

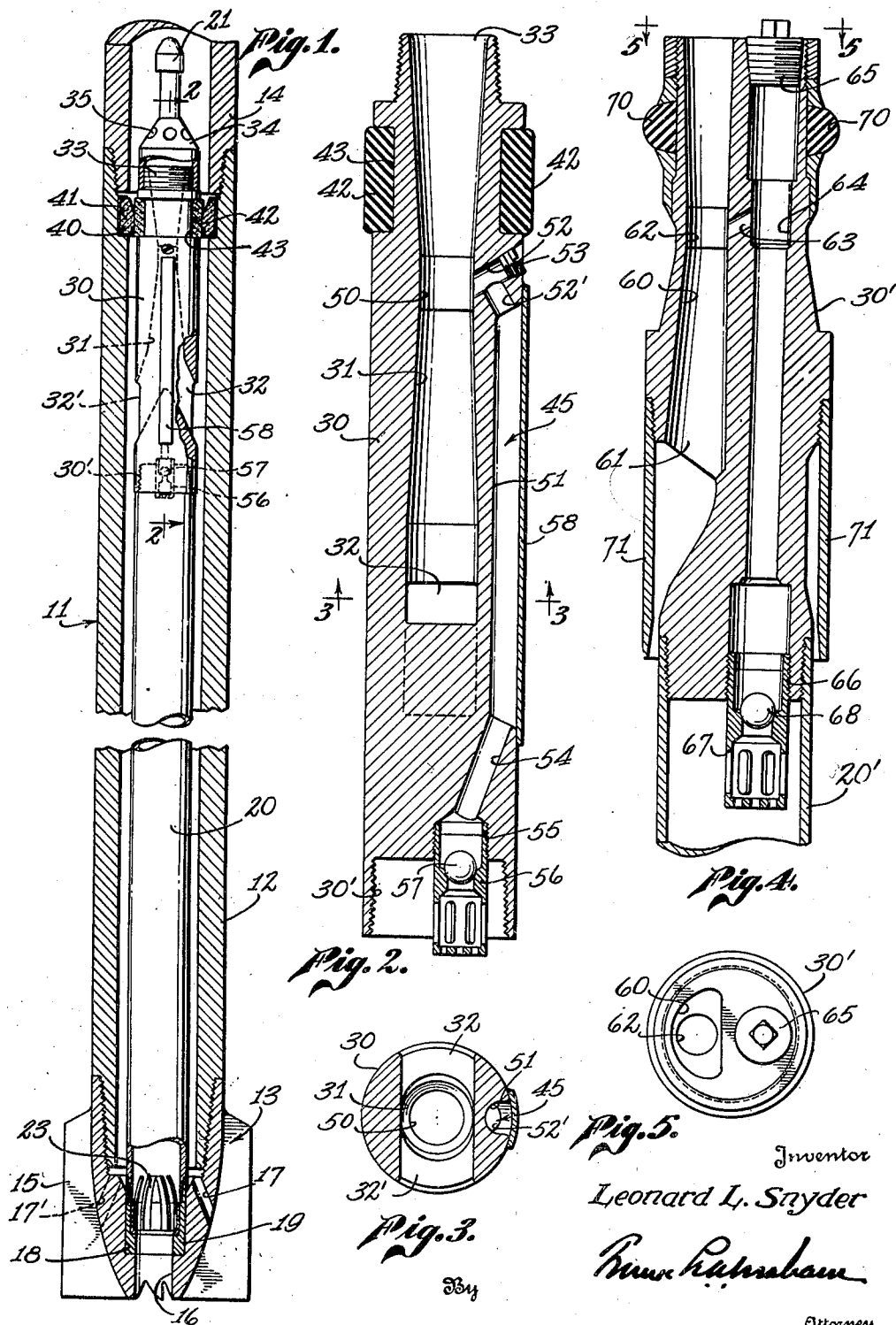
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VALVE HEAD STRUCTURE FOR CORE BARRELS

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VALVE HEAD STRUCTURE FOR CORE BARRELS

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This invention has to do in a general way with oil well drilling operations and is more particularly related to improvements in the construction of core drills which are used in such operations to obtain samples of the formation.

