Aug. 6, 1940. M. O. BOULTER 2,210,359

WELL TUBING PARAFFIN REMOVER

Filed Sept. 12, 1939

Fig. 1.

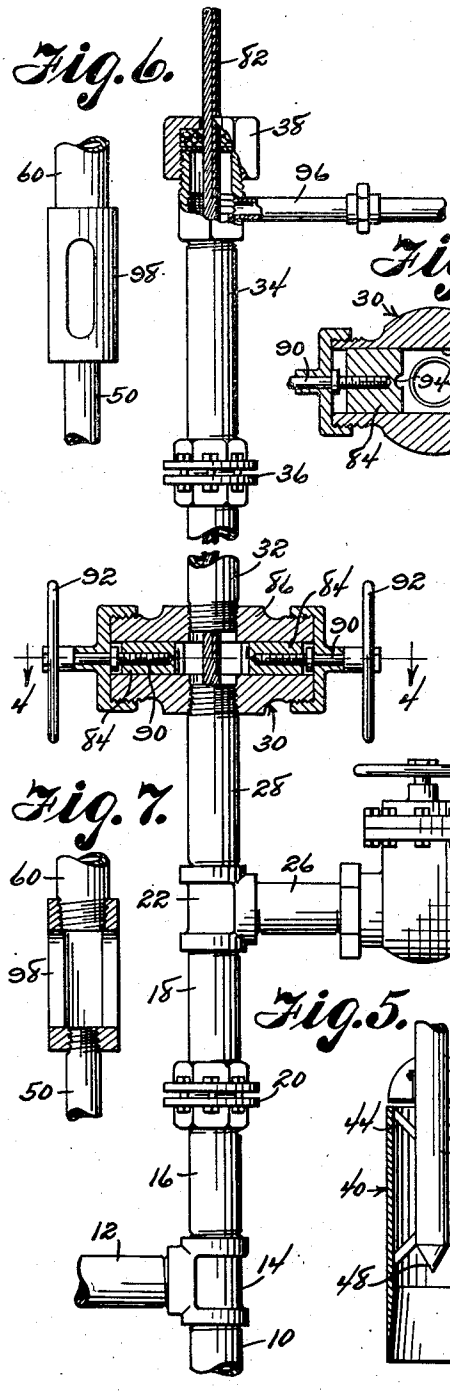

Fig. 2.

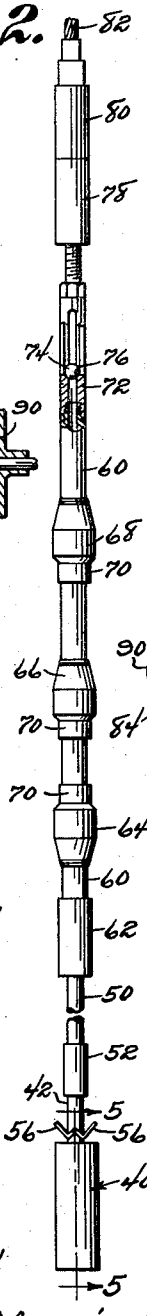

Fig. 3.

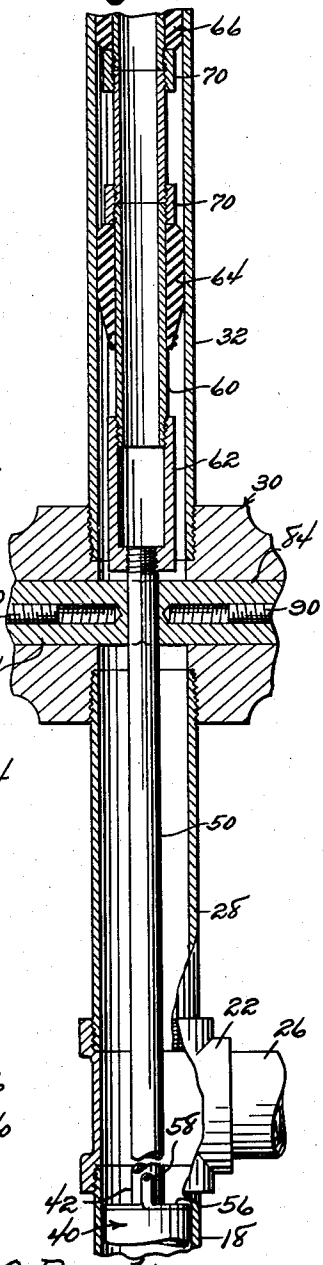

Fig. 4.

