



# UNITED STATES PATENT OFFICE

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## APPARATUS FOR CLEANING OIL WELLS

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My invention relates to the operation of oil wells and has particular reference to removal of paraffin from the walls of the tubing through which the oil flows to the surface.

The object of my invention is to automatically remove paraffin from the walls of the oil flow tubing without the relatively high costs of mechanical and chemical methods formerly employed for this purpose.

In accordance with my invention paraffin is removed from the walls of oil well flow tubing by a tool actuated solely by the flow of oil from the well. More particularly in accordance with my invention, a suitable cutting tool is introduced into the flow tubing of an oil well and permitted to sink to a predetermined level below the point of paraffin accumulation, so that when the flow of oil is begun the cutting tool is carried upwardly solely by the fluid flow and scrapes paraffin from the tube walls; the paraffin is carried up by the oil and is removed from the well.

For a more complete understanding of my invention, reference is to be had to the accompanying drawing, in which

Fig. 1 is a view partly in vertical section of an oil well equipped with a cutting tool in accordance with my invention.

Fig. 2 is a longitudinal section of one form of such tool.

Fig. 3 is a longitudinal section of a modified form of cutting tool.

Fig. 4 is a detail of one end of the tool shown in Fig. 3.

Fig. 5 is a vertical cross-section of a shock-absorbing device.

Fig. 6 is a cross-section of a seat for the tool.

Fig. 7 is a horizontal section of the flow tubing on the line 1—1 of Fig. 1.

Referring to Fig. 2, the tool illustrated consists of a tubular member 1 from which project cutting edges 2 formed for example, by slotting the tube 1 at intervals and bending one edge of each of the slots outwardly so that it projects beyond the surface of the tube wall. This protruding portion may be sharpened to increase its effectiveness as a cutting edge. It is preferred to remove a portion of the member 1 in advance of the cutting edge to form a passageway 3 to permit oil to flow under the cutting edge and carry away the loosened wax. The wax is carried upwardly by the oil and is removed from the well with it.

The lower end 4 of the member 1 is preferably slightly flared or otherwise enlarged to an extent corresponding substantially to the projection of

the cutting edges 2. The enlarged portion 4 acts as a guide for the tool during its passage through the flow tubing.

An internal restriction 5 is preferably provided near the lower end of the member 1 to retard the passage of oil through it. The restriction presents sufficient surface to the flowing oil to permit the latter to carry the tool upwardly. The same effect may be obtained by other means, for example, by providing at the lower end of the tube a cap having one or more apertures in it, to permit the tube to sink through the oil when production is interrupted.

The flow tubing 6 is provided below the point of paraffin accumulation with a seat 7 which acts as a stop for the tool, fixing the level to which the latter sinks in the well and preventing its passing out of the lower end of the flow tubing. The seat may vary in form, one type which has proved satisfactory consists of a section of pipe 8 of smaller diameter than the flow tubing and provided with a plurality of fingers 9 having projections 10 adapted to extend through apertures 11 in the wall of the pipe section 8, and rest upon the upper end of a section of flow tubing at a connection between two sections or upon the threads of the connecting collar. At the upper end of the pipe 8 are provided a plurality of lugs 12 which arrest the downward motion of the tool 1. The fingers 9 are preferably made of resilient metal and are secured to the pipe 8 in such a manner that normally the projections 10 extend through the apertures 11.

To put the seat in place it is lowered on a line in the tubing to approximately the desired level in the well, the fingers 9 being held toward the center of the pipe 8 to prevent the projections extending beyond its outer surface, thus permitting it to descend readily through the flow tubing. The seat 7 is then jarred loose from the line, relieving the fingers, which, due to their resiliency, force the projections 10 through the apertures 11 and cause them to press against the wall of the flow tubing. By means of a suitable tool the member 8 is forced down to the next lower threaded collar 13 connecting two sections of flow tubing 14 and 15. The space between the upper and lower ends respectively of the two pipes permits the projection 10 to extend through the apertures 11 and to rest upon the threads of the connecting collar 13 or upon the upper end of the tubing section 15, and support the seat in place.

The flow tubing 6 connects with a line 16 at the ground level through which oil is conducted

to storage. The flow tubing 6 is extended above the line 16, and at the upper end of the extension 25 is provided a shock-absorbing device 17. A suitable form of apparatus is shown in Fig. 5.

5 A pipe section 18 of larger diameter than the flow tubing 6 and threaded at both ends, is provided with a cap 19 at the upper end and a collar 20 at the lower end adapted to connect to the extension 25 of the flow tubing 6. A compression spring 21, and below it a wooden block 22, preferably of oak and having a metal ferrule 23, are held in the pipe 18 between the cap 19 and collar 20. A gate valve 24 is provided in the extension 25 of the flow tubing above the line 16.

15 In carrying out my invention a cutting tool of the type described is introduced into the extension 25 of the flow tubing 6, preferably during a period when the well is not producing, as for example, by removing the cap 19 after closing the valve 24. The cap 19 is then replaced and the valve 24 opened, allowing the tool to sink through the oil in the tubing; the tool descends to the stop 7, the lower end resting upon the lugs 12. The stop is placed below the lower end of the zone of wax accumulation. When the well is put on stream and oil commences to flow through the tubing 6 the tool 1 is carried upwardly by the pressure of the oil on the surfaces of the tool exposed to the oil flow and the cutting edges 30 scrape the accumulated paraffin or wax from the tube walls. The wax thus loosened is carried up with the oil and is conducted from the well through the flow line 16.