As is well known to those familiar with the art, the usual construction employed in core drills embodies what may be termed an outer barrel mounted on the lower end of the drill stem and equipped with a cutting head or bit on its lower end. This outer barrel contains an inner barrel adapted to receive a core which passes upwardly through a passage in the cutting head during the drilling operation.

As the drill is being operated a drilling fluid commonly known as rotary mud is circulated downwardly through the drill stem under a substantial pressure, discharging through passages in the head to keep the region of the blades free from cuttings.

It is important to the successful operation of a core drill that means be provided for preventing this drilling fluid passing downwardly into the core barrel where it would disintegrate the core and the usual procedure is to mount an upwardly opening check valve in the top of the core barrel which will permit the upward discharge of mud from within the barrel above the core and at the same time prevent the drilling fluid passing downwardly into the core barrel. Inasmuch as this check valve is exposed to the pressure within the drill stem thereabove and in view of the fact that the core barrel itself is generally filled with mud as it is lowered into the well, it will be seen that the pressure in the drill stem is in effect applied directly to the core which causes excessive packing and prevents a full core being taken.

It is a primary object of this invention to provide the inner barrel of a core drill with improved means for relieving the pressure therein during the coring operation and in this connection my invention contemplates a means which employs the pressure fluid used in the drill stem for the purpose of creating a suction in the upper end portion of the inner core barrel.

I am aware of the fact that previous attempts have been made to utilize the drilling fluid for this purpose. So far as I am aware, however, none of these prior devices has proved satisfactory. In the prior devices of this character with which I am familiar and of which the disclosures in United States Letters Patent No. 1,629,026 and 1,669,098 are examples, the inventors have attempted to incorporate a jet of the injector or

ejector type in the upper end of the core barrel and by passing the drilling fluid through such jet have attempted to reduce the pressure in the core barrel. It has been established, however, that devices of this character when employed in actual practice do not operate with the desired degree of success.

Inasmuch as it is difficult to duplicate subterranean conditions in which these devices operate, a definite statement as to just what takes place cannot be made. However, as stated above, these devices employ jets which necessarily require small restrictions through which the drilling fluid must pass, and as is well known to those familiar with the action of steam injectors which employ this principle, they require accurate adjustment of the steam jet and even then they are not positive in operation. It is entirely probable that when operating with a heavy liquid such as the rotary mud, and under a relatively small pressure differential, that the injector type of construction is even less positive in its operation.

In the device contemplated by the present invention, I employ a Venturi passage, the throat of which is connected through a second passage or conduit with the upper end portion of the inner core barrel. The Venturi passage has several distinct advantages over any of the structures of the prior art with which I am familiar. In the first place, it permits the use of a passage in which the minimum cross sectional area at the throat is sufficient to accommodate the required flow of pressure fluid for flushing the bit blades. Also it is of sufficient size to prevent the possibility of its becoming clogged by cuttings as is the case in devices of the prior art referred to above. In addition to this the Venturi passage has the paramount advantage of operating with maximum efficiency and in actual practice has been demonstrated to produce a substantial vacuum within the core barrel under conditions of pressure differential equivalent to those encountered in actual drilling operations. Also, in actual drilling operations equipped with a device of the type contemplated by this invention, reliable core samples of a greater length than ordinarily obtained have always been recovered without the excessive packing frequently encountered in the usual practice.

Details in the construction of certain preferred embodiments of my invention, together with other objects attending its production will be best understood from the following description of the

accompanying drawing which is chosen for illustrative purposes only and in which;

Fig. 1 is a sectional elevation with parts broken away showing a core drill, the inner barrel of which is equipped with one preferred embodiment of my invention;

Fig. 2 is an enlarged fragmentary sectional elevation taken in a plane represented by the line 2—2 of Fig. 1; and illustrating further details in the construction of the suction element shown in Fig. 1;

Fig. 3 is an inverted plan view taken in a plane represented by the line 3—3 of Fig. 2;

Fig. 4 is a fragmentary sectional elevation illustrating a modified form of suction element contemplated by this invention; and

Fig. 5 is a plan view taken in a plane represented by the line 5—5 of Fig. 4.