Fig. 5.

Fig. 6.

Fig. 7.

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WELL TUBING PARAFFIN REMOVER

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11 Claims. (Cl. 166—18)

My invention relates to oil well equipment, and has among its objects and advantages the provision of an improved paraffin remover.

An object of my invention is to provide novel means for removing paraffin and other obstructions which accumulate in the tubing string of oil wells. More specifically, I make use of a novel lubricator mechanism which may be transported from well to well on a truck and which may be connected with the tubing string of the oil well, in which a knife is employed for cutting the paraffin or other obstruction from the tubing, and in which the knife is actuated through the medium of hydraulic pressure imposed on the lubricator for forcing the knife through the obstruction. The lubricator is so devised that elevation of the knife and its actuating mechanism brings the paraffin to the surface and extrudes it from the lubricator mechanism. The invention is so designed and associated with the tubing string as to eliminate the necessity of opening or closing in the well or putting it out of control at any time.

In the accompanying drawing:

Figure 1 is an elevational view of the lubricator part of my invention with certain parts broken away for the sake of clearness;

Figure 2 is an elevational view of the knife and the piston means associated therewith for coaction with the lubricator of Figure 1;

Figure 3 is an enlarged sectional view of the greater portion of the lubricator and the piston means;

Figure 4 is a sectional view along the line 4—4 of Figure 1;

Figure 5 is a sectional view along the line 5—5 of Figure 2;

Figure 6 is a fragmentary view of a hollow sleeve connection cage employed when the tool is used for swabbing in dead wells after the paraffin or other obstruction has been cleaned from the tubing; and

Figure 7 is a sectional view of the structure illustrated in Fig. 6.

In the embodiment selected to illustrate my invention, I make use of the usual well tubing string 10 and a flow line 12 which are permanent parts of the oil well equipment. The upper end of the string 10 is connected with the flow line 12 through the medium of a high pressure T 14, and the T connects with a nipple 16, which in turn is connected with a nipple 18 through the medium of a high pressure bolt union 20. Nipple 18 connects with a high pressure T 22 which communicates with a high pressure gate valve 24 through the medium of a nipple 26, and the T 22 connects with a nipple 28 having its upper end connected with a high pressure stripper gate 30. The lower end of a relatively long tube 32 is connected with the stripper 30, and the nipple is connected with a nipple 34 through the medium of a high pressure bolt union 36. To the upper end of the nipple 34 I connect a packing gland 38 which prevents fluid from escaping from the lubricator while it is in operation for paraffin removing purposes.

Referring to Fig. 2, the paraffin or other obstruction cutting knife 40 is of tubular formation, as illustrated in Fig. 5. The knife is fixedly connected with a rod 42 through the medium of arms 44, as by welding. The inner faces of the knife 40 is tapered to a cutting edge 46, and the knife is of such outside diameter as to fit loosely inside the tubing string 10.

Rod 42 has a tapered lower end 48 to facilitate penetration of the paraffin, and the rod is connected with a second rod 50 through the medium of a coupling 52. Rod 42 is of a relatively small diameter with respect to the knife 40 as to provide ample clearance for the passage of the paraffin core, as at 54. Rod 42 carries two gates 56 which are pivotally connected at 58 to the rod and arranged to assume vertical positions when the knife 40 is forced through the paraffin, but the gates fall to horizontal positions when the knife is raised for trapping the paraffin core above the knife. Fig. 3 illustrates the gates 56 in their horizontal positions on the upper end of the knife 40.

Rod 50 is of relatively small diameter with respect to the inside diameter of the tubing string 10 so as to provide space between the rod and the tubing for accommodating the paraffin core or other obstruction cut from the tubing. The upper end of the rod 50 is connected with a hollow mandrel 60 through the medium of a connection 62, and swab rubbers 64, 66 and 68 are secured on the mandrel 60, which swabs may comprise conventional Guiberson cup assemblies or packing. Such devices are old and well known in the art. Swab unit 64 is reversed with respect to the units 66 and 68, and each unit is provided with a protecting follower 70.

