

Jan. 17, 1967

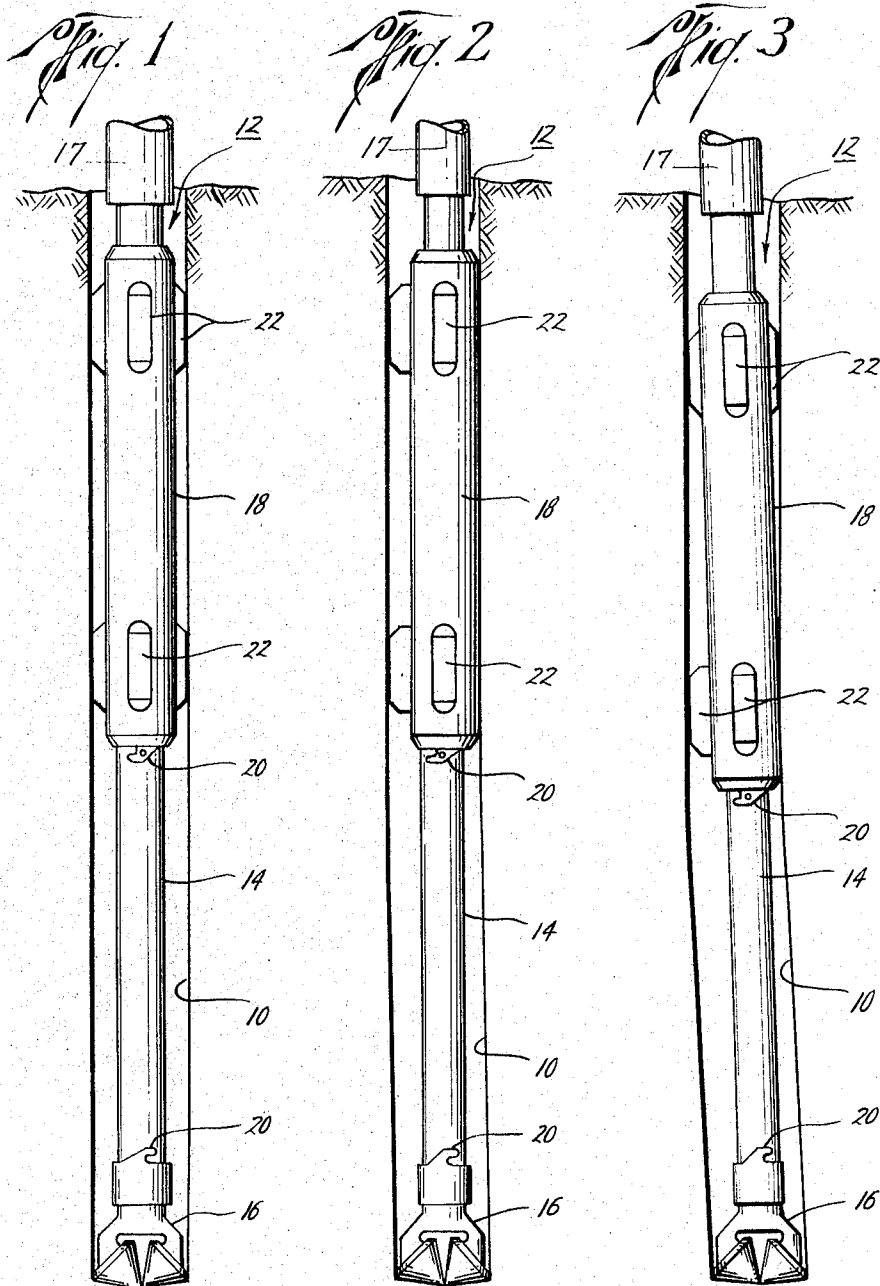
W. S. BACHMAN ETAL

3,298,449

WELL BORE APPARATUS

Original Filed March 10, 1958

7 Sheets-Sheet 1



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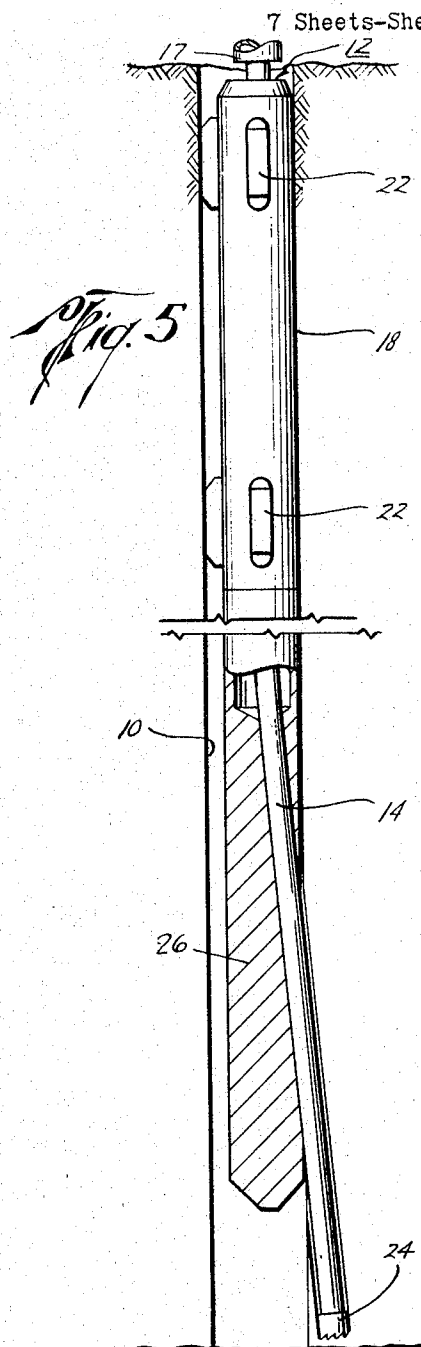
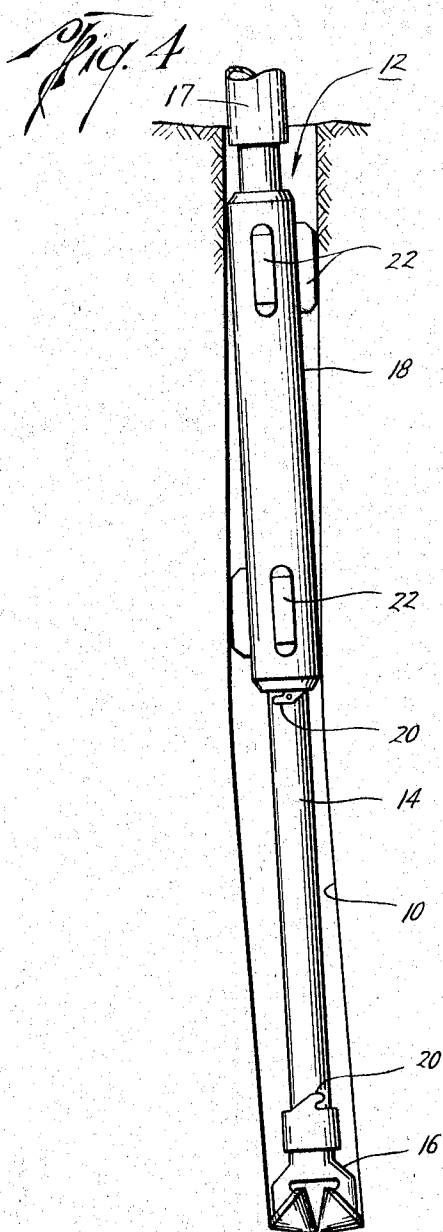
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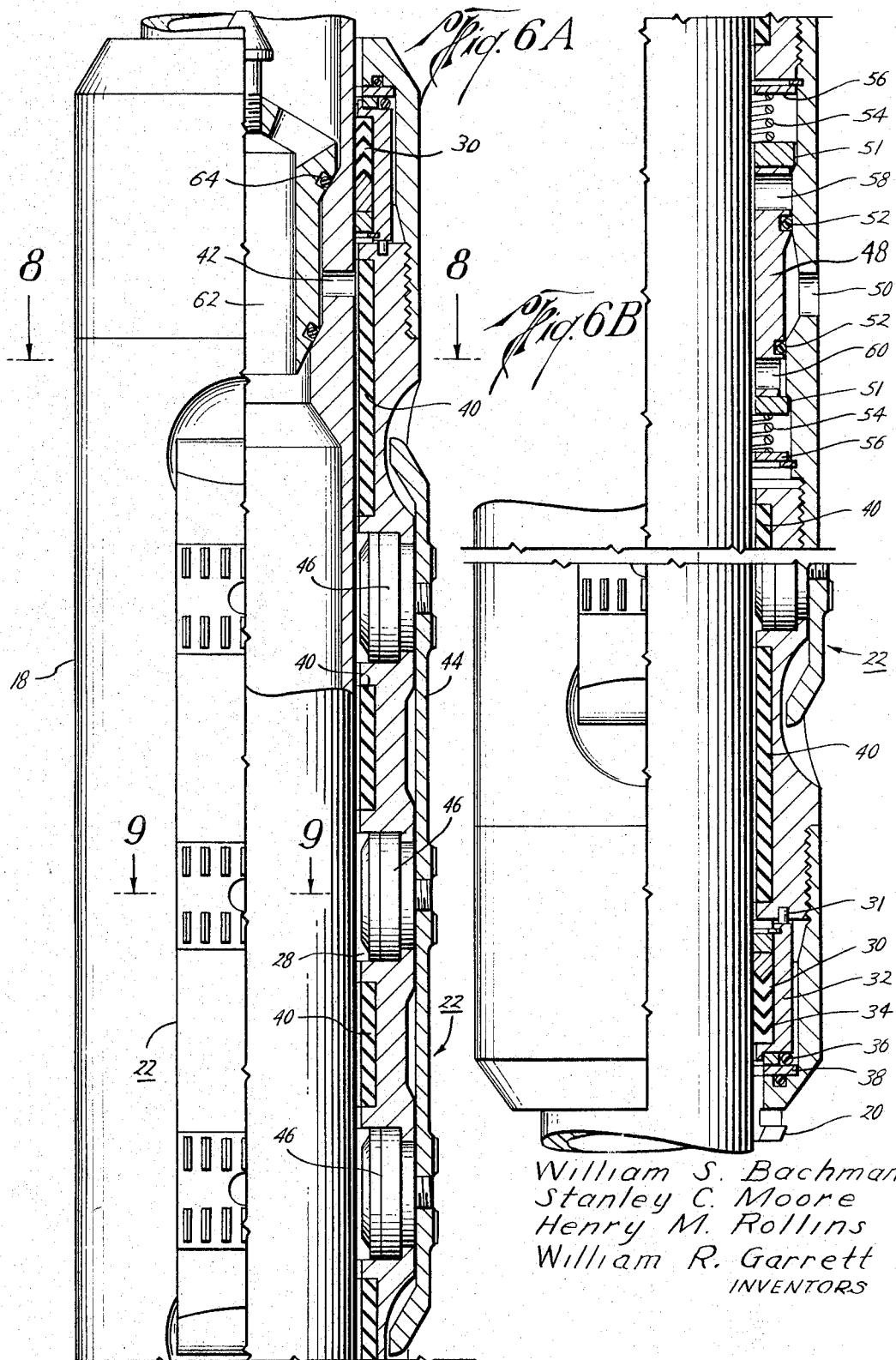
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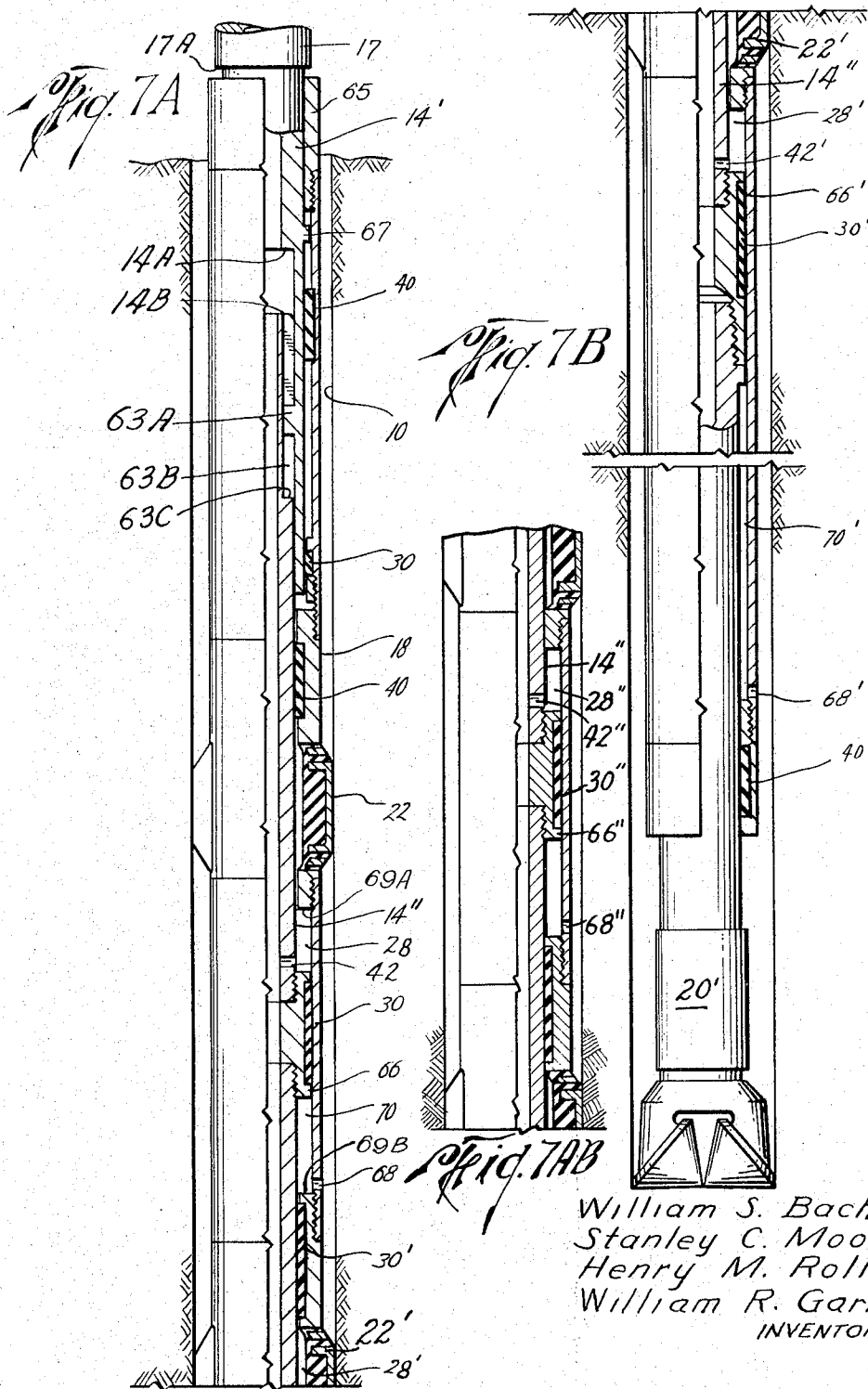
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*Fig. 8*

