

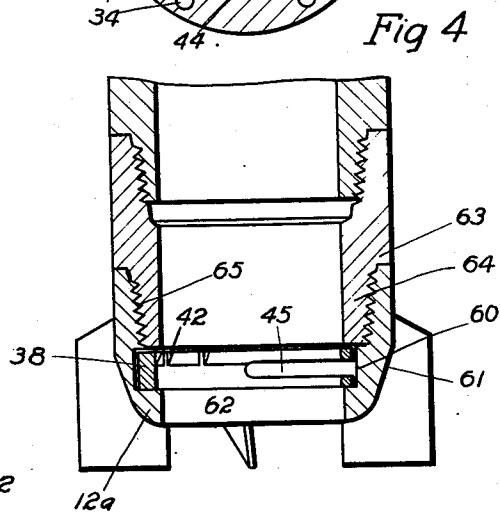
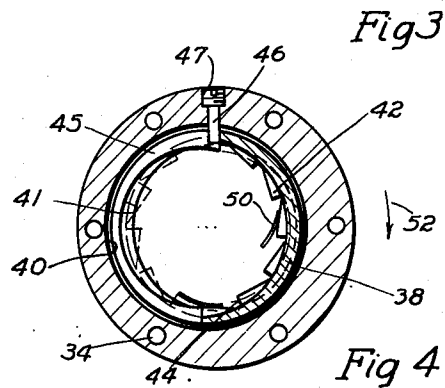
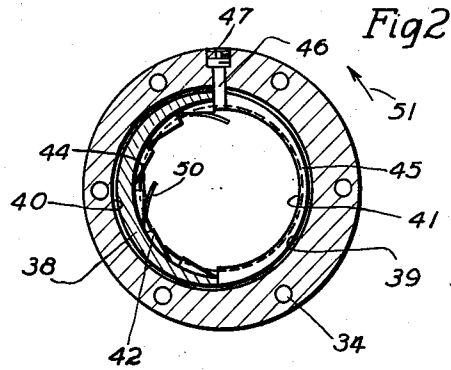
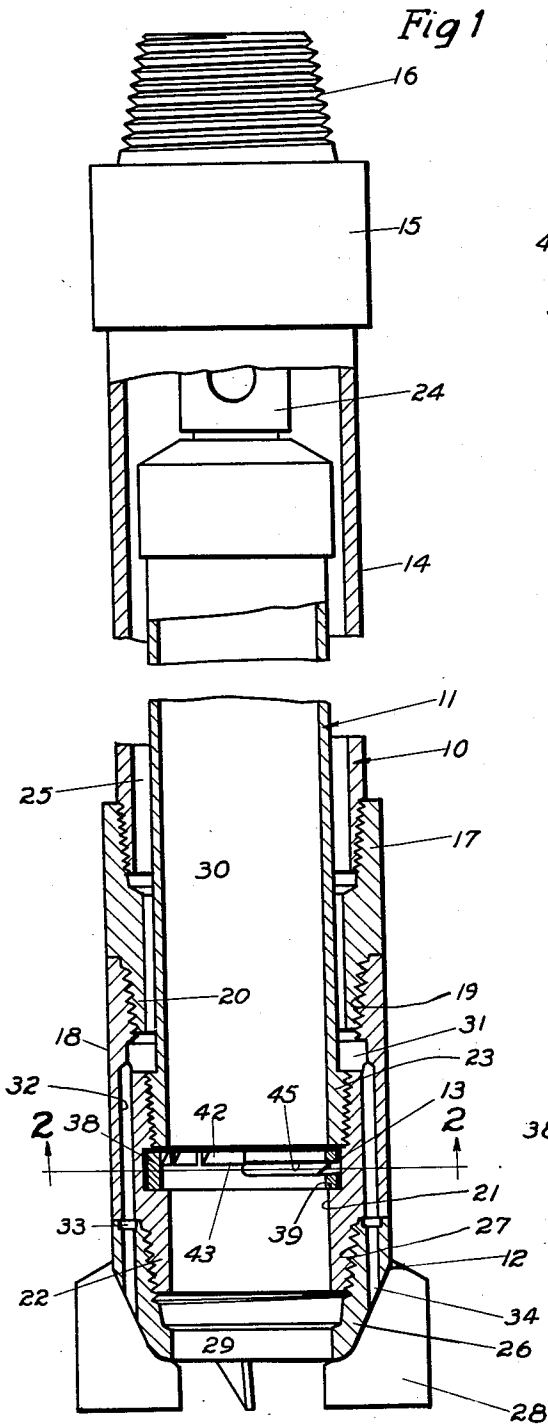
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CORE CATCHER

