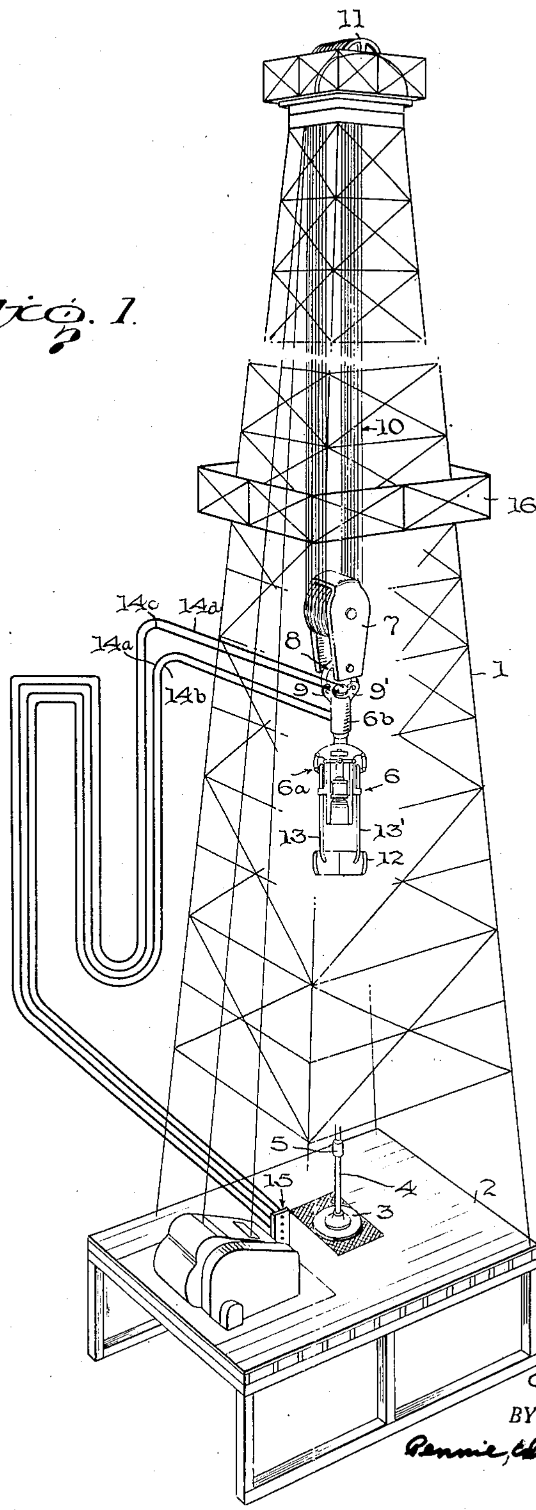
Oct. 7, 1952 C. M. ROBERSON 2,613,102

PNEUMATICALLY OPERATED ELEVATOR BAIL

Filed Dec. 14, 1950 4 Sheets-Sheet 1

FIG. 1.



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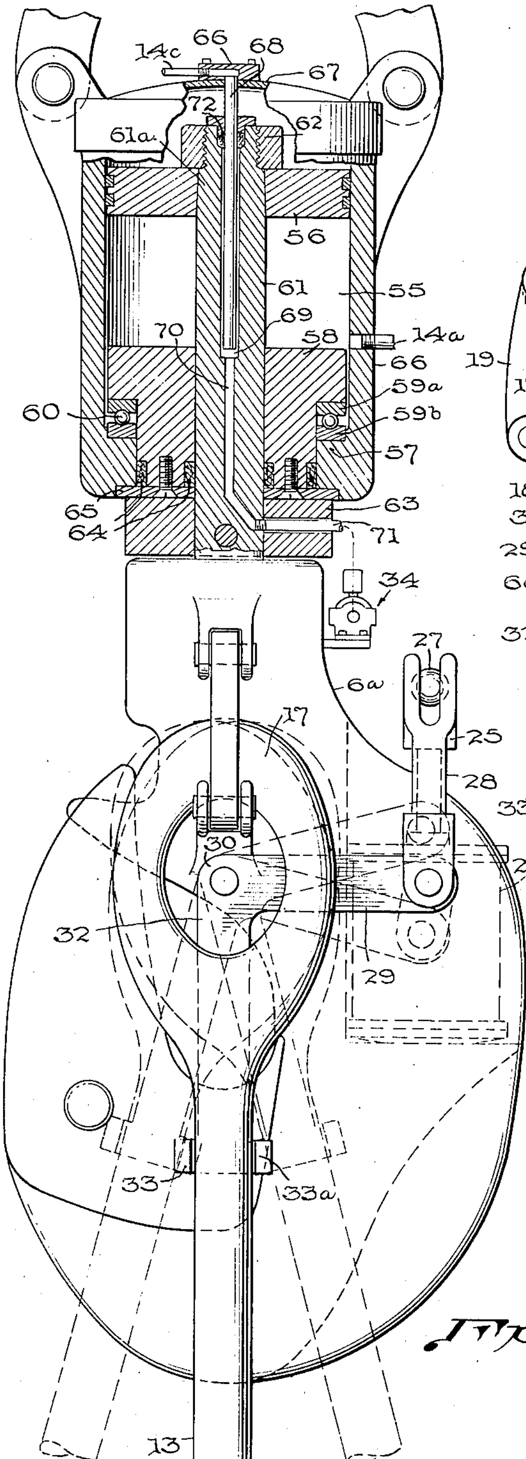