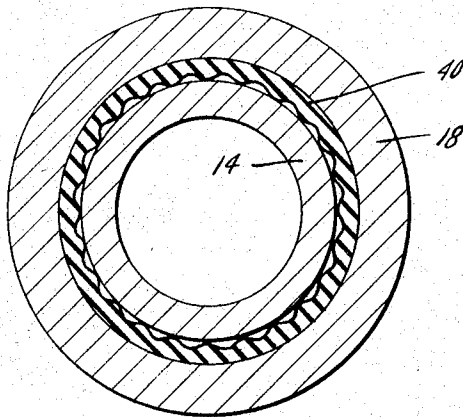


*Fig. 8A*

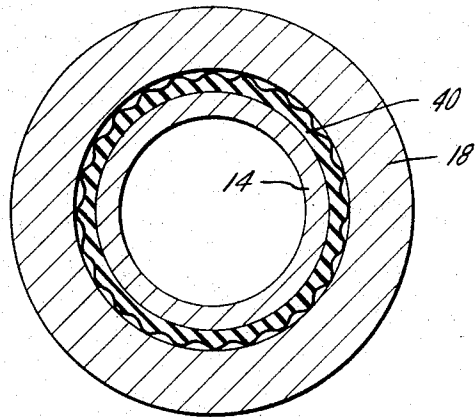


*Fig. 9A*

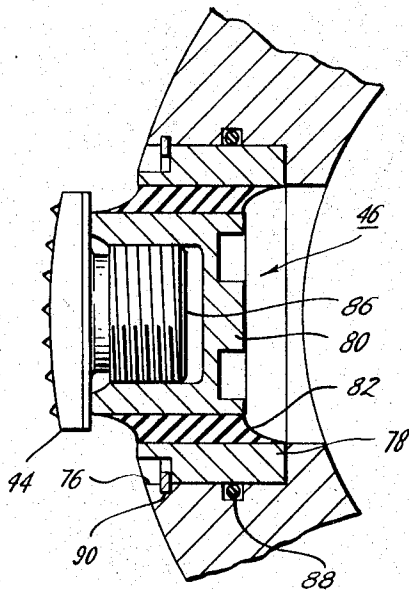
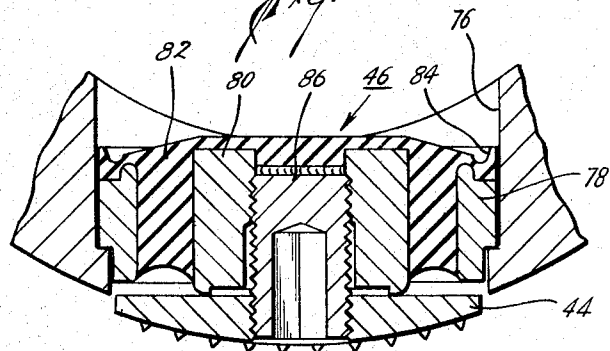


*Fig. 9*



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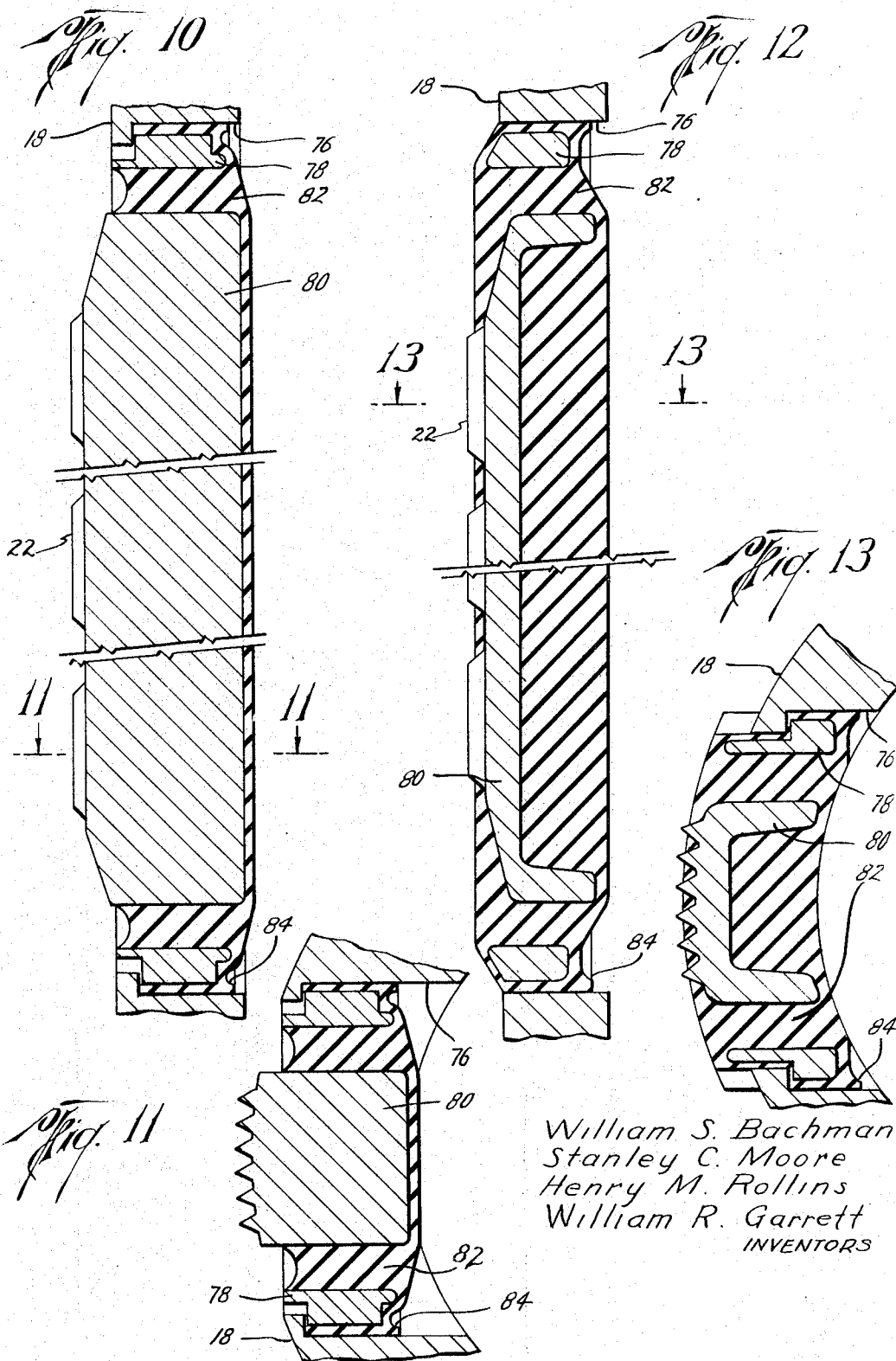
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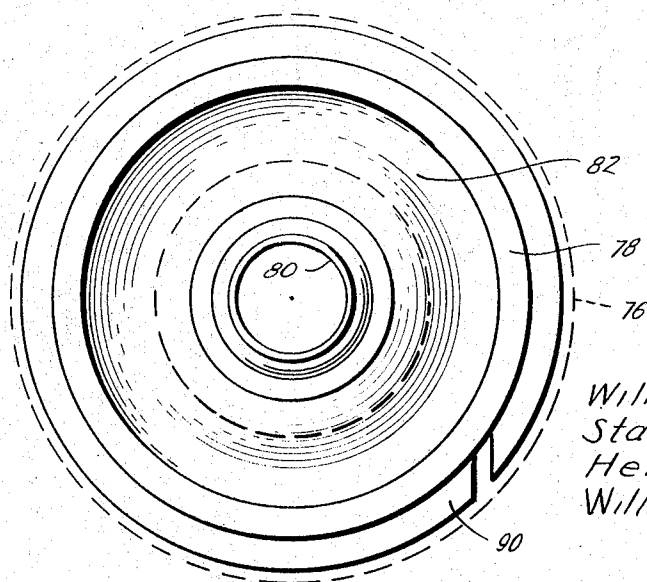
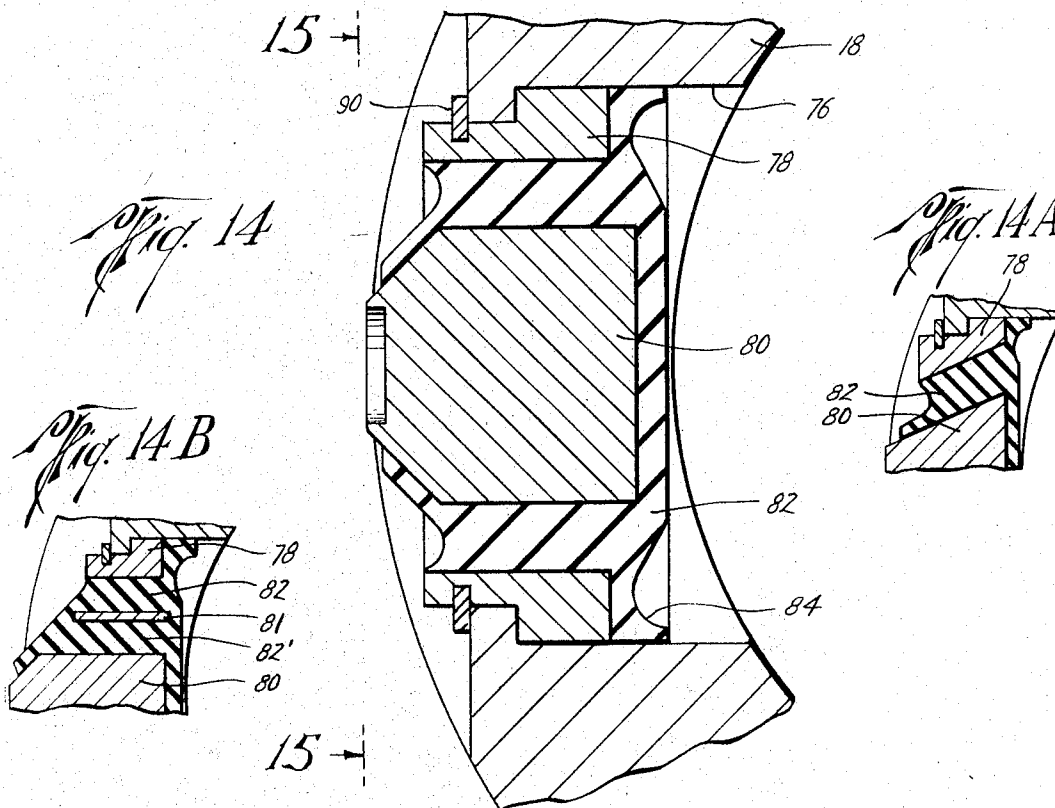
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7 Sheets-Sheet 7



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3,298,449

## WELL BORE APPARATUS

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and William R. Garrett, Midland, Tex., assignors to  
Drilco Oil Tools, Inc., a corporation of Texas  
Continuation of application Ser. No. 720,284, Mar. 10,  
1958. This application Oct. 24, 1963, Ser. No. 318,747  
92 Claims. (Cl. 175-76)

This invention generally relates to well bore drilling apparatus and more specifically relates to hydraulic apparatus for drilling well bores in predetermined directions.

This application is a continuation of copending application Serial No. 720,284 filed March 10, 1958, entitled, "Well Bore Apparatus," now abandoned.

In present well bore drilling practice, drill collars are attached to the drilling string above the drill bit as a means of supplying weight to the bit and maintaining the well bore in a straight vertical direction. The weight and nearly full gauge of these collars tend to maintain the well bore in vertical direction while being drilled. If it becomes expedient to incline the well bore in some direction other than vertical or return the well bore to the vertical, the drilling string is removed and replaced in the well bore with a whipstock oriented to a direction in which the well bore is to be deflected. The drilling is then continued past the whipstock which deflects the drill bit in the direction desired. If greater deflection is desired, the whipstock must again be set.

In areas where the formation strata slope from the horizontal, the additional weight of the drill collars has to be carefully controlled since the direction of the drill bit is affected by the inclination of the strata when too much weight is applied.

Further details of the art and problems of directional drilling are given in a paper entitled, "Controlled Directional Drilling," appearing in the Petroleum Engineer, October 1957, page B-77.

It is one of the general objects of this invention to provide drilling apparatus responsive to the hydraulic pressure of the drilling muds pumped through the drill string to direct the well bore in a preselected direction and, when desired, to effect the drilling of the well bore in response to the hydraulic pressure of the well fluids without maintaining weight on the drill bit from the drill string.

It is a further object of the invention to provide such apparatus which may be repeatedly used without removal of the drill string.

