May 19, 1959 T. B. LOSEY 2,887,347

SWAB CUP

Filed July 30, 1958 2 Sheets-Sheet 1

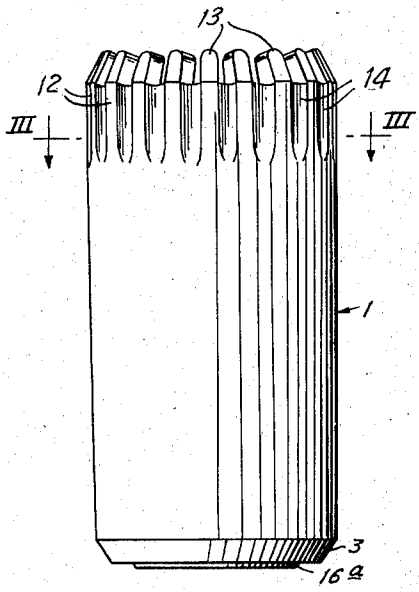


Fig. I

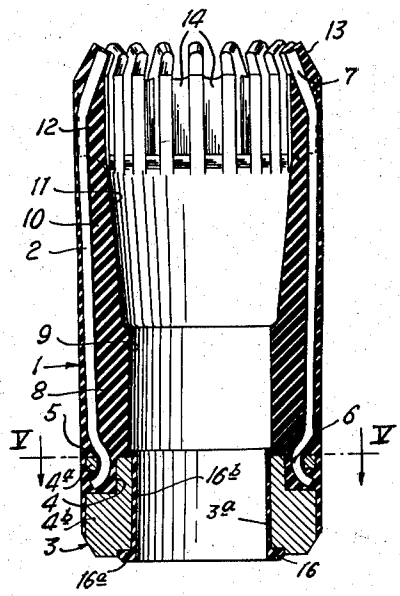


Fig. II

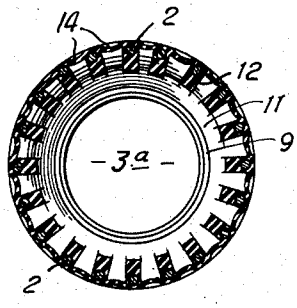


Fig. III

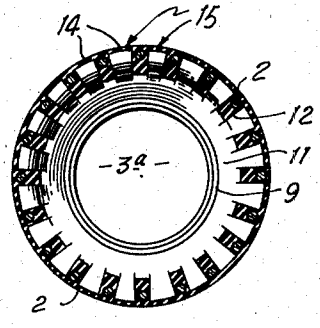


Fig. IV

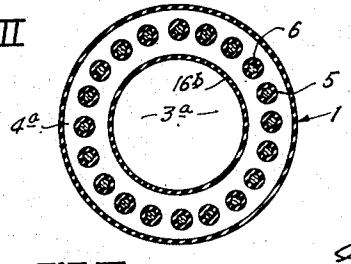


Fig. V

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SWAB CUP

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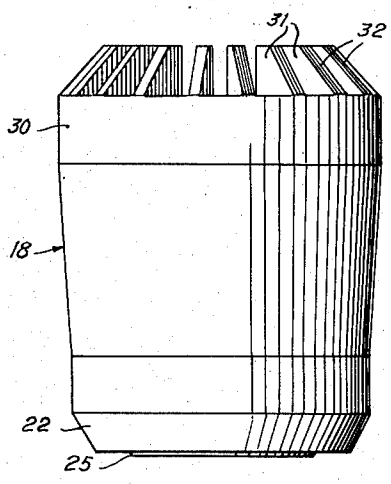


