Nov. 25, 1952 R. A. WILSON ET AL 2,619,393

WELL SWAB

Filed Oct. 20, 1947 2 SHEETS—SHEET 1

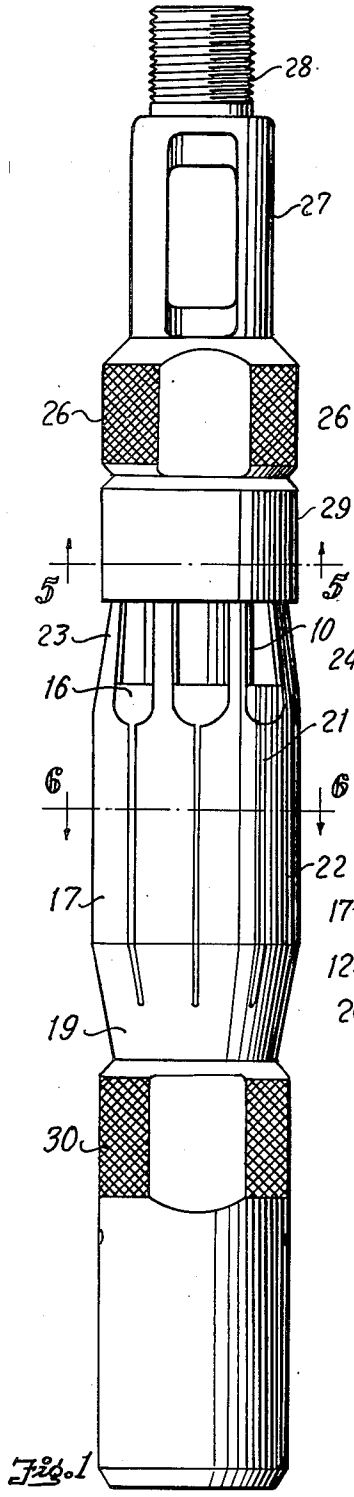


Fig. 1

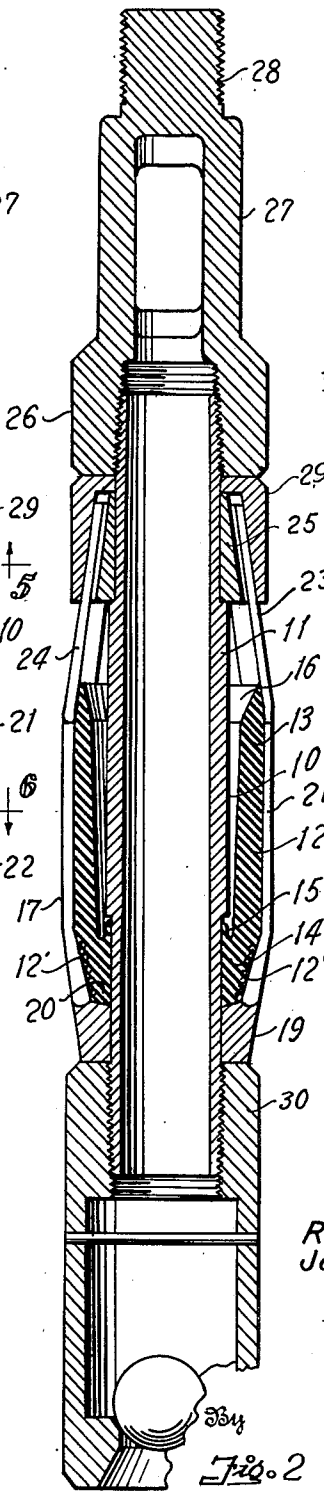


Fig. 2

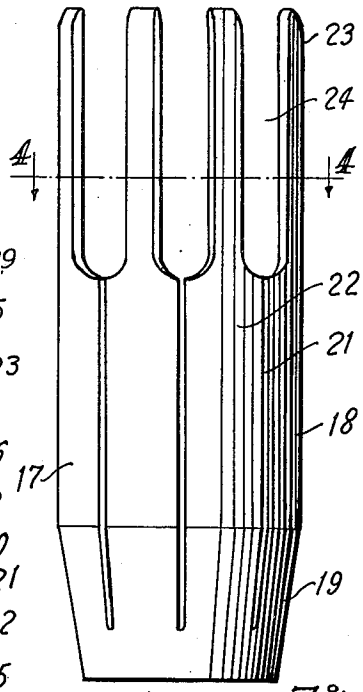


Fig. 3

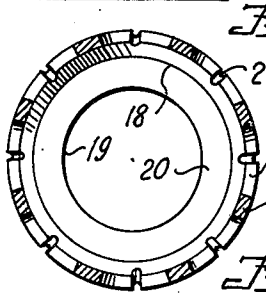


Fig. 4

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Nov. 25, 1952 R. A. WILSON ET AL 2,619,393

