RETRIEVING TOOL FITTING IN AND ENGAGING WASH PIPE

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Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 5

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My invention relates to a retrieving tool fitting into and cooperating with the wash pipe which is used in recovery operations in the drilling of deep wells, such as oil wells, and especially to such wells as are drilled with a rotary bit. For such operations the wash pipe, of larger diameter, and of sufficient length to complete the recovery operation, is attached to the bottom end of the stem of drill pipe and lowered into the hole. My retrieving tool has attached to its lower end the fishing tool which has a diameter smaller than the inside diameter of the wash pipe, and may be any one of several types of tools used in such recovery operations. The cooperation of the wash pipe serves to cause to be pressed outwardly on occasion a set of slips or toothed jaws engaging the inside of the pipe and holding the retrieving tool against sliding in the pipe, and a second set of slips engaging the inside of the pipe and holding the retrieving tool for rotation in one direction.

The objects of my invention are: First, to provide a sliding slip assembly carrying wiper strips to engage the inside of the wash pipe, which assembly is movable as a whole up and down on the retrieving tool through the friction of said wiper strips, and carries slips which are made to hold the tool against sliding in the pipe by relative motion between the parts of the assembly; second, to provide a rotational drive slip assembly fastened on said tool above said sliding slip assembly having slips or vertical teeth which may be pressed outward to engage the inside of the pipe and hold the tool against rotation, such pressing outward being controlled by wiper fingers which fractionally engage the inside of the wash pipe as same is rotated, but said wiper fingers being kept out of such engagement by means on said rotational drive slip assembly when the top of the sliding assembly is not in contact with the bottom of the rotational drive slip assembly; third, to provide for holding the sliding slip assembly at an upper position just under its contact with the rotational drive slip assembly, and for releasing it from that hold by causing it to turn through a small arc; and fourth, to provide for locking the parts of the sliding slip assembly against sliding on each other so that the slips having horizontal teeth may not engage the wash pipe until after such locking is released.

With these and other objects in view my invention resides in the construction and arrangement of parts, herein fully described, and particularly pointed out in the claims.

Referring now to the drawings, which are a part of this specification, and in which like characters indicate like parts:

Fig. 1 is an elevation of my retrieving tool with the sliding slip assembly in bottom position;

Fig. 2 is a plan view of the rotational drive slip assembly with the top disk 22 removed, the slips 42 and 46 and the wiping fingers 46 being placed outside of the disk 23;

Fig. 3 is a plan view of the top disk 22;

Fig. 4 is a side view of the press pin 30;

Fig. 5 is a front elevation of the slip 42, wiping finger 46 and press pin 30;

Fig. 6 is an elevation of the lower end of the tool with sliding slip assembly in contact with the rotational drive slip assembly;

Fig. 7 is a plan view of the clutch 19;

Fig. 8 is a vertical section on the line 8—8 of Fig. 7;

Fig. 9 is a plan view of the upper sliding ring 62;

Fig. 10 is a plan view of the lower sliding ring 63;

Fig. 11 is a section of the gland 16 on the line 11—11 of Fig. 6;

Fig. 12 is a bottom view of the disk 23;

Fig. 13 is a detail of the slip ring 63 in normal position just above the gland 16;

Fig. 14 is a view similar to Fig. 13 with the slip ring 63 resting on top of the gland 16;

Fig. 15 is a view similar to Fig. 13 with the slip ring 63 turned to latch under the latch pin 70;

Fig. 16 is a plan view of the slip ring 63, the sleeve 18 being shown in section;

Fig. 17 is a vertical section showing the fastening of the gland 16 to the sleeve 18; and,

Fig. 18 is a vertical section of the rotational drive slip assembly taken through the key 21a.

The shank 10 of my retrieving tool is hollow, having a bore 11 running through it full length through which may be passed liquids or the wires leading to a backoff shot as is usual. At its bottom end the shank 10 has a thread 13 to be screwed into a thread in the fishing tool 14 and just above the thread 13 a stop collar 15 is welded or fastened to the shank 10.

