

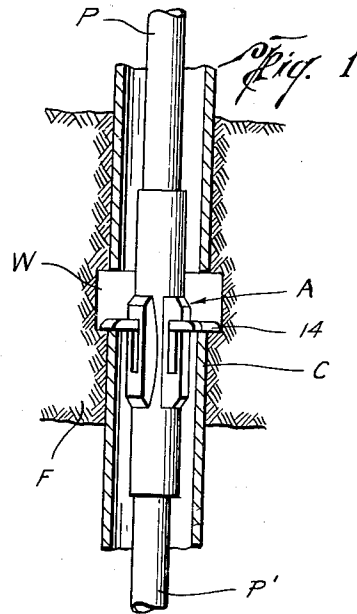
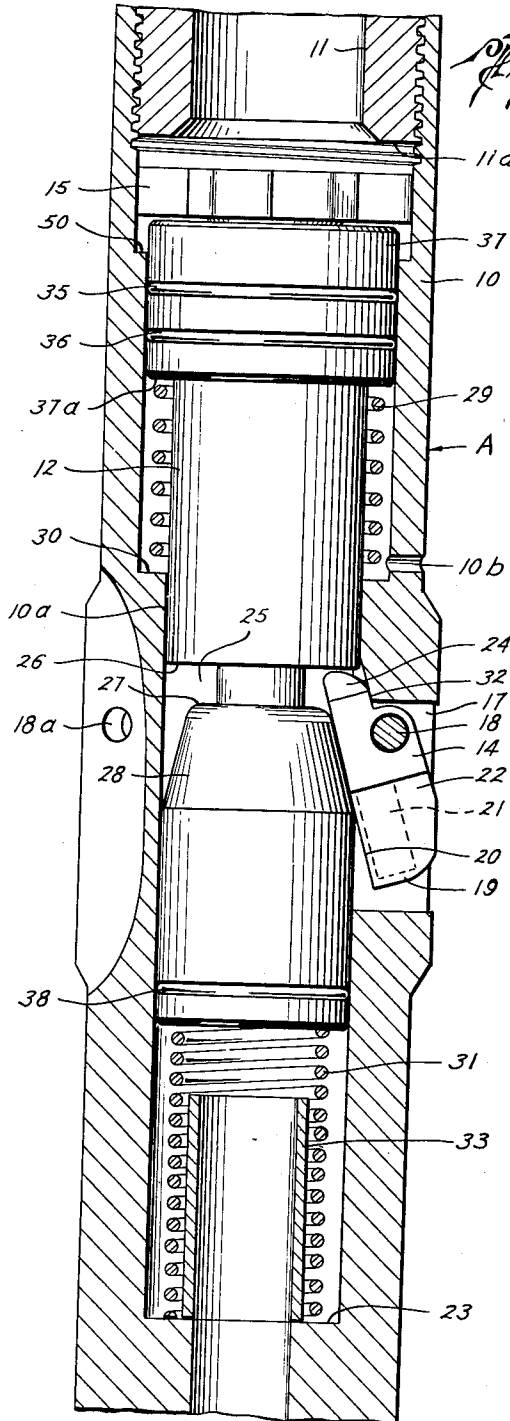
Dec. 6, 1955

Filed March 6, 1953

F. A. HESTER
FLUID PRESSURE OPERATED PIPE CUTTING OR MILLING
APPARATUS WITH FLOATING VALVE

2,725,936

2 Sheets-Sheet 1



Fred A. Hester
INVENTOR.
BY J. Vincent Martin
Joe E. Edwards
B. R. Pravel
ATTORNEYS

