Jan. 8, 1963 R. E. WINDERS 3,072,194

AUTOMATIC SCRAPER FOR USE IN DEEP WELLS

Filed Oct. 28, 1958 2 Sheets-Sheet 1

Fig. 1.

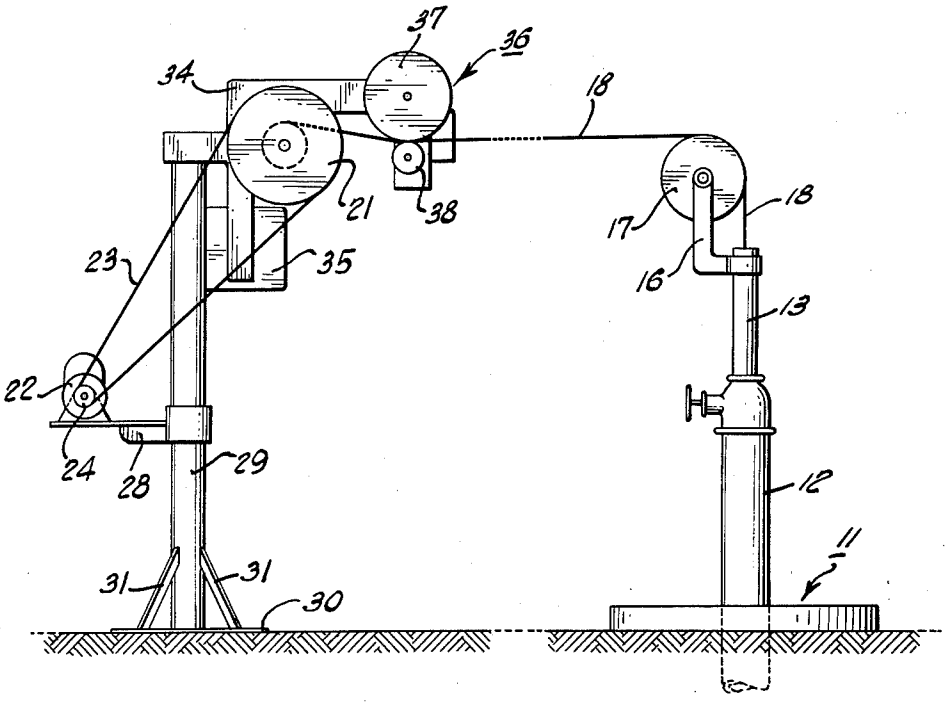
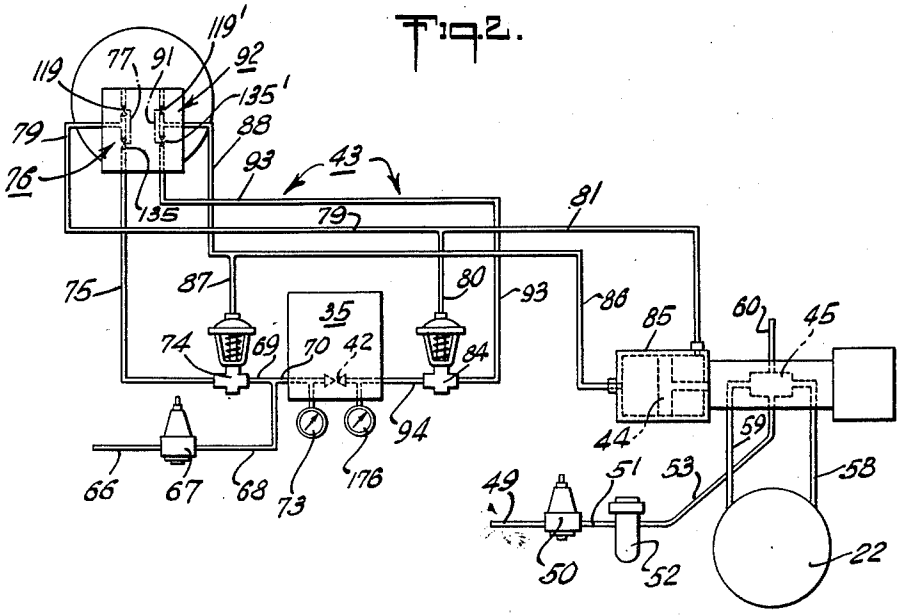


Fig. 2.



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Fig. 3.

