March 31, 1936. J. H. HOWARD 2,035,887

VALVE FOR CORE BARRELS

Filed Oct. 23, 1933

Fig. 1

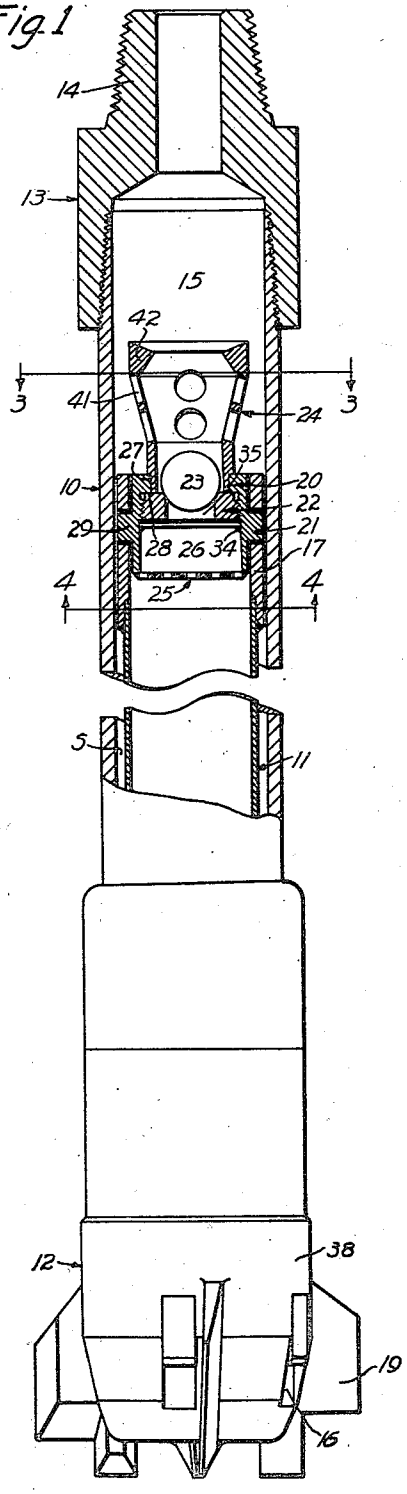


Fig. 2

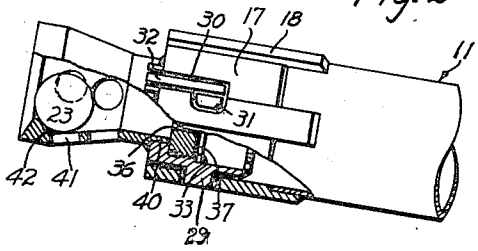


Fig. 3

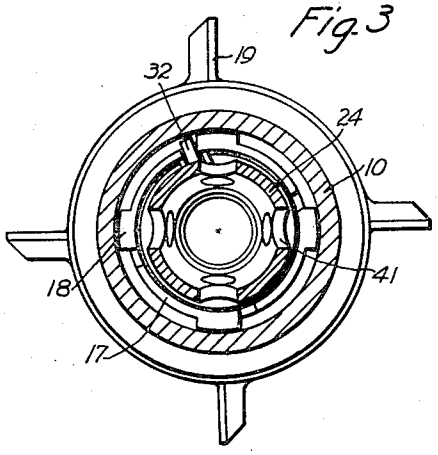
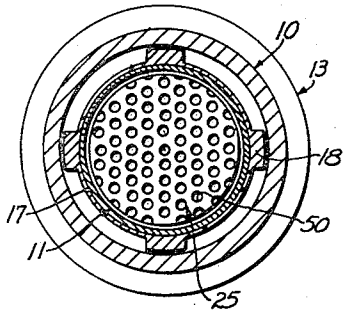


Fig. 4



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UNITED STATES PATENT OFFICE

2,035,887

VALVE FOR CORE BARRELS

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Application October 23, 1933, Serial No. 694,823

1 Claim. (Cl. 255—72)

This invention relates to a core drill or core receiving well drilling tool, and relates more particularly to a valve for the upper end of the core receiving inner barrel of a core drill. It is a general object of the present invention to provide a simple, practical and improved valve means for the core barrel or inner barrel of a well core drill.