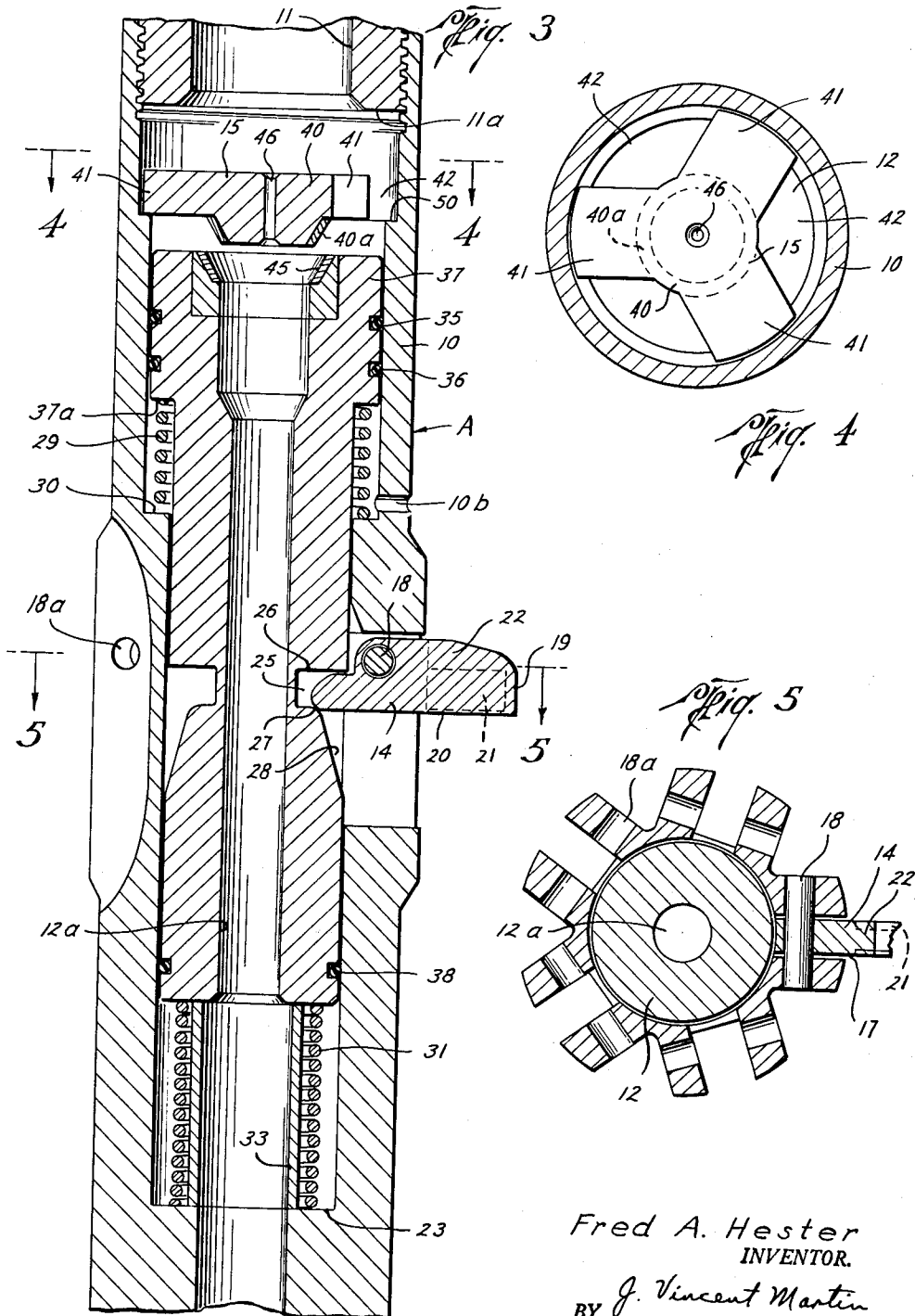
Dec. 6, 1955

F. A. HESTER
FLUID PRESSURE OPERATED PIPE CUTTING OR MILLING
APPARATUS WITH FLOATING VALVE

2,725,936

Filed March 6, 1953

2 Sheets-Sheet 2



Fred A. Hester
INVENTOR.

BY J. Vincent Martin
Joe E. Edwards
B. R. Pravel
ATTORNEYS

1

2,725,936

FLUID PRESSURE OPERATED PIPE CUTTING OR MILLING APPARATUS WITH FLOATING VALVE

Fred A. Hester, Houston, Tex.

Application March 6, 1953, Serial No. 340,784

12 Claims. (Cl. 164—8)

This invention relates to new and useful improvements in fluid pressure operated pipe cutting or milling apparatus with floating valve.