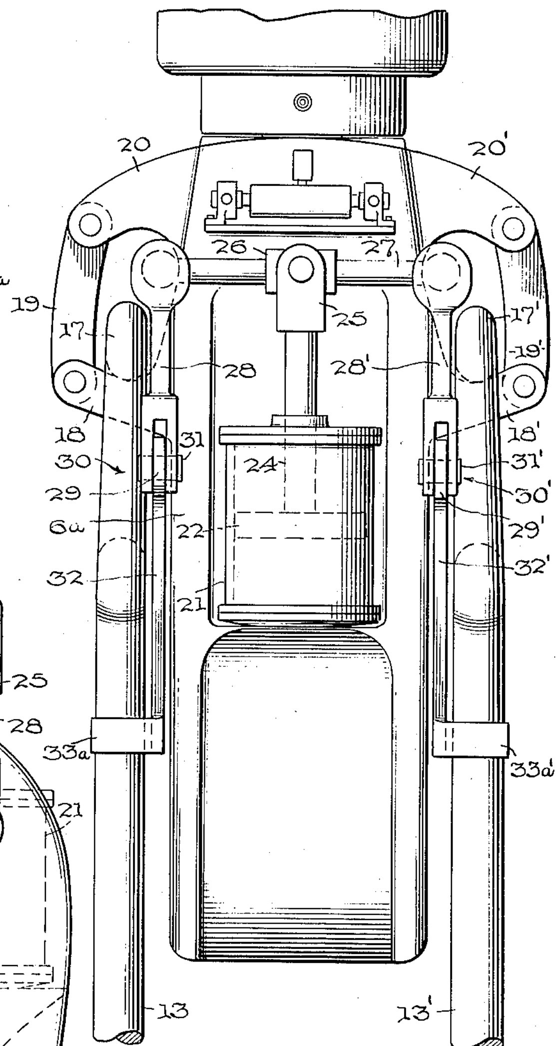

FIG. 3.

FIG. 2.

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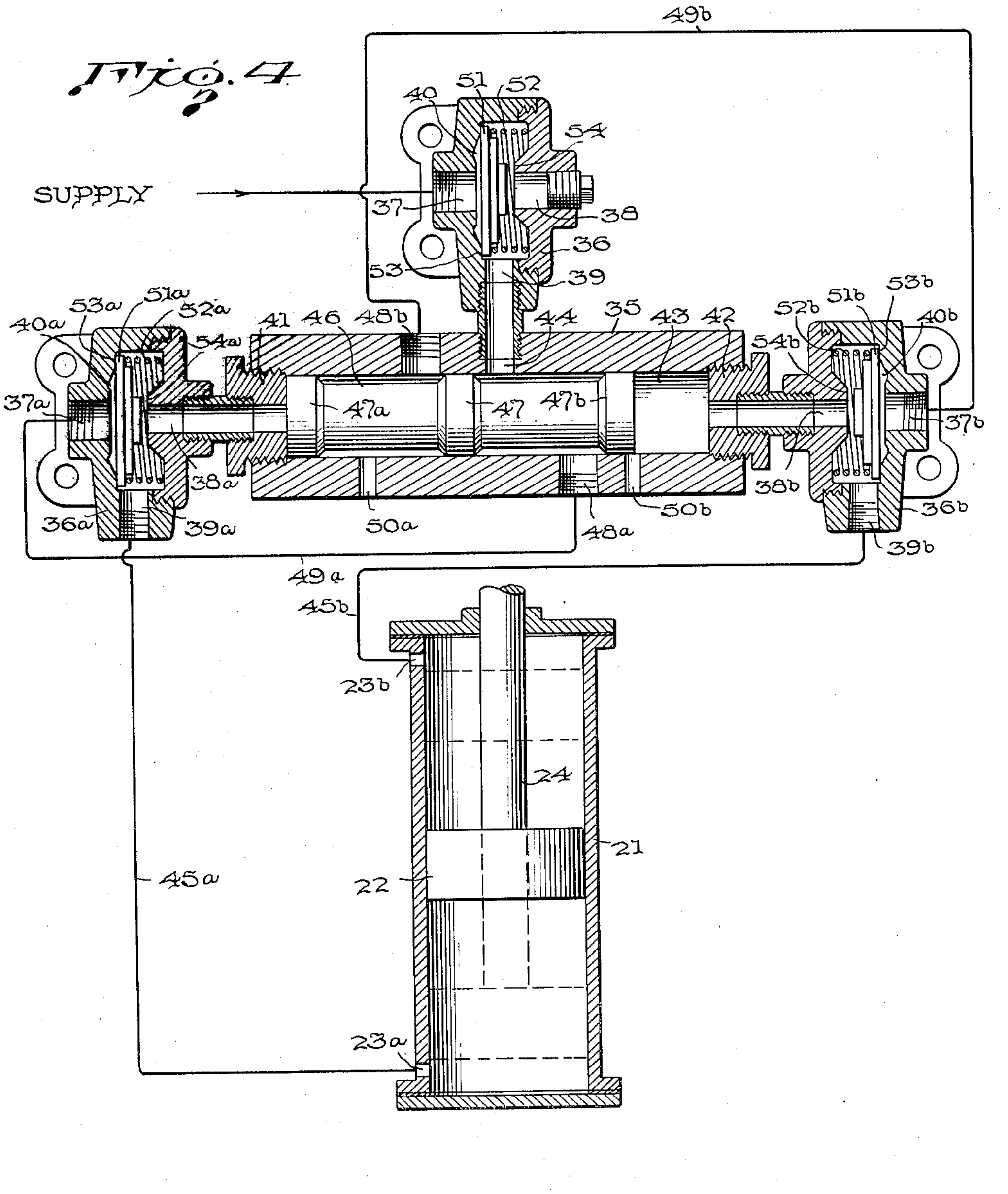
Fig. 4