Above the stop collar 15 is a cone shaped gland 16 increasing in diameter from bottom to top, and above the gland 16 is the sleeve 18 having its threaded end 80 screwed into a recess in the top of the gland 16 and made fast by a set screw 81. The gland 16 has at its top a shoulder 17. The sleeve 18 extends upward a considerable distance and has at its end a clutch 19 integral with it, the clutch 19 being a truncated cone having its larger diameter at the top. The gland 16, sleeve 18 and clutch 19 move together as a single piece sliding on the shank 10, and on these members is mounted the mechanism operating the horizontal slips 74, and the term “sliding slip assembly” is applied to these members and to the mechanism mounted thereon.

A short distance above the clutch 19 is mounted the rotational drive slip assembly which has a cam sleeve 20 provided with a keyway 21 to receive a key 21a fitted into a keyway cut in the shank 10. The cam sleeve 20 has three cylindrical cam surfaces 24, 24 spaced 120 degrees apart, each increasing in distance from the center in clockwise direction, and has at the top an upstanding annular flange 25 to fit into the enlarged inside diameter of the upper disk 22. This upper disk and the lower disk 23 have greater diameters so that they extend outward beyond the cam surfaces 24, 24, and each disk has three countersunk holes through which are passed screws 27, 27 threaded into tapped holes 28, 28 in the cam sleeve 20 by which the disk is fastened to the cam sleeve.

At the middle point of each of the three cam surfaces 24 there is cut inwardly a vertical groove 29, which is shown as dovetailed, but which could as well be rectangular, in which the wedging pin 30 may slide up and down. Each wedging pin 30 has at its upper end a
The rounded portion 31 which fits into and slides in a round hole 32 in the upper disk 22. Below the rounded portion 31 there is a shelf 33 which serves as a stop for an expansion spring 79 placed on the rounded portion 31 to press against the upper disk 22. The shelf 33 and all the lower portions of the wedge pin 30 are rectangular in cross section and the back of the pin toward the center being in a vertical plane surface. The portion 34 just below the shelf 33 is thin, having a small radial dimension, and is followed by a curved or wedging portion 35 increasing in thickness so that the next portion 36 is substantially square in cross section. Below this portion 36 the pin 30 is reduced on both sides in width leaving a rectangular shank 37 of as great thickness as the portion 36 in the radial dimension and providing shoulders 38 at the bottom of the portion 36. This shank 37 passes through and slides in a rectangular hole 39 in the lower disk 23. In normal position the spring 79 will press the shoulders 38 against the upper surface of the disk 23 with the end of the shank 37 protruding downward beyond the disk 23.

In the upper disk 22 are cut three arcuate guide slots 40, and in the lower disk 23 are cut three corresponding arcuate guide slots 41. These guide slots are outside of the cam surface and begin just beyond in clockwise rotation the point from which the cam surface increases in distance from the center. Into the guide-slot 40 fits the upper slip guide 43 for sliding therein, and into the guide slot 41 fits the lower slip guide 44. These slip guides are preferably integral with the slip 42, but of less thickness along the radius, and extend into the slots 40 and 41, to guide the slip 42 along the cylindrical cam surface 24 which its inside surface is shaped to fit. The outer surface of the slip 42 is cut into angular vertical teeth which are adapted to engage the inside of the wash pipe 12 in order to hold against rotation. A horizontal groove or zone 45 is channeled across the teeth of the slip 42 at their middle to receive end of the wiping finger 46 which end is fastened to the slip 42 by a rivet 47.

The wiping finger 46 is a thin strip of resilient material bent to conform to the cylindrical surface of the inside of the wash pipe 12, and of such overall length so that it reaches horizontally across the thickest portion of cam surface 24 to be in contact with the wedge pin 30 when the slip 42 is at starting position with reference to the guide slots, 40 and 41. A horizontal groove or zone 50 is channeled across the thickest portion of cam surface 24 to provide that the wiping finger 46 may rest therein and not be forced against the inside of the wash pipe 12. The wiping finger 46 has a double bend near its free end so that the free end presents a flat foot 49 which is radially inward for the rest of the wiping finger 46 towards the wedge pin 30. In normal position for the wedge pin 30 the flat foot 49 will rest on the thickest portion 34 of the wedge pin when the slip guides, 43 and 44, are in starting position so that the wiping finger 46 is not pressed outwards into contact with the wedge pin 12; but should the wedge pin 30 be moved upward the thick portion 36 thereof will press the foot 49 outward to bring the wiper strip 46 into such contact.

