

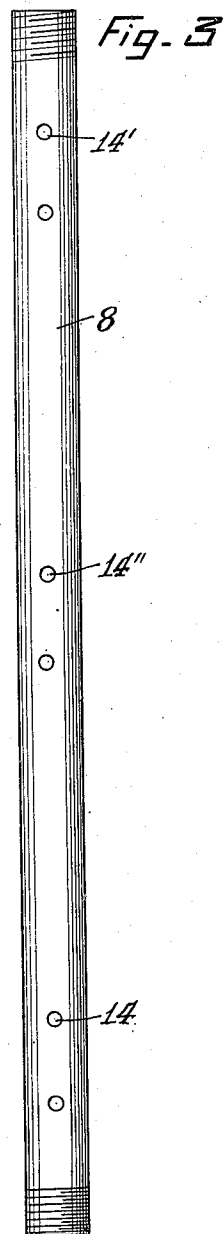
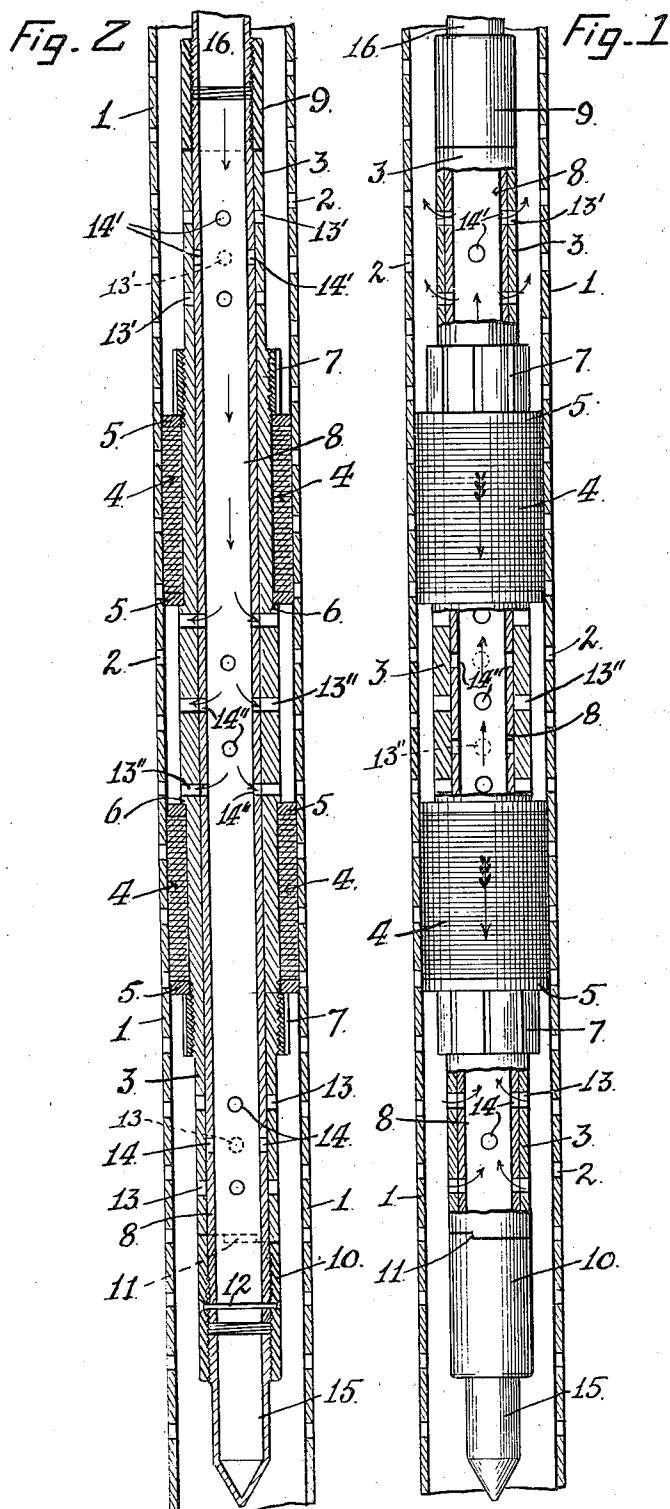
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A. L. HALLIDAY

PERFORATION CLEANER FOR OIL WELL CASINGS

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UNITED STATES PATENT OFFICE.

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PERFORATION CLEANER FOR OIL-WELL CASINGS.

Application filed March 25, 1922. Serial No. 546,587.

