

Nov. 24, 1959

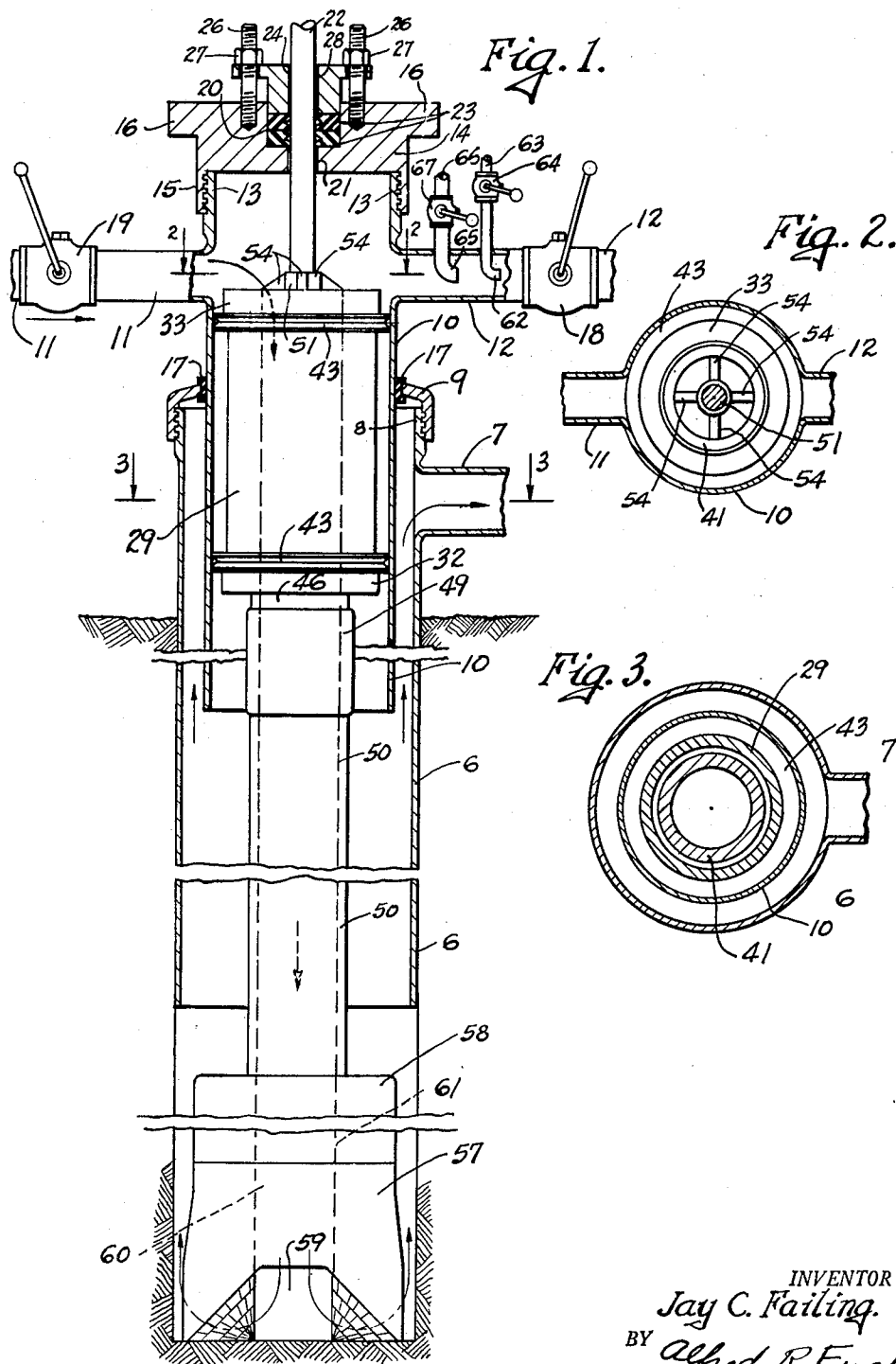
J. C. FAILING

2,914,306

FLUID CIRCULATING DRILLING BARREL

Filed May 16, 1957

2 Sheets-Sheet 1



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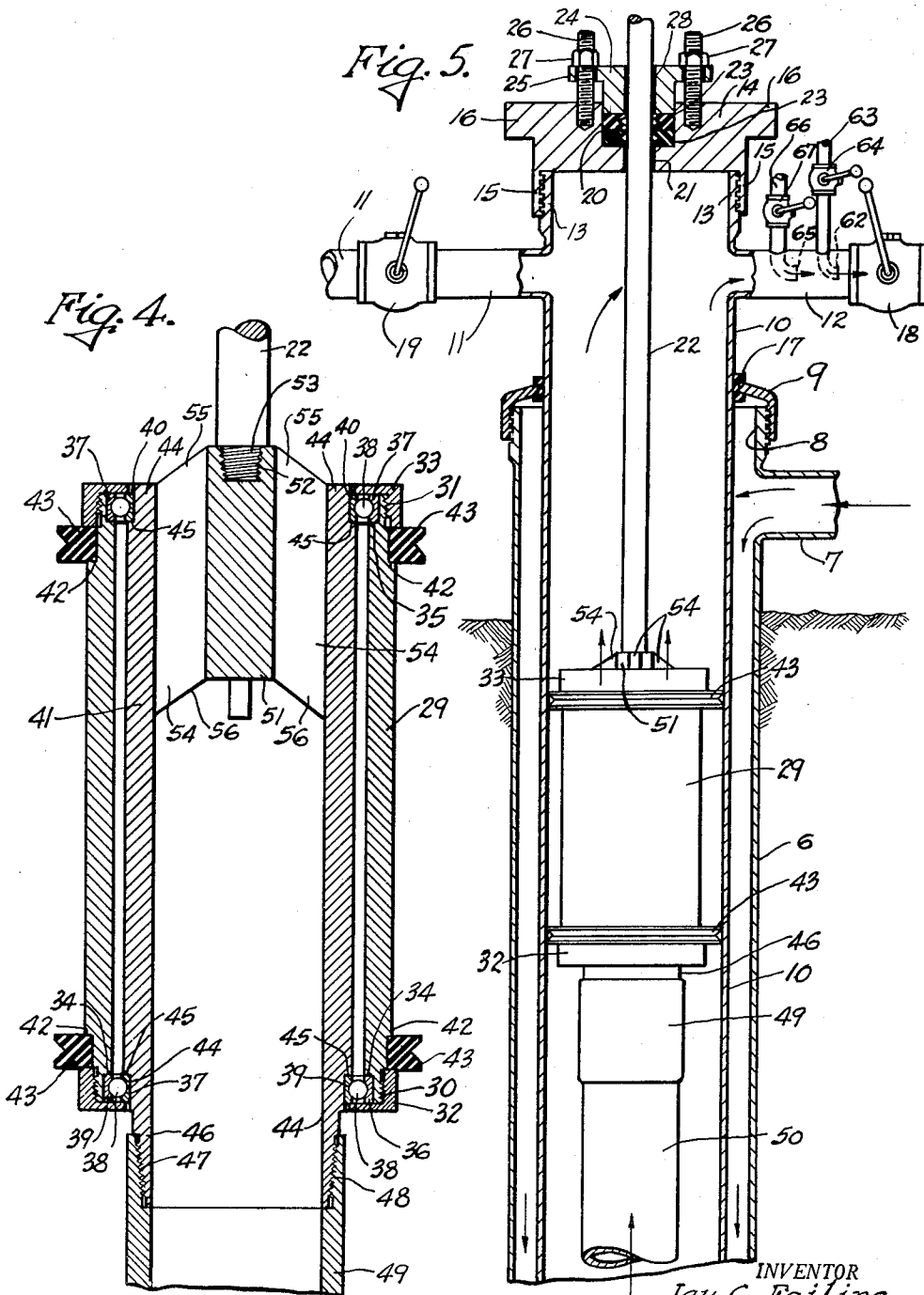
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FLUID CIRCULATING DRILLING BARREL

Jay C. Failing, Encino, Calif.

Application May 16, 1957, Serial No. 659,628

13 Claims. (Cl. 255—19)

My invention relates to rotary well drilling means comprising rotary drilling and drilling fluid circulating means, and more particularly to means for rotating a drill and circulating drilling fluid therethrough, comprising a fluid circulating rotary drilling barrel.

In rotary drilling apparatus for well drilling and similar purposes, in which a drilling fluid is circulated in a conventional manner, the drilling fluid is directed from a pump to a so-called water swivel through a hose under pressure, then through the water swivel, the kelly, drill pipe and bit, and from the bit the fluid travels upwardly on the outside of the bit and drill pipe to the top of the hole where it is directed to the pit from where it is ordinarily picked up by the pump. More recently reverse circulation of the drilling fluid has been used to some extent, the fluid flowing from the top of the hole downwardly on the outside of the drill pipe into the bit and upwardly through the drill pipe and kelly and the water swivel and pressure hose to the pit. This has proved very awkward, however, due to the large connections and hose required, and return velocity is decreased from the ground level upward when the water swivel is in its upward position and the results are unsatisfactory. Rotary drilling utilizing as a drilling fluid air under pressure has also been attempted, the circulation being as with the conventional circulation above referred to.