When a core drill is run into a well, the heavy mud and coarse cuttings that have settled to the bottom of the well fill into the inner barrel of the drill and pass upwardly through the conventional or usual valve on the upper end of the inner barrel and enter the space in the drill above the inner barrel. When the circulation of fluid or rotary mud is started downwardly through the drilling string, the valve at the upper end of the inner barrel closes and the coarse cuttings and heavy mud trapped above the valve are forced downwardly into the annular space between the inner and outer barrels and often clog or obstruct this space and sometimes close the discharge ports and passages in the bit head. Further, the heavy mud and coarse cuttings trapped in the inner barrel, upon closing of the valve through the action of the pumped circulation fluid, often interfere with the passage of the core into the inner barrel and are not ejected or discharged through the valve as the pressure created by the core entering the inner barrel is not sufficient to open the valve against the pressure at the outside of the inner barrel to permit the discharge of the cuttings, etc.

It is another object of this invention to provide a core drill in which heavy mud, coarse cuttings, etc. in the well bore do not in any way interfere with the free circulation of fluid through the drill or with the passage of the core into the drill.

It is another object of the invention to provide a simple, effective valve means for the inner barrel of a core drill that permits the drill to be thoroughly washed free of cuttings and coarse material after being run into the well so that the cuttings etc. cannot clog or obstruct the fluid passages of the drill or interfere with the passage of the core into the inner barrel.

It is another object of the invention to provide a valve for the upper end of the inner barrel of a core drill that allows the inner barrel to be thoroughly washed free of heavy mud, cuttings, etc. after the drill has been run into the well and that thereafter closes the upper end of the inner barrel against the downwardly flowing circulation fluid, but may be readily opened by the pressure created in the inner barrel by the displacing action of the entering core to permit the fluid in the inner barrel to be displaced or discharged therefrom.

It is another object of the invention to provide a valve means for the inner barrel of a core drill that includes a valve seat on the upper end of the inner barrel having a fluid opening that is open and entirely unobstructed when the drill is run into the well so that water or fluid may be pumped downwardly through the drilling string to flow through the inner barrel to wash away or clear it of coarse cuttings, etc., and a ball that is adapted to be dropped through the drilling string after the washing of the inner barrel to cooperate with the seat and close the upper end of the inner barrel against the further entrance of fluid.

It is another object of the invention to provide a valve of the character mentioned for the upper end of the inner barrel of a core drill that includes a strainer or screen below the valve seat for preventing coarse cuttings, etc., from passing upwardly from the upper end of the inner barrel into the outer barrel when the drill is run into the well.

It is another object of the invention to provide a valve for the inner barrel of a core drill that is detachably mounted on the upper end of the inner barrel in a simple, effective manner and without the use of screw threads.

It is another object of the invention to provide a valve of the character mentioned for the inner barrel of a core drill that includes a receiver or guide that is adapted to receive the ball when it is dropped through the string to guide it to the valve seat and that is effective in holding the ball when the drill is disassembled at the surface of the ground and the inner barrel is inclined or moved to a horizontal position.

It is a further object of the invention to provide a valve means for the upper end of the inner barrel of a core drill that is simple and inexpensive of manufacture and that may be easily and quickly applied to and detachable from the inner barrel.

Other objects and features of the invention will be best and fully understood from the following detailed description of a typical form and application of the invention, throughout which description, reference is had to the accompanying drawing, in which;

Fig. 1 is a side elevation of a core drill embodying the present invention and showing its upper portion broken away to illustrate the valve means and adjacent parts in vertical cross section. Fig. 2 is a side elevation of the upper portion of the inner barrel when the inner barrel

is in an inclined or substantially horizontal position after the drill has been taken apart, and showing a portion of the valve means in vertical or longitudinal cross section. Fig. 3 is an enlarged transverse detailed sectional view taken as indicated by line 3—3 on Fig. 1, and Fig. 4 is an enlarged transverse detailed sectional view taken as indicated by line 4—4 on Fig. 1.

The valve or valve means provided by the present invention may be embodied or used in core drills and core receiving well drilling tools of various characters. Throughout the following detailed disclosure I will describe the invention in connection with a core drill of the general character fully described and claimed in the application of John H. Howard and Alfred C. Catland, Serial No. 684,018 entitled Core drill and filed August 7, 1933. It is to be understood that the invention is not to be construed as limited or restricted for embodiment in the particular type of core drill illustrated in the drawing, but is to be taken as including any features or modifications that may fall within the scope of the claim.