The pipe cutting or milling apparatus of this invention is an improved tool which is particularly adapted for cutting a longitudinal section or "window" in a well pipe or casing whereby the walls of the well bore exterior of the casing are exposed to permit subsequent sidetracking or similar operations. The casing milling tools previously known have several main disadvantages, one of which is inadequate mud or drilling fluid circulation to the cutter knives during the milling-out operation which often results in failure of the knives or unsatisfactory cutting or milling, particularly when any bridging of the formation occurs during the milling-out operation.

Another main disadvantage or deficiency in previously known casing milling tools has been in their inability to permit the well fluid to by-pass through the tool and enter the drill pipe as the tool on said drill pipe is lowered within the well pipe. This deficiency materially affects the speed of lowering the tool and often the lowering of the tool must be halted in order to equalize the fluid pressure interiorly and exteriorly of the tool.

Still another disadvantage or deficiency in the prior casing milling tools has been their lack of a means to permit adequate reverse circulation back through the tool from the casing. Reverse circulation may be necessary to remove trash or debris which has collected in the tool during the lowering thereof. If such trash or debris is not removed, the tool must be pulled full of the mud or well fluid which is slow and costly.

It is therefore an object of this invention to provide an improved pipe or casing milling tool which has pipe cutter knives actuatable by fluid pressure and which overcomes the aforesaid disadvantages of the prior known casing milling tools.

An important object of this invention is to provide an improved pipe or casing milling tool wherein a floating valve is provided in the tool which is adapted to be maintained closed during the cutting through of the casing or pipe with cutter knives on the tool and which is adapted to be opened by a predetermined fluid pressure after the knives have cut through the casing or pipe so that adequate liquid or mud circulation can be effected during the milling out of the longitudinal section or window in the casing or pipe to remove all cuttings and any bridging of the formation so as to prevent damage to the cutter knives and thereby avoid pulling the tool for repair or replacement of the knives.

Another object of this invention is to provide an improved pipe or casing milling tool which is adapted to fill up with well fluid automatically during the lowering thereof into the pipe or casing to thereby facilitate the speed of lowering of the tool.

Another object is to provide an improved pipe or casing milling tool through which sufficient reverse liquid circulation can be effected to remove any foreign objects in the tool plugging the same, whereby the tool can be cleared

2

of such objects to obviate pulling the tool while it is full of liquid or mud.

A further object of this invention is to provide an improved pipe or casing milling tool wherein a maximum fluid pressure is utilized for extending the cutter knife or knives while cutting through the pipe or casing and maximum liquid or mud circulation is obtained during the milling of a longitudinal section of the pipe or casing to remove cuttings as well as any bridging of the formation.

The construction designed to carry out the invention will be hereinafter described together with other features thereof.

The invention will be more readily understood from a reading of the following specification and by reference to the accompanying drawings forming a part thereof, wherein in an example of the invention is shown, and wherein:

Figure 1 is an elevational view of the casing or pipe milling tool of this invention, illustrating its use for cutting or milling a window or longitudinal section of the casing;

Figure 2 is a sectional view of the casing or pipe milling tool of this invention, illustrating the details thereof when the cutter knives are in a retracted position,

Figure 3 is a view similar to Figure 2, but illustrating the position of the cutter knives and the other parts of the tool after the knives have been pivoted to their extended position,

Figure 4 is a horizontal sectional view taken on line 4—4 of Figure 3 and illustrates particularly the construction of the valve of the cutter tool, and

Figure 5 is a horizontal sectional view taken on line 5—5 of Figure 3 and illustrates particularly the pivotal connection of the cutter knives to the tool body or housing.

