

Nov. 9, 1965

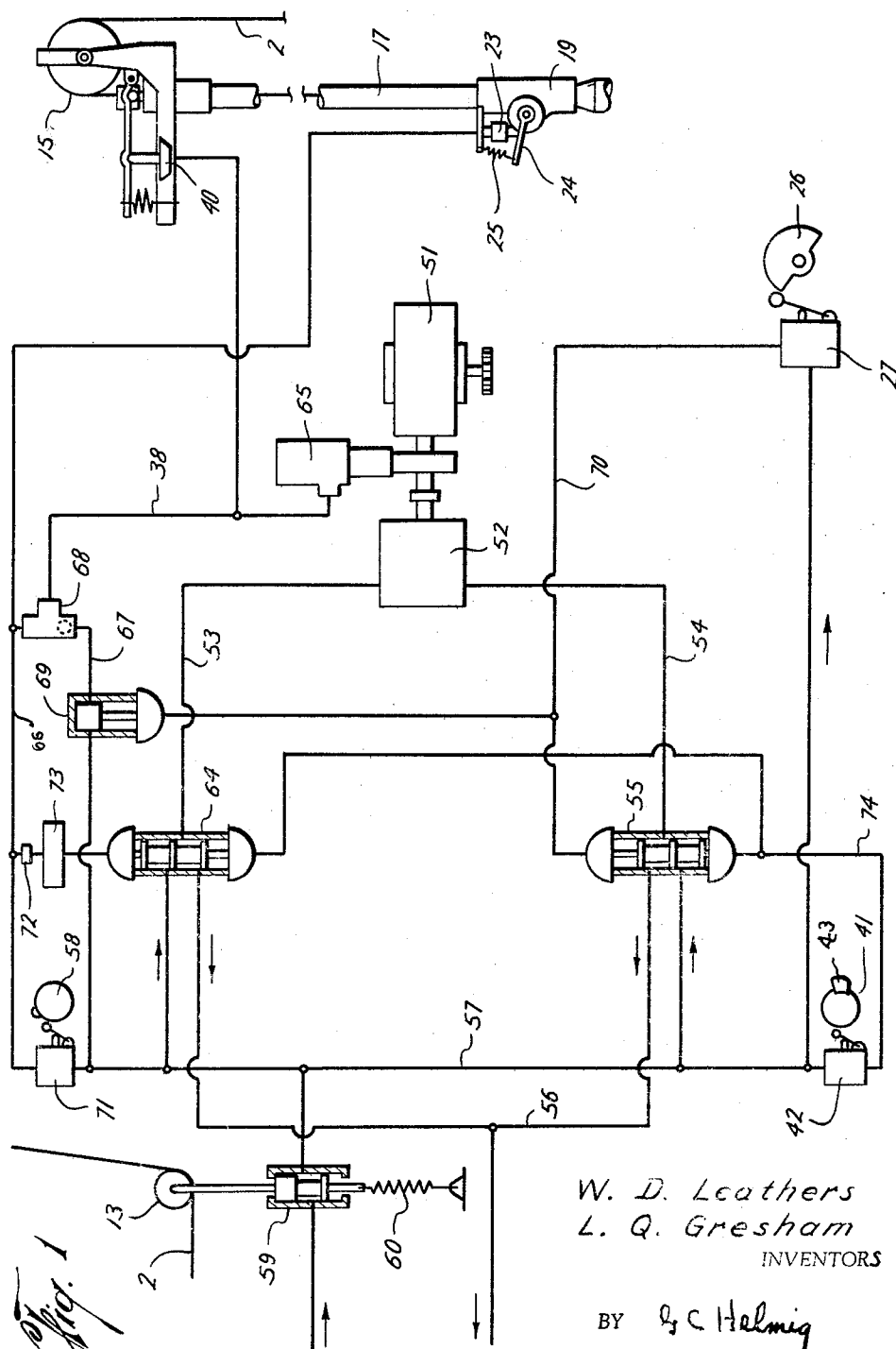
W. D. LEATHERS ETAL

3,216,502

AUTOMATIC PARAFFIN SCRAPER

Original Filed Sept. 22, 1961

3 Sheets-Sheet 1



ATTORNEY

Nov. 9, 1965

W. D. LEATHERS ET AL

3,216,502

AUTOMATIC PARAFFIN SCRAPER

Original Filed Sept. 22, 1961

3 Sheets-Sheet 2

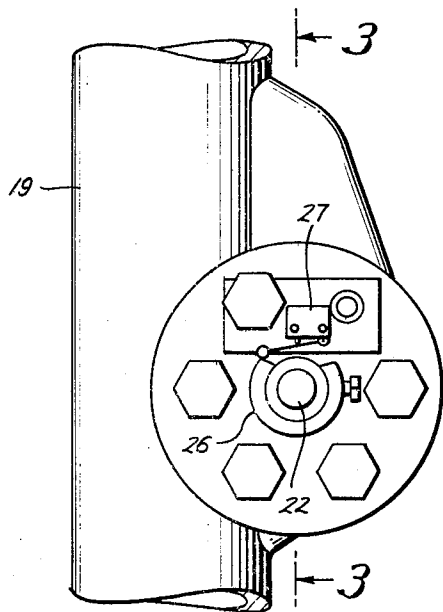


Fig. 2

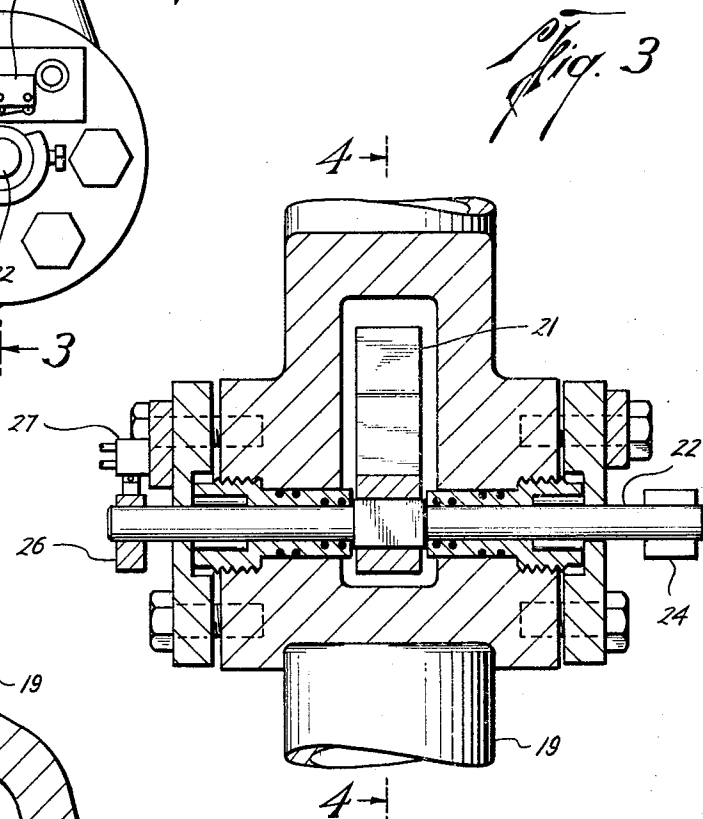


Fig. 3

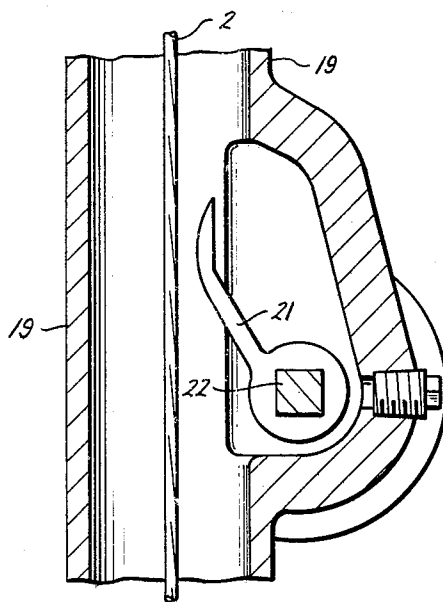


Fig. 4

W. D. Leathers
L. Q. Gresham
INVENTORS

BY *GC Helmig*

ATTORNEY

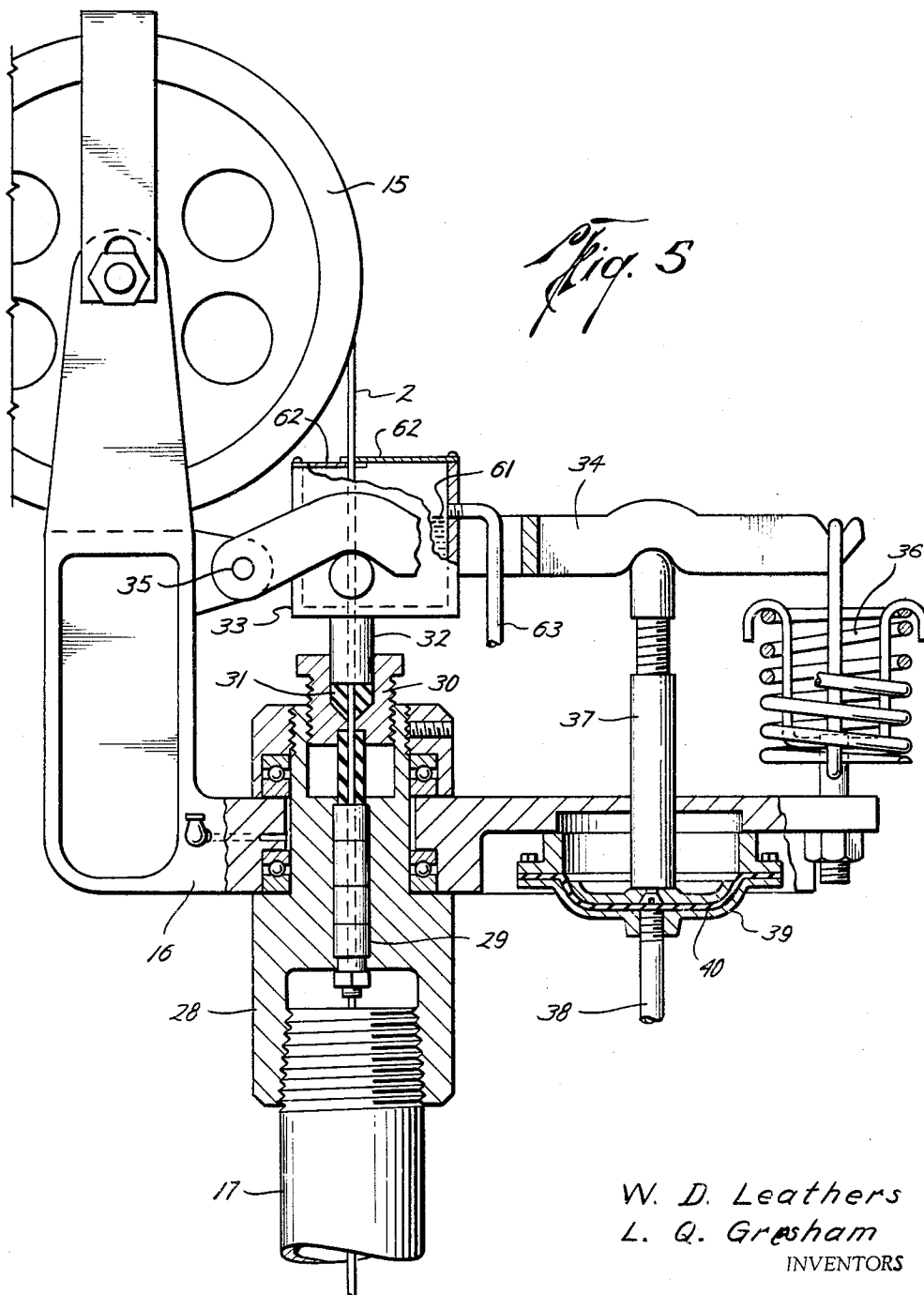
Nov. 9, 1965

W. D. LEATHERS ET AL
AUTOMATIC PARAFFIN SCRAPER

3,216,502

Original Filed Sept. 22, 1961

3 Sheets-Sheet 3



W. D. Leathers
L. Q. Gresham
INVENTORS

BY *G C Helmig*

ATTORNEY

1

3,216,502

AUTOMATIC PARAFFIN SCRAPER

William D. Leathers and Leroy Q. Gresham, Houma, La.,
assignors to Gem Oil Tool Co., Inc., Houma, La., a cor-
poration of Louisiana

Original application Sept. 22, 1961, Ser. No. 139,942, now
Patent No. 3,165,155, dated Jan. 12, 1965. Divided
and this application Sept. 4, 1964, Ser. No. 394,538
