June 20, 1939. J. T. PHIPPS 2,163,058

SWAB

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FIG. 1.

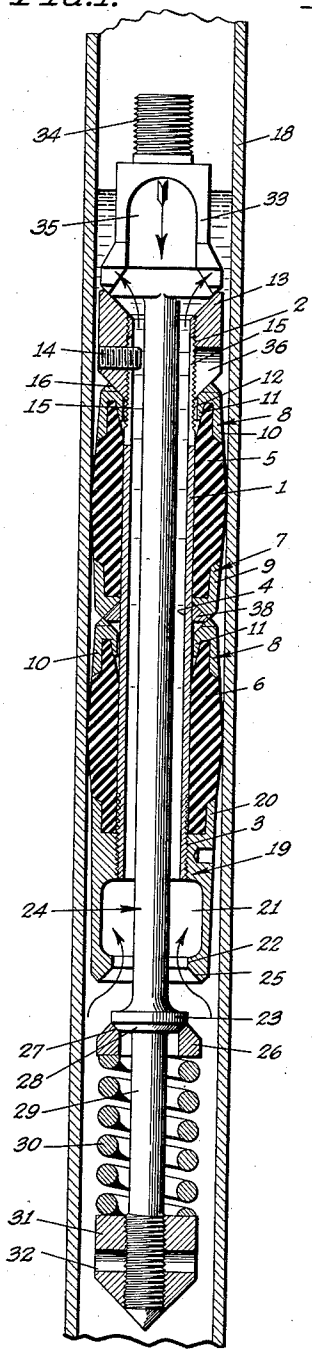


FIG. 2.

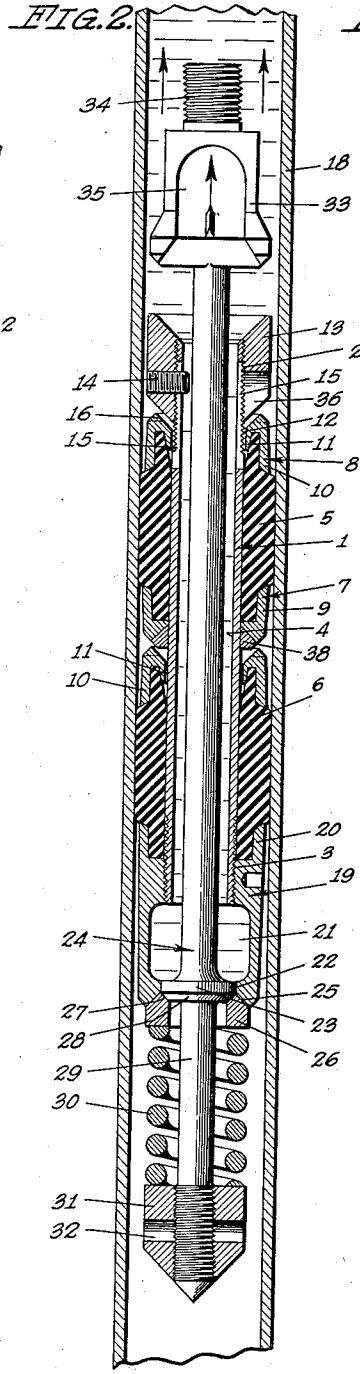
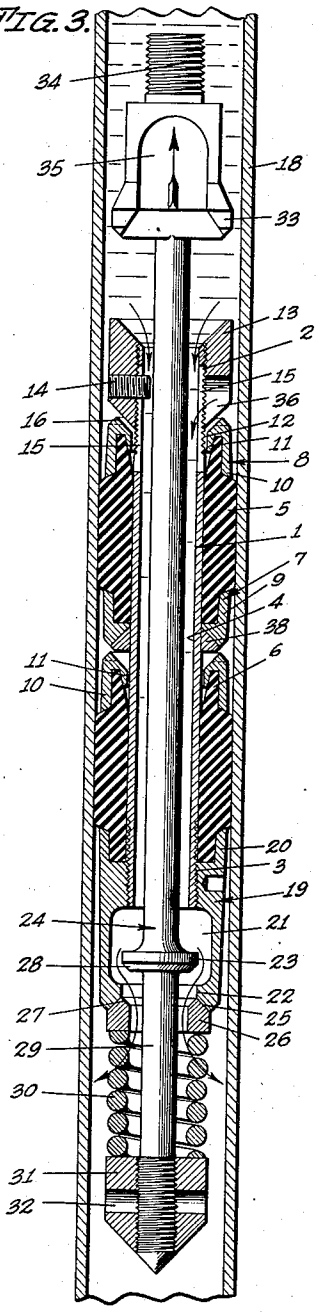


FIG. 3.