Briefly described, the apparatus includes a tubular mandrel adapted for connection between a drill string and a drill bit, having a positioning barrel disposed on the mandrel in freely rotative and reciprocative relation. A releasable and reengagable latching means is provided for connection of the mandrel with the barrel to restrain relative movement until the barrel is oriented. Sealing means are disposed within the barrel to define at least one pressureable chamber intermediate the barrel and mandrel. Means is provided to effect transfer of fluid pressure from within the mandrel to the chamber. Cooperative journal and bearing means, preferably resilient, is provided between the barrel and mandrel. The mandrel may be provided with a piston reciprocable within the chamber and be connected to the drill string by means such as a splined connection transmitting rotation from the drill string to the mandrel while allowing axial extension of the mandrel from the drill string in response to movement of the piston to urge the mandrel through the barrel toward the drill bit in response to pressure applied within the chamber. Extendable positioning or deflection members are disposed in the barrel wall at selected spacings around and along the barrel to urge the axis of the barrel toward or from the axis of the well bore in response

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to pressure within the chamber. A remotely removable valve means may be provided within the mandrel to permit fluid flow through the mandrel and to prevent entry of fluid pressure into the chamber while in position and to permit both fluid flow and fluid pressure into the chamber when removed. A pressure relief valve may be provided within the chamber to relieve excessive pressure across the barrel wall in either direction.

The invention will be more fully described and other objects and advantages of the invention will become more apparent from the following specification and claims taken in view of the accompanying drawing wherein:

FIGURE 1 is an elevation of an embodiment of the apparatus as applied; in the drilling of a straight, usually vertical, hole.

FIGURE 2 is an elevation of an embodiment of the apparatus as applied to position the entire drilling apparatus in an eccentric position relative to the well bore to direct the well bore in a path different from that of the hole previously drilled.

FIGURE 3 is an elevation of an alternate embodiment of the apparatus as applied to position the upper end of the drilling apparatus in the center of well bore and the lower end eccentric to the well bore to direct the well bore in a path different from that of the hole previously drilled.

FIGURE 4 is an elevation of a further embodiment of the apparatus as applied to position the upper end of the drilling apparatus eccentric with the well bore in one direction and the lower end eccentric with the well bore in opposed direction to direct the well bore in a path different from that of the hole previously drilled.

FIGURE 5 is a partly sectional elevation of the apparatus in combination with a core bit deflection guide provided to firmly maintain the core bit guide in a desired vertical and azimuthal position relative to the well bore and preferably eccentric thereto for ready access of the core bit into the side wall of the bore.

FIGURES 6A and 6B are partial longitudinal cross-sections of a portion of the apparatus illustrated in FIGURES 1 through 5.

FIGURES 7A, 7B, and 7AB are partial longitudinal cross-sections of a portion of the apparatus suitable for use as illustrated in FIGURES 1 through 4.

FIGURES 8 and 8A are alternate embodiments of a section taken at 8-8 of FIGURE 6A.

FIGURES 9 and 9A are alternate embodiments of a section taken at 9-9 of FIGURE 6A.

FIGURE 10 is an alternate embodiment of a hydraulic positioning member illustrated in partial section in FIGURE 6A.

FIGURE 11 is a section taken at 11-11 of FIGURE 10.

FIGURE 12 is an alternate embodiment of the positioning member illustrated in FIGURE 10.

FIGURE 13 is a section taken at 13-13 of FIGURE 12.

FIGURE 14 is an alternate embodiment of the positioning members illustrated in FIGURES 9 and 9A.

FIGURES 14A and 14B are alternate embodiments of the positioning member of FIGURE 14.

FIGURE 15 is a view of FIGURE 14 taken at 15-15.

## DRILLING APPARATUS

Referring to FIGURE 1 there is disclosed a drilling apparatus 12 in a well bore 10. As shown, apparatus 12 includes a drilling mandrel 14 connected at its lower end to a drill bit 16 and at its upper end to a sub 17 at the lower end of a conventional drilling string (not shown). Slidably and rotatively disposed about mandrel 14 is a positioning barrel 18 adapted for restrained relation, when desired, with the mandrel 14 by means of a

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latch 20. Disposed on the outer periphery of positioning barrel 18 are positioning members 22.

As shown in FIGURE 1, positioning members 22 are symmetrically disposed about the upper and lower ends of positioning barrel 18 in such manner to provide centralized relation of barrel 18 with well bore 10. As provided in FIGURE 1, expansion of positioning members 22 facilitate drilling of a straight well bore.

In FIGURE 2, barrel 18 is deflected within the well bore 10 into an eccentric position abutting the walls or bore 10. As illustrated, positioning members 22 are asymmetrically disposed at the top and bottom of barrel 18. Positioning barrel 18, when eccentrically disposed relative to well bore 10, urges the bit 16 into eccentric relation with the well bore 10 and deflects the path of succeeding well bore into a different direction.

FIGURE 3 illustrates the positioning barrel 18 urged into a central relation with the well bore 10 at its upper end and an eccentric relation with the well bore 10 at its lower end by provision of positioning members 22 symmetrically disposed about its upper end and asymmetrically disposed about its lower end. Deflection barrel 18 thus assumes an angular relation with the axis of the well bore, also tending to urge the bit 16 into drilling succeeding well bore in a curved path of preselected direction.

In FIGURE 4, the deflection barrel 18 is disposed in eccentric relation with well bore 10 at its upper end by provision of asymmetrically disposed positioning members 22 and eccentrically disposed in opposing direction at its lower end by opposite disposition of asymmetrical positioning members 22. Deflection barrel 18, when provided as shown, urges bit 16 to drill succeeding well bore 10 in a curved path of minimum radius.

It is pointed out that the apparatus in well bore 10 as disclosed in FIGURES 2, 3 and 4 are not drawn to scale and that the curvature of the path of the well bore 10 is exaggerated to show the properties of the present apparatus.

In FIGURE 5 the deflection barrel 18 is disposed in the eccentric relation with well bore 10 as previously illustrated in FIGURE 1. In connection with the lower end of barrel 18 is a core bit guide 26 radially disposed relative to barrel 18 to guide a core bit 24, connected to the lower end of mandrel 14, into the side wall of bore 10. Core bit guide 26 is connected to guide core bit 24 in the direction in which barrel 18 is deflected.

#### POSITIONING BARREL

Positioning barrel 18 is illustrated in greater detail in FIGURES 6A and 6B. As shown, the barrel 18 is disposed about the mandrel 14 in both rotative and reciprocative relation when not restrained by the latch 20. A pressureable chamber 28 is provided intermediate mandrel 14 and barrel 18 by fluid sealing means 30 disposed at both ends of the barrel. Each of sealing means 30 includes a packing retaining sleeve 32, containing packing 34, herein exemplified as that of the "chevron" type. A slot and key 31 prevent rotation of sleeve 32 relative to barrel 18. Sleeve 32 is provided in sealed relation with barrel 18 by sealing means such as "O" rings 36. As shown the sealing means 30 may move eccentrically relative to barrel 18 and concurrently maintain sealing relation with mandrel 14. This feature assumes great importance in protecting the packing 34 when the bearings 40 are flexed by lateral forces on barrel 18. A replaceable thrust plate 38 is provided intermediate sealing means 30 and the outer retaining shoulder of barrel 18 to absorb longitudinal thrust and vibration encountered in operation.

Positioning barrel 18 is radially supported in relation to mandrel 14 by means of resilient bearings 40 annularly disposed intermediate the mandrel and barrel at selected longitudinal spacings. As best shown in FIGURE 8, the bearings 40 are of generally annular cross-

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section and present a fluted convolution of surface between the sliding surfaces. FIGURE 8 shows such convolutions to be intermediate bearing 40 and mandrel 14. Alternate FIGURE 8A illustrates journal and bearing means in which the resilient element 40 is carried by the mandrel and the fluted convolutions are between barrel 18 and journal element 40. Either construction may be employed as desired. Furthermore, it is not necessary to use resilient bearings of either of these types, nor even to use bearings that are resilient, although resilient bearings are preferable and its is especially desirable to use resilient bearings of the types shown in FIGURES 8 and 8A. Bearings such as shown permit circulation of fluids intermediate the sliding surfaces and yet provide a firm but resilient bearing surface which will withstand hard usage. Though bearings 40 may be of any resilient material resistant to abrasion, the preferred example herein illustrated is rubber.

#### MANDREL

Fluid passage from the interior of mandrel 14 to the chamber 28 is provided through a port 42 through which drilling mud fluid pressure may be applied. Port 42 is disposed intermediate between sub 17 at the upper end of the mandrel and latch 20 at the lower end thereof so as to communicate with chamber 28 in all relative positions of the mandrel and barrel as the mandrel and barrel are moved axially relative to each other.

#### POSITIONING MEMBERS

The positioning members 22, as shown in FIGURES 1, 2, 3, 4 and 5, are shown in FIGURES 6A and 6B as including a bore wall engaging shoe 44 attached to pressure responsive projection members 46 disposed in the walls of barrel 18. Pressure applied within the chamber 28 may independently act upon each projection member 46 and urge shoe 44 into engagement with the wall of well bore 10. As shown, it is noticed that some of the members 46 may extend further than others to displace shoe 44 into contact without the binding or jamming found with sliding piston type extension members. Projection members 46 will be later described in detail as embodied in various forms of positioning members.

#### CHAMBER OUTLET VALVE

A pressure relief valve may also be provided intermediate to barrel 18 and mandrel 14 to relieve excess fluid pressures from within or outside of chamber 28. As shown, a sleeve 48 having a first and second diameter is disposed within a corresponding first and second internal diameter of the barrel 18. Fluid passage ports 50 are provided through the wall of barrel 18 intermediate the first and second diameter. O ring seals 52 are provided about the valve sleeve at sufficient longitudinal spacing to straddle the ports 50 when the sleeve 48 is at a rest position. Sleeve 48 is maintained at the rest position by provision of coil springs 54 at both ends. Springs 54 are maintained in a prestressed condition by means of retainer rings 56, and movable keeper rings 51. Toward the end of the greater diameter of sleeve 48 past the seal ring 52 is a fluid passage 58. Toward the end of the smaller diameter of sleeve 48 past the seal ring is a fluid passage 60.

When pressure is applied within chamber 28 it is seen that longitudinal thrust will be imparted to the sleeve 48 proportionate to the area difference between the sleeve diameters. Once such thrust overcomes the prestress compression of the spring 54 in support of the smaller diameter of sleeve 48, the sleeve will move downwardly, which is in the direction from the larger diameter portion of the sleeve toward the smaller sleeve diameter. The "O" ring sealing the larger diameter loses sealing relation with ports 50 and allows fluid passage from the chamber 28 through passages 58 and 60 to the exterior of barrel 18. When the excess pressure

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within chamber 28 has subsided, the sleeve returns to the sealed rest position. Pressure outside barrel 18 greater than that within the chamber 28 also acts through the port 50 on the area difference between diameters to urge the sleeve in an opposing direction. Once the spring 54 opposing such movement has been overcome, the smaller sleeve diameter sealing ring loses sealing contact and allows fluid passage from outside the barrel 18 through the ports 50 and 60 to within the chamber 28.

It is seen that the pressure within the chamber 28 may be selected by means of the relief valve to provide a predetermined positioning force at each of the positioning members 22. It is also seen that the hydrostatic head normally found within a fluid filled well bore 10 may enter the chamber 28 as the drilling apparatus 12 is lowered into the well bore without imposing excess pressure differentials across the sealing members 30.

#### CHAMBER INLET VALVE

As shown, the port 42 extends through the wall of the mandrel 14 intermediate beveled shoulders provided by two smaller diameters within the mandrel. A retrievable wire line port closure valve 62, as shown, is adapted to rest in abutment with the mandrel shoulders and provide a seal between the interior of mandrel 14 and chamber 28. Sealing means 64 are provided intermediate each mandrel shoulder and corresponding shoulders of the valve 62. Axial passage is provided through the valve 62 to permit fluid flow through mandrel 14. A grappling spear is provided at the upper extremity of valve 62 to enable an overshot grapple lowered from a wire line to engage the valve for insertion or removal.

It is seen that pressure applied within mandrel 14 will impart a thrust on the valve 62 into a more tightly sealed closed position in response to the sectional area difference between the sealing means 64. Conversely, a pressure applied through the port 42 in response to opening of the sleeve valve 48 to the exterior of barrel 18 will unseat valve 62, allowing fluids to enter the mandrel 14 from chamber 28. With valve 62 positioned as shown, the chamber 28 is sealed off from the pressure in the drill string and operations such as lowering the string into the hole, drilling, and raising the string out of the hole, or any other desired operation can be performed while the deflecting members of the subject apparatus remain retracted and inoperative. When it is desired to operate the subject apparatus the valve 62 can be removed.

#### STRAIGHT HOLE OPERATION

If the apparatus is to be operated as a hydraulic centralizer, as in FIGURE 1, the drill string fluid pressure can be increased so as to extend the positioning members into engagement with the well wall. Since the positioning members are symmetrically disposed about the axis of the well, the drill string will be centralized. A right hand rotation of the drill string will free the latch 20 and drilling can proceed.

When the drilling has proceeded to the limit of the length of mandrel 14, that is, until sub 17 engages the upper end of barrel 18, the bit can be raised and turned to reengage latch 20, the fluid pressure reduced to retract the positioning members, and the apparatus lowered to a new position. A similar procedure is followed when the apparatus is to be withdrawn from the well. These repositioning and removal procedures are equally applicable to the other forms of the apparatus described herein.

In connection with latch 20, it is to be noted that should the positioning barrel lose its grip on the well wall and fall down to the bit, it will not be rotated by the bit due to the shape of the latch members which engage upon left

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hand rotation of the drill string but ride over one another on right hand rotation.