In all these drilling methods the circulation of the drilling fluid through the water swivel and hose attached thereto involves undesirable features, which it is a purpose of my invention to eliminate. The use of all hose and of a water swivel is entirely avoided by my fluid circulating drilling barrel, as the fluid connections are made in such a manner that pipe is rigidly connected to the drilling means in a fixed position only slightly above the ground level.

An important advantage of my invention is that it makes possible the use of any one or a combination of any of the drilling procedures above referred to. Thus for part of the drilling operation a liquid drilling fluid can be used, such as is used in a conventional manner, for drilling through certain formations that are more difficult to drill through, while air under pressure can be used where sand or other relatively loose material is being drilled through to remove this material from the hole. Similarly, in creating a reverse circulation, an air jet can be used to set up the reverse circulation of the drilling fluid, or a combination of air jet and liquid jet means can be used for this purpose.

More specifically my invention comprises a drilling barrel that comprises an inner tubular member that is connected with suitable rotary driving means for rotating the same and an outer tubular or housing member in which said inner rotatable member is mounted for rotation, the outer or housing member being longitudinally movable in a stationary tubular member that is mounted in fixed position on the well casing and has fluid conduit means communicating therewith, which fluid conduit means is of a rigid and stationary character, such as pipe.

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The entire drilling barrel comprising the housing member and the inner rotary member to which the drill pipe usually provided for connection with the drill bit is connected, are mounted for longitudinal movement in the stationary tubular member above referred to, and sealing means is provided between said housing member and said stationary tubular member with which the fluid conduit means communicates, so that the drilling fluid can circulate in either direction as above explained, in the stationary tubular member, and through the inner rotary tubular member of the drilling barrel either to or from the drill pipe connected with the bit, as the case may be.

It is a further purpose of my invention to provide fluid conduit means connected with the said stationary tubular member of my improved drilling means, that is provided with means whereby either fluid or air can be used for a circulating means, and to provide jet means in conjunction therewith whereby it is possible to change the direction of circulation from the conventional direction, as above described, to the reverse direction, by suitable controlling valve means, without any change in the drilling apparatus or the fluid connections thereto.

It is a further purpose of my invention to provide means for rotating said drilling barrel comprising a drill rod, which is rotated in any suitable manner, as for example, by the means disclosed in my co-pending application, Serial No. 646,377, filed March 15, 1957, for Drive for Earth Boring Tools, said drill rod being connected with the inner rotatable member of my fluid circulating drilling barrel by suitable web or fin members that extend from a central connection for the drill rod to the walls of the inner tubular member, being rigidly and fixedly secured to both said inner central member and said rotatable tubular member, said drill rod extending through a removable end closure member of said above referred to stationary tubular member, means being provided whereby said rod-like member is rotatably mounted in said closure member for longitudinal movement therethrough, and is provided with means to prevent leakage of drilling fluid around said drill rod.

Other objects and advantages of my invention will appear as the description of the drawings proceeds. I desire to have it understood, however, that I do not intend to limit myself to the particular details shown or described, except as defined in the claims.

In the drawings:

Fig. 1 is a view partly in vertical section and partly in elevation of my improved fluid circulating drilling apparatus, partly broken away, showing the apparatus adjusted for conventional drilling.

Fig. 2 is a section taken on the line 2—2 of Fig. 1.

Fig. 3 is a section taken on the line 3—3 of Fig. 1.

Fig. 4 is a fragmentary longitudinal section, on an enlarged scale, through my improved drilling apparatus, showing the drilling barrel and fragmentary portions of the drill rod and drill pipe connected therewith, the well casing and stationary tubular member mounted on said well casing being omitted, and

Fig. 5 is a view similar to Fig. 1, showing the apparatus adjusted for reverse fluid circulation.

Referring in detail to the drawings, in Figs. 1 and 5 is shown a well casing section 6, which has a portion projecting above the ground level, and is provided with a fluid conduit 7 extending laterally from the upwardly projecting portion thereof. The upper end of the casing 6 is provided with suitable threads 8 thereon for securing a threaded cap 9 thereto, and mounted in an opening in said cap 9 is a stationary tubular member 10, said stationary tubular member extending down into the casing 6 a substantial distance and projecting a short distance above the upper end of the casing 6. Preferably the extent of the casing 10 is such that the movable means, to

be described below, can travel lengthwise thereof a distance equal to, or slightly greater than, the length of a section of drill pipe.