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FIG. 4.

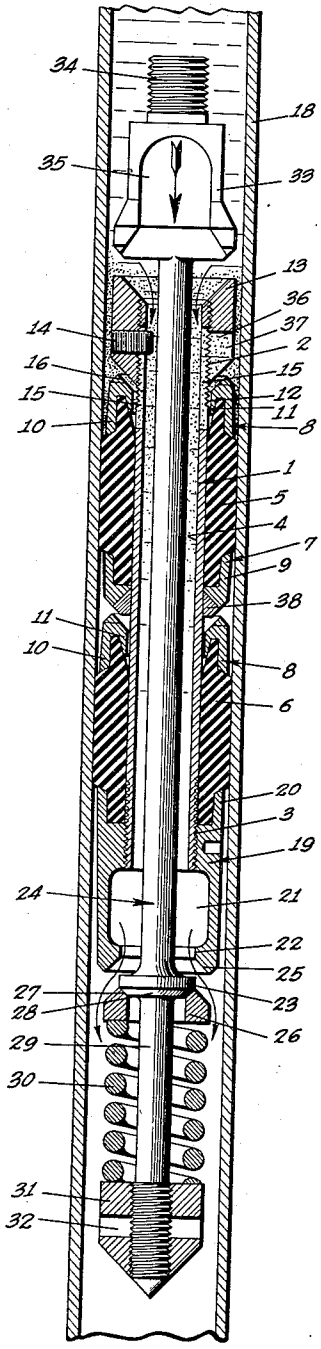


FIG. 5.

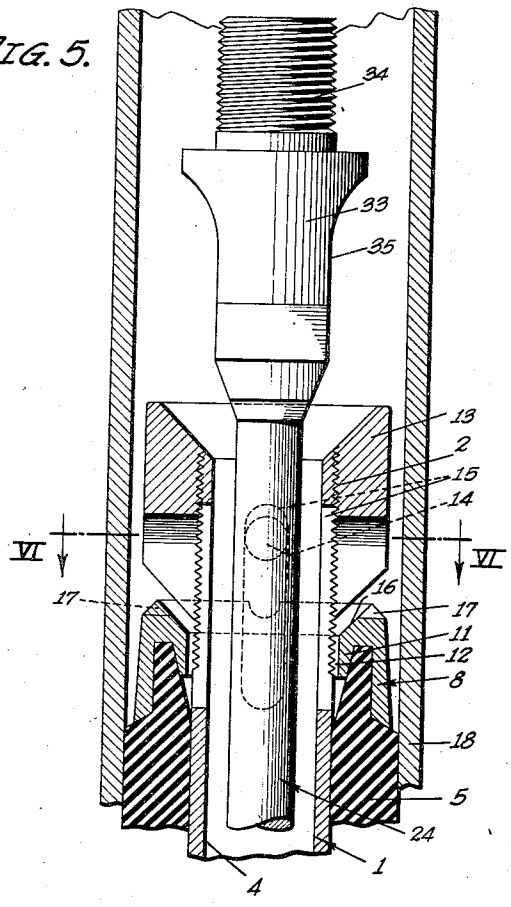
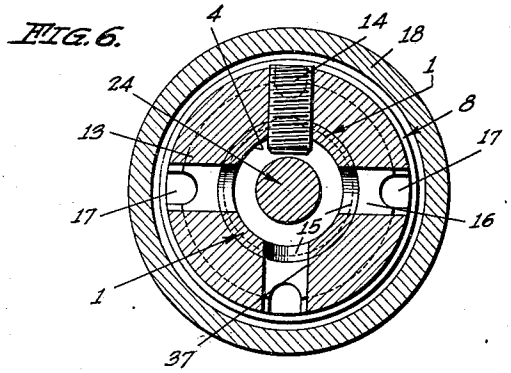


FIG. 6.



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UNITED STATES PATENT OFFICE

2,163,058

SWAB

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Application June 1, 1937, Serial No. 145,697

1 Claim. (Cl. 103—225)

My invention relates to swabs and has particular reference to a swab employed in wells for the purpose of elevating fluid and solids therefrom.