To the upper end of the mandrel 60 I connect a sleeve cage 72 provided with a ball valve 74 and a valve seat 76. A swivel unit 78 is connected with the upper end of the sleeve cage 72, and a rope socket 80 is associated with the swivel body

78 for connection with a sand line 82 which may be connected with a power operated reel on a truck or other suitable mount. The structure of Fig. 2 is normally housed inside the lubricator structure of Fig. 1, as more clearly illustrated in Fig. 3, at which time the sleeve cage 62 is positioned immediately above the gates 84 of the stripper 30. Referring to Figs. 1 and 4, stripper 30 comprises a body 86 provided with a transverse opening 88 which slidably houses the gates 84 and guides the same. Each gate is connected with a screw 90 actuated through the medium of a hand wheel 92 so that the gates may be manually adjusted toward and away from each other. Each gate is provided with a recess 94 aligned to embrace the rod 50 when adjusted according to Fig. 3, at which time the gates 84 are positioned in end contacting relation one with the other, and the recesses 94 snugly embrace the rod so as to constitute a stripper with respect to the rod.

In operation, the tool of Fig. 2 is elevated inside the lubricator of Fig. 1, and the stripper 30 is opened to permit the tool to descend. A high pressure pipe connection 96 communicates with the nipple 34 and the swab 68 functions as a piston. Fluid, such as oil, is pumped into the lubricator and acts on the piston for driving the tool downwardly. As the tool descends, the paraffin or other obstruction is cut from the tubing string and passes upwardly through the knife 40 and accumulates between the rod 50 and the enclosing wall of the tubing.

As the available core space is filled, the tool of Fig. 2 is raised (from any depth in the well that it is cutting paraffin or other substance from the tubing) by means of the sand line 82 until the connection 62 just passes the gates 84 of the stripper (determined by a line gage on the truck not shown). At this time, the gates 84 are closed, the valve 24 is opened and the tool elevated.

With the valve 24 open, elevation of the tool places the cut paraffin under pressure with the result that it is extruded from the system by way of the valve 24. Stripper 30 in its opened position provides clearance for the tool. The gates 84 strip all the paraffin from the rod 50 and constitute a wall or barrier which places the paraffin under pressure to force it out through the valve 24. Any paraffin skim adhering to the pipe string which is not removed by the knife 40 is effectively removed by reason of the swab 64. Swab 66 functions in the same manner as the swab 68 and for the same purpose so as to insure a complete seal to resist the passage of liquid under pressure. Pipe 96 may be connected with a suitable pump and supply mechanism (not shown) carried on a truck or located in any advantageous position.

The tool of Fig. 2 is propelled by liquid pressure for paraffin cutting purposes, and the tool is elevated for extruding the paraffin through the medium of the sand line 82.

During elevation of the tool, pressure is of course removed from the hydraulic fluid so that the tool may be lifted, and when the tool is elevated, the hydraulic fluid above the swabs 68 and 66 is forced to return to the fluid supply on the truck, so that the fluid may be reused on other jobs. The lubricator of Fig. 1 as well as the string of tubing function as a cylinder, with the tool of Fig. 2, particularly the swabs and their mount, constituting a piston for driving the knife 40 through the paraffin or other material adhering to the wall of the tubing.

In connection with the hollow mandrel 60, the mandrel and the check valve 74 are brought into play when swabbing in dead wells after the paraffin or other substance has been cleaned from the tubing. After the paraffin or other substance is cleaned from the tubing, the tool of Fig. 2 is lowered down the tubing through its own weight until it reaches the fluid level of the well. For this purpose, a hollow sleeve connection cage 98 is substituted for the connection 62, see Figs. 6 and 7, so that the fluid will pass through the hollow mandrel and lift the valve 74 from its seat, thus allowing the tool to submerge below the fluid level. After submerging of the tool to a proper depth, the tool is raised by the sand line 82 which causes the ball to reseat and prevent the fluid from passing back through the hollow mandrel. The tool is raised to the surface, thus pulling the oil below the tool with it. This operation may be repeated until the well begins to flow.

I claim:

1. In combination with oil well tubing, a cleaning tool adapted to travel in the tubing and having a cutting knife provided with a port for the passage of material therethrough cut from the tubing, a hydraulic means for driving the tool downwardly of the tubing, means actuated by material cut from the tubing when the tool is elevated for closing said port, said tubing including an outlet opening and a barrier located above the outlet opening, and a hoist connected with the tool for elevating the latter and extruding the material removed from the tubing and trapped between the knife and said barrier through said opening.