The under side of the lower disk 23 has two cam surfaces 51 near its edge, each ending in a vertical shoulder 52 to provide half of a clutch jaw, and the upper side of the clutch 19 has two cam surfaces 53 to match the cam surfaces 51 near its edge ending in a shoulder 54. These four cam surfaces fit together as a clutch whereby the clutch 19 can be turned in a counter-clockwise direction whereby it is in engagement with disk 23. The rest of the top side of the clutch 19 inward from the cam surfaces 51 is a flat plane on which the ends of the shanks 37 may race.

When the clutch 19 is raised so as to contact the disk 23 the wedge pins 30 are pressed upwardly against the springs 79 so that the full width portion 36 of each pin presses the foot 49 outward bringing the wiping finger 46 into contact with the inside of the wash pipe 12. By turning the wash pipe 12 to the right the slips 42 are caused to slide on the cam surfaces 24 so that they engage firmly the inside of the pipe 12 and cause the retrieving tool to turn with the disk 23 to the right, or in clockwise direction, and be held against movement upward or downward in the pipe. Should the pipe 12 be turned to the left, or in counter clockwise direction, the slips 42 will be backed off from engaging the pipe 12, and, unless the wedge pins 30 are again raised by moving the clutch 19, the inside of the wiper strip 46 and the slips will remain out of contact with the inside of the pipe 12.

Just below the upper surface of the clutch member 19 two aligning arcuate grooves 55 rectangular in cross section are cut in the bore wall, each covering nearly a half circle and ending in an abutment 78 at the counter clockwise end of the groove. At the beginning of each of the grooves a slot 60 is cut through to the top of the clutch member 19. The shank 10 has a notch 79 extending inward to contain a detent 57 swinging on a pin 58 and pressed outwardly by a spring 59. The detent 57 has a tapered surface on its under side so that the clutch 19 can pass over it and press inward, and a flat surface normal to the shaft 10 to fit and hold the end of the two half grooves 55 and thereby prevent downward movement of the clutch 19 on the shank 10. Upon turning the clutch 19 in counter clockwise direction the detent 57 will be stopped by the abutment 78, and upon turning the clutch 19 to the right the detent 57 will be brought under the slot 60 and the clutch 19 can slide downward along the shank 10. The position of the detent 57 on the shank 10 is such that when it engages the clutch 19 the latter will be held slightly apart from the disk 23 with the wedge pins 30 not raised.

The sleeve 18 has a key 61 extending from its outer surface for the full length of the sleeve. slidable on the sleeve 18 are an upper sliding ring 62, and a lower sliding ring 63, each having a wide keyway 64 to fit the key 61 loosely and thereby permit a limited turning of the rings, 62 and 63, about the sleeve 18. These sliding rings, 62 and 63, are connected by three wiper strips 65, of resilient metal, having at each end a short portion parallel to the sleeve 18 fastened in a notch on the circumference of one of the slip rings, 62 or 63, by a rivet 66, then a bent portion slanting outwardly, and in the middle a long wiper portion parallel to the sleeve 18 and far enough out from the center to make frictional contact with the inside of the wash pipe 12.

The lower sliding ring 63 has a notch 67 cut upward from its under side to the left of the keyway 64 to receive the dowel pin 68 fastened on the shoulder 17, and a vertical slot 69 cut through it to the right of the keyway 64 through which will pass the latch pin 70 which extends upwardly from the shoulder 17 when the sliding ring is in such alignment of rotation about its axis as to have the dowel pin 68 has been seated in the notch 67. The latch pin 70 has its top end bent over the left so that the top end will rest upon the top of the sliding ring 63 when the ring has been turned in counter clockwise direction so that its bottom rests upon the dowel pin 68. This turning of the sliding ring 63 moves the vertical slot 69 with reference to the latch pin 70 to the end of the latch pin. This relative turning cannot be accomplished when the detent 57 engages one of the half grooves 55 and the clutch member 19 is stopped from turning in counter clockwise direction by the detent coming into contact with the abutment 78, as will be hereinafter explained.

The sliding ring 63 has three horizontal slots 71 cut at its middle to receive the ends 73, bent at a right angle of the strips 72 which support the slips 74. Each of these slots 71 is cut on an arc wider than the strap end 73 so
that the strap end may slide in the slot when the sliding ring 63 is turned slightly on the sleeve 18. The slips 74 slide up and down on the gland 16. Each slip has its inner surface cut so that it may slide on the conical surface to slide downward and the upper teeth to permit sliding on a dovetailed key 75 vertically disposed and fastened on the gland 16. The outer cylindrical surface of each slip 74 is vertical, and is cut to provide a series of horizontal teeth to grip the inside of the wash pipe 12 and hold the retrieving tool against sliding down in the tool. A vertical channel 76 is cut across the upper teeth into which the strap 72 is inserted and fastened by a rivet 77.