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UNITED STATES PATENT OFFICE

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CORE CATCHER

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12 Claims. (Cl. 255—72)

This invention has to do with a well core drill, and has particular reference to a core catcher for a core drill. It is a general object of the present invention to provide a simple, practical and dependable core catching means for embodiment in a core drill for gripping and retaining the core when the drill is withdrawn from the well.

Another object of the invention is to provide a core catcher for embodiment in a core drill that may be operated into gripping and holding engagement with the core by turning or rotating the drill in a left hand or counter-clockwise direction.

It is another object of the invention to provide a core catcher that is extremely simple in construction and that may be embodied in various types of core drills without materially complicating their structure or adding to their size or bulk.

It is another object of the invention to provide a core catching means that includes a core gripping member that is forced or operated directly radially into retaining engagement with the core. The various types of core catchers that have been introduced involve either slips that have longitudinal movement relative to the body or pivoted dogs that have arcuate movement when actuated. As distinguished from the longitudinal movement of the slips and the pivotal movement of the dogs in the common forms of core catchers, the core gripping member of the core catcher provided by the present invention moves directly radially into firm positive holding engagement with the core.

It is another object of the invention to provide a core catching means for embodiment in a well core drill that includes a ring rotatable in an eccentric groove in the wall of the core receiving opening of the tool, which ring has an eccentric opening that is concentric with the opening of the drill when the ring is in an inoperative position, and whose walls are forced into gripping engagement with the core upon the tool or drill being turned in a reverse or left hand direction.

It is a further object of the invention to provide a core catching means of the character mentioned that may be arranged or located in the core drill at a point immediately adjacent the bit head of the drill.

The various objects and features of the invention will be better and fully understood from the following detailed description of typical forms and applications of the invention,

throughout which description reference is had to the accompanying drawing, in which.

Fig. 1 is a longitudinal detailed sectional view of a typical core drill embodying the core catcher provided by the present invention. Fig. 2 is a transverse detailed sectional view taken substantially as indicated by line 2—2 on Fig. 1 and illustrating the core catcher in an inoperative position. Fig. 3 is a view similar to Fig. 2 showing the core catcher in the actuated or core retaining position. Fig. 4 is a central longitudinal detailed sectional view of the lower end portion of another type of core drill embodying the core catcher provided by the present invention.

The core catcher or core catching means provided by the invention may be applied to or embodied in core drills of various types. Further, the core catching means may be varied somewhat to adapt it for use in various classes of tools. Throughout the following detailed disclosure, I will describe the invention embodied in two typical forms of core drills, it being understood that the invention is not to be taken as limited or restricted to the specific forms or applications about to be described, but is to be taken as including any features or modifications that may fall within the scope of the claims.

The core drill illustrated in Fig. 1 of the drawing includes, generally, a body or outer barrel 10, an inner barrel 11, a bit head 12 on the lower end of the body 10, and the core catcher 13 provided by the present invention for holding or retaining the core in the inner barrel 11 when the drill is withdrawn from the well bore.

The outer barrel or body 10 is an elongate tubular structure adapted to be attached to the lower end of an operating string of drill pipe. The main or principal portion 14 of the body 10 may be formed of one or more lengths of tubing and may be provided at its upper end with a suitable sub 15. The sub 15 is provided at its upper end with a screw threaded pin 16 to facilitate connection of the core drill with the operating string. A connecting member 17 is provided on the lower end of the main portion 14 of the body and carries a sub 18. In the particular structure illustrated in the drawing, a socket 19 is provided in the upper end of the sub 18 and a pin 20 on the lower end of the connecting member 17 is threaded into the socket. The sub 18 is provided with a central longitudinal opening 21 for passing the core upwardly into the inner barrel 11 during the drilling operation. The walls of the sub 18 are comparatively heavy or thick and a tapered pin 22 projects from the lower end of the sub.