In oil well practice it frequently becomes necessary to swab or clean out a well casing or pump tubing to clear the same of an excess of fluid mixed with solids such as mud, sand and similar materials. In performing this operation, it is the common practice to lower into the tubing to be cleared a tool employing packing rings adapted to seal against the tube or casing to be cleared, arranged in such manner that an upward pull on the tool compresses or seals the packing rings against the interior walls of the tool so that fluids trapped above the tool will be elevated by a lifting movement of the tool.

It is an object of my invention to provide a swab of the character set forth wherein the packing rings employed are mounted upon a nipple or tubular member having a relatively great interior bore or opening to permit the swab to readily sink through the fluid on its downward movement, thus increasing the rapidity with which the tool may be manipulated in the cleaning of the tube.

Another object of my invention is to provide a swab of the character set forth wherein sand, grit, mud or other solids which may be suspended within the fluid may readily pass through the nipple without binding the packing elements in the tube.

Another object of my invention is to provide a swab of the character set forth wherein an over-load release device is incorporated in the tool to automatically unload a portion of the fluid above the swab in the event the quantity of fluid above the swab exceeds a desired value.

Another object of my invention is to provide a swab of the character set forth wherein the lower end of the nipple bearing the packing elements is formed as a valve and a mandrel to which the operating lines are attached and constitutes a cooperating valve member adapted to open the valve upon release or downward movement of the mandrel and adapted to open the valve upon the exertion of a predetermined resistance to the lifting of the tool.

Another object of my invention is to provide a tool of the character set forth wherein a trap is formed at the lower end of the packing carrying nipple, into which sand or other solids may settle from the fluid without interfering with the lifting movement of the tool.

Another object of my invention is to provide a swab of the character set forth wherein a nipple carrying one or more packing rings is provided with a mandrel member extending through the nipple and bearing upon its lower end a two-way valve member cooperating with the lower end of the nipple member to provide a flushing opening through the nipple either upon the lifting of the mandrel relative to the nipple or a lowering of the mandrel relative to the nipple.

Other objects and advantages of my invention will be apparent from a study of the following specifications, read in connection with the accompanying drawings, wherein,

Fig. 1 is a vertical sectional view of a section of casing or pump tubing and illustrating my swab therein in vertical cross section during the descent of the tool through the fluid in the casing or tube;

Fig. 2 is a sectional view similar to Fig. 1, representing the position of the parts of the tool during the normal lifting operation of the tool;

Fig. 3 is a sectional view similar to Fig. 1, illustrating the position of the parts in the event of an over-load upon the tool;

Fig. 4 is a sectional view similar to Fig. 1, representing the position of the parts when it is desired to voluntarily unload all the load above the tool for the purpose of clearing the same from grit, sand or other debris which may be trapped by the tool;

Fig. 5 is an enlarged sectional view of the upper portion of the tool, looking in the direction of the arrows V—V of Fig. 1; and

Fig. 6 is a detail horizontal sectional view taken along the line VI—VI of Fig. 5.

Referring to the drawings, I have illustrated my swab as comprising a body member 1 which may be constructed as an elongated nipple, preferably of tubular construction, threaded at each end as indicated at 2 and 3. The interior of the nipple or body 1 is provided with a relatively large internal diameter or bore 4 so as to permit the ready flow of fluid through the nipple.

The nipple 1 comprises a support for one or more packing members 5 and 6, which may be constructed as annular rubber or similar expansible packing rings, each of which is provided upon its lower end with a metal ring or burr 7 and upon its upper end with a burr or ring 8, the ring 7 being preferably formed with an upstanding flange 9 engaging exteriorly of the lower end of the packing member 5 so as to hold the lower end of this packing member against outward movement relative to the nipple 1. The upper ring or burr 8 is preferably provided with a pair of flanges 10 and 11, the flange 10 extending

about the exterior of the upper end of the packing member 5 to perform a similar function as the flange 9, while the inner flange 11 is arranged with its internal diameter slightly in excess of the external diameter of the nipple or body 1 so as to provide a space 12 between the interior of the burr 8 and the exterior of the body 1.

The upper end of the nipple 1 has threaded thereon an upper collar 13 which acts to prevent the packing members 5 and 6 from slipping off the upper end of the nipple, this collar 13 being screwed down on the nipple and being held against rotation in any desired position thereon by means of a set screw 14 which enters any one of a plurality of elongated slots 15 formed in and extending through the upper end of the nipple.

The slots 15 constitute ports which intercommunicate between the interior and exterior of the nipple or body 1 and through which fluid may readily flow and through which any grit, sand or other solid matter trapped in the fluid may readily pass.

