July 21, 1942. R. W. SKINNER ET AL 2,290,774

OIL WELL SWAB

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FIG. 1.

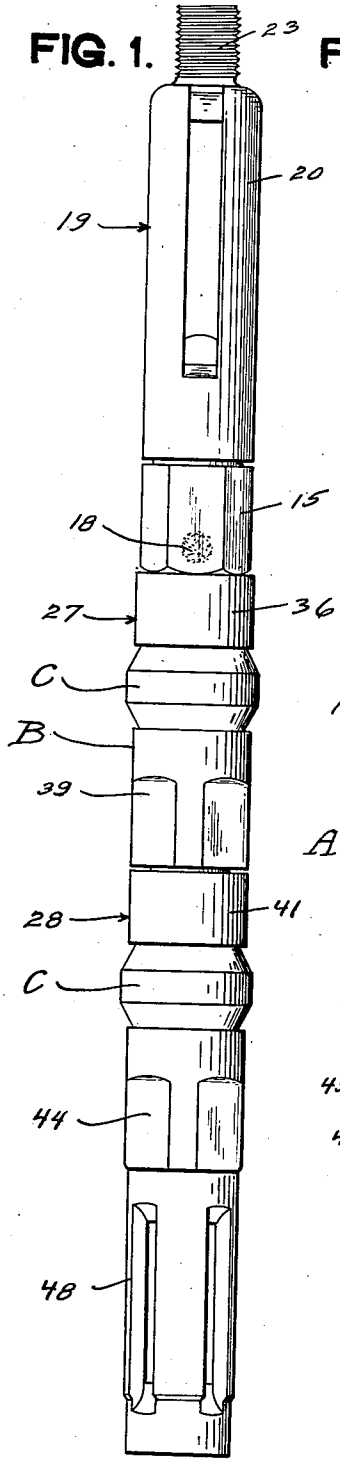


FIG. 2.

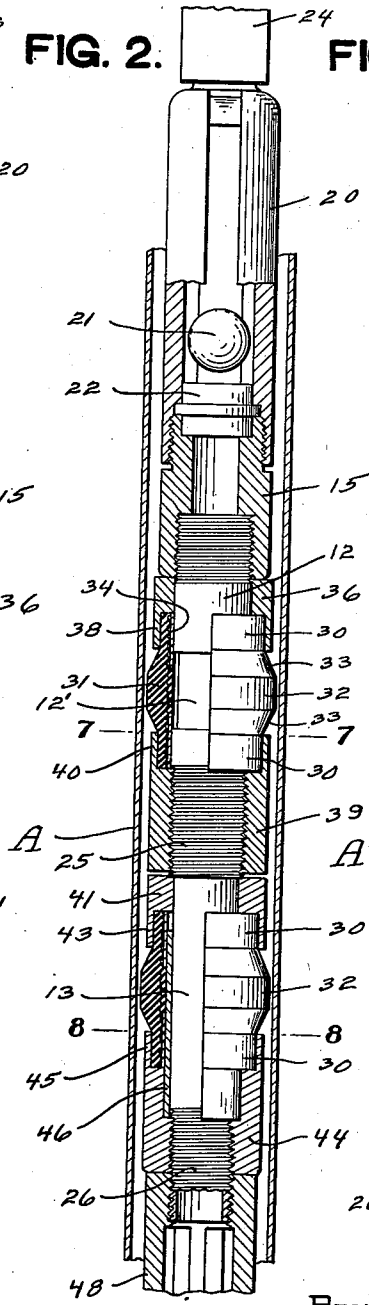
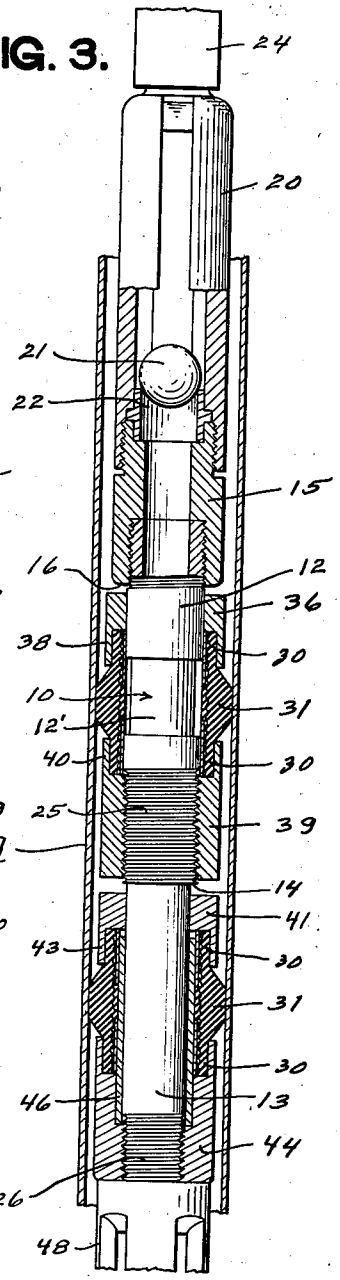


