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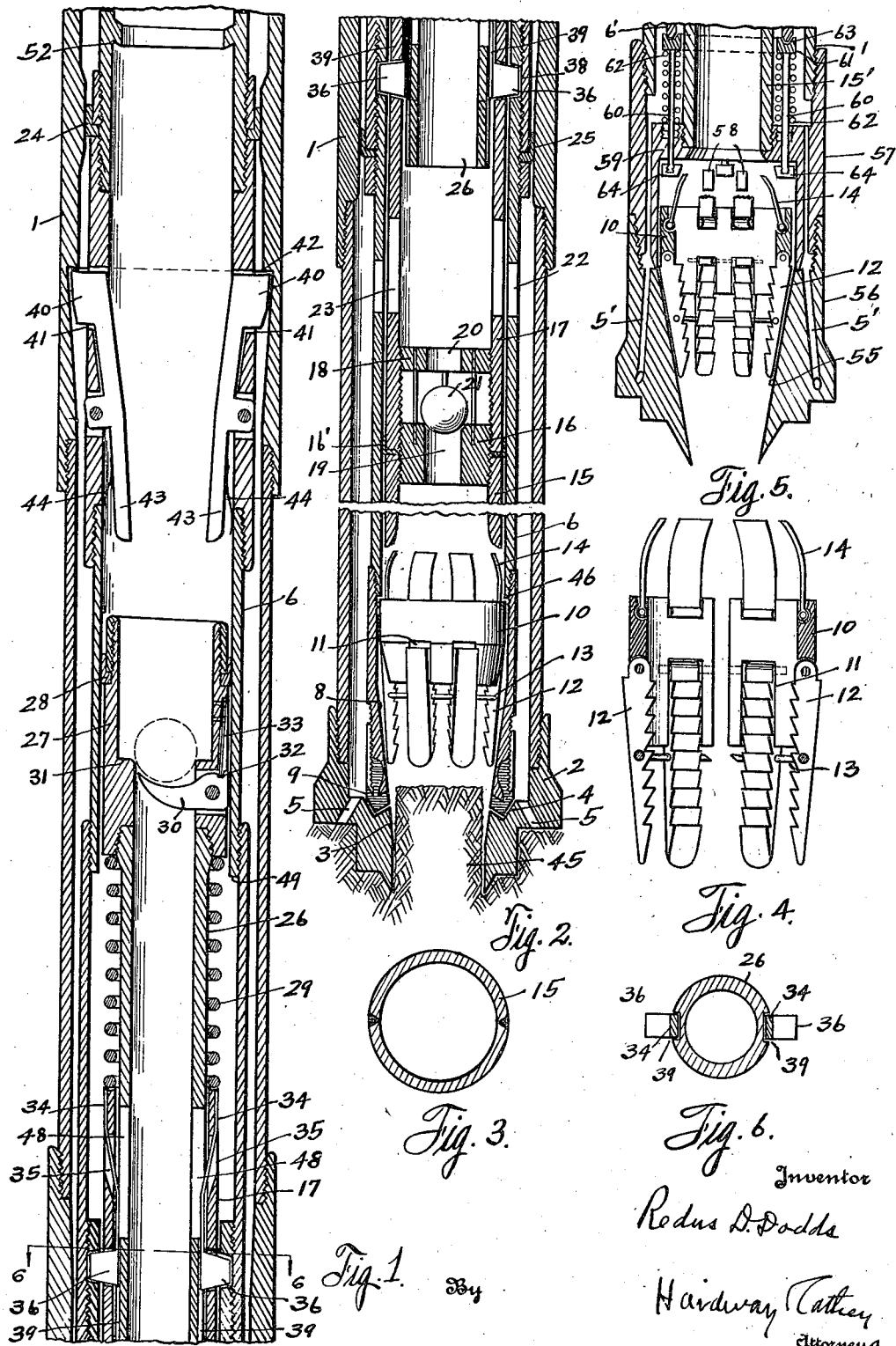
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2,019,176

