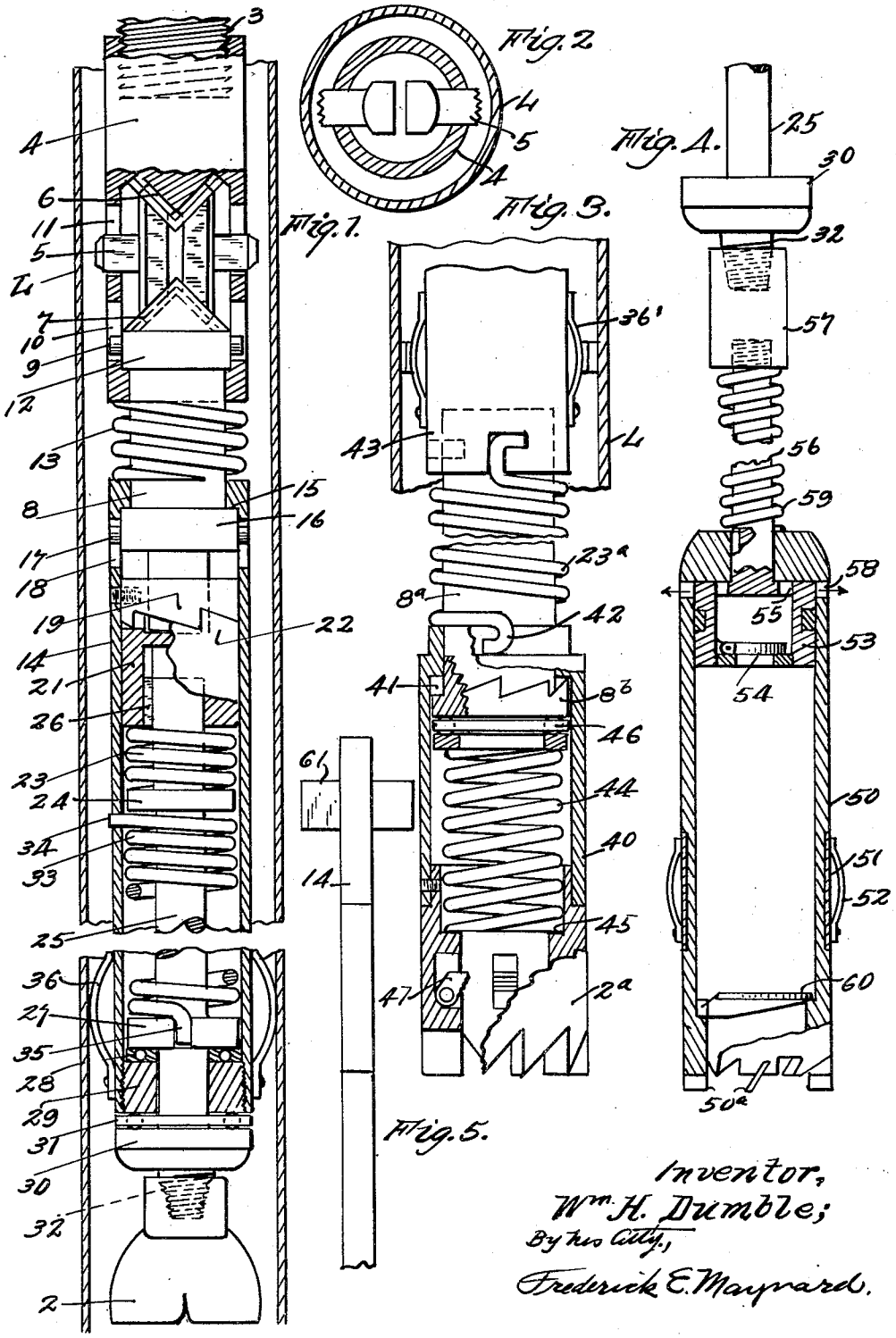
Dec. 5, 1939. W. H. DUMBLE 2,182,374

TOOL SPINNER FOR WELL DRILLING

Filed Jan. 3, 1938



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Patented Dec. 5, 1939 2,182,374

UNITED STATES PATENT OFFICE

2,182,374

TOOL SPINNER FOR WELL DRILLING

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Application January 3, 1938, Serial No. 182,986

16 Claims. (Cl. 255—4)

This invention is a standard-type, well drilling, tool spinner.