FIG. 3.



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FIG. 4.

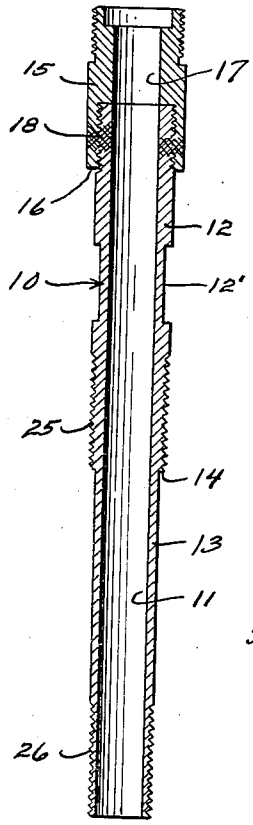


FIG. 5.

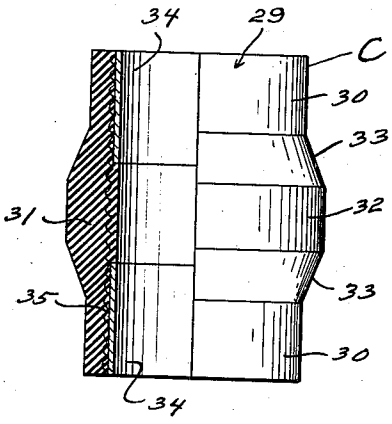


FIG. 6.

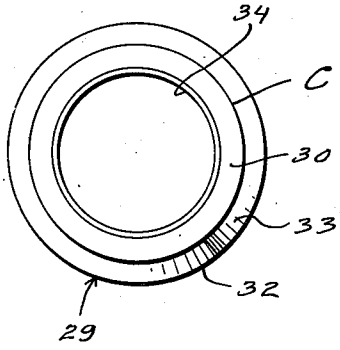


FIG. 7.

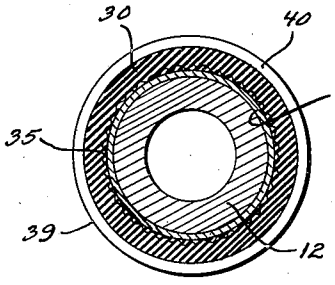


FIG. 8.

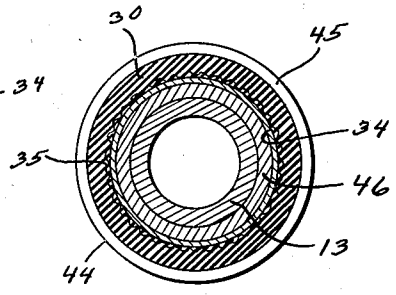


FIG. 10.

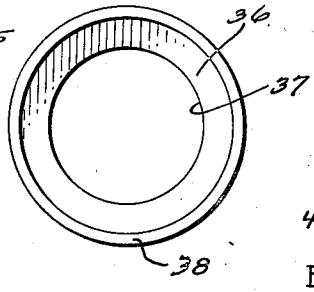


FIG. 11.

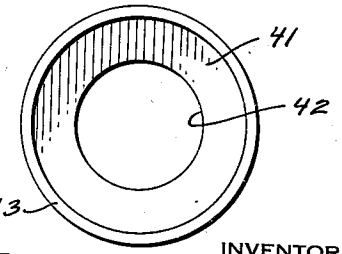
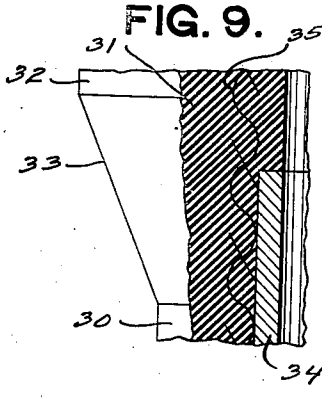


FIG. 9.