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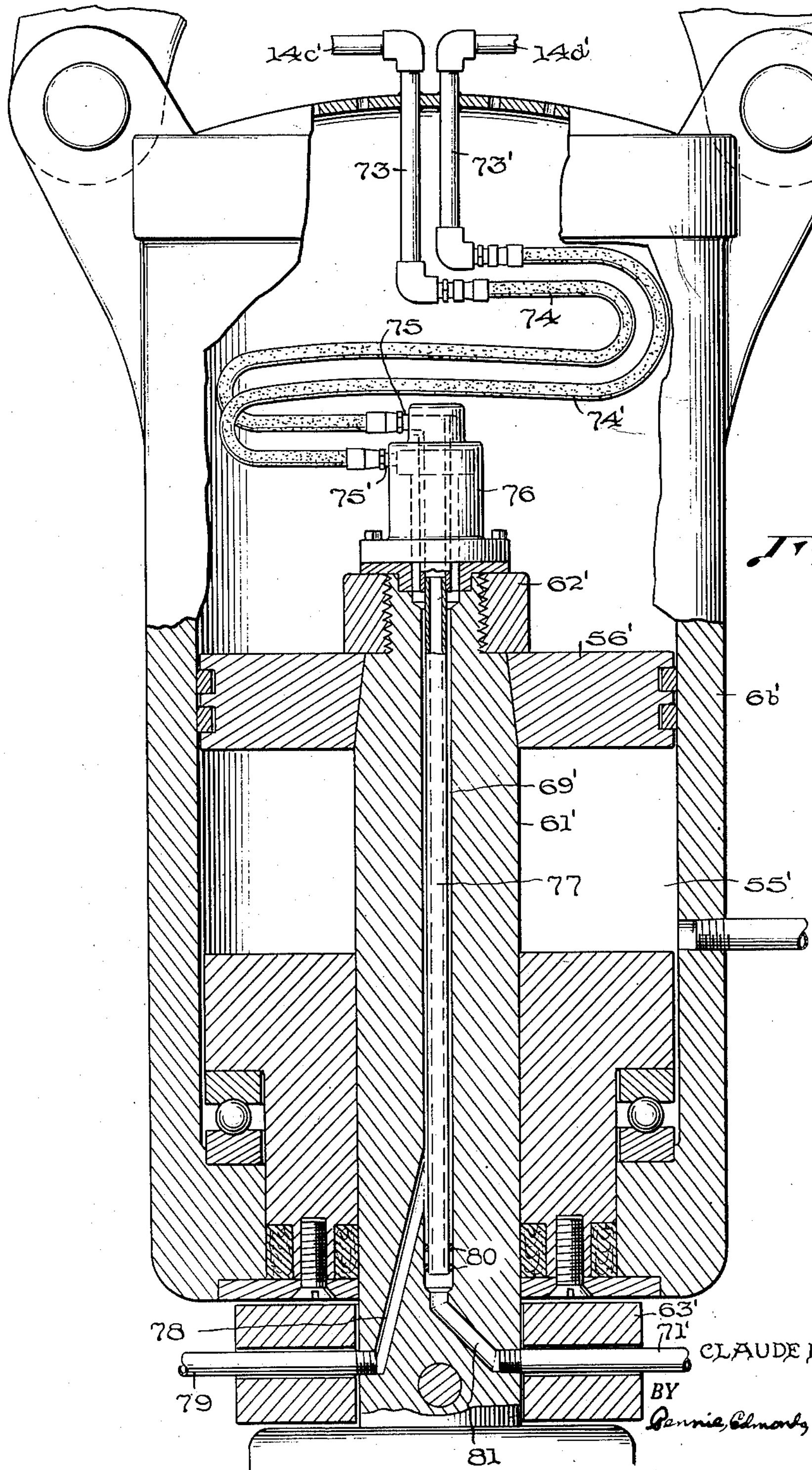

Fig. 5.

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PNEUMATICALLY OPERATED ELEVATOR BAIL

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Application December 14, 1950, Serial No. 200,774

13 Claims. (Cl. 294—82)

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This invention relates to apparatus for operating by pneumatic means elevator bails used in conjunction with hooks to support pipe stands employed in oil well drilling apparatus.

The most commonly used apparatus for drilling oil wells is the rotary drilling rig. This rig employs a derrick mounted over the well site which supports the drill stem and swivel during the drilling operation. A hook assembly supported by a vertically-movable travelling block is used to support a rotary swivel, in which is positioned the uppermost section of the drill stem. The drilling pipe within the well is attached to this uppermost section of the drill stem and means are provided to effect rotation of the drill stem. The drill stem is composed of a plurality of sections of drill pipe connected together by threaded collars or tool joints, a drill collar and a rotary bit all connected together and extending down into the well bore.

During the operation of drilling an oil well, or the like, it is necessary to add sections of pipe to the drill stem as the bit progresses deeper into the earth. To facilitate this operation several sections of pipe are connected together to form a pipe stand, and an appropriate number of pipe stands are stored in a convenient position, usually under the derrick, with their upper sections extending up to a platform in the derrick above the derrick floor called a "safety" platform. When pipe is to be added to the drill stem, an elevator apparatus, suspended from the hook by elevator bails, is latched about one of the stands of pipe. The stand is then lifted from its storage position and aligned with the drill stem, the stem then being rotated to engage the stand with the drill stem. The elevator is then unlatched from the pipe and, if more pipe is to be attached to the stem, the elevator is returned to the "safety" platform where it is once more latched about a pipe stand and the stand lowered into engagement with the drill stem. Again the stand is connected to the stem, the elevator unlatched and, if the stem is now of proper length, the drilling operation is resumed.

It is also sometimes necessary to change the bit during the drilling operation. To do this, step slips or wedge devices are inserted in the rotary bushing to hold the drill stem and the swivel is removed from the hook. The elevator apparatus is then lowered below the uppermost tool joint of the drill stem where it is latched about one of the pipe sections with the upper surface of the elevator bearing against the upper surface of one of the tool joints of the drill stem. The wedges are then removed and the elevator apparatus raised by upward movement of the travelling block till a desired length of the drill stem is above the rotary table. The wedges are reinserted, the stand of pipe above the rotary rotated to disengage the parts of the proper tool

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joint, and the pipe stand which is to be disconnected from the stem swung away from the rotary to the storage position. The elevator is then unlatched and again lowered into position to again engage a pipe section. Once more the elevator is latched, the stem raised and a length of pipe disconnected from the stem. These operations are repeated until the bit is above ground, whereupon the bit is changed and the necessary number of pipe stands attached to the stem by operations the reverse of those described above until the bit is again at the bottom of the well.