In the drawings the letter A designates generally the pipe or casing milling tool of this invention which includes a body or housing 10 which is suspended from and supported by a support pipe or drill pipe P. The connection of the housing 10 to the support pipe P can be by the conventional tool joint or by the use of an adapter 11, a portion of which is shown in Figure 2, such adapter 11 having connection with the support pipe P. Within the bore 10a of the body or housing 10, there is located a piston or fluid-actuated member 12 which co-acts with cutter knives 14 which are pivotally connected to the body or housing 10, whereby upon downward movement of the piston 12 the cutter knife or knives 14 are pivoted radially outwardly for cutting through a casing or pipe C and for thereafter milling out a window or longitudinal section W in the casing or pipe C (Figure 1). A valve member 15 is provided in the bore 10a of the housing 10 for closing a longitudinal passage or bore 12a of the piston 12 during the downward movement of the piston 12 while cutting through the pipe or casing C. The valve member 15 is adapted to be unseated from the piston 12 to permit full fluid flow through the piston passage 12a after the pipe or casing C has been cut through and while the window or longitudinal section W of the pipe or casing C is being cut or milled by the knives 14, as will be explained.

The details of the casing milling tool of this invention are illustrated in Figures 2—5, and therein it can be seen that the housing or body 10 has a plurality of radial slots 17 in its side wall, with a knife 14 being disposed in each of such slots 17. Each knife 14 is pivoted to the housing 10 by a pivot pin 18 which extends through openings 18a for pivotal movement of each knife from a retracted substantially vertical position (Figure 2) to an extended substantially horizontal position (Figure 3). Each cutter knife 14 has a downwardly extending or outer cutting edge 19 and a laterally extending or lower cutting edge 20, each of such edges 19 and 20 preferably being hard surfaced for cutting purposes. The downwardly extending or outer cutting edge 19 is provided for cutting

3

through the pipe or casing C as the cutter knife 14 is pivoted outwardly during rotation of the tool A, while the lower or lateral cutting edge 20 is provided for cutting or milling the casing or pipe C which is beneath the cutter knives 14 after they have been extended to the position shown in Figure 3. It will be observed that each cutter knife 14 has a rectangular recess 21 at its lower end which provides a reduced thickness at the tapered cutting edges 19 and 20. The upper portion of the cutter 14 is designated by the numeral 22 and is of the full width of the cutter to provide sufficient rigidity for the knife during its cutting action. Each knife 14 has an inner projection or lug 24 which extends into the bore 10a of the housing or body 10 and co-acts with the piston 12.

For co-acting with the lugs 24 to pivot the cutter knives 14, there is provided on the external surface of the piston 12 an annular recess 25 whereby an upper radially extending shoulder 26 is formed on the piston 12 for contact with the lugs 24 as the piston 12 moves downwardly relative to the piston or body 10. The lower wall of the recess 25 forms a lower radially extending shoulder 27 which merges with a frusto-conical section 28. When the cutters 14 have been extended to the position shown in Figure 3, an upward movement of the piston 12 relative to the housing 10 causes an engagement of the lower shoulder 27 with the projections or lugs 24 to pivot the cutter knives 14 downwardly to a retracted position (Figure 2). The piston 12 is maintained in the retracted position and is returned to such retracted position by a coil spring 29 disposed below a lower shoulder 37a of an enlarged head 37 at the upper end of the piston 12 and an inwardly extending ledge shoulder 30 in the housing 10. The spring 29 has only sufficient strength to support the weight of the piston 12 and connected parts so that when mud pressure is applied to force the piston 12 downwardly, the force of the spring 29 is overcome. Upward movement of the piston 12 is limited by the engagement of the lugs 24 with an inclined surface 32 in the bore of the housing 10 and contact of the frusto-conical section 28 on the piston 12 with the lower edge of each of the cutters 14. Downward movement of the piston 12 is limited by the contact of the lower end of the piston 12 with the upper end of a stop pipe 33 disposed on a shoulder 23 internally of a coil spring 31, which surrounds the stop 33 and is confined between the lower end of the piston 12 and the shoulder 23. The downward stop provided by the stop pipe 33 prevents the piston 12 from moving so far downwardly that it would shear the pivot pins 18. The spring 31 is of a greater strength than the upper spring 29 and is sufficiently strong to continuously resist downward movement of the piston when mud pressure is applied thereabove; such resistance of spring 31 prevents longitudinal vibration or chatter of the piston 12 as it is lowered to extend the knives 14 and also assures that all of the knives 14 apply substantially the same cutting force.

