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PERFORATION CLEANER

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6 Claims. (Cl. 166—20)

This invention relates to a perforation cleaner designed to be used to clean the perforations in perforated liners such as are used in oil wells.

The principal function of the device is to suddenly induce an inward flow through an isolated portion of a well liner so as to wash the perforations therein clean of any clogging or obstructing material.

An object of the invention is to provide a perforation cleaner which can be lowered to any desired depth within a perforated liner and which will effectively isolate the portion of the liner that is therebelow and which, when operated, will create a sudden and swift inward flow to wash the perforations of the liner clean.

Another object of the invention is to provide a perforation cleaner which can be operated successively in the well without requiring that the device be completely withdrawn from the well for each operation. Instead, with the present construction, the device after having been once operated, need merely be withdrawn to a point above the required level in the well and thereafter returned to the desired depth in the liner for a successive operation.

Another object of the invention is to provide a perforation cleaner which is of relatively simple construction and which is quite durable and which has provision made for effectively cleaning itself so that the moving parts thereof will not become frozen or obstructed in their operation.

A further object of the invention is to provide a perforation cleaner wherein there is an air chamber to which is telescopically connected a swab or equivalent obstruction forming means with provision being made for opening the air chamber to permit ingress thereto from below the swab. The apparatus is characterized by the fact that provision is made for bypassing liquid around the swab while the device is being lowered to the desired depth in a well, the bypass being then closed at the time that ingress is permitted to the air chamber, and subsequently opened to permit bypassing of fluid around the swab while the device is being withdrawn. In this manner, while fluid may be bypassed around the swab during lowering and during withdrawal, the bypass is closed at the time that the air chamber is opened so that the sole means of ingress to the air chamber is from a point or points below the swab.

With the foregoing and other objects in view, which will be made manifest in the following detailed description and specifically pointed out in the appended claims, reference is had to the

accompanying drawing for an illustrative embodiment of the invention, wherein:

Figure 1 is a vertical section through the improved perforation cleaner;

Fig. 2 is a view in side elevation of the same on a slightly smaller scale; and

Fig. 3 is a vertical section through a well liner illustrating the perforation cleaner for operative position therein.

Referring to the accompanying drawing wherein in similar reference characters designate similar parts throughout, 10 designates a well liner in a well having perforations 11 that it is desired to clean. The perforation cleaner comprises a suitable air chamber which may be formed or provided by one or more sections of pipe or tubing 12 closed at the top as by a cap 13 to which may be attached a bail 14 by which the device may be lowered into a well as by a sand line 15. In the bottom of the air chamber 12 there is screwed a nipple 16 which provides a valve seat at 17 for a valve 18. A hollow stem 19 is attached to the nipple and extends downwardly therefrom. This hollow stem is preferably jointed as at 20 and adjacent the joint there is welded or otherwise secured an internal shoulder 21 which forms a spring seat for a coil spring 22 that surrounds the valve stem 23 and urges the valve 18 to closed position against seat 17. A sleeve 24 is telescopically mounted on the hollow stem 19 and carries an obstruction-forming means such as a swab 25. The swab illustrated is of the type now generally known on the market as a Guiberson swab, and when such form of construction is used the sleeve 24 is preferably externally shouldered as at 26 to abut against the internal metal sleeve 27 on the swab. The swab is held in position against the shoulder by means of a cap 28 screwed onto the sleeve. Diametrically opposed slots 29 are formed in the sleeve and longer slots 30 are formed in the hollow stem. A transverse bar or key 31 extends through the slots 30 and 29 and through a nut 32 on the bottom of valve stem 23. This bar has its center recessed on its upper side to receive the bottom of the valve stem that is screwed into the nut, thus locking the bar or key 31 against endwise movement through the nut. Above the swab the hollow stem 19 is provided with an outlet port 33 which is adapted to register with either of two outlet ports 34 and 35 in the sleeve. Upward movement of the sleeve relative to the stem 19 is limited by engagement of the top of the sleeve with nipple 16. Downward movement of the sleeve relatively to the stem 19 is limited by a shoe 36 on the stem which also provides a cage for

a ball valve 37 adapted to seat and close the bottom of the stem 19. 38 designates a diametrical pin that maintains the ball 37 adjacent its seat.