Under the method of operation now in use for attaching and detaching the elevator from the drill stem, the hook is lowered until the elevator is at a proper distance above the floor of the derrick, when the workmen on the derrick floor reach upwardly and push the elevator bails away from the drill stem as the elevator travels downwardly so that it will clear the uppermost tool joint of the drill stem during its downward travel When the elevator is detached from the drill stem, the workmen push the elevator bails away from their neutral positions to allow the elevator to clear the tool joint and to give the elevator a swinging motion so that it will reach the derrickman at the proper position when the travelling block is raised to the "safety" platform. Both of these operations are dangerous to workmen and are relatively slow.

The present invention provides means for moving the elevator bails in opposite directions from their neutral positions during downward and upward movement of the elevator under control of a single operator, who may be located advantageously at a location remote from the drill stem, to facilitate attachment and detachment of the elevator to and from the pipe stand. With the apparatus of this invention, danger to workmen is avoided and operations are speeded up.

The elevator bail operating device of the present invention comprises a fluid-operated reciprocating piston which operates actuating means to move the elevator bails and the elevator in one of two directions away from their neutral positions, depending upon which way the piston is moved from its neutral position. Application of fluid to operate the piston is controlled by an operator, preferably at a remote location, and apparatus is provided to automatically reverse the direction of movement of the elevator and elevator bails upon successive movement thereof.

If fluid were supplied to the bail-swinging apparatus directly from a remote source, a long fluid line in the vicinity of the hook would be necessary and danger of entanglement of the line would be present when the hook was rotated. To avoid this undesirable arrangement, the present invention provides for connection of the fluid supply line to the top of the hook body. The fluid for operation of the bail-swinging apparatus is passed downwardly through the hook body to a point adjacent the location of the bail-swinging apparatus, from which it is transmitted directly to the inlet of the apparatus. The possibility of entanglement of the line is thus eliminated because, though the hook is rotated during the drilling operation, the hook assembly is so designed that the hook body, through which fluid passes, is not rotated.

The invention will be further described with reference to the accompanying drawings which illustrate a preferred embodiment thereof. However, the invention is not to be considered as limited to the apparatus specifically shown and described, but only by the scope of the appended claims.

In the drawings:

Fig. 1 is a diagrammatic perspective view of part of the apparatus used in oil well drilling,

Fig. 2 is a side elevational view, partly in section, of the hook assembly used in a rotary drilling rig, showing the elevator bail operating mechanism of the present invention,

Fig. 3 is a front elevational view of the hook of Fig. 2,

Fig. 4 is a sectional view showing the fluid cylinder and the automatic valve apparatus of the elevator bail operating mechanism, and

Fig. 5 is a sectional elevational view of the hook body of a modified form of the hook assembly of Fig. 2.

A rotary drilling rig for use in drilling oil wells and the like is suspended from the upper end of a derrick 1 extending a substantial distance above a well site which is located beneath a floor 2. On the floor 2 is mounted a rotary table 3, through which the drill stem 4 passes into the well. The drill stem comprises a plurality of pipe sections connected by tool joints 5 and extends from above the rotary table to a point adjacent the bottom of the well bore. To the lowermost pipe section is attached a bit (not shown) which is adapted to cut the earth, rock, etc. through which the well is to be drilled. Rotary movement is imparted to the rotary table 3 by power apparatus (not shown) called the draw works. Rotation of the rotary table 3 causes rotation of the drill stem 4, and consequent rotary movement of the bit.

The drill stem 4 is supported during the drilling operation by a hook assembly 6 composed of a hook 6*a* and a hook body 6*b*. The hook body 6*b* is suspended from a travelling block 7 by a bail 8 connected to a pair of ears 9, 9′ at the top of the hook body. The travelling block 7 is movable vertically within the derrick by adjustment of the length of a drill line 10 which passes over a plurality of sheaves within the travelling block and another set of sheaves in an upper crown block 11 suspended from the top of the derrick.

An elevator 12, used to encase a section of drill pipe and support it during its movement toward or away from the drill stem is supported from the hook by a pair of elevator bails 13 and 13′. Fluid-operated apparatus is provided to move this elevator away from its neutral position, as hereinafter described. A plurality of fluid conducting lines 14*a*, 14*b*, 14*c* and 14*d* are led from an external source of fluid (not shown) to a bank of controls 15 at the driller's station on the derrick floor, and thence to the hook body 6*b* for purposes to be later explained.

The derrick is provided with a platform 16 at a substantial distance above the derrick floor on which the derrickman is stationed and from which he latches and unlatches the elevator 12 to and from the pipe sections above the floor.

Referring to Figs. 2 and 3, the elevator bails 13 and 13′ have eyes 17, 17′ at their upper ends which are fitted over and supported by arms 18, 18′ extending outwardly from the side of the hook 6*a*. The eyes 17, 17′ of the elevator bails are retained on their arms 18, 18′ by links 19, 19′, each connected at one of its ends to the outer end of the corresponding arms 18, 18′ and connected at the other of its ends to the outer end of corresponding arms 20, 20′ projecting from the side of the hook and spaced longitudinally from arms 18, 18′. This construction holds the elevator bails satisfactorily, yet allows free swinging of the bails to the positions A and B shown in dotted lines in Fig. 2.

A vertically-extending fluid cylinder 21 is mounted on the hook 6*a* and has a fluid-operated piston 22 reciprocable therein. Two ports 23*a*, 23*b*, one at each end of the cylinder 21, are provided through which fluid may be selectively supplied to move the piston 22 selectively in one direction or the other, as will be hereinafter more fully described.