Said stationary tubular member 10 is provided with a pair of radially extending conduits or pipes 11 and 12, which are preferably arranged opposite each other, as shown in the drawings. Mounted on the upper threaded end portion 13 of the stationary tubular member 10 is an end closure cap 14, which is provided with a threaded portion 15 that engages the threaded portion 13 of the tubular member 10. Suitable laterally extending lugs 16 are provided on the member 14 that can be struck with a suitable tool for rotating said closure member 14. Suitable packing means 17 is provided between the wall of the opening in the cap member 9 and the stationary tubular member 10 to provide a fluid tight joint between said cap 9 and said tubular member 10. The fluid connection 7 is connected in any suitable manner with the usual pit or other reservoir for the circulating fluid medium.

The fluid conduit 12 is also connected with said pit or similar storage means, having a shut-off valve 18 provided therein, and the fluid conduit 11 is connected with a pump of the usual character, that withdraws the fluid from the pit or similar storage means for the circulating or drilling fluid, and a shut-off valve 19 is interposed between the pump and the tubular member 10 in the fluid conduit 11. The end closure member 14 is recessed as at 20 and has a passage 21 extending from said recess 20 through the inner face thereof. The drill rod 22 extends slidably through the opening 21 and is connected with my improved drilling barrel in a manner to be described below. Suitable packing means is provided for the joint between the end closure 14 and the drill rod 22 so that said drill rod can be rotated relative to the cap member 14 and moved longitudinally through the same without leakage of drilling fluid between said drill rod 22 and the cap member 14, comprising a plurality of compressible packing members 23 and a gland 24 that engages the same and which is seated in the recess 20 and has a flange 25 thereon that is provided with openings through which the screw-threaded members 26 extend, that have the nuts 27 thereon for drawing the gland 24 tightly down against the packing members 23, said gland having a suitable passage 28 therethrough for the drill rod 22.

Mounted within the stationary tubular member 10 is the drilling barrel comprising the outer housing member 29, which has an open ended tubular body portion that has screw-threaded portions 30 and 31 at the ends thereof, with which the flanged rings 32 and 33 are screw-threadedly connected. Also said body portion of the housing 29 is provided with recesses 34 and 35 in the ends thereof for reception of ball races 36 and 37 of anti-friction bearings having the balls 38 provided therein. Cooperating ball races 39 and 40 are provided and are mounted in a manner which will be described below. While ball bearings are shown to provide anti-friction bearings between the outer housing member 29 and the inner rotary tubular member 41, obviously other types of anti-friction bearings, such as roller bearings, could be provided. The tubular housing member 29 is also provided with a reduced portion at each end thereof providing an annular shoulder 42, against which compressible sealing rings 43 are clamped by means of the flanged rings 32 and 33, the flanges on said rings 32 and 33 serving as ball race retaining means.

The rotary inner tubular member of the fluid circulating drilling barrel 41 is provided with reduced portions 44 at opposite ends thereof providing the shoulders 45 against which the ball races 39 and 40 are seated. It will accordingly be seen that the inner tubular member 41 of the rotary drilling barrel is mounted for rotation in and endwise or longitudinal movement with the housing member 29, said housing member 29 being longi-

tudinally movable in the stationary tubular member 10. Said rotary inner tubular member 41 has a portion 46 projecting downwardly beyond the bottom end of the housing 29, which is provided with the usual tool joint thread 47, with which a corresponding thread 48 on a drill pipe coupling means 49 on a drill pipe section is connected. The number of drill pipe sections 50 that are connected with the rotatable member 41 will be dependent upon the length of drill pipe necessary to extend to the bit in its position at the bottom of the hole.

