is positioned between about 30 and 183 centimeters from the box end portion.

117. The method of claim 110 wherein in step "a" each joint of pipe has pin and box end portions, each with a tapered annular shoulder, and the annular enlarged diameter portion is positioned between about 30 and 92 centimeters from the box end portion.

15 118. The method of claim 116 wherein in step "a" the tapered annular shoulder forms an angle of between 10 and 45 degrees with the central longitudinal axis of its joint of pipe.

119. The method of claim 117 wherein the tapered annular shoulder forms an angle of between 10 and 45 degrees with the central longitudinal axis of its joint of pipe.

120. A method of well casing placement comprising the steps of:

20 a) positioning a drilling rig above an undersea well location, the drilling rig having a lifting device, a landing string that is comprised of a number of joints of drill pipe, and a holder for supporting the landing string when one or more pipe joints is to be added to or removed from the landing string;

b) supporting the landing string with the lifting device;

c) lowering a plurality of connected joints of casing to the undersea well, said plurality of connected joints of casing defining a casing string, wherein the landing string in step "a" has upper and lower end portions, the casing string being supported by the lower end portion of the landing string;

d) configuring the combination of landing string and casing string so that the overall, combined length of the landing string and casing string spans at least a majority of the distance between the drilling rig and the undersea well location at the seabed, and wherein the combined weight of landing string and casing string is between about 430,000 and 1,050,000 kilograms;

e) wherein the holder, and an uppermost joint of drill pipe that is supported by the holder, are configured to support the load of step "d", wherein the uppermost joint of drill pipe is rotatable with respect to the holder regardless of the distance between the uppermost joint of drill pipe and the holder.

121. The method of claim 101 wherein the casing string is comprised of joints of casing and wherein each joint of casing has a weight of between about 59 and 119 kilograms per linear meter.

122. The method of claim 110 wherein the casing string is comprised of joints of casing and wherein each joint of casing has a weight of between about 59 and 119 kilograms per linear meter.

123. The method of claim 120 wherein the casing string is comprised of joints of casing and wherein each joint of casing has a weight of between about 59 and 119 kilograms per linear meter.

124. The method of claim 101; further comprising the step of separating the holder from an engaged position with the landing string before step "c".

125. The method of claim 110, further comprising the step of separating the holder from an engaged position with the landing string before step "c".

126. The method of claim 120, further comprising the step of separating the holder

WO 01/94737

PCT/US01/13145

from an engaged position with the landing string before step "c".

127. The method of claim 101 further comprising the step of powering the holder with pressurized fluid.

5 128. The method of claim 110 further comprising the step of powering the holder with pressurized fluid.

129. The method of claim 120 further comprising the step of powering the holder with pressurized fluid.

10 130. The method of claim 104 wherein the wedge members are movable between pipe engaging and released positions, and further comprising the step of powering the wedge members to move using pressurized fluid.

131. The method of claim 111 wherein the wedge members are movable between pipe engaging and released positions, and further comprising the step of powering the wedge members to move using pressurized fluid

15 132. The method of claim 101 wherein step "b" comprises in part lowering a casing string that has a mass of at least about 270,000 kilograms.

133. The method of claim 110 wherein step "b" comprises in part lowering a casing string that has a mass of at least about 270,000 kilograms.

134. The method of claim 120 wherein step "b" comprises in part lowering a casing string that has a mass of at least about 270,000 kilograms.

20 135. The method of claim 101 wherein step "b" comprises in part lowering a casing string that is between 4,500 and 6,100 meters in length.

136. The method of claim 101 wherein step "a" further comprises maintaining the drilling rig above the undersea well location without the use of anchors or anchor lines.

137. The method of claim 110 wherein step "a" further comprises maintaining the

WO 01/94737

PCT/US01/13145

drilling rig above the undersea well location without the use of anchors or anchor lines.

138. The method of claim 101 wherein in step "c" the casing string includes a plurality of joints that each have a maximum diameter that is greater than the maximum diameter of a plurality of the joints of the landing string.

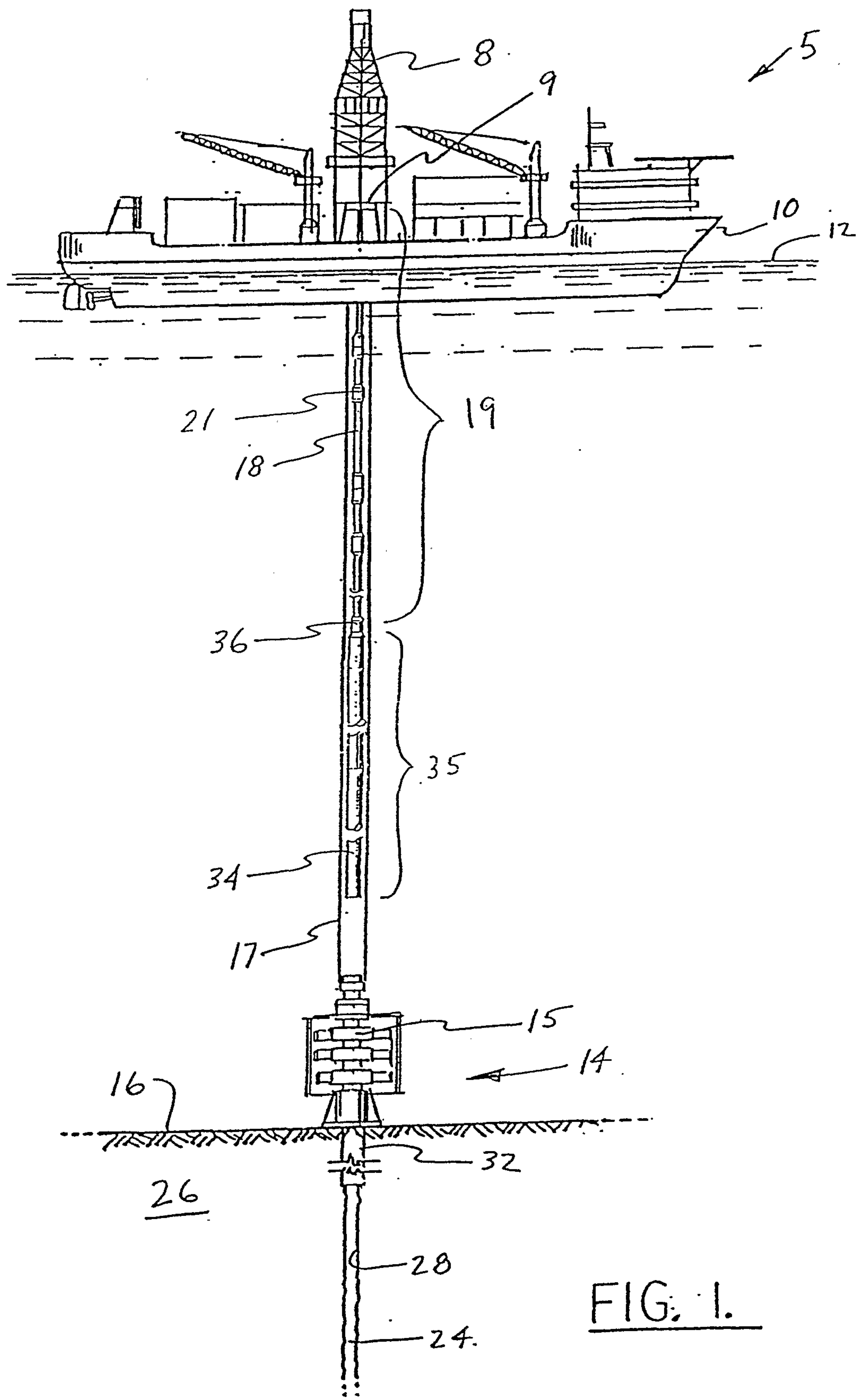
5 139. The method of claim 110 wherein in step "c" the casing string includes a plurality of joints that each have a maximum diameter that is greater than the maximum diameter of a plurality of the joints of the landing string.

