Oct. 7, 1941. A. C. CATLAND ET AL 2,258,352

CORE DRILL

Filed Nov. 27, 1939 2 Sheets-Sheet 1

Fig. 1.

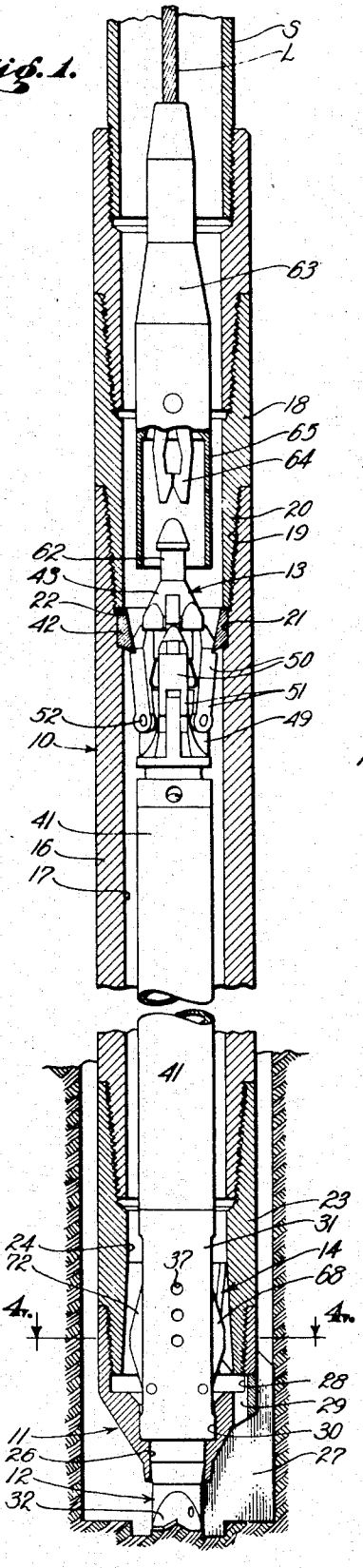

Fig. 2.

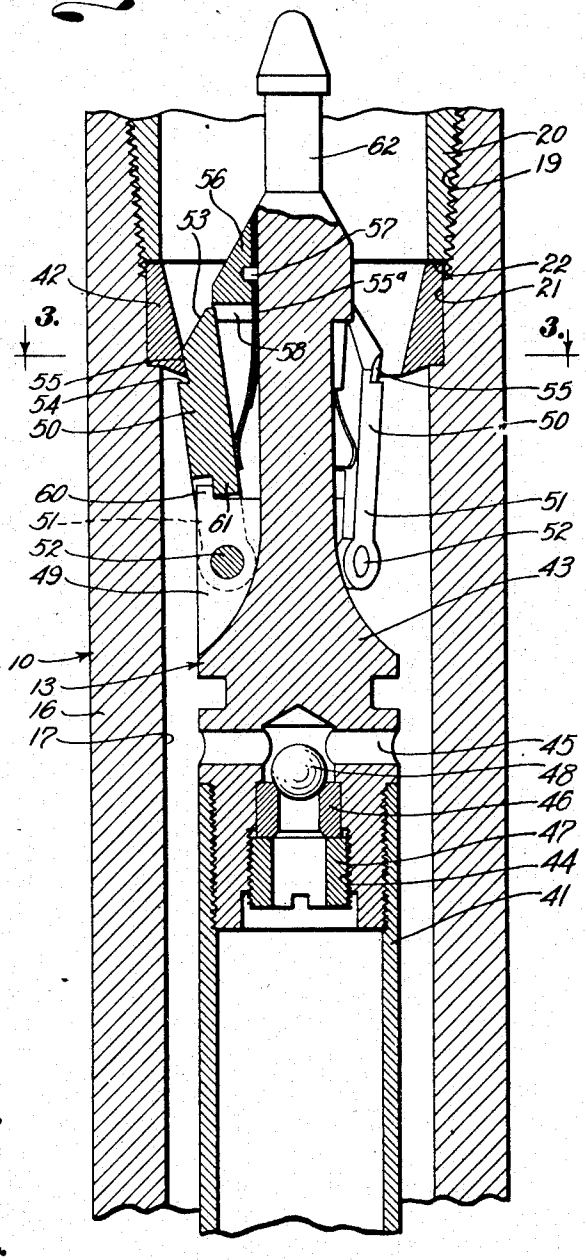

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Fig. 3.