Fig. VI

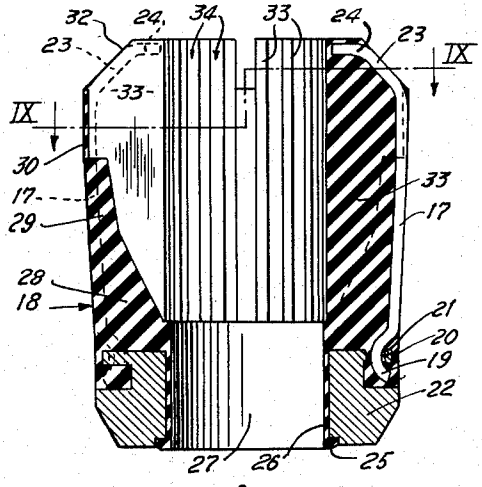


Fig. VII

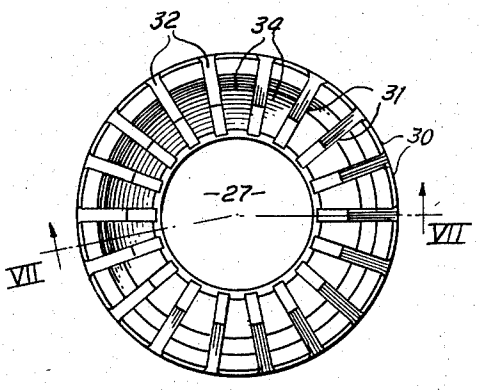


Fig. VIII

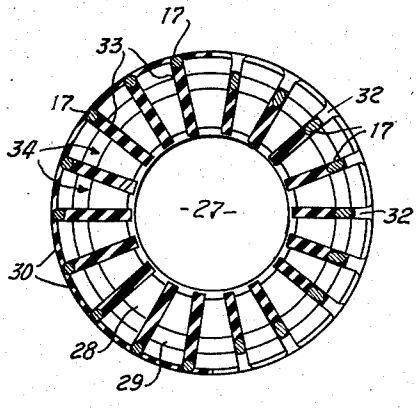


Fig. IX

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SWAB CUP

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Application July 30, 1958, Serial No. 751,911

14 Claims. (Cl. 309—33)

This invention is concerned with a swab cup for use in withdrawing fluid from wells, and is particularly concerned with a swab cup having reinforcing ribs therein extending upwardly from the resilient body thereof which are held together and restricted by flexible material molded integrally with the resilient body of the cup.

This invention is particularly concerned with a swab cup of the so-called "cage type" wherein longitudinal flexible metallic reinforcing ribs or wires are molded and embedded into the resilient material of the cup body in spaced relationship thereabout.

In such swab cups the ribs customarily extend above the resilient cup body and are deformed inwardly and encircled at the top by a metallic ring which is attached to the ribs, or the ribs extend through the holes in the ring, or the ring loosely encircles the ribs. In each instance, however, the wires are either confined against lateral and longitudinal movement in either direction, or in the case of the loose ring the ribs are confined against lateral outward movement. Thus the ribs do not have sufficient freedom of flexure or movement at their upper ends. The purpose of so confining the upper ends of the ribs is to protect them against such outward movement as would cause them to become hung up with couplings and other obstructions within the pipe.

One of the primary purposes of this invention is to provide such a swab cup structure wherein the upper ends of the reinforcing ribs are allowed to flex and move both inwardly and outwardly by providing an elastic web or connection between the upper ends, thus eliminating the necessity for such a ring, and permitting the swab cup to be more quickly and easily conformable to irregularities in the shape and size of the pipe.

At the same time the elastic webs provide sufficient elastic support and confinement of the upper ends of the ribs as to limit their outward movement to such an extent as to protect the wires from becoming hung up with pipe ends when the cup passes through enlarged couplings between sections of pipe.

The elastic limiting of the movement of the upper ends of the ribs, being in the form of elastic webs of considerably lesser thickness and strength and greater elasticity than the body portion of the cup, also permits the cup to more quickly expand to take hold of a load of fluid thereabove than would be the case with the use of a rigid ring about the ribs, which would rigidly confine the outward movement of the ribs, and which would also permit fluid to pass between the upper ends of the wires so that fluid could by-pass the cup for a considerable distance in the pipe before the cup would take hold of the load. This feature is of considerable advantage in that it lessens the number of runs into the pipe to remove a given amount of fluid, resulting in savings of time and lengthening of the life of swab cups.

The swab cup of this construction also provides a seal substantially throughout its length, thereby making it more quickly responsive to pick up a load of fluid and preventing excessive flow-by.

It is, therefore, a primary object of this invention to provide a swab cup wherein the upper ends of the reinforcing ribs are limited in their outward movement by webs of elastic material molded therebetween and made integral with the body of the cup.

It is another object of this invention to provide elastic means for confining and protecting the upper ends of the ribs in the swab cup, which elastic means is also expandable to form a seal with the well pipe.

