March 24, 1942. W. F. CAROTHERS 2,277,580

COMBINATION WASHOVER AND CUTTING TOOL

Filed July 28, 1941

Fig. 1.

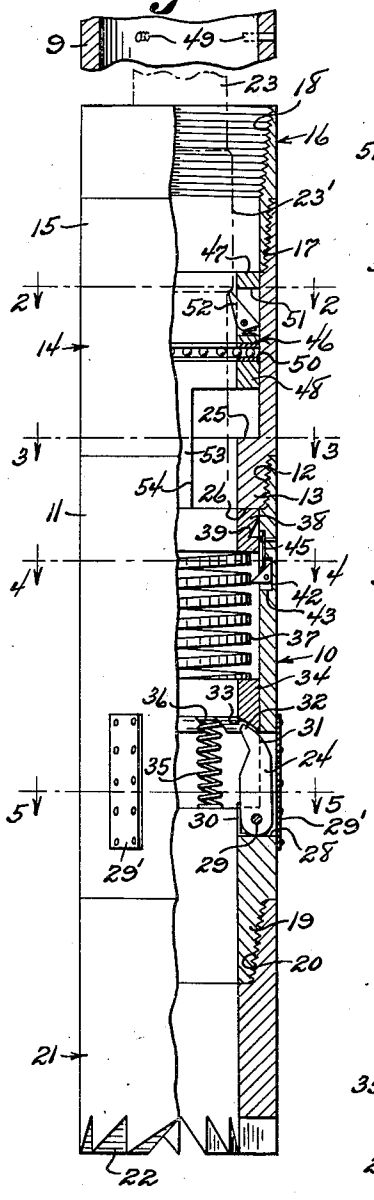


Fig. 2.

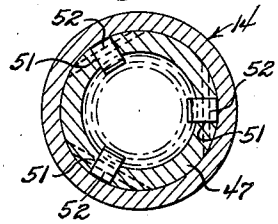


Fig. 3.

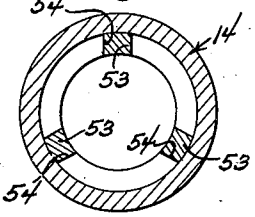


Fig. 4.

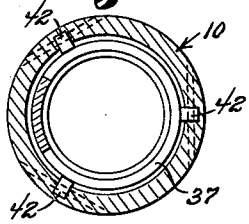


Fig. 5.

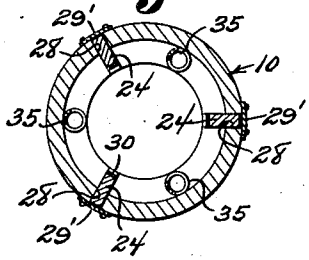
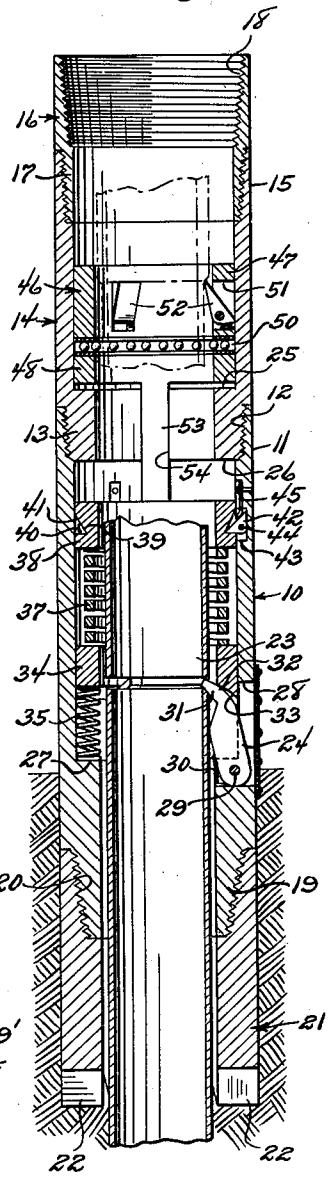


Fig. 6.