25 The rate at which the tool is carried upwardly varies with different wells and in some instances may be sufficient to damage the tubing if means are not provided to arrest its motion before it strikes the upper end of the tubing. For this purpose the shock-absorber 17 is provided, the impact being absorbed by the spring 20, the wooden block 22 serving to prevent direct contact between the tool and the spring. During the flow period the tool is held in the extension 25 immediately above the flow line 16 by the pressure of the oil in the flow tubing 6 and when the flow is discontinued the tool sinks to the stop 7. The size of tool varies in accordance with the different diameters of flow tubing and should be such that it can pass freely through the tubing and at the same time scrape the paraffin from the walls to leave a film of minimum thickness consistent with free motion of the tool.

35 The paraffin accumulation occurs, in general, at the upper portion of the flow tubing where the temperature is low enough to cause it to precipitate from the oil. Most of the accumulation occurs during periods when the well is not producing, as for example, during the period of shut-down in a prorated area, at which time wax tends to precipitate from the oil in the tubing. A paraffin cleaner of the type described is of particular advantage for this purpose since it descends in the flow tubing as soon as the well is shut down, when the paraffin accumulation is at the minimum and, when flow is resumed, the tool is carried up and scrapes the deposit of wax from the tubing.

40 A primary advantage of this type of tool is that it is entirely automatic and does not require attachment to a string of tools, such as is necessary with the usual paraffin cutter, paraffin hook or electric heater which have been used to some extent for this purpose.

45 While my invention has been described with reference to a particular tool, it is to be under-

stood that other forms of cutting device may be used in its stead. A modified form of tool shown in Fig. 3 may be described briefly as a tubular member having at least one cutting edge with apertures adjacent said cutting edge to permit flow of fluid from the interior of said tubular member. It comprises a section of tubing 30 in the upper end of which is provided a solid member 31 carrying a circular cutting edge 32 and a plurality of tapered lugs 33 which act as guides to maintain the tool in proper position in the flow tubing and prevent its sticking. The end of the member 31 projecting into the tubular section 30 is provided with a recess 34. Apertures 35 between the guides 33 and the cutting edge 32 provide channels through which fluid may flow from the interior of the tubing 30. The lower end of the tool is preferably provided with a member 38 carrying the circular cutting edge 36 and lugs or guides 37. An open channel for the passage of fluid is provided through the member 38.

5 The operation of this tool is similar to that described above. When the well is flowing the tool is carried upwardly by the pressure of the oil exerted on the portions of the tool exposed to the oil flow. The cutting edge 32 scrapes the wax from the walls of the flow tubing 6, the loosened wax being carried upwardly by the oil flowing through the apertures 35. As the oil travels more rapidly than the tool the loosened paraffin is carried ahead of it. The apertures 35 are of further advantage in that in case the accumulation of paraffin on the walls of the flow tubing should be such that the tool tends to stick, gas and oil flowing through the apertures will wash away the paraffin and permit the tool to rise.

10 The cutting edge 36 on the lower end of the tool is of advantage in that it removes any small amount of wax which may have accumulated during the flow period and facilitates the settling of the tool upon cessation of oil flow.

15 It will be understood that the above embodiment of my invention is merely descriptive, and it is not limited thereto, for various modifications may be made coming within the spirit and scope of the appended claims.

What I claim is:

1. A paraffin removing tool for use in oil well flow tubing, comprising an elongated tubular member open at one end and provided with a closure at the opposite end, a circular cutting edge adjacent to and facing in the direction of the closed end of said tubular member, and channels through the wall of said tubular member adjacent the face of said cutting edge.

2. A paraffin removing tool for use in oil well flow tubing, comprising an elongated tubular member open at one end and provided with a closure at the opposite end, a circular cutting edge adjacent to and facing in the direction of the open end of said tubular member, a second circular cutting edge adjacent to and facing in the direction of the closed end of said tubular member, and channels through the wall of said tubular member adjacent the face of said cutting edge.

3. A paraffin removing tool for use in oil well flow tubing, comprising an elongated tubular member open at one end and provided with a closure at the opposite end, a circular cutting edge adjacent to and facing in the direction of the open end of said tubular member, a second circular cutting edge adjacent to and facing in the

direction of the closed end of said tubular member, and channels through the wall of said tubular member adjacent the face of said second-mentioned cutting edge, the surface of said tubular member exposed to the flow of fluid being sufficient to cause the tool to be carried upwardly solely by the normal flow of fluid and to sink upon cessation of fluid flow.

4. In combination, an oil well flow tubing and a paraffin removing tool, the latter comprising an elongated tubular member with means adjacent

one end to permit fluid to pass from the tubing into and through the interior of said tubular member, a closure in the opposite end of said tubular member, orifices in the wall of said tubular member adjacent said closure, and a circular cutting edge adjacent said orifices facing in the direction of said closure and between said orifices and said means to permit fluid to flow into said tubular member.

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