WELL SWAB

Filed Oct. 20, 1947 2 SHEETS—SHEET 2

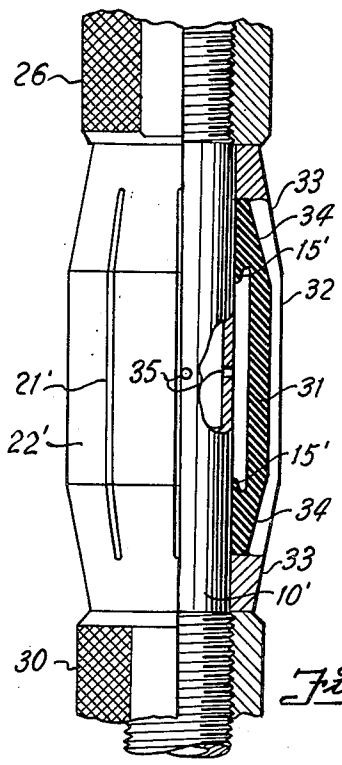


Fig. 7

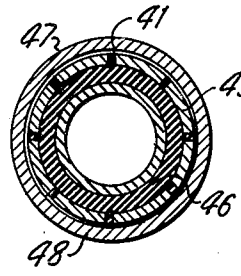


Fig. 9

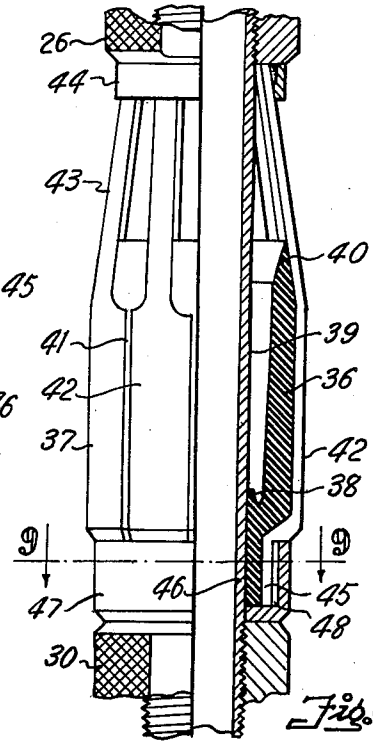


Fig. 8

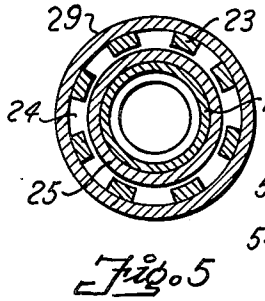


Fig. 5

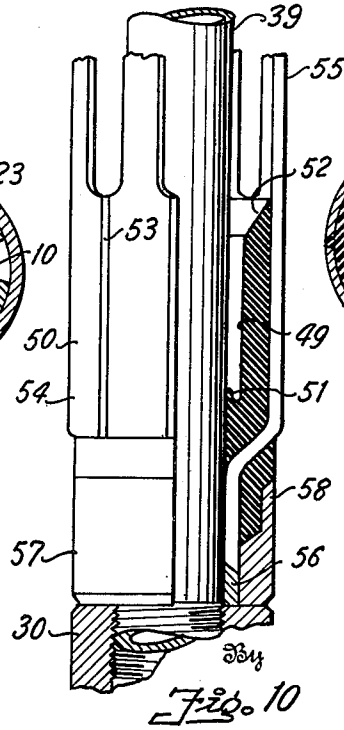


Fig. 10

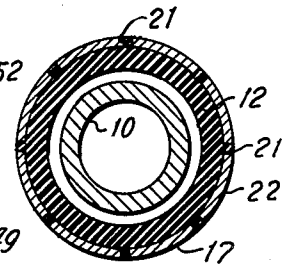


Fig. 6

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UNITED STATES PATENT OFFICE

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WELL SWAB

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Application October 20, 1947, Serial No. 780,960

8 Claims. (Cl. 309—33)

1

This invention relates to new and useful improvements in well swabs and particularly the packing or cup elements thereof.

One object of the invention is to provide an improved well swab which includes a metallic jacket or sleeve, slit or cut longitudinally to permit circumferential or radial deforming or distortion, whereby said sleeve takes the wear and conforms to the internal irregularities of the tubing, in combination with an elastic cup or member surrounded by the jacket, which coacts with the sleeve in distributing and carrying the liquid load.

Another object of the invention is to provide an improved well swab which includes an exterior, metallic protecting jacket or sleeve, having longitudinal slits or cuts and an elastic cup or member molded in the jacket, whereby the elastic material of the cup or member fills the slits or cuts and seals them against leakage.

A further object of the invention is to provide a reinforced well swab, of the character described, wherein the metallic jacket or sleeve is cut or slit longitudinally to give it the desired flexibility and which has its upper portion, beyond said slits, reduced to form resilient fingers or wickers, thereby providing openings for the passage of fluid, as well as a means of securing the upper end of the jacket in place.