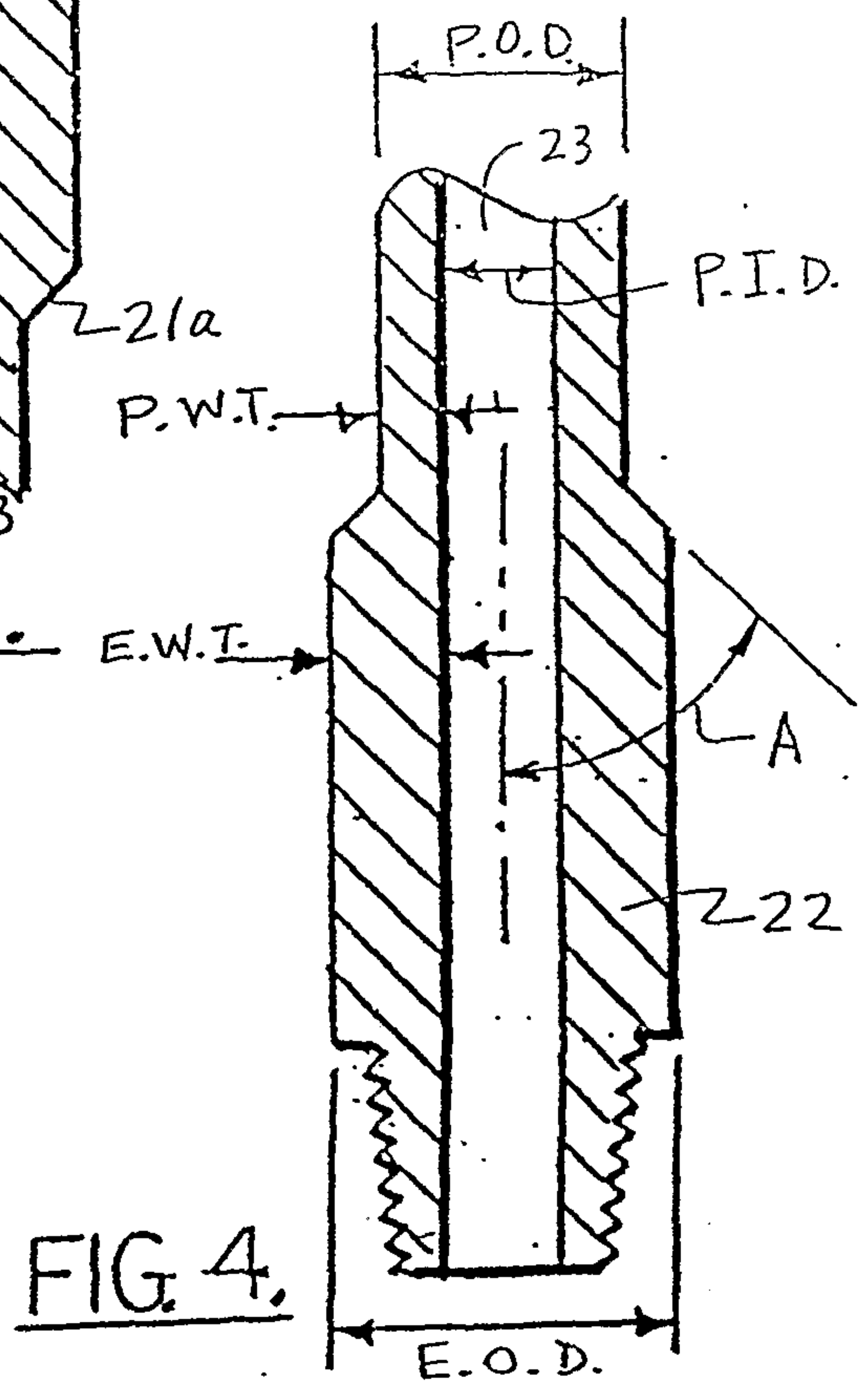
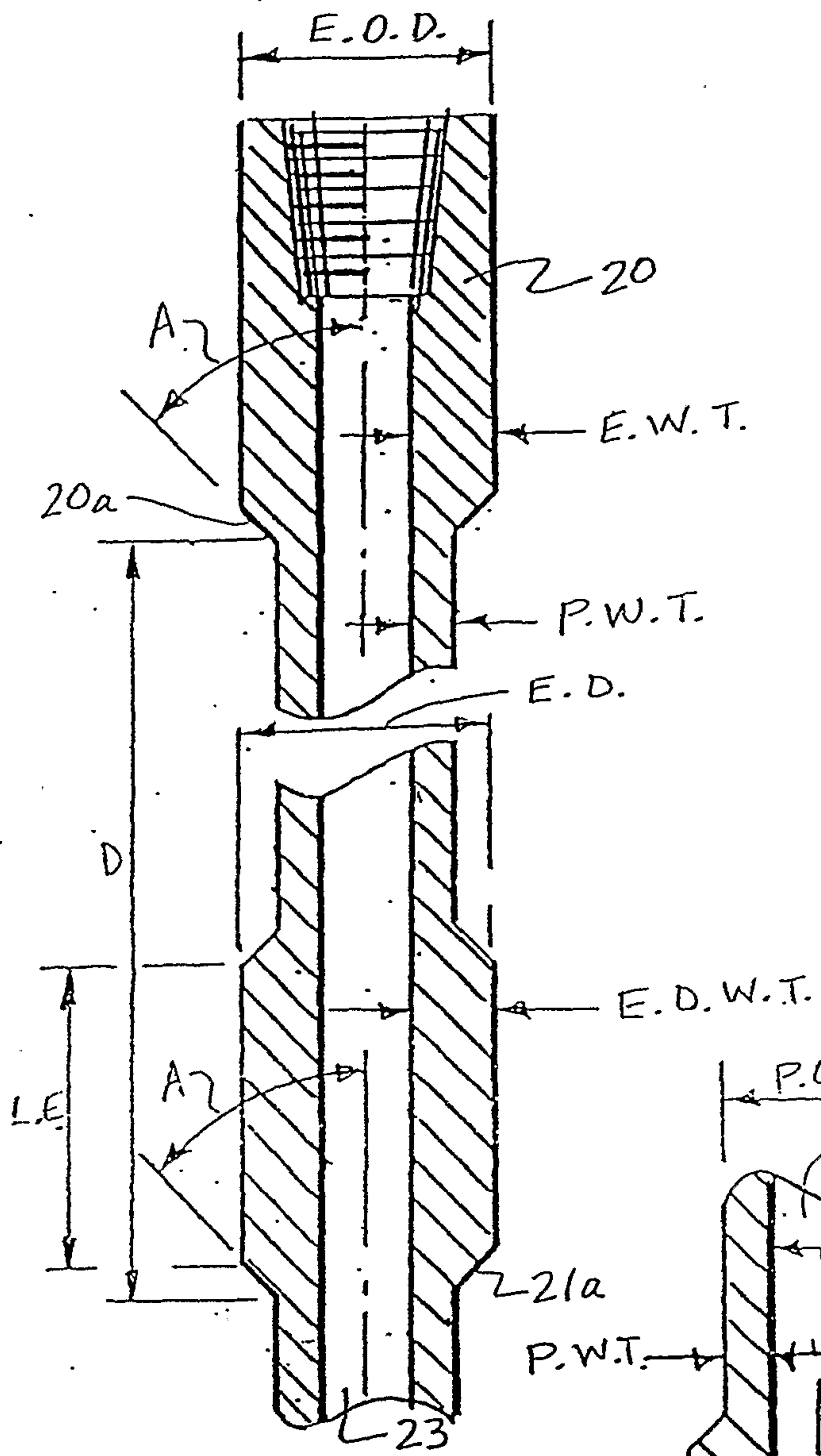
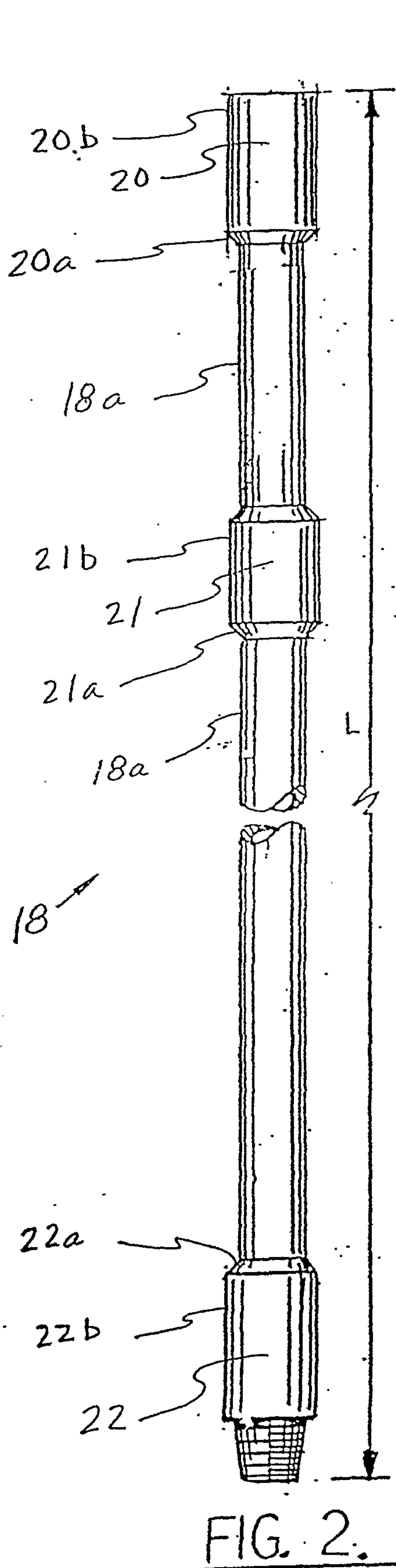
10 140. The method of claim 120 wherein in step "c" the casing string includes a plurality of joints that each have a maximum diameter that is greater than the maximum diameter of a plurality of the joints of the landing string.

