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METHOD AND APPARATUS FOR DRILLING WELL HOLES

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Fig. 2.

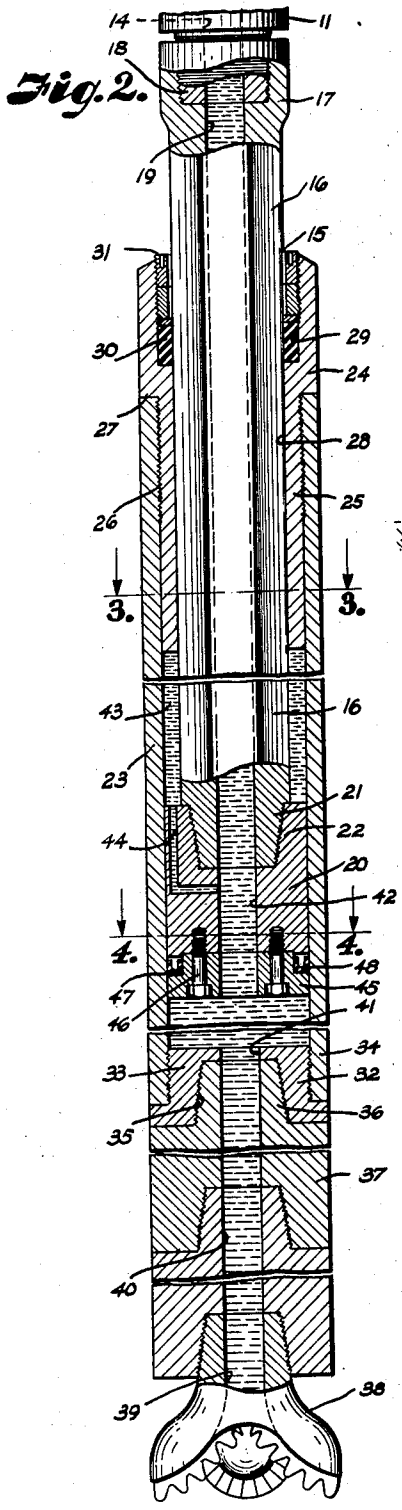

Fig. 1.

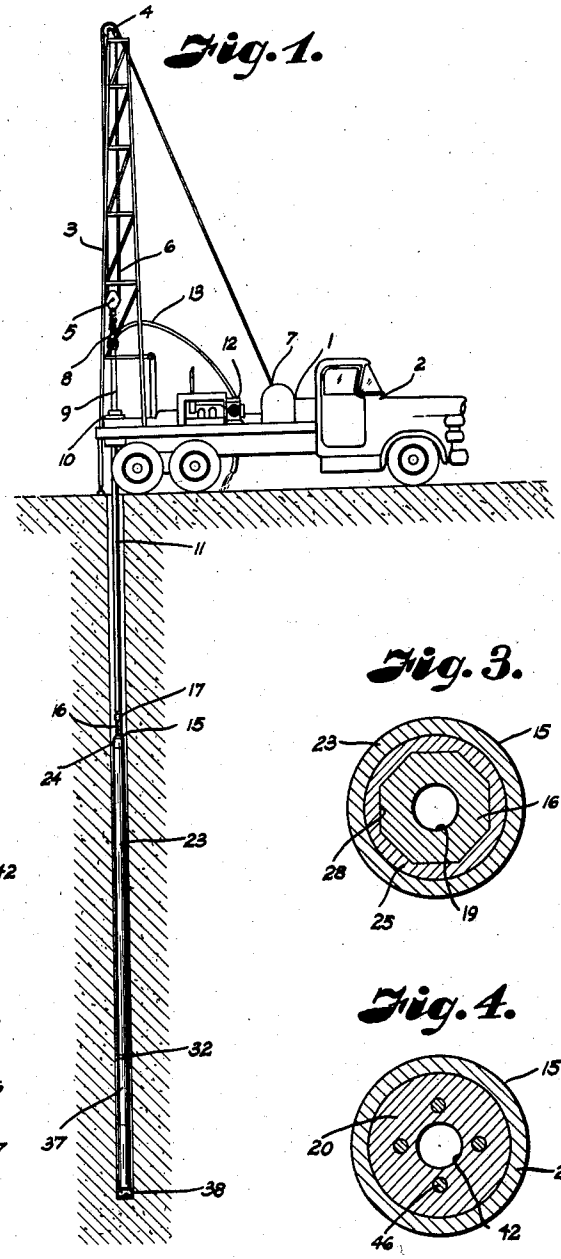

Fig. 3.

Fig. 4.