Still another object of the invention is to provide an improved well swab having an elastic cup enclosed in a metallic jacket, whereby the wall thickness of the cup may be reduced since the jacket takes the wear and the major portion of the radial thrust of the liquid load in the cup or hollow member.

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, wherein examples of the invention are shown, and wherein:

Fig. 1 is an elevation of a swab construction in accordance with the invention,

Fig. 2 is a longitudinal sectional view of the swab,

Fig. 3 is an elevation of the metallic jacket,

Fig. 4 is a horizontal, cross-sectional view, taken on the line 4—4 of Fig. 3,

Fig. 5 is a horizontal, cross-sectional view, taken on the line 5—5 of Fig. 1,

Fig. 6 is a horizontal, cross-sectional view, taken on the line 6—6 of Fig. 1,

Fig. 7 is a view, partly in elevation and partly in section, illustrating a modified form of the invention,

2

Fig. 8 is a view, similar to Fig. 7, of another modification of the invention,

Fig. 9 is a horizontal, cross-sectional view, taken on the line 9—9 of Fig. 8, and

Fig. 10 is a view, partly in elevation and partly in section, showing a modification of the lower portion of one of the cups and its jacket.

In the drawings, the numeral 10 designates a tubular mandrel or support disposed axially of the swab and having its ends screw-threaded. At its medial portion, the mandrel has a cylindrical enlargement 11. An elastic cup or hollow member 12 surrounds the mandrel and may be made of any suitable material such as rubber, synthetic rubber, soft plastic or the like. The cup is generally cylindrical in shape, but is subject to considerable variation in form and shape.

As shown in Figs. 1 to 6, the cup has a cylindrical wall 13 and a reduced or frusto-conical bottom 14, which is annular so as to engage snugly around the mandrel. An upstanding, annular flange or lip 15 is formed on the inner periphery of the cup bottom 14 for sealingly engaging the mandrel. The upper end of the cup is internally beveled to form an annular lip 16, which terminates a substantial distance below the upper end of the enlargement 11.