The invention concerns a type of well drilling apparatus wherein the tool lowered or raised by a cable string as distinguished from a rotary, drilling outfit.

An object of the invention is to provide means whereby one or another of various kinds of well string fittings or tools, such as bits, brushes, bailers, core-barrels and others adaptable, may be readily connected to the string bottom joint and whereby a very forceful and sudden torque is applied to the foot-end, tool or other appliance selected and attached to the string for such particular function as it may be desired to accomplish in an expeditious and economical manner.

Further, an object is to provide means to enable the use of a rotary effort tool or device to the foot end of a standard string so that the erection or installation of a rotary outfit for the purpose is wholly eliminated.

Also, an object of the invention is to an energy-storing mechanism readily combinative with a standard-tool string and which is controlled and automatically released by the applied device which is to be subjected to a powerful and sudden rotary motion as to the axis of the device.

As a specific example, it is an object of the invention to provide means including a spinning mechanism adapted to be bodily lowered into a sand choked well or well hole for rotating a tool to cut or loosen the material, or other obstacle, so as to facilitate bailing the well or hole.

An additional example is the provision of means for use with a standard string whereby to enable the taking of a core sample from the bed of a body of water, as at the ocean shore, by use of a rotary core bit or barrel, without setting up the usual, very costly rotary drilling outfit.

The invention consists in certain advancements in this art as set forth in the ensuing disclosure and having, with the above, additional objects and advantages as hereinafter developed, and whose construction, combination and details of means and the mechanical actions thereof, and the method of working the hole or taking a sample, will be made manifest in the description of the herewith illustrative embodiments of apparatus; it being understood that modifications, variations and adaptations may be resorted to within the scope, principle and spirit of the invention as it is more directly claimed hereinbelow. It is understood that the functional use of the apparatus of this disclosure in any other art than that herein exhibited is deemed to be within the adaptation of the invention.

Figure 1 is an axial, sectional elevation of the invention as embodied for cutting sand in a well lining or tubing, and Figure 2 is a cross-section through the same at the plane of casing slips therein.

Figure 3 is a sectional elevation of an embodiment for cutting a core sample.

Figure 4 is a sectional elevation of a form of a spinning, rotary-cutting bailer.

Figure 5 is a side elevation of a spinner tool adapted for taking a water bed formation sample by use of a standard tool string, without a tool guide casing string.

Sometimes deep wells being drilled and flowing or pumped wells choke up with sand which packs very hard and cannot be removed by mere bailing methods and in such cases it becomes necessary to cut or drill out the packed sand, and then bail the cuttings.

In Fig. 1, there is shown a sand cutting fish-tail bit 2 and means combined directly therewith for rotating it as to a standard cable tool the lower joint or coupler 3 of which receives an attaching, threaded box 4.

In this box there is provided a set of slips 5 designed to be automatically expanded into non-rotative contact with the bore face of a relative size, well lining or tubing L into which the bit 2 and its spinning mechanism are bodily insertible by the cable string. The slips 5 are slidably dovetailed at their upper ends in upwardly divergent guideways 6 provided in the box 4, and at their lower ends are dovetailed into downwardly divergent guideways 7 provided in the upper end of a tappet plunger 8 slidably fitted in the lower end of the box 4 and splined thereto by radial lugs 9 working in respective slots 10 therefor in the sides of the box 4. The slips 5 have vertical and radial action in respective slots 11 in the box wall.

The tappet 8 has a bottoming rim shoulder 12 normally suspending the tappet and its attached, pendent parts from the box 4.

Surrounding the body of the tappet 8 is a substantial helical spring 13 reacting upwardly against the near end of the box 4 and downwardly against the upper end of a tubular housing 14 having an upper, internal shoulder 15 hanging on a shoulder 16 of the tappet 8 which has slidable action in the housing but is keyed thereto against rotation by lugs 17 playing longitudinally in guide slots 18 in the wall of the housing. Therefore the several parts above mentioned are

more or less telescopic and non-rotatively combined.