INVENTOR.
Wayne W. Simmonds and
Arlie J. Simmonds.
BY
Fishburn and Hill
ATTORNEYS.

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METHOD AND APPARATUS FOR DRILLING WELL HOLES

Wayne W. Simmonds, Tulsa, Okla., and Arlie J. Simmonds, Glendale, Calif., assignors to John H. Lucas, Kansas City, Mo.; trustee for Wayne W. Simmonds and Arlie J. Simmonds

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2 Claims. (Cl. 255—28)

This invention relates to the drilling of well holes such as oil, gas and like wells, and more particularly to an improved method and apparatus for drilling such wells with a predetermined weight and controlled variation thereof on the drill bit drilling the formation.

In conventional rotary drilling of well holes, the drill bit on the lower end of a string of drill pipe is lowered into the hole until the bit rests on the formation being drilled, and then the drill pipe and bit are rotated by a rotary table in the drilling equipment at the surface thereabove. While the drilling is at shallow depth, it is common practice to add tubing called drill collars to add weight to the bit, and at greater depths the string of drill pipe becomes so heavy it is necessary to support part of the weight thereon on the cable and pulley blocks and cable drum or draw works in the drilling rig. Weight indicators show the weight supported by the rig and the driller reels in or pays out cable to maintain the desired weight at the bit on the formation being drilled. As the drill is rotated, suitable drilling mud or fluid is pumped down a passage in the drill pipe and through apertures in the bit, the mud flowing up through the drilled hole and carrying the cuttings therewith. With such drilling, if the hole leads to an underground cavity, the bit may drop therein as the sudden shifting of the entire weight of the bit and drill pipe supported on the formation on to the cable will cause stretching of the cable, dropping the bit enough to sometime result in seizure of the bit and possible breakage and loss of part of the drill string.

The principal objects of the present invention are to provide a novel method and apparatus of drilling well holes wherein normally a predetermined fixed weight of drill collars and a drive tube is the weight applied to the drill bit during drilling operations, with the remainder of the weight of the drill pipe and drive shaft supported by the drilling rig; to provide such a method and apparatus with a floating telescopic drive connection in the well hole between the predetermined weight producing portions and the remainder of the drill pipe; to provide such an apparatus with a liquid chamber wherein liquid under pressure tends to hold the parts against relative telescoping movement with an orifice communicating said chamber with a flow passage forming a restricted escape of liquid from the chamber in response to extension force on the members as when the bit breaks through a formation into a cavity or the like; to provide such an apparatus wherein the drive connection is movable to apply additional or less weight to the drill bit; to provide a method of drilling well holes wherein only rotative force is applied between the driving and driven members of the drill string; and to provide a method and apparatus for drilling well holes which overcomes disadvantages of existing methods and that is economical to manufacture and efficient in operation.

In accomplishing these and other objects of the present invention, we have provided improved details of

structure, the preferred form of which is illustrated in the accompanying drawings, wherein:

Fig. 1 is a diagrammatic view of drilling apparatus with a telescoping drill driving connection embodying the features of the present invention.

Fig. 2 is an enlarged vertical sectional view through the telescoping floating drive and drill collars thereon.

Fig. 3 is a transverse sectional view through the drive connection on the line 3—3, Fig. 2.

Fig. 4 is a transverse sectional view through the drive connection on the line 4—4, Fig. 2.

Referring more in detail to the drawings:

1 designates a portable drilling rig of conventional structure which includes a vehicle 2 having a derrick 3 thereon with a crown block 4 and traveling block 5 having cable 6 reeved thereon and adapted to be reeled in or paid out from a cable drum or draw works 7. Supported on the traveling block 5 is a swivel head 8 connected to a kelly rod 9 that extends through a rotary table 10 with the lower end of said kelly rod suitably connected to a plurality of lengths or sections of drill pipe 11. A pump 12 has its discharge connected by a conduit 13 to the swivel head 8 for pumping drilling fluid or mud downwardly through a flow passage 14 in the string of drill pipe sections 11. The drilling rig and drill pipe are illustrative of drilling equipment used in conventional practice and the structure per se of that portion of the equipment forms no part of the present invention.