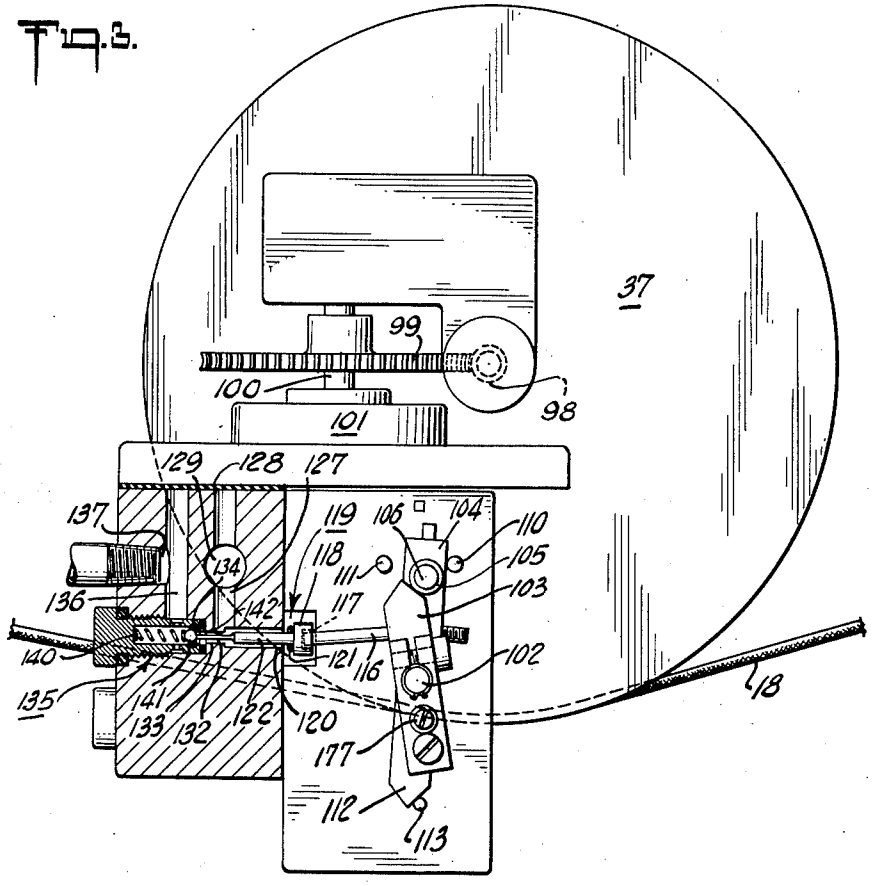
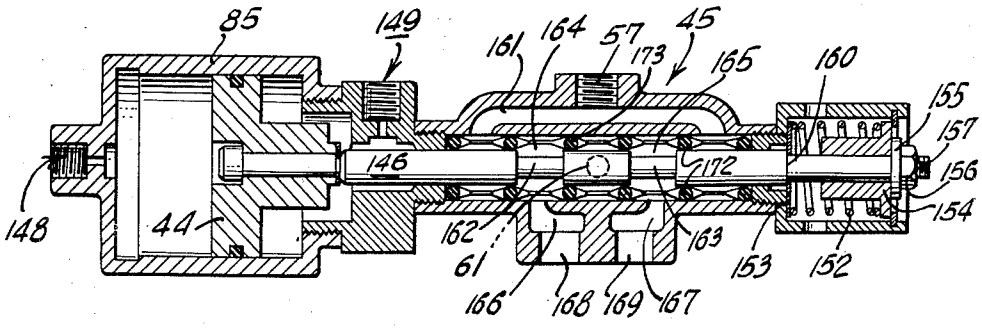


Fig. 4.



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AUTOMATIC SCRAPER FOR USE IN DEEP WELLS

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7 Claims. (Cl. 166—170)

This invention is concerned with oil-well scraping systems, in general, and more specifically deals with a power operated scraping system. This system includes the features of having necessary equipment so that it can operate automatically to run through a complete cycle and stop, ready to repeat the same cycle at predetermined time intervals thereafter.

In many if not most producing oil-wells, the flow of oil up the tubing (or casing if the well is not tubed) soon leaves a solid deposit of paraffin or other solid matter on the walls of the tubing. Therefore, in order to avoid a build up that will harmfully impair the flow of oil, it is necessary to periodically scrape the well free of such deposit. This scraping operation is an arduous job if done manually, and even if power equipment is employed there is a lot of time consumed in maintaining a field of producing wells adequately scraped.

Consequently, it is an object of this invention to provide an improved scraper system that will act unattended to scrape a deep well, or the like, at predetermined periods.

Briefly, the invention includes an automatic scraper operating system for use in deep wells. Such system comprises in combination a scraper for operation in a deep well, and means for suspending said scraper within said well plus means for moving said scraper over a predetermined distance therein. The combination also includes motor means for periodically driving said suspending means in order to move said scraper over said predetermined distance, plus control means for said motor means which comprises timing means for initiating a scraping cycle and means for measuring a distance of travel of said scraper. The control means also includes means actuated by said measuring means for controlling energization of said motor means to cause a complete cycle of operation, including running in one direction until said scraper has moved over the predetermined distance and running in the other direction until the scraper has been returned to its starting position.