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COMBINATION WASH-OVER AND CUTTING TOOL

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Application July 28, 1941, Serial No. 404,425

7 Claims. (Cl. 164—0.6)

My invention relates broadly to cutting tools.

An important object of my invention is the provision of a novel cutting tool of the type adapted to be slipped over a length of pipe and thereafter actuated to cut the pipe into two parts.

My invention is particularly adapted to be used for removing pipe from oil wells or the like. The fact that the drill pipe of the well presents a construction which admits of the use of my invention is not to be construed as a limitation and it is to be understood that I do not wish to restrict the invention to any particular application.

It not infrequently occurs in the drilling of wells by a rotary system that the drill pipe is sometimes lost in the well. The losing of the pipe may result from the twisting off of the pipe or as a result of its being inadvertently disconnected from the tool. When the drill pipe is thus disconnected, the sand will pack around the lower end thereof and the mud normally pumped through the pipe during drilling operations will settle by reason of the lack of circulation. The packing of the sand and settling of the mud prevents the casing from being lifted from the well and, in order to remove the drill pipe, it becomes necessary to wash over the portion of the pipe thus embedded and to thereafter insert a cutter to remove the washed over portion of the pipe. It is then necessary to wash over another portion of the pipe and to again insert the cutter to remove another portion of the pipe. This washing and cutting process is continued until the entire pipe has been removed from the well.

To my knowledge it has heretofore been necessary to first insert a wash pipe into the well for removing the sand and mud that is packed around the pipe before it is possible for the cutting tool to be introduced into the well. It has, therefore, been necessary that the wash pipe be removed before the cutter is placed in the well and, obviously, the alternate applications of the wash and cutter means will require the expenditure of considerable time and labor.

It is, therefore, another object of my invention to provide a combination washover and cutting tool wherein both of the above operations may be simultaneously performed, which tool, being compactly assembled, embodies a minimum number of parts and is efficient and efficacious in the performance of its duties.

Other objects and advantages of my invention will be apparent during the course of the following description.

In the drawing, forming a part of this specification, and wherein like numerals are employed to designate like parts throughout the same,

Figure 1 is a front elevation of a device embodying my invention, parts of the device being broken away for clearness of illustration and the cutting blades thereof being illustrated in the collapsed or inoperative position,

Figure 2 is a transverse sectional view taken on the line 2—2 of Figure 1,

Figure 3 is a transverse sectional view taken on the line 3—3 of Figure 1,

Figure 4 is a transverse sectional view taken on the line 4—4 of Figure 1,

Figure 5 is a transverse sectional view taken on the line 5—5 of Figure 1, and

Figure 6 is a longitudinal sectional view of my device, showing the working parts thereof in a position to advance the cutting blades into operative relation with a pipe section.

In the accompanying drawing, wherein for the purpose of illustration, is shown a preferred embodiment of my invention, the numeral 10 describes a tubular cutter body, the upper end 11 of which is formed with an internally screw-threaded annular socket 12. As best illustrated in Figures 1 and 6, the lower end 13 of a tubular connection 14 is of reduced external diameter and the reduced portion is externally screw-threaded to permit the same to be screw-threadedly connected in the socket 12. The cutter body 10 and connection 14 have the same external diameter whereby the peripheral surface of the connection will join smoothly with the outer peripheral surface of the body when the parts are connected in the above-described manner. The upper end 15 of the connection is internally screw-threaded and a coupling 16 is formed with a longitudinally extending external screw-threaded annulus 17 received within the upper end of the connection. The upper end of the coupling is provided with internal threads 18 which permit the same to be attached to a line of pipe 9 to which the device is attached for insertion into the well. The lower end 19 of the cutter body is of reduced external diameter and this reduced portion is externally screw-threaded to receive the internal threads 20 of the rotary shoe 21. The shoe preferably is the same external diameter as the cutter body and the lower end thereof is formed with cutting teeth 22 which are adapted to bite into any relatively soft material encountered by the device when it is being lowered into the well.