To all whom it may concern:

Be it known that I, ALONZO LEWIS HALLIDAY, a citizen of the United States, residing at Oil Center, in the county of Kern and State of California, have invented certain new and useful Improvements in Perforation Cleaners for Oil-Well Casings, of which the following is a specification.

My invention relates generally to oil-well devices and appliances, and particularly to a device for cleaning out the perforations of a well-casing.

The object of my invention is to provide a simple and effective appliance for this purpose, by the use of which the clogging accumulations in the perforations may be dissolved or disintegrated, and removed by being forced out into the formation.

To this end my invention consists in the novel perforation cleaner which I shall hereinafter fully describe by reference to the accompanying drawings, in which—

Fig. 1 is an elevation, partly broken in vertical section, of my device, showing it in the well casing, the valve controls being in position to permit the cleaner to be lowered or lifted without resistance from the fluid in the well.

Fig. 2 is a vertical section of the device showing the valve controls in position for discharging the perforation-cleaning fluid introduced when the device is in operation.

Fig. 3 is an elevation of the valve-tube. 1 is the well casing, showing that portion which includes the perforated area, the numeral 2 indicating the perforations.

The cleaner appliance comprises a tubular or hollow mandrel 3, to the exterior of which are fitted two packers 4 spaced any predetermined distance apart. A simple and practical fitting of these packers consists in binding them between washers 5 and shoulders 6, by means of nuts 7 screwed upon the mandrel.

Fitted snugly in the smooth bore of the mandrel 3 is an inner tube 8, which constitutes the valve-control.

Upon the upper end of the valve tube is screwed a collar 9, and upon its lower end is screwed a collar 10, the ends of said collars abutting against the upper and lower ends of the mandrel, respectively, thereby closing the mandrel, and confining the tube within it; but said tube is adapted to be oscillated therein on its axis. A stop feature

for this oscillatory axis-movement of the tube 8 is provided, which feature, in its present form, consists of the interengaging shoulders 11, formed by the arcuate cutting away of the abutting faces of the bottom of the mandrel and top of the collar 10. A pin 12, Fig. 2, is riveted through the valve tube and the collar 10 to fix the collar on the tube.

In the wall of the mandrel 3, below the lower packer are ports 13, and in the wall of the valve tube 8 are ports 14 which, by the oscillatory movement of the tube, are thrown into and out of register with the mandrel ports.

Similarly, in the mandrel and valve-tube, above the upper packer are ports 13' and 14', respectively, corresponding in position to the lower ports 13 and 14, so that both sets of ports are moved into and out of register simultaneously, by the turning of the valve-tube. In the walls of the mandrel and the valve-tube, in the area between the two packers 4, are ports 13'' and 14'' respectively. These last named ports are, however, placed relatively to the first named ports, in such wise that when the upper and lower sets of ports are opened the intermediate set is closed and vice-versa; and at an intermediate position all three sets are closed.

The lower end of the valve-tube 8 is closed by a plug 15 screwed to the lower collar 10, said plug serving also as a rest in case the device is lowered to the bottom of the well.

To the upper collar 9 is connected the tubing string 16.

In using the cleaner, the tubing string 16 is connected at the derrick to a discharge line from a force pump, by a swivel connection, the tubing being suspended by means of elevators hooked onto the regular tubing-pulling equipment, but as these parts are not necessary for an understanding of my present invention, I have not herein shown them.

My device being, as above stated, connected to the bottom of the tubing string, is lowered into the well to the desired depth. Due to the fact that the tight fit of the packers 4 in the casing 1, prevents the mandrel 3 from turning, the valve tube 8 may be turned in the mandrel (by turning the tubing string at the derrick) until it is arrested by the stop 11, and in this position the lower set of ports 13 and 14 and the upper set of

ports 13' and 14' are in respective register, as shown in Fig. 1, so that the fluid in the well may pass in through the ports 13 and 14 and up in the inner tube 8, and out through the ports 13' and 14' as indicated by the arrows. By such relief passage for the fluid in the well, the device may be lowered easily; otherwise, the packers 4 would act as pistons and would have to be forced down against pressure. When the device has been lowered to the desired depth, the valve tube is turned back again to its stop, thereby closing the ports 13, 14, 13' and 14' and opening the intermediate ports 13'' and 14'', in the area between the two packers, as shown in Fig. 2. Then fluid is pumped down through the tubing string 16 and this fluid, discharging through the ports 13'' and 14'' of the cleaner, clears the perforations 2 in the casing 1, in the zone or region lying between the two packers, said fluid being prevented from discharging otherwise, because the valve tube 8 is closed except at the ports 13'' and 14''.