Means are provided in the housing 14 whereby to automatically spin the drill 2, or such other implement as is attached, and which is under the automatic control of the tool 2, and includes means to lock the tool to the housing while under a spinning torque and until released by the tool at a given shift of relation of the tool longitudinally as to the tappet plunger 8.

Such means includes an inverted, ratchet ring 19 fixed in the housing preferably just below the slots 18 and axially guiding the adjacent, lower end of the tappet 8 and which end is adapted to shift downward to a degree sufficient to cause it to tap the near upper end sleeve 21 slidably fitting the housing 14 and having a ratchet crown 22 yieldably engaging the ratchet 19 under up-thrust of a locking spring 23 which is of higher resistance than the tappet spring 13, for a purpose later set forth.

Spring 23 seats on an annular shoulder 24 of a spinnable stem 25 the upper end of which is splined at 26 for telescope thereon of the ratchet sleeve 22—21. The lower portion of the somewhat elongate stem 25 is provided with an annular bead 27 the lower face of which thrusts downward onto an anti-friction bearing 28 supported on a bushing 29 rigidly fixed in the lower end of the housing 14; the lower end of the stem 25 turnably fitting in the bushing 29 and having a rigidly fixed collar 30 carrying an up-thrust bearing, of ball or roller type, 31 running on the lower face of the bushing, and the stem 25 terminating with a screw 32 or other suitable means for ready attachment of the drill bit 2 or other appliance for a given use.

It will be seen that the stem 25 is swivelled to the foot of the housing against axial motion and is capable of axial movement therewith relative to the tappet 8 so that when the string of parts is lowered by the cable and its joint or coupler 3 until the drill bit bottoms on a firm, resisting obstacle, as packed sand in the casing or lining or tubing L, or even in an unlined hole being drilled, the slip box 4 will initially slide downward as to the tappet 8 and will cause the radial projection of the slips 5 by their wedge-like guideways 6—7; this action taking place by compression of the lighter spring 13. The expanded slips 5 will bite into the face of the lining bore or the well wall formation in possible cases, to hold the box 4, the tappet 8 and the housing 14 against rotation but still permitting all parts to move downward enough to bring the sole of the tappet down onto the crown of the ratchet sleeve 21 and to disengage its teeth 22 from the fixed locking ratchet ring 19 by compression of its supporting spring 23 to the extent needed.

When the sleeve 21 is thus unlocked it and the splined drill carrying stem 25 are freed to rotate in and as to the housing 14. This rotation of the stem and the drill 2 is effected by means of an elongate, helical spring or motivating device 33 one end 34 of which is fixed to the housing 14 whilst its lower end 35 is attached as to the bead 27 of the stem 25. The main spring 33 is preferably of left-pitch helically and the stem 25 is turned to the left before tool is lowered into the well so that the spring will be torsioned to place the stem 25 under a right-hand torque (looking downward on the stem assembly); the closed ratchet parts 19—22 holding the spring wound up,—that is, locking the stem to the housing.

If the now prepared spinner assembly be lowered into the hole or well it will be centered therein by suitable external guides 36 fixed to the housing 14, and when the drill 2, or other appliance, encounters the packed sand, for instance, it will come to rest and slips will be thrust out to bind on the lining or well wall and the tappet 8 will move downward and engage the sleeve 21 and draw its ratchet 22 from locking engagement with the now non-rotative housing ratchet. At this instant the stem 25 will be free to turn and the unwinding effort of the main spring 33 will rotate the drill on the packed sand and cut and break it up so that the loosened parts can be bailed out, or otherwise gotten rid of.

The spinner can be pulled from the hole and quickly rewound and lowered for a repeat until the sand pack is entirely removed.

There is shown in Fig. 3 an adaptation of the invention in the form of a hollow or core bit 2^a having a sleeve 40 with an internal inverted ratchet ring 41 and being interhooked at 42 with the lower end of a torque or main spring 23^a. This spring surrounds a stem 8^a the upper end of which is fixed in the lower end of a housing or string section 43 to be lowered into the hole or well in the manner as above set forth. The lining L is engaged by a toothed form of guide 36' on the housing 43 which will prevent rotation of the latter in the lining L.