In the operation of my device the retrieving tool is held vertical, as by being threaded into the fishing tool which is held at the platform above ground by the slips on the platform, and the wash pipe 12 is lowered over it. Raising the wash pipe causes the slips, 62 and 63, to be raised by friction of the wiper strips 65 and lift the slips 74 along the gland 16 so that they spread out and their teeth engage the wash pipe thereby holding the retrieving tool against sliding downward in the wash pipe 12; and the wash pipe lifts the wiper pipe 19 into contact with the disk 23 causing the wedge pins 30 to slide upward and bringing the wiping fingers 46 into frictional contact with the inside of wash pipe 12. A short turn of the wash pipe 12 in clockwise direction will then clear the slips 62 and 63 in engagement with the inside of the wash pipe to hold the retrieving tool for clockwise turning with the pipe, and also to hold it against sliding in the pipe, especially against sliding upward. The clutch member 19, being held in angular position about the shank 10 by the setting of the slips 74 against the wash pipe 12 will not necessarily be rotated at all about the shank 10 as the rotary grip and its lower disk 23 are turned slightly in clockwise direction, since the lower disk 23 and shank 10 can rotate so as to take a different angular position from that of the clutch 19.

The clutch 19 can now be permitted to slide down a short distance away from the disk 23 to where the detent 57 will engage in one of the grooves 55 in the clutch member 19 and hold it against further downward sliding. The slips 74, being in engagement with the wash pipe 12, will tend to hold the slidding rings, 62 and 63, in the shank 10 and will with reference to the wash pipe 12, and the gland 16 sliding down a short distance along with the clutch 19 will tend to force the slips 74 more firmly outward. The retrieving tool is now threaded into the fishing tool 14 and locked to the wash pipe 12, and is ready to go down into the drilled hole. Sufficient lengths of wash pipe to effect the recovery operation are made up together, and the top joint attached to the drill pipe, which is of smaller diameter; then the whole string of fishing tool, retrieving tool, wash pipe and drill pipe is lowered into the hole until the bottom end of the fishing tool 14 reaches the top of the lost tool or lost work piece. Then by some manipulation, turning the wash pipe from above, and applying some of the weight of the string the fishing tool can be threaded into the lost tool or lost work piece. After connection has been made with the lost tool it will be desirable to start the washer operation to wash off the dirt from around it. For this it will be desirable to release the retrieving tool from gripping the wash pipe so that the wash pipe can be passed downward over the tool. To accomplish this allow some of the weight of the string and the wash pipe 12 to bear down on the retrieving tool and give the wash pipe a slight counter clockwise rotation of about half a turn. This will loosen the grip of the slips 42 on the wash pipe 12 and bring the wiping fingers 46 back to where their feet 49 rest upon the portion 34 of the wedge pins 30. The clutch 19 will then be held against sliding down on the shank 10 by the detent 57 engaging in one of the grooves 55. By then, giving the wash pipe 12 a slight turn in clockwise direction the friction of the wiper strips 65 will cause the clutch 19 to turn in clockwise direction about the shank 10 bringing the slot 60 over the detent 57. This permits the clutch 19 and the whole slip assembly 63 to slide downward and the downward movement of the wash pipe 12 it slides down until the bottom of gland 16 is in contact with the stop collar 15. The retrieving tool will then offer no resistance to the downward movement of the wash pipe 12, and when the latter reaches the stock point the dirt can be washed from the tool.

