Oct. 4, 1938. A. C. CATLAND 2,132,014

CORE CATCHER

Filed Sept. 25, 1936

FIG. 1.

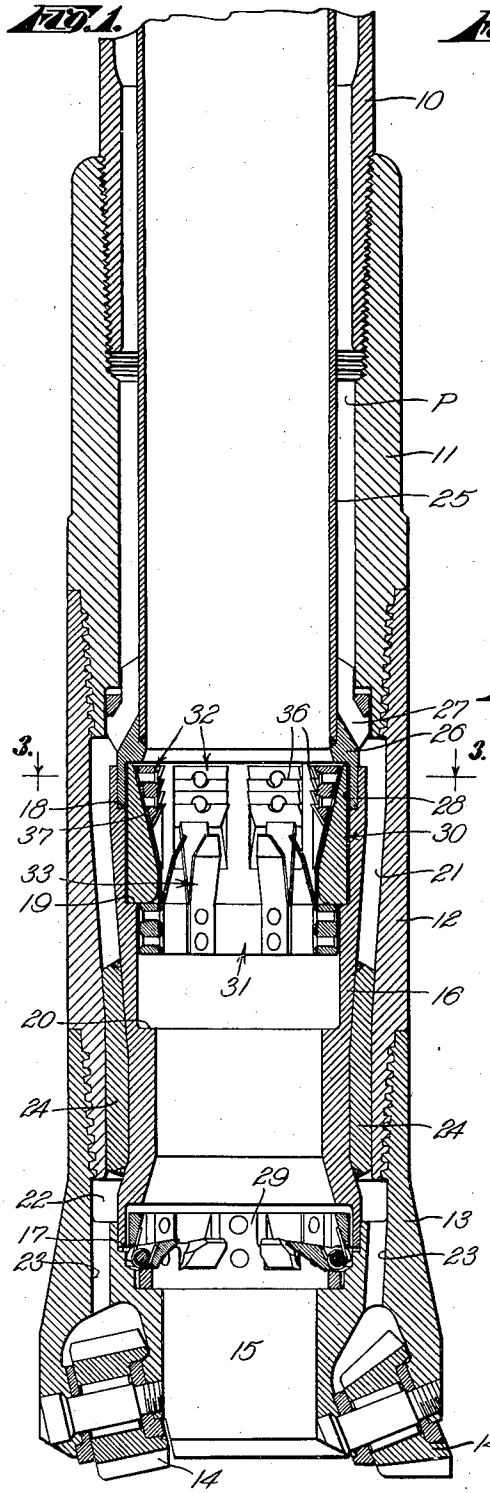


FIG. 2.

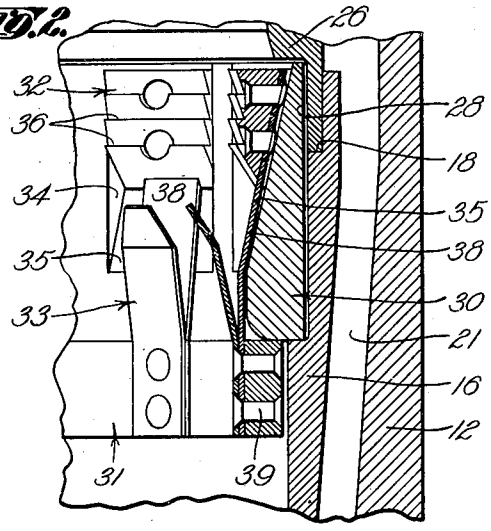
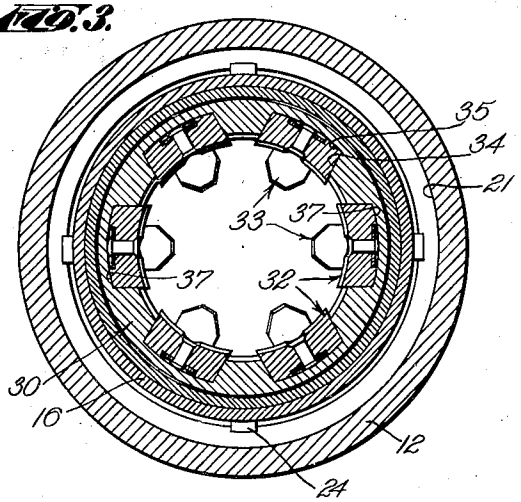


FIG. 3.



