March 1, 1938. F. A. THAHELD 2,109,913

SWAB

Filed Feb. 10, 1936 2 Sheets-Sheet 1

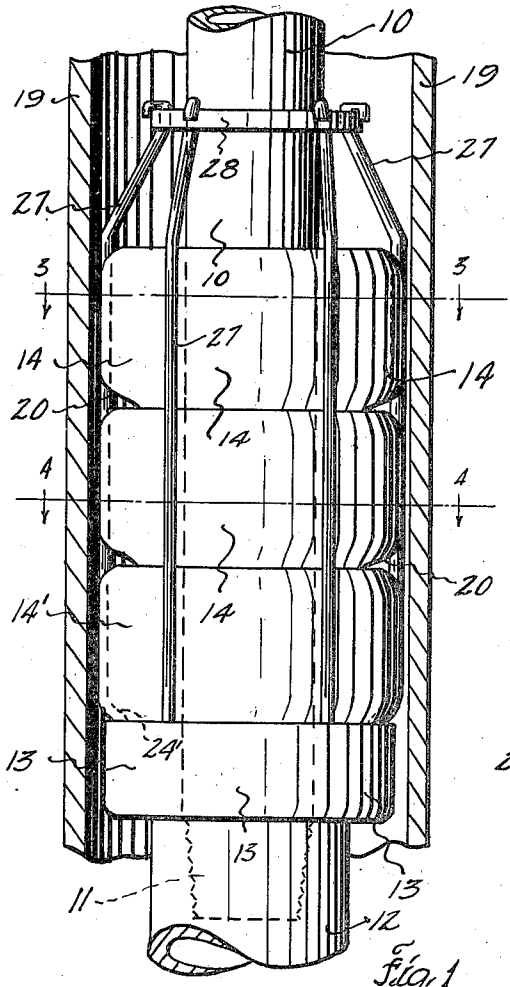


Fig. 1

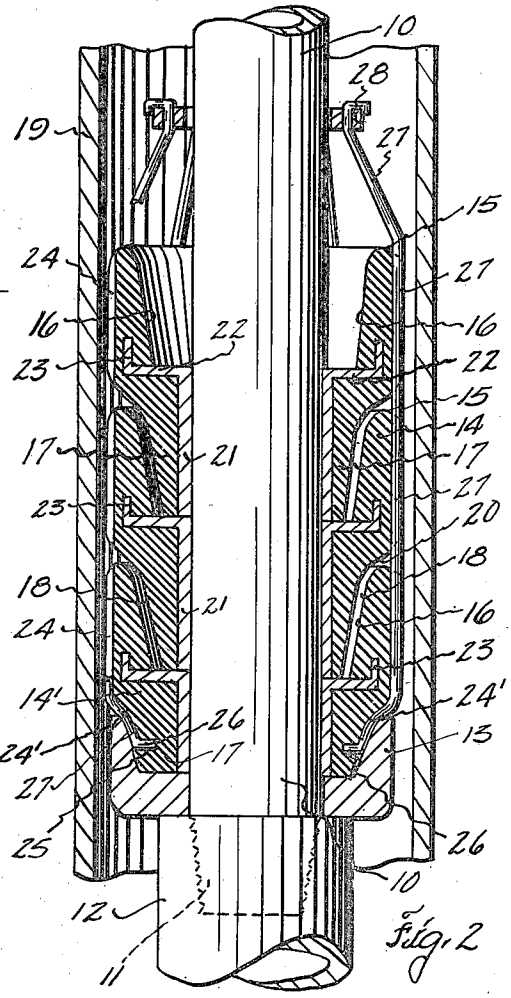


Fig. 2

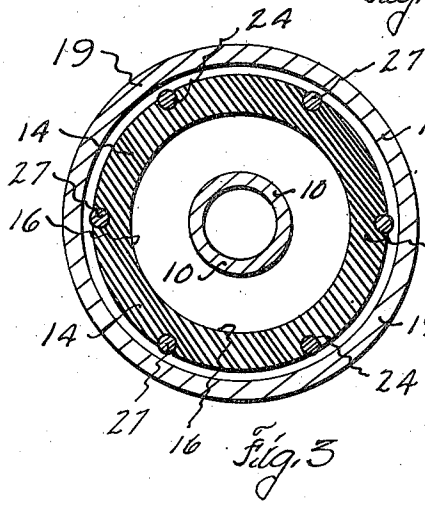


Fig. 3

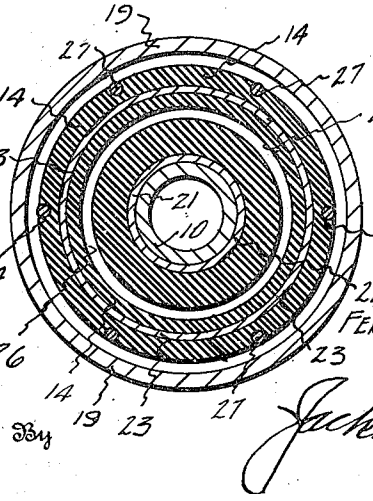


Fig. 4

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SWAB

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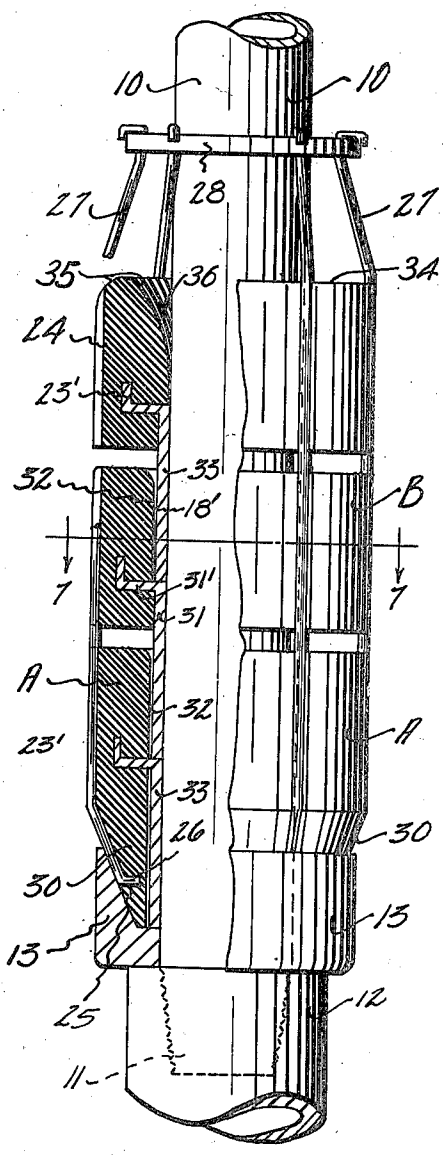