A still further object of this invention is to provide a swab cup wherein the upper ends of the ribs are encased in rubber material of substantially the same thickness as the wall of the upper body portion of the swab cup to provide limited flexibility, and which are joined by webs of elastic material, molded integrally with the body of the cup, which provide an additional elasticity between the separate ribs.

An additional object is to provide such a swab cup wherein the lower ends of the ribs are mounted and carried in the flexible body of the cup, and which have limited lateral and longitudinal movement in the body of the cup.

A still further object of the invention is to provide such a swab cup wherein the upper ends of the ribs are turned inwardly and provided with an inwardly beveled elastic covering to provide a resilient buffer and protector therefor.

A still further object of the invention is to provide such a swab cup wherein the upper ends of the ribs have elastic webs therebetween which collectively hold the wires together.

Another object of the invention is to provide such a swab cup having a reinforced elastic wall which is graduated in thickness and flexibility from the bottom up so that it will quickly expand into sealing engagement under a load of fluid.

Still another object of the invention is to provide such a swab cup having an elastic seal about the lower face thereof which may come into sealing engagement with a shoe support on a swab mandrel to prevent fluid from passing between the support and the lower end of the swab cup.

Other and further objects will become apparent upon reading the detailed specification hereinafter following and by referring to the drawing annexed hereto.

In the drawings:

Figure I is a side elevational view of the swab cup made in accordance with the improvements disclosed herein;

Figure II is a half sectional, elevational view of the swab cup;

Figure III is a transverse cross-sectional view of the swab cup taken on the line III—III of Figure I, showing the swab cup in relaxed condition;

Figure IV is a view similar to Figure III showing the swab cup after it has been expanded by a load of fluid thereabove;

Figure V is a transverse cross-sectional view of the swab cup taken on the lines V—V of Figure II, showing the holes in the upper flange of the reinforcing bushing;

Figure VI is a side elevational view of an alternate form of swab cup, incorporating my invention;

Figure VII is a sectionalized elevational view of the form of swab cup shown in Figure VI, taken on the line VII of Figure VIII;

Figure VIII is a top plan view of the modified form of swab cup;

Figure IX is a horizontal cross-sectional view taken on the line IX—IX of Figure VII.

Numeral references are employed to designate the various parts of the swab cup shown in the drawing, and

like numerals indicate like parts throughout the various figures of the drawing.

The numeral 1 indicates the resilient body of the swab cup which may be made of natural or synthetic rubber molded into the shape indicated. One or more of such swab cups are mounted on a support or mandrel (not shown) and lowered into a well pipe on a wire cable. When withdrawn below a column of fluid the cups will expand into sealing engagement with the pipe and force the fluid out of the pipe at the surface.

A plurality of flexible, metallic reinforcing ribs 2 are embedded and molded in the body 1 of the cup, said ribs extending longitudinally of the cup body and being spaced annularly thereabout. The ribs 2 reinforce the rubber body to provide sufficient rigidity for the cup.

The lower end of the cup is provided with a reinforcing bushing 3, having a circular bore 3*a* therethrough, said bushing 3 being molded in the body 1 of the cup.

An annular groove 16 is formed about the lower inner side of the bushing 3 in which a resilient cushion 16*a* is molded at the time the cup is made, such cushion, as shown, being integral with the resilient body of the cup, and connected to the resilient material of the body of the cup by a resilient lining 16*b*. The resilient cushion 16*a* provides a seal against a supporting shoe (not shown) on a swab mandrel when the cup is pressed downwardly against the shoe by the weight of a fluid column thereabove.

The bushing 3 also has formed thereabout an annular groove 4 providing an upper flange 4*a* and a lower flange 4*b*. The upper flange 4*a* has spaced holes 5 therethrough, which holes receive the lower outwardly turned ends 6 of the ribs 2. It will be observed that the holes 5 are considerably larger in diameter than the ribs 2 so that when the resilient material of the body 1 is molded thereabout the lower ends 6 of the ribs may move laterally in the resilient material to a limited extent, and may also move vertically to a limited extent, because the lower ends of the ribs are spaced from the lower flange 4*b*.