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UNITED STATES PATENT OFFICE

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CORE CATCHER

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Application September 25, 1936, Serial No. 102,528

12 Claims. (Cl. 255—72)

This invention relates to well drilling tools and relates more particularly to a core catcher for use in a well core drill. A general object of this invention is to provide a practical dependable and very effective core catcher for use in a rotary core drill.

Another object of this invention is to provide improvements in core catchers of the general type set forth in Patent No. 2,063,437, issued December 8, 1936.

Another object of this invention is to provide a core catcher of the character mentioned operable to dependably retain and recover a core with a minimum of mutilation of the same.

Another object of this invention is to provide a core catcher embodying slips positioned and mounted so that they do not injure or foul the core when it is received in the drill.

Another object of this invention is to provide an improved core catcher embodying a combination of slips for gripping the core, a control ring connected with the slips to assure their simultaneous actuation and spring arms connected with the ring to assist in controlling the slips and gripping the core.

Another object of this invention is to provide a core catcher of the character mentioned in which the assembly of the control ring and the spring arms is light in weight so that its momentum does not tend to prematurely actuate the slips when the drill is run into the well.

Another object of this invention is to provide a core catcher of the type mentioned that is not made inoperative by accumulations of mud, cuttings, etc.

A further object of this invention is to provide a core catcher of the character mentioned in which the slips are received in grooves so that they do not scrape mud and sand from the core, which might interfere with their proper operation.

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

Fig. 1 is a central longitudinal detailed sectional view of a well core drill embodying the core catcher of the present invention. Fig. 2 is an enlarged fragmentary longitudinal detailed sectional view of a portion of the drill and core catcher illustrating the slips in their unactuated positions and Fig. 3 is an enlarged transverse detailed sectional view taken as indicated by line 3—3 on Fig. 1.

The improved core catcher of the present invention is adapted to be employed in core drills of various forms and types. In the following detailed disclosure I will describe a typical form of the invention as employed in a core drill of the type fully described and claimed in my co-pending application entitled Core drill, filed August 12, 1936, Serial No. 95,513, Patent No. 2,093,633, issued September 21, 1937. It is to be understood that the invention is not to be construed as limited or restricted to the specific form or application about to be described.

The core drill illustrated in the drawing includes an outer barrel 10 adapted to be connected with the lower end of a rotary well drilling string. A sub 11 is threaded on the lower end of the barrel 10 and carries a tubular bit head sub 12. A bit head 13 is threaded on the lower end of the sub 12. The particular bit head 13 illustrated has a plurality of spaced roller cutters 14 set in recesses in its lower end. The bit head 13 has a central vertical opening 15 for receiving the core. A tube or sleeve 16 is arranged longitudinally through the sub 12. The lower end of the sleeve 16 may rest on a shoulder 17 in the bit head 13. The sleeve 16 extends upwardly to a point adjacent the lower end of the sub 11. The upper portion of the sleeve 16 is internally stepped having three vertically spaced upwardly facing shoulders 18, 19 and 20. The sleeve 16 is spaced from the interior of the sub 12 leaving an annular fluid passage 21. The lower end of the passage 21 communicates with an annular recess 22 in the bit head 13. Ports 23 extend through the bit head 13 to conduct the fluid downwardly from the recess 22 to the cutter receiving sockets. Ribs 24 are provided on the sleeve 16 to hold it centralized.