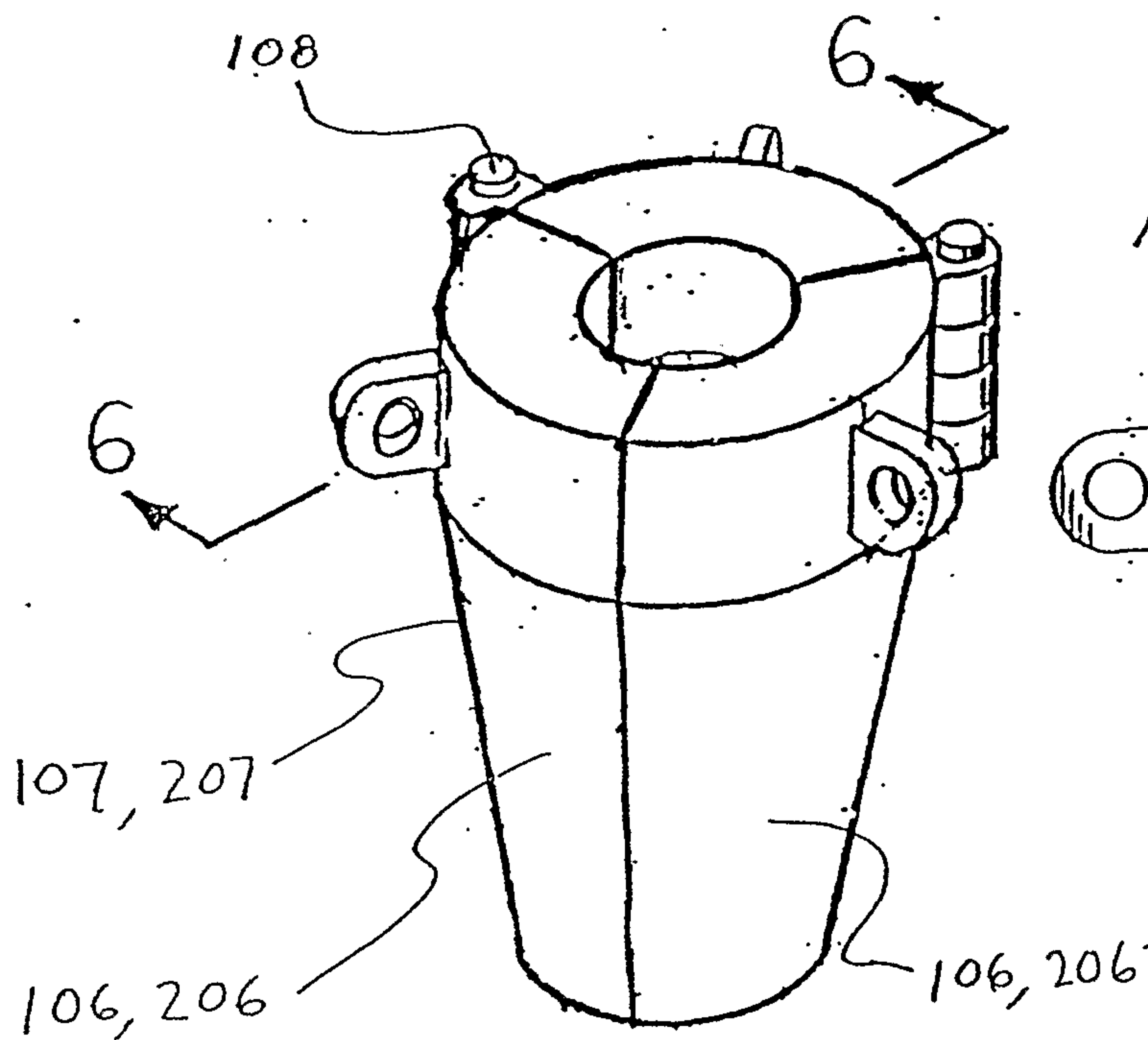
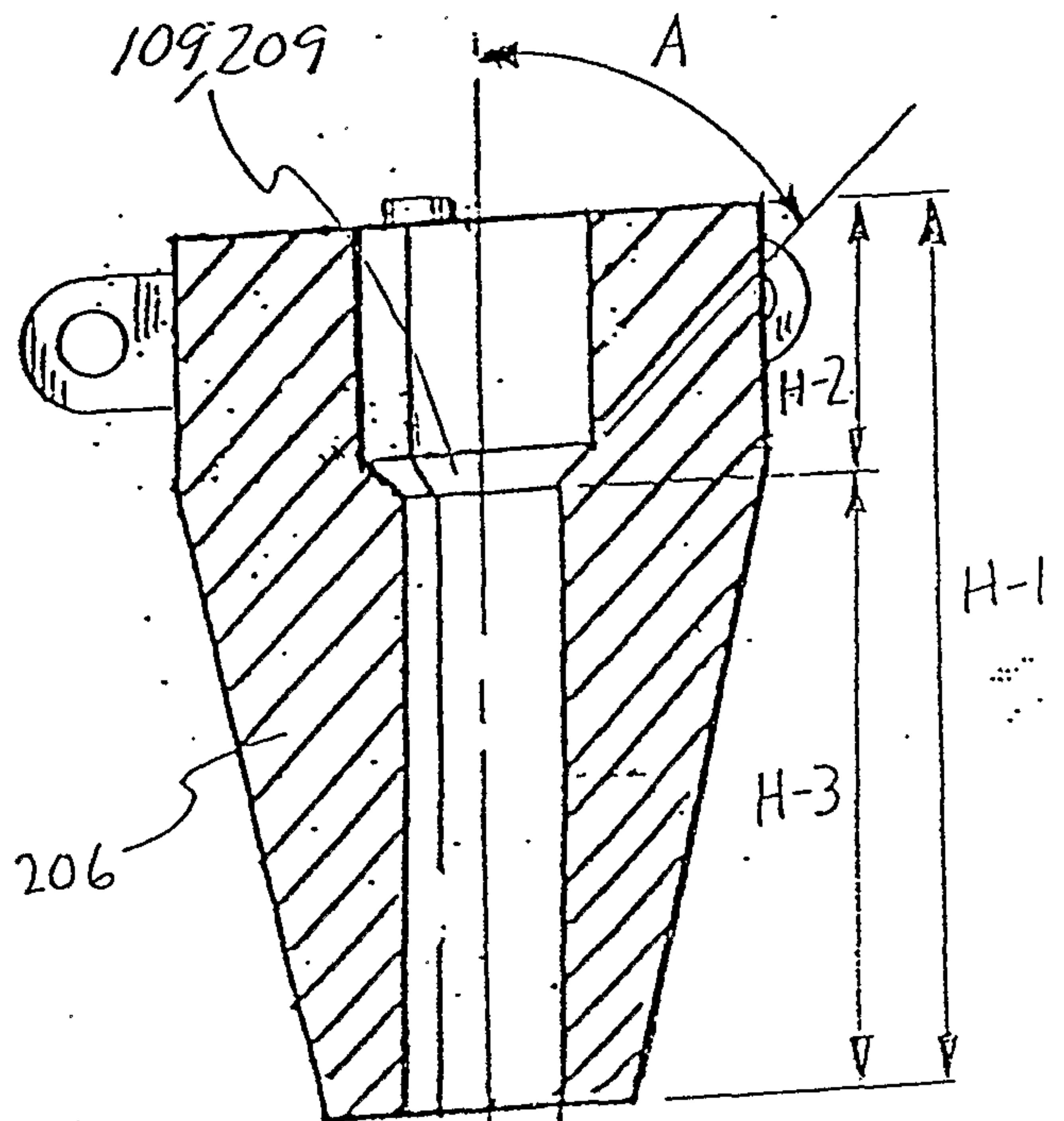
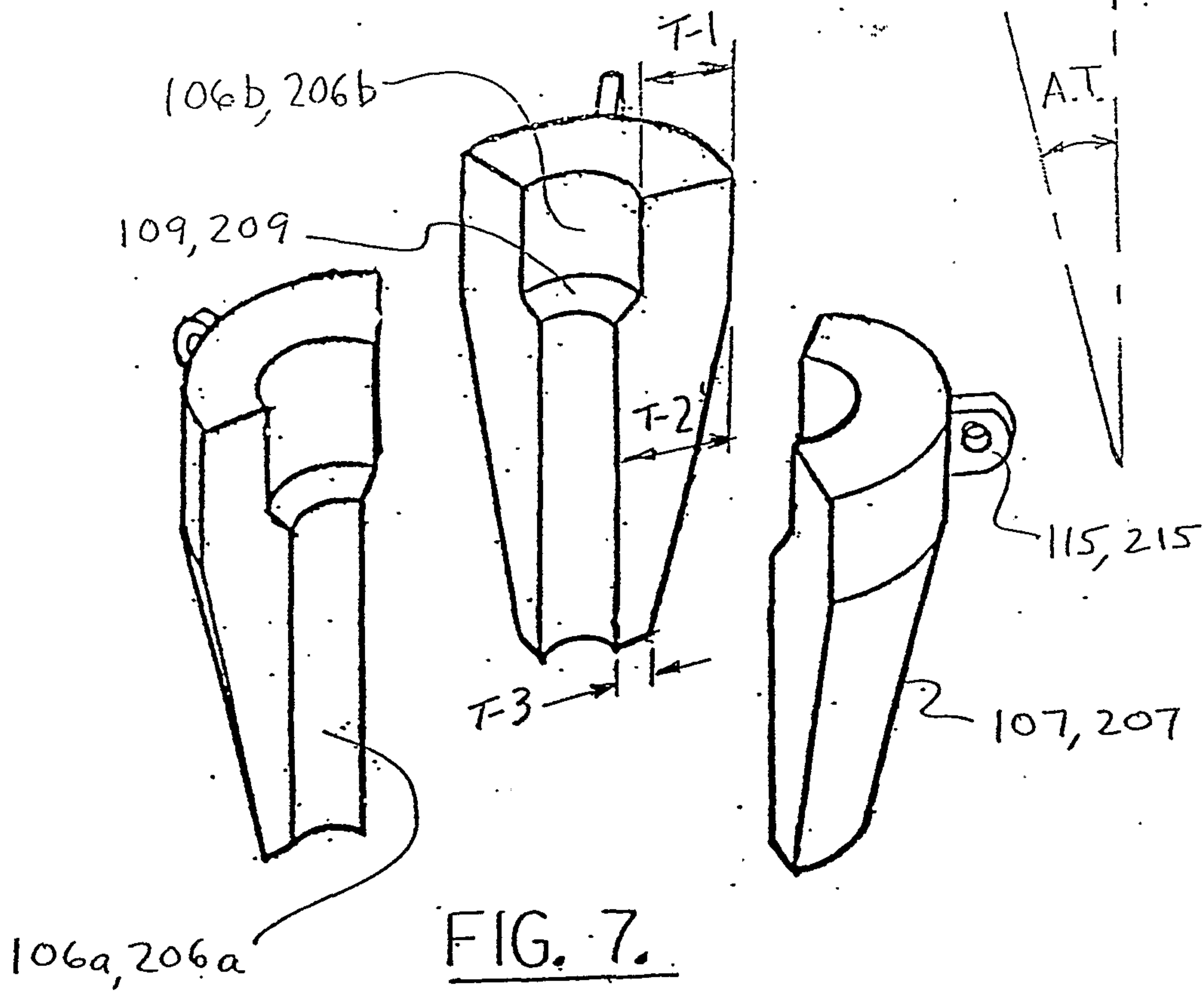
141. The method of claim 101 wherein the plurality of joints of casing include joints of casing of differing diameters.