The core drill illustrated in the drawing includes an outer barrel 10 and inner barrel 11, and a bit head 12 on the lower end of the outer barrel for making an annular cut in the earth formation and to form the core for reception by the inner barrel. The outer barrel 10 is adapted to be connected with a drilling string of drill pipe, or the like, and is provided at its upper end with suitable means for connecting with the drilling string or for connecting with a drill collar on the lower end of a string. In the particular case illustrated in the drawing, a sub 13 is screw threaded on the upper end of the barrel 10 and is provided with an upwardly projecting tapered screw-threaded pin 14 to facilitate connection with the drilling string or a drill collar on the string. The inner barrel 11 is arranged longitudinally within the outer barrel 10 and is provided to receive the core cut by the bit head 12. The exterior of the inner barrel 11 is spaced from the wall of the longitudinal opening 15 in the outer barrel providing an annular space or fluid passage S between the two barrels. In the particular class of drill illustrated in the drawing, the inner barrel 11 has thin walls to be light in weight and inexpensive of manufacture. A collar or enlargement 17 is provided on the upper end of the barrel 11 to facilitate the attachment or connection of the valve means with the inner barrel as will be subsequently described. The enlargement 17 is provided with longitudinally extending ribs 18 to centrally space the upper end of the inner barrel in the outer barrel, to strengthen the connection between the enlargement 17 and the barrel 11, and to protect and strengthen the valve means. The inner barrel is supported at its lower end in a manner not illustrated in the drawing and its lower end is open to receive the core cut by the bit head 12. The bit head 12 on the lower end of the outer barrel 10 comprises a body or shoe 38 and cutting parts 19 projecting from the shoe. The cutting parts 19 are in the nature of blades projecting downwardly from the lower end of the shoe and substantially radially outward from the shoe. Discharge openings 16 are provided in the shoe 38 at the forward faces of the cutting parts 19 to discharge the circulation fluid downwardly immediately in front of the cutting parts. The fluid discharge openings 16 are in communication with the annular passage or space S, so that the circulation fluid pumped downwardly through the drilling string flows downwardly through the space S and ultimately discharges from the ports or openings 16.

The valve or valve means provided by the invention includes generally, a body 20, means 21 for detachably connecting the body 20 with the inner barrel 11, a valve seat 22 on the body adapted to be engaged by a closure member or ball 23 dropped through the drilling string, a receiver or guide 24 for guiding the ball 23 to the seat 22, and a screen or strainer 25 on the body 20 for preventing coarse cuttings etc. from passing upwardly through the body.

The body 20 is adapted to be positioned or arranged within the upper portion of the inner barrel, for example, it is adapted to be arranged within the enlargement 17 of the inner barrel. The body 20 is a tubular member having a central longitudinal opening 26. An annular inwardly projecting flange 27 is provided at the upper end of the body 20 and provides a downwardly facing shoulder 28 in the body opening. The body 20 may be comparatively short, for example it may be of less length than the collar or enlargement 17 of the inner barrel.

The means 21 for connecting the body 20 with the inner barrel 11 is such that the body 20 of the valve may be easily and quickly attached to and detached from the inner barrel. The detachable connecting means 21 is in the nature of a bayonet type of connection and includes a plurality of lugs 29 on the body 20 for cooperating with slots 30 in the barrel enlargement 17. There may be any desired or suitable number of lugs 29 projecting from the exterior of the body 20. In the particular case illustrated in the drawing, there are four equally spaced lugs 29. The slots 30 extend downwardly in the barrel enlargement 17 from its upper end and are spaced and proportioned to properly receive the lugs 29. In the preferred construction, the slots 30 are provided in the barrel enlargement 17 immediately adjacent its ribs 18. Lateral enlargements or notches 31 are provided at the lower ends of the slots 30 for receiving the lugs 29. The notches 31 preferably extend into the ribs 18 as clearly illustrated in Fig. 2 of the drawing. In assembling the body 20 on the inner barrel 11, the lugs 29 are positioned in register with the slots 30 and the body is moved into the barrel enlargement 17 to move the lugs 29 inwardly through the slots 30. The body 20 may then be turned relative to the inner barrel 11 to bring the lugs 29 into the notches 31 to connect the body with the inner barrel. In practice, a latch 32 may be pivotally mounted on the upper end of the body 20 in a position so that it is adapted to be pivoted downwardly into a slot 30 after the positioning of the lugs 29 in the notches 31 as above described, to hold the body 20 against turning relative to the barrel 11 and therefore hold the lugs 29 against movement out of the notches. The latch 32 is proportioned so that it may be readily pivoted into the slot 30 before the assembling of the inner barrel in the outer barrel 10 and is such that it cannot become disengaged from the slot 30 while the inner barrel is within the outer barrel. When the body 20 is detachably connected with or mounted in the enlargement 17 of the inner barrel as just described, its upper end is preferably substantially flush with the upper end of the barrel enlargement.