The foregoing and other objects and benefits of the invention will be more fully understood in connection with the description below, which is in greater detail. This more detailed description is illustrated in the drawings, in which:

FIG. 1 is a side elevation, somewhat schematic in nature, showing the mechanical elements of the system;

FIG. 2 is a schematic diagram, showing the pneumatic system that is involved in the control of the motor drive for running the scraper operation;

FIG. 3 is an enlarged, detail view looking from the other side and partially in cross-section, showing elements of both the measuring unit and one of a pair of three-way-control valves that are employed in the pneumatic control system; and

FIG. 4 is a longitudinal cross-section view, also enlarged, showing the pilot valve with its piston actuating unit.

Referring to FIG. 1, there is illustrated an oil well 11 that has a casing 12 therein in addition to tubing (not shown) in some instances. Attached to the top of the top of the tubing, and/or the casing 12, there is a pipe or tubular housing 13 for containing a scraper (not shown) when it is at the top of a scraping cycle, i.e. above the tubing that is being scraped.

The scraper employed in any given instance may be

one having many different designs or forms. Generally it consists of certain combinations of knife blades which are weighted so that they will fall of their own accord through the tubing or casing to be scraped. The details of the scraper form no part per se of this invention.

Clamped or otherwise attached to the upper end of the pipe 13, there is a support bracket 16 that carries a pulley wheel 17 that is pivoted thereon for free rotation. There is a wire line 18 that has the scraper attached to the free end thereof, and that passes over the pulley 17 to be wound upon a reel 21. Reel 21 is rotated under power by a pneumatic motor 22. Motor 22 may be connected for driving the reel 21 in any convenient manner, e.g. by means of a belt 23 and pulley 24 that is carried on the end of the shaft of motor 22. The reel belt 23 is attached for providing a speed reduction of the reel in any convenient manner, e.g. by means of a V-belt-receiving groove around the periphery of one side of the reel 21 itself.

The motor 22 is carried on a bracket 28 of any convenient structure, that is attached to a standard 29 which in turn has a base 30 and angled supports 31 for holding the standard 29 in an upright position.

Standard 29 has bracket structure 34 attached near the top thereof, for carrying the reel 21 in addition to other elements of the system. One of the other elements is a timing unit 35 that is a conventional unit housed in a generally rectangular box.

Also carried by the structure 34, there is a measuring unit 36 that has a freely rotating wheel 37 so positioned as to have the wire line 18 remain in frictional contact with the periphery thereof at all times. Preferably the structure of the wheel 37 is such that there is a groove around the edge thereof for accommodating the wire line 18. The sides of such groove act to hold the wire line within the groove; but, this is aided by means of an idler wheel 38 which is preferably also maintained in frictional contact with the wire line 18. Sufficient force is used in the frictional contact between wire line 18 and the edge of measuring wheel 37, so that there will be no relative slippage therebetween; and the rotation of the wheel 37 will correspond at all times with the position of the scraper on the end of the wire line 18.

Referring to FIG. 2, there is shown a schematic diagram of the pneumatic control system that is employed with the various elements that are illustrated in FIG. 1. This control system determines the operation of the motor 22 in accordance with the positions of, i.e. the distance travelled by, the scraper as determined by the measuring unit 36.

Operation of the motor 22 takes place in a cyclic manner automatically, with the initiation of each cycle determined by the timing unit 35. There is a valve 42 incorporated in the timing unit 35, and connected into a pneumatic circuit 43 that acts as the control circuit for determining the operation of the motor 22. In order to do this, the pneumatic circuit 43 has a branch that is connected to a piston 44 that actuates a control valve 45, the details of which are illustrated in FIG. 4.

Control valve 45 acts to determine the direction of rotation of the motor 22, as well as to stop the operation of the motor when the valve is in its neutral position. Thus, there is a supply line 49 for introducing pneumatic fluid under pressure. Line 49 is connected to a pressure regulator 50 which regulates the supply pressure to the motor 22, so as to maintain it at a desired level. Then a pipe 51 carries the pneumatic fluid from the regulator 50 to an oil lubricator 52, from which the pneumatic fluid is carried via a pipe 53 to a pressure inlet port 57 (FIG. 4) of the control valve 45. Then the fluid flows either over a pipe 58 or another pipe 59 to the motor 22, depending upon the position of the elements of control

valve 45. The fluid exhausting from the motor 22, returns over the other of the pipes 58 or 59 and is directed to an exhaust pipe 60 via a port 61 (see FIG. 4). Of course pneumatic fluid does not flow through either of the pipes 58 or 59 when the control valve 45 is in its neutral position.

As indicated above, the position of the control valve 45 is determined by the piston 44. Piston 44 is in turn positioned pneumatically by pneumatic control circuit 43, that may be traced from the two sides of the piston 44 as follows. Commencing with the supply end of the circuit there is a pipe 66 that is connected to a pressure regulator 67. From pressure regulator 67 there is a pipe 68 that leads to parallel connections made by pipes 69 and 70. Pipe 69 leads to one port of a pressure actuated three way valve 74, while the pipe 70 leads to one side of the timer actuated valve 42.