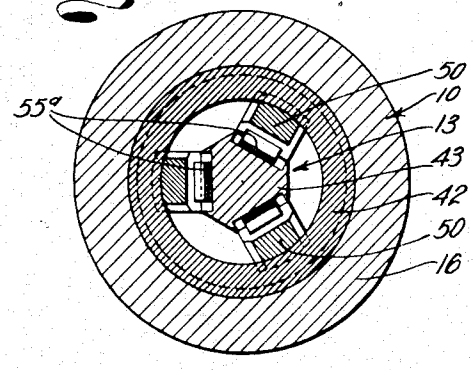


Fig. 4.

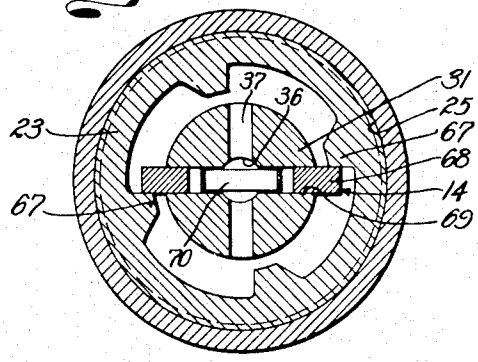


Fig. 5.

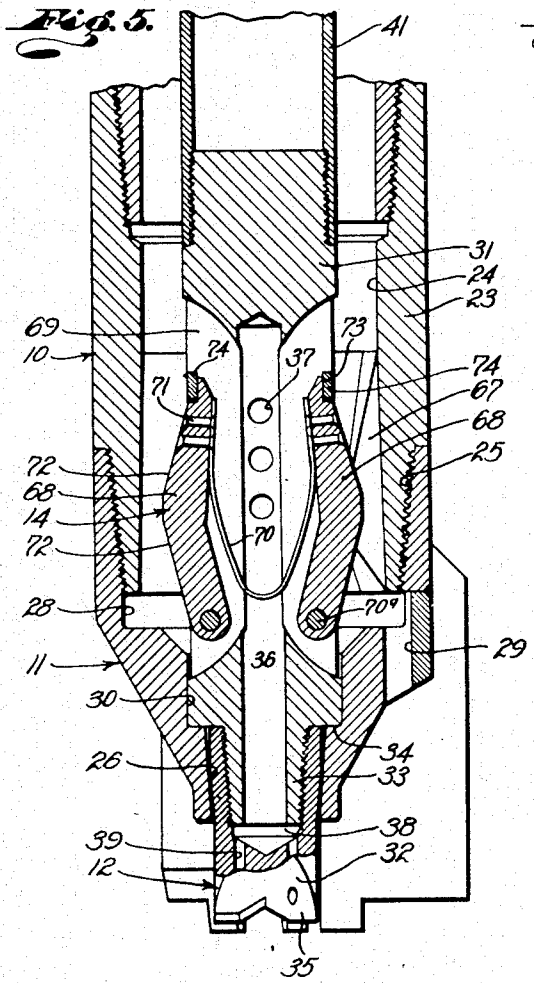
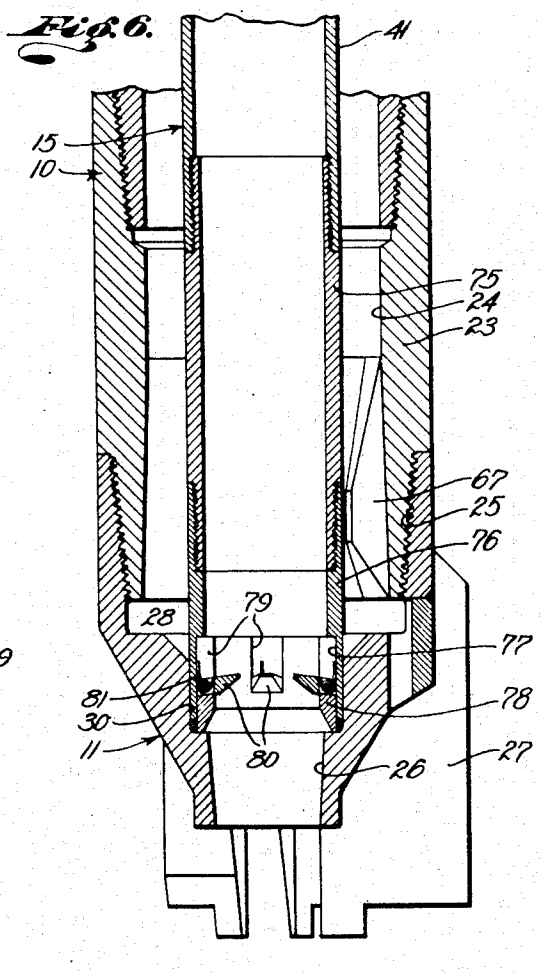


Fig. 6.