#### DEFLECTION OPERATION

If the apparatus is to be used for guiding the drill bit into a different direction from the axis of the bottom of the hole, either to restore verticality, correct for lateral deviation, or for intentional deviation from a straight or vertical hole into some desired direction, apparatus as shown in FIGURES 2 through 4 may be used. In such case the apparatus will be lowered into the hole with latch 20 engaged and the positioning members retracted, either due to the low pressure in the drill string or by closure use of valve 62. The drill string will be turned until the positioning barrel is in the desired azimuthal position as determined by means of any conventional known or desired indication apparatus. If it is merely desired to return the hole to vertical, such indicating apparatus need only indicate the low side of the hole; if a particular compass direction is desired other surveying equipment such as a non-magnetic pipe joint and a recording compass may be used. With the positioning barrel in the desired position, the fluid pressure in chamber 28 is increased to extend the non-symmetrically disposed positioning members and the barrel is anchored in the well bore in a position to guide the drill bit as desired. The drilling string is rotated to free latch 20 and drilling is commenced.

#### CORING OPERATION

The apparatus of FIGURE 5 is operated in similar fashion to that of FIGURES 2-4, except that it is not usually desired to take a core in any particular direction, so that the initial positioning of the positioning barrel in a particular azimuthal position is unnecessary. However, in case such positioning is desired, or if it is desired to take cores in several different directions around the axis of the hole, then a latch such as 20 or other suitable releasable mechanically or hydraulically operated means should be added to enable the positioning barrel to be held against rotation relative to the drill string so as to be positionable by turning the drill string. Such latching means also may hold the barrel against vertical motion relative to the drill string in order to facilitate placement thereof in the well. It may be added that since the core drilling apparatus of FIGURE 5 incorporates a mechanical bit guide or positioning member 26, the positioning barrel 18 thereof might have symmetrically disposed positioning members, as in FIGURE 1, in which case it would serve solely as an anchor against both vertical and rotational displacement of the mechanical whipstock.

#### TUBING ANCHOR

The apparatus could also be used in similar fashion as a tubing anchor, in which case the tubing could be connected to the barrel, like the whipstock 26 of FIGURE 5, both at the upper and lower ends of the barrel, and the mandrel, seals, and bearings omitted entirely; or the tubing could be connected to the mandrel like the drill string and bit of FIGURES 1-5 and relative axial movement therebetween prevented, e.g. by shoulders, such as those adjacent sub 17 and latch 20, provided on the mandrel both above and below the barrel. In the former case there could be no relative rotation of tubing and anchor whereas such motion would be possible with the latter arrangement.

#### FLUID PRESSURE DRILLING APPARATUS

A further use of the apparatus as an anchor is in connection with fluid pressure means for applying axial thrust to the drill bit. In such case the barrel anchors one part of a piston and cylinder combination means relative to the well. For example the barrel may provide a cylinder anchored in the well and a piston may be connected to the mandrel so that hydraulic pressure applied between piston

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and mandrel causes the bit to press downwardly. Such an arrangement is shown in FIGURES 7A and 7B.

Barrel 18 and mandrel 14 of the apparatus 12 are illustrated in modified form in FIGURES 7A and 7B. First referring to these figures in reference to FIGURES 6A and 6B, it is seen that the latch means 20, the relief sleeve valve 48 and the retrievable port closure valve 62 are, for simplicity in illustration, not again shown as elements. It is to be understood, however, that these elements may be incorporated.

The mandrel 14 of FIGURES 7A and 7B is divided at its upper end into two telescoping portions 14' and 14'' having splined relation. As provided, the upper portion 14' is rotatable within the barrel 18, but longitudinally the extent of movement is limited, the range of longitudinal movement being fixed by complementary shoulders between the mandrel portion 14' and the upper portion of barrel 18. Such shoulders are provided by the upper and lower ends of sleeve 65 on the upper end of the barrel engaging the shoulder provided by the upper face of flange 67 and the shoulder 17A provided by the lower face of sub 17. As in the FIGURE 1 and other previously described embodiments the upper portion 14' is a hollow shaft section connected at its upper end to sub 17 at the lower end of a conventional drill string (not shown). The upper shaft section 14', with the resetting shoulder provided by sub 17, thus provides means for connecting the housing member (case) or barrel 18 to the drill string whereby the barrel can be raised and lowered. The telescopic joint section including key 63A and keyway 63B connects the upper shaft section 14' to the lower shaft section or mandrel portion 14''. Longitudinal upward travel of the lower shaft section 14'' relative to the upper shaft section 14' is limited by shoulder 14A on section 14' which overlies the upper end 14B of lower shaft section 14'' or by engagement of key 63A with shoulder 63C.

A sealing means 30 is again provided between the upper mandrel portion 14' and barrel 18 to provide an upper seal for chamber 28. A lower seal 30 is disposed on an enlarged diameter part of the lower portion 14 to provide a lower seal for chamber 28. The enlarged diameter of mandrel portion 14' serves as a piston 66 within the barrel 18. Shoulders 69A and 69B within barrel 18 limit piston 66 to reciprocation between an upper and lower position. Fluid pressure within chamber 28 urges piston 66 from the upper to the lower position. A port 68 in the wall of barrel 18 provides an exhaust passage from a chamber 70 disposed within barrel 18 below piston 66.

Chamber 28 is in communication with a plurality of positioning members 22, such that pressure exerted within the chamber urges the member 22 into contact with the well bore 10. The deflection members 22 shown in FIGURES 7A and 7B are alternate forms of the members shown in FIGURES 6A and 6B, later described in detail (see especially FIGURES 12 and 13).

Referring to the lower portion of FIGURE 7A and to FIGURE 7B, a separate second chamber, designated as 28', is shown intermediate mandrel portion 14'' and barrel 18. Chamber 28' is in pressureable communication with a second grouping of positioning members 22' and a second piston 66' connected with mandrel portion 14''.

#### FLUID PRESSURE DRILLING OPERATION.

As shown in FIGURES 7A and 7B, fluid pressure through the mandrel 14 is transmitted through the ports 42 into communication with the positioning members 22. Members 22 are then extended outwardly into firm support with the walls of well bore 10 and urge the barrel 18 into positions illustrated in FIGURES 1 to 5.

The fluid pressure within chamber 28 is also exerted against the faces of pistons 66 and urges the mandrel portion 14'' downwardly within the barrel 18. Since the barrel 18 is firmly supported within the well bore 10, such pressure urges the drill bit 16, connected to the

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lower end of mandrel portion 14'' by means of sub 20' into drilling contact with the bottom of the well bore with no weight applied to the mandrel portion 14'' from the above attached drilling string. Mandrel 14 rotates in bearings 40.

When drilling has proceeded to the limit provided by engagement of the piston 66 with shoulder 69B, the fluid pressure can be reduced to retract the positioning members 22 and the apparatus lowered to a new position, in a manner similar to that previously described except that the barrel 18 can be pushed down with shoulder 17A while the bit remains on bottom. Drilling can then be resumed in the manner previously described. This process of drilling and then repositioning the barrel can be repeated until drilling is completed. Then fluid pressure can be reduced and the apparatus withdrawn from the well. In the withdrawal of the apparatus, the lower mandrel portion 14'' is carried out by the shoulder 69B on the barrel 18 engaging beneath piston 66. The barrel itself is carried out by the flange 67 on the upper mandrel portion 14' engaging beneath sleeve 65. Thus, the upward travel of the upper mandrel portion 14' is in this manner limited relative to lower mandrel portion 14'' so that both are removed from the well when the drill string is pulled up.

It is seen that each piston 66 will exert a given push down force on the bit 16 relative to the pressure applied through the mandrel 14. Thus, additional pistons 66 will provide additional multiples of such force. Though only two stages of pistons 66 are herein illustrated, additional stages may be provided when required. For example an additional modular unit such as shown in FIGURES 7A and 7B, duplicating the lower half of FIGURE 7A, previously described, could be inserted between the apparatus of FIGURE 7A and that of FIGURE 7B.

#### POSITIONING MEMBERS—TYPE I

Now referring to FIGURE 9, there is shown one of the pressure responsive projection members 46 forming a portion of the positioning members 22 illustrated in FIGURES 6A and 6B. As shown, projection member 46 is of circular shape adapted for support within a complementary shouldered recess 76 disposed through the wall of barrel 18. Member 46 has a shouldered retainer ring 78 about its outer periphery adapted for longitudinal abutment with the shoulder of recess 76. An extension piston 80, having a smaller outer diameter than the inner diameter of retaining ring 78, is disposed in concentric relation within the retainer ring 78.

In the annular space between the piston 80 and the retainer ring 78 is a resilient extension means 82 attached to the piston and the retainer ring in bonded relation. As an example extension member 82 may be of rubber bonded to the piston and retainer ring by vulcanizing or equivalent means. A fluid seal is provided between retainer ring 78 and recess 76 by a resilient sealing lip 84 which may be formed as a portion of extension member 82, as illustrated. Pressure then applied within the chamber 28 will force retainer ring 78 into sealed abutment with the shoulder of recess 76.

A stud 86 is provided in threaded connection with piston 80 to provide external threaded connection with engaging shoe 44. As illustrated, stud 86 has been threaded into piston 80, then welded. A portion of the hole into which stud 86 is threaded has been counterbored to permit the tensional elasticity of stud 86 to lock shoe 44 into abutment with piston 80.

The projection member 46 of FIGURE 9 is assembled into connection with shoe 44 by inserting member 46 into recess 76 through the interior of the barrel 18 and rotating the entire member into screwed connection with shoe 44. Locked abutment of piston 80 with shoe 44 is effected by the leverage of a wrench inserted into an octagonal recess provided in stud 86.

It is pointed out that for clarity and simplicity of description, corresponding elements of the various em-

bodiments of the positioning members 22, including various types of projection members with and without separate shoes, illustrated in FIGURES 9-15 have been assigned corresponding numbers.

### TYPE II

An alternate form of the positioning member 22, with a projection member 46 adapted for external assembly into the barrel 18, is illustrated in FIGURE 9A. As shown, the retainer ring 78 is externally inserted into abutment with an internal counterbore disposed within the barrel recess 76. A seal is effected between the recess 76 and the ring 78 by provision of an O-ring 88. Retainer ring 78 is retained within recess 76 by means of a snap ring 90. Stud 86 forms a part of shoe 44 and has threaded connection into piston 80.

To assemble the positioning member 22 of FIGURE 9A, the positioning members 46 are threaded onto the studs 86 of the shoe 44 and locked by means of a spanner wrench placed in spanner holes disposed in the rear of the piston 80. The assembled member 22 is then placed into the recesses 76 from the exterior of barrel 18 and latched into place by means of snap rings 90.

In comparing FIGURES 9 and 9A, it is seen that the positioning member is in a retracted position with the extension member 82 at rest in FIGURE 9, and at an extended position with the extension member 82 flexed in FIGURE 9A. Pressure applied from within chamber 28 extends each piston 80 from a position illustrated in FIGURE 9 to that in FIGURE 9A. Upon termination of such pressure, each piston will revert to the position illustrated in FIGURE 9 in response to the resilience of the extension member 82. Also seen is that the previously described bond established between extension member 82 and the complementary surfaces of piston 80 and retainer ring 78 effects a completely fluid tight seal during both extension and retraction.

It is pointed out that the piston 80 need not extend into a position of axial alignment with the retainer ring 78. Since extension member 82 provides like flexibility in any direction of travel of piston 80, it is seen that the shoe 44 may be extended into contact with a well bore wall located at various angles tangent to the wall of barrel 18 and various angles relative to the axis of barrel 18 with equal facility in effecting the forceful contact previously described.

### TYPE III

Another form of the positioning member 22 suitable for use in the apparatus disclosed in FIGURES 6 and 7 is illustrated in FIGURES 10 and 11. As shown in FIGURE 10 and accompanying FIGURE 11, the recess 76 of the barrel 18 is of elongated form, having a major dimension along the axis of the barrel. As was shown in FIGURE 9, an abutment shoulder is disposed about the recess perimeter to support the retainer 78 which conforms to the inner perimeter of recess 76. Extension piston 80 is provided of generally elongated shape and rectangular cross section. The side dimensions of piston 80 are sufficiently less than the inner dimensions of retaining ring 78 to include the resilient extension member 82 in bonded relation therebetween, as previously described. A fluid seal is provided between retainer ring 78 and recess 76 by means of the lip type sealing element 84.

The face of piston 80 of FIGURE 10 is provided with wicker teeth as was shoe 44 in FIGURE 9, thus combining the shoe with the piston and combining projection member 46 into positioning member 22. Positioning member 22 is assembled into barrel 18 by inserting the member 22 through the inner bore of the barrel and into abutment of retainer ring 78 and the shoulder of recess 76. The mandrel 14 is then inserted, preventing withdrawal of the member.

It is pointed out that the member 22 as shown in FIGURES 10 and 11 may be of generally rectangular shape

when viewed from the face of piston 80, or may terminate at its either end in half circle configuration with equal utility.

### TYPE IV

An alternate form of the positioning member 22 of FIGURES 10 and 11 is shown in FIGURES 12 and 13. Though the overall configuration is generally the same, it is seen that the retainer ring 78 abuts with an accommodating shoulder of the recess 76 at the sides only of the recess 76 and not at the ends. Also, the piston 80 is generally U-shaped in cross section. A face complementary to the interior face of retainer ring 78 is also provided bonded to the resilient extension member 82. As shown the resilient material forming extension member 82 may extend across the face of the piston 80 as a continuous film through which the wicker teeth protrude. As shown, the hollowed portion of the piston 80 may also be filled with such resilient material, if desired. Retainer 78 is sealed in respect to the barrel recess 76 by means of the lip type seal 84 as before.

As with FIGURES 10 and 11, the positioning member 22 of FIGURES 12 and 13 may be generally rectangular in shape, as viewed from the face of piston 80, or may terminate at either end in semi-circular shape. Furthermore, in the embodiment of FIGURES 12 and 13, the same as with the embodiment of FIGURES 10 and 11, the resilient material, e.g. rubber, forming the extension member, extends into the space between the retainer 78 and recess 76, so that retainer 78 need not be machined to fit closely within recess 76, the molded resilient material filling the gap instead. A further saving in machining cost is effected in the embodiment of FIGURES 12 and 13, by eliminating the shoulder at the ends of recess 76 although this provides somewhat less support for retainer 78.

