

Jan. 24, 1939.

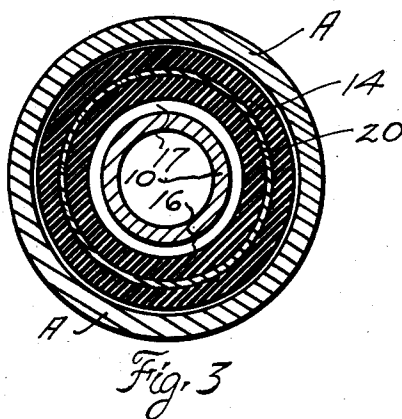
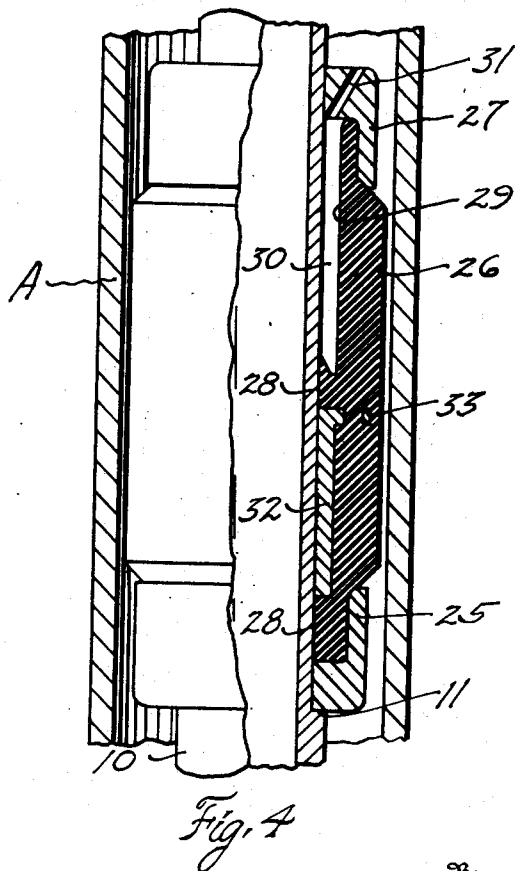
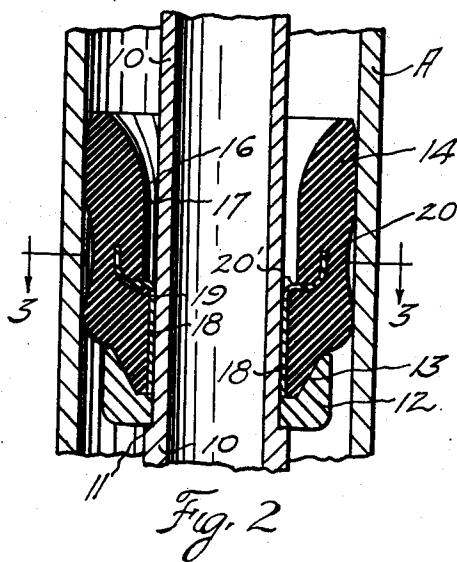
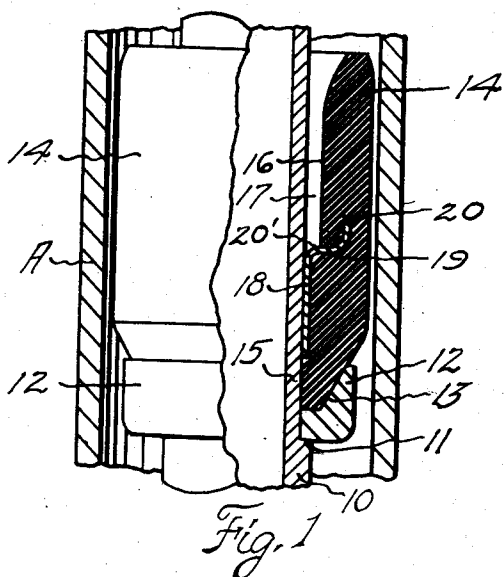
F. A. THAHELD

2,144,997

WELL SWAB

Filed April 13, 1936

2 Sheets-Sheet 1



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Jan. 24, 1939.