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UNITED STATES PATENT OFFICE

2,258,352

CORE DRILL

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Application November 27, 1939, Serial No. 306,260

9 Claims. (Cl. 255—72)

This invention relates to well drilling tools and relates more particularly to a core drill for use in the rotary method of well drilling. A general object of this invention is to provide a practical, effective, and dependable core drill of the type in which the core barrel may be withdrawn on a wire line or cable.

Another object of this invention is to provide a core drill having a core receiving barrel adapted to be removed on a wire line and embodying novel means for releasably latching or retaining the barrel in the core receiving position.

Another object of this invention is to provide a core drill of the character mentioned in which the barrel retaining or latching means is located at the upper end of the barrel and is constructed to securely latch the barrel against upward movement and to be readily released by a retrieving tool lowered through the drilling string.

Another object of this invention is to provide a core drill of the character mentioned in which the core receiving barrel is free to "float" or to remain non-rotatable during the coring operation.

Another object of this invention is to provide a core drill of the character mentioned embodying a plug bit for cutting away the central portion of the earth formation when no core is being taken, which bit is releasably latched in the tool to be readily withdrawn on a wire line when it is desired to resume coring operations.

Another object of this invention is to provide a core drill of the character mentioned embodying novel and effective means for transmitting rotation or driving forces from the tool body to the plug bit.

A further object of this invention is to provide a core drill of the character mentioned in which the latch means for releasably retaining the core barrel and the valve for the relief of pressure in the core receiving barrel are embodied in a single compact unit.

The various objects and features of our invention will be fully understood from the following detailed description of a typical preferred form and application of our invention, throughout which description reference is made to the accompanying drawings, in which:

Fig. 1 is a longitudinal detailed sectional view of the core drill in the lower portion of a well showing the inner elements in elevation and illustrating the plug bit in drilling engagement with the bottom of the well. Fig. 2 is an enlarged fragmentary longitudinal detailed sectional view illustrating the latch means for latching the plug bit and the core barrel in the body. Fig. 3 is a reduced horizontal detailed sectional view taken as indicated by line 3—3 on Fig. 2. Fig. 4 is an enlarged horizontal detailed sectional view taken as indicated by line 4—4 on Fig. 1. Fig. 5 is an enlarged, fragmentary, longitudinal detailed sectional view of the lower portion of the tool illustrating the plug bit and the means for transmitting the driving forces from the body to the plug bit and Fig. 6 is a view similar to Fig. 5 showing the lower portion of the core receiving barrel seated in the cutter head.

The present invention may be said to comprise, generally, an outer barrel or body 10 having a cutting head 11 on its lower end, a bit 12 to be lowered into the body 10 to act on the formation at the central or inner portion of the well bore, means 13 for latching or retaining the bit 12 in the body 10, adapted to be released to permit withdrawal of the bit 12, means 14 for transmitting turning forces from the body 10 to the bit 12 and a core receiving barrel 15 adapted to be lowered into the body 10 and latched in the core receiving position by the means 13.

The outer barrel or body 10 is adapted to be secured to the lower end of a well drilling string S of rotary drill pipe. The body 10 is a tubular structure or assembly including a drill collar 16. The drill collar 16 is an elongate member having a central longitudinal opening 17 of substantial diameter. It is preferred to construct the drill collar 16 with heavy or thick walls so that the drill collar imposes the desired weight on the cutting means and lends stability to the tool. A connecting member or sub 18 is provided on the upper end of the drill collar 16 to facilitate the connection of the body 10 with the string S. The upper end of the drill collar 16 has a tapered threaded socket 19 receiving a tapered threaded pin 20 on the lower end of the sub 18. An internal annular groove 21 is formed in the drill collar 16 at the lower end of the socket 19 and the lower end of the pin 20 forms a downwardly facing shoulder 22 at the upper end of the groove 21. A sub or tubular member 23 is threadedly secured to the lower end of the drill collar 16. The member 23 preferably has a thick or heavy side wall and the lower portion of its opening 24 is enlarged or flared. The member 23 is provided with elements of the driving means 14, as will be later described.

