Dec. 13, 1927. 1,652,744

L. SORENSEN

SWAB

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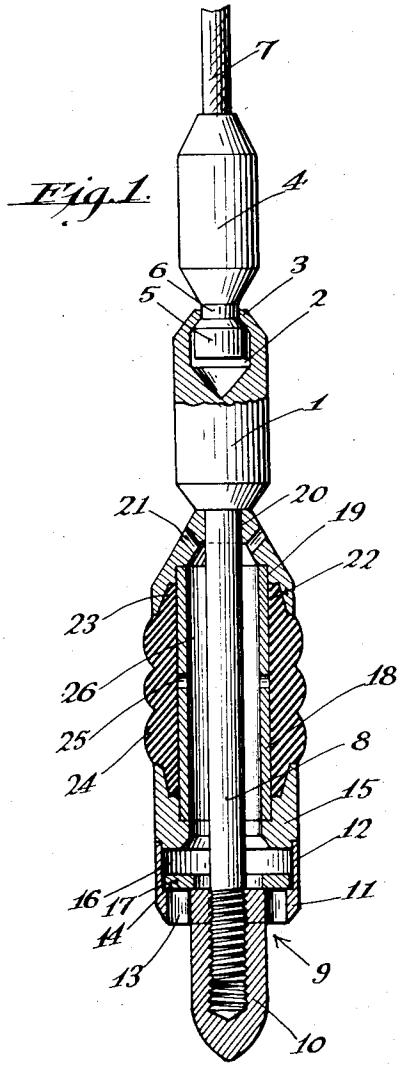



Fig. 1.

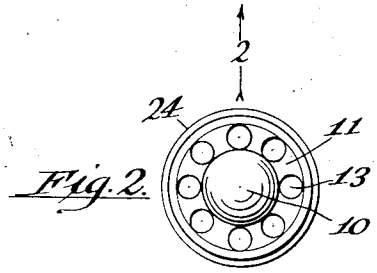



Fig. 2.

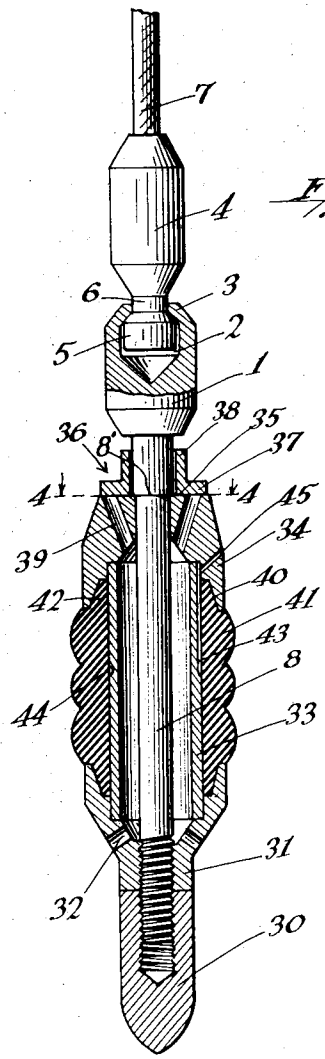



Fig. 3.

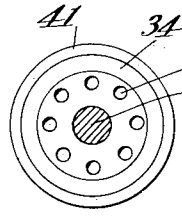



Fig. 4.

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# UNITED STATES PATENT OFFICE.

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## SWAB.

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My invention is a swab for cleaning deep wells, such as oil wells or the like, these swabs being especially designed to clean the casings of oil wells or other pipes, such as an oil pipe string in oil well production.

An object of my invention is the construction of a swab which may be readily lowered into a well, the oil or other liquid passing freely through the body of the swab and on pulling this swab upwardly a resistance to the flow of oil down through the swab is created so that the liquid expands the swab, thus causing it to clean the inside surface of the pipes through which it is drawn.

