Sept. 16, 1958 H. E. BOWERMAN 2,852,323

SWAB CUPS

Filed Feb. 13, 1956

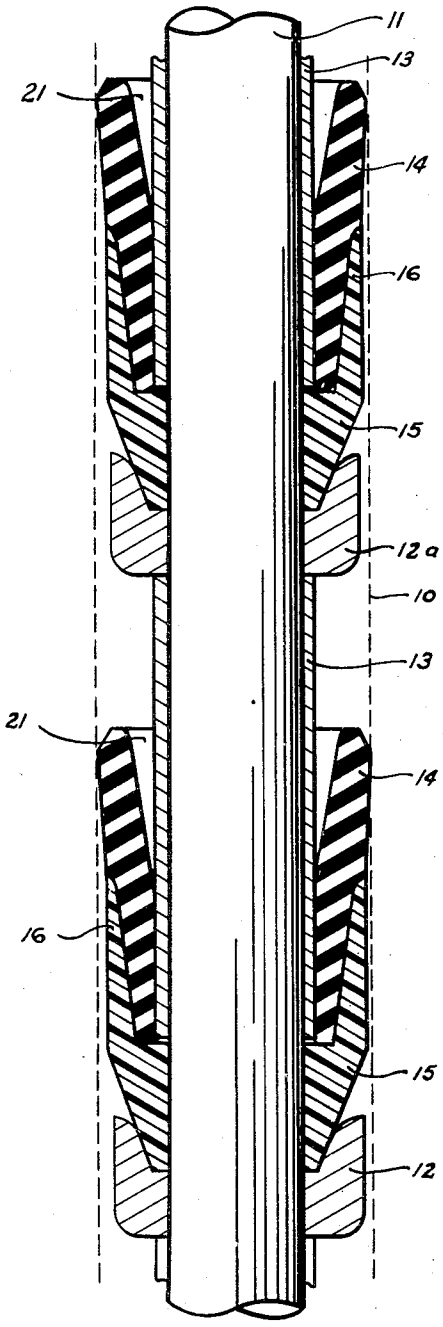


Fig. I

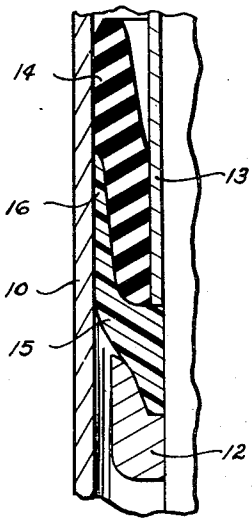


Fig. II

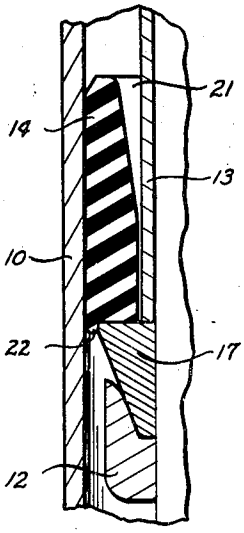


Fig. III

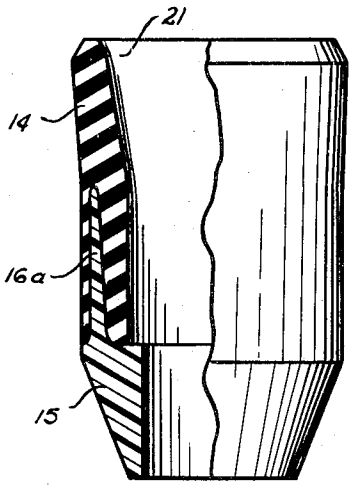


Fig. IV

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SWAB CUPS

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4 Claims. (Cl. 309—33)

This invention relates to well swabs and more particularly to the provision of a highly efficient and durable novel reinforcing medium for the usual rubber-like sealing element of a swab cup.

Heretofore it has been the practice in the art to provide such a reinforcing means as a basket composed of an assembly or arrangement of generally vertically disposed wires which were sometimes embedded in the rubber element. At other times these wires were placed in grooves formed in the wearing face of the swab rubber and generally the lower ends of these wires are assembled into and/or carried by a rigid metal base for the cup assembly. Moreover if these wires are small and flexible enough to facilitate expansion of the swab rubber-wire basket-assembly the upper ends of the wires have to be secured by an additional retainer else they will splay apart, enter the tube couplings in the spaces between ends of the well tubes, be doubled back, torn loose, and otherwise be destructive of the cup assembly.

In any event these embedded wires provide weakened sections of the rubbers since the bond of the rubber to the metal wires is not as strong as the tensile strength of the rubber, when in fact such bonding does exist. Also when sections of the rubber cup are restrained from distorting outwardly in response to the loads of fluid being lifted from the well other sections of the rubber are stretched and stressed beyond efficient and durable working limits. It will thus be seen that while the wire basket assembly provides a general overall support for the rubber the remedy sets up other and destructive factors.