It will be noted that the upper end of the burr 8 is provided with an angular or beveled seat 16 adapted to be engaged by an angular or beveled surface on the lower end of the collar 13, but that a plurality of radially extending depressions or recesses 17 are formed in the upper end of the burr 8 through which fluid may readily flow into the space 12 between the burr 8 and the nipple 1. Thus whenever the tool is immersed in fluid, at least a portion of the hydrostatic pressure of the fluid when the tool is lifted will tend to exert a force interiorly of the burr 8 and will be distributed upon the inside portion of the packing member 5, thus increasing the tendency of the packing member to be expanded outwardly into snug liquid sealing engagement with a casing or pump tubing 18 through which the swab is to be drawn.

The nipple 1 is provided upon its lower end with a lower sub or annular member 19 threaded upon the lower end 3 of the nipple 1, the lower sub 19 having an upwardly extending flange 20 which engages the lower end of the lower packing member 6 in the same manner as described with reference to the flange 9 on the burr 7 for the packing member 5. The lower sub 19 is provided with an enlarged bore 21 preferably of greater diameter than the interior diameter of the nipple 1, the lower end of which terminates in a relatively large diameter opening 22 adapted to snugly fit the exterior of a valve flange 23 formed upon a mandrel 24 so that when the mandrel 24 is drawn upwardly through the nipple 1 to the position shown in Fig. 2, the valve flange 23 will substantially close the lower end of the fluid passage formed through the nipple 1 and the lower sub 19.

The extreme lower end of the sub 19 is provided with a beveled or tapered valve seat face 25, against which is adapted to seat a valve ring 26 carried by the lower end of the mandrel 24. The valve ring 26 has an inclined inner face 27 adapted to seat upon an inclined valve surface 28 found upon the lower side of the valve flange 23, the valve face 27 being adapted to be pressed snugly against the valve surface 28 by means of a compression spring 29 surrounding an extension 30 on the mandrel 24 and adapted to be placed under any desired compression by means of an adjusting nut 31 screwed upon the lower end of the extension 30, suitable openings 32 being provided in the nut 31 to assist in screwing the nut 31 to the desired location thereon.

It will be observed from the foregoing description that the valve flange 23, with its valve surface 27 and the valve ring 26, will constitute in effect a valve carried wholly by the mandrel 24 in such manner that when the mandrel is drawn upwardly in the nipple 1 the valve flange 23 and the valve ring 26 will close the lower end of the fluid passage through the nipple 1.

The valve flange 23 and the ring 26 constitute in effect a three-way valve so that when the mandrel is lowered to the position shown in Fig. 1 a free passage for fluid through the lower end of the body 1 is permitted, while when the mandrel is drawn upwardly to the position shown in Fig. 2 this fluid passage is closed by the flange 23, the valve surface 27, and the valve ring 26, while a further upward movement of the mandrel 24 will raise the valve flange 23 and its valve surface 27 away from the ring 26, allowing a free passage of fluid downwardly through the ring, as indicated in Fig. 3.

The mandrel 24 is illustrated as extending entirely through the nipple 1 and has upon its upper end a head 33 which may be provided with a suitable pin 34 to which suitable connection may be made to connect a cable or other line extending to the top of the well by which the swab may be lifted and lowered in the well.

It will be noted that the head 33 constitutes an enlargement of the mandrel 24, the lower surface of which is adapted to seat upon the upper end of the collar 13 but that the side walls of the enlarged head 33 are cut away as indicated at 35 so as to provide a ready and free passage of any fluid lying above the swab into and through the nipple, or body 1.

With the tool assembled as hereinbefore described, a cable or line attached to the mandrel 24 may be employed to lower the tool into and through the casing or pump tubing to be swabbed, the packing members 5 and 6 being preferably of such diameter as to drag slightly on the walls of the casing or tubing as the tool descends so that the mandrel 24 during this downward motion will assume a position such as that shown in Fig. 1. When the tool arrives at the fluid level, it will sink through the fluid, the fluid having a ready passage through the open valve structure 22, 23, 26, 27, as indicated by the arrows shown on Fig. 1, such fluid passage being of relatively great area whereby little or no resistance to the sinking or passage of the tool through the fluid may be encountered.

Ordinarily the operator at the top of the well cannot determine how far the tool has descended into the fluid and he relies upon his judgment to start the lifting of the tool when he thinks the tool has descended to a sufficient depth. An upward lift upon the cable or line will cause the mandrel to be lifted to the position shown in Fig. 2, wherein the valve structure 22, 23, 26, 27 will close the lower end of the fluid passage through the interior of the body 1 and will tend to lift all of the fluid trapped thereabove.