Fig. 6

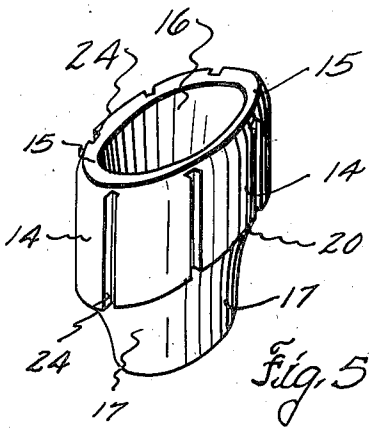


Fig. 5

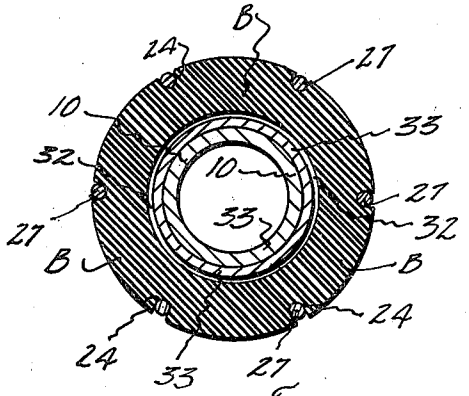


Fig. 7

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Patented Mar. 1, 1938 2,109,913

UNITED STATES PATENT OFFICE

2,109,913

SWAB

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Application February 10, 1936, Serial No. 63,156

9 Claims. (Cl. 309—23)

This invention relates to new and useful improvements in swabs.