In constructing my swab I utilize a body structure having a tubular passage therethrough, there being a rod or stem extending centrally through this passage. A rubber swabbing device is fitted on the tubular structure. I provide ports at the top and bottom of the body structure so that oil may freely pass through the tubular body structure in lowering the swab into the well and provide a check valve which prevents the back-flow or downward flow of the liquid through the body of the swab. In one form of my construction the liquid or oil is conveyed between the rubber and the body structure from the tubular passage and in another construction by means of a passage directly connected to the liquid above the swab. This expands the rubber against the tube or pipe and allows its cleansing.

My invention is illustrated in the accompanying drawings, in which:

Figure 1 is a vertical longitudinal section diametrically through one form of my swab.

Figure 2 is a base view taken in the direction of the arrow 2 of Fig. 1.

Figure 3 is a section similar to Fig. 1 of a modified form of swab.

Figure 4 is a horizontal section through the swab of Fig. 3 on the line 4—4 of such figure in the direction of the arrows.

Dealing with the swab of Figs. 1 and 2, this has a head 1 which, by means of the socket 2 having the in-pressed ends 3, is connected to a swivel 4 having an enlarged lower end 5 with a reduced neck 6, this swivel being connected to a cable 7.

A stem 8 extends downwardly from the head 1, being rigidly connected thereto, and on the lower end of this stem a plug 9 is screw threaded. Such plug has a separate piercing point 10 and a shoulder 11 with an upwardly extending flange 12 parallel to the stem. There are a series of ports 13 through the shoulder and the upper part of the shoulder forms a valve seat 14. A lower collar 15 rests on the upper end of the flange 12 leaving a space 16 in which the valve 17 may operate, such valve being annular and preferably flat to form a closure of the ports 13 when it rests on the seat 14 and is spaced from the stem 8.

A tube 18 is connected to the collar 15, extending upwardly therefrom, and has an upper collar 19 attached thereto. This upper collar has a sliding fit on the stem 8, as indicated by the numeral 20, and is provided with a series of diagonal ports 21.

The lower and the upper collar form with the tube 18 a pair of annular sockets 22 and in these sockets is fitted the tapered end 23 of the rubber or other resilient swabbing element 24 of an expanding type, there being a plurality of perforations 25 through the tube 18 leading from the pressure chamber 26 inside the tube to the inner surface of the rubber swab element.

The manner of operation of my swab of Figs. 1 and 2 is substantially as follows:

When this is lowered into a well having oil or other liquid therein, as the swab substantially fills the casing or pipe, the oil or liquid is forced through the ports 13 lifting the valve 17, flows up the space between the valve and the stem 8, and in the pressure chamber 26 between the stem 8 and the tube 18, the oil or other liquid flowing out of the ports 21 in the upper collar 19. Thus the swab is allowed to sink through the oil or other liquid in the well.

On the upward pull of the cable the relative downward flow of the liquid in the pressure chamber 26 closes the valve 17 against the seat 14, thereby shutting off the ports 13 and preventing down-flow of the liquid. Due to the relative rising motion of the swab through the liquid a considerable pressure is exerted in the pressure chamber due to the free hydraulic communication through the ports 21 and this forces the liquid through the apertures 25 in the tube 18, thus forcing liquid between the inner surface of the resilient swab element 24 and the tube 18, expanding such swab element or packer until it bears tightly against the pipe or casing and hence scouring or swabbing such structures on the upward pull of the device.

In the construction shown in Figs. 3 and

4 the details of the elements 1 through 8 are substantially the same, with the exception of the shoulder 8′ as those above described. In this case, however, I prefer to have a separate point 30 screw threaded on the lower end of the stem 8 and to also have a lower collar 31, also screw threaded thereon, this collar having a series of ports 32. A tube 33 rests on the collar 31, extending upwardly therefrom, and has an upper collar 34 resting on the upper end of such tube. This upper collar preferably has a flat upper surface 35 on which is fitted a valve 36, such valve having a horizontal flange 37 and a cylindrical sleeve 38, the sleeve having a sliding fit on the stem 8 and the horizontal flange forming a closure for the ports 39 extending through the collar 34. The upper and lower collars form annular sockets 40 and the swab elements 41 or packers, formed of rubber or other resilient material, have tapered ends 42 fitting in such sockets. The tube is provided with one or more longitudinal grooves 43 and preferably with an annular groove 44 extending around the central portion of the tube. The longitudinal grooves connect to a pressure port 45 extending through the upper cap.