The operation of the device is substantially as follows: The normal position of the device is substantially as shown in Fig. 1 wherein the entrance to the air chamber 12 is closed by valve 18. The spring 22 is sufficiently strong to keep the valve closed even though the weight of the sleeve 24 and the swab is resting on the bar or key 31. The device is lowered into the well by the sand line 15 to the desired position within the liner 10. As the valve 18 is kept closed during the lowering of the device, it is manifest that the air within the air chamber is kept at approximately atmospheric pressure.

During the lowering operation it will be noted that port 34 is in registration with port 33 so that fluid entering the hollow stem either through the shoe 36 or through the slots 29 and 30 may bypass around the swab and discharge from the stem through the registered ports 33 and 34. When the device has been lowered to the desired depth within the liner, the sand line is pulled upwardly lifting the air chamber relatively to the swab. It will be appreciated that the friction between the swab and the liner will be sufficient to hold the swab in position and cause the ends of the bar or key 31 to be drawn upwardly against the top of slots 29.

When the upward movement takes place port 33 is first moved out of registration with port 34 so that the bypass around the swab is closed. On the continued upward movement, as the upward movement of valve 18 is arrested by the engagement of the bar or key 31 with the top of the slots 29, the seat 17 is drawn away from the valve thus opening the entrance to the air chamber. The bypass having been closed, the sole means of ingress to the air chamber is from a point below the swab and as the hydrostatic pressure in the well is many times greater than the atmospheric pressure of the air in the air chamber, there will be a sudden, swift inrush of liquid into the air chamber. This sudden inrush causes ball 37 to be lifted and to seat against the bottom of the hollow stem closing the bottom of the hollow stem and thus causing the major portion of the flow to take place through slots 29 and 30. This sudden inrush of fluid into the device at a point below the swab effectively sucks the perforations in the liner clean. As the swab forms a type of obstruction isolating the lower portion of the liner from the upper portion, this suction effect is effective on the perforations below the swab.

On continued upward movement of the sand line 15 and of the air chamber, the hollow stem 19 is drawn upwardly with the sleeve 24 until the sleeve engages shoe 36. In this other extreme position port 35 is brought into registration with port 33 thus re-opening or re-establishing a bypass around the swab permitting liquid to bypass while the device is withdrawn.

It is not necessary to withdraw the device entirely from the well for each operation. Instead, it is merely necessary to withdraw the device to a point above the liquid level in the well so as to empty the air chamber or inrushed liquid and to re-fill the air chamber with air at substantially atmospheric pressure. When this is accomplished the device is ready to be re-lowered to either the same or a different level in the liner and again operated.

The primary purpose of the valve 37 is to permit the bottom of the hollow stem 19 to empty itself

of sand or debris that may tend to collect therein. The ball 37 will normally drop to the pin 38 so that the bottom of the stem is normally open. This keeps the bottom of the stem clean so that no sand will collect therein to obstruct downward movement of the valve stem 23 through the hollow stem when the device is operated.

Where the well is extremely sandy so that fluid rushing into the device and into the air chamber carries sand with it, a bailer bottom or a similar check valve device may be installed between nipple 16 and the pipe or tubing formed in the air chamber so as to effectively entrap the sand entering the air chamber. This is only used under extreme conditions for the reason that when employed the device must be completely withdrawn from the well every time that it is operated so as to open the air chamber and reduce the air chamber to atmospheric pressure.