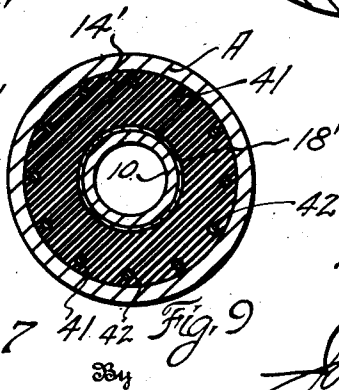
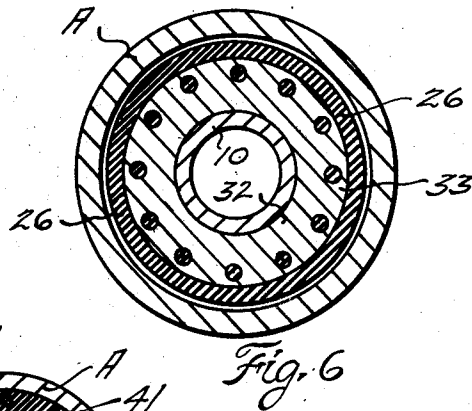
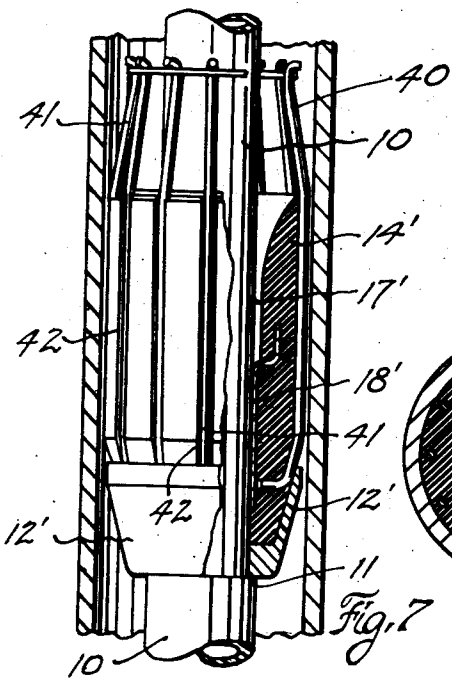
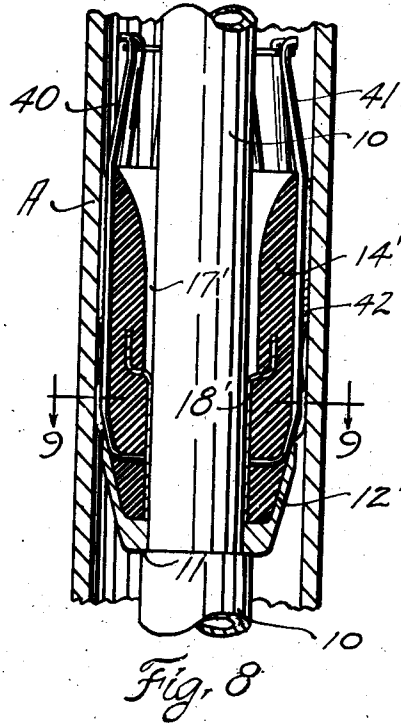
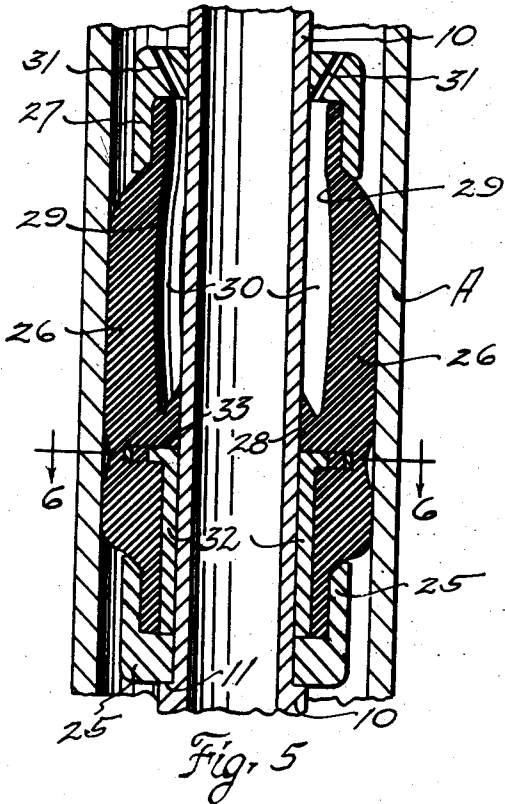
F. A. THAHELD