The drill rod 22 is rotated in any desired or well known manner as above referred to, and extends to a suitable connecting means between said drill rod and the tubular open ended body portion 41 or inner tubular member of the drilling barrel. Preferably the means for connecting said drill rod with the rotatable tubular member 41 comprises a central body portion 51, which has the upper end thereof projecting slightly above the upper end of the tubular member 41 and which is provided with a threaded socket 52 therein for reception of the usual tool joint thread 53 provided on the drill pipe 22. The central body portion 51 is connected with the inner surface of the tubular member 41 by means of a plurality of webs or fins 54, which are either integrally connected with the tubular member 41 and the central body portion 51 of said connecting means, or welded thereto, as may be found desirable. Preferably said webs or fins are arranged 90° apart around the central member 51, as shown in Fig. 2, although any other desirable number of fins may be provided, as long as a strong joint is provided between the drill rod 22 and the rotary member 41 thereby. The upper projecting end portions of the fins 54 are provided with inclined end edges 55, thus providing tapering projecting ends thereon protruding from the upper end of the tubular member 41. The lower end edges 56 of the fins may be similarly inclined, if desired. The fin arrangement shown is provided in order that there will be no interference with the flow of drilling fluid lengthwise through the inner rotary member 41 of the drilling barrel, it being obvious that the passage through the inner rotatable tubular member 41 provides means for communication between the interior of the stationary member 10 and the drill pipe 50. The arrangement further provides for the ready attachment of the drill rod to the rotatable member 41 due to the fact that the screw-threaded connection between the drill rod and the body portion 51 of the driving connection between the drill rod and the rotary tubular member 41 is projected slightly outwardly above the upper end of the rotary tubular member 41.

The rotary drill 57 of any well known character is connected with the lowermost section of drill pipe 50 by means of a drill collar 58, a fluid passage or passages 59 being provided, extending outwardly from the passage 60 in the drill, which is connected through the passage 61 in the drill collar with the passage through the connected drill pipe sections 50. In the fluid conduit 12 an air jet 62 is provided, which is supplied with air under pressure from the pipe 63, which is connected with a suitable supply of compressed air and which has a valve 64 provided therein for controlling flow through the air jet 62. A liquid jet 65 is also provided in the conduit 12, preferably sufficiently out of line with the jet 62 so that they do not interfere with each other, and it is supplied with drilling fluid through the pipe 66 and the supply to the jet 65 is controlled by means of the valve 67. The jet means is only shown in a diagrammatical manner, as any suitable jets for the air and liquid may be provided as long as they are located in the conduit 12 adjacent the entrance into the same from the stationary tubular member 10.

In operation the end closure member 14 is detached from the stationary tubular member 10 in order to withdraw the fluid circulating drilling barrel therefrom so that the joint between the same and the uppermost drill

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pipe section will be exposed when it is desired to add a new section of drill pipe. Suitable holding means is utilized for preventing the drill pipe from dropping downwardly in the well when it is disconnected from the rotating inner tubular member 41 of the drilling barrel. The drill rod 22 and the drilling barrel are then elevated sufficiently that an additional section of drill pipe can be secured to the string of drill pipe that is in the well and then the rotary drilling barrel is again connected with the drill pipe by connecting with the added section. The drill rod and the drilling barrel are then lowered to substantially the position shown in Fig. 1, and after the end closure member 14 has been replaced, the drilling operation is resumed, the drill rod being fed downwardly as it is rotated so as to move the drilling barrel and the attached drill pipe downwardly in the hole while rotating the drill pipe and the bit by means of the drill rod 22 and the rotatable inner member 41 of the drilling barrel.

If it is desired to circulate the drilling fluid in the conventional manner, the valves 64 and 67 are moved to a closed position, as is also the valve 18, and the valve 19 is opened, the pump supplying the drilling fluid through the valve 19 and the fluid conduit 11 to the outer stationary tubular member 10, the flow then being in the direction indicated by the arrows in Fig. 1 through the passage extending longitudinally through the rotary inner tubular member 41 into the string of drill pipe 50 down through the bit 57 and out through the openings 59, and then upwardly between the drill pipe 50 and the wall of the drill hole and on up between the casing 6 and the drill pipe, and finally between the casing 6 and the outer stationary tubular member 10 to the discharge pipe 7 and to the pit. If it is desired to drill reversely, then the valve 19 is closed, as shown in Fig. 5, and the valves 18 and 64, or the valves 18, 64 and 67, are opened, depending upon whether it is desired to create suction to obtain reverse circulation by means of either a jet of air or jet of air and liquid. Or, if desired, the air jet may be dispensed with and only the liquid jet 65 utilized, the valves 64 and 67 being available to get any selection of jet means that may be desired. With the jets operating to create a flow from the stationary tubular member 10 through the valve 18 in the direction indicated by the arrows in Fig. 5, the flow will be inwardly through the conduit or pipe 7 from the pit downwardly in the casing 6 and inwardly through the passage 59 into the interior of the bit and then upwardly through the string of drill pipe 50 and through the passage extending longitudinally through the rotary inner tubular member 41 to the discharge conduit 12. If air under pressure is to be used as a drilling fluid, then the valve 18 can be kept closed, the valve 67 closed, and the valve 64 opened to supply air under pressure to the conduit 12 and thus to the stationary tubular housing 10 and to the bit, the flow being in the direction indicated in Fig. 1 under those circumstances, and outwardly through the conduit or pipe 7 to be discharged at any desired point to which the pipe may lead. If desired, a suitable connection can be provided with the pipe conduit 11 to supply air under pressure through the valve 19 instead of through the jet 62, should a greater supply of air under pressure be necessary.