An inner barrel 25 extends longitudinally through the outer barrel 10 to receive the core. The barrel 25 is spaced from the interior of the outer barrel 10 leaving an annular fluid passage P. A bearing collar 26 is fixed to the lower end of the inner barrel 25 and extends downwardly into the sleeve 16. The lower end of the collar 26 may rotatably bear on the shoulder 18. Ports 27 in the collar 26 connect the lower end of the passage P with the upper end of the passage 21. An annular recess 28 extends upwardly in the collar 26 from its lower end. The particular drill illustrated embodies a dog-type core catcher 29 rotatably supported in the bit head 13 and the lower portion of the sleeve 16.

The present invention is not primarily concerned with the details of the core catcher 29 and such details are omitted from the description.

The core catcher of the present invention includes, generally, a free sleeve 30 arranged in the sleeve 16, a ring 31 in the sleeve 16 below the sleeve 30, slips 32 connected with the ring 31 and operable through cooperation with the sleeve 30, and spring arms 33 on the ring 31 for cooperating with the core.

The sleeve 30 is provided to present inclined abutments for actuating the slips 32. In accordance with the invention the sleeve 30 may be a simple, tubular, one piece member, as illustrated. It is a feature of the invention that the sleeve 30 may be of uniform wall thickness throughout its length. In practice the sleeve 30 may be comparatively thick walled. The sleeve 30 is provided with flat upper and lower ends and concentrically curved internal and external surfaces. The sleeve 30 is arranged within the sleeve 16 between the shoulder 19 and the upper wall of the recess 28 in the collar 26, its upper portion being received in the recess. The sleeve 30 is proportioned to be free to turn or remain stationary in the sleeve 16 at will. The internal diameter of the sleeve 30 is such that the sleeve may freely pass the core during the coring operation. Longitudinal movement of the sleeve 30 is prevented or limited by the shoulder 19 and the upper wall of the recess 28.

In accordance with the invention a plurality of circumferentially spaced longitudinal slots, channels or grooves 34 are provided in the interior of the sleeve 30. The grooves 34 extend downwardly from the upper end of the sleeve 30 and are equally spaced one from the other. In accordance with the invention the grooves 34 may have flat parallel side walls. The inner walls or bottom walls 35 of the grooves 34 are inclined downwardly and inwardly relative to the longitudinal axis of the drill. Due to the inclination of their bottom walls 35 the grooves 34 are of substantial depth at their upper ends and terminate some distance above the lower end of the sleeve 30. The grooves 34 are preferably identical.

The ring 31 is provided to carry the spring arms 33 and to assure the simultaneous actuation of the several slips 32. It is a feature of the invention that the ring 31 may be a simple, light weight member. The ring 31 is arranged within the sleeve 16 at the lower end of the sleeve 30 and is proportioned to be free to rotate or to remain stationary at will. The opposite ends of the ring 31 may be flat and parallel as illustrated. The ring 31 may be of substantially the same internal diameter as the sleeve 30.

The slips 32 are provided to grip and support the core when the drill is raised after the drilling operation. The slips 32 are in the nature of toothed wedges operable longitudinally in the grooves 34. In accordance with the invention the slips 32 have flat parallel sides for shiftably cooperating with the side walls of the grooves 34. The active sides or inner sides of the slips 32 may be concave to conform, generally, to the core and are provided with teeth 36 for gripping the core. The slips are proportioned to be substantially entirely received in the grooves 34 when in their retracted up positions and to project inwardly a substantial distance from the grooves when in their down, actuated positions. The slips 32 are provided with downwardly and inwardly inclined surfaces 37 for shiftably bearing on the bottom walls 35 of the grooves 34. During relative vertical movement between the sleeve 30 and the slips 32 in one direction the cooperation of the walls 35 and surfaces 37 effects the inward displacement or movement of the slips 32 to bring their teeth 36 into gripping engagement with the core.

Means is provided for connecting the slips 32 with the ring 31 whereby the slips are connected for simultaneous operation and are controlled or actuated through the engagement of the spring arms 33 with the core. The means for connecting the slips 32 with the ring 31 includes spring members or reins 38 secured to the interior of the ring 31 and projecting upwardly through the sleeve 30 and grooves 34 to the slips 32. Suitable rivets 39 may rigidly secure the reins 38 to the ring 31. The reins 38 are proportioned to support the slips 32 in the upper portions of the grooves 34 when the ring 31 is at the lower end of the sleeve 30, as illustrated in Figs. 1 and 2.