The main spring 23^a seats against and interhooks with the lower end of the housing section 43 and when torsionally wound to the right (Fig. 3) by rotation of the core bit 2^a places the bit under a right hand torque (looking down endwise on the inserted tool of Fig. 3); the spring having the further function of pressing the internal ratchet 41 down onto the cooperative ratchet ring 8^b provided rigidly on the lower end of the stem 8^a; whereby to hold the drill spinning spring wound up. Within the drill sleeve 40 (which constitutes also a core barrel) is another expansion spring 44 reacting between a shoulder 45 in the bit 2^a and a superposed anti-friction bearing 46 running on the end face of the ratchet stem 8^a.

The operation of the core bit is substantially the same as that of the bit 2. That is, when the core bit 2^a bottoms on an obstacle in the well or hole, on the formation at the bottom of a body of water, as at seashore, the load of the housing or section 43 will depress the ratchet ring 8^b of the stem 8^a from the ratchet ring 41 of the bit sleeve 40, incidently compressing the spring 44, and thus permitting the unwinding effort of the main spring 23^a to very forcibly turn the drill bit 2^a to the right (looking down on the bit) and take a core-making cut in the formation or packed sand as the use of the outfit will determine. Core passing into the sleeve or barrel 40 will be caught, broken off and trapped as by suitable automatic dogs 47.

Another embodiment of the invention is illustrated in Fig. 4, wherein a spinning bailer barrel 50 is attached by suitable connection to the screw joint 32 of the string shown in Fig. 1, in place of the fish-tail bit 2. The bailer barrel 50 has an exterior ferrule 51 turnable thereon and having wall-engaging guides 52 to center the tool in a liner, a tubing, or well wall formation. In the barrel is a packed piston 53 having an up-lifting check valve 54 for passage of fluid to outlet ports 55 in the piston so that this can be readily forced downward by its rod 56 which is connected by a coupling 57 to the screw pin 32,

Fig. 4. The barrel 50 is provided with top ports 58 providing for fluid flow to and from the chamber above the piston 53. The barrel 50 is pressed downwardly along the rod 56 to the piston 53 by an expansion spring 59 which is weaker than the top spring 13 in the string to which the stem 25 and its screw pin 32 is attached. The rod 56 and the barrel 50 are co-rotatively connected as by a suitable spline, such as 26, Fig. 1.

Thus when the bailer barrel 50 bottoms with its cutting teeth 50a against the obstacle, the piston 53 will be forced down in the barrel, vacuum being broken by fluid inflow at ports 58. When the piston reaches its downward limit in the barrel 50 then the main spring 33 of the string of parts, is tripped by the unlocking of the ratchet rings 19—22 and the torque of the spring will be spent in turning the bailer teeth on the formation or sand and the cuttings will be sucked into the bailer as the piston 53 is retracted by pulling up the string assembly. The cuttings will be trapped in the bailer barrel by the usual or a suitable check valve 60. The spring 59 acts to hold the bailer barrel against bottom whilst the piston 53 is being drawn back into the barrel.

Where any of these spinnable or rotative tools are employed in bodies of water without any other means for holding the main spring anchoring element, as housing 14, against rotation, then such element will be provided with water wings or surfaces 61 to block the element against noticeable rotation when the main spring is tripped.

What is claimed is:

1. The combination in a cable-type well tool string, of a rotary tool carrier, a body adapted for attachment to and support by such a string, means on the body to hold the body against rotation while suspended in service, the carrier being rotatively mounted on said body and having capacity for relative, axial motion, as to the holding means, a torsional spring connecting the body and the carrier for rotating the carrier, and releasable locking means connecting the body and the carrier against relative rotation by the spring and including mutual parts being releasable upon axial action of the holding means as to the carrier.

2. A well tool string apparatus including means attachable to a string for service in a well hole and having a holding device to engage a well bore surface to restrain rotation of said means while suspended in service, a tool coupling rotatively supported by said means, a torsional power spring means connecting said means and the coupling and for rotating the coupling, a locking device on said attachable means to restrain the coupling against such rotation, and a means on said attachable means to release the locking device for coupling rotation.