What I claim is:

1. In rotary well drilling means, a casing member, a stationary tubular member mounted in said casing member in annularly spaced relation thereto, said tubular member having an exposed upper end extending endwise beyond the upper end of said casing member, means at the upper end of said casing member closing the space between said casing member and said tubular member, said exposed upper end of said tubular member having a fluid conduit connected therewith and said stationary tubular member having an upper end closure, means mounted for longitudinal movement in said stationary tubular member comprising an outer housing member and an in-

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ner tubular member mounted for rotation in said housing member, rotary driving means extending through said end closure of said stationary tubular member and connected with said inner tubular member to rotate therewith, a drill bit and tubular driving means connecting said drill bit and inner tubular member, said inner tubular member being open at one end thereof to said stationary tubular member and at the other end thereof to said tubular driving means to provide a fluid passage between said stationary tubular member and said tubular driving means.

2. In rotary well drilling means, a casing member, a stationary tubular member mounted in said casing member in annularly spaced relation thereto, said tubular member projecting upwardly beyond the upper end of said casing member, stationary means at the upper end of said casing member closing the space between said casing member and said tubular member, a removable closure member mounted on the top end of said stationary tubular member, said stationary tubular member being exposed above the upper end of said casing member, a fluid conduit directly connected with the exposed portion of said stationary tubular member between said top closure member and said stationary means, means mounted for longitudinal movement in said stationary tubular member comprising an outer housing member and an inner tubular member mounted for rotation in said housing member, rotary driving means extending through said closure member and connected with said inner tubular member to rotate therewith, a drill bit and tubular driving means connecting said drill bit and inner tubular member, said inner tubular member being open at one end thereof to said stationary tubular member and at the other end thereof to said tubular driving means to provide a fluid passage between said stationary tubular member and said tubular driving means.

3. In rotary well drilling means, a casing member, a stationary tubular member mounted in said casing member in annularly spaced relation thereto, said tubular member having an exposed upper end extending endwise beyond the upper end of said casing member, means at the upper end of said casing member closing the space between said casing member and said tubular member, said exposed upper end of said tubular member having a fluid conduit rigidly connected therewith and said stationary tubular member having an upper end closure, means mounted for longitudinal movement in said stationary tubular member comprising an outer housing member, sealing means between said stationary tubular member and said housing member and an inner tubular member mounted for rotation in said housing member, rotary driving means extending through said end closure of said stationary tubular member and connected with said inner tubular member to rotate therewith, a drill bit and tubular driving means connecting said drill bit and inner tubular member, said inner tubular member being continuously open at one end thereof to said stationary tubular member and at the other end thereof to said tubular driving means to provide a fluid passage between said stationary tubular member and said tubular driving means.

4. In rotary well drilling means, a casing member, a stationary tubular member mounted in said casing member in annularly spaced relation thereto, said tubular member having an exposed upper end extending endwise beyond the upper end of said casing member, means at the upper end of said casing member closing the space between said casing member and said tubular member, said exposed upper end of said tubular member having a fluid conduit communicating therewith and having an upper end closure, means mounted for longitudinal movement in said stationary tubular member comprising an outer housing member and an inner tubular member mounted for rotation in said housing member, rotary driving means comprising a drill rod, said inner tubular member being provided with a drill rod receiving member

detachably connected with said drill rod to rotate therewith and a plurality of webs extending between and connecting said rod receiving member and the tubular wall of said inner tubular member to mount said drill rod receiving member thereon, a drill bit and tubular driving means connecting said drill bit and inner tubular member, said inner tubular member being continuously open at one end thereof to said stationary tubular member and at the other end thereof to said tubular driving means to provide a fluid passage between said stationary tubular member and said tubular driving means.