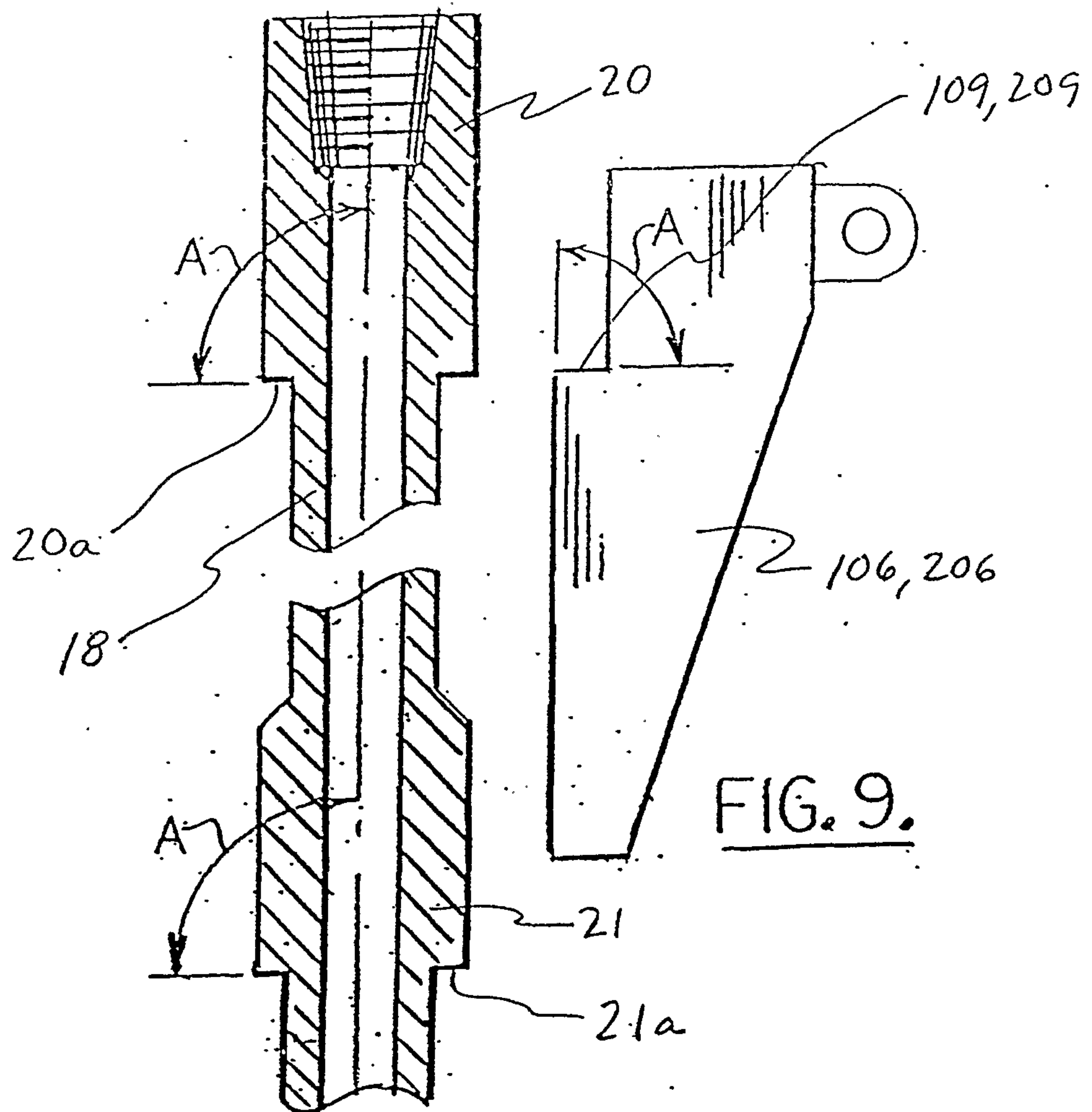
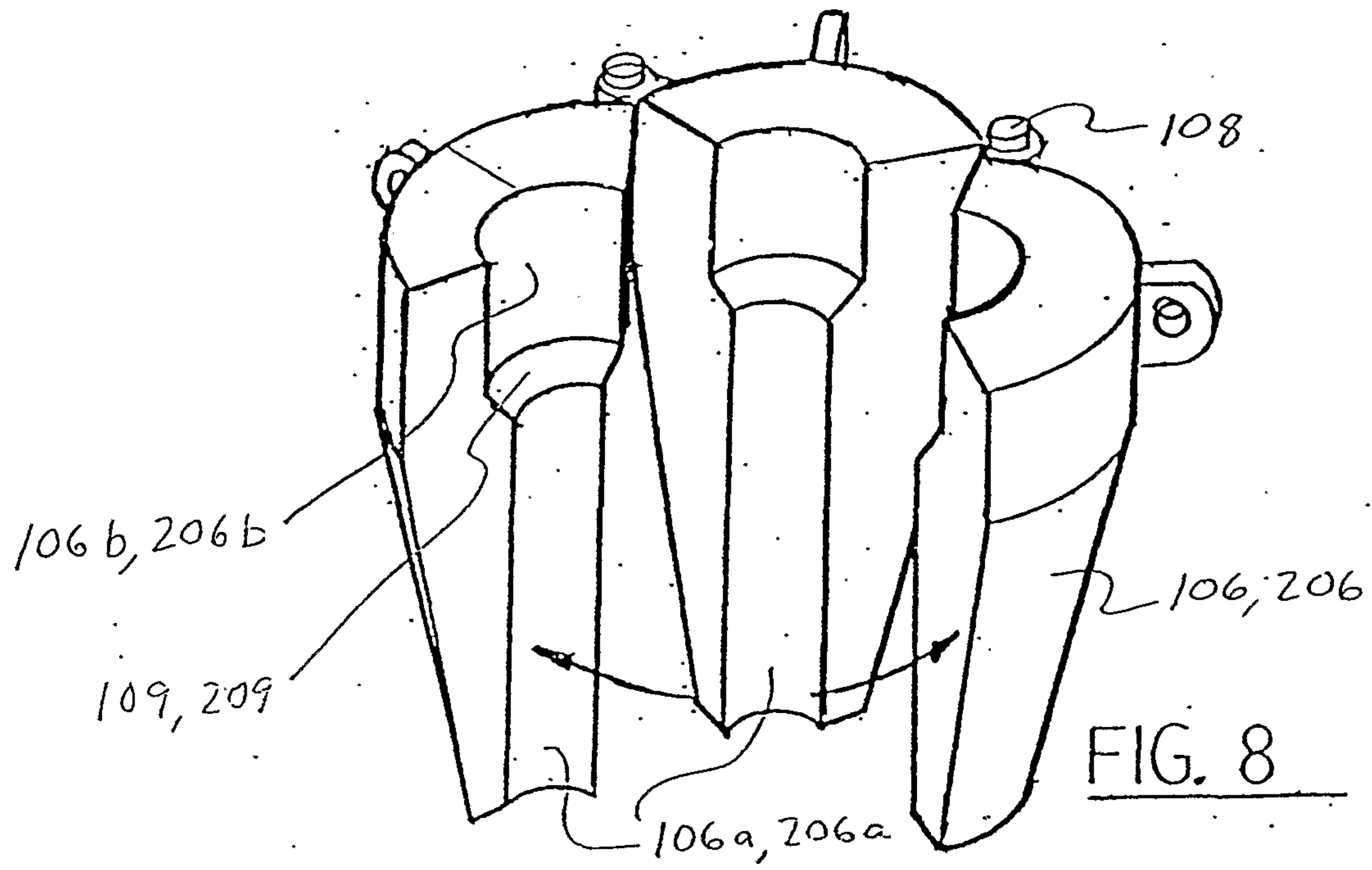
142. The method of claim 110 wherein the plurality of joints of casing include joints of casing of differing diameters.

15 143. The method of claim 120 wherein the plurality of joints of casing include joints of casing of differing diameters.

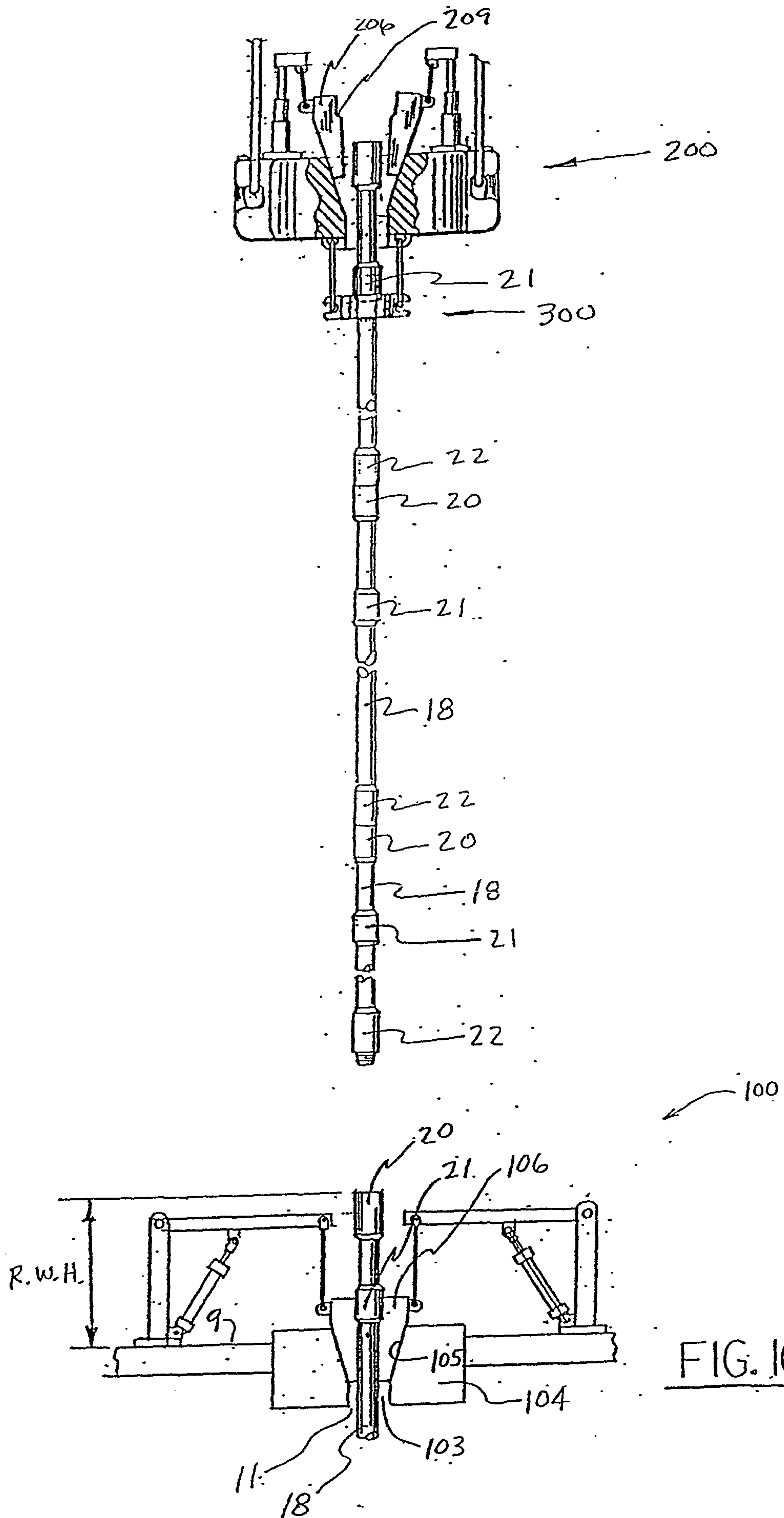




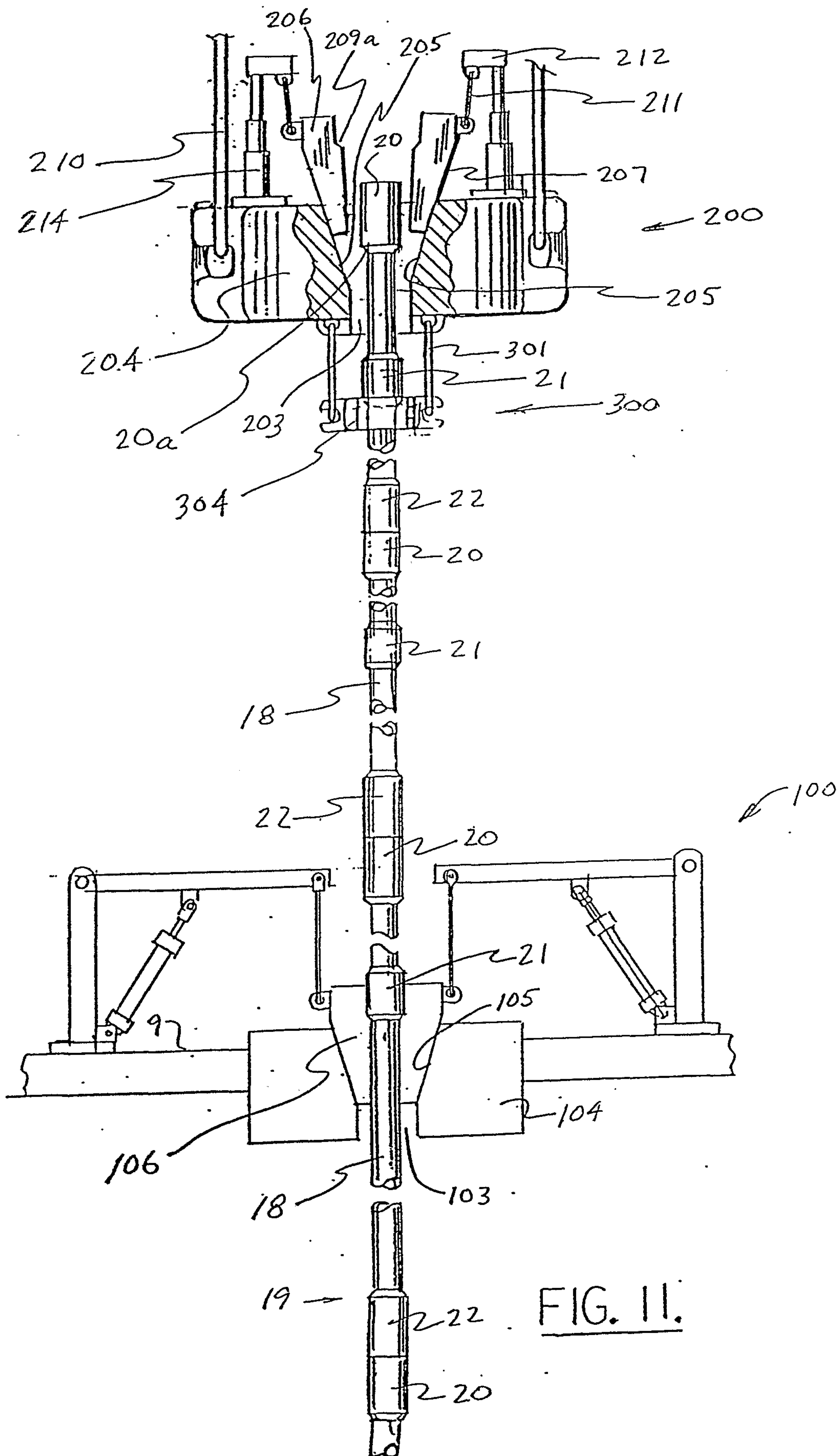
FIG. 5.FIG. 6FIG. 7.