A telescoping drive coupling 15 is suitably connected to the lower end of the string of drill pipe 11. In the illustrated structure, a drive shaft 16 has a box end 17 screwed on to a threaded lower end 18 of the lowermost section of drill pipe 11 with an axial bore 19 in the drive shaft in communication with the flow passage 14 in the drill pipe. The lower end of the drive shaft is suitably fixed to a piston or guide member 20. In the illustrated structure the lower end of the drive shaft has a threaded pin 21 screwed into a threaded socket 22 in the upper end of the piston 20. The piston 20 is cylindrical and of larger diameter than the drive shaft with the periphery of said piston slidably engaging the inner surface of an elongate tubular member or drive tube 23. A drive collar 24 has a sleeve portion 25 extending into the upper end of the drive tube 23 and is secured thereto as by threads 26 with a shoulder 27 on the drive collar engaging the upper end of said drive tube. The drive collar 24 and sleeve 25 have a bore 28 slidably receiving the drive shaft 16. The drive shaft 16 and bore 28 are of corresponding shape keying one to the other for rotative movement throughout the length of their relative longitudinal movement. In the illustrated structure, the periphery of the drive shaft 16 and the bore 28 are octagon in shape; however, they may be of any polygonal shape or suitably splined for relative telescoping movement which maintains rotative driving engagement at all times. The upper end of the drive collar 24 is provided with a counterbore 29 with suitable packing 30 therein which is compressed by packing nuts 31 threaded into the upper end of the counterbore whereby the packing forms a seal between the periphery of the drive shaft and the drive collar. The lower end of the drive tube has a plug adapter 32 secured therein. In the illustrated structure, the plug adapter has a threaded shank 33 screwed into a threaded lower end 34 of said drive tube, said adapter having a threaded box 35 opening from its lower end into which is screwed a threaded pin 36 on the upper end of a drill collar 37. A plurality of drill collars are secured one to the other to provide a string thereof below the drive tube wherein the weight of the drive collars 37 will provide the desired

weight that will be applied to a drill bit 38 during drilling operations. The drill bit 38 may be of any conventional structure and is secured in the usual manner at the lower end of the string of drive collars with the fluid passage 39 in said drill bit in communication with an axial bore 40 in the drill collars. The plug 32 has an axial bore 41 and the piston 20 has an axial bore 42 whereby there is a liquid passage for flow of drill mud from the drill pipe to the drill bit.

The drive tube 23 preferably is of a length substantially the same as the desired length of sections of drill pipe, and the piston 20 cooperates with the lower end of the sleeve 25 on the drive collar to define a liquid containing chamber 43 which has communication through a bleed hole or orifice 44 with the bore 42 in the piston, the bleed hole or orifice being of relatively small size to restrict flow of liquid from the chamber 43 as later described.

The lower end of the piston has a head 45 suitably secured thereon by fastening devices 46 such as screws, said head having a groove 47 in which a suitable seal ring 48 is located to slidably engage the interior of the drive tube to form a seal between the piston and said tube.

In performing drilling operations with the apparatus constructed as described, the drill bit is connected to the lower end of a plurality of drill collars 37 to provide a total weight desired on the bit during the drilling of the formation. The telescoping drive structure 15 is then connected to the uppermost drill collar 37 and the upper end of the drive shaft 16 is connected to the lower end of a string of drill pipe sections 11 of suitable length to extend to the bottom of the hole, and the upper end of the uppermost section of the drill pipe is connected to the lower end of the kelly rod 9. Each of these connections of the equipment is made a section at a time and lowered through the turntable 10 by operation of the draw works 7 as in conventional practice. The swivel head 8 is then connected to the upper end of the kelly rod and said swivel head connected by the conduit 13 to the discharge of the mud pump 12. The brake on the draw works 7 is then released sufficiently for the drill pipe and drive member to be lowered until the drill bit engages the formation to be drilled. During the lowering operation, the upper end of the piston 20 will engage the lower end of the sleeve 25 on the drive collar. After the drill bit engages the formation, further lowering of the drill pipe will effect disengagement of the piston from the sleeve 25 and that change in weight supported by the cable 6 will be apparent to the driller from the usual instruments in the drilling rig. The lowering of the drill pipe is continued until the piston head 45 engages the upper end of the plug 32, and then the draw works is reversed to pick up the drill pipe until the head 45 is slightly raised above the upper end of the plug 32. The pump is then operated to supply drilling mud or liquid under pressure for flow through the axial passages to the drill bit, and the rotary table 10 is engaged with the kelly rod 9 to rotate the kelly rod, drill pipe and through the telescoping drive and drill collars rotate the drill bit. The fluid under pressure passing through the axial bore 42 will also move through the bleed passage or orifice 44 and fill the chamber 43. As drilling continues, the only weight on the bit is that provided by the drive tube 23 and drill collars 37, and as drilling proceeds the draw works 7 is held stationary and the drill bit proceeds downwardly in the hole as drilled, extending the telescoping drive members 15 until the upper end of the piston 20 engages the lower end of the sleeve 25. Then additional drill pipe is added to the upper end of the string and the procedure repeated to continue the drilling of the well. If the drill bit should enter a cavity or the like, the liquid pressure in the chamber 43 tends to prevent the bit from dropping and said bit will proceed downwardly extending the telescoping drive 15 only as the liquid in the chamber 43 is forced through the bleed passage or orifice 44, thereby preventing sudden drops and seizure of the bit.