More particularly describing the invention as herein illustrated, reference numeral 11 indicates a core drill assembly which is shown as comprising an outer body member 12 having a cutting head 13 threaded to its lower end, such body being attached at its upper end to a drill stem or drill pipe indicated by reference numeral 14.

The cutter head 13 is shown as being of any conventional type, such head having blades 15, a central core passage 16 and fluid outlet passages 17 and 17' positioned so as to direct drilling fluid into the region of the head adjacent the blades.

The passage 16 is shown as being provided with an enlarged portion 18 in the upper end thereof, such enlarged portion being adapted to receive the lower end portion 19 of an inner barrel 20.

In this form of my invention the inner barrel 20 is shown as being of a character such that it can be removed from the outer barrel through the medium of a cable while the drill is in the well. In other words, this inner barrel 20 is what is known to the trade as a "wire line" type of barrel, such barrel being slidably received in the socket 18 within the head and equipped at its upper end with a spear 21 adapted for engagement with a suitable grappling tool. It will be understood, however, that the suction element contemplated by this invention is not in any way limited for its use to a "wire line" type of barrel, but may be used with equal satisfaction in connection with a conventional rigid type barrel which is threaded or otherwise secured within the cutter head.

The inner barrel 20 is shown as being provided with a core catcher 23 of any conventional type.

As has been previously pointed out, it is the principal object of this invention to provide a device for use in conjunction with an inner core barrel which will utilize the drilling fluid to relieve the pressure therein, and at this time it is pointed out that my invention contemplates such a device which is of simple form and construction, does not increase the over-all diameter of the core barrel assembly at any point, and carries no parts which are liable to injury during its installation in the event it is used in connection with a wire line type of barrel. As has also been pointed out, my invention contemplates in this connection the use of a Venturi passage, the throat of which is connected to the top portion of the inner barrel and is effective to reduce the pressure therein.

In the construction shown in Figs. 1 to 3 inclusive, I have illustrated the invention as embracing what may be termed a body member 30 which is shown as being threaded at 30' to the

top of the inner barrel 20. This body member is formed with a Venturi passage 31 therethrough, such passage having discharge openings 32 and 32' in the wall of the body above the top of the inner barrel and having an inlet opening 33 in the top of the body in alignment with the line of flow of drilling fluid passing through the drill stem. In the embodiment of my invention shown in Fig. 11, the top of the body is shown as being equipped with a cap 34 having inlet ports 35 therein, such cap carrying the spear 21 referred to above. In this connection it is again pointed out that the body 30 may be mounted upon a conventional type of core barrel which is permanently mounted in the upper barrel in which event the cap 34 and its associated parts may be dispensed with.

In order that substantially the entire stream of drilling fluid may be forced to flow through the Venturi passage, which I consider important for maximum efficiency in operation, I provide packing means about the body 30 near the upper end thereof, such packing means being interposed between the body and the inner surface of the outer barrel. Various types of construction may be employed to effect this packing and in the form shown, I have illustrated the outer barrel as being equipped with an annular recess 40 which carries a packing ring 41 of yieldable material, such as rubber. This ring may be of sufficient thickness to have tight fitting engagement with the outer surface of the body 30, but in order to provide a replaceable member, to receive any wear which may attend the leakage of fluid past the packing 41, I prefer to equip the body 30 with a packing ring 42 which is also composed of a yieldable material such as rubber and which is shown as being carried in an annular groove 43 formed on the periphery of the body.

In order that suction or reduced pressure created at the throat 50 of the Venturi passage, may be utilized to relieve the pressure within the top portion of the inner barrel, the body 30 is shown as being formed with a conduit generally indicated by reference numeral 45 which connects the throat with the top of the inner barrel. This conduit 45 may be formed in various ways, but for convenience in the manufacture of the unit, I propose to form the conduit 45 by casting a groove or channel 51 on the outer wall portion of the body connecting such channel with the throat 50 through drill passages 52 and 52', the passage 52 being closed with a suitable plug 53. The lower end of the channel 51 communicates through the bottom of the body 30 in a drilled passage 54 which opens into an enlarged opening 55 threaded to receive a cage 56 which carries an upwardly opening check valve 57. A closed passage is formed through the channel 51 by providing the same with a cover plate 58 which is welded or otherwise secured to the outer surface of the body.