The piston 12 moves longitudinally in the housing 10 with the bore 10a serving as a piston chamber. Fluid seals are provided by O-rings 35 and 36 mounted in grooves at the upper enlarged end 37 of the piston 12 and an O-ring 38 disposed near the lower end of the piston 12 below the frusto-conical section 28. A radial port 10b is provided in the side wall of the body 10 to permit ingress and egress of well fluid into the bore 10a during longitudinal movement of the piston 12.

The valve member 15 which is disposed above the piston in the bore 10a of the housing 10 is formed with a central circular plug section 40 which has extending radially therefrom a plurality of radial guide legs 41, which legs 41 form the appearance of a "Y" as seen from the top of the tool (Figure 4). The longitudinal spaces 42 between each of the legs 41 forms openings or passages for fluid flow through the valve member 15. The plug section 40 extends downwardly below the lower surfaces of the legs 41 and forms a tapered valve seating surface 40a

4

for seating upon a similarly tapered valve seat 45 at the upper end of the longitudinal passage or bore 12a of the piston 12. An orifice 46 which is of a very small diameter in comparison to the diameter of the longitudinal passage 12a is provided in the valve 15, and it extends through the center of the central plug section 40 to establish fluid communication between the area above the valve 15 and the fluid passage 12. This fluid communication through the orifice 46 will exist even if the valve seating surface 40a is seated on the valve seat 45 to otherwise close the longitudinal passage 12a.

Upward movement of the valve member 15 is limited by an internally disposed stop shoulder 11a formed by the lower end of the adapter 11 or any similar section which connects with the support pipe P. When the cutter knives 14 are fully retracted and the piston 12 is in its extreme upper position (Figure 2) the valve member 15 will normally rest on the top of the piston 12 with the valve seating surface 40a seating on the valve seat 45 to substantially close the passage 12a. In the event that a fluid pressure is exerted upwardly through the tool by the lowering of a tool into the well casing, for example, such pressure will act upwardly through the passage 12a and move the valve member 15 upwardly with the limit of upward movement thereof being the stop shoulder 11a.

Downward movement of the valve member 15 is limited by an internal annular shoulder 50 in the upper portion of the bore 10a of the housing 10. The shoulder 50 is so positioned that it stops the downward movement of the valve member 15 prior to the time that the lower end of the piston 12 seats upon the upper end of the stop pipe 33, thereby permitting the piston 12 to move downwardly relative to the valve member 15 to unseat the valve seating surface 40a from the valve seat 45. This permits fluid from the support pipe P to pass through the spaces or openings 42 between the radial guide legs 41 and then downwardly into the longitudinal passage 12a. It is believed evident that the flow through the passage 12a with the valve member 15 unseated is much greater than when the orifice 46 is the only fluid inlet to the passage 12a from above the valve member 15; thus, with the valve member 15 unseated, a maximum of fluid can be supplied downwardly to the tool A and upwardly into the casing so as to remove the cuttings during the milling out of the window W in the casing C and to prevent any bridging of the formation F into the casing C during the milling operation.

In the operation of the casing milling tool A of this invention, the tool is lowered into the casing to be cut upon a support pipe P which can be conventional drill pipe, and as the tool is lowered into the casing C the well fluid which is already in the casing can move upwardly into the tool through the open tail pipe P' or the open end of the tool if such tail pipe P' is not used, and thence upwardly through the longitudinal passage 12a to move the valve member 15 upwardly to unseat same and to permit fluid to enter the support pipe P. Thus, during the lowering of the tool into the casing, there is an automatic equalization of fluid pressures interiorly and exteriorly of the tool and its support pipe, with the amount of fill-up with the well fluid being determined by the amount of well fluid in the casing C. This is a particular advantage over the previously known tools since it avoids the necessity for filling the drill pipe or support pipe P with liquid as the tool is lowered into the casing, and therefore it avoids the stopping of the lowering of the tool for such filling as is necessary with the previous devices. Therefore, by reason of this construction the tool can be lowered into the well casing without stopping its lowering movement, and the fluid pressure interiorly and exteriorly of the tool is automatically equalized.