The upper ends of the ribs 2 extend upwardly from the main body 1 of the cup and are turned inwardly at their upper extremities as indicated at 7, and such upper ends are encased in resilient material 12, molded integral with the body 1, of substantially the same thickness as the upper portion 10 of the body 1. The upper extremities of the resilient material about the upper ends of the ribs are beveled inwardly as indicated at 13 to provide a resilient skid and buffer for the wires to slide over obstructions in the pipe as the swab cup is drawn upwardly.

Attention is called to the fact that the resilient body 1 of the cup includes a thickened lower portion 8, having a straight inner bore 9, a relatively thinner intermediate wall portion 10, having a tapered inner bore 11, and the upper ends of the ribs 2 are encased in resilient covering material, indicated at 12, of substantially the same thickness as the upper part of the intermediate wall portion 10.

The upwardly extending ends of the ribs 2 are spaced apart and joined by webs 14 of resilient material molded integrally with the body portion 1 and the material 12, which webs are relatively thin as compared with the body portion 1 and covering material 12, so that such webs are more flexible than the body and quickly responsive to pressure differential thereacross. At the same time the webs 14 provide a flexible joinder between the upper ends of the ribs so as to hold the upper ends of the ribs together collectively but to permit their outward and inward flexure to a limited extent, either individually or collectively. The thickened coverings 12 of the upper ends of the ribs also provide molding bodies for the molding of the webs 14 between the ribs.

The webs 14 should be of sufficient strength to limit the outward flexure of the upper ends of the ribs to such an extent as to protect them from becoming engaged with obstructions in the well pipe when passing through portions of enlarged diameter, such as collars, but at the same time permit the upper ends of the ribs to move sufficiently to conform to and provide a seal with irregular contours of the normal diameter of the pipe. The beveled surfaces 13 will permit the upper ends of the wires to slide over irregularities and obstructions in the pipe and webs 14 cause the cup to instantly reconform to the pipe to maintain a seal therewith. The ribs 2 are free to bend and move to a limited extent in all directions by reason of their flexible mounting in resilient material at both top and bottom.

The webs 14, as shown, are slightly curved inwardly when the swab cup is not under load, as indicated in Figure III. However, this is not necessary because they could be straight and perform the same function.

When the swab cup is subjected to differential fluid pressure thereacross, as when being withdrawn from the pipe under a column of fluid, the webs 14 will instantly expand outwardly, as indicated at 15, into sealing engagement with the pipe. The webs 14 act in the fashion of a parachute which instantly responds to pressure differential thereacross to expand and seal. They instantly catch the pressure and confine it and transfer it to the tapered wall portion 10 of the cup and such pressure is distributed through the wall of the cup. When the cups, so made, are lowered into a column of fluid and then drawn upwardly, they instantly respond to differential pressure thereacross and immediately take hold of the load, allowing no appreciable by-pass of fluid thereabout, and when the cup is distorted in the pipe by passing through irregularly shaped portions, the webs 14 instantly pick up the load again before any appreciable amount of fluid is lost. Thereby greater quantities of fluid can be raised at a single run and fewer runs of the swab into the well are required.

In Figures VI–IX is shown a modified form of swab cup, incorporating the improvements claimed herein. In such form the flexible, metallic reinforcement wires 17 are embedded in the resilient wall 18 of the cup. The lower ends of the wires 17 are turned inwardly and then outwardly to form a hook 19 thereon.

The hooks 19 extend through enlarged holes 20 in the upper flange 21 of a bushing 22, embedded in the lower end of the resilient wall 18.

It will be noted that the lower ends of the wires 17 are supported only by the elastic material of the cup body so that they are free to move both laterally and longitudinally to a limited extent.

The upper ends of the wires 17 are turned inwardly to provide an angular portion 23 and an end portion 24 which extends substantially at right angles to the longitudinal axis of the cup. Such inward extension of the upper ends of the wires provides additional protection against the wires becoming engaged with obstructions in the well pipe upon expansion of the cup while passing through enlarged sections in the pipe.

The elastic material of the body is molded about the wires 17 and the bushing 22 after the wires are assembled with the bushing.