A piston rod 24 is connected to the piston for reciprocating movement therewith and carries at its outer end a clevis 25, which is connected to a sleeve 26, fitted about a cross bar 27. The opposite ends of the cross bar 27 are connected to the upper ends of links 28 and 28′. The lower ends of the links 28 and 28′ are connected to the outer ends of arms 29 and 29′ of bell crank levers 30 and 30′, pivoted at 31 and 31′. Each of the other arms 32 and 32′ of the bell crank levers extends downwardly alongside of one of the bails 13, 13′. The lower end of the arm 32 is provided with a pair of spaced, outwardly-extending operating fingers 33 and 33*a* positioned, respectively, at the opposite sides of, and closely adjacent the elevator bail 13, and the lower end of the arm 32′ has a corresponding pair of operating fingers 33′ and 33*a*′.

Movement of the piston 22 within the cylinder 21 in the upper direction by admission of fluid under pressure to the lower port 23*a* will cause the piston rod 24 to move the cross bar 27 upwardly. The cross bar 27, through the links 28, 28′ will cause the bell crank levers 30, 30′ to move in a counterclockwise direction about their pivot pins 31, 41′. Each of the operating fingers 33, 33′ will then engage the left side of each of the elevator bails 13, 13′, as viewed in Fig. 2, forcing each bail in the counterclockwise direction to position A. When it is desired to return the bails to their normal or neutral position, the fluid pressure is released. The weight force of the elevator and its bails will cause the return of the bails to their neutral positions, and the consequent movement of the bell crank levers in the reverse, or clockwise direction will return the piston 22 to the center of the cylinder 21.

To move the elevator bails 13, 13′ to position B, fluid under pressure is admitted to the upper port 23*b* of the cylinder 21. The piston 22 and the piston rod 24 will then move downwardly and lower the cross rod 27 and the links 28, 28′. The lowering of the links will cause the bell crank levers 30, 30′, to rotate about their respective pivots 31, 31′, in a clockwise direction to bring the respective operating fingers 33a, 33a' into engagement with the other side of each of the elevator bails 13, 13', to move the bails to position B. Return of the elevator and its bails to their neutral positions is effected by releasing the fluid pressure as before, whereupon the piston 22 returns to its neutral position.

Control over the ports 23a and 23b, through which the fluid is supplied to the cylinder 21, is provided by the automatic valve assembly, generally indicated at 34 and shown in detail in Fig. 4. This valve assembly comprises a cylindrical valve body 35 mounted on the hook 6a and three quick-opening valves 36, 36a and 36b, which are mounted, respectively, one at a side of the valve body 35 and the others at the opposite ends thereof. The quick-opening valve 36 has three ports 37, 38 and 39, which provide access to the inner chamber 40 of the valve and the valves 36a and 36b have corresponding ports denoted by the suffixes a and b, respectively, to provide access to the inner chambers 40a and 40b. The side ports, 37, 37a and 37b of valves 36, 36a and 36b, respectively, are the ports through which fluid is supplied to the valves. The opposite side port 38 of valve 36 is plugged, but the corresponding ports 38a and 38b of valves 36a and 36b, respectively, are connected to passages through opposite ends 41 and 42, respectively, of the valve body 35 which communicate with a cylindrical chamber 43 within the valve body.

The lower port 39 of the valve 36 is connected directly to an inlet passage 44 in the valve body 35 which communicates with the cylindrical chamber 43 therein. The lower port 39a of the valve 36a is connected by a section of flexible tubing 45a to the lower port 23a of the fluid cylinder 21, and the lower port 39b of the valve 36b is connected by a section of flexible tubing 45b to the upper port 23b of the fluid cylinder.

A piston valve 46 is positioned in the cylindrical chamber 43 of the valve body 35. The piston valve 46, for the greater portion of its length, is of less diameter than the diameter of the cylindrical chamber 43, and has lands 47 at its center, and 47a and 47b at opposite ends thereof. Each of these lands is of a diameter such that it fits closely within the cylindrical chamber 43 and prevents fluid from escaping from one of its sides to the other. The piston valve 46 is of less length than the cylindrical chamber within which it is positioned and is so constructed that when its land 47a is at the end 41 of the cylindrical chamber 43, communication is established through the chamber between the inlet 44 in the upper wall thereof and an outlet 48a through the wall of the chamber.

When the land 47b is at the end 42 of the chamber 43, communication is established between the inlet 44 of the chamber and an outlet 48b through the opposite wall of the chamber.

A section of flexible tubing 49a connects the outlet 48a of the chamber to the inlet port 37a of the valve 36a and a section of flexible tubing 49b connects the outlet 48b of the chamber to the inlet port 37b of the valve 36b.

An exhaust port 50a is located at one side of the chamber 43 in such position that communication is established between the end 41 of the valve body 35 and the exhaust port when the land 47b of the piston valve 46 is moved to the end 42 of the valve body. A second exhaust port 50b, at the other end of the valve body, is so located that communication is established between the end 42 of the valve body and the exhaust port 50b when the land 47a of the piston valve is moved to the end 41 of the valve body.

The quick-opening valves 36, 36a and 36b have double-acting valve members 51, 51a and 51b, respectively, in their respective inner chambers 40, 40a and 40b. The valve members are normally urged by springs 52, 52a and 52b, respectively, to bring one side of each valve member against corresponding seats 53, 53a and 53b surrounding the inlet ports 37, 37a and 37b to prevent communication between the inlet ports and the chambers of the valves. However, when fluid under pressure is conducted to any one of the inlet ports of the valves 36, 36a and 36b, the corresponding valve member is displaced from its normal seat by the force of the fluid, and the opposite side of the valve member is urged against the force of its spring against a corresponding seat 54, 53a or 54b surrounding the corresponding port 38, 38a or 38b of the corresponding quick-acting valve, to allow fluid to enter through the inlet port to the chamber but to prevent fluid from exiting from the chamber through the corresponding outlet port 38, 38a or 38b.