After the tool has been lowered to the point at which it is desired to cut through the casing or pipe C in the

well bore, fluid under pressure is applied downwardly through the support pipe P from the surface of the well, which fluid pressure acts upon the valve member 15 to urge it downwardly. Since the valve member 15 is seated on the top of the piston 12 and substantially closes the longitudinal passage 12a in the piston 12, the fluid pressure serves to move the valve member 15 and the piston 12 downwardly together. While the fluid pressure is being applied to move the valve member 15 and the piston 12 downwardly, the support pipe P is rotated by an conventional means at the surface of the well so that as the cutter knives 14 are moved radially outwardly into engagement with the interior of the pipe or casing C, the rotation of the knives provides a cutting action on the casing or well pipe C. As the cutting through of the well pipe or casing C progresses, the fluid pressure continues to pivot the cutter knives 14 radially outwardly toward the fully extended position (Figure 3), and such action continues until the casing or well pipe C is cut all of the way through. Just prior to the time that the cutter knives 14 reach their fully extended position, the valve member 15 is stopped in its downward movement by the stop shoulder 50 so that the fluid pressure then forces the piston 12 downwardly relative to the valve member 15 and unseats the seating surface 40a from the valve seat 45, whereby the fluid under pressure then can pass through the opening 42 into longitudinal passage 12a. This provides for circulation of fluid through and around the tool to effect the removal of the cuttings and also prevents bridging of the formation across the interior of the casing after the pipe or casing C has been cut through.

The cutter knives 14 may be maintained in their substantially horizontal extended position shown in Figure 3 to effect the milling out of the casing C by the application of a predetermined amount of fluid pressure through the support pipe P, or by imposing the weight of the drill pipe on the tool so that the contact of the lower cutting edge 20 with the upper edge of the portion of casing which is beneath the knives 14 urges such knives to the position shown in Figure 3. If desired, both the fluid pressure acting on the piston 12 and the weight of the support pipe P may be utilized to hold the cutter knives extended.

With the cutter knives 14 thus held extended in a substantially horizontal position and resting upon the upper edge of the portion of the casing beneath the cutters 14, the rotation of the tool by the rotating means at the surface of the well will cause the lower cutting surfaces 20 to mill or cut the casing as the tool is lowered. The length of window or longitudinal section W which is cut in the casing C will, of course, depend upon the purpose of such window. The window or longitudinal section W in the casing C may be desired for setting a whipstock and directing a drill bit into the formation through the window, or for the production through the formation adjacent the window, as well as other operations.

As pointed out previously, during such milling operation in cutting the window or longitudinal section in the casing C, a sufficient amount of drilling fluid or mud can be circulated through the spaces or openings 42 and into the longitudinal passage 12a and thence downwardly and out through the open end of the tool and upwardly into the casing C to prevent the cuttings from collecting and interfering with the cutting operation and to prevent the formation from bridging or falling into the casing.

After the longitudinal section or window W is cut in the casing C, the fluid pressure can be released from above the valve member 15 and the return spring 30 will move the piston 12 upwardly to again seat with the valve member 15 to close the passage 12a and to retract the cutters 14, whereby the tool can be removed from the casing C or can be moved to another position for cutting.

In some instances it may be desirable to locate couplings in the well pipe or casing C prior to the cutting operation. This is vital in making measurements for opening a sand section in the formation or in instances where directional drilling couplings are utilized. These couplings can be located by applying a fluid pressure to the valve member 15 and the piston 12 through the support pipe P to move the knives 14 outwardly into the recess at the coupling. When the knives move into the recess, the downward movement of the tool will be prevented, and this can further be checked by continuing the lowering of the tool until the weight indicator shows that the device is being supported on the knives in the coupling recess. Having located the coupling, then the position at which the cutting is to be performed is located and the knives are retracted and the tool is lowered to the position in the casing C with respect to the located coupling at which it is desired to cut through the casing.