The important feature of the invention is a metallic sleeve or jacket 17 which snugly encloses and surrounds the cup. This jacket is preferably made of steel or other suitable metal and includes a medial cylindrical wall or portion 18 and a reduced or frusto-conical, annular bottom 19, which is formed with a socket 20 shaped to receive the bottom 14 of the cup.

The cylindrical wall 18 is formed with regularly spaced longitudinal kerfs or slits 21 which are narrow and which extend down into the socket portion 20. By reason of the slits, the cylindrical wall is divided into a plurality of elongate or longitudinal panels 22 which are substantially coextensive with the cup. This structure permits the jacket to deform or distort circumferentially or radially so that the cylindrical wall 18 adapts itself to irregularities in the bore of the well pipe (not shown) and also assures a sufficient seal with said bore, when the swab is loaded, so as to prevent undesirable by-passing of the fluid. The cylindrical panelled wall 18 of the jacket constitutes, not only a wearing surface, but a sealing or working surface; the individual panels 22 being forced into sealing contact with the inner surface of the tubing by the radial expansion of the elastic cup 12, when the latter is loaded.

The upper portion of the jacket is cut out on each side of the slits to form reduced fingers **23** with elongate openings **24** therebetween. These reduced fingers are readily bent or sprung inwardly so as to surround a frusto-conical collar or retaining member **25** mounted on the mandrel and resting upon the shoulder formed by the enlargement **11**, or in any other suitable member. A head or fixture **26** is screwed onto the upper end of the mandrel and has a cage **27** and a screw-threaded pin **28**, as is common in this art. Below the head, a thimble or bowl **29**, encircles the mandrel and has a bore conforming to the collar **25**, but of larger diameter so as to provide an annular space therebetween, in which the upper ends of the fingers **23** are confined. A foot valve fixture **30** is screwed onto the lower end of the mandrel and engages the bottom **9** of the jacket, whereby the packet is confined on said mandrel.

The jacket **17** is first formed in the shape shown in Fig. 3. The elastic cup **12** is preferably molded in the jacket and bonded thereto. The elastic material fills the slits **21** and thus seals them. Owing to the protection and reinforcing afforded by the metal jacket, the cylindrical wall **13** of the cup may be comparatively thin. If desired, suitable fabric **12'** may be embedded in the lower portion of the cup to reinforce and prevent cold flowing of the same under pressure.

When the cup and jacket unit is placed on the mandrel **10**, the fingers **23** are bent or sprung inwardly against the collar **25** and received in the bowl **29**, when the fixture **26** is screwed onto said mandrel. If desired the fixture **26** may first be secured on the mandrel and the unit then slit upwardly so that the fingers enter the socket, after which the fixture **30** is applied. Owing to the reduced bottom **19** of the jacket and the inwardly bent fingers **23**, only the cylindrical wall **18** of said jacket engages the inner surface of the well pipe and the swab will thus readily pass obstructions.

For some uses, it may not be desirable to use a cup and in Fig. 7 an elastic hollow member or barrel **31** is shown. The barrel is similar in construction to the cup **12**, except that both ends are formed like the bottom of said cup and have similar internal, annular lips **15'** for sealing off around an axial mandrel **10'**. A complementary jacket **32** surrounds the barrel **31** and has each end **33** reduced like the bottom **19** of the jacket **17** with sockets or recesses **34** formed therein for snugly receiving the ends of said barrel. Longitudinal slits or cuts **21'** extend into the reduced ends **33** of the jacket to provide flexible panels **22'** similar to the panels **22** of the jacket **17**. There is, of course, some clearance between the jacket **32** and the inner wall of the well pipe (not shown) to facilitate lowering of this form of swab through said well pipe. One or more ports **35** are formed in the mandrel **10'** for exposing the barrel to the well fluids so as to expand and distort said barrel. The head **26** directly engages the upper reduced end of the jacket.

