July 27, 1943. R. G. TAYLOR, JR., ET AL 2,325,556

WELL SWAB

Filed March 22, 1941

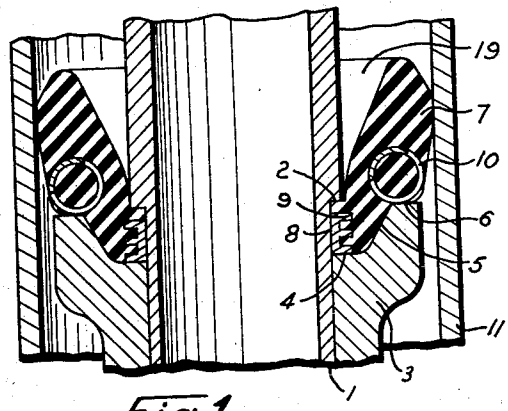

Fig. 1

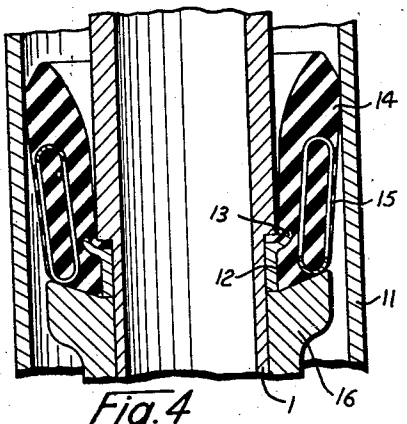

Fig. 4

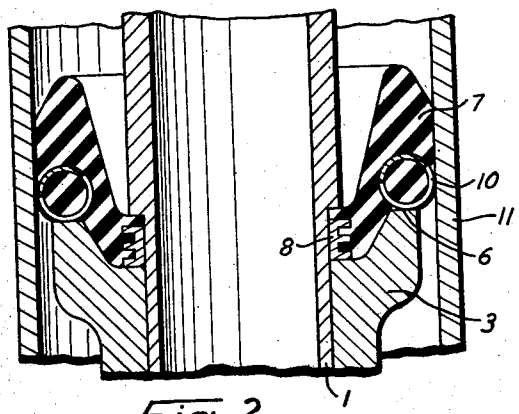

Fig. 2

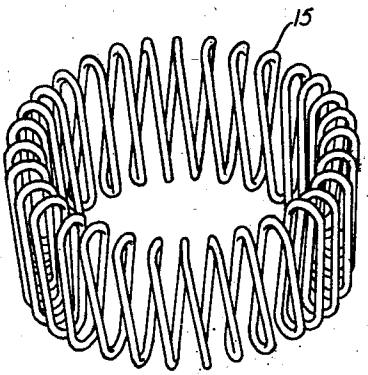

Fig. 5

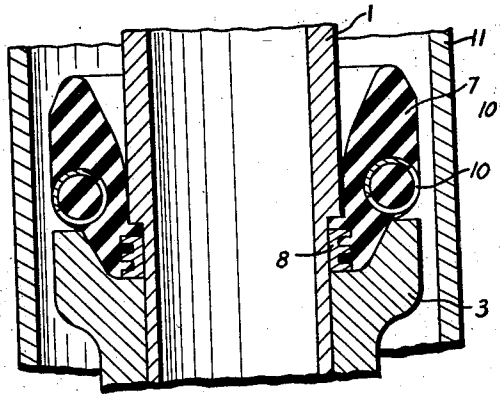

Fig. 3

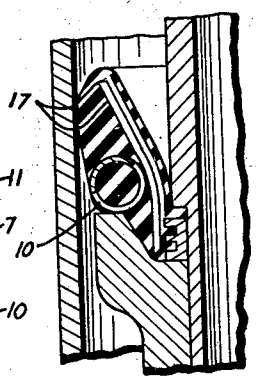

Fig. 6

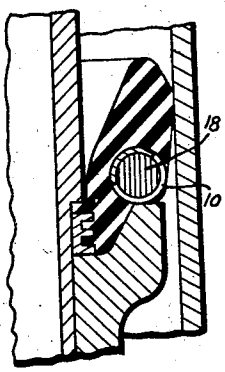

Fig. 7

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WELL SWAB

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10 Claims. (Cl. 309—4)