The cutting head 11 is secured to the sub 23 on the lower end of the body 10 and is operable to make an annular cut in the earth formation to form the main outer portion of the well bore.

The character or type of the cutting head 11 employed of course depends upon the kind of earth formation encountered. In the case illustrated the head 11 is intended for use in soft earth formations and has drag type cutting elements. It is to be understood that the core drill of the present invention may be provided with a cutting head having toothed rollers for use in rock or hard earth formations.

The head 11 has a threaded socket 25 in its upper end receiving a threaded lower pin portion of the tubular member 23. A central vertical opening 26 is provided in the head 11 to receive or pass the core. The cutting elements or blades 27 project downwardly and outwardly from the head to cut the well bore to the desired gauge and to trim or form the core. The cutting head 11 is provided with means for handling or directing the circulation fluid. A space 28 occurs in the head at the lower end of the member 23 and receives the circulation fluid from the opening 24. Circumferentially spaced ports 29 extend downwardly through the head 11 from the space 23 to the lower end of the head to discharge the circulation fluid adjacent the cutting blades 27. In the preferred construction the cutting head 11 is formed to support or receive the bit 12 and the lower portion of the barrel 15. A central cylindrical socket 30 is formed at the upper end of the opening 26 to receive parts of the bit 12 and barrel 15. The mouth of the socket 30 is flared to guide the parts into the socket.

The bit 12 is operable to cut away the inner or central portion of earth formation left by the blades 27 of the cutting head 11. In accordance with the invention the bit 12 is adapted to be lowered through the string S and body 10 to its operative position at the head 11 and is adapted to be withdrawn upwardly through the body and string when it is desired to install the barrel 15 to obtain a core. The bit 12 includes a stem or body 31 and a head 32 on the lower end of the body 31. The body 31 is an elongate member proportioned to readily pass down through the drilling string S and the body 10 to be received in the opening 24 with substantial clearance leaving an annular space for the circulation fluid. The body 31 is provided at its lower end with a threaded pin 33 and a downwardly facing annular shoulder 34 at the upper end of the pin. The lower portion of the body 31 is adapted to be received in the socket 30 and the shoulder 34 is adapted to bear or rest on the bottom wall of the socket 30. The body 31 fits the socket 30 with slight clearance to readily enter the socket when the bit 12 is lowered into place.

The cutting head 32 is threaded on the pin 33 and projects downwardly in the opening 26 of the outer cutting head 11 assuming the bit 12 to be in its operative position. The opening 26 and the upper portion of the head 32 may be tapered. The cutting head 32 is adapted to project downwardly beyond the lower face of the head 11 and its projecting lower end is provided with suitable cutting blades 35. A central opening 36 extends upwardly through the body 31 from the lower end of its pin 33 and lateral ports 37 connect the upper portion of the opening 36 with the opening 24 in the member 23. The cutting head 32 has a central cavity 38 and ports 39 extend downwardly from the cavity to discharge the circulation fluid adjacent the cutting blades 35. The cutting head 12 is operable to drill away or break up the portion of the earth formation within the path of the blades 27. A barrel section 41 may have a threaded connection with the upper end of the bit body 31 to extend upwardly through the body 10. The barrel section 41 may form a part of or may be of the same construction as a portion of the core receiving barrel 15.

The means 13 serves to latch or retain the bit 12 in its operative position in the tool during the usual drilling operations and serves to latch the barrel 15 in the body 10 when a core is being taken. In accordance with the invention the latch means or retaining means 13 includes an element arranged at the upper end of the drill collar 16 and a unit or latch means adapted to be secured to the upper end of the barrel section 41 of the bit 12 or of the barrel 15. The element of the latch means 13 carried by the body 10 is in the nature of a latch ring 42 arranged in the groove 21. The ring 42 may be turnably or rotatably seated in the groove 21 and is held against vertical movement or displacement by the shoulder 22 and the lower wall of the groove. The socket 19 and the pin 20 threaded together to connect the sub 18 with the drill collar 16 are such that they cannot be tightened down to bring the shoulder 22 against the upper end of the latch ring 42. The ring 42 is proportioned to project into the opening 17 of the drill collar 16 and the internal surface of the ring 42 slopes downwardly and inwardly. The lower end of the latch ring 42 is preferably pitched and slopes downwardly and inwardly.