One object of the invention is to provide an improved swab having a plurality of cups superposed on a mandrel and so arranged as to all be mounted within a single reinforcing cage, which obviates the necessity for each cup being mounted within a separate reinforcing cage; also, the cups are nested, whereby the overall length of the swab is reduced.

Another object of the invention is to provide a swab having a plurality of cups all mounted within one reinforcing cage so that the wear from the travelling of the swab is distributed on each of the cups, whereby the life of the swab is prolonged, the frequent replacing of the cups reduced, and an increased packing efficiency of the swab obtained.

A further object of the invention is to provide a swab having a plurality of cups mounted in a single cage, the cups being so arranged that fluid may act on each cup to individually distort the same into contact with the tubing or casing of the well upon the upstroke of the swab, so that the weight of the fluid will be distributed among the cups, whereby none of said cups will be ruptured or blown out due to overloading.

Still another object of the invention is to provide a plurality of elastic cups mounted on a support and each cup having a metal sleeve therein abutting the sleeve of the next lowest cup, so that each sleeve individually supports each cup, and all the sleeves together form a rigid core for the cups, whereby crushing and undue or harmful distortion of the cups is prevented.

A construction designed to carry out the invention will be hereinafter described, together with other features of the invention.

The invention will be more readily understood from a reading of the following specification and by reference to the accompanying drawings, in which an example of the invention is shown, and wherein:

Figure 1 is an elevation of a well swab constructed in accordance with the invention, and disposed in a casing which is shown in vertical section,

Figure 2 is a vertical, sectional view of the swab and casing,

Figure 3 is a horizontal, cross-sectional view taken on the line 3—3 of Figure 1,

Figure 4 is a similar view taken on the line 4—4 of Figure 1,

Figure 5 is a perspective view of one of the swab cups,

Figure 6 is a view, partly in section and partly in elevation, of a modified form of the invention, and

Figure 7 is a horizontal cross-sectional view taken on the line 7—7 of Figure 6.

In the drawings, the numeral 10 designates a tubular mandrel having an externally screw-threaded, tapering pin 11 on its lower end screwed into the box of a collar 12. An inverted, annular thimble 13 is mounted on and snugly engages the lower end of the mandrel and rests upon the collar. A plurality of flexible swab cups 14 are superposed on the mandrel above the thimble 13. These cups may be composed of rubber, rubber compound or any suitable material capable of use with the invention. The cup illustrated is of the mushroom type, such as is used with a reinforcing cage and mandrel for lifting fluids in a well or for cleaning a well, but the invention is not to be limited to such a cup or shape, and may be applied to any style of cup suitable for the purpose.

The cups are all substantially the same with the exception of the lowermost cup 14'. The cups are nested one within the other, and while three cups have been shown, the invention is not to be limited to any particular number of cups as any number desired may be used. The type of cup chosen for illustration is provided with a large, flared, counter bore or well 16 and has at its upper edge an annular lip 15 which is rounded in cross-section. The lower portion of each cup is reduced to form a tubular shank 17 which is externally tapered, the shank of the lowermost cup 14' being shortened so as to snugly engage in the thimble 13.

It is pointed out that the well 16 of each cup is sufficiently large to receive the shank 17 of the cup immediately thereabove and to provide an annular space 18 between said shank and the walls of the well. A curved shoulder 20 is formed between the upper portion and the reduced shank 17 of each cup, so that the shoulder overhangs the rounded lip 15. Attention is called to Figure 2, wherein it will be noted that fluid may flow between the shoulder and the lip and readily enter the space 18, in order that said fluid may act on each cup to distort the same into contact with the tubing 19 of the well.