There may be a pressure gage 73 that indicates the line pressure of the pneumatic fluid being delivered to the control circuit 43.

Another port of the pressure actuated valve 74 is connected via a pipe 75 to an inlet port of a special three way valve 76, that is actuated by the measuring unit 36 in a manner that will be more fully disclosed in connection with the detailed showing of FIG. 3. As will appear, this three way valve 76 is actually a specially constructed valve that has two separate valves connected mechanically together to provide the desired valving action. The mechanical connection for these separate valves is indicated by a dashed line 77 in FIG. 2. The structure of this special valve 76 forms no part, per se, of this invention.

Connected to another port of the special three way valve 76, there is a pipe 79 that connects in parallel to another pipe 80 as well as to a pipe 81. The pipe 80 leads to the pressure actuator portion of another pressure actuated three way valve 84, while the pipe 81 leads to one side of the piston 44, within a containing cylinder 85, therefor.

The space within the cylinder 85 on the other side of the piston 44 is connected via a pipe 86, in parallel to a pipe 87 and a pipe 88. Pipe 88 leads to an outlet port of another special three way valve 92, while pipe 87 leads to the pressure actuator portion of the three way valve 74. It will be noted that the mechanical connection between the two separate valves of special three way valve 92, is indicated by a dashed line 91.

The inlet port of valve 92 is connected via a pipe 93 to an outlet port of the three way valve 84. The inlet port of valve 84 is connected via a pipe 94 to the other side of the time control valve 42. The operation of this pneumatic control circuit 43, will be described below following a description of the details of the construction and operation of special three way valves 76 and 92, in addition to those of the control valve 45 and its actuating piston 44.

Referring to FIG. 3, there are shown some of the details of the structure of the measuring unit 36, as well as the elements of one of the special three way valves 76 and 92, each of which is substantially the same as the other.

The measuring unit 36 is mechanically connected to both of the valves 76 and 92, in order to actuate these valves at predetermined positions of the scraper that is connected to the end of the wire line 18. Movement of the wire line 18, as the scraper descends or is raised upward in the well 11, causes the wheel 37 to rotate in one direction or the other depending upon which way the scraper is travelling. Wheel 37 is fastened securely to a worm 98 which is rotated with the wheel. Worm 98 meshes with a worm gear 99 that is fastened to a shaft 100 and causes rotation thereof with the gear 99. Shaft 100 is connected into further reduction gearing situated in a housing 101 which encloses this reduction gearing (not shown). The whole reduction gear train terminates at a shaft 102, situated with the actuating structure of the special three way valves 76 and 92 (FIG. 2).

Again referring to FIG. 3, and particularly to the details of one of the special valves 76 or 92 (the other being located behind, as viewed in FIG. 3); it is pointed out that there is securely attached to the shaft 102, a pointed cam 103 that acts to position a cam follower arm 104, which in turn has a roller 105 attached thereto by a stud 106.

Arm 104 has a longitudinally shiftable pivot structure (not shown) so that as the cam 103 moves clockwise (when viewed as shown in FIG. 3) the arm 104 will be urged, by means of the following roller 105, to shift its position longitudinally and slide upward while maintaining contact with a stop pin 110. Then as the roller 105 passes over the tip of the point on cam 103, the arm 104 will pivot and shift over counterclockwise as roller 105 rolls down the other side of the pointed cam surface of cam 103.

The above described action provides a snap acting shift of the cam follower arm 104, from the illustrated position to its other position when it has rotated counterclockwise a small amount and has come to rest in contact with another stop pin 111. It is pointed out that as the follower arm 104 shifts from the position illustrated to the other position (resting against stop pin 111) it makes a longitudinal sliding motion which allows the lower extremity of the arm 104 (which has a pointed tip 112) to move longitudinally upward and then swing over to the other side of a pin 113. Thus pin 113 acts to hold the arm 104 in one or the other of its two extreme positions, in a positive manner.

Pivotally connected to the follower arm 104, there is a push rod 116 that rests in a cup shaped socket 117 in the end of a head member 118 of a bleeder valve 119. The bleeder valve 119 includes a port 120 that is opened or closed by means of a seal ring 121 that surrounds a valve stem 122 and rests against the under edge of the head element 118.

It is pointed out that when the cam follower arm 104 is in its other position from that illustrated, the push rod 116 will be shifted to the left (as viewed in FIG. 3) so as to push the valve stem 122 over to the left also, and close the valve by pressing the seal ring 121 against the surface around the opening of port 120. Of course, in the position illustrated, the valve of bleeder valve 119 is open allowing free passage of fluid therethrough. The bleeder valve 119 thus acts to vent the passages connected to the port 120 when it is open, but closes this passage to prevent such venting when it is closed.