A modified form of swab is shown in Figs. 8 and 9 and includes an elastic hollow member or cup **36**, similar to the cup **12**, which is surrounded by a somewhat similar jacket or sleeve **37**. The cup **36** has an internal, annular lip **38** for sealing off around a mandrel **39** and its upper end is beveled to provide a lip **40** similar to the lip **16**. The jacket **37** includes longitudinal slits **41**, panels **42** and fingers **43** with the latter being welded or otherwise secured within an annular retaining

member or ring **44**. The head **26** is in direct engagement with the ring **44** which functions in the same manner as the collar **25** and thimble **29**. In fact, the latter elements are interchangeable with the ring and either type of retaining means may be employed with either form of the invention. However, the coacting collar and thimble provide greater flexibility. Instead of the annular bottom **19**, the slits **41** and panels **42** extend throughout the reduced lower end of the jacket **37** to provide inwardly-disposed extensions or fingers **45**. The lower end of the cup **36** is also elongated or extended as shown by the numeral **46** and the panel extensions **45** are preferably embedded or molded therein. For confining the panel extensions, an inverted thimble **47** is confined upon the mandrel **39** by the fixture **30** in surrounding relation to said extensions. The internal diameter of the thimble **47** is greater than the external diameter of the panel and cup extensions to provide an annular space **48** therebetween, whereby limited outward movement of said extensions is permitted upon expansion of the panels and cup. Due to the flexible mounting of the extensions, permanent distortion or breakage of the panels is reduced to a minimum.

In Fig. 10, a slight modification of the invention is shown and includes an elastic hollow member or cup **49** similar to the cup **36** and surrounded by a similar jacket **50**. An internal, annular lip or flange **51** projects upwardly from the lower end of the cup **49** for sealing off around the mandrel **39**, while the upper end of said cup is internally beveled to provide a lip **52** similar to the lip **16**. If desired, the wall of the cup may be relatively thick and of constant internal and external diameters. The jacket **50** includes longitudinal slits **53**, panels **54** and fingers **55**, similar to the slits **21**, panels **22** and fingers **23** of the cup **17**, and the upper ends of said fingers **55** are adapted to be confined by either of the retaining members **29** and **44**. It is pointed out that the slits **53** and panels **54** extend well into the reduced lower end **56** of the jacket which engages the mandrel and the lower portions of said panels are embedded within the lower end of the cup. A thimble or bowl **57**, having an annular, upstanding skirt **58**, surrounds the reduced lower end of the jacket below the cup and may be made integral with said jacket although shown as a separate element. The skirt **58** encircles the lower end of the cup, which may be molded therein, so as to reinforce said cup and the portions of the jacket panels **54** embedded in the cup. When not secured to the jacket or the cup, the thimble **57** is maintained in position by the valve fixture **30**.

It is particularly pointed out that the wide longitudinal panels **22**, **22'**, **42** and **50** function in a new manner in this art. By completely surrounding the rubber cup and not exposing portions of surface of the cup, as in Figs. 8 and 10 of my prior Patent No. 2,456,551 and Thaheld 2,144,997, Fig. 7, the cylindrical surface of the rubber cup is not exposed to contact with the pipe wall and therefore is not subjected to wear as in said patents.

The foregoing description of the invention is explanatory thereof and various changes in the size, shape and materials, as well as in the details of the illustrated construction may be made, within the scope of the appended claims, without departing from the spirit of the invention.

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

1. A well swab including, an axial support, an elastic cylindrical cup surrounding said support, an elongated metallic cylindrical jacket enclosing the cup, the jacket having widely spaced narrow longitudinal cuts dividing it into elongated broad deformable panels exposed on the exterior of the swab, a supporting member on the support engaging the bottom of the jacket, an annular retaining member engaging the upper end of the jacket, the lower portions of the panels being embedded within the cup, and a reinforcing member surrounding the embedded panel portions.