SAMPLE TAKING DEVICE

Filed May 7, 1932

3 Sheets-Sheet 1



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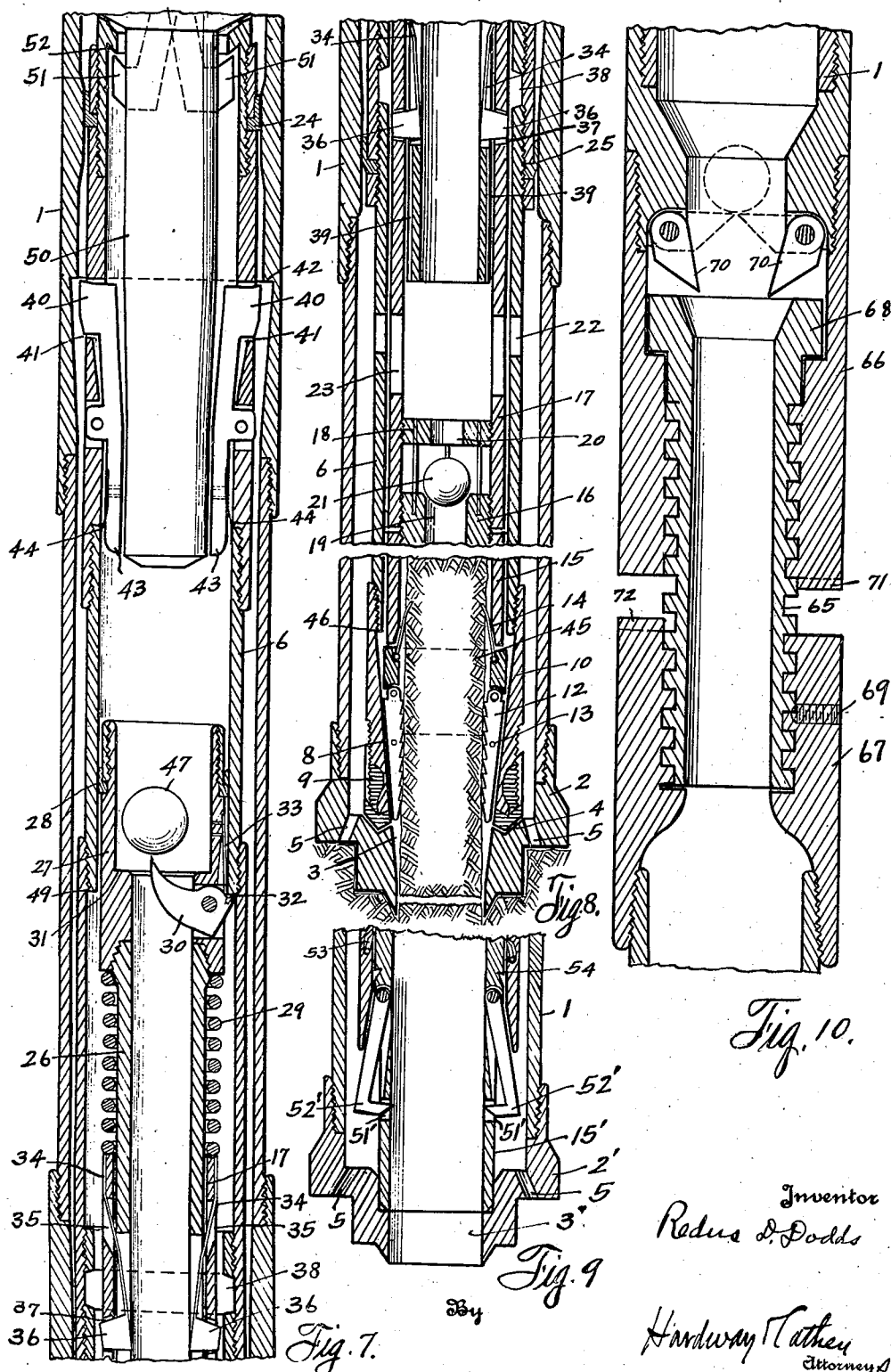
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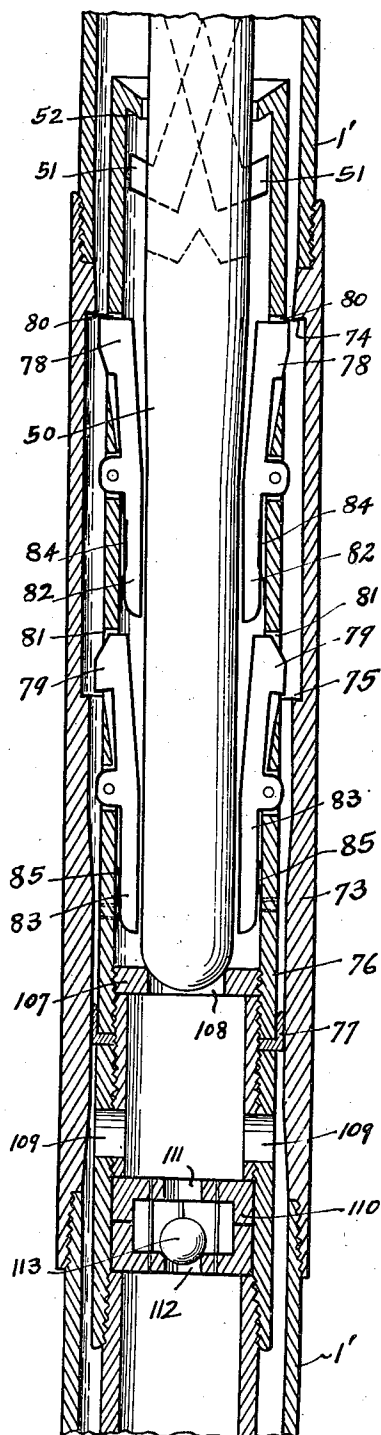