The inner barrel 11 is provided to receive or contain the core and is arranged within the outer barrel or body 10. The inner barrel 11 is an elongate tubular structure carried by the sub 18. An enlarged portion 23 on the lower end of the inner barrel 11 is screw-threaded into the opening 21 of the sub 18. The usual valve 24 is provided on the upper end of the inner barrel 11 to permit the escape of fluid from the inner barrel 10 when the core is passing into the barrel and to normally prevent the entrance of circulation fluid into the upper end of the inner barrel. The inner barrel 11 is of less diameter than the opening in the outer barrel or body 10 so that an annular circulation passage 25 is provided between the two barrels.

The bit head 12 is attached to the lower end of the sub 18 and is provided to make an annular cut in the earth formation. The bit head 12 includes a tubular body or shoe 26 having a socket 27 in its upper end receiving the screw threaded pin 22 of the sub 18. A plurality of spaced cutting blades 28 project downwardly and outwardly from the lower end of the shoe 26. The cutting blades 28 project inwardly at the lower end of the shoe opening 29 so as to cut a core that will pass through the opening 29 and the sub opening 21 with suitable clearance. The opening 30 of the inner barrel 11 is of substantially the same diameter as the sub opening 21 and is adapted to readily receive the core.

The core drill illustrated in Fig. 1 of the drawing includes means for passing the circulation fluid downwardly to discharge from the lower end of the bit head shoe 26. An enlargement or groove 31 is provided in the interior of the sub 18 at the lower end of the socket 19 and spaced passages 32 extend longitudinally through the walls of the sub. The upper ends of the passages 32 are in communication with the groove 31 which, in turn, is in communication with the lower end of the annular passage 25. An annular groove 33 is provided in the upper end of the shoe 26 to register with the lower ends of the fluid passages 32. Fluid passages 34 extend downwardly through the shoe 26 from the groove 33 to the lower end of the shoe where they discharge the circulation fluid downwardly adjacent the cutting parts 28. The well core drill described above is merely typical of one class of core drill in which the core catching means provided by the present invention may be embodied, and the invention is not to be construed as limited to the specific details of this particular drill.

The core catcher or core catching means 13 with which the present invention is primarily concerned, is such as to permit the free passage of the core upwardly into the inner barrel 11 during the drilling operation and is operable to tightly grip the core upon the drill being turned in a reverse or left hand direction so that the core may be broken away from the formation and dependably retained in the inner barrel 11 when the drill is withdrawn from the well. The core catching means 13 includes a single member 38 in the form of a ring carried in a groove 39 in the wall of the core receiving opening of the drill.

In accordance with the broader aspects of the invention, the groove 39 for carrying the ring 38 may be located at any desired or practical position and may be provided in any part or member of the drill. In the particular case illustrated in the drawing, the groove 39 is formed in the wall of the sub opening 21. The groove 39 is annular and has flat upper and lower walls that

are substantially normal to the longitudinal axis of the drill. In the construction illustrated in the drawing, the groove 39 is provided in the wall of the opening 21 at the lower end of the inner barrel 11 so that the end of the enlarged portion 23 of the barrel 11 forms a portion of the upper wall of the groove. In accordance with the invention, the groove 39 is eccentric to the core receiving opening 21 of the sub. The outer wall 40 of the groove 39 is cylindrically curved about a point offset or spaced from the longitudinal axis of the drill. The core gripping member or ring 38 is turnable or rotatable in the groove 39.

It is a feature of the invention that the core retaining means 13 may include only a single integral ring 38 as illustrated in the drawing. The ring 38 has flat upper and lower ends to cooperate with the opposite ends of the groove 39 and has a cylindrically curved periphery which has rotative engagement with the outer walls 40 of the groove. An opening 41 is provided in the ring 38 to receive or pass the core cut by the bit head 12. In accordance with the invention, the opening 41 of the ring 38 is eccentric relative to the cylindrically curved periphery of the ring. The eccentricity of the opening 41 relative to the periphery of the ring 38 is substantially equal to the eccentricity of the outer walls 40 of the groove 39 relative to the sub opening 21. The eccentric opening 41 of the ring 38 is preferably of slightly less diameter than the sub opening 21. When the ring 38 is in its normal or unactuated position, its opening 41 is concentric with the sub opening 21 so as to freely pass the core upwardly into the inner barrel 11.