The object of this invention is to provide an improved well swab in which the swab is reinforced by spring means to prevent it flowing downwardly between its support and the well casing when the swab is subjected to high pressures. Various reinforcing means for the swab cup have heretofore been suggested but we believe that we are the first to embed in the swab cup a continuous expansible spring so as to adequately support the cup when subjected to high pressures and to prevent it flowing downwardly between the support and the casing. The spring might be a continuous helix or it might be a continuous spring, each of the convolutions thereof, when viewed in a plane extending vertically through the same, would appear to be very much the shape of a paper clip, and it would not only support the bottom portion of the cup but would support a major portion of its height. Another object of the invention is to provide, in addition to the spring, one or more layers of a fibrous material. Various such materials might be used, one of which might be canvas. Instead of providing layers of the fibrous material, a core of fibrous material might be inserted in the spring and in that case we would suggest that the core be formed and the spring then wrapped around it forming a helix and the ends of the spring united together so as to make it continuous, the spring with its core then being molded in the flexible material which might be rubber or preferably one of the rubber substitutes, such as neoprene, duprene or other material which would not be readily attacked by oil or other well fluid.

Other objects and advantages of the invention will appear in the detailed specification and claims which follow.

The invention may be better understood by referring to the attached drawing in which

Fig. 1 is a cross-sectional view of our swab cup assembly, the cup being shown in its unexpanded condition or when it is subjected to very light pressures,

Fig. 2 is a cross-sectional view showing the cup in its expanded or loaded condition,

Fig. 3 is a cross-sectional elevational view showing the position of the cup when it is being lowered in the well and the well fluid is passing around the cup,

Fig. 4 is a vertical cross-sectional view of a modification,

Fig. 5 is a perspective view of the spring shown in Fig. 4,

Fig. 6 is a vertical cross-sectional view of a portion of a swab cup assembly showing a second modification, and

Fig. 7 is a vertical fragmentary view showing still another modification.

Referring to Figs. 1, 2 and 3, the tubing 1 is provided with a shoulder 2 and a support 3 is secured to the tubing, the support being provided with a horizontal shoulder 4 communicating with an outwardly flaring surface 5 communicating with a horizontal surface or shoulder 6. The flexible cup 7, which constitutes the swab cup per se, rests on the shoulder 4 and surfaces 5 and 6 and it has a bushing 8 in the lower portion thereof embracing the tubing. The bushing has external annular ribs 9 and the swab cup 7 is molded to the bushing, the ribs serving as an additional bonding surface between the cup and the bushing. A portion of the swab cup also extends between the upper portion of the bushing and the shoulder 2. The swab cup, above its lower portion, flares outwardly forming a cup portion 19 for well fluid.

Molded in the swab cup is a helical spring 10, it being embedded in the lower portion of the cup immediately above the surface 6. This helical spring may be made by bending a spring around a ring so that it is circular in cross section and the ends of the spring should be united so the helical spring is continuous. Preferably the swab cup is made of rubber or a rubber-like substance, such as neoprene or duprene. It may be made of various substances but the essential point is that the swab cup must be flexible.

When the swab cup is subjected to little; if any, pressure of the well fluid, the parts would be substantially in the position shown in Fig. 1. If now the operator raised the tubing, the swab cup would lift all of the well fluid above the swab cup. The well fluid would radially expand the cup into the position shown in Fig. 2 and it will be noticed that the spring 10 rests on the shoulder 6 and bridges the space between the upper end of the support 3 and the well casing 11, thereby preventing the swab cup from flowing downwardly through the space between the outer portion of the support and the casing 11. When the tubing is being lowered in the well so that well fluid would pass between the cup and the casing the swab cup would be moved into the position shown in Fig. 3 thereby providing a free channel for the fluid. It will, therefore, be noticed that the swab cup not only allows the well fluid to pass by the cup as the swab cup assembly is being lowered through the fluid but when the tubing is raised the swab cup makes

an effective seal between the tubing and the well casing and the spring prevents the flow of the swab cup downwardly between the support and the casing.