The manner of operation of the swab of Figs. 3 and 4 is substantially as follows:

After this is lowered through the oil or other liquid in the well, such liquid flows upwardly through the ports 32, the annular space between the stem 8 and the tube 33, and out of the ports 39, in such action lifting the valve 36 by the outflowing liquid impinging on the flange 37. Thus the swab may be sunk to the desired depth in the well.

On pulling up on the cable the valve 36 is seated, closing the ports 39 and thus preventing the relative downward flow of the liquid through the swab in its upward travel. On account of the close fit of the swab or packer element 41 to the casing or pipes, the liquid develops a pressure which forces some of same through the pressure port 45 and into the groove or grooves 43. Such liquid then distributes itself around the inside of the swab or packer element 41, between same and the tube 33, thus expanding the element 41 into sufficiently close contact with the pipe or casing to scour or swab same in the upward travel of the device. It will be understood that the higher the rate of travel of the swab, the greater pressure it develops against the sides of the tube or casing.

Various changes may be made in the principles of my invention without departing from the spirit thereof, as set forth in the description, drawings and claims.

I claim:

1. A swab comprising in combination a stem having means to connect same to a cable, a tube surrounding the stem, two rigid structures connected to the upper and lower ends of the tube, means connecting the structure at the lower end of the tube to the lower end of the stem, an annular expansible swab element on the tube, ports through the structures at the upper and lower ends of the tube, a slidable valve to close the ports in one of said structures to prevent downward flow of liquid through the tube but to allow upward flow of liquid, and means on the outside of the tube to pass some of the liquid, on the upward movement of the swab in the pipe, outside the tube and underneath the expanding swab element to expand same.

2. A swab comprising in combination a stem having means to connect same to a cable at its upper end, a lower collar connected to the lower end of the stem, an upper collar having a loose fit on the stem, a tube between said collars having an expansible swab element thereon, said element being engaged by the collars to retain the ends thereof, ports through the collars entering into the tube, a valve on the upper part of the stem forming a closure for the ports in the upper collar, the upper collar having a pressure port there-through, and means on the tube to lead the fluid from said port between the tube and the swab element to expand the latter on the upward movement of the swab through a pipe containing a liquid.

3. A swab comprising in combination a stem having means to connect same at its upper end to a cable, a collar attached to the lower end of the stem, a tube supported by the collar, an upper collar fitted on the tube and on the stem, an annular expansible swab element on the tube between the collars, ports through the collars leading into the tube, a valve on the upper part of the stem forming a closure for the ports in the upper collar, said valve allowing the upward flow of liquid through the tube but preventing downward flow, and the upper collar having means through which liquid flows between the swab element and the tube to expand the said swab element on the upward movement of the swab.

4. A swab comprising in combination a stem having means to connect same to a cable at its upper end, a tube surrounding part of the stem, upper and lower means securing the stem and the tube to retain the tube in position, an annular swab element on the tube, a valve on the stem above the upper means securing the tube on the stem, said means having ports there-through, said valve permitting upward flow of liquid but preventing downward flow, and a passage in the upper securing means allowing flow of liquid between the swab element and the tube on the upward movement of the stem.

5. A swab comprising in combination a stem having a head at its upper end with means therein to swivelly connect same to a

cable, the lower end of the stem being screw-threaded, a structure forming a point threaded on said lower end, a lower collar threaded on the lower end of the stem above the point, a tube resting on said collar surrounding the stem, an upper collar slidable on the stem, engaging the upper part of the tube, there being a shoulder on the stem engaging the upper collar, a swab element on the tube between the said collars, there being ports through said collars, an annular valve surrounding the stem seated on the upper collar, said valve allowing upward movement of liquid but preventing downward movement, there being a passage for liquid between the swab element and the tube to allow expansion of said element on the upward movement of the stem.

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

LUTHER SORENSEN.