In the form of my invention shown in Figs. 4 and 5, the body 30' is shown as being provided with a Venturi passage 60 offset from the center thereof, such passage being of arcuate shape at its upper end as illustrated in Fig. 5 and having a discharge opening 61 at its lower end through the wall of the body above the upper end of the inner barrel 20'. The discharge portion of the passage is similar in shape to the inlet portion illustrated in Fig. 5. This Venturi passage is provided with a throat 62 which is shown as being circular in cross section, such throat communicating through an auxiliary passage 63 with 75

a second passage 64, the outer end of which is closed by a plug 65 and the lower end of which opens into an enlarged threaded opening 66 which carries a valve cage 67 and a check valve 68 in the top portion of the inner barrel 20'.

The body 30' is shown as being equipped with a packing ring 70 which, like the packing ring 42 shown in Figs. 1 and 2, may cooperate with another packing ring in the outer barrel, or in either type of suction member the packing ring may be eliminated in which event the ring in the outer barrel alone will be used or the ring in the outer barrel may be eliminated in which event the packing ring on the body will then serve as the sole packing means between the inner and outer barrel.

In the form of my invention shown in Fig. 4 I have illustrated the body as being provided with a skirt 71 positioned over the discharge opening from the Venturi passage, such skirt serving to receive any wear which may attend the passage of drilling fluid therethrough and thereby protect the surface of the outer barrel.

It is to be understood that while I have herein described and illustrated certain preferred forms of my invention, that the invention is not limited to the precise structures described above, but includes within its scope whatever changes fairly come within the spirit of the appended claims.

I claim as my invention:

1. For use in combination with a core drill having an outer barrel member, a core barrel therein and a drill pipe secured to the top of said outer barrel, means for relieving the pressure within said core barrel during circulation of drilling fluid through said drill stem embodying: an elongated body mounted on the top of said core barrel and having a Venturi passage formed therein in the path of drilling fluid in said drill pipe, said body having a suction passage communicating between the throat of said Venturi passage and the upper end of said core barrel; and an upwardly opening check valve in said suction passage.

2. For use in combination with the core barrel of a core drill assembly; means operable by drilling fluid for reducing the pressure in the top of said core barrel comprising: an elongated body member mounted on the top of said core barrel; a packing ring mounted in said body near the upper end thereof for engaging a core barrel enclosing member in said assembly; said body having a Venturi passage formed therein with an inlet opening through the top of said body and

an outlet opening through the wall of said body below said packing ring, and a suction passage communicating between the throat of said Venturi passage and the upper end portion of said core barrel.

3. For use in combination with the core barrel of a core drill assembly; means operable by drilling fluid for reducing the pressure in the top of said core barrel comprising: an elongated body member mounted on the top of said core barrel; a packing ring mounted on said body near the upper end thereof for engaging a core barrel enclosing member in said assembly, said body having a Venturi passage formed therein with an inlet opening through the top of said body and an outlet opening through the wall of said body below said packing ring, and a suction passage communicating between the throat of said Venturi passage and the upper end portion of said core barrel and an upwardly opening check valve in said suction passage.

4. For use in combination with a core drill having an outer barrel, a core barrel therein and a drill pipe secured to the top of said outer barrel, means for relieving the pressure within said core barrel during circulation of drilling fluid through said drill stem, embodying: an elongated body mounted on the top of said core barrel having a passage formed therein in the path of the drilling fluid in said drill pipe, said passage having a restricted cylindrical throat portion intermediate its length, and a gradually diverging substantially frusto conical portion leading from said throat portion to the outlet of said passage, said body having a suction passage communicating with the throat portion of said passage and the interior of the upper end of said core barrel.

5. For use in combination with a core drill having an outer barrel member, a core barrel therein and a drill pipe secured to the top of said outer barrel, means for relieving the pressure within said core barrel during circulation of drilling fluid through the drill stem embodying: an elongated body mounted on the top of said core barrel and having a Venturi passage formed therein in the path of drilling fluid in said drill pipe, said body having a suction passage communicating between the throat of said Venturi passage and the upper end of said core barrel; and upwardly opening check valve in said suction passage; and means interposed between said outer barrel and said elongated body for directing substantially all of said drilling fluid through said Venturi passage.

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