2. A well swab including, an axial support, a cylindrical elastic cup surrounding said support, an elongated cylindrical metallic jacket enclosing the cup, the jacket having longitudinal narrow cuts dividing it into broad elongated deformable panels exposed on the exterior of the swab, said jacket having an annular portion below its cuts surrounding the support, a supporting member on the support engaging the bottom of the jacket, longitudinal spaced fingers integral with the medial portion of the jacket above the cup, the fingers being bent inwardly, an annular retaining member engaging the upper ends of the bent fingers, the lower portions of the panels being embedded within the cup, and a reinforcing member surrounding the embedded panel portions.

3. A well swab including an axial support, an elastic hollow member surrounding the support and having the major portion of its length cylindrical with its lower end frusto-conical, and an elongate metal jacket completely surrounding the elastic member from the bottom to the top thereof having an elongated cylindrical portion surrounding and enclosing the cylindrical length of the elastic member above its frusto-conical end, the cylindrical portion of the jacket having elongate slits widely spaced circumferentially thereof and presenting wide circumferential panels along the cylindrical portion above the frusto-conical end of the elastic member, whereby the cylindrical portion of the elastic member above its frusto-conical end is completely shielded from the wall of a tubing by the slitted portion of the cylindrical portion of the jacket above the frusto-conical lower end of the elastic member, the entire cylindrical surface of the elastic member being completely shielded by the slitted cylindrical portion of the jacket.

4. A well swab including, an axial support, an elastic member surrounding the support having a vertically elongated cylindrical portion and a bottom portion of reduced diameter, and a metallic jacket completely surrounding enclosing the elastic member having a reduced bottom portion surrounding the bottom portion of the elastic member and a vertically elongated outer sealing portion thereabove having elongated closely spaced wide panels encasing the cylindrical portion of the elastic member above the reduced bottom thereof and constituting the tube engaging portion of the jacket, whereby the cylindrical surface of the elastic member is completely shielded from contacts exterior of the jacket.

5. A well swab including, an axial support, an elastic cylindrical member having a reduced annular lip at its upper end and surrounding the support, and a metallic cylindrical jacket enclosing the elastic member having narrow longitudinal slits terminating substantially at the lip of said elastic member and providing wide metallic panels shielding the plastic member and reduced fingers extending from the ends of the panels beyond the lip of the elastic member.

6. A well swab including, an axial support, an elastic cup surrounding said support, an elongate metallic jacket completely surrounding and enclosing the cup, the jacket having circumferentially spaced narrow longitudinal slits dividing the circumferential surface of the jacket into elongate wide panels, each panel exposing a broad deformable working face many times wider than the slits on each side thereof, said jacket having an annular portion below its slits surrounding the support, a supporting member on the support engaging the bottom of the jacket, longitudinal spaced fingers integral with and extending from the upper ends of the panels, each finger being of a less width than its correlated panel, and an annular retaining member engaging the upper ends of the fingers.

7. A well swab including, a tubular mandrel, a fixture mounted on the lower end of the mandrel, an elastic cup mounted on the mandrel, a metallic jacket completely surrounding and enclosing the cup and resting upon the fixture, the jacket having a cylindrical surface exposed on the exterior of the swab and provided with widely spaced longitudinal slits along said cylindrical surface, whereby said exposed surface is divided into closely spaced wide panels, transversely reduced fingers extending from the upper ends of the panels, a collar receiving the upper ends of said fingers, and a fixture mounted on the upper end of the mandrel and overhanging the fingers.

8. A well swab including, an axial support, a metallic jacket having a medial cylindrical portion formed of wide elongate panels separated by narrow longitudinal slits and constituting a complete circumferential metallic working surface, and an elastic cup disposed within the jacket having a cylindrical portion completely surrounded and covered by the cylindrical portion of the jacket.

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