Core engaging parts or teeth 42 may be provided on the ring 38 for gripping or biting into the core. In the particular case illustrated in the drawing, there is a circumferentially aligned series of core engaging teeth 42 extending substantially 180° around the wall of the opening 41. In accordance with the invention, the series of teeth 42 are provided in the opening 41 where the ring 38 is of the greatest wall thickness so as to project into the core passing opening of the drill when the ring is actuated. The series of teeth 42 may extend along the upper end portion of the ring opening 41 as illustrated in Fig. 1 of the drawing. The teeth 42 may be shaped so as to effectively cut or bite into the core upon rotation of the ring 38 in a reverse or counterclockwise direction relative to the core. The teeth 42 illustrated in the drawing have upwardly and inwardly tapered lower faces 43 to allow for the free upward passage of the core into the core barrel 11 during drilling. Substantially vertical edges 44 are provided on the teeth 42 and face rearwardly relative to the direction of rotation of the drill during normal drilling operations.

The invention includes means for limiting relative turning or rotation between the ring 38 and the body 10. To provide for the maximum radial movement of the ring 38, there should be substantially 180° of relative rotary movement between the ring and the body 10. In accordance with the broader principles of the invention, any suitable form of stop means may be embodied in the tool for limiting relative movement between the ring 38 and the body 10. In the form of the invention illustrated in the drawing, a circumferentially extending slot 45 is provided in the ring 38. The slot 45 is provided in the thin wall portion of the ring 38 and is of substantially 180° extent having its opposite ends adjacent the ends of the series of teeth 42. A stop 46

is provided on the sub 18 to cooperate with the ends of the slot 45 to limit the relative movement between the body 10 and the ring 38. The stop 46 may be in the form of a pin extending through a radial opening in the sub 18 and projecting from the wall 40 of the groove 39 to extend into the slot 45. The stop pin 46 may have a head threaded into a counter-bore 47. It will be apparent how the stop pin 46 is adapted to cooperate with the opposite ends of the slot 45 to limit relative turning between the body 10 and the core engaging ring 38.

The core catcher 13 may include means on the ring 38 for yieldingly engaging the core to insure the proper cooperation of the ring 38 with the core so that the ring will be held against rotation when the drill is turned in a counter-clockwise direction to actuate the ring. Leaf springs 50 are carried by the ring 38 to yieldingly or frictionally engage the core. In the particular case illustrated in the drawing, the springs 50 project inwardly and rearwardly from the teeth 44 relative to the normal right hand direction of rotation of the drill. The springs 50 in projecting rearwardly from the teeth 42 are flexed outward when the drill is turned in a right hand direction so that they do not interfere with the free passage of the core into the inner barrel 11 but are adapted to grip or slightly bite into the core to hold the ring 38 against turning when the drill is rotated in a left hand direction.

When the core drill is being rotated in the right hand direction indicated by the arrow 51 in Fig. 2 of the drawing, the core gripping ring 38 is held in its inoperative position where its opening 41 is concentric with the openings 21 and 30 of the drill. The stop pin 46 engages the forward end of the slot 45 causing the ring 38 to rotate with the body when the drill is turned in the right hand direction for drilling. The ring 38, in being in the position illustrated in Fig. 2 of the drawing, does not interfere with the free passage of the core into the core barrel 11. When it is desired to actuate the core catching means the drill is turned in a reverse or left hand direction. Upon turning of the drill in the reverse or left hand direction, the springs 50 engage the core to hold the ring 38 against rotation. The turning of the drill in the reverse or left hand direction, as indicated by the arrow at 52 in Fig. 3 of the drawing, while the ring 38 is held against rotation, causes the cooperation of the eccentric wall 40 of the groove 39 with the periphery of the ring 38 which forces the ring 38 radially inward so that its teeth 42 are projected into gripping engagement with the core. As the opening 41 in the ring 38 is eccentric, rotation of the body 10 in a left hand direction relative to the core passing opening of the drill thereby increasing or doubling the radial or inward movement of the core engaging teeth 42 relative to the wall of the opening 21. The cooperation of the walls of the eccentric groove 39 with the ring 38 and the eccentric relation between the ring opening 31 and the core passing opening 21 provides for a substantial inward movement of the toothed portion of the ring 38 so that the ring obtains a firm dependable grip on the core. As only one segment or portion of the core is forced into gripping or holding engagement with the core, the opposite sides of the core are tightly forced against the walls of the opening 21. The stop 46 limits the reverse or left hand turning of the body 10 relative to the ring 30 so that there is no further movement between the body 10 and ring

38 after the ring has been actuated to its innermost core gripping position illustrated in Fig. 3 of the drawing.