The operation of the automatic valve apparatus is as follows: With the piston valve 46 in the position shown, when fluid under pressure is conducted to the inlet port 37 of the valve 36, the valve member 51 thereof will be forced away from its normal seat 53 against its seat 54, allowing the fluid to pass into the chamber 40 of the valve and through the outlet port 39 into the chamber 43 of the valve body 35. Since the land 47 of the piston valve 46 prevents communication with the outlet 48b and the exhaust port 50a and the land 47b prevents communication with the exhaust port 50b, the fluid entering the valve chamber will be conducted through the outlet 48a and the flexible tubing 49a to the inlet port 37a of the valve 36a. The fluid will there press the valve member 51a away form its normal seat 53a surrounding its inlet port 37a to allow the fluid to pass into the chamber 40a of the valve and through the lower port 39a and the flexible tubing 45a to the lower port 23a of the fluid cylinder 21.

The piston 22 will then be moved upwardly in the fluid cylinder 21 and will cause movement of the elevator bails 13, 13' to position A.

When the elevator bails are to be returned to their neutral positions, the fluid pressure is turned off. The valve member 51a of the valve 36a will then be returned to its normal position by its spring 52a to close the inlet port 37a of the valve. The weight of the elevator bails and the elevator will swing the elevator bails to their neutral positions, thus pushing the piston rod 24 and the piston 22 downwardly to their normal positions in the cylinder 21. This downward movement of the piston 22 will force the fluid below it out of the lower port 23a of the cylinder through the port 39a and into the chamber 40a of the valve 36a. Since the valve member 51a closes the supply port 37a at this time and communication is had between the chamber 40a and the port 38a, the fluid will exit from the valve 36a into the end 41 of the valve chamber 43, forcing the piston valve 46 away from the end 41 to the end 42 of the valve chamber. The fluid will then be exhausted into the atmosphere through the exhaust port 50a of the valve chamber. The automatic valve apparatus is thereby set up to move the elevator bails to position B the next time the fluid pressure is turned on.

When fluid is next supplied to the valve 36, the valve member 51 will again be forced off its seat 53 onto its seat 54, thus allowing the fluid to pass into the chamber 40 of the valve and from thence through the port 39 and the inlet passage 44 of the valve body 35 into the chamber 43 of the valve body. Since the land 47 of the piston valve 46 is now at the other side of the passage 44 from that shown in Fig. 4, the fluid will exit from the chamber 43 through the outlet 48*b*, rather than the outlet 48*a*, as previously. The fluid passes from the outlet 48*b* through the flexible tubing 49*b* to the inlet port 37*b* of the valve 36*b*, where it will force valve member 51*b* off its seat 53*b* and onto its seat 54*b*, thus allowing the fluid to enter the chamber 40*b* of the valve. From the chamber 40*b* the fluid passes through the tubing 45*b* into the upper port 23*b* of the fluid cylinder 21. The piston 22 will then be moved downwardly in the cylinder to cause movement of the elevator bails 13, 13′ to position B.

When the fluid pressure is again released, the weight of the elevator and the elevator bails will cause their return to their neutral positions, thus forcing the piston 22 to move upwardly to its normal position. The fluid compressed by this upward movement of the piston 22 will exit through the port 23*b* of the cylinder and pass through the tubing 45*b* to the port 39*b* of the valve 36*b*. Since the fluid pressure supplied to the port 37*b* of the valve has been removed, the spring 52*b* will return to the valve member 51*b* to its seat 53*b*, thus allowing the fluid entering the valve through the port 39*b* to pass through the valve and into the end 42 of the valve chamber 43. The fluid then forces the piston valve 46 away from the end 42 of the chamber to the end 41 and exits to the atmosphere through the exhaust port 50*b* of the chamber. At this time, the valve assembly is once more prepared to provide for movement of the elevator bails to position A upon the next application of fluid pressure to the assembly.

The walls of the book body 6*b* form a cylindrical chamber 55 within which a fluid-operated piston 56 is positioned. At the lower end of the chamber 55, the wall of the hook body extends inwardly to form a shoulder 57 which supports a bearing member 58 within the chamber.

During use of the hook assembly, it is frequently necessary that the hook 6*a* be rotated to effect engagement or disengagement of the threaded tool joints 5 connecting the sections of the drill stem. Since rotary movement of the hook body 6*b* would cause entanglement of the drill line 10, the hook is supported by the hook body for rotary movement relative thereto. For this purpose, upper and lower bearing plates 59*a* and 59*b* are provided to separate the bearing member 58 from the shoulder 57 and ball bearings 60 are inserted between the bearing plates to allow the bearing member to rotate with the hook 6*a* relative to the hook body.

A piston rod 61 has a tapered portion 61*a* which extends within an upwardly converging bore through the piston 56. The upper end of the piston rod 61 projects above the piston 56 and is threaded to allow engagement with a nut 62 which secures the piston to the piston rod. The lower portion of the piston rod extends through a bore in the bearing member 58 and is threadedly, or in other suitable manner, secured to the hook 6*a*. A bearing collar 63 is pinned to the piston rod 61 between the hook 6*a* and the hook body 6*b* to limit the upward movement of the hook.

Fluid under pressure from an external source

(not shown), for movement of the piston, is transmitted through the fluid line 14*a* into the cylindrical chamber 55 adjacent the upper side of the bearing member 58.

A small clearance is provided between the bearing member and the inner wall of the hook body so that the fluid can communicate with the lower side of the bearing member. Consequently, the pressure exerted on the upper surface of the bearing member is lower than that which would exist if the bearing member were closely fitted against the wall of the hook body. Thus, the tendency for the bearing member to jam against the hook body and resist rotation is reduced. Sealing packing 64 is positioned between the piston rod 61 and the bearing member 58 and between the bearing member and the wall of the hook body to prevent fluid from escaping from the cylindrical chamber 55. The packing is held in position by a plate 65 bolted to the under side of the bearing member 58 and rotatable therewith.

When fluid under pressure is supplied through the line 14*a* to the chamber 55, it exerts an upward force on the piston 55, tending to move the piston upwardly to the position shown in the drawings. That force will be transmitted to the hook through the piston rod 61. Since the elevator 12 is supported by the hook through the elevator bails 13, 13′, such upward force will be transmitted to the elevator and the pipe section which it holds. The lifting force can be controlled by adjustment of the fluid pressure to raise the pipe stand held by the elevator at the proper moment when the tool joint connecting that stand to the drill stem is disengaged.