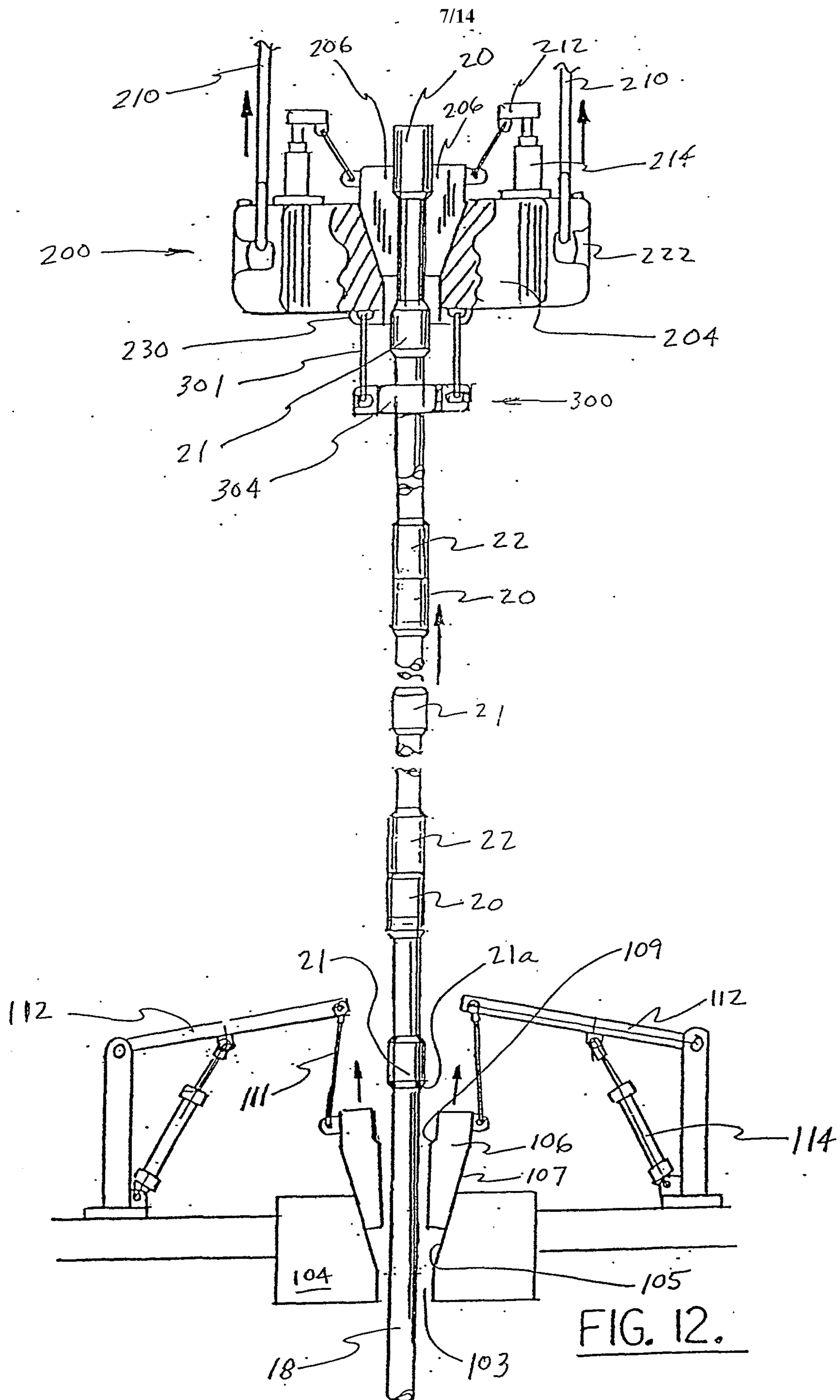


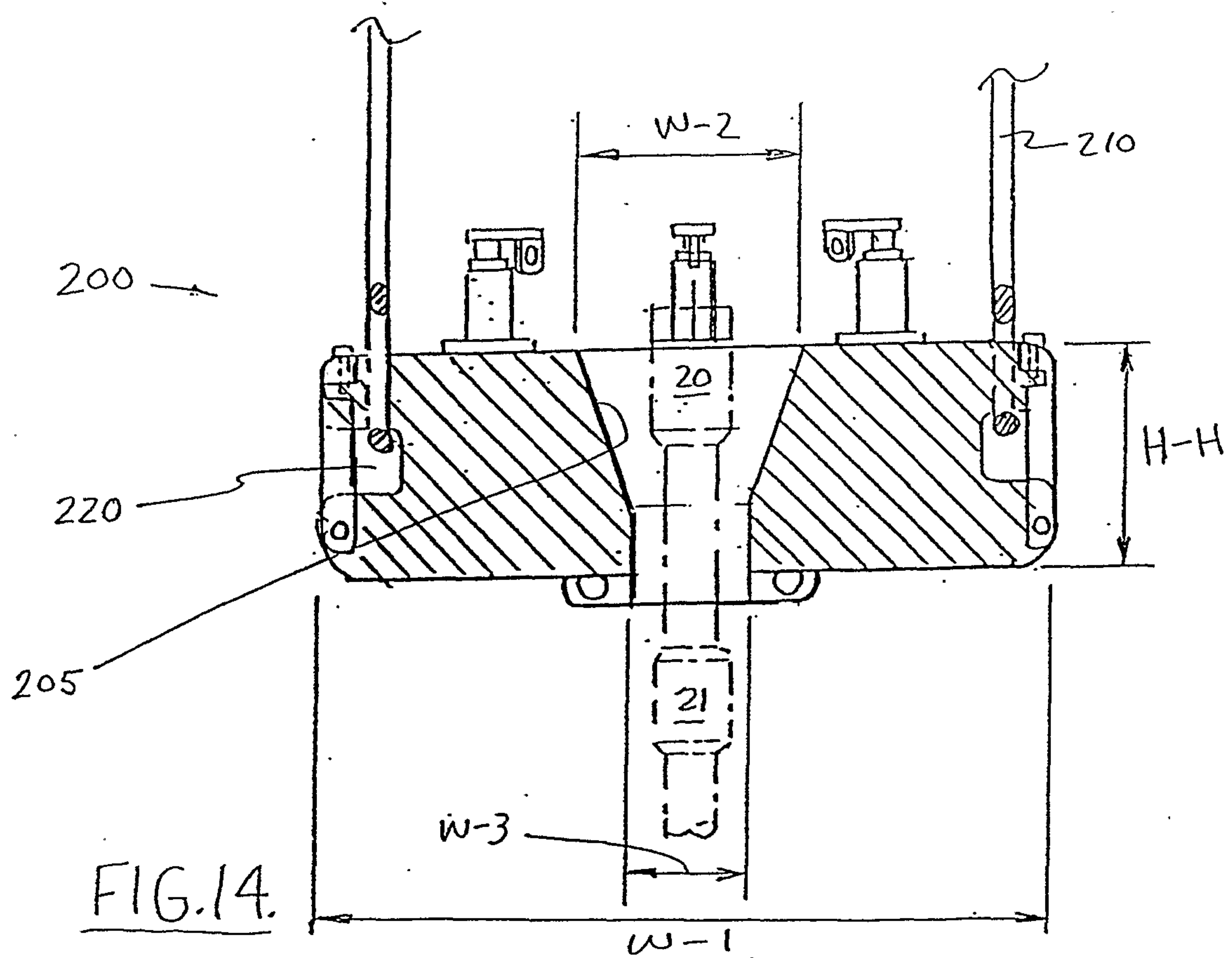
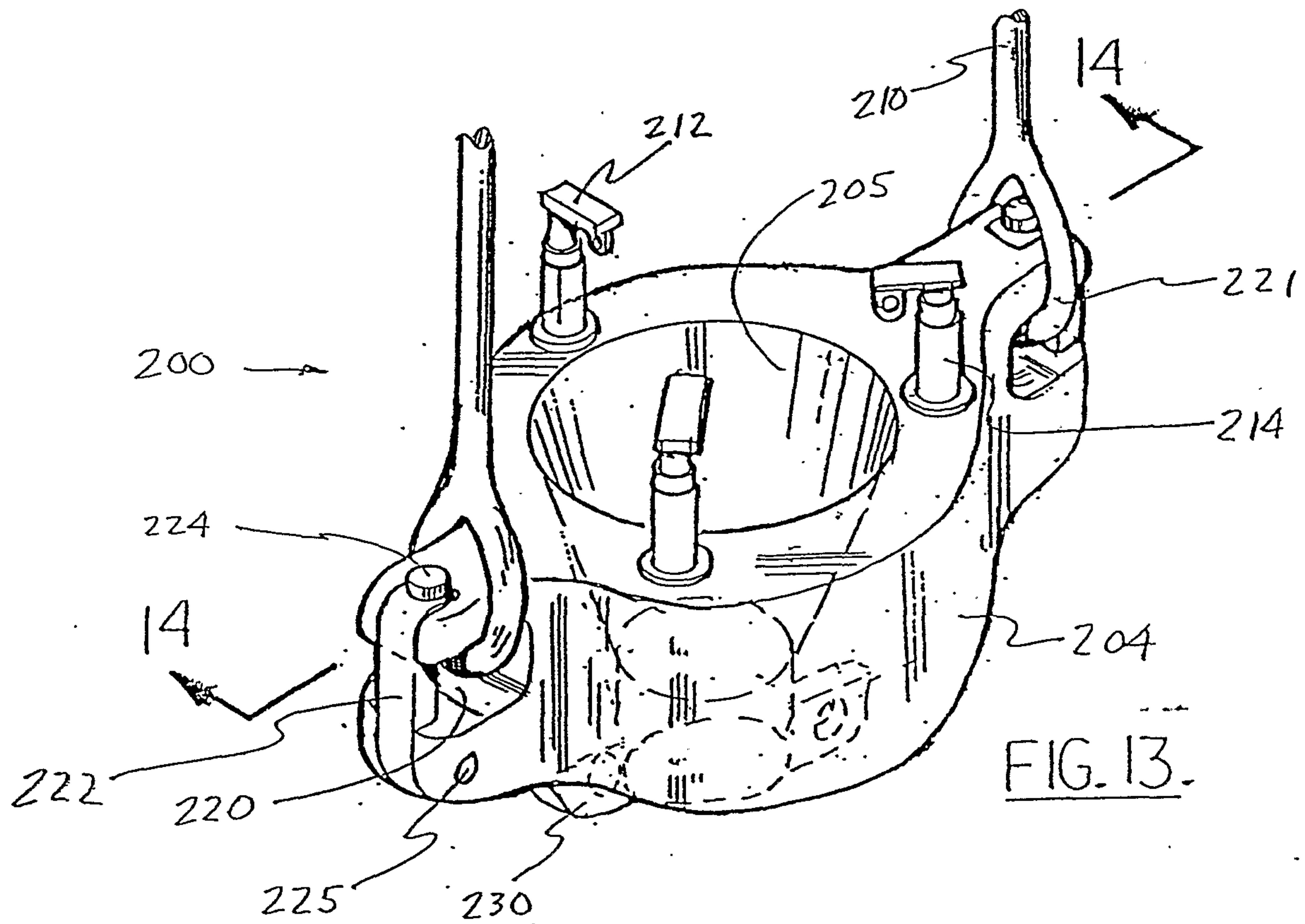
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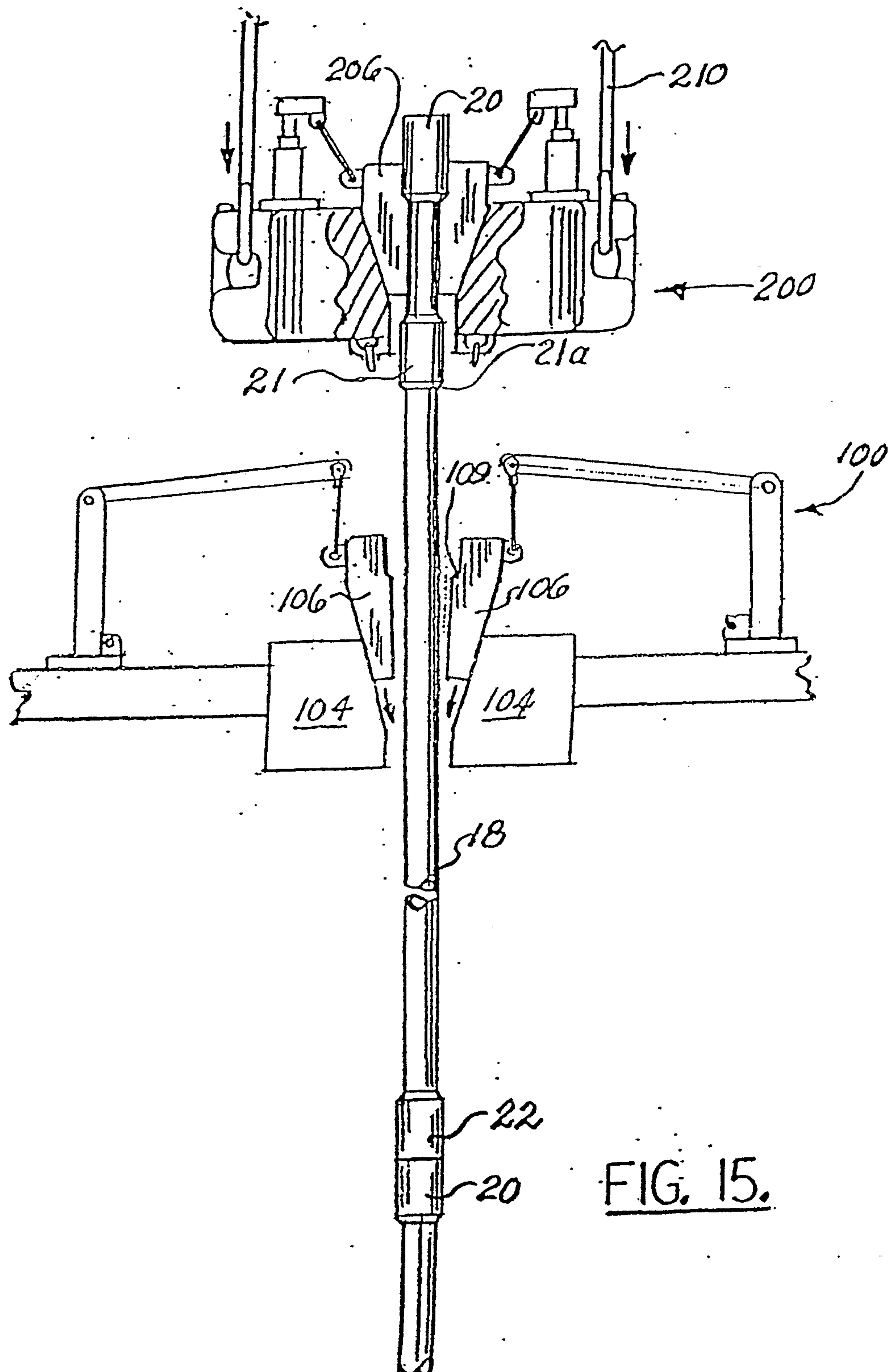