The spring arms 33 are provided on the ring 31 to resist relative movement between the ring and the core when the drill is raised so that the upward movement of the drill causes the walls 35 of the grooves 34 to actuate the slips 32 inwardly against the core. The spring arms 33 also assist in gripping and supporting the core. The spring arms 33 are in the nature of strap or leaf springs and are secured to the interior of the ring 31 to project upwardly and inwardly from the ring. In accordance with the invention the spring arms 33 may be secured to the ring 31 by the rivets 39, as illustrated throughout the drawing. The upper end portions of the spring arms 33 may be rather sharply inclined inwardly and may be bevelled to better cooperate with the core.

During the drilling or coring operation the cutters 14 make an annular cut in the earth formation leaving a core which is received in the opening 15. As the drilling progresses the core is received in the sleeve 16 and passes through the core catcher of the present invention into the inner barrel 25. During the passage of the core through the core catcher the spring arms 33 yieldingly engage the core and their engagement with the core holds the ring 31 upwardly against the lower end of the sleeve 30. Thus the engagement of the spring arms 33 with the core may hold the slips 32 in their uppermost positions where they do not contact or engage the core. As described above, the slips 32 are substantially entirely received in the upper portions of the grooves 34 when in their uppermost positions, and, therefore, cannot foul or mutilate the core during the coring operation. Further, as the slips are practically entirely housed within the grooves 34 they do not accumulate mud, cuttings, etc., which may later interfere with their actuation.

When sufficient core has been obtained the drilling operation is suspended and the drill is raised. When the drill is moved upwardly the engagement of the spring arms 33 with the stationary core resists upward movement of the ring 31 and, therefore, resists upward movement of the slips 32 connected with the ring by the reins 38. The shoulder 19 engaging the lower end of the sleeve 30 causes the sleeve to move upwardly with the drill. The inclined walls 35 on the upwardly moving sleeve 30 cooperate with the inclined surfaces 37 on the slips 32 which are held against movement as described above. The cooperation of the walls 35 and the surfaces 37

effects inward displacement or actuation of the slips 32 bringing them into tight gripping contact with the core. Thus the slips 32 obtain gripping and supporting engagement with the core and as the drill is raised the slips break the core free from the earth formation and retain it in the drill. The spring arms 33 may also assist in supporting and retaining the core.

Having described only a typical preferred form and application of my invention, I do not wish to be limited or restricted to the specific details herein set forth, but wish to reserve to myself any variations or modifications 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 catcher for use in the core receiving opening of a well drill comprising, a sleeve for arrangement in the opening, the sleeve having longitudinal grooves provided with inclined inner walls, slips movable in the grooves and operable through cooperation with said walls, and a spring connected with the slips and engageable with the core for controlling the operation of the slips.

2. A core catcher for use in the core receiving opening of a well drill comprising, a sleeve of substantially uniform wall thickness for arrangement in the opening, the sleeve having longitudinal grooves provided with inclined inner walls, slips movable in the grooves and operable through cooperation with said walls, and spring means engageable with the core and connected with the slips for controlling the operation of the slips.

3. A core catcher for use in the core receiving opening of a well drill comprising, a sleeve for arrangement in the opening, the sleeve having longitudinal grooves provided with inclined inner walls, core gripping slips movable longitudinally in the grooves and operable into engagement with the core through cooperation with said walls, the deep portions of the grooves substantially entirely receiving the slips in their retracted positions, and core engaging means controlling the actuation of the slips, said means comprising core engaging spring arms connected with the slips.

4. A core catcher for use in the core receiving opening of a well drill comprising, a sleeve for arrangement in the opening, the sleeve having longitudinal grooves provided with inclined inner walls, slips movable in the grooves and operable through cooperation with said walls, and means controlling the operation of the slips, said means including, a free ring below the sleeve, and reins connecting the slips with the ring.