3 Claims. (Cl. 166—84)

This application is a division of our patent application Serial Number 139,942, filed September 22, 1961, now Patent No. 3,165,155, and relates to equipment which periodically operates to scrape solid paraffin wax accumulation from the inside of the tubing string wall of a producing gas or oil well and more particularly to a system for automatically cycling the operation of lowering a tubing scraper tool from the wellhead to a selected depth and then elevating the tool for return to the surface, whereupon the operation stops and subsequently is repeated following a given interval which has been set according to the rate of wax coating build-up in the particular well.

An object of the invention is to provide a periodically active and self cycled scraper controlled assembly for lowering and raising a suspension wire line through a tubing string having an upper terminal section which houses a packing ring normally under applied deforming pressure into tight gripping sealed relation with the wire line between running intervals but under lesser deforming pressure for a running seal embracement with the wire line during wire line travel in both directions.

Other objects and advantages of the invention will become apparent upon inspection of the accompanying drawings wherein

FIG. 1 diagrams the pneumatic interconnections between the various components of the operating system;

FIG. 2 is an elevation of a valve controlling structure which is responsive to the location of the scraping tool within the tubing at the wellhead;

FIG. 3 is a vertical section as on line 3—3 of FIG. 2;

FIG. 4 is a vertical section on line 4—4 of FIG. 3; and

FIG. 5 is an enlarged view with parts in section of the closure packing for the top of the tubing and through which the suspension wire line is run.

A pneumatic system as diagrammed in FIG. 1 controls a gas powered motor 52 for driving a winding drum to pay-out and rewind a wire line 2 by which a scraper tool is suspended and run in a well tubing string. This wire line 2 passes in tension about a first pulley 13 and then about a pulley 15 mounted on a bracket 16 at the upper end of a tubing string extension 17. From the pulley 15 the wire line passes through a stuffing box at the upper end of the extension tube 17 and has connection with a scraper tool assembly.

The scraper tool here contemplated includes a knife or cutting member at the bottom of the tool assembly together with a series of weights above the knife and an upper terminal or wire line socket or coupling. In the normal raised position of the tool, the upper terminal is pocketed within a special tubing section 19 which is spaced below the upper tube packing closure a distance which is slightly greater than the over-all length of the scraper tool assembly for a purpose later to be described.

The special tubing 19, just referred to, is shown in the enlarged views of FIGS. 2, 3 and 4 as having a bore aligned with the production tubing and lateral internal recesses for co-operation with a pivoted trigger arm 21 which is mounted on a rock shaft 22 pivotally supported in the side walls and projected therebeyond at opposite ends. The trigger arm 21 is shown outwardly projected from the side recess and into the path of the scraper tool.