Fig. 11.

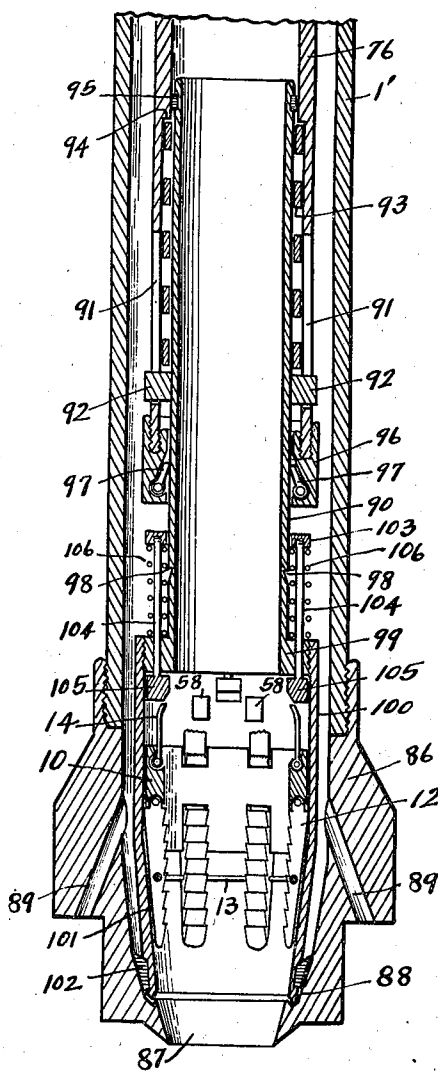


Fig. 12.

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UNITED STATES PATENT OFFICE

2,019,176

SAMPLE TAKING DEVICE

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14 Claims. (Cl. 255—72)

This invention relates to a sample taking device.

An object of the invention is to provide an apparatus of the character described specially designed for taking cores or samples of either hard or soft formation being pierced in the process of drilling wells.

Another object of the invention is to provide, in an apparatus of the character described, a novel type of core catcher.

Another object is to provide novel means for actuating said catcher into, and maintaining the same in, secure engagement with the core or sample.

Another object is to provide novel means for indicating to the operator that the core catcher has been actuated into core retaining position. Another object is to provide, in a device of the character described, a novel type of core barrel.

Another object is to provide novel means for anchoring the device in the drill stem.

Another object is to provide a core taking apparatus that may be readily let down into, anchored in, and removed from the drill stem, while said stem and drill remains in the bore.

With the above and other objects in view this invention relates to certain novel features of construction, operation and arrangement of parts an example of which is given in this specification and illustrated in the accompanying drawings, wherein:—

Figures 1 and 2 show vertical sectional views, respectively, of the upper and lower ends of the apparatus shown in core receiving position.

Figure 3 shows a cross sectional view of the core barrel.

Figure 4 shows a vertical sectional view of the core catcher.

Figure 5 shows a fragmentary vertical sectional view of the lower end of a modified form of the device.

Figure 6 shows a sectional view of the core barrel locking device, taken on the line 6—6 of Figure 1.

Figures 7 and 8 show vertical sectional views, respectively, of the upper and lower ends of the apparatus shown in core retaining position.

Figure 9 shows a fragmentary vertical sectional view of still another form of the lower end of the apparatus showing a modified form of core retainer.

Figure 10 shows a fragmentary vertical sectional view of the drill stem, above the core taking apparatus, showing a type of releasable ball retainer employed, and

Figures 11 and 12 show vertical sectional views of the upper and lower ends, respectively, of another modification.