The port 120 connects directly to a drilled passage 127 that is closed off at the open end thereof by a gasket 128. However, there is an outlet passage 129 that connects with the passage 127.

On the end of the valve stem 122, there is a reduced diameter extension 132 which extends through a passage 133. Passage 133 connects the inside ends of the passage 127 and the port 120, with a drilled and partially tapped hole 134 that contains a spring biased ball valve 135 inserted therein. This hole 134 is connected via a groove and passage as illustrated, into communication with the inside end of another drilled passage 136. Passage 136 is likewise closed at the other end thereof by the gasket 128. However, connected into the side of the passage 136, there is an inlet passage 137 for pneumatic fluid that is under control of the valve.

It will be noted that the ball valve 135 includes a bias spring 140, a ball 141, and a valve seat 142. Also it will be noted that the extension 132, of valve stem 122, rests against the ball 141. Thus, when the ball valve 135 is closed (i.e. when it is in the position illustrated in FIG. 3) the bleeder valve 119 is open. Also, vice versa, when the bleeder valve 119 is closed, the ball valve 135 will be opened, by reason of the movement of the valve stem 122 and the reduced diameter extension 132 which will act

to lift the ball 141 off its seat 142, and thus open the ball valve 135. In this manner, the ball valve 135 and the bleeder valve 119 together go to make up a three way valve that acts in conjunction with the inlet and outlet passages 137 and 129 respectively, so as to either close the passage 137 while venting the passage 129 to the atmosphere (at the open bleeder valve 119); or to directly connect the passage 137 to the passage 129 without any venting.

As indicated above, there is an additional special three way valve, which includes all of the elements described above, e.g. a ball valve and a bleeder valve. These elements are substantially identical with the ball valve 135 and the bleeder valve 119 described; and therefore in the schematic indication of these valves in the control system (FIG. 2), the reference numbers for the ball valves and bleeder valves that are used are 135, 119 and 135', 119' respectively. This additional valve structure is located behind the elements illustrated in FIG. 3, and is set up for actuation at a desired position of the scraper that is attached to the wire line 18, in accordance with the desired action of the system that will be more fully described below.

Referring to FIG. 4, it is pointed out that there are illustrated the details of the control valve 45, which valve determines the operation of the pneumatic motor 22. This control valve 45 is a commercial item and need not be described in great detail; but for complete understanding of the operation thereof, reference to FIG. 4 may be had wherein it will be observed that there is a central shaft 146 that has attached at one end thereof the piston 44 which is carried by the cylinder 85. The cylinder 85 has passages 148 and 149 for introducing pneumatic fluid on either side of the piston 44, within the cylinder 85. It will be noted that the pipe 81 (FIG. 2) will be connected to the passage 149, while the pipe 86 (FIG. 2) will be connected to the passage 148.

At the other end of the shaft 146 from piston 44, there is a spring centering-structure for longitudinally biasing the shaft 146 into a neutral or central position, i.e. that illustrated in FIG. 4 herein. This centering mechanism includes a spring 152 that is under compression from a washer 153 at one end thereof, and a flanged grommet 154 at the other end. Grommet 154 is held in place around the end of the shaft 146, by means of a washer 155 and a hexagonal nut 156 that is received by a threaded tip 157 on the shaft 146. The washer 153 rests against a shoulder 160 that is formed on the shaft 146 where its diameter is sharply reduced.

In this manner, whenever the shaft 146 is moved longitudinally to the right (as viewed in FIG. 4) the washer 153 will be moved also to the right and will cause the spring 152 to be additionally compressed. Similarly, whenever the shaft 146 is moved longitudinally to the left, the flanged grommet 154 will be moved to the left therewith by reason of its attachment to the shaft, and the spring 152 will again be compressed. Thus, the shaft 146 is under a spring bias tending to return it to the neutral position from either direction that it may be moved therefrom.

The valve passages involved in the control valve 45 are clearly illustrated, and will be only briefly referred to as follows. Port 57 has a common passage 161 that connects the port 57 to the two annular spaces between the pairs of seals (illustrated) at either end of the passage 161. The port 61, on the other hand is directly connected to a single annular space that surrounds the shaft 146 between the centermost pair of seals. It will be noted that the shaft 146 has two reduced diameter portions 162 and 163 which lie adjacent to annular spaces 164 and 165 respectively. These spaces 164 and 165 surround the shaft 146, and lie between pairs of seals as illustrated. Connected to each of the annular spaces 164 and 165, there is a separate passage 166 and 167 respectively which in turn is connected to one of a pair of ports 168 and 169. The pipes 59 and 58 (FIG. 2) that lead to the pneumatic motor 22, are connected to the ports 168 and 169.