The member 22 of FIGURE 12 is assembled as is the member of FIGURE 10.

It is pointed out that the member 22 of either FIGURE 10 or 12, when extended by pressure within the chamber 28, may extend further at one end than at the other into contact with an adjacent well bore wall, or may longitudinally pivot into contact with a well bore wall if the barrel 18 is eccentric within the bore. In either event, or combination of such events, member 22 will function with equal utility. Further pointed out is that any of the disclosed forms of member 22 may repeatedly extend and retract without metallic frictional contact, a factor of great importance when operating in abrasive drilling muds.

### TYPE V

For conditions requiring a small area of gripping contact within a bore a further form of the pressure responsive projection member 46 is illustrated in FIGURES 14 and 15. As shown, piston 80 terminates at its face in a circular gripping wicker. The retainer ring 78 extends outwardly through the shouldered recess 76 and is latched against return by a snap ring 90. A face view of the extension member 46 is shown in FIGURE 15. As with the previous forms described, piston 80 may extend from the barrel 18 in directions other than normal with the axis of recess 76 and engage the surrounding bore wall with equal utility.

### TYPES VI and VII

FIGURE 14A illustrates a further form of projection member 46. As shown piston 80 and the interior of retainer ring 78 are of complementary tapered rather than cylindrical form. When so provided, extension of piston 80 imparts compressional stress in member 82, permitting greater pressure application within the barrel. FIGURE 14B illustrates a further form of projection member 46 wherein a plurality of extension members 82, indicated at 82 and 82', are bonded to an intermediate support ring 81. When provided as shown additional

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extension of piston 80 may be had without loss of strength to the extension member.

It is pointed out that, in construction, the retainer ring 78 could be dispensed with and the resilient extension member 82 could be bonded directly to the walls of the barrel recess 76. Such construction would have equal utility in each individual installation made. However, as shown by reference to FIGURES 1-5, the positioning members 22 need to be disposed on the barrel 18 at different positions for different requirements of the drilling apparatus 12. Thus, ready removal and installation of the members is required to effect the greatest utility of the tool. The members are therefore provided to be installed or removed as is required. The recesses 78 of the barrel 18 not housing positioning members 22 are then closed off by means of blank seal covers (not shown) similar in exterior configuration to the retainers 78. As with positioning members 22, such covers are also adapted for ready installation or removal.

It is also pointed out that the apparatus 12 of the present invention is flexible and easily adapted for varied requirements. It is seen that the various elements herein illustrated and described each perform a cooperative function in combination with the apparatus 12 which may be formed as required by those skilled in the art.

It is therefore obvious that such changes may be made in the construction and arrangement of the present apparatus without departing from the real spirit and purpose of the invention as defined in the appended claims.

That being claimed is:

1. Well bore apparatus comprising drill bit drive means including a tubular mandrel provided with means for connection to a drill bit at one end and a drill string at the other to provide fluid communication from the drill string to the drill bit, drill bit guide means including a barrel shorter than said mandrel disposed about the mandrel, said drill bit drive and guide means including cooperative journal and bearing means providing for free rotational and axial motion of the mandrel relative to the barrel throughout the length of the mandrel between a position with the barrel adjacent said bit connection means and a position with the barrel adjacent said drill stem connection means, sealing means defining a pressure chamber intermediate said barrel and mandrel, means for transmitting pressure from said mandrel to said pressure chamber in all positions of said mandrel relative to said barrel, said sealing means being spaced apart at opposite sides of said pressure transmitting means, means extendable from the barrel in response to fluid pressure in said pressure chamber to engage a well wall and hold said barrel in desired position relative thereto while said mandrel moves axially there-through from one position to another, piston means connected to the mandrel and extending radially from the mandrel to the barrel and disposed in said pressure chamber between said sealing means for moving the mandrel axially relative to the barrel in response to fluid pressure in said pressure chamber.
2. The combination of claim 1 with means for connecting the mandrel to a drill string to transfer fluid therebetween and transfer rotational motion from one to the other while allowing axial relative motion therebetween.
3. The combination of claim 1 wherein the means extendable from the barrel to engage a well wall includes a resilient extension member disposed in bonded relation to the internal wall of an opening through the barrel wall, an extendable member having a wall of smaller dimension and similar configuration to said opening disposed within the opening in bonded relation with the extension mem-

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ber to present the extendable member wall to the opening wall at substantially equal spacing, the extendable member being adapted to extend from the barrel to the walls of a well bore upon pressure application from within the barrel and to withdraw to the barrel upon release of pressure in response to the resilience of the extension member.

4. The apparatus of claim 3 wherein the resilient extension member is bonded to the inner walls of a hollow retainer member having inner and outer walls conforming to the perimeter of the opening and supported within the opening in fluid sealed relation.

5. An apparatus as defined in claim 1 including releasable and reengageable means to connect said barrel to said mandrel in a single predetermined relative azimuthal position for driving said barrel azimuthally with said mandrel.

6. An apparatus as defined in claim 1 including releasable and reengageable means for holding said barrel on said mandrel against relative longitudinal movement while said barrel is in a position adjacent said bit connection means.

7. Well bore apparatus comprising, a tubular mandrel adapted for connection to a drill bit at one end and a drill string at the other to provide fluid communication from the drill string to the drill bit, a barrel disposed about the mandrel being in freely rotative and reciprocative relation, a releasable latching means between the mandrel and barrel restraining the barrel from movement relative to the mandrel until released, radially floating sealing means within the barrel defining a plurality of pressureable chambers intermediate the barrel and mandrel, pressure transfer means providing transfer of fluid pressure from within the mandrel to the chambers, journal and bearing means within the barrel including a resilient element presenting a fluted rotational support surface between the barrel and mandrel, a piston connected to the mandrel within each chamber urging the mandrel through the barrel toward the drill bit in response to pressure applied within the chamber, a splined connection providing rotation transfer from the drill string to the mandrel and axial extension of the mandrel from the drill string in response to movement of the pistons, and means including a plurality of extendable deflection members disposed in the barrel wall at selected spacings around and along the barrel in pressure communication with the chambers urging the axis of the barrel laterally relative to the axis of a well bore into position determined by the member spacings in response to pressure applied within the chamber.

8. The apparatus of claim 7 wherein the extendable positioning member includes a resilient extension member disposed in bonded relation to the internal wall of an opening through the barrel wall, an extendable member having a wall of smaller dimension and similar configuration to said opening disposed within the opening in bonded relation with the extension member to present the extendable member wall to the opening wall at substantially equal spacing, the extendable member being adapted to extend from the barrel to the walls of a well bore upon pressure application from within the barrel and to withdraw to the barrel upon release of pressure in response to the resilience of the extension member.

9. The apparatus of claim 8 wherein the resilient extension member is bonded to the inner walls of a hollow retainer member having inner and outer walls conforming to the perimeter of the opening and supported within the opening in fluid sealed relation.

10. The apparatus defined in claim 9 including a remotely removable valve means within the mandrel permitting fluid flow through the mandrel and preventing fluid pressure transfer to the chamber while in the mandrel and permitting fluid flow through the mandrel and fluid transfer into the chamber when removed.

11. The apparatus of claim 10 including a valve sleeve having two portions of unequal external diameter dis-

posed within the barrel chamber in reciprocative relation across a port defined at the juncture of two portions of the barrel of unequal internal diameter, prestressed resilient supporting means at each end of the sleeve to axially support the sleeve at a balanced position across the port, fluid sealing means axially spaced on each side of the port between the larger of said unequal diameter portions of the sleeve and the barrel and between the smaller of said unequal diameter portions of said sleeve and barrel effecting a closure of the port upon the sleeve being at the balanced position, fluid passage means through the sleeve wall spaced past the sealing means at each end of the sleeve permitting fluid passage between the interior and exterior of the barrel upon the sleeve being axially displaced from the balanced position.

12. Well bore directing apparatus including a hollow mandrel provided with means for connection to a drill bit at one end and a drill string at the other, a directing barrel shorter than said mandrel rotatably disposed about said mandrel and moveable longitudinally thereon from a position in which said barrel is adjacent said bit connection means to a position in which said barrel is adjacent said drill string connection means through a range of positions therebetween, a releasable latching means restraining the barrel from movement relative to the mandrel until released, radially floating sealing means defining a pressureable chamber intermediate the barrel and mandrel, means to transfer fluid pressure from the interior of the mandrel into the chamber, said sealing means being spaced apart longitudinally on opposite sides of said pressure transmitting means in all relative positions of said mandrel and barrel, resilient bearings of annular cross-section presenting a bearing surface between the barrel and mandrel, and means including a plurality of radially extendable positioning members disposed in the barrel wall in pressure communication with the chamber to urge the barrel into desired relation with the well bore when pressure is applied into the chamber from inside the mandrel.

13. Well bore directing apparatus including a hollow mandrel provided with means for connection to a drill bit at one end and a drill string at the other, a directing barrel shorter than said mandrel rotatably disposed about said mandrel and moveable longitudinally thereon from a position in which said barrel is adjacent said bit connection means to a position in which said barrel is adjacent said drill string connection means through a range of positions therebetween, a releasable latching means restraining the barrel from movement relative to the mandrel until released, sealing means defining a pressureable chamber intermediate the barrel and mandrel, means to transfer fluid pressure from the interior of the mandrel into the chamber, said sealing means being spaced apart longitudinally on opposite sides of said pressure transmitting means in all relative positions of said mandrel and barrel, journal and bearing means between the barrel and mandrel to support same for relative rotation, and means including radially extendable positioning members disposed in the barrel wall at preselected spacings on the barrel in pressure communication with the chamber to urge the barrel into desired relation with the well bore when pressure is applied into the chamber from inside the mandrel, the uppermost members being symmetrically circumferentially disposed and the lowermost members being asymmetrically circumferentially disposed.

14. The apparatus of claim 13 including a valve sleeve having two portions of unequal external diameter disposed within the barrel chamber in reciprocative relation across a port defined at the juncture of two portions of the barrel of unequal internal diameter, prestressed resilient supporting means at each end of the sleeve to axially support the sleeve at a balanced position across the port, fluid sealing means axially spaced on each side of the port between the larger of said unequal diameter portions of the sleeve and the barrel and be-

tween the smaller of said unequal diameter portions of said sleeve and barrel effecting a closure of the port upon the sleeve being at the balanced position, fluid passage means through the sleeve wall spaced past the sealing means at each end of the sleeve permitting fluid passage between the interior and exterior of the barrel upon the sleeve being axially displaced from the balanced position in response to a pressure applied across the annular area between the diameters.

15. The apparatus defined in claim 13 including a remotely removeable valve means within the mandrel permitting fluid flow through the mandrel and preventing fluid pressure transfer to the chamber while in the mandrel and permitting fluid flow through the mandrel and fluid transfer into the chamber when removed.

16. The apparatus of claim 13 wherein each of the extendable positioning members includes a resilient extension member disposed in bonded relation to the internal wall of an opening through the barrel wall, an extendable member having a wall of smaller dimension and similar configuration to said opening disposed within the opening in bonded relation with the extension member to present the extendable member wall to said opening wall at substantially equal spacing. The extendable member being adapted to extend from the barrel to the walls of a well bore upon pressure application from within the barrel and to withdraw to the barrel upon release of pressure within said barrel in response to the resilience of the extension member.

17. The apparatus of claim 16 including a hollow retainer member having inner and outer walls conforming in shape to the perimeter of the opening supported within the opening in fluid sealed relation, and wherein the resilient extension member is bonded to the inner wall of said hollow member.

18. Well bore directing apparatus including, a hollow mandrel provided with means for connection to a drill bit at one end and a drill string at the other, a positioning barrel shorter than said mandrel rotatably disposed about said mandrel and moveable longitudinally thereon from a position in which said barrel is adjacent said bit connection means to a position in which said barrel is adjacent said drill string connection means through a range of positions therebetween, said barrel having a core bit guide on the lower end thereof, a releasable latching means restraining the barrel from movement relative to the mandrel until released, sealing means defining a pressureable chamber intermediate the barrel and mandrel, means to transfer fluid pressure from the interior of the mandrel into the chamber, said sealing means being spaced apart longitudinally on opposite sides of said pressure transmitting means in all relative positions of said mandrel and barrel, journal and bearing means between the barrel and mandrel, to support same for relative rotation, and means including radially extendable positioning members disposed in the barrel wall at longitudinal and circumferential spacings on the barrel in pressure communication with the chamber to urge the barrel into desired relation with the well bore when pressure is applied into the chamber from inside the mandrel.

19. Well bore directing apparatus including, a hollow mandrel provided with means for connection to a core bit at one end and a drill string at the other, a directing barrel shorter than said mandrel rotatably disposed about said mandrel and moveable longitudinally thereon from a position in which said barrel is adjacent said bit connection means to a position in which said barrel is adjacent said drill string connection means through a range of positions therebetween and having a core bit guide on the lower end thereof, sealing means defining a pressureable chamber intermediate the barrel and mandrel, means to transfer fluid pressure from the interior of the mandrel into the chamber, said sealing means being spaced apart longitudinally on opposite sides of

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said pressure transmitting means in all relative positions of said mandrel and barrel, journal and bearing means between the barrel and mandrel to support same for relative rotation, and means including radially extendable positioning members disposed in the barrel wall at aligned longitudinal and symmetrical circumferential spacings on the barrel opposite the direction which the core bit is guided and in pressure communication with the chamber to urge the barrel into eccentric relation against the wall of the bore when pressure is applied into the chamber from inside the mandrel.