Referring now more particularly to the drawings, wherein like numerals of reference designate similar parts in each of the figures the numeral 1 designates the tubular drill stem to the lower end of which a core forming drill 2 may be attached. The drill has a central core receiving opening 3 and around this opening may have 10 an inside annular groove forming a seat 4. The channels 5, 5 for flushing fluid lead outwardly from the stem, through said drill, outside of said seat.

There is a tubular housing 6 whose lower end 15 has a downwardly converging seat 8 therein and said lower end has an annular, resilient ring 9 secured thereon which seats in the seat 4 and forms a fluid tight joint therewith.

On the seat 8 there is mounted a core catcher 20 which will now be described:—This core catcher comprises a tubular body 10, preferably split at one side so that it will be expansible to permit the core, or sample, to pass readily therethrough. The lower end of the catcher body has a plurality 25 of wide slots 11 in which the slips are mounted. The upper ends of these slips are pivoted in the body and their lower ends are free and depend beneath said body. The outer sides of the slips are tapered downwardly to conform to the pitch 30 of, and to rest upon, said seat 8 and the inner faces of the slips are preferably toothed. A flexible split ring 13 is fitted loosely through bearings in said slips which serves to normally hold the lower ends of the slips apart so as not to interfere with the entrance of the core, or sample. Pivoted to the inside of the upper end of the body 10 are the relatively wide, upstanding, inwardly curved flexible fingers 14. These fingers will readily yield outwardly to readily permit the entrance of a core, or sample, and upon the withdrawal of the device the fingers will engage underneath a soft sample in the core barrel 15 above and will thus retain samples that are of such a nature that the slips 12 will not engage 45 and retain.

The core barrel 15 is attached, by an inside coupling 16, to the lower end of the tubular barrel hanger 17 and spaced above said coupling, in the hanger there is threaded the ring 18. The hanger 17 is surrounded by a suitable packer, as 16'.

The coupling 16 and ring 18 have the aligned fluid passageways 19, 20, respectively there- 55 through which may be controlled by the ball

valve 21 located between them. The housing 6 and hanger 17 have the respective ports 22, 23 which register, or partially register, at all times and between the housing and drill stem are the upper and lower upwardly opening cup rings 24, 25. When the apparatus is being lowered through the drill stem the drilling fluid in the stem attempting to enter through the passageway 19 will lift the valve 21 to close the passageway 20 and the only inflow of said drilling fluid into and up through the apparatus, as it descends, will be restricted to the ports 22, 23 so that the apparatus will be retarded in its downward passage through the drill stem to final position and consequently may be lowered, or floated in, without the use of a line or cable to lower the same.

The tubular core barrel is preferably formed of two complementary lengthwise sections which may be soldered together, as shown in Figure 3, so that when the core or sample is taken and withdrawn the sections may be readily separated to gain access to the sample. These sections may be otherwise secured together so that they may be readily taken apart.

In the upper end of the barrel hanger 17 there is a tube 26 whose upper end is extended above said hanger and attached to said upper end there is an enlarged tubular head 27 having the surrounding upwardly opening cup ring 28 which forms a close fit in the housing 6. The head 27 rests on a strong coil spring 29 which surrounds the tube 26 and rests on the upper end of the hanger 17. Pivotaly mounted in a side slot in the head 27 there is a finger 30 having a straight outer end face which normally rides against the inner wall of the housing and the finger is thereby retained in transverse position across the passageway through the tube 26 and above said finger the head 27 is enlarged, internally, forming the annular seat 31. The upper margin of the outer end of the finger has a notch 32 in which the free end of the flat spring 33 engages to assist in maintaining the finger in said position. The upper end of this spring is attached to the head 27.

Attached to the upper end of the barrel hanger 17 are the flexible springs 34, 34 which work inwardly through the side slots 35, 35 of said hanger and to the inner ends of these springs the outwardly directed dogs 36, 36 are attached. These dogs work through the side bearings 37, 37 of the hanger 17 and when the apparatus is assembled to be let down through the drill the dogs project into the inside annular groove 38 in the housing 6 and are retained in said locking position by the tube 26 which works between them and which has the external vertical grooves 39, 39 in which said dogs work. These dogs serve to lock the barrel hanger and barrel against longitudinal movement relative to the housing.

In assembling the apparatus the core catcher is located on the seat 8 and the barrel hanger and barrel are assembled together and are anchored in the housing as shown in Figure 1, with the lower end of the barrel spaced above the core catcher and as thus assembled the apparatus is let down through the drill stem and the lower end of the housing finally lands on the seat 4. Pivotaly mounted in the housing 6 above the head 27 are the locking dogs 40, 40 which work outwardly through the housing slots 41, 41 and engage under the inside annular shoulder 42 within the drill stem. There will be a slight rebound of the resilient member 9 which will hold said dogs 40 closely against said shoulder 42. The

dogs 40 have the downwardly converging extensions 43, 43 against which the inwardly working flat springs 44, 44 work whereby the dogs 40 are retained in engagement with the shoulder 42.