Now it will be clear that when the control valve 45 is in the neutral position, as illustrated in FIG. 4, no flow of fluid is permitted from any one of the ports to another. However, when the piston 44 is shifted to the right (as viewed in FIG. 4) the shaft 146 will likewise be longitudinally moved to the right, and the reduced diameter portions 162 and 163 will move over so as to provide a passageway for connection from the passage 161 to the passage 167, past a seal 172 that will now lie opposite the reduced diameter portion 163. At the same time the other reduced diameter portion 162 similarly will lie across a seal 173, so that the port 61 and its connected annular space around the shaft 146, in turn will be connected to the space 166. Then, of course, the reverse situation will hold true when the piston 44 is shifted to the left, and consequently at such time the port 61 will be connected to the space 167 while the port 57 (via passage 161) will be connected to the space 166 and port 168.

Operation

Referring now to FIG. 2, the operation of the system will be described in greater detail. The operation may be thus described by following the action of the apparatus through a complete cycle, as initiated by the timing unit 35.

When the timing unit 35 reaches a set predetermined time the valve 42 thereof will be opened and pneumatic fluid under pressure (as regulated by regulator 67) will be allowed to flow through pipe 94 and continue via three way valve 84 which is at this time open for through passage since the diaphragm actuator thereof is not under pressure. It will be observed that there may be a gage 176 on the down stream side of the valve 42 to show the pressure on the control circuit side of this valve.

Pneumatic pressure is thus introduced into the pipe 93 and thence to the ball valve 135' of the special three way valve 92, that is actuated by the measuring unit 36 as described above. At this time, the cycle will be just beginning and the scraper will be at the top of the well 11 so that wire line 18 will be fully reeled up onto the reel 21. It will be remembered that the special three way valve 92 has structure for the ball valve 135' and bleeder valve 119' that is substantially identical with the corresponding structures that were described in detail above.

At this stage in the operation the special three way control valve 92 is set in its "cocked" position so that there is a passage open between the pipe 93 and the pipe 88 leading from the other opening or passageway of the three way valve structure, i.e. ball valve 135' is open. At the same time the bleeder valve 119' is closed to prevent bleeding of pneumatic fluid at the special valve 92 at this time. Consequently, pneumatic pressure will be introduced to the pipe 88 and thence pipe 87 as well as pipe 86. This will cause the piston 44 to be moved to the right, so as to shift control valve 45 over and cause the pneumatic motor 22 to be energized to run in the proper direction to feed out the wire line 18, and cause the scraper to descend in the well 11. Also, pneumatic pressure in pipe 87 will cause the three way valve 74 to be actuated, so that the pipe 69 is shut off at the valve 74 while the pipe 75 is vented to atmosphere at the valve 74.

Before the foregoing first step of the operation in a given cycle takes place, the left hand special three way valve 76 is in its so-called "tripped" position (like that illustrated in FIG. 3) so that the ball valve 135 is closed and the pipe 75 is not free to vent to atmosphere at the special three way valve 76.

Now, as the wire line 18 is payed out and the scraper descends in the well 11, the adjustments are such that after about 500 feet of travel down the well, the special three way valve 76 is shifted to its cocked position (ball valve 135 open and bleeder valve 119 closed) and the scraper continues to descend.

It is to be noted that at the first step, i.e. when piston 44

was shifted by introduction of the pneumatic pressure on the left side thereof (via pipe 86) the pneumatic fluid present on the right hand side of the piston was allowed to exhaust via pipe 81 and pipe 79, to the special three way valve 76. This exhaust path was open because the bleeder valve 119 of valve 76, was at this time open while the ball valve 135 thereof was closed.

Now, when the scraper reaches a predetermined depth in the hole as set by the adjustment of the cam 103' (not shown) on the shaft 102 (other end from that in view in FIG. 3) the special three way valve 92 is tripped; and thus the bleeder valve 119' thereof opens, while the ball valve 135' thereof is closed. This means that the pressure on the left hand end of piston 44 is released and the piston returns to its neutral position stopping the motor 22. However, because the special three way valve 76 was previously cocked (when the scraper had descended about five hundred feet), the pneumatic fluid pressure is now introduced to the right hand side of piston 44, via the pipes 75, 79 and 81. This last named pneumatic circuit is completed with the venting of pressure on the left hand side of the piston 44; because the pressure in pipe 87 is also relieved with that on the left side of piston 44 (pipe 86), and the pressure actuated valve 74 then returns to its no pressure position, so that the pneumatic fluid circuit from pipe 69 to pipe 75 is connected.

Thus the motor 22 will immediately start up again in the opposite direction, and begin raising the scraper by reeling in the wire line 18.