The ring 38, in being directly carried in the groove 39 transmits the load or weight of the core directly to the sub 18 of the body. After the ring 38 has obtained its hold on the core the drill may be raised to break the core loose from the formation and the ring 38 maintains its grip on the core so that it retains the core in the inner barrel 11 when the drill is withdrawn from the well. It is to be noted that the toothed portion of the ring 38 is forced directly radially inward into gripping engagement with the core when the ring is actuated to obtain a dependable grip on the core. The ring 38 may be readily released from the core when it is desired to remove the core from the drill by turning the body 10 in a right hand direction relative to the core or by disconnecting the sub 18 from the connecting member 17. It is to be noted that the core catching means 13 is particularly simple as it involves only a single moving part. The eccentric face 40 for causing inward movement of the ring 38 is provided by a wall of the groove 30, so that the provision of the core catching means 13 in the drill does not necessitate the adding of material or heavy parts to the drill structure. The eccentric wall 40 is comparatively long to have long camming or active engagement with the periphery of the ring 38 and its curvature is relatively gradual so that a great inward force is exerted on the ring 38 when the drill is turned in the reverse or left hand direction to actuate the ring. The springs 50 engage the core when the drill is turned in the right hand direction during drilling so that the core gripping ring 38 is normally maintained in its inoperative position where it does not in any way interfere with the free passage of the core into the inner barrel 11.

Fig. 4 of the drawing illustrates the core catching means provided by the present invention applied to or embodied in a single barrel type of core drill. In the single barrel type of core drill and in other forms of tools, it may be practical or desirable to arrange the core gripping ring 38 in a groove 60 in the shoe 61 of the bit head 12^a. The construction and operation of the core gripping ring 38 has been above described and the groove 60 carrying the ring is eccentric relative to the core passing opening 62 of the shoe 61 and has the same purpose and function as the groove 39. In the construction illustrated in Fig. 4 of the drawing, a connecting member or sub 63 is provided on the lower end of the drill body to carry the bit head 12^a. The sub 63 has a pin 64 on its lower end, screw-threaded into a socket 65 in the upper end of the bit head shoe 61. The groove 60 carrying the ring 38 is at the lower end of the socket 65 so that the lower end of the pin 64 forms the upper wall of the groove 60 for rotatably carrying the ring 38. The ring 38 operates in the the manner described above, being normally in the inoperative position illustrated in Fig. 4, and being actuated into gripping engagement with the core through cooperation with the walls of the eccentric groove 60 when the drill is turned in the reverse or left hand direction. It is to be noted that the core catching and retaining ring 38 embodied in the present invention may be rotatably carried in an eccentric groove provided in any suitable member or part of a core drill.

Having described only typical forms and applications of my invention, I do not wish to limit

myself to the specific forms and details set forth, but wish to reserve to myself any changes or variations that may appear to those skilled in the art or fall within the scope of the following claims.

Having described my invention, I claim:

1. A core drill including, a tubular body, a bit head on the lower end of the body for making an annular cut when the drill is rotated in one direction, and means on the body for gripping the core when the drill is rotated in the other direction, there being a recess in the wall of the body opening, said means including a ring rotatable in the recess and having an eccentric opening concentric with the body opening during operation of the bit head, and means on the ring for engaging the core whereby the opening in the ring is made eccentric relative to the body opening upon turning of the drill in the said other direction.

2. A core drill including, a tubular body, a bit head on the lower end of the body for making an annular cut when the drill is rotated in one direction, and means on the body for gripping the core operable by rotation of the drill in the other direction, there being a recess in the wall of the body opening having a wall eccentric to the body opening, said means including a ring rotatable in the recess and having an eccentric opening that is concentric with the body opening during drilling to pass the core and that is made eccentric to the body opening by rotation of the body in the said other direction.

3. In a core drill, a tubular body, a bit head rigidly connected with the lower end of the body for making an annular cut in the formation when the drill is rotated in one direction, and core catcher means operable upon rotation of the drill in the other direction, said means including a surface on the body eccentrically curved relative to the body opening, a member forced radially into the body opening through cooperation with the surface upon turning of the drill in the said other direction, and means on the member normally engaging the core and operable through such engagement to hold the member against rotation when the drill is rotated in the said other direction.