5. A core catcher for use in the core receiving opening of a well drill comprising, a sleeve for arrangement in the opening, the sleeve having longitudinal grooves provided with inclined inner walls, slips movable in the grooves and operable through cooperation with said walls, and means controlling the operation of the slips, said means including a free ring below the sleeve, reins connecting the slips with the ring, and core engaging parts on the ring.

6. A core catcher for use in the core receiving opening of a well drill comprising, a sleeve of substantially uniform wall thickness arranged in the drill to move vertically therewith, the sleeve having longitudinal internal grooves with downwardly and inwardly inclined bottom walls whereby they have the greatest depth at their upper ends, longitudinally movable slips in the grooves initially substantially entirely within the deep portions of the grooves and operable inwardly against the core by said walls upon upward movement of the sleeve with the drill, and core engaging spring arms connected to the slips for resisting upward movement of the slips.

7. A core catcher for use in the core receiving opening of a well drill comprising, a sleeve of substantially uniform wall thickness, the sleeve having longitudinal internal grooves with downwardly and inwardly inclined bottom walls whereby they have the greatest depth at their upper ends, longitudinally movable slips in the grooves initially substantially entirely within the deep portions of the grooves and operable inwardly against the core by said walls upon movement of the sleeve, and means resisting upward movement of the slips, said means including, a ring in the opening below the sleeve, reins connecting the slips with the ring, and core engaging members on the ring for resisting movement of the ring.

8. A core catcher for use in the core receiving opening of a well drill comprising, a sleeve of substantially uniform wall thickness arranged in the drill to move vertically therewith, the sleeve having longitudinal internal grooves with downwardly and inwardly inclined bottom walls whereby they have the greatest depth at their upper ends, longitudinally movable slips in the grooves initially substantially entirely within the deep portions of the grooves and operable inwardly against the core by said walls upon upward movement of the sleeve with the drill, and means resisting upward movement of the slips, said means including, a ring in the opening below the sleeve, reins connecting the slips with the ring, and core engaging spring arms on the ring for resisting movement of the ring.

9. A core catcher for use in the core receiving opening of a well drill comprising, a sleeve arranged in the opening to move vertically with the drill, downwardly and inwardly inclined internal surfaces on the sleeve, core gripping slips actuated inwardly by said surfaces upon upward movement of the sleeve, a free ring in the opening below the sleeve, reins connecting the slips with the ring, and resilient parts on the ring cooperating with the core to resist upward movement of the ring during upward movement of the sleeve.

10. A core catcher for use in the core receiving opening of a well drill comprising, a sleeve arranged in the opening to move vertically with the drill, downwardly and inwardly inclined internal surfaces on the sleeve, core gripping slips actuated inwardly by said surfaces upon upward movement of the sleeve, a free ring in the opening below the sleeve, reins connecting the slips with the ring, and spring arms on the ring cooperating with the core to resist upward movement of the ring during upward movement of the sleeve.

11. A core catcher for use in the core receiving opening of a well drill comprising, a sleeve arranged in the opening to move vertically with the drill, downwardly and inwardly inclined internal surfaces on the sleeve, core gripping slips actuated inwardly by said surfaces upon upward movement of the sleeve, a free ring in the opening below the sleeve, reins attached to the slips, members attaching the reins to the ring, and spring arms for engaging the core attached to the ring by said members to resist movement of the ring during upward movement of the sleeve.

12. A core catcher for use in the core receiving opening of a well drill comprising, a sleeve of

substantially uniform wall thickness, the sleeve having longitudinal internal grooves with downwardly and inwardly inclined bottom walls whereby they have the greatest depth at their upper ends, longitudinally movable slips in the grooves initially substantially movable slips in the grooves initially substantially entirely within the deep portions of the grooves and operable inwardly against the core by said walls upon movement of the sleeve, and means resisting upward movement of the slips, said means including, a free ring in the opening below the sleeve, reins attached to slips, members attaching the reins to the ring, and spring arms attached to the ring by said members and operable to engage the core to resist movement of the ring during upward movement of the sleeve.

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