2,144,997

WELL SWAB

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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

2,144,997

WELL SWAB

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Application April 13, 1936, Serial No. 74,078

7 Claims. (Cl. 309—33)

This invention relates to new and useful im-
provements in well swabs.

One object of the invention is to provide an
improved swab which is particularly adapted for
use in swabbing and cleaning well tubing, and
the like.

An important object of the invention is to
provide an improved well swab which is so con-
structed that substantially the entire surface of
the packing element engages the tubing wall,
whereby more efficient swabbing is had.

Another object of the invention is to provide
an improved well swab including an elastic pack-
ing element arranged to be distorted into en-
gagement with the tubing or casing wall, with
positive means for distorting the lower end of the
elastic member after the upper end of said ele-
ment has engaged the tubing wall, whereby sub-
stantially the entire surface of the packing ele-
ment engages the wall; said means also serving
to limit the distortion of the element so as to
prevent rupturing or damaging the element un-
der excessive pressure.

A further object of the invention is to provide
an improved well swab including an elastic pack-
ing member having a floating liner or bushing
therein, said liner serving to reinforce and
strengthen said packing member.

A construction designed to carry out the in-
vention 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 a view, partly in elevation, and
partly in section, of a swab constructed in ac-
cordance with the invention and showing the
same in its normal position, disengaged from the
tubing wall,

Figure 2 is a view, similar to Figure 1, with the
swab in its distorted position,

Figure 3 is a horizontal, cross-sectional view,
taken on the line 3—3 of Figure 2,

Figure 4 is a view, partly in elevation and
partly in section of another form of the inven-
tion, showing it in its normal disengaged position,

Figure 5 is a view, similar to Figure 4, with
the swab distorted,

Figure 6 is a horizontal cross-sectional view,
taken on the line 6—6 of Figure 5,

Figure 7 is a view, similar to Figure 4, of still
another form of the invention, the swab being
in its normal position,

Figure 8 is a view, similar to Figure 7, showing
the swab distorted, and

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

In the drawings, the numeral 10 designates a
tubular mandrel which is provided with an an-
nular offset or shoulder 11. The mandrel may
have suitable connection (not shown) at its upper
and lower ends, whereby said mandrel may be
connected in a string of pipe. An annular thim-
ble 12 surrounds the mandrel and rests on the
shoulder 11, whereby it is supported upon the
mandrel. The thimble is provided with an an-
nular bevelled upwardly flared recess 13 which
is arranged to receive the lower tapered or conical
end of a packing member 14.

The packing member is constructed of rubber,
rubber compound, or other suitable material and
has an axial bore 15 the lower portion of which
is of the same diameter as the outside diameter
of the mandrel, whereby it will snugly fit around
said mandrel when positioned within the thimble.
The upper end of the bore 15 is enlarged at 16
whereby an annular space 17 is provided between
this enlarged portion of the bore and the man-
drel. The extreme upper end of the enlarged
portion 16 is flared or curved outwardly so as to
assure the entrance of fluid within the annular
space 17.