A cylindrical bushing or sleeve 21 extends axially of each cup from the bottom of the well 16 to the lower end of the shank 17 and forms

a reinforcing member for the cup. This bushing is preferably made of metal or any other suitable material, and is embedded in the shank of the cup so that its lower end terminates substantially flush with the bottom of the shank. The upper end of the bushing is provided with an outwardly directed, annular flange 22 extending radially on the bottom of the well 16 and into the wall of the cup, as will be seen in Figure 2. The outer edge of the flange is formed with an upturned, circumferential lip 23, which is also embedded in the wall.

Attention is again called to Figure 2, wherein it will be noted that the bushings 21 rest endwise one upon another, so as to form a rigid core through the cups. The lower end of the lowermost bushing rests upon the bottom of the thimble 13 and is supported thereby. Thus, it will be seen that the rigid core being supported by said thimble will reinforce the cups and prevent their collapsing or being crushed longitudinally by the extreme weight of the fluid. The flange 22 and the lip 23 support the lower end portions of the walls of the wells so as to prevent undue bulging or rupturing of the cups at this point. It is pointed out that the cups are so mounted and the bushings 21 so embedded in the cups, that the maximum protection thereto is had, and the cups are protected from undue distortion, crushing, collapsing or rupture.

The outer surface of the upper portion of each cup is provided with spaced longitudinal grooves 24, and the lowermost cup has continuing grooves 24' extending down the shank to within a short distance of the bottom of the cup, as will be seen in Figure 2. Short radial pockets 25 are directed inwardly at the lower ends of the grooves 24' for receiving the inturned ends 26 of reinforcing rods 27 which are embedded in the grooves 24 and 24' of the cups. The upper ends of the rods are fastened in the usual retaining ring 28. This structure comprises a single reinforcing cage, in which applicant has mounted all of his cups, whereas, the common practice has been to mount each cup in an individual reinforcing cage. The cups being nested reduces the overall length of the swab assembly, so that the device is more compact and less likely to stick or hang in a crooked tubing.

The cups being formed of pliable and resilient material, the upper end portions thereof are free to flex and may be retracted or expanded. However, there is sufficient body to the upper portion, as to prevent the same from being too flexible. The inner diameter of the bushing 21 is much less than the diameter of the well 16, and this permits the bushing 21 to be snugly fitted onto the mandrel 10 or any other support of less diameter than said well. The upper end of the mandrel may be obviously provided with a regular sub and wrench-gripping faces for connecting to the usual wire line, none of which are shown.

One of the greatest disadvantages and objections to the swabs now in common use is the rapidity with which the cups wear out and which necessitates the frequent replacing thereof. Applicant has found that this is largely due to the individual caging and widely spaced mounting of the cups, whereby each cup receives the full thrust of the extreme weight of the fluid and is subjected to the resultant friction with the tubing or casing encountered in swabbing a well. Frequently after a comparatively short use the cups are so worn as to render them useless for the purpose for which they were designed. Applicant has overcome this disadvantage or objection by closely spacing the cups and surrounding them with the reinforcing rods 27 to form a single reinforcing cage for all of the cups.

The cups being mounted on the mandrel, one above the other, permits the weight and the load of the fluid to be distributed on each of the cups. This is accomplished by the fluid entering the space 18 between the shank 17 and well 16 of each cup and entering the well of the uppermost cup to act on each individual cup and distort the same into contact with the tubing 19. It is pointed out that each cup bearing a portion of the load, the friction on each cup is not as great as it would be on a single cup. Thus, it will be seen, that the cups of applicant's swab will not only last much longer, but their period of usefulness is materially increased, whereby the life of the swab is prolonged; and the frequent replacing of the cups being obviated the packing efficiency of the swab thus increased. In some instances and under certain conditions, the greatest load of fluid may be carried by the top cup, and the other cups only carrying a proportionate amount of the balance of the weight; and under other conditions, the bottom cup may be made to take the greatest weight of the fluid, with the other cups carrying a proportionate amount thereof. It is noted that even under these instances where either the top or bottom cup would be worn out first, the other cups would still function and take the place of the worn out cups.