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OIL WELL SWAB

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Application September 9, 1940, Serial No. 356,100

3 Claims. (Cl. 309—23)

The present invention relates to improvements in swab assemblies and the primary object of the invention is to provide a well swab for deep oil wells, embodying swab rubbers of improved construction for withstanding the great hydrostatic pressure of the well fluid above the swab as the swab is being raised in the well.

A further object of the invention is to provide an improved well swab assembly embodying spaced apart separately acting swab rubbers which when compressed longitudinally, will be radially expanded at their intermediate portion into engagement with the well tubing.

A further object resides in the novel construction and manner of assembling and securing the swab rubbers on their carrying member to permit independent functioning of the swab rubbers, and whereby the swab rubbers may be of like construction so as to be readily interchangeable one for the other.

A further object is to provide a well swab of this character which may be economically constructed and easily assembled and dismembered for renewing of the swab rubbers when required.

A further object resides in the improved construction permitting use of the swab in well tubing or pipe having irregularities on the inner surface thereof.

A still further and important object of the invention resides in the specific construction of the swab rubbers having reinforced cylindrical end portions and an elastic intermediate portion capable of being radially expanded upon movement of the end portions toward one another.

Other objects and advantages of the invention will be apparent from the following detailed description taken in connection with the accompanying drawings forming a part of this specification and in which drawings:

Figure 1 is a view in elevation of the improved well swab assembly.

Figure 2 is a view part in section and part in elevation of the swab within a well tubing and showing the relation of parts as when the swab is being lowered into the tubing.

Figure 3 is a view part in section and part in elevation and showing the swab rubbers expanded into contact with the tubing by the fluid pressure above the swab as when the swab is being raised in the tubing.

Figure 4 is a view in longitudinal section of the tubular supporting stem of the swab.

Figure 5 is a view half in elevation and half in longitudinal section of one of the swab rubbers.

Figure 6 is an end view of a swab rubber.

Figures 7 and 8 are enlarged transverse sections on the respective lines in Figure 2.

Figure 9 is an enlarged fragmentary section thru the intermediate portion of a swab rubber.

Figure 10 is a bottom plan view of the top cap or thimble for the upper swab rubber.

Figure 11 is a bottom plan view of the top cap or thimble for the lower swab rubber.

In the drawings and wherein like reference characters designate corresponding parts thruout the several views, the letter A designates a section of well tubing, and B the improved swab for raising fluid within the well tubing, and in the example shown, embodying two swab rubbers C independently functioning to engage the tubing A when the swab is being raised in the tubing.

The swab B comprises a tubular stem or mandrel 10 having a bore 11 extending thruout its length and forming a passage for the well fluid to pass thru the stem. The one-piece stem 10 is formed with an upper sleeve portion 12 having a reduced intermediate portion forming an annular recess 12', and a lower sleeve portion 13 which is of less diameter than the upper sleeve portion and forms a downwardly facing annular stop shoulder 14 disposed substantially midway the ends of the stem. The upper end of the tubular stem 10 is externally screw threaded for receiving a coupling head 15 providing an annular stop shoulder 16 and having a bore 17 axially aligning with the stem bore 11. This coupling head 15 is provided about its lower portion with wrench engaging faces for threading the head upon the stem 10 and after which the head is welded to the stem, as shown at 18. By constructing the coupling head 15 separate from the stem 10, results in a great saving of material and ease of production.

The upper end of the coupling head 15 is threaded for attachment of a check valve 19 of known construction, embodying a cage 20 enclosing a ball 21 which engages on a ring seat 22 having its lower portion fitted in the upper end of the head 15. The upper end of the cage 20 is provided with a threaded stem 23 for attachment of the usual hoisting cable coupling 24 whereby the swab may be raised and lowered in the well.

The lower end of the upper sleeve portion 12 of the tubular stem 10 is screw threaded as at 25, while the lower end of the reduced lower sleeve portion 13 is screw threaded as at 26. Arranged on

the upper sleeve portion 12 is an upper swab unit 27, while arranged on the lower sleeve portion 13 is a lower swab unit 28 acting independently of the upper swab unit 27. Each swab unit 27 and 28 includes one of the swab rubbers C, the swab rubbers in each unit being alike.