From the above-described construction it will be appreciated that the device is of relatively simple and durable construction having few moving parts but enabling liquid to bypass around the swab during the lowering of the device, then a closing of the bypass and opening the air chamber to create the sudden inrush of fluid through the perforations and a subsequent opening of the bypass to permit fluid to bypass around the swab as the device is withdrawn.

Various changes may be made in the details of construction without departing from the spirit and scope of the invention as defined by the appended claims.

I claim:

1. A perforation cleaner comprising means providing an air chamber having a valve controlled inlet, a sleeve telescopically connected to the air chamber, a swab on the sleeve, spring means urging the valve into closed position, means connecting the valve to the sleeve whereby upon upward movement of the air chamber relative to the sleeve the air chamber may be opened, there being an inlet to the sleeve below the swab and two outlets from the sleeve arranged above the swab to bypass fluid around the swab before and after the valve is opened but to be closed at the time that the valve is opened.

2. A perforation cleaner comprising means providing an air chamber, a valve closing the bottom of the air chamber, spring means urging the valve into closed position, a sleeve telescopically connected to the air chamber, a swab on the sleeve, means connecting the valve to the sleeve, there being an inlet to the sleeve below the swab and two outlets from the sleeve above the swab, said outlets being arranged so as to open a bypass around the swab while the device is being lowered into a well and then to close the bypass at the time that the valve is opened and subsequently open the bypass after the valve has been opened.

3. A perforation cleaner comprising means providing an air chamber having a hollow stem connected thereto, a valve seat in the hollow stem, a valve for the valve seat closing the entrance to the air chamber, a sleeve telescopically mounted on the hollow stem, a swab on the sleeve, there being an inlet to the hollow stem below the swab, an outlet port in the hollow stem above the swab, there being two outlet ports in the sleeve above the swab, each of which is adapted to register with the outlet port in the hollow stem, and means connecting the valve to the sleeve whereby on upward movement of the air chamber relative to the swab the outlet from the hollow stem will first be closed, the inlet to the air chamber will

then be opened and the outlet from the hollow stem will subsequently be re-opened.

5 4. A perforation cleaner comprising means providing an air chamber having a hollow stem connected thereto, a valve seat in the hollow stem,
10 a valve for the valve seat closing the entrance to the air chamber, a sleeve telescopically mounted on the hollow stem, a swab on the sleeve, there being an inlet to the hollow stem below the swab,
15 an outlet port in the hollow stem above the swab, there being two outlet ports in the sleeve above the swab, each of which is adapted to register with the outlet port in the hollow stem, and means connecting the valve to the sleeve whereon on upward movement of the air chamber relative to the
20 swab, the outlet from the hollow stem will first be closed, the inlet to the air chamber will then be opened and the outlet from the hollow stem will subsequently be re-opened, and an upwardly closing check valve arranged at the bottom of the hollow stem.

5 5. A perforation cleaner comprising means providing an air chamber, a valve normally closing the bottom of the air chamber against ingress thereto, spring means urging the valve into closed
25 position, a sleeve telescopically connected to the air chamber, a swab on the sleeve, means connecting the valve to the sleeve, so as to permit of a limited relative movement of the sleeve with respect to the air chamber without disturbing the valve, there being an inlet to the sleeve below the swab and two outlets from the sleeve above the swab, said outlets being arranged so as to open a bypass around the swab while the device is being lowered into a well and then to close the bypass at the time the valve is opened to permit ingress to the air chamber and thereafter to open the bypass after the valve has been opened.

6. A perforation cleaner comprising means providing an air chamber, a hollow stem extending downwardly therefrom, a sleeve telescopically mounted upon the hollow stem, a swab on the sleeve, a valve normally closing the entrance to the air chamber, spring means urging the valve into closed position, means connecting the valve to the sleeve in such a manner as to permit of limited relative movement between the sleeve and valve without opening the valve, there being an entrance to the stem below the swab, an outlet port in the stem above the swab and vertically spaced outlet ports in the sleeve above the swab either of which may be brought into registration with the outlet port in the stem.

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