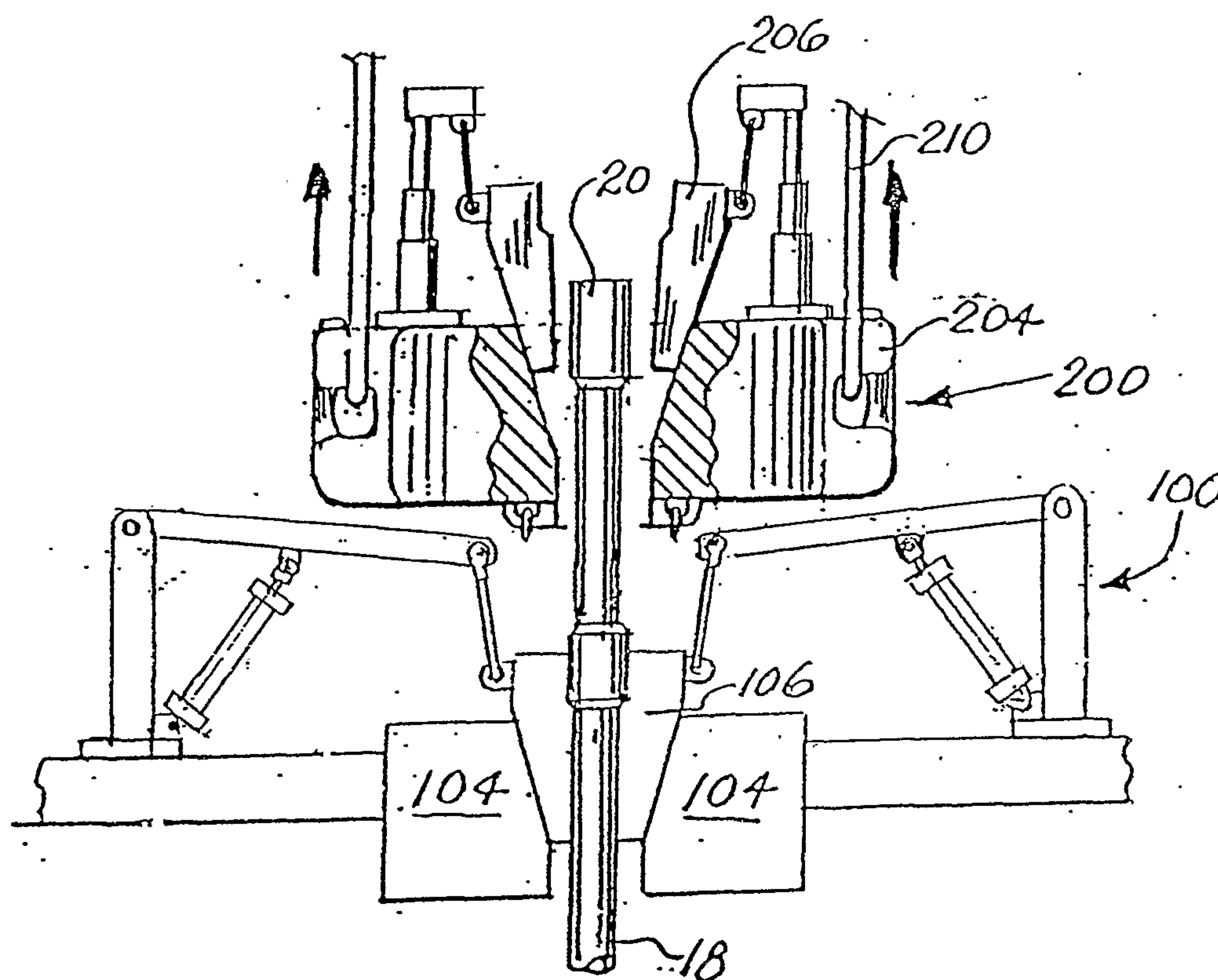
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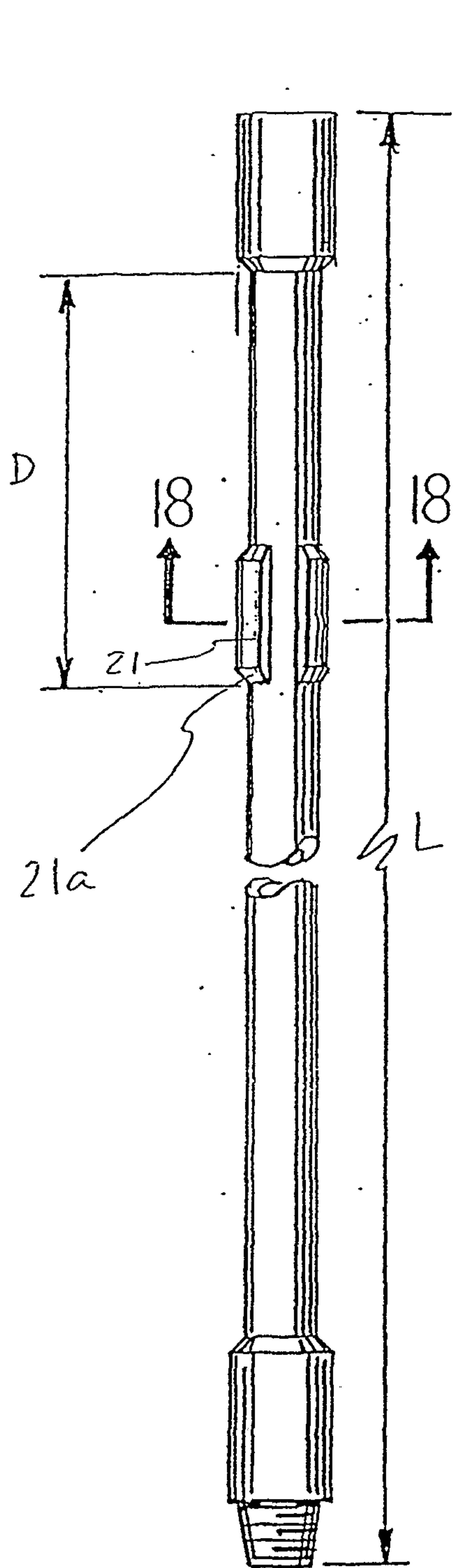
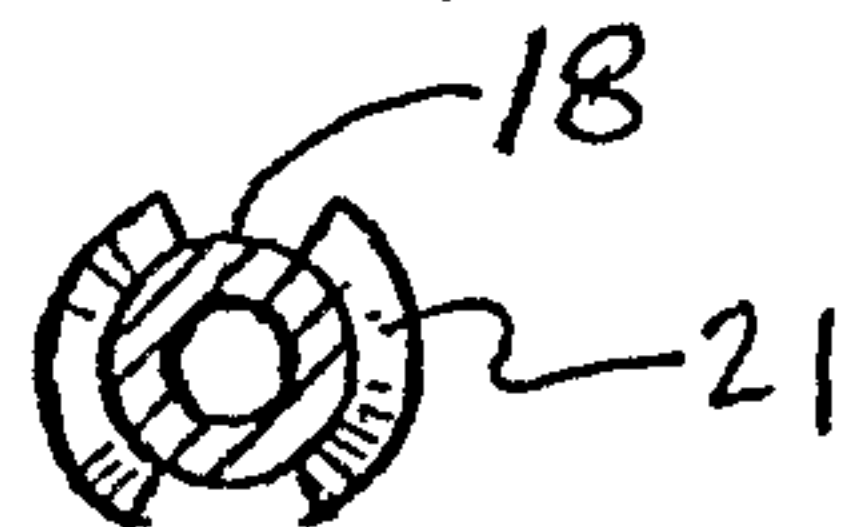
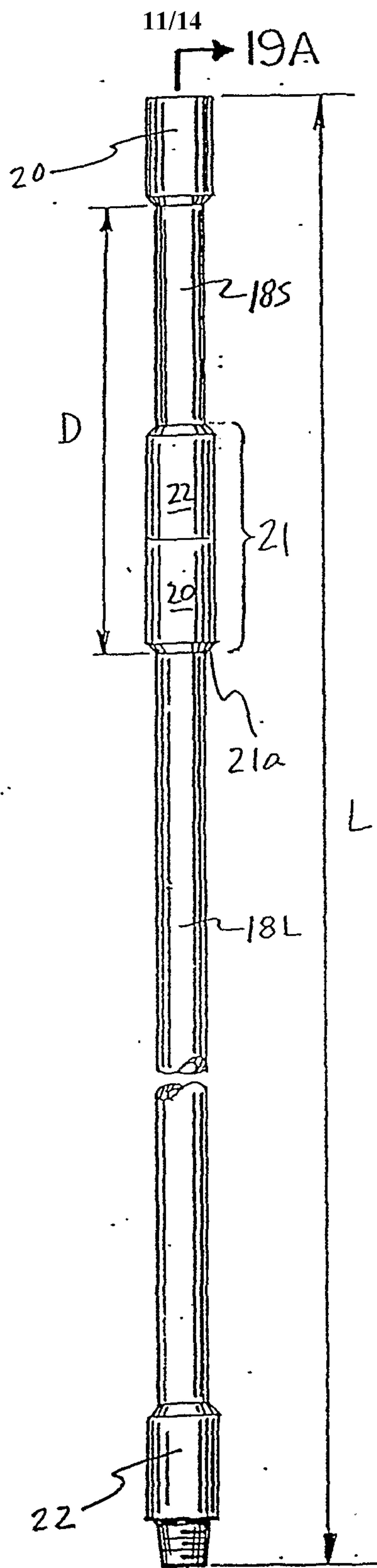