Referring first to the construction of the swab rubbers C, the same are preferably moulded or otherwise formed from rubber or any other suitable flexible material into tubular body portions 29 having cylindrical or ring-shaped end portions 30 and an externally flanged or enlarged central portion 31. This central portion 31 provides an outer cylindrical working face 32 for contacting the inner wall of the tubing A, and at each end of the face 32 are tapering surfaces 33 which taper toward the ring-shaped end portions 30. Disposed in each end of the tubular body portion 29 is a metallic reinforcing and restraining sleeve 34, and these sleeves as shown particularly in Figure 5, have their outer ends flush with the ends of the flexible body portion 29, while their inner ends terminate in spaced relation at the enlarged central portion 31. The inner ends of these sleeves 34 are radially inward of the tapering surfaces 33, and the material of the body portion 29 extends between the spaced ends of the sleeves, as shown clearly in Figure 9 whereby an even diameter bore extends from end to end of the swab rubber. A fabric layer 35 encircles the sleeves 34 and extends from end to end of the body 29.

While the swab rubbers may be constructed in various ways, by way of example, the swab rubbers may be made by placing the sleeves 34 in spaced relation on a suitable core and then the fabric 35 wound about the sleeves. The rubber or other flexible material of the body portion 29 may then be moulded in any suitable manner so as to impregnate the fabric 35 and fill the space between the inner ends of the sleeves 34.

Referring particularly now to the upper swab unit 27 and the manner in which the same is assembled and retained in operative relation on the upper sleeve portion 12, this unit comprises a top retaining cap 36 having a bore 37 slidably fitting the upper sleeve portion 12, and provided with a straight depending peripheral flange or skirt 38 forming an annular pocket for snugly receiving a cylindrical end 30 of the upper swab rubber. This cap 36 abuts the annular shoulder 16 which limits upward movement of the cap, but the cap is free to slide downward on the sleeve portion 12. Threaded upon the screw threaded lower end 25 of the sleeve portion 12 is a lower abutment member 39 having a straight upstanding peripheral flange or skirt 40 at its upper end forming an annular pocket for snugly receiving the cylindrical end 30 at the lower end of the upper swab rubber. It will be noted that the depth of the flanges 38 and 40 is equal to the length of the cylindrical end portions of the swab rubber whereby the externally flanged central portion 31 of the swab rubber is exposed with the normal diameter of the working face 32 being slightly greater than that of the flanges 38 and 40. It will also be noted particularly in Figures 2 and 7 that the internal diameter of the sleeves 34 is equal to the diameter of the upper sleeve portion 12. The lower end of the threaded abutment member 39 preferably terminates slightly above the annular shoulder 14 formed at the lower end of the upper sleeve portion 12.

The lower swab unit 28 comprises a top retaining cap 41 having a bore 42 slidably fitting the reduced lower sleeve portion 13, and provided with a straight depending peripheral flange or skirt 43 forming an annular pocket for receiving a cylindrical end 30 of the lower swab rubber. This cap 41 is freely slidable on the sleeve portion 13 and is limited in its upward movement thru engagement with the annular shoulder 14. As shown in Figures 10 and 11, the bore of the cap 36 is slightly greater than the bore of the cap 41, but the diameters of the flanges 38 and 43 are equal. Threaded upon the screw threaded lower end 26 of the lower sleeve portion 13 is a lower abutment member 44 having a straight upstanding peripheral flange or skirt 45 at its upper end forming an annular pocket for receiving the cylindrical end 30 at the lower end of the lower swab rubber.

Since the diameter of the lower sleeve portion 13 of the tubular stem 10 is less than the diameter of the upper sleeve portion 12 of the stem, and the bore or opening thru the upper and the lower swab rubbers which are of like construction are of like diameter, a bushing sleeve 46 encircles the sleeve portion 13 between the cap 41 and the abutment 44 so as to compensate for the difference in diameter between the sleeve portions 12 and 13 and permit of like sized swab rubbers being used in both the upper and the lower swab units 27 and 28. Thus the inner surface of the metal sleeves 34 of both the upper and the lower swab rubbers have surface contact with a cylindrical metallic surface. As shown in Figures 2 and 3, the abutment member 44 is counterbored to receive the lower end of the sleeve 46, and that the upper end of the sleeve terminates short of the cap 41 so as to permit downward movement of this cap toward the fixed abutment member 44 for longitudinally compressing and radially expanding the swab rubber portion 31.