2

It can be swung out of the projected position and into fully retracted position within the lateral recess. Such retraction can be effected either by engagement of the trigger with the scraper tool or by supplying power to a piston and cylinder motor 23 bracketed to the housing 19 and having a projecting rod engageable with a rock lever 24 fixed on one end of the shaft 22. A coil spring 25 bears on the lever 24 for biasing the same in a direction for projecting the trigger arm 21. At its opposite end the rock shaft 22 has fixed thereon a cam 26 for co-operation with an operating arm of an air valve 27. In the trigger arm projected position of the parts, the valve 27 will be closed and in the retracted position of the lever arm 21 the valve 27 will be opened.

The detail of the wire line embracing closure for the upper end of the extension tube 17 is illustrated in FIG. 5. It involves an adapter fitting 28 screw threaded onto the extension tube 17 and pivotally mounting on a vertical axis the pulley mounting bracket 16. A central opening through the adapter 28 receives the wire line 2 and houses one or more cylindrical packing elements 29 in running seal engagement with the wire line. The packing elements 29 and their mounting are of conventional nature and in use they have been found to be fairly reliable for a running fit but tend to allow slight leakage of high pressure fluids after a period of use and while the line is not being run. For remedying that situation, a packing box 30 is here provided outwardly beyond the conventional packing rings 29 and it houses an elastic deformable packing ring 31 in embracing relation to the wire line. An adjustable gland 32 bears on the upper face of the packing 31 and terminates upwardly in an enlarged and cupped head 33 having lateral trunnion pins with which engage the transversely spaced apart arms of a lever assembly 34. One end of the lever 34 is hinged at 35 to the bracket 16 and the opposite lever arm is harnessed through a suitable spring device 36 to the opposite end of the bracket 16. The spring 36 transmits its force through the lever 34 to the gland 32 for depressing the same and thereby squeezing the packing 31 into tight sealing engagement with the wire line 2 in a manner to insure a good seal even after abnormal wear of the packing 31 incident to the slide fit engagement with the wire line. The spring 36 is active when the wire line is stationary. During movement of the wire line, the force of the biasing spring 36 can be overcome by suitable pressure fluid responsive motor shown in FIG. 5 as including a lever engageable ram 37 for transmitting the force of pressure fluid supplied through a pipe 38 to one side of a diaphragm chamber afforded by the bracket 16 and a cap 39 which clamps the rim of a movable diaphragm 40.

As the wire line tool leaves the tubing string during a reeling operation, the packing rings 29 and 31 will wipe the line clean of any excessive wax accumulation. To soften and wash off any remaining wax film, the cup 33 is provided to contain a solvent liquid 61 through which the wire passes. Additionally, the open top of the cup 33 may be closed as by means of a pair of flexible wiper flaps 62—62 having overlapping slitted portions for receiving the wire line with a close fit. Any wax will tend to go into solution in the solvent 61 and the solvent liquid will also tend to wash away any well fluid that may leak past the packings and which except for the cup would push out and deposit around the upper tube parts as messy and dirty accumulation. Cleanliness of the mechanism is permitted by trapping materials forced or carried out of the tube. The additions may tend to raise the liquid level within the cup and to carry away excess liquid, a drip conduit or pipe 63 is fastened to a side wall of the cup near its upper end to receive liquid in excess of the desired level and carry such excess downwardly through the pipe 63 which will be of a length to extend to adja-

cent the ground and at one side of the wellhead equipment.

For pay-out and rewinding of the wire line 2, its drum receives power transmitted through a gear box 51 from an air motor 52 which is of the reversible type and has pipe connections 53 and 54 controlled by conventional shuttle valving for delivery and exhaust of pressure fluids for forward and reverse motor drive. The shuttle control valve shown at 55 is for connection with the line 54 and includes a shiftable spool within a housing for alternately communicating the line 54 with either an exhaust conduit 56 or a pressure fluid supply conduit 57. A pair of spool shifting motors which may be of a diaphragm type are carried by the housing and joined to opposite ends of the spool. The spool is so arranged that it will remain in any position to which it has been shifted and can be shifted in either direction by the application of pressure fluid to one or the other of the end motors. Such valving is conventional, as is also an adjustable clock or timing mechanism illustrated at 58. The controller may be considered as being a clock driven cam which is preset so that at given spaced apart time intervals the cam will actuate a control valve for initiating action of the system, as will be described.