The spring 29 is preferably selected of such strength that it will support only a predetermined pressure of fluid above the tool and any excess of fluid will cause the spring 29 to be compressed by the upward pull on the cable or line. In such instance the three-way valve structure 22, 23, 26, 27 will assume a position such as that shown in Fig. 3, the valve flange 23 being drawn upwardly into the enlarged bore or sump 21 and any over-load of fluid above the tool will be dumped until the pressure of the fluid above

the tool is equalized by the force of the spring 29. Thus it is impossible to over-load my swab and breakage of lines or cables is effectively prevented. In this connection, it will be noted that when the valve 23 is raised to the position shown in Fig. 3 the fluid has a ready and free passage through the body 1 directly to the exterior of the tool and a great quantity of fluid may be released in a relatively short time. The judgment of the operator is therefore not relied upon to determine what load of fluid is to be drawn from the well by an upward movement of the tool.

It frequently occurs that the fluid in the well contains sand, grit, mud or other solid matter which, as the swab is drawn upwardly, settles down through the fluid upon the upper end of the swab, causing the swab to bind in the tube or casing through which it is drawn. I permit the greater portion of such solid matter to settle, not upon the upper end of the tool, but to pass inwardly of the tool into the sump formed by the enlarged bore 21, thus preventing the collection of such sand or other solid matter between the packing members and the casing or tubing. The sump 23 may be made sufficiently large to contain a relatively large quantity of solid matter; in fact, the entire interior of the body 1 may constitute a receptacle for such solid matter without interfering with the normal upward motion of the tool.

If, however, any solid matter does enter between the packing burr 8 and the casing or tubing 18, it may be readily flushed therefrom by a momentary lowering of the cable or line which will allow the mandrel 24 to descend to the position shown in Fig. 4, moving the valve structure 22, 23, 26, 27 downwardly to open the lower end of the body 1 and permit a rapid flow of fluid through the body or nipple 1. This flow of fluid will wash out or flush out any sand or other solid matter which collects at the top of the tool, as indicated at 36. To facilitate the flushing of such sand from the upper end of the tool, I prefer to provide a plurality of recesses 37 in the upper collar 13, distributed about the collar 13 to be aligned with the ports 15 in the upper end of the body or nipple 1. By suitably distributing these recesses about the collar 13, the reception of the set screw 14 in any one of the ports 15 will accurately align the recesses 37 with the remaining ports 15, providing relatively large areaed passages through which great quantities of fluid may flow and carry with it any solid particles which may be trapped above the packing members 5 and 6.

It will also be observed that by providing relatively large ports 15, which are normally open and disposed immediately at the upper end of the upper packing member 5, any solid particles which tend to settle out of the fluid are permitted to readily pass into the interior of the body or nipple 1 and thus there is little tendency for such particles to accumulate above the packing member 5.

While I have illustrated only two packing members 5 and 6, it will be understood by those skilled in the art that any number of packing members may be employed upon the swab. I prefer to employ an outwardly extending flange 38 formed upon the body member 1 as by welding a bead of metal about the surface of the nipple 1 against which the lower packing burr 7 may bear and by providing a series of such beads about the nipple 1 a series of packing members may be distributed throughout the length of the nipple 1.

It will therefore be observed that I have provided an improved swab construction wherein as the tool descends into the fluid a relatively large area passage is provided, permitting the tool to rapidly sink or descend through the fluid, even though such fluid may be of relatively dense character, such as the mud fluid employed in the drilling of the well. Then when the tool is to be lifted the valve structure provided will automatically close the fluid passage but will permit the retention or trapping of only a predetermined load of fluid above the swabbing tool, any excess being automatically dumped or released until the desired amount of fluid remains above the tool.

I have also provided with a single valve structure a ready means for flushing or discharging any solid matter, sand, grit or the like, which may be trapped above the tool, and which would otherwise cause a binding of the tool in the casing or tubing.

While I have shown and described the preferred embodiment of my invention, I do not desire to be limited to any of the details of construction shown or described herein, except as defined in the appended claim.

I claim:

In a swab for wells, a hollow elongated body member having a fluid passage extending longitudinally therethrough, said body member being open at both of its ends, valve means for closing the lower end of said body member including a valve port formed upon said body member, and a valve operable to three positions, one closing against said port, another disposed below said port and a third disposed above said port.

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