The specific construction of the swab assembly will permit use of the swab in well tubing or pipe having irregularities in its inner surface such as may have been caused by bending or tong dents in handling, or corrosion. If, upon lowering the swab into a well tubing, free downward passage of the swab is prevented by a dent or other irregularity at some point in the tubing, the swab is withdrawn and the bushing sleeve 46 removed from the assembly. This will permit inward yielding of the central portion 31 of the lower swab rubber so that when the swab is again lowered into the tubing, this swab rubber will readily ride past the irregularity in the tubing. The annular recess 12' in the upper sleeve portion 12 will permit inward yielding of the central portion 31 of the upper swab rubber to allow this upper swab rubber to readily ride past the irregularity in the tubing. As will be noted in Figures 2 and 3, the central portion 31 of the upper swab rubber is disposed concentrically of the annular recess 12'. Since the inner ends of the sleeves 34 are spaced apart, the central portion 31 of the rubbers may readily yield inwardly.

Threaded upon the lower extremity of the tubular stem 10 is a coupling member 48 of any preferred type which is turned into engagement with the abutment member 44 and serves as a lock nut for the abutment member.

In use, as the swab is lowered into a well, the well fluid passes upwardly thru the bore 11 of

the tubular stem 19 and lifts the ball 21 from its seat as in Figure 2. The intermediate portion 31 of the swab rubbers is only slightly smaller in diameter than the inner diameter of the well tubing A, so as to permit relatively free movement of the swab downwardly in the tubing and this downward movement is further erased by the tapering surfaces of the swab rubbers. Upon upward movement of the swab as when being lifted in the well as in Figure 3, the ball 21 will seat and close fluid passage thru the bore of the stem 19 whereupon the weight of the well fluid above the swab will act upon the retaining caps 36 and 41 so as to longitudinally compress the swab rubbers and radially expand their central portion 31 into contact with the inner wall of the tubing. Owing to the specific shape of the elastic intermediate portion of the swab rubbers, together with the end reinforcing arrangement and manner of mounting the swab rubbers, the swab rubbers will withstand the great hydrostatic pressure of the fluid above the swab without being distorted out of proper engagement with the wall of the tubing nor stripped from their mountings on the tubular stem.

Changes in detail may be made to the form of the invention herein shown and described, without departing from the spirit of the invention or the scope of the following claims.

We claim:

1. In a swab, a tubular stem having upper and lower cylindrical sleeve portions, a stop shoulder at the upper end of each sleeve portion, screw threads on the lower end of each sleeve portion, an abutment member threaded on the lower end of each sleeve portion and having an upstanding peripheral flange forming an annular pocket, means freely slidable away and toward said stop shoulder upon reciprocation of said swab, comprising a cap slidable on said upper sleeve portion, means freely slidable away and toward said abutment member upon reciprocation of said swab comprising a cap slidable on said lower sleeve portion, each of said caps having a depending peripheral flange forming an annular pocket, and a swab rubber in contacting encircling relation on each sleeve portion having ring-shaped end portions snugly confined in said annular pockets, and an externally flanged intermediate portion having a cylindrical working face and tapering surfaces extending from each end of the working face to the ring-shaped end portions.

2. In oil well apparatus, in combination with a well tubing, a swab for the tubing including a tubular stem thru which fluid may pass from one end to end of the stem, fixed abutments spaced on the stem, a slidable cap on the stem above each abutment, and a swab rubber fitting about the stem between each cap and adjacent abutment, said swab rubbers each having reinforced ends held in the cap and abutment and an elastic externally flanged intermediate portion capable of being radially expanded into contact with the tubing upon sliding movement of the cap toward the abutment by fluid pressure in the tubing above the swab, and capable of being radially contracted upon sliding movement of the cap away from said abutment.

3. In a swab, a tubular stem having an upper sleeve portion and a reduced lower sleeve portion forming an intermediate stop shoulder, a coupling head secured to the upper end of the stem and forming an upper stop shoulder, an abutment member threaded on the lower end of each sleeve portion and each forming an upwardly opening ring-like pocket, a cap slidable on the upper sleeve portion and having upward limited movement by said upper stop shoulder, a cap slidable on the lower sleeve portion and having upward limited movement by said intermediate stop shoulder, said caps each forming a downwardly opening ring-like pocket, and a swab rubber encircling each sleeve portion between the cap and abutment thereon, each having ring-shaped ends fitting in said pockets and an intermediate externally flanged portion converging toward the ring-shaped ends.

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