The valve seat 22 is provided in the body 20

to be engaged by the ball 23 to close the upper end of the inner barrel 11 against the entrance of fluid passing downwardly through the drill. The valve seat 22 may be a simple annular or tubular member arranged in the body 20 at the lower side of its flange 27. In the preferred construction the valve seat 22 is replaceably or detachably connected with the body. In the construction illustrated in the drawing, the valve seat 22 is threaded in the body opening 26 in a manner to have its upper end bearing upwardly against the flange 27. A slot 33 may be provided in the lower end of the valve seat 22 to receive a wrench or the like for facilitating its threading into the body. A rod 37 at the lower end of the valve seat 22 may be welded to the body 20 as at 34. The valve seat 22 is provided with a central fluid opening 35 which is adapted to pass fluid downwardly into the inner barrel 11 prior to the dropping of the ball 23 through the string and that is adapted to allow for the discharge or displacement of fluid from the inner barrel 11 when the core is received in the inner barrel. A suitably shaped annular seat or face 36 is provided on the seat 22 around the upper end of its opening 35 to be cooperated with by the ball 23.

The ball 23 which constitutes a valve member or closure member for cooperating with the seat 22 to close the upper end of the inner barrel is adapted to be dropped or passed downwardly through the drilling string to come to rest on the valve seat face 36 where it closes the opening 35. The ball 23 is of sufficient diameter to positively close the opening 35 against the entrance of fluid into the inner barrel 11 and is proportioned so that it may readily pass down through the drilling string and guide 24. The ball 23 may be introduced into the drilling string in any suitable manner for example, a connection in the string at the derrick may be broken to allow the ball 23 to be dropped through the drilling string to come to rest on the valve seat 22.

The guide 24 projects upwardly from the body 20 and is provided to receive the ball 23 and guide it to the seat 36. It is a feature of the present invention that the guide 24 is operatable to dependably hold the ball 23 when the inner barrel 11 is inclined or moved to an inclined or horizontal position at the derrick. The guide 24 may be a tubular funnel-like member flaring upwardly and outwardly to be of increased diameter at its upper end. The guide 24 may be attached to the body 20 in any suitable manner. In the particular instance illustrated in the drawing, the guide 24 has a reduced lower portion 40 fitted within the flange 27 and has its lower portion welded to the body 20. The inner and outer diameters of the guide 24 gradually increase upwardly so that the upper end of the guide is comparatively large and has its exterior comparatively close to the wall of the opening 15 in the outer barrel 10. In practice, the space between the large upper end of the guide 24 and the wall of the opening 15 is less than one-half of the diameter of the ball 23 so that the ball 23 cannot become wedged or lodged between the guide and the wall of the opening, and cannot rest on the upper end of the guide. The walls of the guide 24 may be perforated or provided with spaced openings 41 to provide for the free circulation of fluid downwardly to the annular spaces.

In accordance with the invention, means is provided on the upper end of the guide 24 to hold the ball 23 within the guide when the inner barrel 11 is tipped or moved to a horizontal or nearly horizontal position. An inwardly projecting flange or lip 42 is provided in the upper portion of the guide to prevent the ball 23 from falling out of the guide when the inner barrel is moved about after being disconnected from the outer barrel 10. The lip 42 is of sufficient thickness or width to effectively prevent the accidental or unintentional displacement of the ball 23 from the guide. Fig. 2 of the drawing illustrates the manner in which the lip 42 effectively prevents the ball 23 from rolling or passing out through the upper end of the guide 24 when the inner barrel 10 is moved to a horizontal or nearly horizontal position. The inner or lower side of the lip 42 is preferably inclined while the upper surface of the lip is bevelled downwardly and inwardly to aid in guiding the ball 23 into the guide 24.