The latch means or retaining means 13 further includes a stem or latch carrier 43 adapted to be secured to the upper end of the section 41 of the bit 12 and adapted to be secured to the upper end of the core receiving barrel 15. The carrier 43 is an elongate element and is preferably integral. In the preferred construction illustrated the lower portion of the carrier 43 is removably threaded in the upper end of the section 41. A vertical opening 44 extends upwardly into the carrier 43 and has communication with the interior of the section 41. Lateral ports 45 in the carrier 43 place the upper end of the opening 44 in communication with the body opening 17. A valve seat 46 is held in the opening 44 by a threaded nut or retainer 47 and a ball valve 48 engages downwardly against the seat 46. The ball 48 is adapted to seal against the seat 46 to prevent the downwardly flowing circulation fluid from entering the barrel section 41. When the carrier 43 is applied to the bit 12 or the section 41 on the bit 12 the valve 48 is not essential.

The carrier 43 is reduced in cross sectional area and is shaped to have a plurality of circumferentially spaced tongues 49. The tongues 49 are located above the ports 45. Latches 50 are spaced about the reduced portion of the carrier 43 and have yokes 51 receiving the tongues 49. Pivot pins 52 are arranged in substantially horizontal openings in the togues 48 and the yokes 51 to pivotally support the latches 50. The latches 50 project upwardly and outwardly and are formed for latching engagement with the ring 42. The upper ends 53 of the latches 50 slope downwardly and outwardly so that the latches may be readily retracted by the socket or retrieving tool 63 as will later be described and so that the latches are readily received in the retrieving tool. Each latch 50 is notched away at its outer side to have an upwardly facing shoulder 54 and a substantially flat surface 55 extending upwardly from the shoulder 54. The shoulders 54 are engageable with the lower end of the latch ring 42 and the surfaces 55 are en-

gageable with the sloping interior of the ring 42 when the latches are in their operative positions. The engagement of the shoulders 54 with the lower end of the ring 42 of course prevents upward movement of the carrier 43 and the parts connected therewith. The engagement of the surfaces 55 with the interior of the ring 42 limits the outward movement or pivoting of the latches 50.

Means are provided for yieldingly urging the latches 50 outwardly to have automatic or latching engagement with the ring 42. Sets of leaf springs 55a are arranged against the carrier 43 and curve downwardly and outwardly to bear against the inner sides of the latches 50. Blocks 56 are arranged against the upper portions of the spring 55a to assist in securing the springs to the carrier 43. The blocks 56 may be welded or otherwise fixed to the carrier 43. Dowels 57 cooperate with openings in the springs 55a and the blocks 56 to assist in connecting the springs and blocks. Grooves 58 are provided in the lower sides of the blocks 56 and are adapted to receive the upper end portions of the latches 50. The grooves 58 assist in guiding the latches 50 and serve to stabilize the latches. The upper sides of the blocks 56 slope downwardly and outwardly to divert the downwardly flowing fluid from the latches 50. It will be seen that the blocks 56 assist in securing the springs 55a to the carrier 43, guide the latches 50 and divert the circulation fluid from the latches. Means are provided for limiting the outward pivoting of the latches 50 so that the latches cannot assume positions where they may engage in obstructions in the drilling string S. The upper ends of the tongues 49 are provided with projections 60 and pins or lugs 61 are provided on the latches 50 to cooperate with the projections 60. The lugs 61 may be formed integral with the latches 50 or may be welded or otherwise secured to the latches. The projections 60 and the lugs 61 are related so that they prevent excessive outward pivoting of the latches 50 under the influence of the springs 55a.

The latch carrier 43 is provided with a stem 62 engageable by a retrieving tool 63. The stem 62 projects from the upper end of the carrier 43 and has an enlarged head on its upper end engageable by spring urged gripping fingers 64 of the tool 63. The tool 63 includes a tubular sleeve 65 that projects downwardly around the fingers 64. The sleeve 65 is cooperable with the sloping upper ends 53 of the latches 50 and this cooperation serves to retract the latches 50 from the ring 42. The sloping internal surface of the ring 42 may serve to guide the lower end of the sleeve 65 into engagement with the sloping upper ends 53 of the latches 50. When the tool 63 is lowered to retrieve the bit 12 the sleeve 65 comes into contact with the latches 50 to retract the same and the fingers 64 then engage under the enlarged head of the stem 62 to grip the same. The tool 63 is suitably secured to the lower end of a cable or wire line L and upon being withdrawn from the well carries with it the bit 12 or the other means connected with the latch carrier 43.