During the use of the hook assembly, it is desirable at times to restrain the hook against rotation. To that end, a fluid-operated stop may be provided within the hook body 6*b*, as shown in my Patent No. 2,519,288, to allow this control. To supply this stop with fluid, the fluid conducting line 14*b* is led from the source of fluid under pressure to the control position 15 and then to the fluid-operated stop within the hook body. With this arrangement the driller can prevent the rotation of the hook from his position on the elevator floor, without the necessity of touching the hook.

Fluid for the operation of the automatic valve apparatus and the consequent displacement of the elevator and elevator bails is supplied from an external source (not shown) through the fluid supply line 14*c* to the inlet of a connection block 66, bolted to a cap 67 at the top of the hook body 6*b*. A fluid supply tube 68 has one end extending through the cap 67 into communication with the outlet of the connecting block 66 and extends therefrom downwardly into a passage 69 extending longitudinally within the piston rod 61. The fluid supply tube is telescopically mounted within the passage 69 so that the piston 56 may slide longitudinally of and relative to the fluid supply tube and the tube is located centrally of the piston 56, so that the piston and piston rod may rotate relative to the tube. The fluid supply tube is of such length that its lower end terminates adjacent the lower end of the passage 69 when the piston is in its upper position.

A smaller passage 70 communicates with the lower end of the passage 69 and extends downwardly therefrom within the piston rod 61 to a point adjacent the bearing collar 63. A fluid pipe 71 communicates with the lower end of the passage 70 in all positions of the hook and extends outwardly through the collar 63. The other end of the pipe 71 is connected to the supply port of the quick-acting valve 36. A sealing gland 72 is positioned in the upper end of the large passage 69 between the piston rod 61 and the fluid supply tube 68 to prevent the escape of fluid from the passages in the piston rod to the cylindrical chamber 55.

The operation of the apparatus described will now be explained. When it is desired that the elevator bails be moved to position A to swing the elevator away from its normal position, fluid under pressure is admitted through the fluid supply line 14c to the fluid tube 68 from which it passes by way of the passages 69 and 70 to the valve 36 of the automatic valve apparatus 34. From valve 36, the fluid is transmitted to the port 23a of the fluid cylinder 21, causing the piston 22 to move upwardly and swing the elevator bails to position A.

When the elevator is to be latched about the pipe joint, the fluid pressure is released whereupon the weight of the elevator and elevator bails swings them to their normal positions. As explained above, the piston valve 46 will change its position at this time to prepare the automatic valve apparatus for its next operation.

After the elevator has been unlatched from the pipe joint, the elevator and elevator bails are swung to position B by again applying fluid pressure, at the control position 15, to the fluid line 14c to cause the apparatus to function as earlier explained to swing the elevator away from the tool joint of the pipe section to permit upward movement of the elevator past the tool joint. The fluid pressure is then once more released and the elevator and its bails again returned to their normal positions. During this movement, the piston valve 46 is shifted to the other end of the chamber 43 to a position to supply fluid to the lower port 23a of the fluid cylinder when the pressure is next applied.

In Fig. 5, there is shown a modified connection between the fluid supply line and the automatic valve apparatus. Rather than being attached to the inlet of a fluid connection block, the fluid lines 14c' and 14d' are connected to a pair of vertically-extending pipes 73, 73' which are welded, or in other suitable manner, attached to the cap of the hook body. A section of flexible tubing 74 is connected at one end to the lower end of th pipe 73 and has its other end connected to the central inlet connection 75 of a known type of fluid connection 76, called a "double rotorseal," which provides for fluid communication between a rotatable element, here the piston rod 61', and a non-rotating element, here the flexible tubing 74. Another section of flexible tubing 74' connects the pipe 73' to the outer inlet connection 75' of the "rotorseal." The double "rotorseal" is bolted to the nut 62' at the top of the piston rod.

The outer inlet 75' of the double "rotorseal" communicates with a passage 69' in the piston rod 61', and the central inlet 75 communicates with a fluid-conducting tube 77 positioned within this passage.

Near the lower end of the passage 69', a second passage 78 leads off from the passage 69' to a point in the piston rod 61' adjacent the inner wall of the bearing collar 63'. One end of a fluid connection 79 extends through the bearing collar and is threaded into the end of the passage 78.

A pair of sealing rings 80 are positioned between the fluid tube 77 and the walls defining the passage 69' below the juncture of the passage 69' and the passage 78, to prevent fluid from the passage 69' from entering the automatic valve apparatus.

The tube 77 terminates just below these sealing rings, and fluid from the tube flows through a smaller passage 81 which extends outwardly to the wall of the piston rod, where it is connected to a fluid conducting pipe 71' which extends through the bearing collar 63' and conducts fluid to the automatic valve mechanism, as described above.

As with the apparatus of the previously described embodiment of the invention, the piston rod of the apparatus shown in Fig. 5 slides upwardly and downwardly about the tube 77 without moving the tube. The "double rotorseal" also makes it possible to rotate the piston and piston rod with the hook without rotating the tube.

The embodiment of the invention shown in Fig. 5 is adapted for use with hooks provided with a fluid-operated hook latch mechanism such as is described in my application Serial No. 190,516, filed October 16, 1950, to selectively open and close the bail-receiving notch of the hook. Fluid-conducting tube 14d' conducts fluid for the operation of this latch mechanism to the hook body. This fluid passes through the "double rotorseal," the passage 69', and the passage 78 to the latch-operating mechanism (not shown).

It will be obvious that many further changes could be made in the apparatus herein shown and described without departing from the scope of the invention, as defined in the attached claims.

I claim:

1. A hook assembly for oil well drilling comprising a hook, a hook body, an elevator-supporting bail supported by said hook for swinging movement, and means carried by the hook assembly and connected to the bail for swinging said bail.