2. In combination with oil well tubing, a cutting knife for cutting material from the tubing and provided with a port for the passage of said material therethrough, piston means connected with said knife slidable inside said tubing, means for introducing fluid under pressure into the tubing above said piston means for driving the knife downwardly of the tubing, means actuated by material cut from the tubing when the tool is elevated for closing said port, said tubing including an outlet opening and a barrier located above the outlet opening, and a hoist connected with the tool for elevating the latter and extruding the material removed from the tubing and trapped between the knife and said barrier through said opening.

3. In combination with oil well tubing, a cutting knife for cutting material from the tubing and provided with a port for the passage of said material therethrough, piston means connected with said knife slidable inside said tubing, means for introducing fluid under pressure into the tubing above said piston means for driving the knife downwardly of the tubing, means actuated by material cut from the tubing when the tool is elevated for closing said port, said tubing including an outlet opening and a barrier located above the outlet opening, a hoist connected with the tool for elevating the latter and extruding the material removed from the tubing and trapped between the knife and said barrier through said opening, and a swab means movable with said knife for wiping off material left by the knife on the tubing.

4. In combination with oil well tubing, a cutting knife for removing material on the tubing and provided with a port for the passage of material therethrough, a piston slidable in said tubing, a rigid connection between the piston and said knife, said rigid connection being of materially smaller diameter than the inside

diameter of the tubing to provide a space for material moving through said port, means for introducing fluid under pressure into the tubing above said piston for driving the knife downwardly of the tubing, said tubing including an outlet valve and a barrier located above the outlet valve, and a hoist connected with the tool for elevating the latter and extruding the material removed from the tubing and trapped between the knife and said barrier through said outlet valve.

5. In combination with oil well tubing, a cutting knife for removing material on the tubing and provided with a port for the passage of material therethrough, a piston slidable in said tubing, a rigid connection between the piston and said knife, said rigid connection being of materially smaller diameter than the inside diameter of the tubing to provide a space for material moving through said port, means for introducing fluid under pressure into the tubing above said piston for driving the knife downwardly of the tubing, said tubing including an outlet valve and a barrier located above the outlet valve, a hoist connected with the tool for elevating the latter and extruding the material removed from the tubing and trapped between the knife and said barrier through said outlet valve, and a swab mounted on said rigid connection below the piston for wiping off material left by the knife on said tubing.

6. In combination with oil well tubing having a flow line connected therewith, a lubricator in the nature of a tubular structure mounted on said tubing and having an outlet valve, a tool mounted inside said lubricator comprising a rigid shank having a cutting knife connected with its lower end for cutting material from the tubing, piston means carried by said rigid shank above said cutting knife with the diameter of the shank beneath said piston means of materially smaller diameter than the inside diameter of the tubing to provide a space for material cut from the tubing, said cutting knife being provided with a port for the passage of material including means actuated by material cut from the tubing when the tool is elevated for closing said port, a stripper gate associated with said lubricator for closely embracing the small diameter reach of said shank for wiping material therefrom and constituting a barrier located above said outlet valve, means for introducing a high pressure liquid into the lubricator above said piston means for driving the cutting knife downwardly of the tubing, and a hoist line connected with said shank for elevating the cutting knife and extruding the material removed from the tubing and trapped between the knife and said gate through said outlet valve.

7. In combination with oil well tubing having a flow line connected therewith, a lubricator in the nature of a tubular structure mounted on said tubing and having an outlet valve, a tool mounted inside said lubricator comprising a rigid shank having a cutting knife connected with its lower end for cutting material from the tubing, piston means carried by said rigid shank above said cutting knife with the diameter of the shank beneath said piston means of materially smaller diameter than the inside diameter of the tubing to provide a space for material cut from the tubing, said cutting knife being provided with a port for the passage of material including means actuated by material cut from the tubing when the tool is elevated for closing said port, a stripper gate associated with said lubricator for closely embracing the small diameter reach of said shank for wiping material therefrom and constituting a barrier located above said outlet valve, means for introducing a high pressure liquid into the lubricator above said piston means for driving the cutting knife downwardly of the tubing, and a hoist line connected with said shank for elevation the cutting knife and extruding the material removed from the well casing and trapped between the knife and said gate through said outlet valve, said piston means comprising a swab follower.