4. In a core drill, a tubular body, a bit head rigidly connected with the lower end of the body for making an annular cut in the formation when the drill is rotated in one direction, and means for gripping the core operable upon rotation of the drill in the other direction, the said means including a surface on the interior of the body extending circumferentially relative to the body opening, a member moving radially inward into engagement with the core through rotational cooperation with said surface when the drill is rotated in the said other direction, and means for limiting relative movement between the body and the member.

5. In a core drill, a tubular body, means rigidly connected with the lower end of the body for making an annular cut in the formation when the drill is rotated in one direction, there being a recess in the wall of the body opening, a member carried in the recess and shiftable radially inward into the body opening to grip the core therein through rotational cooperation with the wall of the recess when the drill is turned in the other direction, and means on the member adapted to normally engage the core and operable to hold the member against turning when the drill is turned in the said other direction.

6. In a core drill, a tubular body, means on the lower end of the body for making an annular cut in the formation when the drill is rotated in one direction, there being an annular eccentric recess in the wall of the body opening, a ring rotatable in the recess and having an eccentric opening, means limiting rotation of the ring relative to the body in a position where the eccentric opening is concentric with the body opening when the drill is rotated in the said direction, and means limiting rotation of the ring relative to the body to stop it in a position where its opening is eccentric to the body opening when the drill is rotated in the other direction.

7. In a core drill, a tubular body, means on the lower end of the body for making an annular cut in the formation when the drill is rotated in one direction, there being an eccentric recess in the wall of the body opening, a ring rotatable in the recess and having an eccentric opening, means limiting rotation between the ring and body to stop the ring in a position where its opening is concentric with the body opening when the drill is rotated in the said direction and to stop the ring in a position where its opening is eccentric to the body opening when the drill is rotated in the other direction, and parts on the ring to bite into the core when the ring is in the last mentioned position.

8. In a core drill, a tubular body, means on the lower end of the body for making an annular cut in the formation when the drill is rotated in one direction, there being an eccentric recess in the wall of the body opening, a ring rotatable in the recess and having an eccentric opening, means limiting rotation between the ring and body to stop the ring in a position where its opening is concentric with the body opening when the drill is rotated in the said direction and to stop the ring in a position where its opening is eccentric to the body opening when the drill is rotated in the other direction, means on the ring to engage the core in the body when the drill is rotated in the said other direction to hold the ring against rotation, and parts on the ring to bite into the core when the ring is in the last mentioned position.

9. In a core drill, a tubular body, means on the lower end of the body for making an annular cut in the formation when the drill is rotated in one direction, there being an eccentric recess in the wall of the body opening, a ring rotatable in the recess and having an eccentric opening, means limiting rotation between the ring and body to stop the ring in a position where its opening is concentric with the body opening when the drill is rotated in the said direction and to stop the ring in a position where its opening is eccentric to the body opening when the drill is rotated in the other direction, a spring on the ring to engage the core to hold the ring against rotation when the drill is rotated in the said other direction, and teeth on the interior of the ring for gripping the core when the drill is rotated in the said other direction.

10. A core drill including a body comprising two tubular sections, there being a socket in an end of one of the sections, a pin on the other section threaded into the socket, there being an eccentric recess in the lower end of the socket beyond the pin, means rigidly connected with the lower end of the body for making an annular cut in the formation when the body is rotated in one direction, and a ring in the recess actuated radially inward into holding engagement with the core when the drill is rotated in the other direction.

11. A core drill including, a tubular body, a tubular bit head for making an annular cut in the formation and having a socket in its upper end, a pin fixed on the lower end of the body and threaded into the socket to rigidly connect the bit head with the body, there being an eccentric recess in the bit head at the lower end of the pin, and a ring in the recess operated radially inward into holding engagement with the core when the drill is rotated in a left hand direction.

12. In a core drill, the combination of a tubular body, cutting means fixed on the lower end

of the body to cut an annular bore when the body is turned in a forward direction, the body having an internal recess, and a member in the recess related to the body for relative turning, the member having an opening concentric with the longitudinal axis of the body during forward turning of the body and made eccentric relative to said axis through the cooperation of the wall of the recess with the member when the body is turned in the reverse direction whereby the member is made to grip the core.

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