An additional control valve is shown at 59 in FIG. 1 as including a spring 60 for biasing the valve to closed position and a motion transmitting link connected with the pulley 13. So long as the wire line 2 is under a predetermined tension, the bias of the spring 60 will be overcome for maintaining the valve 59 open but should slack occur in the line, the valve 59 will be closed.

This last mentioned valve, as seen in FIG. 1, is in the main line for delivering pressure gas to the operating system and normally it remains in open position. A shuttle valve 64, identical in structure to the shuttle valve 55 previously referred to, is for alternate connection of the motor conduit 53 with a branch of the fluid pressure manifold supply line 57 and with a branch of the exhaust manifold 56. FIG. 1 additionally illustrates a spring applied brake assembly 65 co-operating with the motor drive shaft to maintain the same stationary when the motor is not in operation. The brake assembly 65 includes a fluid pressure actuated piston for releasing the brake. This brake release device as well as the motor for relieving pressure on the pack-off assembly at the top of the well tubing, are arranged to receive fluid pressure through the line 38 and from either of two pressure lines 66 and 67 as delivered through a directional valve 68. The directional valve 68 includes a pressure responsive valve element which is shiftable between seats at the inlet connections with the pressure lines 66 and 67 and will open whichever of the lines 66 and 67 is under the higher pressure and closes the lower pressure line. The line 67 is arranged to communicate with a branch of the pressure manifold line 57 through a valve assembly 69 which is spring pressed to open position and moved to closed position by a pressure fluid motor having pressure supply connection by a conduit 70 and which receives pressure fluid when the top limit valve 27 is open. The top limit valve has its inlet going to one of the branch supply lines of the pressure manifold 57, and its outgoing line 70, in addition to being joined with the valve unit 69, is joined to one of the end motors of the shuttle valve 55 so that pressure fluid supplied to actuate the shuttle valve 55 places the spool in position to exhaust the motor line 54. This is the condition which prevails whenever the wire line socket of the scraper tool is in engagement with the rock shaft trigger 21.

The line 66, leading to the directional valve 68, also leads to the trigger release cylinder 23 and is supplied with pressure fluid from the manifold 57 through a clock actuated valve 71. When the clock operated controller 58 calls for a scraping operation, its driven cam will effect an opening for a relatively short given duration, of the valve 71 whereupon pressure fluid moves through the line 66 to the cylinder 23 for applying retracting force

on the trigger in opposition to the projecting spring 25; through the directional valve 68 and line 38 to the motor 40 for relieving pressure on the pack-off device and to the brake assembly 65 for releasing the motor shaft; and, additionally, pressure air will go through a branch containing a speed control or flow delay unit 72 ahead of a bottle or pressure fluid accumulation vessel 73 and the diaphragm motor at one end of the shuttle valve unit 64. After a given interval of pressure build-up, the shuttle valve will be shifted from its exhaust position illustrated, to the pressure flow position for delivery of pressure fluid through the line 53 to the motor for driving the motor in the forward and reel unwinding direction. The valve 71 will remain open for a period of time sufficient to insure that the scraper tool has passed downwardly and entirely below the trigger 21 and at the end of the time period the valve 71 will close. The instantaneous response of the trigger actuating spring 25 will be to project the trigger and rock the cam 26 for closing the top limit valve 27. Resultant bleed-down of pressure in the line 70 will result in an opening of the valve 69 for directing pressure through the directional valve 68 for maintaining the brake in release condition and the pack-off in pressure relief relationship. This lowering operation will continue until the predetermined length of wire line has been let out and has driven a counting wheel and its geared-down connections with the indexing disk 41 for bringing the cam plate 43 into position for opening the valve 42. When this occurs, pressure from the manifold supply 57 passes the bottom limit valve 42 and is directed through the conduit 74 connected to reversing motors of each of the valves 55 and 64 and thereby shuttling both spools from the initial position previously referred to, to exhaust the motor connecting conduit 53 and supply pressure through the motor conduit 54 for reversing the direction of motor rotation.