As the drill stem and drill are rotated the drill will form a core, as 45 which will gradually enter the core barrel 15, passing up through the core catcher. The core will hold the core catcher elevated above the seat 8 but the range of elevation will be limited by the inside annular shoulder 46 in the housing. The core passageway through the drill converges downwardly, as shown, so as to minimize the friction with the core, so that the core, particularly if a hard core, will not be broken off or injured, and the catcher will engage with and be sustained by said core and will not rotate with the housing. The core barrel, if desired, may have a conventional swivel connection with the hanger 17 instead of the rigid connection formed by the coupling 16.

When it is desired to remove the core, or sample, a ball, as 47, may be dropped through the drill stem 1 and this ball will land on the seat 31, as shown in dotted lines in Figure 1, and fluid pressure exerted downwardly through the stem 1 will move the tube 26 downwardly compressing the spring 29 and when the slots 48, 48, cut through the tube 26 register with the dogs 36, said dogs will be moved inwardly, by the springs 34, through said slots and thereupon the barrel hanger and barrel 15 will move downwardly and the lower end of the barrel will surround and press downwardly against, the fingers 14 and will force the catcher downwardly onto the seat 8 which will contract the slips 12 securely against the core; or if a soft core has been taken the fingers 14 will be closed underneath, and will retain, said sample. The fluid pressure should be applied until the outer end of the finger 30 has passed beneath the inside shoulder 49 of the housing whereupon the spring 33 will operate to lift the inner end of the finger 30 and to carry the upper outer corner of said finger out underneath the shoulder 49. Upon release of the pressure the spring 29 will move the tube 26 upwardly but the outer end of the finger 30 will engage the shoulder 49 and the inner end of said finger, and the ball 47, will be elevated above the seat 31. Fluid may now circulate freely down through the drill stem and tube 26 and out through the openings 23, 22 and thence out through the passageways 5 to the drill, but said fluid will at all times be excluded from the barrel 15 by the valve 21 which closes the passageway 19 against the entrance of said fluid. The pump for supplying the pressure fluid will now speed up to indicate that the core has been secured. The means for controlling the passageway is shown and claimed in my copending application for Screen setting apparatus filed February 11, 1930, under Serial No. 427,602.

If desired mechanical means may be employed to force the tube 26 and core barrel downwardly to effect the securing of the core, or sample.

Any suitable type of fishing tool may now be lowered through the stem 1 to release and withdraw the apparatus. As shown this fishing tool has a mandrel 50 which may enter between and expand the extensions 43 and thus withdraw the dogs 40 from underneath the shoulder 42, and said tool also includes the dogs 51 which may engage underneath the inside shoulder 52 of the housing 6 and said tool and apparatus may be withdrawn the core barrel may be removed and the soldered joints melted to permit the separa-

tion of the barrel sections and access thus gained to said core.

As shown in Figure 9 the lower end of the core barrel 15' may be detachably secured to the drill 2 in alignment with the core passageway 3'. This core barrel 15' may have the bearings 51', 51' adjacent its lower end through which the inwardly turned core retaining dogs 52', 52' work. The upper ends of these dogs are pivoted to the core barrel 15'. In this form the housing 6' is downwardly movable and when the ball 47 is dropped onto the seat 49 and fluid pressure is applied said dogs 36 will be released, as hereinabove described and said housing will be moved downwardly by said pressure and its lower end will operate against the dogs 52', 52' to force them inwardly and they will sever, and engage underneath, the core. When the housing is moved downwardly the upper ends of the inwardly working dogs 53, 53, carried by said housing, will engage underneath the external annular shoulder 54, around the barrel 15' and will lock said housing in its lower position to retain the dogs 52' in engagement underneath said core. In other respects the form shown in Figure 9 is the same as that shown in Figure 1.