By my present invention there is provided a novel and efficient reinforcing element, very economical of manufacture and of a single piece in providing both a supporting base for the rubber and a reinforcing of the latter against undue distortion under load, this reinforcing being uniform entirely around the rubber. The distortion of the rubber will therefore be uniform and free from the high stress areas inherent in the wire-basket construction. Moreover, I use a material for my base and reinforcing which is more flexurally compatible with selected rubbers than is steel wire or other metals. It is also readily observed that the contact areas are much greater between the rubbers and reinforcing provided by my cup than is attainable with the wire-basket assemblies, which results in my having an overall stronger, more durable and efficient cup unitary assembly.

I have attained a further advantage by providing reinforcing for the rubber of my cups which elongates under stress and returns to original dimension when stress is relieved, but which possesses a higher modulus of elasticity than the rubber. The performance of my novel reinforcing is that as the rubber tends to reach its practical limits of resistance to the working loads my reinforcing relieves the rubber of destructive stresses. The main function of the rubber is sealing between the swab assembly and the tube, while my reinforcing is mainly

a load and stress carrying medium, protective of the rubber.

Novel features of my invention will be readily understood by those skilled in the art from the following description together with the accompanying drawings in which:

Figure I is a schematic view of my swab assembly as introduced into a well tube not under load;

Figure II shows my swab cup of Figure I under load;

Figure III shows a conventional swab cup under load;

Figure IV shows a modified form of my swab cup.

In the several views like references indicate similar parts wherein **10** is a well tube, **11** is a swab mandrel, **12** is a thimble fixed to mandrel **11** while thimble **12***a* may preferably be free to move on mandrel **11**. Spacer sleeve **13** acts to separate the swab cups and to support the upper cups of the assembly on thimble **12**. **14** is a rubber upper portion of the swab cup and **15** is a base portion of the swab cup which I prefer to make of a material such as molded zytel nylon or Kel F and formed with an upwardly tapered extension **16** embracing the lower part of rubber cup **14**. In Figure IV extension **16***a* is shown embracing a part of the rubber of cup **14** and embedded therein for purposes later to appear herein. In Figure III a metal base portion **17** of a conventional swab cup is shown.

The operation is as follows:

I first mold the nylon base portion of my cup integrally with extension **16** shaped so as to be more responsive to outward pressures induced by thrust loads than other portions progressively downward. I then mold the rubber portions of my cup preferably bonded to the nylon base as an insert in the mold at this stage and thus form a unitary cup component.

As many of my cups as desired for a particular operation are passed over mandrel **11** with separator sleeves **13** interposed therebetween. Bases **15** will be seated against and supported by thimble **12**, sleeves **13** and bases **12***a* respectively, bases **15** being of such proportions and strength as to carry their respective loads without material distortion. The assembly is then introduced into the well tube as outlined in Figure I with only the upper or lip portions of the rubber of the cups contacting the walls of the tube. A suitable support for the swab (such as a wire line), not shown, is attached to the upper end of the assembly and the complete swab lowered into the fluid of the well to the desired depth, the fluid passing up through a central bore or opening of mandrel **11**. A suitable ball or other conventional check valve is operatively associated with mandrel **11**. The desired immersion in the fluid of the well having been achieved, conventional equipment lifts the swab with its load upwardly of the tube whereupon the rubber section of the cup distorts outwardly and downwardly responsive to the liquid pressure above and within the well of the cup **21**, transmitting this thrust likewise downwardly into the upper extension **16** of the base portion of the cup, which due to its thinner upward portion expands outwardly to itself contact the well tube under full load as indicated in Figure II thus protecting the rubber section of the cup from destructive effects of the unprotected rubber distorting past the rigid base portions of a cup as illustrated in Figure III at **22**.

Thus my cup will lift greater heads of liquids from the well each trip and effect like economies in completing the entire swabbing operation.

It will be understood that the respective parts of my cup are shaped and proportioned to respond to well depths, fluid penetrations and the like in the optimum manner; certain detrital concentrations in the fluid or other conditions may indicate embedding extensions of

the base of my cups within the rubber portions as indicated at **16***a* in Figure IV.

My cups will function with equal facility on other types of swab mandrels such as shown in my prior Patent No. 2,518,275.

What I claim is:

1. A swab cup comprising an annular upper portion of resilient material bonded to a thick base portion of material harder than said resilient material, said base portion having an integral relatively thin upwardly extending sleeve surrounding the lower end of said upper portion, the thickness of the sleeve diminishing in a direction upwardly along the upper portion to provide an increasingly yieldable reinforcement of the upper portion.

2. In a cup as set forth in claim 1, the outer surface of the cup comprising at its upper end said resilient material and at its lower end said elastic material and the contour of said outer surface being smooth and continuous.

3. In a cup as set forth in claim 1, a layer of said resilient material extending downwardly and covering at least the upper end of said sleeve and being integral with said upper portion.

4. In a cup as set forth in claim 1, said resilient material being rubber and said elastic material being nylon.

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