3. A tool string as in claim 2, and the releasing means including means controlled by a tool when applied and in use.

4. A well tool string drive apparatus including a body means attachable to a string and having a relatively rotative, axially movable tool coupling, a device on the body means to engage a bore wall and prevent rotation of the body means, a torsional spring connecting the body means and the coupling, means to interlock the body means and the coupling against relative rotation by the spring, and means operative by relative downward thrust of a part of the body means to release the interlocking means.

5. A tool string as in claim 4, and including a means operative by axial reaction of the coupling against the body means to set the bore engaging device.

6. A tool string as in claim 4, and including means controlled by the coupling to set the device in holding position and to release it when tension is placed on the body means to pull the drive apparatus.

7. A well tool drive apparatus including a coupling, a body on which the coupling is rotatively, axially supported and which includes an upper telescopic member attachable to a tool string, means controlled by axial shift of said member as to said coupling for engaging a bore surface to hold the body against rotation in the hole, a spring means on the body connected to the coupling for rotating the coupling to drive a relative tool when attached thereto, and releasable means controlled by the coupling for temporarily interlocking the coupling against rotation by the spring means.

8. A well tool apparatus having a tool coupling, a body structure rotatively carrying the coupling and attachable in suitable manner to a tool string and having means to engage a hole bore surface to hold the body structure against rotation in a hole, a torsional spring for spinning the coupling in the body structure, a locking means to interconnect the coupling and the body structure to prevent rotation of the coupling by the spring, and coupling controlled means to effect release from the locking means; said holding means being axially movable as to said coupling.

9. A well tool apparatus having a cable-attaching top member provided with bore surface engaging means to hold the member against rotation when suspended in a hole, a body structure connected coaxially to and splined with said member for preventing relative rotation; said member operative to set the holding means and to release it, a tool coupling rotatively mounted on the body structure, a torsional motor device on the body structure to turn the coupling, means to lock the coupling against rotation by said motor device, and means controlled by the coupling under reaction to unlock the locking means; the said member being movable as to the coupling to effect such unlocking result.

10. A tool as in claim 9, and including a yieldable device between the top member and the body structure operative to normally separate the same to limit of the spline action.

11. A well tool spinner, comprising a top member joinable to a non-rotative supporting string, holding means on said member to engage a bore surface to hold the member against rotation, a body structure splined to said member for relative axial motion only, a tool coupling mounted for rotation on said body structure, a torsional spring connecting the body structure and the said coupling to turn the coupling whilst the body structure is held by said means, means to interlock the coupling against rotation on the body structure by the spring, and means to effect unlock of the interlocking means upon axial shift of said member as to the coupling.

12. A tool as in claim 11, and including a yieldable means thrusting the coupling in a direction to effect the locking thereof to the body structure and provide for unlocking shift of the member.

13. A tool as in claim 11, and including a yieldable means between the top member and the body structure to normally retract the holding

means and provide for its setting by relative descent of the member as to the body structure when this is initially arrested in service installation and before the interlocking means is disengaged.

14. A tool as in claim 11, and including means to effect a retraction of the set holding means by a relative lift of the top member as to the body structure.

15. A well tool comprising in combination, a body supported by a cable, means on the body to engage well bore surface to prevent rotation of the body, cutting means rotatively mounted on the body and projecting below it to engage the bottom of the well hole, a torsional spring connected to the body and the cutting means for rotating the cutting means, locking means on the body to engage the cutting means and to prevent it from rotating, and means to release the cutting means from the locking means when the cutting means strikes the well bottom.

16. A cable string tool driver comprising, in combination, a body structure attachable to a part of the string to be suspended thereby, a locking device on said structure operative to engage a surrounding bore surface to hold the structure against rotation while suspended in the bore hole, a tool carrier rotatively mounted on the body structure to rotate a suitable applied tool, a motor spring connected to the said structure and to the said carrier for rotating the carrier, locking means on the body structue to engage the carrier and hold it against rotation by the spring, and means forming a part of the body structure, movable as to and controlled by reaction of the arrested carier to disengage the locking means so that the carrier may be spun by the spring.

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