5. In rotary well drilling means, a casing member, a stationary tubular member mounted in said casing member in annularly spaced relation thereto, said tubular member having an exposed upper end extending endwise beyond the upper end of said casing member, means at the upper end of said casing member closing the space between said casing member and said tubular member, said exposed upper end of said tubular member having a fluid conduit communicating therewith and having an upper end closure, means mounted for longitudinal movement in said stationary tubular member comprising an outer housing member and an inner tubular member mounted for rotation in said housing member, rotary driving means comprising a drill rod, said inner tubular member being provided with a drill rod receiving member screw-threadedly connected with said rod and a plurality of webs extending between and connecting said rod receiving member and the tubular wall of said inner tubular member to mount said drill rod receiving member thereon, a drill bit and tubular driving means connecting said drill bit and inner tubular member, said inner tubular member being continuously open at one end thereof to said stationary tubular member and at the other end thereof to said tubular driving means to provide a fluid passage between said stationary tubular member and said tubular driving means.

6. In rotary well drilling means, a casing member, a stationary tubular member mounted in said casing member in annularly spaced relation thereto, said tubular member having an exposed upper end extending endwise beyond the upper end of said casing member, means at the upper end of said casing member closing the space between said casing member and said tubular member, said exposed upper end of said tubular member having a fluid conduit communicating therewith and having an upper end closure, means mounted for longitudinal movement in said stationary tubular member comprising an outer housing member and an inner tubular member mounted for rotation in said housing member, rotary driving means comprising a drill rod, said inner tubular member being provided with a drill rod receiving member detachably connected with said drill rod to rotate therewith and a plurality of webs extending between and connecting said rod receiving member and the tubular wall of said inner tubular member to mount said drill rod receiving member thereon, said webs having tapering upper ends extending beyond the upper end of said inner tubular member, a drill bit and tubular driving means connecting said drill bit and inner tubular member, said inner tubular member being continuously open at one end thereof to said stationary tubular member and at the other end thereof to said tubular driving means to provide a fluid passage between said stationary tubular member and said tubular driving means.

7. In rotary well drilling means, a casing member, a stationary tubular member mounted longitudinally in said casing member in annularly spaced relation thereto, said tubular member projecting upwardly beyond the upper end of said casing member, a removable closure member mounted on the top end of said stationary tubular member, fluid conduits laterally connected with the projecting portion of said stationary member and said casing member having a fluid conduit communicating therewith, means at the upper end of said casing closing

the space between said casing and said tubular member, means mounted for longitudinal movement in said stationary tubular member comprising an outer tubular housing member co-axially mounted in said stationary tubular member and an inner tubular member co-axially mounted for rotation in said housing member, rotary driving means extending through said removable closure axially of said stationary member, means projecting endwise beyond said housing member connecting said inner tubular member with said driving means to rotate therewith, a drill bit and tubular driving means connecting said drill bit and inner tubular member, said inner tubular member being continuously open at one end thereof to said stationary tubular member and at the other end thereof to said tubular driving means to provide a fluid passage between said stationary tubular member and said tubular driving means.

8. In rotary well drilling means, a casing member, a stationary tubular member mounted longitudinally in said casing member in annularly spaced relation thereto, said tubular member having an exposed upper end extending endwise beyond the upper end of said casing member, means at the upper end of said casing member closing the space between said casing member and said tubular member, said exposed upper end of said tubular member having a fluid conduit communicating therewith and having an upper end closure, means mounted for longitudinal movement in said stationary tubular member comprising an outer housing member co-axially mounted in said stationary tubular member and an inner tubular member co-axially mounted for rotation in said housing member, rotary driving means comprising a drill rod extending axially through said end wall, means providing a liquid tight seal between said drill rod and end closure, said inner tubular member being provided with a drill rod receiving member axially mounted therein, having a central body portion extending beyond the upper end of said housing member connected with said drill rod, and means connecting said rod receiving member and inner tubular member, a drill bit and tubular driving means connecting said drill bit and inner tubular member, said inner tubular member being continuously open at one end thereof to said stationary tubular member and at the other end thereof to said tubular driving means to provide a fluid passage between said stationary tubular member and said tubular driving means.

9. In rotary well drilling means, a casing member, a stationary tubular member mounted in said casing member in annularly spaced relation thereto and projecting upwardly above the upper end thereof, means connected with said projecting upper end of said stationary tubular member for withdrawing drilling fluid therefrom, an upper end closure for said stationary tubular member, means at the upper end of said casing closing the space between said casing and said tubular member, means mounted for longitudinal movement in said stationary tubular member comprising an outer housing member and an inner tubular member mounted for rotation in said housing member, sealing means between said housing member and stationary tubular member, rotary driving means extending through said closure and connected with said inner tubular member to rotate therewith, a drill bit and tubular driving means connecting said drill bit and inner tubular member, said inner tubular member being continuously open at one end thereof to said stationary tubular member and at the other end thereof to said tubular driving means to provide a fluid passage between said stationary tubular member and said tubular driving means.