It will be evident from the foregoing description that the casing milling tool of this invention provides a structure wherein sufficient fluid pressure can be exerted on the knives for cutting through the well casing, while sufficient fluid or mud circulation can be obtained at the cutter knives during the milling out of the window or longitudinal section of the casing. Additionally, the tool can be lowered into the well without stopping such lowering to fill the drill pipe in order to equalize the pressure on the interior of the drill pipe with that on the exterior in the casing. Another advantage which should be pointed out is that the device may be cleared of any debris or foreign articles which may enter and plug the lower end of the tool during the cutting through and milling out operations. With this tool the fluid circulation can be reversed by forcing fluid under pressure, such as drilling mud, downwardly through the casing and thence upwardly through the longitudinal passage 12a to dislodge any debris and foreign articles in the lower end of the tool. Then as the tool is raised in the casing to remove the tool therefrom, the fluid in the tool can pass through the orifice 46 and passage 12a as the tool is raised so that it is not necessary to pull the tool while it is completely full of mud. In prior tools, when they became plugged up with debris or foreign articles, the pipe string supporting the tool had to be pulled full of mud which necessitated a much greater lifting force and a loss of the drilling mud.

It might also be pointed out that each of the cutting knives of this invention has both an outer cutting edge and a lower cutting edge which are hard surfaced with a material such as diamond, so that if the knives are displaced at the initial cut due to a shifting of the pipe, the cutting edges will always be able to re-engage the pipe and cut the same.

The foregoing disclosure and description of the invention is illustrative and explanatory thereof, and various changes in the size, shape and materials, as well as in the details of the illustrated construction may be made, within the scope of the appended claims, without departing from the spirit of the invention.

What is claimed is:

1. In a casing milling tool adapted to be rotated for cutting through a casing or pipe and for thereafter milling a longitudinal section of the casing, a housing having an axial bore, a fluid-actuated piston in said bore adapted to move longitudinally therein, a cutter knife pivotally mounted on said housing, means on said piston and said knife for pivoting said knife from a retracted substantially vertical position to an extended substantially horizontal position upon downward movement of said piston relative to said housing, said piston having a longitudinal passage therethrough communicating with the bore of said housing, valve means movable independently of the piston and operable by the fluid pressure acting on opposite sides thereof for substantially closing said passage while moving said piston downwardly to pivot said cutter outwardly for cutting through the pipe or casing, and

means within the housing engageable with the valve means to open said passage after said pipe or casing is cut through whereby sufficient fluid circulation can be maintained downwardly through the tool and upwardly into the pipe or casing to wash away cuttings and the like encountered while milling out the longitudinal section of the pipe or casing.

2. The structure set forth in claim 1, including a support pipe from which said housing is suspended, and means to rotate said support pipe to impart rotation to said tool, said knife being maintained in extended position on the upper end of the casing or pipe beneath the cutter knife by imposing the weight of the support pipe on the tool.

3. The structure set forth in claim 1, wherein said cutter knife has a downwardly directed cutting edge for cutting through the casing or pipe, and a laterally directed cutting edge for engagement with the upper end of the casing or pipe beneath the cutter knife for milling out a longitudinal section of the casing or pipe as the knife is rotated and forced downwardly.

4. A pipe or casing milling tool including, a tubular body, a cutter knife mounted on the body for movement from a retracted position to an extended cutting position, a piston slidably mounted within the body between limits therein and movable downwardly by the application of fluid pressure from above, said piston having means thereon co-acting with said cutter knife for moving said knife to its extended position when the piston is moved downwardly within the body, said piston having a longitudinal passage therethrough which when open permits a circulation of fluid in either direction through the piston and body, a valve member movable independently of the piston by the pressures acting thereacross and adapted to co-act with the passage for controlling the flow through the passage, means within the tubular body engageable by the valve for limiting movement of the valve so that said valve member is movable between limits with respect to the body and with respect to the piston whereby the passage through the piston is controlled by the valve member in accordance with the position of the piston and also in accordance with the pressures acting on the valve member.