The elastic body 18 is so molded about the bushing 22 and wires 17 as to provide a sealing ring 25 about the lower face of the bushing 22, a thin layer of material 26 on the inner face of the bore 27, and progressively thinner and weaker wall portions 28 and 29, and relatively thin webs 30 between the wires 17. The upper ends of the wires 17 are encased in a relatively thick covering of resilient material, indicated at 31, which is beveled inwardly as at 32, to provide a guide for sliding over obstructions. A plurality of inwardly extending resilient ribs 33 are spaced about the inner side of the cup wall, each such rib 33 being molded to and extending inwardly from, a wire 17 and being integrally molded with the cup wall 18. The ribs 33 provide compartments

34 spaced about the inner side of the wall 18. Such ribs 33 strengthen the cup body and limit the outward flexure of the wires 17 and at the same time provides spaced compartments about the inner wall of the cup to distribute the fluid load in the cup. The webs 30 perform the same function as in the preferred form previously described, such cup construction having all of the advantages hereinbefore described.

Therefore, it will be seen that a cage type swab cup has been provided which is much more flexible in that the upper ends of the ribs are joined together by flexible webs therebetween so as to limit, but not unduly restrict outward movement, to protect them against obstructions in the pipe when passing through enlarged or irregular diameters, and at the same time provides a swab cup which is more quickly responsive to pressure differential thereacross and thereby lifts greater volumes of fluid more efficiently.

It will be understood that other and further forms of this invention may be made without departing from the spirit and scope of the appended claims.

I claim:

1. A swab cup comprising: a body portion of resilient material; a plurality of longitudinal ribs molded in the body and being spaced thereabout, the said ribs being extended above the body portion; and webs of flexible material molded integrally with the body and the upward extensions of the ribs, said webs being less in thickness than the body and connecting the upward extension of the ribs.

2. The combination called for in claim 1 wherein the upper ends of the ribs are turned inwardly and covered with resilient material thicker than the webs.

3. The combination called for in claim 1 with the addition of a bushing molded in the lower end of the body having a central bore therethrough; and an annular seal of resilient material about the lower face of the bushing.

4. The combination called for in claim 1 wherein the cup body has a central bore therethrough consisting of a straight wall portion at the lower end and an outwardly tapered wall portion extending upwardly therefrom.

5. The combination called for in claim 1 wherein the upper ends of ribs are turned inwardly and covered with resilient material thicker than the webs and beveled inwardly on the upper, outer side.

6. A swab cup comprising: a body portion of resilent material; a plurality of longitudinal ribs molded in the body of the cup and being spaced thereabout, said ribs having ends extending upwardly from the body which are encased in resilient covering material of substantially the same thickness as the upper portion of the body; and webs of flexible material molded integrally with the body and covering material, said webs being of less thickness than the covering material and the body and connecting the upward extensions of the ribs.

7. The combination called for in claim 6 wherein the upper ends of the ribs are turned inwardly and the covering material encasing the upper ends of the ribs is beveled inwardly at the upper, outer sides thereof.

8. The combination called for in claim 6 wherein the body comprises a thickened lower wall having a substantially straight bore therethrough and an upper wall portion having a bore with an inner surface tapered upwardly and outwardly from the bore of the lower wall portion.

9. A swab cup comprising: a cup body of resilient material; a cylindrical bushing molded in the lower end of the body having a circular bore therethrough; an annular groove formed about the bushing, providing an upper flange and a lower flange; a plurality of holes spaced about the upper flange; a plurality of reinforcing ribs molded in the cup body and having outwardly turned lower ends inserted through the holes and upper ends extending above the cup body; the said holes being larger in diameter than the ribs, and the lower ends of the ribs being spaced from the lower flange; resilient material of the body surrounding the lower ends of the ribs and forming an elastic cushion thereabout; and elastic webs connecting the upward extensions of the ribs, said elastic webs being less in thickness than the body and molded integrally with the body and the ribs.

10. The combination called for in claim 9 with the addition of an elastic cushion about the lower end of the bushing and molded thereto to provide a seal against the base of a swab support.

11. The combination called for in claim 1 wherein the upper ends of the ribs are turned inwardly at substantially right angle to the longitudinal axis of the body.

12. The combination called for in claim 6 with the addition of a plurality of resilient ribs molded integrally with the body and extending inwardly of the body to provide a plurality of compartments about the inner wall of the body.

13. The combination called for in claim 12 wherein one of the resilient ribs extends inwardly from each of the longitudinal ribs.

14. The combination called for in claim 12 wherein one of the resilient ribs extends inwardly from each of the longitudinal ribs and is of the same thickness as the covering material.

No references cited.