The shoe 21, tubular cutter body 10, connection 14 and coupling 16 are all adapted to be

slipped over the pipe section 23 to be removed. The device may thus be inserted downwardly into the well and any material that has fallen into the well or lodged about the pipe may be cut away by the teeth 22. The line of pipe 9 to which the device is connected is preferably gripped in a rotary table in the conventional manner, which table may be actuated to rotate the device and to cause the teeth 22 to cut away the material packed around the pipe. The loosened material may then be washed away by a flushing fluid in the usual manner.

When the device has been telescoped downwardly a sufficient distance from the upper end of the pipe 23, the rotary table is stopped and the device is actuated in a manner presently to be described in detail to cause the working ends of the cutter blades 24 to be moved into pressed engagement with the pipe 23.

As best illustrated in Figure 6, the lower end portions 13 and 19 of the connection 14 and cutter body 10, respectively, are of reduced internal diameter which portions, while of lesser diameter than the rest of the respective sections, are of substantially greater diameter than the outside diameter of the pipe 23. The lower portion 13 of the connection 14 provides an upper shoulder 25 and a lower shoulder 26, which lower shoulder is disposed in longitudinally spaced but confronting relation with the shoulder 27 at the lower end of the body 10.

The cutter blades are disposed in the same horizontal plane and are preferably equi-spaced around the body. Each of the blades is disposed within a separate elongated slot 28 which extends through the wall of the body and the lower ends thereof are journalled on the pivot pins 29. The slots are closed by plates 29' and the blades are normally held in the inoperative or collapsed position illustrated in Figure 1 by the leaf springs 30. When thus positioned, no portion of the blades will project inwardly of the internal wall of the lower portion of the cutter body. The lower portion of the slots extends itno the relatively thick lower portion of the cutter body and the upper portion of the slots extends above the annular shoulder 27, whereby the upper working ends 31 of the cutter blades will project inwardly of the portion of the internal wall of the body extending above the shoulder. The swinging ends of the cutter blades are arcuately curved to provide cam surfaces 32 adapted to cooperate with the wedge-shaped lower end 33 of the ring member 34. The member 34 snugly engages the inner wall of the body above the shoulder 27 and is readily slidable within the body in either direction. If desired, the ring member may be splined to the cutter body to prevent the same from rotating relative to each other. I prefer that the ring member be normally disposed free from engagement with the cutter blades and I have therefore provided a plurality of relatively weak springs 35, the lower ends of which seat against the shoulder 27 and the upper ends of which extend into recesses 36 provided in the wedge-shaped bottom edge of the ring member.

In order that the ring member 34 may be shifted longitudinally within the cutter body to move the working ends of the cutter blades into engagement with the pipe 23 when the device has been lowered to the desired position, I have provided a relatively strong coil spring 37, the lower end of which seats against the top surface of the ring member and the upper end of which seats against the bottom surface of the ratchet head 38. The ratchet head is in the form of an annular ring the outer peripheral surface of which snugly but slidably contacts the inner wall of the cutter body. The outer surface of the head is formed with a plurality of annularly spaced recesses 39 each having a transverse bottom wall 40 and an angular top wall 41 which extends from the inner edge of the bottom wall to the outer surface of the head. The recesses 39 are adapted to receive the ratchets 42 pivotally mounted within the recesses 43 in the inner wall of the cutter body directly below the recesses 39. The ratchets are of generally triangular formation and the apexes thereof are journalled on the pivot pins 44, the opposite ends of which pivot pins seat within sockets provided in the side walls of the recesses 43. Leaf springs 45 seat within elongated grooves extending above each of the recesses 43 and the yieldable lower ends of the springs extend into the recesses to contact the bases of the ratchets in a manner to hold one side thereof pressed against the vertical wall of the recess.

It may thus readily be seen that sliding of the ratchet head in the direction of the ring member 34 will move the bottom edge thereof into engagement with the ratchets and that continued movement of the ratchet head will pivot the ratchets against the resilient action of the leaf springs 45. When the ratchets are thus positioned, they will be entirely accommodated within the recesses 43 to permit the ratchet head to be moved a sufficient distance to bring the recesses 39 into register with the ratchets. The resilient action of the leaf springs 43 will then again pivot the ratchets to the initial position whereby one side thereof will project radially inwardly of the inner wall of the cutter body and into the confronting recesses in the ratchet head.