8. In combination with an oil well tubing having a flow line connected therewith, a lubricator in the nature of a tubular structure mounted on said oil well tubing and having an outlet valve, a tool mounted inside said lubricator comprising a rigid shank having a cutting knife connected with its lower end for cutting material from the well casing, piston means carried by said rigid shank above said cutting knife with the diameter of the shank beneath said piston means of materially smaller diameter than the inside diameter of the well tubing to provide a space for material cut from the well casing, said cutting knife being provided with a port for the passage of material including means actuated by material cut from the well casing when the tool is elevated for closing said port, a stripper gate associated with said lubricator for closely embracing the small diameter reach of said shank for wiping material therefrom and constituting a barrier located above said outlet valve, means for introducing a high pressure liquid into the lubricator above said piston means for driving the cutting knife downwardly of the well tubing, and a hoist line connected with said shank for elevating the cutting knife and extruding the material removed from the well tubing and trapped between the knife and said gate through said outlet valve, said piston means comprising swab followers.

9. In combination with an oil well tubing having a flow line connected therewith, a lubricator in the nature of a tubular structure mounted on said oil well tubing and having an outlet valve, a tool mounted inside said lubricator comprising a rigid shank having a cutting knife connected with its lower end for cutting material from the well tubing, piston means carried by said rigid shank above said cutting knife with the diameter of the shank beneath said piston means of materially smaller diameter than the inside diameter of the well tubing to provide a space for material cut from the well tubing, said cutting knife being provided with a port for the passage of material including means actuated by material cut from the well tubing when the tool is elevated for closing said port, a stripper gate associated with said lubricator for closely embracing the small diameter reach of said shank for wiping material therefrom and constituting a barrier located above said outlet valve, means for introducing a high pressure liquid into the lubricator above said piston means for driving the cutting knife downwardly of the well tubing, a hoist line connected with said shank for elevating the cutting knife and extruding the material removed from the well tubing and trapped between the knife and said gate through said outlet valve, said piston means comprising swab means, and a swab for removing skim left on said well tubing by the knife.

10. In combination with an oil well tubing

having a flow line connected therewith, a lubricator in the nature of a tubular structure mounted on said oil well tubing and having an outlet valve, a tool mounted inside said lubricator comprising a rigid shank having a cutting knife connected with its lower end for cutting material from the well tubing, piston means carried by said rigid shank above said cutting knife with the diameter of the shank beneath said piston means of materially smaller diameter than the inside diameter of the well tubing to provide a space for material cut from the well tubing, said cutting knife being provided with a port for the passage of material including means actuated by material cut from the well tubing when the tool is elevated for closing said port, a stripper gate associated with said lubricator for closely embracing the small diameter reach of said shank for wiping material therefrom and constituting a barrier located above said outlet valve, means for introducing a high pressure liquid into the lubricator above said piston means for driving the cutting knife downwardly of the well tubing, and a hoist line connected with said shank for elevating the cutting knife and extruding the material removed from the well tubing and trapped between the knife and said gate through said outlet valve, said gate being adjustable to an open position to permit the shank and the piston means to pass therethrough.

11. In combination with an oil well tubing having a flow line connected therewith, a lubricator in the nature of a tubular structure mounted on said oil well tubing and having an outlet valve, a tool mounted inside said lubricator comprising a rigid shank having a cutting knife connected with its lower end for cutting material from the well tubing, piston means carried by said rigid shank above said cutting knife with the diameter of the shank beneath said piston means of materially smaller diameter than the inside diameter of the well tubing to provide a space for material cut from the well tubing, said cutting knife being provided with a port for the passage of material including means actuated by material cut from the well tubing when the tool is elevated for closing said port, a stripper gate associated with said lubricator for closely embracing the small diameter reach of said shank for wiping material therefrom and constituting a barrier located above said outlet valve, means for introducing a high pressure liquid into the lubricator above said piston means for driving the cutting knife downwardly of the well tubing, and a hoist line connected with said shank for elevating the cutting knife and extruding the material removed from the well tubing and trapped between the knife and said gate through said outlet valve, said shank including a hollow mandrel having port means located below said piston means and a check valve located above the piston means.

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