As shown in Fig. 4, a bushing 12 is provided which is of a different configuration than the bushing 6. It is further provided with an outwardly extended flaring flange 13 and the cup 14 is molded to the bushing 12 and flange 13. In this modification instead of using a spiral spring 10 we suggest the use of a spring 15 which is shown in vertical cross-section in Fig. 4 and a perspective view of which is shown in Fig. 5. In the vertical view shown in Fig. 4 it will be noted that the shape of this spring is very much like that of a paper clip but it will be noted from Fig. 5 it is a continuous spring formed of successive convolutions. The parts would be in the position shown in Fig. 4 when little, if any, pressure from well fluid was imposed upon the cup. When the cup is subjected to well pressures and is under the condition shown in Fig. 2, the outer end of the spring 15 would lie substantially flush with the inner walls of the casing, being separated therefrom by only a thin portion of flexible material of the swab cup and the lower portion of the spring would effectively support the lower portion of the swab cup so that the same could not flow downwardly between the support 16 and the well casing 11.

In the modification shown in Fig. 6 the parts are substantially identical with the construction shown in Figs. 1, 2 and 3 except that we have embedded fibrous layers 17 between the spring 10 and the inner surface of the cup. The function of these fibrous layers is to afford an additional support for the cup. In Fig. 6 we have shown two such layers but obviously one or more might be employed. These layers should be made of strong material such as stout canvas, although we do not limit ourselves to the particular material of which the layers are composed. In some cases stout layers of linen or leather might be employed.

The modification shown in Fig. 7 is the same as the construction shown in Fig. 1 with the exception that we have embedded a band of fibrous material 18 within the ring 10. This fibrous material forming the band should likewise be made of any stout material such as canvas or linen and it serves the function to strengthen the wires so as to prevent material distortion of the wire support or at least to tend to prevent this distortion when the cup is subjected to very heavy pressures. In oil well practice it has been found extremely difficult to prevent the flexible swab cup from flowing downwardly between its support and the well casing and in all the forms of the invention shown in this application means are provided to prevent the swab cup from thus flowing.

We realize that many changes may be made in the specific form shown by way of illustration herein and we desire to claim the same broadly as we may limit ourselves in the appended claims.

Having now described our invention, we claim:

1. A well swab for use on a pipe in a casing including a support on said pipe, a swab cup of resilient material supported by said support, the support being smaller than the inner cross sectional area of the casing and a circumferentially extending spring embedded in said cup and adapted to bridge the space between the support and pipe to prevent the cup from flowing downwardly between the support and casing.

2. A well swab for use on a pipe in a casing including a support on said pipe, a swab cup of resilient material supported by said support, there being a passageway for well fluid between said support and casing and adapted to be closed by the swab cup expanding radially when the pipe is lifted and a continuous circumferentially extending spring embedded in said cup and adapted to bridge the space between the support and pipe to prevent the cup from flowing downwardly between the support and the casing.

3. A swab cup of resilient material and a continuous circumferentially expansible spring embedded in the outer lower part of said cup.

4. A well swab for use on a pipe in a casing including a support on said pipe, there being a passageway between the support and casing so that well fluid can flow by said support when the pipe is being lowered in the well, a swab cup of flexible material resting on said support and adapted to be expanded into engagement with the casing by well fluid when the pipe is lifted and a circumferentially expansible spring embedded in the lower portion of the cup and resting on the support and adapted to prevent the cup from flowing downwardly between the support and the casing.

5. A swab cup of resilient material and a continuous helical spring embedded in said cup.

6. A swab cup of resilient material, a continuous spring embedded in said cup and a fibrous material embedded in the cup between the spring and the surface of the cup.

7. A swab cup of resilient material, a continuous spring embedded in the cup and a layer of fibrous material embedded in the cup between the spring and the inner surface of the cup.

8. A swab cup of resilient material having a continuous spring and a fabric embedded in the cup.

9. A swab cup of resilient material, a continuous helical spring embedded in the cup and layers of canvas embedded in the cup between the spring and the inner surface of the cup.

10. A swab cup of resilient material having a continuous helical spring and a fabric embedded in said cup.

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