10. In rotary drilling and drilling fluid circulating means, a stationary tubular member, a closure member for the upper end of said tubular member, said tubular member being open at its lower end, a fluid conduit connected with said tubular member, a tubular housing member mounted for longitudinal movement in said sta-

tionary tubular member, and means for rotating a drill comprising an inner open ended tubular member mounted in said housing member for rotation about its axis, sealing means between said stationary member and said housing member, and rotary driving means for said inner tubular member extending into the upper end thereof, comprising a drill rod extending through said closure member, said inner tubular member being provided with a central drill rod receiving member detachably connected with said drill rod to rotate therewith and webs connecting said central drill rod receiving member with the tubular wall of said inner tubular member to mount said drill rod receiving member thereon to rotate therewith.

11. In rotary drilling and drilling fluid circulating means, a stationary tubular member, a closure member for the upper end of said tubular member, said tubular member being open at its lower end, a fluid conduit connected with said tubular member, a tubular housing member mounted for longitudinal movement in said stationary tubular member, and means for rotating a drill comprising an inner open ended tubular member mounted in said housing member for rotation about its axis, sealing means between said stationary member and said housing member, and rotary driving means for said inner tubular member extending into the upper end thereof, comprising a drill rod extending through said closure member, said inner tubular member being provided with a central drill rod received member detachably connected with said drill rod to rotate therewith and webs connecting said central drill rod receiving member with the tubular wall of said inner tubular member to mount said drill rod receiving member thereon to rotate therewith, said webs having tapered upper ends projecting upwardly from the upper end of said inner tubular member.

12. In rotary well drilling means, a casing member, a cap mounted on the upper end thereof having an opening therein, a stationary tubular member mounted in said casing member in annularly spaced relation thereto and extending through said opening in said cap in fluid tight relation therewith to provide an exposed upper end portion on said stationary tubular member projecting upwardly above the upper end of said casing member, a stationary closure mounted on the upper end of said stationary tubular member having an opening there-through, a drill rod extending through said opening in said stationary closure member, a cylindrical housing mounted for longitudinal movement in said stationary tubular member, sealing means between said housing and stationary tubular member, an inner tubular member open

at opposite ends thereof rotatably mounted in said housing, said housing and said inner tubular member being mounted to move longitudinally of said stationary tubular member as a unit, means projecting from the upper end of said inner tubular member connected with said drill rod and inner tubular member to provide a driving connection between said drill rod and inner tubular member, a drill bit, tubular driving means connecting the lower open end of said inner tubular member with said drill bit, and fluid conduits directly connected with said casing member and the exposed upper end portion of said stationary tubular member, said inner tubular member being open to said stationary tubular member at its upper end to provide a fluid passage between said stationary tubular member and said tubular driving means.

13. In rotary well drilling means, a casing member, a cap mounted on the upper end thereof having an opening therein, a stationary tubular member mounted in said casing member in annularly spaced relation thereto and extending through said opening in said cap in fluid tight relation therewith to provide an exposed upper end portion on said stationary tubular member projecting upwardly above the upper end of said casing member, a stationary closure mounted on the upper end of said stationary tubular member having an opening there-through, a drill rod extending through said opening in said stationary closure member, a cylindrical housing mounted for longitudinal movement in said stationary tubular member, sealing means between said housing and stationary tubular member, an inner tubular member open at opposite ends thereof rotatably mounted in said housing, said housing and said inner tubular member being mounted to move longitudinally of said stationary tubular member as a unit, means projecting from the upper end of said inner tubular member connected with said drill rod and inner tubular member to provide a driving connection between said drill rod and inner tubular member, a drill bit, tubular driving means connecting the lower open end of said inner tubular member with said drill bit, and a pair of fluid conduits directly connected with the exposed upper end portion of said stationary tubular member, said inner tubular member being open to said stationary tubular member at its upper end to provide a fluid passage between said stationary tubular member and said tubular driving means.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 2,914,306

November 24, 1959

Jay C. Failing

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 9, line 29, for "received" read -- receiving --.

Signed and sealed this 17th day of May 1960.

(SEAL)

Attest:

KARL H. AXLINE
Attesting Officer

ROBERT C. WATSON
Commissioner of Patents