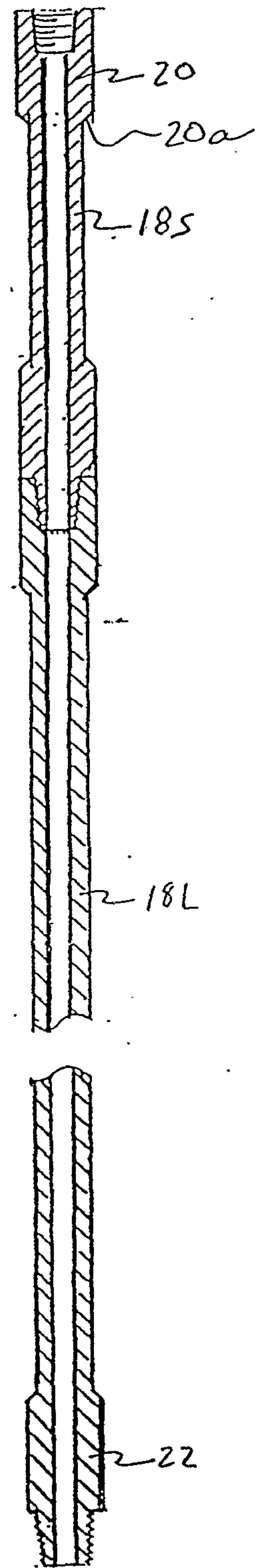








FIG. 16.

FIG. 17.FIG. 18.FIG. 19.FIG. 19A.

12/14

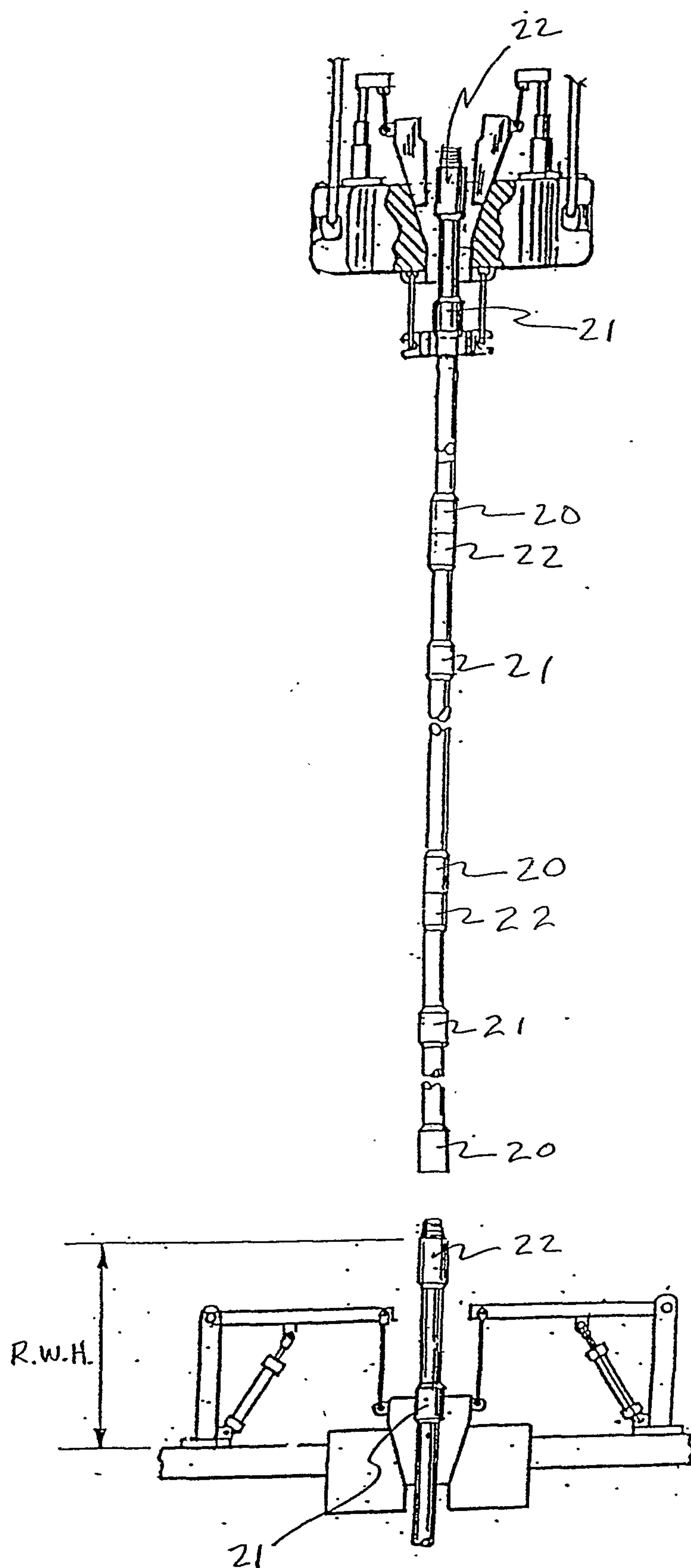
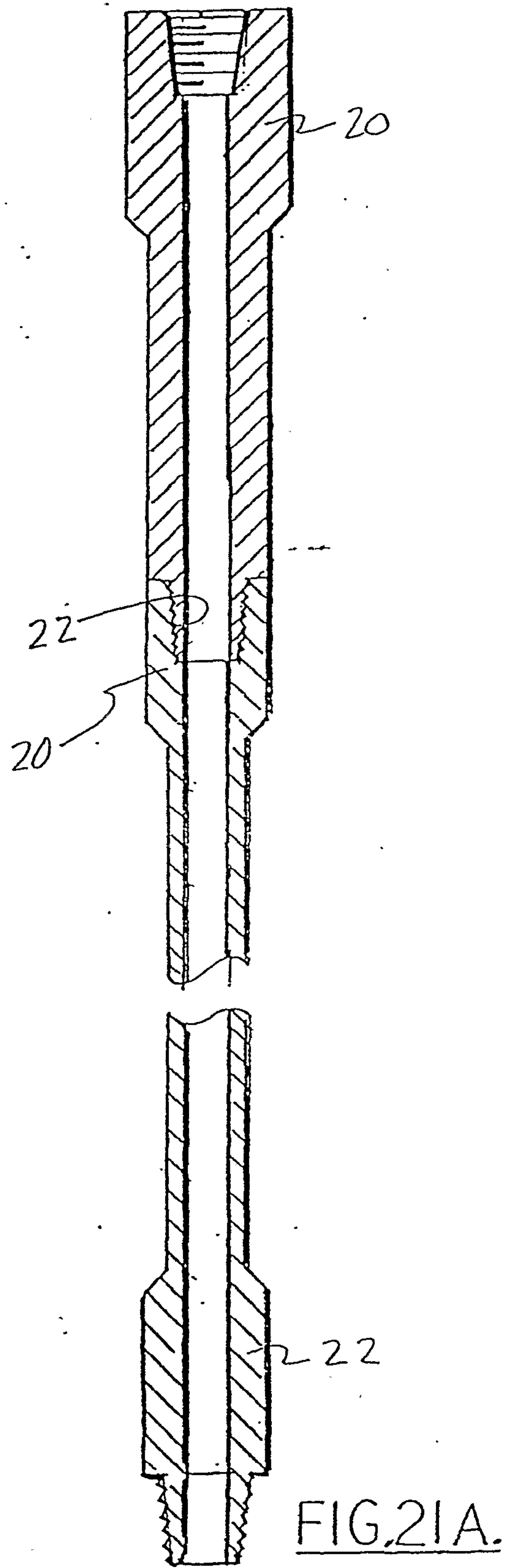
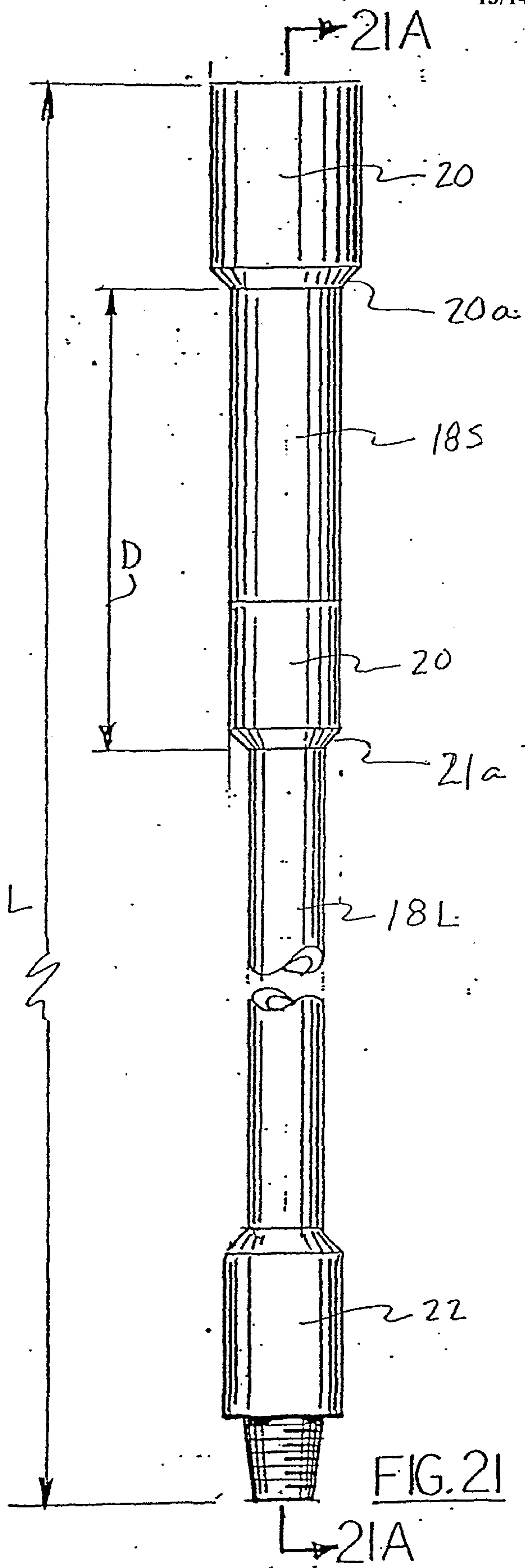