The volume and pressure of the fluid pumped out through the relatively restricted space between the packers is effective to remove or dissolve the clogging accumulations from the casing perforations 2 and from the outer wall of the casing.

By vertically moving the cleaner at intervals, a distance determined by the length of the space between the packers, and applying fluid pressure, as mentioned, the entire section of well-casing perforations may be cleaned.

A further advantageous feature in the operation of the cleaner is that by turning the inner tube only partially all the port sets may be closed. The fact that they are closed may be indicated by a pressure gage on the force pump line at the derrick. After this pressure has reached a desired height, the inner tube may be turned farther to open the ports 13'' and 14''; and by thus suddenly releasing this high pressure, it will serve more effectively to remove the clogged formation from the casing perforations.

Upon removing the device from the well, the upper and lower sets of ports are again opened to permit the fluid above the top packer and that which stands in the tubing string to flow back into the well, and thus prevent the pulling of a wet string. Any fluid such as oil, distillate or water may be used in the operation of the device, to suit the particular difficulty encountered. Clean crude oil of low gravity and slightly warm will be found effective, as it acts to suspend in solution the formation with which it comes in contact, and so allows it to flow back into the well, to be pumped out.

Another point of advantage lies in the fact that by the use of this device any imperforate spaces of the well casing, which

sometimes happen, by reason of a defective perforating machine, may be located, as such spaces will show on the pressure gage.

I claim:—

1. A perforation cleaner for well-casing comprising a hollow mandrel having ports in its side; a pair of spaced packers carried by the mandrel one on each side of its ports and adapted for contact with the interior of the well casing to close an annular space between the mandrel and casing; and a valve member seated within said mandrel for controlling its ports.

2. A perforation cleaner for well-casing, comprising a hollow mandrel having ports in its side; a pair of spaced packers carried by the mandrel one on each side of its ports and adapted for contact with the interior of the well casing to close an annular space between the mandrel and casing; an axially oscillatory hollow valve member fitted within and closing the mandrel, said valve member having ports in its side adapted to move into and out of register with the ports in the mandrel; and a tubing string connected with and adapted to pass fluid under pressure into the valve member.

3. A perforation cleaner for well-casing comprising a hollow mandrel having upper, lower and intermediate ports in its side; a pair of spaced packers carried by the mandrel one between the upper and intermediate ports and one between the lower and intermediate ports, said packers being adapted for contact with the interior of the casing to close an annular space between the mandrel and casing; an axially oscillatory hollow valve-member fitted within and closing the mandrel, said valve member having upper, lower and intermediate ports in its side adapted to move into and out of register with the corresponding ports of the mandrel, the upper and lower ports of the mandrel and valve member relatively corresponding, whereby their control is simultaneous, and the intermediate ports being angularly offset relatively to and their control alternative with said upper and lower ports; and a tubing string connected with and adapted to pass fluid under pressure into the valve member.

4. A perforation cleaner for well-casing comprising a hollow mandrel having upper, lower and intermediate ports in its side; a pair of spaced packers carried by the mandrel one between the upper and intermediate ports and one between the lower and intermediate ports, said packers being adapted for contact with the interior of the casing to close an annular space between the mandrel and casing; an axially oscillatory hollow valve-member fitted within and closing the mandrel, said valve member having upper, lower and intermediate ports in its side adapted to move into and out of register

ter with the corresponding ports of the mandrel, the upper and lower ports of the mandrel and valve member relatively corresponding whereby their control is simultaneous, and the intermediate ports being angularly offset relatively to and their control alternative with said upper and lower ports; a stop for defining the limits of oscillation of the valve member; and a tubing string connected with and adapted to pass fluid under pressure into the valve member.

5. A perforation cleaner for well casing comprising a member to be suspended within the casing and adapted for discharging a fluid under pressure against the perforated section thereof; means seated within said

member for controlling the discharge therefrom and means for closing the space in the casing around said member in the zone of its discharge.

6. A perforation cleaner for well casing comprising a member to be suspended within the casing and adapted for discharging a fluid under pressure against the perforated section thereof; an axially oscillatory valve seated within said member for controlling the discharge therefrom; and means for closing the space in the casing around said member in the zone of its discharge.

In testimony whereof I have signed my name to this specification.

ALONZO LEWIS HALLIDAY.