If the formation is such that for a short period of time additional weight is desired on the drill bit, the drill pipe may be lowered until the head 45 engages the upper end of the plug 32 and a desired proportion of the weight of the drill pipe added to the weight of the drill collars acting on the bit. If for a short period of time, a lesser weight than the drill collars is desired to act on the bit, the draw works is operated to raise the drill pipe and the drive shaft 16 until the piston 20 engages the lower end of the sleeve and then a portion of the drill collar weight supported by the cables 6. This addition or lessening of the weight acting on the bit is for unusual circumstances as under normal drilling operations all of the weight acting on the bit will be supplied by the drill collars 37, and collars added or removed for changing such weight.

It is to be understood that while we have illustrated and described one form of our invention, it is not to be limited to the specific form or arrangement of parts herein described and shown except insofar as such limitations are included in the claims.

What we claim and desire to secure by Letters Patent is:

1. In apparatus for drilling of well holes having apparatus at the surface operable for raising, lowering and supporting a string of drill pipe and rotating same in a well hole and a supply of drilling fluid under pressure connected to the upper end of the string of drill pipe for flow therethrough, a drill bit, a plurality of drill collars connected to and extending upwardly from the drill bit for applying weight thereto; a telescoping drive coupling comprising, an elongate tubular member having a cylindrical bore extending longitudinally therein, means connecting the lower end of the tubular member to the upper end of the uppermost drill collar and in flow communication therewith, a drive collar secured to the upper end of the tubular member and having a longitudinal bore extending therethrough, said drive collar having a sleeve portion extending downwardly in the upper portion of said tubular member and closely engaging the walls of said cylindrical bore, a hollow drive shaft extending through the drive collar and sleeve portion and into the tubular member and movable longitudinally thereof in telescoping relation to the tubular member, interengaging means on the drive shaft and drive collar keying same together whereby said drive shaft slidably engages said drive collar and is rotatable therewith, means sealingly engaging the drive shaft and drive collar to provide a fluid tight seal therebetween, a piston on the lower end of the drive shaft below the bottom of said sleeve portion slidably engaging the interior of the tubular member in fluid tight relation and cooperating with the sleeve portion of said drive collar to define a chamber therebetween, and a bleed passage communicating the interior of the hollow drive shaft and the chamber for filling said chamber from flow in the drill pipe when the telescoping drive coupling is contracted and for restricting flow of fluid from the chamber in response to unsupported weight of the drill bit and drill collars acting on the tubular member to extend the telescoping drive shaft and tubular member whereby extension of the telescoping drive coupling is retarded and sudden dropping of the drill bit into a cavity is prevented.

2. A rotary well drilling system comprising, a tubular drill string adapted to be rotated in a bore hole and having an upper portion and a lower predetermined weight producing portion having a drill bit on the lower end thereof, a drive coupling comprising, a cylinder member and a tubular plunger member extending therein from one end thereof and mounted for limited reciprocation in said cylinder member, an enlarged piston on the end of the plunger in the cylinder member and slidable in

the cylinder member, means at said one end of the cylinder member sealingly engaging the plunger member, means arranged in engagement with each other on the inner periphery of the cylinder member and the outer periphery of the plunger member to prevent relative rotation of said members, said plunger and cylinder members defining a chamber between the piston and said one end of the cylinder member, one of said members being connected to the lower end of the upper portion of the drill string thereabove and the other member being connected to the upper end of the lower portion of the drill string, an orifice means through the wall of one of said members and located at a level to permit restricted fluid flow from the drill string to and from said chamber at all positions of the tubular plunger member from substantially fully contracted to substantially fully extended position from

the cylinder member, said orifice means permitting only restricted flow of fluid from said chamber in response to weight, the lower portion of the drill string tending to extend the plunger from the cylinder and acting on the fluid in said chamber whereby downward movement of the drill bit resulting from extension of the plunger member from the cylinder member is retarded and sudden dropping of the drill bit in a cavity is prevented.

References Cited in the file of this patent

UNITED STATES PATENTS

1,513,955	Barnhart et al.	Nov. 4, 1924
1,686,945	Abercrombie	Oct. 9, 1928
1,860,675	Kammerdiner	May 31, 1932
2,776,817	Gregory et al.	Jan. 8, 1957