FIG. 20.



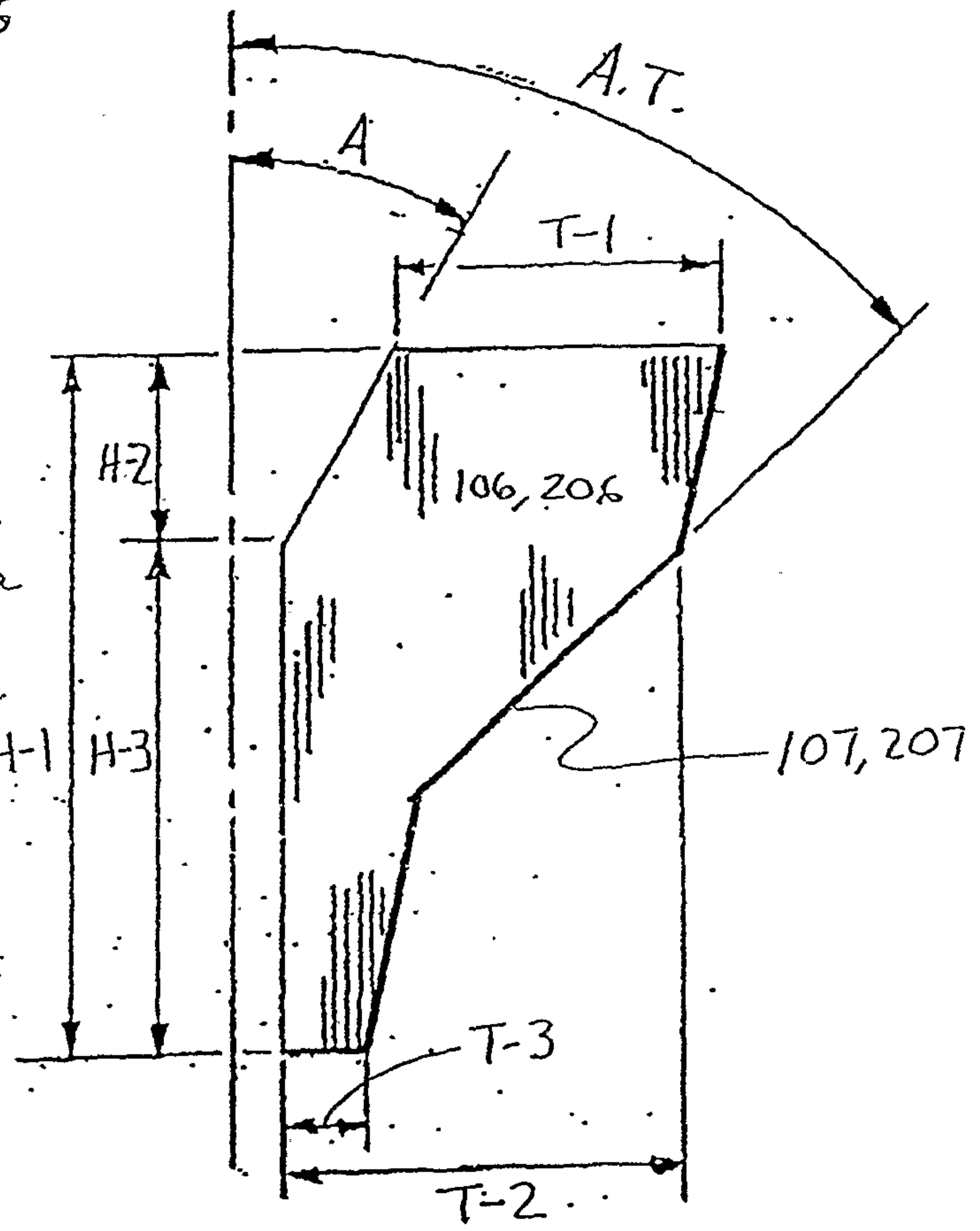
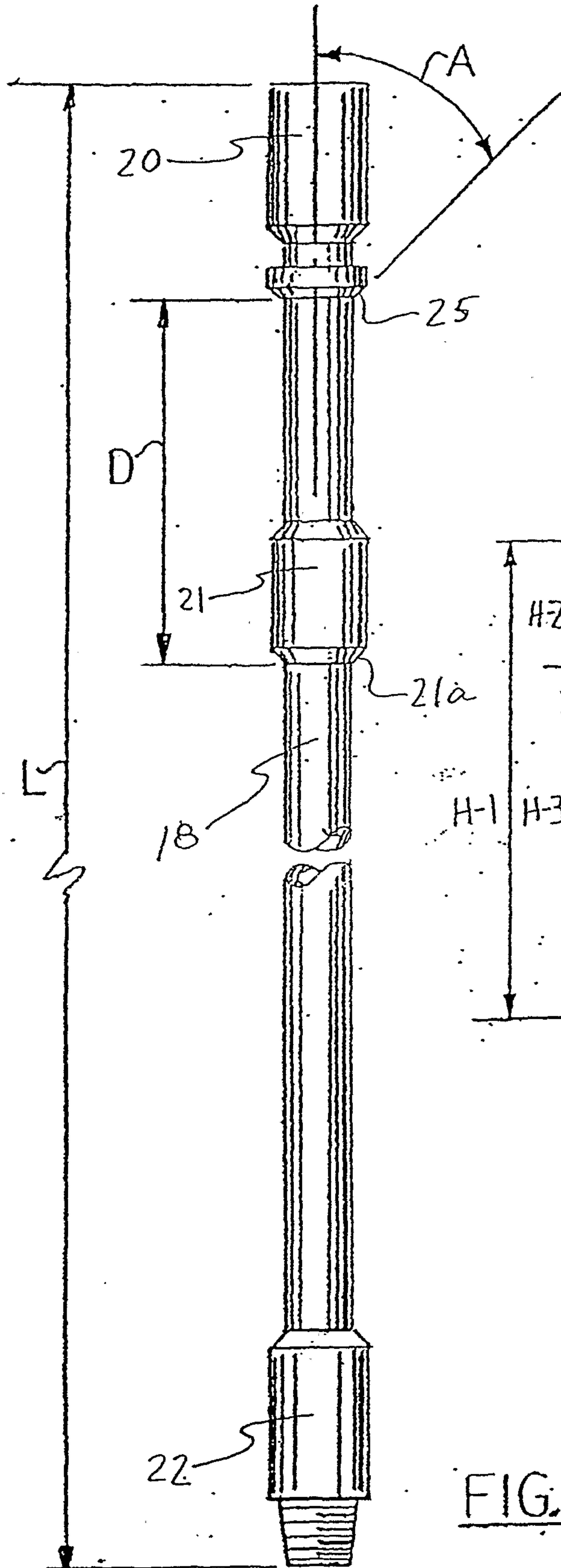


FIG. 23.

FIG. 22.