In the form shown in Figure 5, the core catcher is located in the downwardly converging seat 55 in the core drill 56, and this drill is connected to the stem 1 by means of the drill collar 57 which has the passageways 5' leading downwardly therethrough to conduct the drilling fluid from the drill stem to the drill. This drill collar has the inside stops 58 to limit the upward movement of the core catcher. In this form the core barrel 15' is attached to the inwardly thickened portion 59 on the drill collar. There are the vertical push rods 60 which work through bearings in the thickened portion 59 and whose upper ends are attached to the ring 61 around the barrel 15. The ring 61 is seated on the coil springs 62 which surround the rods 60 and are supported on the drill collar. The upper side of the ring 61 has an annular groove 63 wherein the lower end of the housing 6' is seated. The lower ends of the rods 60 have the heads 64 thereon and when the housing 6' is moved downwardly, as hereinbefore explained in connection with the description of Figure 9 the heads 64 will force the core catcher downwardly to cause the slips 12 to engage with and grip the core that has been formed, or if a soft sample has been taken the fingers 14 will be forced into position to engage underneath and retain said sample. In this form also the housing 6' and the barrel 15' may be provided with the interlocking dogs 53 and shoulders 54 to engage and lock the housing 6' in its lower position. When the core has been secured the drill stem and core taking apparatus therein may be withdrawn with the slips 12 moved downwardly and inwardly on the seat 55 to grip and retain the core.

Another modification of the apparatus is illustrated in Figures 11 and 12 wherein the drill stem 1' has a special type of coupling 73 incorporated into the same and which has the upper and lower annular shoulders 74, 75 therein which face downwardly and upwardly, respectively. In this form there is a tubular housing 76 adapted to pass through said coupling and which has a suitable packing 77 therearound to form a close fit in the coupling 73. The housing 76 has the upper and lower locking dogs 78, 78 and 79, 79 respectively, pivoted therein which work outwardly through the housing slots 80, 80 and 81, 81 and

engage with the corresponding shoulders 74 and 75 respectively. These dogs 78, 79 have the downwardly converging extensions 82, 82 and 83, 83, respectively, against which the inwardly working flat springs 84, 84 and 85, 85, respectively, work, whereby said dogs are retained in engagement with said shoulders.

Attached to the lower end of the drill stem 1 is a core drill 86 having a central inlet passageway 87 for the sample and having the inside 10 downwardly converging seat 88 above said inlet, and this drill also has the channels 89, 89 for the flushing fluid leading outwardly from above said seat 88.

The lower end of the housing 76 telescopes over 15 the core barrel 90 and has the longitudinal side slots 91, 91, through which the lugs 92, 92, carried by the core barrel work. Around the core barrel and between it and the housing there is a strong coil spring 93 which is seated on the lugs 92 and whose upper end abuts the inside annular shoulder 94 in the housing and above said shoulder there is a packing ring 95 between said barrel and housing. The lugs 92 are preferably welded to the core barrel after said barrel, spring and 25 housing are assembled. An annular head 96 is attached to the lower end of the housing and surrounds said barrel and this head carries the pivotally mounted inwardly working dogs 97, 97 adapted to engage the external downwardly facing shoulders 98, 98, on the core barrel, when the housing has been moved to lower position on the core barrel as hereinafter explained and to lock said housing in said lower position.

The lower end of the core barrel has an external annular flange 99 and attached to this flange there is a depending cage 100 whose lower end converges downwardly forming the seat 101. The lower end of this cage may have a surrounding packing 102 to seat in the seat 88 of the drill. 40 Mounted in the cage 100 there is a core catcher similar to that shown in Figures 2, 4, and 5.

Around the core barrel beneath the head 96 there is a ring 103 and vertical push rods 104 having their upper ends attached to said ring 45 and these rods work through bearings in the flange 99. The lower ends of the push rods 104 have the heads 105. Surrounding the rods 104 are the coil springs 106 which are seated on the flange 99 and on which the ring 103 is seated. 50

Beneath the dogs 79 there is a ring 107 secured in the housing 76 and having an opening 108 therethrough for the passage of drilling fluid and beneath said ring the housing has the outlet openings 109, 109 through which the drilling 55 fluid may pass outwardly into the stem 1' and thence down and out through the passageways 89.

Secured in the housing 76 beneath the openings 109 there is a valve cage 110 having the upper and lower openings 111, 112 controlled by 60 the ball valve 113, confined by said cage.

This form of the apparatus assembled as hereinabove described may be lowered into the drill stem and the pressure of the fluid beneath will lift the valve 113 so as to close the opening 65 111 and the entrance of the fluid from the drill stem into the housing will be restricted to the passageways 109 and the downward movement of the apparatus will be thereby retarded and the apparatus may thus be floated in without the 70 use of a line or cable. When the dogs 79 pass the shoulder 74, they will be expanded and when the apparatus has moved on down until its lower end seats on the seat 88 the dogs 79 will hang on the shoulder 75 and the dog 78 will clear the 75

shoulder 74 and will be expanded by the springs 84 into engagement with said shoulder 74.