Figure 1 best illustrates the manner in which the coil spring 37 normally holds the ratchet head spaced substantially above the ratchets. Obviously, movement of the ratchet head within the cutter body a sufficient distance to permit the ratchets to enter the recesses 39, will tension the spring 37. The resilient action of the spring 37 is substantially greater than the combined action of the springs 35 and tensioning of the larger spring will therefore drive the ring member 34 against the cutter blades to permit the wedge-shaped bottom surface 33 to force the blades against the pipe 23.

The numeral 46 designates a spring setting unit which comprises an annulus 47 adapted to be slidably received within the upper end of the connection 14 and an annulus 48 disposed therebelow and separated therefrom by a ball race 50. The annulus 47 is removably associated with the connection and is formed with circumferentially spaced elongated slots 51 which receive the pivoted dogs 52. The lower annulus 48 is adapted to be permanently retained within the connection 14 and is provided at circumferentially spaced points therearound with downwardly extending arms 53, which slidably operate in grooves 54 provided in the relatively thick lower portion 13. The upper annulus 47 is normally supported by the shear pins 49 projecting into the bore of the wash pipe substantially above the coupling 16. After the pipe 23 has been washed, a strain is taken to shear the pins 49 whereby to permit the annulus 47 to drop into the connection 14. The upper ends of the dogs 52 swing into the bore of the connection and the same will therefore ratchet freely over the couplings 23' connecting

adjacent sections of the pipe 23 when the tool is being lowered along the pipe during the washing operation. However, as soon as the wash pipe 9 is pulled upwardly to move the annulus 47 relative to the well pipe 23, the upper ends of the dogs 52 will engage below the first coupling 23'. It will, of course, be necessary to raise the wash pipe 9 a sufficient distance to effect engagement of the dogs with one of the couplings 23' and this distance will be determined by the length of the well pipe sections. Obviously, continued elevation of the wash pipe after engagement of the dogs with the well pipe coupling will sever the shear pins 49 to permit the annulus 47 to drop into the connection 14 and against the ball race 50. The wash pipe is then lowered until the cutting end of the tool is again disposed at the lower end of the washed over portion of the well pipe. In order that the spring setting unit may be actuated to move the cutter blades into operative relation with the well pipe, the wash pipe is again raised to move the dogs 52 into engagement with a coupling 23'. This coupling may or may not be the same coupling against which the first strain was taken for it will be readily apparent that the device may be easily lowered relative to the well pipe after the first strain has been taken. When the second strain is taken, continued lifting of the wash pipe will shift the annuluses 47 and 48 in the direction of the shoulder 25. It will be readily apparent that movement of the unit in the above manner will cause the arms 53 to force the ratchet head 38 downwardly against the resilient action of the relatively large spring 37. As soon as the ratchet head moves downwardly to bring the recesses 39 into register with the ratchets 42, the spring 37 will be held in the compressed position. I prefer that this spring be of a size sufficient to develop approximately 1200 pounds pressure against the ring member 34. It is to be understood that a spring of the above size has been found to produce satisfactory results in practice, however, I do not intend to in any way limit the construction of the device to a spring of any particular size. Tensioning of the spring 37 to slide the ring member 34 in the direction of the cutter blades will force the working ends of the blades against the outer peripheral surface of the pipe 23 in the manner illustrated in Figure 6. Actuation of the rotary table supporting the pipe line to which the device is attached will then cause the working ends of the cutter blades to bite into the pipe and to transversely sever the same. As soon as the cutters have cut through the pipe, the resilient action of the spring 37 will force the blades inwardly upon raising of the device which inwardly extending blades will act as supports for the portion of the pipe 23 extending thereabove. Raising of the device from the well will therefore also effect removal of the severed portion of the pipe. When the tool has reached the surface of the ground the mentioned pipe section may be removed and the device again inserted into the well to effect removal of another section of the pipe in the manner described.

It is to be understood that the form of my invention, herewith shown and described, is to be taken as a preferred example of the same, and that various changes in the size, shape and arrangement of parts may be resorted to without departing from the spirit of my invention, or scope of the appended claims.