20. Well bore directing apparatus including, a hollow mandrel provided with means for connection to a drill bit at one end and a drill string at the other, a directing barrel shorter than said mandrel rotatably disposed about said mandrel and moveable longitudinally thereon from a position in which said barrel is adjacent said bit connection means to a position in which said barrel is adjacent said drill string connection means through a range of positions therebetween, a releasable latching means restraining the barrel from movement longitudinally relative to the mandrel until released, said releasable latching means including a first latch on the mandrel adjacent said bit connection means and a second latch on the directing barrel engageable with the first latch when the barrel is adjacent said bit connection means, said latches being engageable by rotation of the mandrel relative to the barrel in one direction, when the barrel is adjacent said bit connection means, and releasable by rotation of the barrel in the opposite direction, said latches when fully engaged preventing further relative rotation of said mandrel relative to said barrel in said one direction and in addition preventing relative longitudinal motion of said barrel and mandrel, sealing means defining a pressurable chamber intermediate the barrel and mandrel, means to transfer fluid pressure from the interior of the mandrel into the chamber, said sealing means being spaced apart longitudinally on opposite sides of said pressure transmitting means in all relative positions of said mandrel and barrel, journal and bearing means including a resilient element of annular cross-section presenting a rotational support surface between the barrel and mandrel, and means including a plurality of radially extendable positioning members disposed in the barrel wall at longitudinal and circumferential spacings on the barrel in pressure communication with the chamber to urge the axis of the barrel laterally relative to the axis of the well bore into a position determined by the member spacing when pressure is applied into the chamber from inside the mandrel, and piston means connected to the mandrel and extending radially from the mandrel to the barrel and disposed in said pressure chamber between said sealing means for moving the mandrel axially relative to the barrel in response to fluid pressure in said pressure chamber.

21. In well drilling directing apparatus including a tubular mandrel adapted for connection to a drill bit at one end and a drill string at the other to provide fluid communication from the drill string to the drill bit, a barrel disposed about the mandrel being in freely rotative and reciprocative relation, sealing means within the barrel defining a pressurable chamber intermediate the barrel and mandrel, pressure transfer means providing transfer of fluid pressure from within the mandrel to the chamber, said barrel having an opening through the wall of the barrel, an extendable positioning member disposed in the opening, including, a hollow rigid metal retainer member having inner and outer walls substantially conforming in shape to the perimeter of the opening supported within the opening in fluid sealed relation, a resilient extension member disposed in bonded relation to the perimeter of the inner wall of the retainer member, an extendable rigid metal member having a wall of smaller dimension and similar configuration to the retainer member disposed within the retainer member in bonded relation to the extension member to present the perimeter of the extendable

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member wall to the perimeter of the retainer member inner wall at substantially equal spacing, said extension member being adapted to flex and permit said extendable member to extend from the barrel to the walls of a well bore when pressure is applied within the barrel and to withdraw to the barrel when the pressure is released within the barrel.

22. The combination of claim 21 in which the resilient extension member extends behind the extendable member and closes over the inner end of the extendable member.

23. The combination of claim 21 in which the resilient extension member extends behind the retainer member into contact with the wall of the barrel opening and terminates in a lip sealing element sealing with said barrel.

24. The combination of claim 23 in which the resilient extension member extends behind the extendable member and closes over the inner end of the extendable member.

25. In well drilling directing apparatus including a tubular mandrel adapted for connection to a drill bit at one end and a drill string at the other to provide fluid communication from the drill string to the drill bit, a barrel disposed about the mandrel being in freely rotative and reciprocative relation, sealing means within the barrel defining a pressurable chamber intermediate the barrel and mandrel, pressure transfer means providing transfer of fluid pressure from within the mandrel to the chamber, said barrel defining openings through the wall of the barrel along the axis of the barrel, an extendable positioning member disposed in each opening, including, a hollow retainer member having inner and outer walls substantially conforming in shape to the perimeter of the opening supported within the opening in fluid sealed relation, a resilient extension member disposed in bonded relation to the perimeter of the inner wall of the retainer member, an extendable member having a wall of smaller dimension and similar configuration to the retainer member disposed within the retainer member in bonded relation to said extension member to present the perimeter of the extendable member wall to the perimeter of the retainer member inner wall at substantially equal spacing and a rigid extension shoe connected to each of the extendable members, each of the extension members being adapted to flex and permit said extendable members to extend the shoe from the barrel to the walls of a well bore when pressure is applied within the barrel and to withdraw the shoe to the barrel when the pressure is released within the barrel.

26. In well drilling directing apparatus including a tubular mandrel adapted for connection to a drill bit at one end and a drill string at the other to provide fluid communication from the drill string to the drill bit, a barrel disposed about the mandrel being in freely rotative and reciprocative relation, sealing means within the barrel defining a pressurable chamber intermediate the barrel and mandrel, pressure transfer means providing transfer of fluid pressure from within the mandrel to the chamber, said barrel having an opening through the wall of said barrel, an extendable positioning member disposed in the opening, including, an annular rigid metal retainer ring having concentric inner and outer walls and disposed within the opening in fluid sealed relation and in abutment with a counterbored shoulder facing into the barrel, a resilient extension member disposed in bonded relation to the inner wall of the retainer ring, an extendable rigid metal piston having a wall of smaller diameter than the inside diameter of the retainer ring concentrically disposed within the retainer ring in bonded relation to the extension member, the extension member being adapted to flex and permit the extendable piston to extend from the barrel to the walls of a well bore when pressure is applied within the barrel and to withdraw to the barrel when the pressure is released within the barrel.

27. In well drilling directing apparatus including a tubular mandrel adapted for connection to a drill bit at one end and a drill string at the other to provide fluid

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communication from the drill string to the drill bit, a barrel disposed about the mandrel being in freely rotative and reciprocative relation, sealing means within the barrel defining a pressurable chamber intermediate the barrel and mandrel, pressure transfer means providing transfer of fluid pressure from within the mandrel to the chamber, said barrel having an opening through the wall of said barrel, an extendable positioning member disposed in the opening, including, an annular rigid metal retainer ring having concentric inner and outer walls and disposed within the opening in fluid sealed relation, a snap ring latching said retainer ring in position, a resilient extension member disposed in bonded relation to the inner wall of the retainer ring, an extendable rigid metal piston having a smaller diameter than the inside diameter of the retainer ring concentrically disposed within the retainer ring in bonded relation to said extension member, the extension member being adapted to flex and permit the extendable piston to extend from the barrel to the walls of a well bore when pressure is applied within the barrel and to withdraw to the barrel when the pressure is released within the barrel.

28. In well drilling directing apparatus including a tubular mandrel adapted for connection to a drill bit at one end and a drill string at the other to provide fluid communication from the drill string to the drill bit, a barrel disposed about the mandrel being in freely rotative and reciprocative relation, sealing means within the barrel defining a pressurable chamber intermediate the barrel and mandrel, pressure transfer means providing transfer of fluid pressure from within the mandrel to the chamber, said barrel having an elongated opening along and through the wall of said barrel, an elongated extendable positioning member disposed in the opening, including, an elongated hollow rigid metal retainer member having inner and outer walls substantially conforming to the perimeter of the opening supported in abutment with an inward facing shoulder within the opening in fluid sealed relation, a resilient extension member disposed in bonded relation to the perimeter of the inner wall of the retainer member, an extendable rigid metal member having a wall of smaller dimension and similar configuration to the retainer member disposed within the retainer member in bonded relation to said extension member to present the perimeter of the extendable member wall to the perimeter of the retainer member inner wall at substantially equal spacing, the extension member being adapted to flex and permit said extendable member to extend from the barrel to the walls of a well bore when pressure is applied within the barrel and to withdraw to the barrel when the pressure is released within the barrel.

29. In well drilling directing apparatus including a tubular mandrel adapted for connection to a drill bit at one end and a drill string at the other to provide fluid communication from the drill string to the drill bit, a barrel disposed about the mandrel being in freely rotative and reciprocative relation, sealing means within the barrel defining a pressurable chamber intermediate the barrel and mandrel, pressure transfer means providing transfer of fluid pressure from within the mandrel to the chamber, said barrel having an elongated opening along and through the wall of said barrel, an elongated extendable positioning member disposed in the opening, including an elongated hollow rigid metal retainer member having inner and outer walls substantially conforming to the perimeter of the opening supported in abutment with an inward facing shoulder within the opening in fluid sealed relation, a resilient extension member disposed in bonded relation, to the perimeter of the inner wall of the retainer member, an extendable rigid metal member having a thin wall of smaller dimension and similar configuration to the retainer member disposed within the retainer member in bonded relation to said extension member to present the perimeter of the extendable member wall to

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the perimeter of the retainer member inner wall at substantially equal spacing, the extension member being adapted to flex and permit a face of said extendable member to extend from the barrel to the walls of a well bore when pressure is applied within the barrel and to withdraw to the barrel when the pressure is released within the barrel.

30. In well bore apparatus including a tubular mandrel adapted for connection to a drill bit at one end and a drill string at the other to provide fluid communication from the drill string to the drill bit, a barrel disposed about the mandrel being in freely rotative and reciprocative relation, sealing means within the barrel defining a pressurable chamber intermediate the barrel and mandrel, pressure transfer means providing transfer of fluid pressure from within the mandrel to the chamber, said barrel having an opening disposed through the barrel wall, an extendable positioning member disposed in said opening, including, an annular rigid metal retainer ring having inner and outer walls and disposed within said opening in fluid sealed relation a resilient extension member disposed in bonded relation to the inner wall of the retainer ring, an extendable rigid metal piston inside said resilient member and bonded thereto, the adjacent surfaces of said piston and resilient member and the adjacent surfaces of said ring and resilient members flaring inwardly, the resilient member being adapted to flex and permit the extendable piston to extend from the barrel to the walls of a well bore when pressure is applied within the barrel and to withdraw to the barrel when the pressure is released from the barrel.

31. In well bore apparatus including a tubular mandrel adapted for connection to a drill bit at one end and a drill string at the other to provide fluid communication from the drill string to the drill bit, a barrel disposed about the mandrel being in freely rotative and reciprocative relation, sealing means within the barrel defining a pressurable chamber intermediate the barrel and mandrel, pressure transfer means providing transfer of fluid pressure from within the mandrel to the chamber, said barrel having an opening disposed through the barrel wall, a plurality of generally tubular resilient extension members coaxially disposed one inside the other, the outermost one of said members being disposed in bonded relation at its outer periphery to the internal wall of the opening, a rigid metal support member bonded between each adjacent pair of said extension members, an extendable rigid metal member having a wall of smaller dimension and similar configuration to said opening disposed within the opening in bonded relation with the inner periphery of the innermost one of the extension members, to present the extendable member wall to the opening wall at substantially equal spacing the extendable member being adapted to extend from the barrel to the walls of a well bore upon pressure application from within the barrel and to withdraw to the barrel upon release of the pressure in response to the resilience of the extension members.

32. In well drilling directing apparatus including a tubular mandrel adapted for connection to a drill bit at one end and a drill string at the other to provide fluid communication from the drill string to the drill bit, a barrel disposed about the mandrel being in freely rotative and reciprocative relation, sealing means within the barrel defining a pressurable chamber intermediate the barrel and mandrel, pressure transfer means providing transfer of fluid pressure from within the mandrel to the chamber, said barrel having a bore through the wall of said barrel, an extendable positioning member disposed in the opening, including an annular rigid metal retainer ring having inner and outer walls disposed within the opening in fluid sealed relation, a resilient extension member disposed in bonded relation to the inner wall of the retainer ring, an extendable rigid metal piston having a smaller diameter than the inside diameter of the retainer ring disposed within the retainer ring in bonded relation

to said extension member, the outer face of the piston being provided with gripping teeth, the extension member being adapted to flex and permit the teeth of said extendable member to extend from the barrel to the wall of a well bore when pressure is applied within the barrel and to withdraw to the barrel when the pressure is released within the barrel.

33. In well bore apparatus including a tubular mandrel adapted for connection to a drill bit at one end and a drill string at the other to provide fluid communication from the drill string to the drill bit, a barrel disposed about the mandrel being in freely rotative and reciprocative relation, sealing means within the barrel defining a pressurizable chamber intermediate the barrel and mandrel, pressure transfer means providing transfer of fluid pressure from within the mandrel to the chamber, said barrel having an opening disposed through the barrel wall, an apertured retainer member disposed in said opening, a resilient extension member disposed in bonded relation to the internal wall of said retainer member, an extendable member having a wall of smaller dimension and similar configuration to said aperture disposed within the aperture in bonded relation with the extension member to present the extendable member wall to the aperture wall at substantially equal spacing, said resilient extension member having a portion extending outwardly from said extendable member over said retainer member into lip sealing engagement with said barrel around said opening, the extendable member being adapted to extend from the barrel to the walls of a well bore upon pressure application from within the barrel and to withdraw to the barrel upon release of the pressure in response to the resilience of the extension member.

34. An apparatus for forcing a bit against the bottom of a borehole comprising: an upper hollow shaft section; a lower hollow shaft section; a telescoping joint section connecting said upper shaft section and said lower shaft section in a longitudinally slidable and non-rotatable relationship; a housing member rotatably mounted around said upper shaft section and extending around said lower shaft section in a longitudinally slidable and rotatable relationship therewith; pushdown means positioned between said lower shaft section and said housing operable to exert a force on said lower shaft section longitudinally thereof in the direction of said bit and to exert the reaction thrust of such force on said housing member; means to transfer the force on said lower shaft section to said bit; anchor means attached to said outer housing and of a character to transfer the reaction thrust to the borehole wall.

35. Combination according to claim 34 including clutch means on said housing and lower shaft section positively engageable by predetermined motion of said lower shaft section relative to said housing when said anchor means is operative to transfer reaction thrust to the borehole wall and engageable in but a single relative azimuthal position of housing and lower shaft section to prevent rotation of the housing and lower shaft section in one direction whereby said housing can be turned with said mandrel into a desired selected azimuthal position, and latching means releasable and engageable whenever desired by a predetermined motion of the lower shaft section relative to the housing to hold the housing in its lowermost position relative to the lower shaft section.