The means 14 is operable to transmit driving forces or rotation from the body 10 to the bit 12 during the rotary drilling operations. The means 14 includes a plurality of circumferentially spaced ribs 67 on the wall of the opening 24. The ribs 67 extend vertically or longitudinally and are preferably formed in the flared lower portion of the opening 24. The upper and lower ends of the ribs 67 taper or slope toward one another. The means 14 further includes one or more dogs 68 on the bit carrier 31. In the structure illustrated there are two diametrically opposite slots 69 formed in the carrier 31 and a dog 68 mounted in each slot. The dogs 68 are pivoted at their lower ends on pins 70a and are adapted to project outwardly from the mouths of slots 69. The vertical sides of the dogs 68 are flat for cooperation with the ribs 67. The forward sides of the ribs 67, relative to the direction of rotation of the strings S, are vertical and parallel with the lines radial with respect to the central vertical axis of the tool to cooperate with the flat vertical sides of the dogs 68. The rear sides of the ribs 67 relative to the direction of rotation of the tool may be pitched relative to radial lines. The flat vertical sides of the dogs 68 are adapted to engage the side walls of the slots 69 for the direct transmission of forces from the dogs to the carrier 31.

Means is provided for urging the pivoted dogs 68 outwardly to cooperate with the ribs 67. A substantially U-shaped spring 70 is arranged between the spaced dogs 68 and the upper parts of its arms are secured to the dogs as by rivets 71 The spring 70 normally urges the dogs outwardly to protrude from the slots 69 and is yieldable to permit retraction of the dogs. The projecting or projectable portions of the dogs 68 have inclined upper and lower surfaces 72 that may engage obstructions in the drilling string S. The engagement of the surfaces 72 with obstructions or restrictions in the drilling string results in camming or pivoting of the dogs so that the dogs are moved into the slots 69 against the action of the spring 70. Means are provided for limiting the outward pivoting of the dogs 69. Notches 73 are provided in the upper outer corners of the dogs 68 and stops 74 are provided in the slots 69 to be engaged by the notched upper portions of the dogs. The notches 73 cooperate with the stops 74 to normally hold or stop the dogs 68 in positions where they project from the mouths of the slots 69 for cooperation with the ribs 67. The ribs 67 on the rotating body 10 engage the dogs 68 for the transmission of torque or turning forces so that the bit 12 is made to turn with the body 10.

The barrel 15 is provided to receive and retain the core of earth formation left by the annular outer cutting head 11. The barrel 15 is adapted to be lowered through the string S into the body 10 to a position where it may receive the core and following the coring operation is adapted to be removed or pulled from the string S by the line L and the tool 63. The means 13 described above may serve to releasably latch the barrel 15 in the body 10 for the coring operation. The barrel 15 is an elongate tubular member or assembly proportioned to be received in the openings 17 and 24 with substantial clearance to leave an annular passage for the circulation fluid.

The core receiving barrel 15 includes the section 41 which may be similar to the section 41 or may be the self same section 41 of the bit 12 described above. The section 41 is provided at its upper end with the carrier 43 and the means 13 so that the means 13 serves to automatically latch or retain the barrel 15 in the core receiving position when the barrel is lowered into the body 10. A tubular adapter 75 is threaded on the lower end of the section 41 and takes the

place of the body 31 described above. The adapter 75 carries a core trapping or retaining means. In accordance with the broader aspects of the invention the barrel 15 may be provided with any suitable form or type of core catcher for retaining the core. In the construction illustrated a tubular member 76 is threaded on the lower end of the adapter 75 and has a socket 77 in its lower end. The socket 77 receives a ring 78 provided with a plurality of spaced vertical slots 79. Core catching dogs 80 are pivotally mounted in the slots 79 and are urged downwardly and inwardly by springs 81. The ring 78 may be welded or otherwise fixed in the socket 77. When the barrel 15 is lowered into the body the lower portion of the member 76 enters the socket 30 of the cutting head 11 and its lower end may rest on the bottom wall of the socket to support the barrel. The member 76 is proportioned to enter the socket 30 with slight clearance so that the barrel 15 may remain non-rotatable during the drilling operation. With the member 76 entered in the socket 30 the core received by the opening 26 is adapted to enter the lower end of the barrel 15. The pivoted dogs 80 are operable to bite into and support the core when the barrel 15 is raised at the termination of the coring operation.