Having thus described my invention, I claim:

1. A tool comprising a tubular body adapted to slip over a pipe, normally collapsed cutting blades pivotally mounted within the body, a member disposed above the cutter blades movable into engagement therewith to swing the working ends of the same into an operative position against the pipe, a relatively strong spring means seating against the member, a ratchet head supported by the spring means, and relatively weak spring means for holding the member, the first spring and ratchet head spaced from the cutter, said ratchet head being movable to a position to tension the first spring by raising of the body and tensioning of the first spring effecting sliding of the blade actuating member against the resilient action of the second spring means to move the cutter blades to the operative position.

2. A tool comprising a tubular body adapted to slip over a pipe, normally collapsed cutting blades pivotally mounted within the body, a member disposed above the cutter blades movable into engagement therewith to swing the working ends of the same into an operative position against the pipe, a relatively strong spring means seating against the member, a ratchet head supported by the spring means, relatively weak spring means for holding the member, the first spring and the ratchet head spaced from the cutter, said ratchet head being movable to a position to tension the first spring by raising of the body, and means for holding the ratchet head in the last mentioned position, tensioning of the first spring effecting sliding of the member against the resilient action of the second spring means to move the cutter blades to the operative position.

3. A tool comprising a tubular body adapted to slip over a pipe, normally collapsed cutting blades pivotally mounted within the body, a member disposed above the cutter blades movable into engagement therewith to swing the working ends of the same into an operative position against the pipe, a relatively strong spring means seating against the member, a ratchet head supported by the spring means, relatively weak spring means for holding the member, the first spring means and the ratchet head spaced from the cutter blades, and actuator means rendered operative by raising of the body to shift the ratchet head within the body against the resilient action of the first spring means in a manner to tension the first spring means for driving the blade actuating member against the cutter blades and to hold the same in pressed engagement with the pipe.

4. A tool comprising a tubular body adapted to slip over a pipe, normally collapsed cutting blade pivotally mounted within the body, a member disposed above the cutter blades movable into engagement therewith to swing the working ends of the same into an operative position against the pipe, a relatively strong spring means seating against the member, a ratchet head supported by the spring means, relatively weak spring means for holding the member, the first spring and the ratchet head spaced from the cutter, an actuator means rendered operative by raising of the body to shift the ratchet head within the body against the resilient action of the first spring means, tensioning of the first spring means driving the blade actuating member against the cutter blades to hold the same in pressed engagement with the pipe, and ratchets disposed to engage the ratchet head when the

same is in the spring tensioning position to hold the same against further movement within the body.

5. In a pipe cutter, the combination with a cutting tool suspended from a string of pipe, which pipe and tool are adapted to telescopically receive a second string of pipe, of shear pins extending into the bore of the first-mentioned string of pipe a substantial distance from the tool, a supporting member slidable within the said first pipe and tool but normally seating against the said shear pins, and dogs pivoted to the support for engaging an outer annular shoulder of the second-mentioned string of pipe.

6. In combination with a pipe cutting tool of the type wherein a tubular cutter body is suspended from a line of pipe and telescopically applied to another line of pipe to be cut, shear pins projecting into the bore of the first pipe a substantial distance from the tool, and an actuator member slidable within the first pipe and tool normally supported by the shear pins, said member having pivoted parts adapted to ratchet freely over the inner pipe when the said telescopically related pipes are moved relative to each other in one direction but to bindingly engage with the inner pipe when the said pipes are moved relative to each other in the opposite direction.

7. In combination with a pipe cutting tool of the type wherein a tubular cutter is suspended from a line of pipe and telescopically applied to another line of pipe to be cut, shear pins projecting into the bore of the first pipe a substantial distance from the tool, and means for actuating parts of the cutter slidable within the outer string of pipe but normally supported by the shear pins, said means being adapted to freely slide relative to the inner string of pipe in one direction but to bindingly engage therewith when moved relative thereto in the opposite direction, whereby to sever the shear pins from the pipe to permit the said actuator means to move into engagement with the cutter and into operative relation with the mentioned parts.

WILLIAM F. CAROTHERS.