36. In a rotary drilling apparatus for drilling a borehole which includes a drill string and a bit, the improvement which comprises: a hollow telescoping shaft having an upper section and a lower section and adapted to be connected at its upper end of its upper section to said drill string and at its lower end of its lower section to said bit, said shaft being further adapted to transmit fluid and torque from said drill string to said bit, an upwardly facing shoulder on said upper section of the hollow shaft; a case rotatably mounted on said upper shaft section and extending around said lower shaft section in a longitu-

dinally slidable and rotatable relationship therewith, said case having a downwardly facing shoulder on its upper end adapted to engage the upwardly facing shoulder of said upper section; wall anchor means mounted on said case and operable to anchor said case to the wall of the borehole; pushdown means positioned between the lower section of said shaft and said case operable to exert a force on said shaft longitudinally thereof in the direction of said bit and to exert the reaction thrust of such force on said case; and a resetting shoulder member on said upper shaft section having a downwardly facing face adapted to contact the upper end of said case.

37. An apparatus as defined in claim 36 in which the longitudinal movement of said lower section on the shaft and said case with respect to each other is limited in each longitudinal direction, and said lower section of said shaft is connected to said bit by a sub longitudinally spaced from the lower end of said case.

38. In a rotary drilling system for drilling a borehole, including a drill string and a bit, the improvement which comprises: a hollow telescoping shaft member connected at its upper end to said drill string and at its lower end to said bit and adapted to convey fluid therebetween, said telescoping shaft including an upper section and a lower section which have a non-rotatable relation with respect to each other, the exterior surface of said lower section defining a piston; a case surrounding said telescoping shaft in a rotatable relationship with the upper section thereof and in rotatable and longitudinally slidable relationship with the lower section thereof and defining a cylinder for said piston; port means in said lower section of said shaft to provide fluid communication between the interior of said shaft and said cylinder above said piston; second port means in said case to provide fluid communication between the cylinder below said piston and the exterior of said case; wall anchor means mounted on said case and operable to anchor said case to the wall of the borehole; means to limit in each direction the longitudinal movement of said case and said lower section of the hollow shaft with respect to each other; and a resetting shoulder mounted about the upper end of said upper section of the shaft and adapted to contact said case on downward movement of said upper section with respect to said case.

39. An apparatus for forcing a bit against the bottom of a borehole comprising an inner telescoping shaft comprising an upper section and a lower section and whose longitudinal movement with respect to each other is limited with respect to downward travel of the upper section relative to the lower section, the lower end of said lower section of the shaft being attachable at its lower end to said bit; an outer case rotatably mounted on said upper shaft section and surrounding said lower shaft section in a longitudinally slidable and rotatable relationship therewith; plural pushdown means longitudinally spaced and positioned between the lower section of said shaft and said case for exerting a force on said lower section of said shaft longitudinally thereof in the direction of said bit with respect to said case; plural anchor means located in said outer case spaced longitudinally and each associated with one of said pushdown means and of a character to transfer reaction thrust of the force exerted on the bit to the borehole wall; and a resetting shoulder mounted about said upper section of the shaft exterior of said case and arranged to contact the upper exterior end of said case upon relative movement between said upper section of said shaft and said housing.

40. An apparatus as defined in claim 39 in which each pushdown means includes piston means on the lower shaft section moving in cylinder means provided by the case, sealing means between the case and lower shaft section above the piston means, port means in the lower shaft section above the piston means, and a stop carried by the case between the piston means and the sealing means.

41. An apparatus for forcing a bit against the bottom of a borehole comprising: an upper hollow shaft section; a lower hollow shaft section; a telescoping joint section connecting said upper shaft section and said lower shaft section in a longitudinally slidable and non-rotatable relationship, the longitudinal movement of said upper shaft and said lower shaft relative to each other being limited in each direction longitudinally; a housing member mounted around said upper shaft and said lower shaft in a longitudinally slidable and rotatable relationship therewith; pushdown means positioned between said lower shaft section and said housing operable to exert a force on said lower shaft section longitudinally thereof in the direction of said bit and to exert the reaction thrust of such force on said housing member; means to transfer the force on said lower shaft section to said bit; anchor means attached to said outer housing and of a character to transfer the reaction thrust to the borehole wall.

42. In a rotary drilling apparatus for drilling a borehole which includes a drill string and a bit, the improvement which comprises: a hollow telescoping shaft having an upper section and a lower section and adapted to be connected at its upper end of its upper section to said drill string and at its lower end of its lower section to said bit, said shaft being further adapted to transmit fluid and torque from said drill string to said bit, the telescoping movement of each section of the shaft with respect to the other being limited in each longitudinal direction; an upwardly facing shoulder on said upper section of the hollow shaft; a case mounted around said shaft in a longitudinally slidable and rotatable relationship therewith, said case having a downwardly facing shoulder on its upper end adapted to engage the upwardly facing shoulder of said upper section; wall anchor means mounted on said case and operable to anchor said case to the wall of the borehole; pushdown means positioned between the lower section of said shaft and said case operable to exert a force on said shaft longitudinally thereof in the direction of said bit and to exert the reaction thrust of such force on said case; and a resetting shoulder member on said upper shaft section having a downwardly facing face adapted to contact the upper end of said housing.

43. In a rotary drilling system for drilling a borehole, including a drill string and a bit, the improvement which comprises: a hollow telescoping shaft member connected at its upper end to said drill string and at its lower end to said bit and adapted to convey fluid therebetween, said telescoping shaft including an upper section and a lower section which have a non-rotatable relation with respect to each other, the exterior surface of said lower section defining a piston; a case surrounding said telescoping shaft in a rotatable and longitudinally slidable relationship therewith and defining a cylinder for said piston; port means in said lower section of said shaft to provide fluid communication between the interior of said shaft and said cylinder above said piston; second port means in said case to provide fluid communication between the cylinder below said piston and the exterior of said case; wall anchor means mounted on said case and operable to anchor said case to the wall of the borehole; means to limit in each direction the longitudinal movement of said upper section and said lower section of the hollow shaft with respect to each other; and a resetting shoulder mounted about the upper end of said upper section of the shaft and adapted to contact said case on downward movement of said upper section with respect to said case.

44. An apparatus for forcing a bit against the bottom of a borehole comprising an inner telescoping shaft comprising an upper section and a lower section and whose longitudinal movement with respect to each other is limited in each longitudinal direction, the lower end of said lower section of the shaft being attachable at its lower end to said bit; an outer case surrounding said shaft in a

longitudinally slidable and rotatable relationship therewith; pushdown means positioned between the lower section of said shaft and said case for exerting a force on said lower section of said shaft longitudinally thereof in the direction of said bit with respect to said case; anchor means located in said outer case spaced longitudinally below said pushdown means and of a character to transfer reaction thrust of the force exerted on the bit to the borehole wall; and a resetting shoulder mounted about said upper section of the shaft exterior of said case and arranged to contact the upper exterior end of said case upon relative movement between said upper section in said shaft and said housing.

45. Well bore directing apparatus including a hollow mandrel provided with means for connection to a drill bit at one end and a drill string at the other, a directing barrel shorter than said mandrel rotatably disposed about said mandrel and moveable longitudinally thereon from a position in which said barrel is nearer to said bit connection means than to said drill string connection means to a position in which said barrel is nearer said drill string connection means than to said bit connection means through a range of positions therebetween, a releasable latching means holding the barrel in said position on the mandrel nearer said bit connection means than to said drill string connection means until the latching means is released, sealing means defining a pressureable chamber intermediate the barrel and mandrel, means to transfer fluid pressure from the interior of the mandrel into the chamber, said sealing means being spaced apart longitudinally on opposite sides of said pressure transmitting means in all relative positions of said mandrel and barrel, and means extendable from the barrel when pressure is applied into the chamber from inside the mandrel to engage a well wall and to hold said barrel in a desired position relative to the well wall while said mandrel is moved axially therethrough from said position in which the barrel is nearer said bit connection means to said position in which the barrel is nearer said drill string connection means after said releasable latching means has been released, said means extendable from the barrel including a resilient extension member disposed in bonded relation to the internal wall of an opening through the barrel wall, and extendable member having a wall of smaller dimension than said opening disposed within the opening in bonded relation with the extension member, the extendable member being adapted to extend from the barrel toward the walls of a well bore upon pressure application from within the barrel and to withdraw to the barrel upon release of pressure within said barrel in response to the resilience of the extension member.

46. Combination according to claim 45 including clutch means on said barrel and mandrel engageable in but a single relative azimuthal position of barrel and mandrel to prevent relative rotation of the barrel and mandrel in one direction whereby said barrel can be turned with said mandrel into a desired selected azimuthal position, when said extendable member is withdrawn to the barrel, said clutch means being engageable only when said latch means is engaged.

47. Combination according to claim 45 wherein said means extendable from the barrel is asymmetrically disposed thereon to position the mandrel axis eccentric to the well bore, and including centralizer means above said asymmetrically disposed means urging a part of the mandrel above said asymmetrically disposed means into a position concentric with the axis of the well bore while said mandrel is moved axially relative to said barrel.

48. Combination according to claim 45 including a plurality of said means extendable from the barrel disposed at longitudinally spaced apart positions along the length of the barrel, and including resilient elastomer bearing means longitudinally spaced apart with respect to the length of the barrel, said resilient bearing means presenting resilient bearing surfaces between said mandrel

and barrel at longitudinally spaced apart positions relative to the length of the barrel.

49. The apparatus of claim 45 including a hollow retainer member having an outer wall conforming in shape to the perimeter of the opening supported within the opening in fluid sealed relation, and wherein the resilient extension member is bonded to the inner wall of said retainer member.

50. Well bore directing apparatus including a hollow mandrel provided with means for connection to a drill bit at one end and a drill string at the other, a directing barrel shorter than said mandrel rotatably disposed about said mandrel and moveable longitudinally thereon from a position in which said barrel is nearer to said bit connection means than to said drill string connection means to a position in which said barrel is nearer said drill string connection means than to said bit connection means through a range of positions therebetween, a releasable latching means holding the barrel in said position on the mandrel nearer said bit connection means than to said drill string connection means until the latching means is released, sealing means defining a pressureable chamber intermediate the barrel and mandrel, means to transfer fluid pressure from the interior of the mandrel into the chamber, said sealing means being spaced apart longitudinally on opposite sides of said pressure transmitting means in all relative positions of said mandrel and barrel, means extendable from the barrel when pressure is applied into the chamber from inside the mandrel to engage a well wall and to hold said barrel in a desired position relative to the well wall while said mandrel is moved axially therethrough from said position in which the barrel is nearer said bit connection means to said position in which the barrel is nearer said drill string connection means after said releasable latching means has been released, a port in the barrel extending through the barrel from said pressureable chamber to the exterior of the barrel, and normally closed valve means controlling the flow through said port and responsive to the pressure in the chamber to open when the pressure exceeds a predetermined pressure to protect said sealing means against blowout.

51. Well bore directing apparatus including a hollow mandrel provided with means for connection to a drill bit at one end and a drill string at the other, a directing barrel shorter than said mandrel rotatably disposed about said mandrel and moveable longitudinally thereon from a position in which said barrel is nearer to said bit connection means than to said drill string connection means to a position in which said barrel is nearer said drill string connection means than to said bit connection means through a range of positions therebetween, a releasable latching means holding the barrel in said position on the mandrel nearer said bit connection means than to said drill string connection means until the latching means is released, sealing means defining a pressureable chamber intermediate the barrel and mandrel, means to transfer fluid pressure from the interior of the mandrel into the chamber, said sealing means being spaced apart longitudinally on opposite sides of said pressure transmitting means in all relative positions of said mandrel and barrel, means extendable from the barrel when pressure is applied into the chamber from inside the mandrel to engage a well wall and to hold said barrel in a desired position relative to the well wall while said mandrel is moved axially therethrough from said position in which the barrel is nearer said bit connection means to said position in which the barrel is nearer said drill string connection means after said releasable latching means has been released, a remotely removable valve means within the mandrel permitting fluid flow through the mandrel and preventing fluid transfer to the chamber while in the mandrel and permitting fluid flow through the mandrel and fluid transfer into the chamber when removed.

52. The apparatus of claim 51 wherein each of said means extendable from the barrel includes a resilient extension member disposed in bonded relation to the internal wall of an opening through the barrel wall, an extendable member having a wall of smaller dimension than said opening disposed within the opening in bonded relation with the extension member, the extendable member being adapted to extend from the barrel toward the walls of a well bore upon pressure application from within the barrel and to withdraw to the barrel upon release of pressure within said barrel in response to the resilience of the extension member.

53. Well bore directing apparatus including a hollow mandrel provided with means for connection to a drill bit at one end and a drill string at the other, a directing barrel shorter than said mandrel rotatably disposed about said mandrel and moveable longitudinally thereon from a position in which said barrel is adjacent said bit connection means to a position in which said barrel is adjacent said drill string connection means through a range of positions therebetween, sealing means defining a pressureable chamber intermediate the barrel and mandrel, means to transfer fluid pressure from the interior of the mandrel into the chamber, said sealing means being spaced apart longitudinally on opposite sides of said pressure transmitting means in all relative positions of said mandrel and barrel, means extendable from the barrel when pressure is applied into the chamber from inside the mandrel to engage a well wall and to hold said barrel in a desired position relative to the well wall while said mandrel is moved axially therethrough from said position in which the barrel is nearer said bit connection means to said position in which the barrel is nearer said drill string connection means, clutch means on said barrel and mandrel positively engageable by predetermined motion of said mandrel relative to said barrel when said means extendable from the barrel is extended to hold the barrel in position by engagement with a well wall and engageable in but a single relative azimuthal position of barrel and mandrel to prevent relative rotation of the barrel and mandrel in one direction whereby said barrel can be turned with said mandrel into a desired selected azimuthal position and latching means releasable and engageable whenever desired by predetermined motion of the mandrel relative to the barrel to hold the barrel in said position on the mandrel nearer said bit connection means than to said drill string connection means.