In the use or operation of the tool of this invention the body 10 is connected with the lower end of the rotary well drilling string S and the string is rotated so that the cutting head 11 acts on the formation at the bottom of the well bore. During the usual drilling operations the bit 12 is positioned in the body 10 to drill away the central portion of the bore. As above described, the latches 50 cooperate with the under side of the ring 42 to hold the bit 12 against upward movement relative to the body 10 and the latches thus retain the bit in its operative cutting position. The dogs 68 are engaged by the ribs 67 so that the rotary forces are transmitted from the body 10 to the bit 12. Circulation fluid is pumped downwardly through the spring S to flow through the body 10 and discharge from the ports 29 to the cutting head 11. Circulation fluid passes through the ports 37 and the slots 69 to flow through the opening 36 and discharge from the ports 39 of the bit 12.

When it is desired to obtain a core the tool 63 is run down through the string S on the line L to enter the upper end of the body 10. The tool 63 is lowered until its sleeve 65 cooperates with the inclined upper ends 53 of the latches 50 to retract the latches from the latch ring 42. Simultaneously with this retraction of the latches 50 the fingers 64 come into gripping engagement with the enlarged end of the stem 62 so that the tool obtains a firm hold on the stem. The line L is then raised to withdraw the bit 12 and the parts associated therewith from the body 10. The barrel 15 provided at its upper end with the carrier 43 and the parts thereon is then run down through the string S to its position in the body 10. The member 76 of the barrel 15 is adapted to seat in the socket 30 when the barrel 15 reaches the position where the latches 50 cooperate with the ring 42. The spring urged latches 50 come into engagement with the inclined inner surface of the ring 42 and are retracted by this engagement until their shoulders 54 latch under the ring. This latches the barrel 15 in the body 10 and the barrel is ready for the coring operation. The core drill is operated in the usual manner to cut a core and the core is received in the barrel 15. When a sufficient amount of core has been cut the tool 63 is lowered to bring its sleeve 65 into contact with the inclined ends 53 of the latches 50 to free the latches from the ring 42. Simultaneously with the release of the latches 50 the fingers 64 grip the stem 62. The line L may then be raised to lift the barrel 15. Upon upward movement of the barrel 15 the dogs 80 bite into the core to free the same and to thereafter support the core in the barrel. The barrel 15 is readily removable on the line L. The bit 12 may then be returned to its operative position in the body 10 and the drilling operations may be resumed.

Having described only a typical preferred form and application of our invention, we do not wish to be limited or restricted to the specific details herein set forth, but wish to reserve to ourselves any variations or modifications that may appear to those skilled in the art or fall within the scope of the following claims:

Having described our invention, we claim:

1. A core drill for use on a tubular rotary well drilling string comprising a tubular body for attachment to the string, a tubular cutting head on the lower end of the body, a barrel to be lowered through the string into the body to receive the core formed by the cutting head, a bit to be lowered through the string into the body when the barrel is not in use and operable to drill away the core, means at the head for supporting the lower ends of the barrel and bit, position means for transmitting rotation from the body to the bit comprising an internal rib in the body adjacent the head having a radial forward face and a pitched rear face, and a yieldable dog on the bit cooperable with the rib, a latch ring rotatably supported in the body, a carrier attachable to the upper end of the barrel and the upper end of the bit, and spring urged latches on the carrier for engaging the ring to hold the barrel and the bit in their operative positions in the body.

2. In a core drill for use on a tubular well drilling string, a tubular body to be secured to the lower end of the string, the body including threadedly connected sections, a ring retained between said sections to be held against vertical movement and adapted to freely rotate, the ring projecting inwardly at the interior of the body, a cutting head at the lower end of the body for making an annular cut in the earth formation, a barrel to be lowered through the string into the body to receive the core left by the cutting head, means at the head for rotatably supporting the barrel, a carrier on the upper end of the barrel, valve means in the carrier for relieving internal pressure from the barrel, and spring urged latches on the carrier for engaging under the ring to releasably hold the barrel in the core receiving position in the body.