Drilling may now be proceeded with as hereinbefore explained and the core or sample will enter through the core catcher and will pass on up through the core barrel 90 and into the housing 76 above. In this form the barrel is relatively short and the housing above is larger than the core barrel so as to give greater capacity and consequently the core or sample will not be liable to congest in or clog the core barrel. As the sample enters the core barrel the air or water in the barrel or housing above will lift the valve 113 and pass out through the openings of the core barrel but the valve 113 will prevent the entrance of the drilling fluid into the sample chamber.

When a sample has been taken, a fishing tool of the character hereinabove described may be lowered through the drill stem into the upper end of the housing 76 and the mandrel 50 thereof will enter between and expand the extensions 82, 83 and thus withdraw the dogs 78, 79, from engagement with their corresponding shoulders 74, 75 and the lower end of said mandrel will land on the ring 107 and close the opening 108 thus cutting off the drilling fluid which will affect the operation of the pump and indicate to the operator that the housing has been released. The housing 76 is now free to move downwardly and the head 96 thereof will land on the ring 103 and will force the rods 104 and the heads 105 downwardly into contact with the fingers 14 thus forcing the core catcher downwardly into secure engagement with the core or sample. Thereupon the fishing tool may be elevated and the dogs 51 thereof will engage underneath the shoulder 52 of the upper end of the housing and the entire apparatus with the sample therein may be withdrawn to the ground surface for inspection. While being withdrawn the core catcher will be maintained in secure engagement with the core or sample by means of dogs 97 which engage with the shoulders 98 when the housing has been moved into its lower position relative to the core barrel 90.

In some cases the drill stem 1 may have a float valve therein above the core taking apparatus and in such case the ball 47 can not be dropped from the ground surface through said stem. When such float valve is used in the stem it is necessary to provide means for supporting said ball in the stem beneath the float valve and for dropping said ball onto the seat 31 at the desired time. Such means is illustrated in Figure 10. As shown in this figure there is a tubular coupling sleeve 65 having external coarse threads which are screwed through the upper couplings 66 and into lower couplings 67 which are in turn connected to the upper and lower sections of said drill stem. The upper end of the sleeve 65 has an enlarged head 68 which prevents the detachment of said sleeve from the coupling 66 and the lower end of the sleeve 65 is fastened in the coupling 67 by means of a set screw 69. Above the head 68 there are the pivoted dogs 70, 70 and when the coupling 66 is screwed down on the sleeve 65 into abutting relation with the coupling 67 of the head 68 will engage the dogs 70, 70 and hold them in transverse position as shown in dotted lines in Figure 10 and in this position they will support the ball 47. When the couplings 66, 67 are screwed together the shoulders 71, 72 will abut to prevent the parts from being so tightly screwed together that they cannot be readily unscrewed. In this position drilling may be proceeded with

until a core or sample has been taken and the upper portion of the drill stem may be reversed to run the coupling 66 upwardly relative to the sleeve 65 to release the dogs 70 and to permit the ball 47 to drop onto the seat 31 for the purpose hereinabove explained.

In case the form shown in Figures 11 and 12 is used, a mandrel, such as 50 may be supported on the dogs 70, 70 and released in the manner hereinabove described, when the core is taken, to release the dogs 78, 79.

The drawings and description disclose what is now considered to be preferred forms of the invention by way of illustration only while the broad principle of the invention will be defined by the appended claims.

What I claim is:

1. In a core taking device, a core catcher including a tubular expansible body, core engaging slips pivoted thereon and whose lower ends are free, a yieldable means independent of the body and connecting said slips and normally holding said free ends apart.

2. In a core taking device, a core catcher including a tubular expansible body, core engaging slips pivoted thereon and whose lower ends are free, yieldable means independent of and beneath the body and connecting said slips and normally holding said free ends apart, and inwardly movable core engaging means upstanding from the body.

3. In a core taking device, a core catcher comprising a tubular split body, having slots at one end, core engaging slips pivoted to work through said slots, a split, flexible, ring connected to said slips and normally holding their lower ends apart and inwardly movable, upwardly directed fingers on said body.