2. A hook assembly for oil well drilling comprising a hook, a hook body, an elevator-supporting bail supported by said hook for swinging movement from a neutral position, means connected to said bail and operable by fluid under pressure to swing said bail away from its neutral position, and means for supplying fluid under pressure to said means operable by fluid under pressure.

3. The apparatus defined in claim 2 in which the means operable by fluid under pressure comprises a fluid cylinder, a piston reciprocable within said cylinder, means engaging the elevator bail movable to swing the bail away from its neutral position, and means connecting the piston to the means engaging the elevator bail and operable upon movement of the piston to move the means engaging the elevator bail, the means for supplying fluid under pressure being connected to the fluid cylinder, whereby supply of fluid under pressure to the fluid cylinder will cause movement of the piston to move the means engaging the elevator bail and thereby swing the elevator bail away from its neutral position.

4. The apparatus defined in claim 3 in which the means engaging the elevator bail comprises an operating finger positioned adjacent one longitudinal edge of the bail, and said means connecting the piston to the means engaging the elevator bail comprises a piston rod connected to the piston for movement therewith and a bell crank lever pivotally mounted on the hook, with one arm thereof so connected to the piston rod,

and the other arm to the operating finger that movement of the piston causes pivotal movement of the bell crank lever and of its associated operating finger to move the elevator bail away from its neutral position.

5. In a hook assembly for oil well drilling comprising a hook, a hook body, an elevator and a pair of elevator bails supported on said hook for holding said elevator, a fluid cylinder, a piston reciprocable within said cylinder, means operably connected to said piston and movable by movement of the piston in one direction to cause movement of the elevator bails in one direction away from their neutral positions and movable by movement of the piston in the opposite direction to cause movement of the elevator bails in another direction away from their neutral positions, and means for selectively supplying fluid under pressure to the opposite ends of said fluid cylinder.

6. The apparatus defined in claim 5 in which the movable means for causing movement of the elevator bails comprise two pairs of operating fingers, one pair embracing each of the elevator bails.

7. The apparatus defined in claim 6 in which the movable means for causing movement of the elevator bails further comprise a pair of ball crank levers pivoted on the hook, one arm of each bell crank lever carrying a pair of said operating fingers, the other arm of each bell crank lever being operably connected to the piston for pivotal movement of the bell crank lever upon movement of the piston.

8. The apparatus of claim 5 in which the means for selectively supplying fluid under pressure to opposite ends of the fluid cylinder comprises a valve body having a longitudinal chamber therein, means for conducting fluid under pressure to said chamber, a first means for conducting fluid from the chamber to one end of the fluid cylinder, a second means for conducting fluid from the chamber to the other end of the fluid cylinder, means in said chamber movable from a position allowing communication between said chamber and said first means and blocking communication between said chamber and said second means to a position blocking communication between said chamber and said first means and allowing communication between said chamber and said second means, and means for moving said movable means from one of its said positions to the other.

9. The apparatus of claim 5 in which the means for selectively supplying fluid under pressure to opposite ends of the fluid cylinder comprises a valve body having a longitudinal chamber therein, a piston valve reciprocable within said longitudinal chamber and having a land on each of its ends and a third land intermediate its ends, said lands closely fitting within the inner wall of said valve chamber, a main supply inlet and a pair of main supply outlets, one on each side of the inlet of the valve chamber, the inlet and outlets and said third land of the piston valve being so arranged that the inlet communicates only with the first outlet in one position of the piston valve and only with the second outlet in another position of the piston valve, means for admitting fluid under pressure to the inlet of said valve chamber, means for connecting said first outlet to one end of the fluid cylinder when the piston valve is in said one position, means for connecting said second outlet to the other end of the fluid cylinder when the piston valve is in said other position, and means for moving said piston valve from one of said positions to the other when the elevator bails return to their neutral positions, whereby the elevator bails are moved from their neutral positions in one direction upon one application of fluid under pressure to the means for admitting fluid under pressure to the valve chamber and, after return of the elevator bails to their neutral positions, they are moved in another direction from their neutral positions upon the next application of fluid under pressure.

10. The apparatus of claim 9 in which the means for connecting the outlets of the valve chamber to the ends of the fluid cylinder compromise a pair of quick-acting valves each having an inlet and a pair of ports, one port being connected to one end of the fluid cylinder and the other port being connected to one end of the valve chamber, said quick-acting valves each having a valve member yieldingly urged against its inlet and adapted to be displaced to close said other port when fluid under pressure is admitted to the inlet.

11. In a hook assembly for oil well drilling apparatus comprising a hook and a hook body, the hook body having a chamber therein, a fluid operated piston reciprocable within the chamber, a piston rod connected at one end to the piston and at its other end to the hook and an elevator-supporting bail supported by said hook for swinging movement from a neutral position, means connected to said bail and operable by fluid under pressure to swing said bail away from its neutral position, and means for supplying fluid under pressure to said means operable by fluid under pressure, said fluid-supplying means comprising a passageway extending longitudinally within the piston rod and a fluid-conducting tube mounted at one of its ends on said hook body and extending within said passageway, said tube being so arranged in said passageway that the piston rod is longitudinally and rotatably movable with respect to the tube, said tube communicating at said one end with a source of fluid under pressure and at its other end with said fluid-operable means.

12. In a hook assembly for oil well drilling apparatus comprising a hook and a hook body, the hook body having a chamber therein, a fluid-operated piston reciprocable within the chamber, a piston rod connected at one end to the piston and at its other end to the hook and an elevator-supporting bail supported by said hook for swinging movement from a neutral position, means connected to said bail and operable by fluid under pressure to swing said bail away from its neutral position, and means including a conduit extending longitudinally within the piston rod for supplying fluid under pressure to said means operable by fluid under pressure.

13. Apparatus as defined in claim 12 in which said fluid-supplying means includes a pipe mounted on said hook body, and means mounted on said piston for rotatably connecting one end of the pipe to one end of said conduit.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,825,018	Smith	Sept. 29, 1931
2,519,288	Roberson	Aug. 15, 1950