3. In a core drill for use on a tubular well drilling string, a tubular body to be secured to the lower end of the string, the body including threadedly connected sections, a freely rotatable ring retained between said sections to be held against vertical movement and to project at the interior of the body, a cutting head at the lower end of the body for making an annular cut in the earth formation, a barrel to be lowered through the string into the body to receive the core left by the cutting head, means at the head for rotatably supporting the barrel, a carrier on the upper end of the barrel, valve means in the carrier for relieving internal pressure from the barrel, spring urged latches on the carrier for engaging under the ring to hold the barrel in the body, a stem

on the carrier engageable by a retrieving tool for removing the barrel, and sloping faces on the latches engageable by the retrieving tool to release the latches.

4. In a core drill for use on a tubular well drilling string, a tubular body to be secured to the lower end of the string, an annular cutting head on the lower end of the body, an internal shoulder on the body spaced above the cutting head, an internal rib on the body above the cutting head, bit means adapted to be lowered through the string into the body to drill away the core of formation left by the cutting head, releasable latch means on the bit means for engaging the shoulder to hold the bit means in active position, and a retractable spring held dog on the bit means engageable with the rib for the transmission of rotation from the body to the bit means.

5. In a core drill for use on a tubular well drilling string, a tubular body to be secured to the lower end of the string, an annular cutting head on the lower end of the body, an internal shoulder on the body spaced above the cutting head, an internal rib on the body above the cuting head, bit means adapted to be lowered through the string into the body to drill away the core of formation left by the cutting head, latches at the upper end of the bit means engageable with the shoulder to hold the bit means against upward movement in the body, and a spring held dog on the bit means below the latches adapted to retract upon movement through the shoulder and cooperable with the rib for the transmission of rotation from the body to the bit means.

6. In a core drill for use on a tubular well drilling string, a tubular body to be secured to the lower end of the string, an annular cutting head on the lower end of the body, a latch ring in the body spaced above the cutting head, spaced longitudinal ribs on the interior of the body adjacent the cutting head, a bit adapted to be lowered through the string and body to the head to drill away the core of earth formation left by the head, a structure extending upwardly from the bit, pivoted spring urged dogs on said structure retractable through contact with the latch ring and other restrictions in the string and body and cooperable with the latch ring for the transmission of rotation from the body to the bit, a carrier at the upper end of said structure, and pivoted latches on the carrier engageable under the latch ring to releasably retain the bit and said structure in the body.

7. In a core drill for use on a tubular well drilling string, a tubular body to be secured to the lower end of the string, an annular cutting head on the lower end of the body, a latch ring in the body spaced above the cutting head, spaced longitudinal ribs on the interior of the body adjacent the cutting head, a bit adapted to be lowered through the string and body to the head to drill away the core of earth formation left by the head, a structure extending upwardly from the bit, pivoted spring urged dogs on said structure retractable through contact with the latch ring and other restrictions in the string and body and cooperable wih the latch ring for the transmission of rotation from the body to the bit, a carrier at the upper end of said structure, a stem on the carrier engageable by a retrieving tool for removing the bit and structure from the body, and pivoted spring held latches on the carrier for engaging under the latch ring to retain the bit and said structure in the body, and latches having sloping faces engageable by said tool to cause retraction of the latches.

8. In a core drill for use on a tubular well drilling string, a tubular body to be secured to the lower end of the string, the body including threadedly connected sections, a ring retained between said sections for free unrestrained rotation and to project at the interior of the body, a cutting head at the lower end of the body for making an annular cut in the earth formation, a barrel to be lowered through the string into the body to receive the core left by the cutting head, means at the head for rotatably supporting the barrel, a carrier on the upper end of the barrel, valve means in the carrier for relieving internal pressure from the barrel, spring urged latches on the carrier for engaging under the rotatable ring to hold the barrel in the core receiving position, and parts on the carrier guiding the latches and diverting the fluid from the latches, the latches having surfaces clear of the ring and said parts engageable to release the latches from the ring.

9. A core drill for use on a tubular rotary well drilling string comprising a tubular body for attachment to the string, a tubular cutting head on the lower end of the body, a barrel to be lowered through the string into the body to receive the core formed by the cutting head, a ring supported in the body for free unrestrained turning, and positively held against vertical movement relative to the body, the ring being spaced above the head, means at the head for supporting the lower end of the barrel, a carrier secured to the upper end of the barrel, and a spring urged latch on the carrier engageable with the ring to hold the barrel against upward movement in the body, the latch having a surface in the interior of the ring clear of the ring and engageable by a retrieving tool to release the latch from the ring.

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