It may be also desirable to set the retrieving tool so that the wash pipe 12 can be pulled upward over it without causing the slips 74 to come into contact with the wash pipe. To accomplish this the drill string and wash pipe are raised a distance sufficient for the friction of the wiper strips 65 to bring the clutch 19 upward to where the detent 57 engages and holds in one of the grooves 55. Then the wash pipe 12 is given less than half turn in counter clockwise direction to cause the clutch 19 to rotate in counter clockwise direction about the shank 10 until the detent 57 is in contact with the abutment 78 so that the clutch 19 and the gland 16 are held against rotation in a counter clockwise direction. Next the wash pipe 12 is lowered so that the wiper strips 65 will bring the sliding ring 63 down on the sleeve 18 into position for latching, which position is just above the dowel pin 68 with the latch pin 70 extending through the slot 69. Finally the wash pipe 12 is given a short turn in counter clockwise direction so that the wiper strips 65 will cause the sliding ring 63 to move slightly in that direction as far as is permitted by the extra width of the keyway 64, and become latched under the latch pin 70. With this latching accomplished the slips 74 cannot slide upward on the gland 16 to come into engagement with the inside of the wash pipe 12 and the latter can be raised to a point where it is desired that the retrieving tool engage it at a new position.

To reengage the retrieving tool with the wash pipe 12 the latter is rotated slightly in clockwise direction sufficient to cause the wiper strips 65 to move the sliding ring 63 in clockwise direction and unlatch it from the pin 70. The slips 74 can then slide on the gland 16 and be brought into engagement with the wash pipe 12 by lifting same with tool. It will also be effective to effect the grip of the slips 42 by rotating the wash pipe 12 as above shown to hold the retrieving tool from sliding upward in the wash pipe as well as against relative rotation. Whether the grip of the slips 74 was effective can be told by the additional indicated weight of the string. After both slips 74 and 42 have engaged the whole string with the lost tool at the end can be lifted out.

What I claim as new, and desire to secure by Letters Patent of the United States, is:

1. A grip against rotation fitting inside of a pipe, comprising a longitudinal shank, a sleeve fastened on said shank having a plurality of cam surfaces each increasing in distance from the axis in one direction of rotation, a slip for each cam surface adapted to slide thereon having extensions upward and downward beyond said cam surfaces and having longitudinal teeth to engage the inside of the pipe, means fastened to said shank disposed above and below said cam surfaces for guiding said extensions as each one of said slips slides on its cam surface, a wiping finger extending transverse to the axis attached to each slip at one end having the free end adapted to be pressed outwardly to bring the wiping finger into frictional contact with the inside of the pipe, said sleeve having a groove cut longitudinally in each cam surface, a wedge pin having slips slides on its cam surface, a portion thereof being mounted to slide in each groove from the point where a thin portion of the pin underlies the free end of the wiping finger to the point where a thick portion thereof underlies and presses outward the free end of the wiping
A grip against rotation as described in claim 2 wherein each wedge pin has an abutment to engage the disk which is on one side of the sleeve, and a spring pressing against the other disk and against a second abutment on the wedge pin holding its thin portion under the free end of the wiping finger, but permitting the wedge pin to be moved against said spring to bring its thin portion under said free end.

A member sliding upon a vertical shank, both positioned within a vertical pipe, stops on said shank above and below said member to limit its sliding, said member having at its lower end a gland increasing in its conical diameter from bottom to top, a sleeve above said gland having a key for its entire length, and a member of larger diameter above said sleeve, two sliding rings, each having a keyway wider than said key joined to a plurality of wiper strips which extend outward to contact the inside of said pipe, said two sliding rings sliding on said sleeve, a plurality of slips below said sleeve supported by straps from the lower of said sliding rings, each slip having an inside surface contacting said gland to permit the slip to slide thereon and a cylindrical outer surface provided with horizontal teeth which engage the inside of said pipe when the slip is lifted, said lower sliding ring having for each strap a wide horizontal slot permitting a slight rotation of the ring with reference to the strap, the portion of the slidable member above its sleeve having an annular groove cut outwardly from its center bore, said annular groove being divided into a plurality of portions, each portion having an escape hatch cut down to it from the top of the member at its beginning and an abutment closing the groove at its end, said shank having a recess cut inwardly from
its surface, a detent pivoted in said recess adapted to per-
mit the slidable member to slide upward over it, but to
engage in said annular groove to hold said slidable mem-
ber near the top of its travel on the shank but permit
the said member to slide downward when said member
has its escape hatch in alignment with said detent, said
lower sliding ring having a vertical slot, a latch pin
mounted on the shoulder at the top of said gland adapted
to pass through said slot when the lower sliding ring rests
on said shoulder and further adapted to hold said lower
sliding ring when the ring is turned on said sleeve against
the holding of said detent in contact with said abutment
in said annular groove.

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