5. A pipe or casing milling tool including, a tubular body, a cutter knife mounted on the body for movement from a retracted position to an extended cutting position, a piston slidably mounted within the body between limits therein and movable downwardly by the application of fluid pressure from above, said piston having means thereon co-acting with said cutter knife for moving said knife to its extended position when the piston is moved downwardly within the body, said piston having a longitudinal passage therethrough which when open permits a circulation of fluid in either direction through the piston and body, a valve member movable independently of the piston by the pressures acting thereacross and adapted to co-act with the passage for controlling the flow through the passage, a lower stop element within the body engageable by the valve member to limit downward movement of said member and located so that downward movement of the valve member is halted to open the passage through the piston before the piston has completed its full downward travel and prior to the time the cutter knife has been fully extended, and an upper stop element within the body also engageable by the valve member for limiting its upward movement, said upper stop member being so located that when the piston is at its uppermost limit of travel the valve member may undergo sufficient movement to open the passage through the piston.

6. A pipe or casing milling tool including, a tubular body, a cutter knife mounted on the body for movement from a retracted position to an extended cutting position, a piston slidably mounted within the body between limits therein and movable downwardly by the application of fluid pressure from above, said piston hav-

ing means thereon coacting with said cutter knife for moving said knife to its extended position when the piston is moved downwardly within the body, said piston having a longitudinal passage therethrough which when open permits a circulation of fluid in either direction through the piston and body, a valve member movable independently of the piston by the pressures acting thereacross and adapted to coact with the passage for controlling the flow through the passage, said valve member being movable between limits with respect to the body and with respect to the piston whereby the passage through the piston is controlled by the valve member in accordance with the position of the piston and also in accordance with the pressures acting on the valve member, said valve member having an orifice therein which permits limited flow past said valve when the valve is in a position closing the passage through the piston.

7. A pipe and milling tool as set forth in claim 5, wherein the valve member has an orifice therein which permits limited flow past the valve when the valve is in a position closing the passage through the piston.

8. A pipe or casing milling tool including, a tubular body, a cutter knife mounted on the body for movement from a retracted position to an extended cutting position, a piston slidably mounted within the body between limits therein and movable downwardly by the application of fluid pressure from above, said piston having means thereon co-acting with said cutter knife for moving said knife to its extended position when the piston is moved downwardly within the body, said piston having a longitudinal passage therethrough which when open permits a circulation of fluid in either direction through the piston and body, a valve seat at the upper end of the passage, a valve member movable within the body above the piston and adapted to co-act with the valve seat to control flow through the passage, said valve member being movable by pressures acting on opposite sides thereof, a lower stop element within the body engageable by the valve member for limiting downward movement of the valve member, said stop element being so located with respect to the travel of the piston that downward movement of said valve is halted prior to the time the piston completes its downward travel whereby during the latter portion of the piston's downward travel the valve member is unseated and the piston passage is open to permit free circulation of fluid downwardly through the piston and body.

9. A pipe or casing cutter as set forth in claim 8, together with an upper stop element within the body engageable by the valve member for limiting its upward movement in the body, said upper stop element being so located with respect to the piston travel that said valve member may move upwardly away from the piston when the piston is at its upper limit of travel whereby the pressure below the valve member may act to open the passage when the piston is in its uppermost position.

10. A pipe or casing cutter as set forth in claim 8, together with an upper stop element within the body engageable by the valve member for limiting its upward movement in the body, said upper stop element being so located with respect to the piston travel that said valve member may move upwardly away from the piston when the piston is at its upper limit of travel whereby the pressure below the valve member may act to open the passage when the piston is in its uppermost position, said valve member having a reduced size orifice therein permitting flow past said member when the same is in a position closing the piston passage.

11. A pipe or casing milling tool as set forth in claim 5, together with a spring means associated with the piston for normally urging said piston upwardly within the body.

12. A pipe or casing milling tool as set forth in claim 8, together with a spring means associated with the piston for normally urging said piston upwardly within the body.

2,725,936

9

References Cited in the file of this patent

UNITED STATES PATENTS

Re. 21,824	Lowrey -----	June 10, 1941
1,632,015	Ventresca -----	June 14, 1927
2,218,766	Parker -----	Oct. 22, 1940

5

2,299,528

2,482,674

412,023

10

Conner -----	Oct. 20, 1942
Kriegel -----	Sept. 20, 1949

FOREIGN PATENTS

Germany -----	Apr. 9, 1925
---------------	--------------