54. Well bore directing apparatus including a hollow mandrel provided with means for connection to a drill bit at one end and a drill string at the other, a directing barrel shorter than said mandrel rotatably disposed about said mandrel and moveable longitudinally thereon from a position in which said barrel is nearer to said bit connection means than to said drill string connection means to a position in which said barrel is nearer said drill string connection means than to said bit connection means through a range of positions therebetween, a sealing means defining a pressureable chamber intermediate the barrel and mandrel, means to transfer fluid pressure from the interior of the mandrel into the chamber, said sealing means being spaced apart longitudinally on opposite sides of said pressure transmitting means in all relative positions of said mandrel and barrel, and means extendable from the barrel in pressure communication with the chamber to urge the barrel into desired relation with the wall of the bore when pressure is applied into the chamber from inside the mandrel, said means extendable from the barrel being asymmetrically disposed thereon to position the mandrel axis eccentric to the well bore, and centralizer means above said asymmetrically disposed means urging a part of the mandrel above said asymmetrically disposed means into a position concentric with the axis of the well bore.

55. Combination according to claim 54 including a remotely removable valve means within the mandrel permitting fluid flow through the mandrel and preventing fluid transfer to the chamber while in the mandrel and permitting fluid flow through the mandrel and fluid transfer into the chamber when removed.

56. Combination according to claim 54 including a port in the barrel extending through the barrel from said pressurable chamber to the exterior of the barrel, and normally closed valve means controlling the flow through said port and responsive to the pressure in the chamber to open when the pressure exceeds a predetermined pressure to protect said sealing means against blowout.

57. The apparatus of claim 54 wherein the means extendable from the barrel includes a resilient extension member disposed in bonded relation to the internal wall of an opening through the barrel wall, an extendable member having a wall of smaller dimension than said opening disposed within the opening in bonded relation with the extension member, the extendable member being adapted to extend from the barrel toward the walls of a well bore upon pressure application from within the barrel and to withdraw to the barrel upon release of pressure within said barrel in response to the resilience of the extension member.

58. The apparatus of claim 57 including a hollow retainer member having an outer wall conforming in shape to the perimeter of the opening supported within the opening in fluid sealed relation, and wherein the resilient extension member is bonded to the inner wall of said hollow member.

59. In well bore apparatus, an anchor barrel positioning member, adapted for insertion into a port in an anchor barrel wall, comprising

a hollow rigid retainer member having an inner periphery and an outer periphery and a forward end and a rearward end,

the outer periphery of said retainer member having a forwardly facing shoulder thereon,

a resilient extension member having a generally tubular portion,

said tubular portion having an outwardly facing peripheral surface disposed in bonded relation to the inner periphery of the retainer member,

said tubular portion having an inner peripheral surface, the thickness of said tubular portion between said inner peripheral surface and said outwardly facing peripheral surface being less than the axial length of said tubular portion,

said outwardly facing peripheral surface of the resilient extension member that is in bonded relation to the inner periphery of the retainer member extending from forwardly of said shoulder on the retainer member to rearwardly thereof,

an extendable rigid member having an outwardly facing surface and having a forward end and a rearward end,

said outwardly facing surface of said extendable member being disposed in bonded relation to said inner peripheral surface of the extension member,

said outwardly facing surface of said extendable member that is in bonded relation to the inner periphery of the extension member extending from forwardly of said shoulder on the retainer member to rearwardly thereof, said extension member being adapted to extend and permit said extendable member to move forwardly when fluid pressure is applied to the rearward end thereof and to retract to move said extendable member back when said fluid pressure is relieved,

said forward end of said extendable member having means thereon providing a surface for engaging a well wall to prevent relative sliding motion therebetween when said extension member is extended and said extendable member has moved forwardly.

60. Combination according to claim 59 wherein said resilient extension member extends behind the rearward end of the retainer member and includes a lip seal adjacent the outer periphery of the retainer.

61. Combination according to claim 59 wherein said resilient extension member extends behind the rearward end of said extendable rigid member and closes over said rearward end of said extendable rigid member.

62. Combination according to claim 61 wherein said means for engaging a well wall includes a shoe, said shoe and said extendable member have coaxial threaded ports therethrough, including a threaded member in said ports holding said shoe to said extendable member, and said resilient extension member extends behind said extendable member closing said port therein.

63. Combination according to claim 59 wherein said resilient extension member extends behind both said retainer member and said extendable rigid member and includes a lip seal adjacent to the outer periphery of the retainer member and closes over the rearward ends of both of said retainer member and said extendable rigid member.

64. Combination according to claim 63 wherein said resilient extension member extends around the outer periphery of said retainer member.

65. Combination according to claim 59 including a rubber member around the outer periphery of said retainer member.

66. Combination according to claim 65 wherein said rubber member is integral with said resilient extension member.

67. Combination according to claim 59 wherein said resilient extension member extends in front of a portion of said forward end of said extendable rigid member with only said well surface engaging means extending therethrough.

68. Combination according to claim 59 including a rigid support member integrally molded in said extension member spaced from said inner and outwardly facing peripheral surfaces thereof.

69. Combination according to claim 59 wherein said inner and outwardly facing surfaces of the resilient extension member are conical and said outwardly facing surface of the extendable member and said inner periphery of the retainer member are also conical correlative to said conical surface of said resilient extension member to which they are respectively bonded.

70. Combination according to claim 59 wherein said resilient extension member extends in front of said forward end of said extendable rigid member and behind said rearward end thereof and over said outer periphery thereof forming a forwardly facing shoulder over said forwardly facing shoulder of retainer member.

71. Combination according to claim 59 wherein said peripheries and peripheral surfaces of said retainer member, extension member, and extendable member of circular cross section in a plane perpendicular to the direction of extension and retraction of said extension member, and said forward end of said extendable member is a frustum of a cone and said resilient extension member includes a portion extending over the conical portion at the front end of the extendable rigid member.

72. Combination including a plurality of anchor barrel positioning members as set forth in claim 71 said means for engaging a well wall including a common shoe secured to the forward ends of the extendable rigid members of said plurality of positioning members, said shoe having rearwardly turned ends, the front of the shoe being provided with groups of legs, said groups being located adjacent each extendable member.

73. Combination according to claim 59 wherein said extendable member, extension member, and retainer member are each elongated in a direction perpendicular to the direction of extension and retraction of said extension member.

74. Combination according to claim 73 wherein said well wall engaging means comprises a plurality of lugs on said forward end of said extendable member, said lugs being elongated with their lengths parallel to the direction of elongation of said elongated extendable member.

75. Combination according to claim 73 wherein said shoulder on the retainer member lies only at the sides thereof parallel to the length thereof.

76. Combination according to claim 73 wherein the cross-section taken perpendicular to the length of said positioning member is concave as viewed from the rear.

77. Combination according to claim 73 wherein the back of the extendable member is hollow and of U-shaped cross-section taken perpendicular to the length of the extendable member.

78. Combination according to claim 77 wherein said resilient extension member extends behind said extendable rigid member and fills the hollow back thereof.

79. In well bore apparatus including a tubular mandrel adapted for connection to a drill bit at one end and a drill string at the other to provide fluid communication from the drill string to the drill bit, a barrel disposed about the mandrel being in freely rotative and reciprocative relation, sealing means within the barrel defining a pressurable chamber intermediate the barrel and mandrel, pressure transfer means providing transfer of fluid pressure from within the mandrel to the chamber, said barrel having an opening disposed through the barrel wall, a resilient extension member, said member being disposed in bonded relation at its outer periphery to the internal wall of the opening, an extendable rigid metal member having a wall of smaller dimension and similar configuration to said opening disposed within the opening in bonded relation with the inner periphery of the extension member to present the extendable member wall to the opening wall at substantially equal spacing, the extendable member being adapted to extend from the barrel to the walls of a well bore upon pressure application from within the barrel and to withdraw to the barrel upon release of the pressure in response to the resilience of the extension member.

80. Well bore directing apparatus including a hollow mandrel provided with means for connection to a drill bit at one end and a drill string at the other, a positioning barrel shorter than said mandrel rotatably disposed about said mandrel and moveable longitudinally thereon from a position in which said barrel is nearer to said bit connection means than to said drill stem connection means to a position in which said barrel is nearer said drill string connection means than to said bit connection means through a range of positions therebetween, radially floating sealing means defining a pressurable chamber intermediate the barrel and mandrel, means to transfer fluid pressure from the interior of the mandrel into the chamber, said sealing means being spaced apart longitudinally on opposite sides of said pressure transmitting means in all relative positions of said mandrel and barrel, resilient bearing means between the barrel and mandrel to support same for relative rotation and axial translation, and means extendable from the barrel in pressure communication with the chamber to urge the barrel into desired relation with the well bore when pressure is applied onto the chamber from inside the mandrel.

81. Combination according to claim 80 including a port in the barrel extending through the barrel from said pressurable chamber to the exterior of the barrel, and normally closed valve means controlling the flow through said port and responsive to the pressure in the chamber to open when the pressure exceeds a predetermined pressure to protect said sealing means against blowout.

82. Combination according to claim 80 including a remotely removable valve means within the mandrel permitting fluid flow through the mandrel and permitting transfer to the chamber while in the mandrel and permit-

ting fluid flow through the mandrel and fluid transfer into the chamber when removed.

83. The apparatus of claim 80 wherein the means extendable from the barrel includes a resilient extension member disposed in bonded relation to the internal wall of an opening through the barrel wall, an extendable member having a wall of smaller dimension than said opening disposed within the opening in bonded relation with the extension member, the extendable member being adapted to extend from the barrel toward the walls of a well bore upon pressure application from within the barrel and to withdraw to the barrel upon release of pressure within said barrel in response to the resilience of the extension member.

84. The apparatus of claim 83 including a hollow retainer member having an outer wall conforming in shape to the perimeter of the opening supported within the opening in fluid sealed relation, and wherein the resilient extension member is bonded to the inner wall of said hollow member.

85. Well bore directing apparatus including a hollow mandrel provided with means for connection to a drill bit at one end and a drill string at the other, a directing barrel shorter than said mandrel rotatably disposed about said mandrel and movable longitudinally thereon from a position in which said barrel is nearer to said bit connection means than to said drill string connection means to a position in which said barrel is nearer to said drill string connection means than to said bit connection means through a range of positions therebetween, sealing means defining a pressurable chamber intermediate the barrel and mandrel, means to transfer fluid pressure from the interior of the mandrel into the chamber, said sealing means being spaced apart longitudinally on opposite sides of said pressure transmitting means in all relative positions of said mandrel and barrel, means extendable from the barrel to urge the barrel into desired relation with the well bore when pressure is applied into the chamber from inside the mandrel, a port in the barrel extending through the barrel from said pressurable chamber to the exterior of the barrel, and normally closed valve means controlling flow through said port and responsive to the pressure in the chamber to open when the pressure exceeds a predetermined pressure to protect said sealing means against blowout.

86. The apparatus of claim 85 wherein said valve means includes a valve sleeve having two portions of unequal external diameter disposed within the barrel chamber in reciprocative relation across said port which lies at the juncture of two portions of the barrel of unequal internal barrel diameter, a prestressed resilient supporting means at each end of the sleeve to axially support the sleeve at a balanced position across the port, fluid sealing means axially spaced on each side of the port between the larger of said unequal diameter portions of the sleeve and the barrel and between the smaller of said unequal diameter portions of said sleeve and barrel effecting a closure of the port upon the sleeve being at the balanced position, fluid passage means through the sleeve wall spaced past the sealing means at each end of the sleeve permitting fluid passage between the interior and exterior of the barrel upon the sleeve being axially displaced from the balanced position in response to a pressure applied across the annular area between the diameters.

87. The apparatus defined in claim 86 including a remotely removable valve means within the mandrel permitting fluid flow through the mandrel and preventing fluid pressure transfer to the chamber while in the mandrel and permitting fluid flow through the mandrel and fluid transfer into the chamber when removed.

88. The apparatus of claim 85 wherein the means extendable from the barrel includes a resilient extension member disposed in bonded relation to the internal wall of an opening through the barrel wall, an extendable member having a wall of smaller dimension than said

opening disposed within the opening in bonded relation with the extension member, the extendable member being adapted to extend from the barrel toward the walls of a well bore upon pressure application from within the barrel and to withdraw to the barrel upon release of pressure within said barrel in response to the resilience of the extension member.

89. The apparatus of claim 88 including a hollow retainer member having an outer wall conforming in shape to the perimeter of the opening supported within the opening in fluid sealed relation, and wherein the resilient extension member is bonded to the inner wall of said hollow member.

90. Well bore directing apparatus including a hollow mandrel provided with means for connection to a drill bit at one end and a drill string at the other, a directing barrel shorter than said mandrel rotatably disposed about said mandrel and movable longitudinally thereon from a position in which said barrel is nearer to said bit connection means than to said drill stem connection means to a position in which said barrel is nearer to said drill string connection means than to said bit connection means through a range of positions therebetween, sealing means defining a pressurable chamber intermediate the barrel and mandrel, means to transfer fluid pressure from the interior of the mandrel into the chamber said sealing means being spaced apart longitudinally on opposite sides of said pressure transmitting means in all relative positions of said mandrel and barrel, means extendable from the barrel in pressure communication with the chamber to urge the barrel into desired relation with the well bore when pressure is applied into the chamber from inside the mandrel, and a remotely removable valve means within the mandrel permitting fluid flow through the mandrel and preventing fluid pressure transfer to the chamber while in the mandrel and permitting fluid flow through the mandrel and fluid transfer into the chamber when removed.

91. The apparatus of claim 90 wherein the means extendable from the barrel includes a resilient extension

member disposed in bonded relation to the internal wall of an opening through the barrel wall, an extendable member having a wall of smaller dimension than said opening disposed within the opening in bonded relation with the extension member, the extendable member being adapted to extend from the barrel toward the walls of a well bore upon pressure application from within the barrel and to withdraw to the barrel upon release of pressure within said barrel in response to the resilience of the extension member.

92. The apparatus of claim 91 including a hollow retainer member having an outer wall conforming in shape to the perimeter of the opening supported within the opening in fluid sealed relation, and wherein the resilient extension member is bonded to the inner wall of said hollow member.

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