The screen or strainer 25 is provided to prevent coarse cuttings or the like from passing upwardly through the body 20 and into the upper end of the inner barrel 11 when the drill is run into the well. In accordance with the broader aspects of the invention, the strainer 25 may be varied considerably in construction, etc. In the simple form of the invention illustrated in the drawing, the strainer 25 is in the nature of a perforated plate extending across the lower end of the body 20. The strainer plate is provided with a multiplicity of openings 50 that are sufficiently small in diameter to prevent any large cuttings from passing upwardly into the body 20. The openings 50 are sufficient in number and fluid capacity to allow for the free and proper passage of fluid through the strainer in both directions. The screen or strainer 25 extends completely across the lower end of the body opening 26 and may be welded to the body as illustrated in the drawing.

In operation the core drill is run into the well on the lower end of a drilling string in the usual manner and the opening 35 through the valve seat is open or entirely unobstructed at this time as the ball 23 is not arranged on the seat when the drill is run into the well. As the drill is run into the well the fluid or mud in the well is free to pass upwardly into and through the inner barrel 11 and through the valve into the opening 15 above the valve. The screen or strainer 25 is effective in preventing any coarse cuttings or the like from passing upwardly through the valve into the opening 15. In this manner the strainer 25 retains the coarse cuttings within the inner barrel 11. When the drill has reached its position at the lower end of the well bore the downward circulation of fluid through the drilling string may be started so that the downwardly flowing fluid under pressure passes downwardly through the inner barrel to clear or wash it of the coarse cuttings and heavy mud. After the drill has been thoroughly cleared of cuttings, etc. by the passage of circulation fluid downwardly through it, the circulation of the fluid is stopped and a connection in the drilling string at the derrick is broken. The ball 23 is then introduced into the string at the broken connection to drop or pass downwardly through the string. Upon the ball 23 reaching the opening 15 in the outer barrel, the guide 24 receives it and guides it to its proper position in engagement with the face 36 of the seat 22 where it closes the opening 35. The downward circulation of fluid through the drilling string may be resumed and the drilling may be started. As the drill has

been washed or cleared of large cuttings and mud prior to the insertion of the ball 23 in the drilling string, the circulation fluid is free to pass downwardly through the space S and discharge from the ports 16. Further, the core is free to enter the inner barrel as the inner barrel has been thoroughly cleared of coarse cuttings, etc. When the pressure created by the displacing action of the core received in the inner barrel becomes sufficient, the ball 23 may be raised from its seat to permit the discharge of fluid from the upper end of the inner barrel.

After sufficient core has been taken and the drill has been withdrawn from the well, the outer barrel 10 may be disengaged from the inner barrel in the usual manner by being raised off of the inner barrel. The inner barrel 11 is then lifted and its lower end is placed on a casing wagon or the like, which is pulled away from the rotary table as the upper end of the inner barrel is allowed to lower. The inner barrel is thus brought to a horizontal or substantially horizontal position. During this handling of the inner barrel 11, the guide 24 holds or retains the ball 23, the lip 22 being particularly effective from preventing the ball rolling from the guide. This function of the guide 24 is important for if the ball were allowed to fall from the guide it might injure the drillers or might fall into the well where it would cause considerable trouble. The valve means of the present invention insures the proper operation of the core drill as it allows the core drill to be thoroughly flushed out before the actual drilling operation so that proper circulation may be maintained. The connecting means 21 is such that the body 20 of the valve may be easily and quickly assembled from the inner barrel and may be quickly detached from the barrel when desired. The latch 32 may be swung to an up position to allow the lugs 29 to be turned out of the notches 31 and moved out of the slots 30. In this manner the valve means may be disconnected from the inner barrel to permit the attachment of a pressure head to the inner barrel for ejecting the core from the barrel. The slots 30 and notches 31 in the inner barrel are adapted to receive the bayonet lugs of a pressure head of the character fully described and claimed in application Serial No. 684,019, entitled Pressure head for core barrels filed August 7, 1933.

Having described only a typical form and application of my invention I do not wish to be limited or restricted to the specific form or application herein set forth, but wish to reserve to myself any modifications or variations that may appear to those skilled in the art or fall within the scope of the following claim.

Having described my invention, I claim:

In a core drill for use on a drilling string, an outer barrel, two elements, one a core receiving inner barrel within the outer barrel, the other a body having a fluid opening, means for detachably connecting the body with the upper end of the inner barrel so that its opening is in communication with the interior thereof, said means including a lug on one element, there being a bayonet slot in the other element for receiving the lug, and a latch on one element adapted to occupy the slot to hold the lug therein and normally retained in the slot by the outer barrel, and an object adapted to be dropped through the string to come to rest on said body and close the opening.

JOHN H. HOWARD.