After the scraper has been raised upward from its lowest position for about five hundred feet, the other special three way valve 92 will again be cocked so that its ball valve 135' will be opened while its bleeder valve 119' is closed. This accomplishes the setting of this valve in the proper position for the commencement of the next cycle. During the five hundred feet before the valve 92 is cocked, the escape of pneumatic fluid at the vent of the bleeder valve 119' is prevented because the three way valve 84 stands pressure actuated by reason of the pneumatic pressure supplied by the pipe 89, which is in parallel with the pneumatic pipe 81 that is supplying pressure to move the piston 44 to the left.

In regard to the valves 74 and 84, it is pointed out that the three way valve 84 acts to cut off the passage connected to pipe 94 while venting the passage connected to pipe 93, when it is actuated by pressure. Similarly, the three way valve 74 acts to cut off the passage connected to pipe 69 while venting the passage connected to pipe 75, when the valve is actuated by pressure (in pipe 87).

At this point, it may be noted that the timing unit 35 is set so that the valve 42 controlled thereby remains open during the first half of the cycle and continuing on until sometime after the scraper is being raised from its lowermost position. Usually this time will be set to be about at the point when the scraper is half way up out of the hole. This then sets up conditions so that the operation will stop at the top of the cycle and await the opening of valve 42 again before commencing another cycle.

The completion of a cycle comes when the wire line 18 has been reeled up on the reel 21 until the scraper has been raised to the top of its travel. This condition is met by adjustment of the connection from measuring unit 36 to the cam actuated elements of special three way valve 76. This adjustment is made by the position of the cam 103 on the shaft 102. These are adjusted so that the valve 76 will be tripped when this top position is reached. Such tripping of the valve will, of course, open the bleeder valve 119 while closing the ball valve 135 and these actions will cause the piston 44 to return to neutral since the pressure on the right hand side of the piston will be relieved at the bleeder valve 119. Also, the pneumatic

fluid pressure will be maintained within the pipe 75 by the closing of the ball valve 135.

The adjustments mentioned above for the cams of special three way valves 76 and 92, include vernier adjustment elements 177 (FIG. 3) for accurate setting of the tripping positions of these valves at the desired travel positions of the scraper.

It will be observed that by means of the apparatus in accordance with this invention a scraping cycle may be provided which takes place automatically, unattended, and may be set to repeat at predetermined intervals as desired. This action is accomplished by providing the connection, or mechanical tie, with the position of the scraper (as determined by its wire line) to act upon the pneumatic control arrangement for energizing the motor that unreels and reels the wire line which supports the scraper.

It is pointed out that there may be a level wind arrangement (not shown) incorporated into the reel drive, if desired, in order to avoid any binding or snarling of the wire line, particularly in a deep hole.

While a particular embodiment of the invention has been described in considerable detail in accordance with the applicable statutes, this is not to be taken as in any way limiting the invention but merely as being descriptive thereof.

What is claimed as the invention is:

1. An automatic scraper operating system for use in deep wells comprising in combination, a scraper for operation in a deep well, a wire line for suspending said scraper within said well, a reel for containing said wire line to position said scraper over the length of the well, a pneumatic motor connected to drive said reel for moving the scraper up and down the well, and a control system for said motor comprising a piston actuated valve for reversibly controlling the supply of pneumatic fluid to the motor having a piston and cylinder means for actuation thereof, a measuring wheel unit in contact with said wire line to determine the position of the scraper in the well, a timing unit having a valve actuated by said timing unit, a first pair of three way valves connected to and for actuation by said measuring wheel unit, a second pair of three way valves each having pressure controlled actuators, and a pneumatic circuit for controlling the actuation of said piston including a connection for receiving pneumatic fluid under pressure, a parallel circuit connection from said receiving connection to one side of said timing unit valve and to one of said second pair of three way valves, a circuit connection from said one of the second pair of three way valves to one of said first pair of three way valves, a parallel circuit connection from said one of the first pair of three way valves to the actuator of the other of said second pair of three way valves and to one side of said piston, a circuit connection from the other side of said timing unit valve to the other of said second pair of three way valves, a circuit connection from said other of said second pair of three way valves to the other of said first pair of three way valves, a parallel circuit connection from said other of the first pair of three way valves to the actuator of the said one of said second pair of three way valves and to the other side of said piston, whereby actuation of said timing unit valve will initiate a cycle of scraper operation to cause said motor to run in a predetermined direction until one of said first pair of three way valves is actuated when the motor will be reversed and run in the opposite direction until the other of said first pair of three way valves is actuated when the motor will be stopped because of the closing of said timing unit valve in the meantime.

2. An automatic scraper operating system for use in deep wells comprising in combination, a scraper for operation in a deep well, a line for suspending said scraper within said well and for moving said scraper over a predetermined extended vertical distance therein, a reel, said line wound thereon, reversible motor means adapted to

travel through a cycle for driving said reel to move said scraper over said predetermined distance and return, and cyclic control means for said motor means comprising a timing unit having means for initiating said cycle, means for measuring the distance of travel of said scraper, means actuated by said measuring means for controlling energization of said motor means to cause a complete cycle of operation thereof including running in one direction until said scraper has moved over the predetermined distance and running in the other direction until the scraper has been returned to its starting postion.