In Figures 6 and 7, I have shown a modified form of the invention in which the cups have a slightly different construction, but the principle of the invention and the operation is the same. The lowermost cup A has a downwardly tapering shank 30 for fitting within the thimble 13. The upper end of the said cup has its inner edge rounded to a small degree. The well 32 is much smaller in diameter than the well 16, so that the space 18' is much smaller than the space 18. A reinforcing member or bushing 33 is provided similar to the bushing 21 and performs the same functions. The second cup B is shaped more in the form of a cylindrical collar, as will be noted in Figure 6, and is molded around a bushing 31 having a flange 31' and a lip 23'. The bushing extends downwardly therefrom. The inner edge of the upper end portion is rounded the same as the lower cup and also has a similar well 32. The top cup is similar to the second with the exception that the upper edge 34 is rounded as at 35 somewhat similar to the rounded lip 15 of the first form. So, too, as shown, the well 36 of the top cup is preferably flared upwardly.

In the form shown in Figures 6 and 7, the bushings 33 and 31 rest one upon the other with the lowermost one abutting the thimble 13, so that the same rigid, non-collapsible, supporting core is formed as that formed by the bushings 21. The rest of the swab is similar to that as shown in Figures 1 and 2, and it will be seen that with this form also, the weight of the fluid is distributed among the cups and their period of usefulness is materially increased.

What I claim and desire to secure by Letters Patent is:

1. A swab including, a mandrel, a plurality of tubular swab cups of compressible and expansible resilient material sleeved on said mandrel in superposed relation, the upper portions of the cups having annular wells open at the top, and a rigid bushing in each of said cups provided with an annular outwardly extending portion em-

bedded in the cup at the bottom of the annular well thereof, said bushings being respectively fitted about the mandrel and abutting each other endwise whereby to constitute a continuous support for the assembled cups and each cup is individually supported against undue distortion by compression and expansion.

2. A swab including, a support, a plurality of swab cups superposed on the support and each cup having a well, said cups being nested so that a portion of one extends into the well of another, a reinforcing bushing in each cup, and a single reinforcing cage in which the cups are confined.

3. A swab including, a mandrel, a plurality of swab cups superposed on the mandrel and each cup having a well therein, said cups being nested, whereby the lower portion of one extends into the well of the one therebelow, a reinforcing bushing embedded in each cup and extending into the lower portion of the cup, and a single reinforcing cage in which all of the cups are confined.

4. A swab including, a mandrel, a plurality of swab cups superposed on the mandrel and each cup having a well therein, a reinforcing bushing embedded in each cup, some of said bushings depending and extending into the well of the next cup, whereby the lower ends thereof abut the bushings in said next cups, and a single reinforcing cage for confining all of the cups.

5. A swab including, a mandrel, a plurality of swab cups superposed on the mandrel and each cup having a well therein, and a reinforcing bushing embedded in each cup, each bushing resting on the one therebelow so as to form a rigid support for the cups and prevent collapsing of the same.

6. A swab including, an axial support, a plurality of elastic cups, reinforcing means partially embedded in each cup and having a portion exposed and engaging around said support, the exposed portions of the reinforcing means being superimposed and forming a rigid core for said cups, and a single cage in which all of said cups are confined.

7. A swab including, an axial support, a plurality of reinforcing, superimposed members mounted on said support and having an outwardly projecting portion, a plurality of elastic cups surrounding the support and the reinforcing members and having the projecting portions thereof embedded therein, and a single cage in which all of said cups are confined.

8. A swab including, an axial support, a plurality of elastic cups mounted on the support and having a plurality of external grooves, and reinforcing rods in the grooves to form a single cage for confining all of the cups.

9. A swab including, an axial support, a plurality of elastic cups mounted on the support and having a plurality of grooves on the cups, the grooves in the lowest cup teminating in sockets, and reinforcing rods fitted within the grooves and having inturned ends to fit in said socket to form a single cage for confining all of the cups.

FERI A. THAHELD.