The scraper tool is pulled back up the tubing string until the upper wire line socket enters the tubing extension riser of the wellhead and strikes the trigger arm 21 for retracting the same. With trigger retraction, its rock shaft, through the cam 26, reopens the top limit valve 27 which directs the signal to the valve 55 for shuttling its valve to exhaust position and to the valve 69 for closing the passage of pressure gas to the lines 67 and 38. Simultaneously, the motor 52 is stopped, the brake is applied to the motor drive shaft and spring pressure is effective for deforming the pack-off ring 31 around the stationary wire line at the upper end of the tubing string. The parts are now in the position of rest and remain so until the cycling controller again calls for scraper operation.

The various components of the system are arranged for co-operation and response to malfunctioning for preventing damage and the need for costly servicing operations. If for any reason the frictional grip of the packing element resists free running of the wire line as to result in a lack of wire line tension at the valve 59, this valve under the bias of the spring 60 will close off the pressure supply for stopping further motor operation and for applying the brake 65. This prevents wire entanglements and enables remedial measures to be taken. Similarly, should the lowering of the scraper tool be obstructed within the tubing for any reason, the occurrence of wire line slack will result in closure of the valve 59.

While only a specific embodiment of the invention has been referred to in this specification, it will be understood that such modifications and adaptations may be made as come within the scope of the appended claims.

What is claimed is:

1. Well tubing scraper control mechanism for running a wire line suspended scraper tool through a tubing string and from and return to an inactive location within a scraper housing section at the top of the tubing string, including a fluid pressure motor controlling wire line travel, valving connections supplying pressure fluid to the motor for its operation, a stuffing box on the housing

5

section for wire line passage therethrough, an elastic deformable packing ring contained in the box in wire line embracing relation, a gland bearing on the packing ring for transferring deforming force thereon, means connected with the gland and active to supply such deforming force, a pressure fluid actuated motor active in opposition to said means for relieving the force thereof and means supplying pressure fluid to the last mentioned motor throughout operation of the first mentioned motor.

2. Well tubing scraper mechanism adapted to run a wire line suspended scraper tool through a well tubing string and including a terminal tubing string section having a stuffing box for the passage therethrough of a wire line, a wire line drive motor, a wire line embracing packing contained within the stuffing box, a movable gland bearing on the packing for the application and relief of deforming pressure thereon, biasing means connected with the gland to move the same in a pressure applying direction, a motor active in opposition to said biasing means for the relief of gland applying pressure on the packing and controller mechanism connected with both motors and operative to effect concurrent delivery and shutoff of actuating power to said motors.

3. Wire line packing structure for the upper end of a well tubing string, including a stuffing box, a deformable packing ring contained within the box and provided with a wire line receiving aperture, a reciprocating gland bearing downwardly on the packing ring and terminating up-

6

wardly in a liquid enclosing cup, said gland having a passageway aligned with the packing ring aperture for wire line passage therethrough and through said cup, liquid level limiting means for said cup and comprising a liquid conductor leading downwardly from the cup and having a liquid overflow receiving inlet within the cup for outflow of liquid in excess of a given level, a spring biased lever arm connected with the gland for pressure application on the packing ring and a pressure fluid actuated motor connected with an active on the lever arm in opposition to spring bias and in response to fluid pressure supplied to the motor.

References Cited by the Examiner

UNITED STATES PATENTS

1,566,816	12/25	Carlson	277—113
1,627,945	4/27	Wigle	166—84
2,231,221	2/41	Rector	277—113
2,283,048	4/42	Collett	166—70
2,292,738	8/42	Bonney	254—174
2,513,812	7/50	McClay	254—174
2,678,696	4/54	Crake	166—70
3,145,995	8/64	Adamson et al.	166—84

CHARLES E. O'CONNELL, *Primary Examiner*.

BENJAMIN HERSH, *Examiner*.