3. An automatic scraper operating system for use in deep wells comprising in combination, a scraper for operation in a deep well, a line for suspending said scraper within said well and for moving said scraper over a predetermined extended vertical distance therein, a reel, said line wound thereon, reversible pneumatic motor means adapted to travel through a cycle for driving said reel to move said scraper over said predetermined distance and return, and cyclic control means for said motor means comprising a timing unit having means for initiating said cycle, means for measuring the distance of travel of said scraper, means actuated by said measuring means for controlling energization of said motor means to cause a complete cycle of operation thereof including running in one direction until said scraper has moved over the predetermined distance and running in the other direction until the scraper has been returned to its starting position.

4. An automatic scraper operating system for use in deep wells comprising in combination, a scraper for operation in a deep well, a line for suspending said scraper within said well and for moving said scraper over a predetermined extended vertical distance therein, a reel, said line wound thereon, reversible pneumatic motor means adapted to travel through a cycle for periodically driving said reel to move said scraper over said predetermined distance and return, and cyclic control means for said motor means comprising a timing unit having means for initiating said cycle, means for measuring the distance of travel of said scraper, a pilot valve for controlling operation of said motor, a pneumatic system connected to said pilot valve including control valve means actuated by said measuring means for causing a complete cycle of operation thereof to take place after initiation by said timing means.

5. An automatic scraper operating system for use in deep wells comprising in combination, a scraper for operation in a deep well, a line for suspending said scraper within said well and for moving said scraper over a predetermined extended vertical distance therein, a reel, said line wound thereon, reversible pneumatic motor means adapted to travel through a cycle for periodically driving said reel to move said scraper over said predetermined distance and return, and cyclic control means for said motor means comprising a timing unit having means for initiating said cycle, means for measuring the distance of travel of said scraper, a pilot valve for controlling operation of said motor, pneumatic circuit means for controlling said pilot valve including a piston and cylinder means for actuating said pilot valve, a valve controlled by said initiating means, a pair of valves controlled by said measuring means, pneumatic circuit connections for connecting said piston and cylinder means with said pair of valves and said initiating valve in order to cause a complete cycle of operation after initiation thereof by said timing unit.

6. An automatic scraper operating system for use in deep wells comprising in combination, a scraper for operation in a deep well, a line for suspending said scraper within said well and for moving said scraper over a predetermined extended vertical distance therein, a reel, said line wound thereon, reversible pneumatic motor means adapted to travel through a cycle for driving said reel to move said scraper over said predetermined distance and return, and cyclic control means for said motor means comprising a timing unit having means for initiating said cycle, means for measuring the distance of travel of said scraper, a pilot valve for controlling operation of said motor, pneumatic circuit means for controlling said pilot valve including a piston and cylinder means for actuating said pilot valve, a valve controlled by said initiating means, a first pair of valves controlled by said measuring means, a second pair of valves controlled by the pressure applied to said piston, pneumatic circuit connections for connecting said piston with said first and second pairs of valves and said initiating valve and including a circuit connection for receiving a supply of pneumatic pressure, all whereby a complete cycle of operation will take place automatically after initiation thereof by said timing unit.

7. An automatic scraper operating system for use in deep wells comprising in combination, a scraper for operation in a deep well, a line for suspending said scraper within said well and for moving said scraper over a predetermined extended vertical distance therein, a reel, said line wound thereon, reversible pneumatic motor means adapted to travel through a cycle for driving said reel to move said scraper over said predetermined distance and return, and cyclic control means for said motor means comprising a timing unit having means for initiating said cycle, means for measuring the distance of travel of said scraper, a pilot valve for controlling operation of said motor, pneumatic circuit means for controlling said pilot valve including a piston and cylinder means for actuating said pilot valve, a valve controlled by said initiating means, a first pair of valves controlled by said measuring means, a second pair of valves controlled by the pressure applied to said piston, a pneumatic circuit including a connection for receiving a supply of pneumatic pressure, a connection to one side of said initiating valve and to one of said second pair of valves, a connection from the other side of said initiating valve to the other of said second pair of valves, connections from each of said second pair of valves to one of said first pair of valves respectively, and other connections from said first pair of valves in parallel to one side of said piston and to the control element of one of said second pair of valves respectively, said pneumatic circuit connections being so arranged that said initiating valve actuation will supply pressure to one side of said piston and cause said motor means to drive said suspending means in a predetermined direction until one of said first pair of valves is actuated by said measuring means, and then supply pressure to the other side of said piston while venting the first named side thereof until the other of said first named pair of valves is actuated by said measuring means to vent the other side of the piston and stop the scraping cycle.

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