4. A core taking apparatus including a tubular stem, a core forming drill on the lower end of the stem having a core receiving opening and an inside seat around said opening, a tubular housing in the stem whose lower end is adapted to form a close fit with said seat and is provided with an inside downwardly converging seat, releasable means for locking the housing in the stem, a core-catcher on the seat in said housing, a core barrel in the housing, means for locking said core barrel in the housing spaced above the core catcher, said barrel being movable downwardly, upon release of the barrel locking means, into engagement with the core catcher, whereby said catcher is moved downwardly on said housing seat into secure engagement with the core.

5. A core taking apparatus comprising a tubular stem, a core forming drill at the lower end of the stem having an inlet for the core and an inside seat around said inlet, a tubular housing in the stem whose lower end is adapted to form a close fit with said seat and is provided with an inside, downwardly converging seat, means for releasably locking the housing in the stem, a core catcher on the housing seat, a core barrel releasably secured in the housing and movable downwardly upon release of the barrel and effective, upon such downward movement, to move said catcher downwardly on its seat into secure engagement with said core.

6. A core taking apparatus comprising a tubular stem, a core forming drill at the lower end thereof having an inlet for the core, said apparatus having an inside downwardly converging seat, a contractile core catcher on said seat having upstanding inwardly directed fingers, a tubular member in the stem above said seat, means lock-

said tubular member in one position, said member being movable downwardly, upon release thereof, into another position in engagement with said core catcher whereby said fingers are forced inwardly and the catcher is contracted by said seat into engagement with said core.

7. Core taking apparatus comprising a tubular stem, a core drill on the lower end thereof having a core receiving inlet, said apparatus having a downwardly converging seat adjacent the lower end thereof, a contractile core catcher on said seat, a core barrel releasably secured in the stem above the core catcher and movable downwardly upon release thereof into engagement with said catcher whereby the catcher may be moved downwardly on the seat and contracted into engagement with the core.

8. Core taking apparatus comprising a tubular stem, a core drill on the lower end thereof having a core receiving inlet, said apparatus having an inside seat adjacent the lower end thereof, a core catcher on said seat, a tubular housing in the stem, a tubular core barrel in the housing, said housing and stem being one fixed against downward movement relative to the stem and the other releasably secured relative to the stem and being downwardly movable upon release thereof and being effective, upon such downward movement, to engage and move said catcher downwardly relative to said seat and into engagement with said core.

9. Core taking apparatus comprising a tubular stem, a core drill on the lower end thereof having a core receiving inlet, core engaging means around said inlet, a tubular housing in the stem, a core barrel in the housing, said housing and barrel being releasably secured against relative longitudinal movement and one being movable downwardly relative to the other, upon release thereof and being effective, upon such downward movement to move said core engaging means into secure engagement with the core.

10. Core taking apparatus comprising a tubular stem, a core drill on the lower end thereof having a core receiving inlet, core engaging means around said inlet, a tubular housing in the stem, a core barrel in the housing, said housing and barrel being releasably secured against relative longitudinal movement and one being movable downwardly relative to the other, upon release thereof and being effective, upon such downward movement to move said core engaging means into

secure engagement with the core, and means effective to engage and lock said housing and barrel in said last mentioned position.

11. A sample taking apparatus comprising a tubular stem, a drill at the lower end thereof having an inlet for the sample, sample engaging means adjacent the lower end of the apparatus, a housing in the stem, a sample receiving barrel in the housing, releasable interlocking means for locking the housing and barrel against relative movement, means for releasing said locking means, said housing and barrel being, one movable downwardly relative to the other, upon such release, whereby said sample engaging means may be actuated into engaging relation with the sample.

12. A sample taking apparatus comprising a tubular stem, a drill at the lower end thereof having an inlet for the sample, a tubular housing in the stem, a sample receiving barrel in the housing, means for releasably locking said housing and barrel against relative longitudinal movement, said housing and barrel being provided, one with an inside seat having sample engaging means thereon, and the other being downwardly movable, when said locking means is released, and being effective, upon such downward movement, to move said sample engaging means into sample retaining position.

13. In a sample taking device, a tubular stem having adjacent parts connected by threads, ball retaining means therein arranged to be held in ball retaining position by said parts, when said parts are in one position, said parts being relatively rotatable to move them relatively into another position to release said retaining means.

14. A sample taking apparatus comprising a tubular stem, a drill at the lower end thereof having an inlet for the sample, a tubular housing in the stem, a tubular sample receiver associated with the housing, means for releasably securing the housing and sample receiver one against longitudinal movement relative to the other, said housing and receiver being provided, one with an inside seat having sample engaging means thereon including upstanding fingers, and the other being downwardly movable when said securing means is released, and being effective, upon such downward movement, to contract said fingers and move said sample engaging means into sample retaining position.

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