An annular metallic bushing or liner 18 is
molded, or otherwise secured within the bore 15 of
the packing member and the upper end portion
of this bushing is offset at 19 whereby an an-
nular flange 20 is formed at the extreme upper end
of said bushing. By observing Figure 1, it will
be seen that when the bushing is positioned
within the bore 15, the offset portion 19 and the
flange 20 of said bushing will be embedded within
the packing member 14. It is noted that the
size and location of the bushing is such that the
offset portion 19 thereof is positioned at the
lower end of the enlarged portion 16 of the bore,
whereby a metallic annular interior shoulder 20'
is provided at the lower end of said enlarged
portion. It is pointed out that the bushing does
not extend normally to the extreme lower end of
the packing member 14 but terminates short
thereof whereby when the packing element is in
its normal position on the mandrel, there is a
goodly portion of the material of which the
packing member is constructed located between
the lower edge of said bushing 18 and the thim-
ble 12.

In operation, the mandrel, and the parts car-
ried thereby, are lowered into the well tubing or

casing A in any suitable manner. The normal position of the packing element 14 is as shown in Figure 1 with the outer periphery of said packing member retracted from the inner wall of the tubing A. The metallic liner or bushing 18 will, of course, aid in holding the packing element in this position. Also, while the mandrel is being lowered through the well fluid, said well fluid passing upwardly through the space between the outer periphery of the packing member and the inner surface of the tubing will tend to force the packing element inwardly toward the mandrel. This annular space also provides a by-pass for the well fluid, whereby the swab may be easily lowered therethrough.

When the upstroke of the swab begins, it will be obvious that the well fluid will enter the annular space 17 in the upper end of the packing element 14. Continued upward movement of the mandrel and packing element will cause the pressure of the well fluid to force the upper portion of the packing member 14 outwardly into contact with the inner wall of the well tubing A. As soon as this upper portion of the packing member comes into contact with the tubing, the pressure of the well fluid will then be transferred to the metallic member 20 formed by the offset in the bushing 18 and from this point on the pressure of the fluid will be exerted against the lower portion of the packing member 14. This pressure will cause the bushing 18 to move downwardly on the mandrel until the lower edge of said bushing contacts the thimble 12 as is shown in Figure 2. During such movement of the bushing 18, the lower portion of the packing member 14 will be compressed longitudinally and expanded radially outwardly into contact with the tubing because of the offset 19 in said bushing, and, thus, it will be seen that the lower portion of the packing member 14 is moved into engagement with the tubing wall. After the lower edge of the bushing 18 strikes the thimble 12, further movement or distortion of the packing member 14 is prevented and thereafter, regardless of the pressure above the packing member, further distortion cannot be had. Thus, it will be seen that the bushing not only serves to distort the lower portion of the packing member into positive engagement with the tubing wall, but also provides a positive means for limiting the distortion of the member beyond its elastic limit. As soon as the pressure is relieved above the packing member 14, said member will, of course, immediately move back to its normal position, which is that shown in Figure 1. Upon the next stroke of the swab, the action is repeated.

From the above it will be seen that the metallic bushing not only provides a reinforcement or means for strengthening the elastic packing member 14, but also provides a means for distorting the lower end of the packing member, after the upper end thereof has moved into engagement with the tubing wall. It is the offset in the bushing which assures the distortion of the lower end of the member 14. The bushing further provides a positive stop means, whereby the member 14 cannot be distorted beyond its elastic limit.

In Figures 4 to 6, another form of the invention is shown. In this form, the mandrel 10 having the annular shoulder 11 is employed, and a suitable thimble 25 is supported on the shoulder 11. An elongate elastic packing member 26 has its lower end confined within the thimble

25, while its upper end is confined within a flanged cap 27. The packing member has a bore 28 having the same diameter as the outside diameter of the mandrel 10, whereby when said member is confined between the cap and thimble, the lower portion of said bore will snugly engage the outer periphery of said mandrel. The upper portion of the bore 28 is enlarged at 29, whereby an elongate annular space or well 30 is formed between the mandrel and packing member. The cap 27 is provided with openings or ports 31 which establish communication between the upper end of the well 30 and the interior of the tubing A. Within the lower end of the packing member 26 an elongate sleeve 32 is molded. The sleeve is positioned similar to the bushing 18 in the first form, and is provided with an outwardly directed annular flange 33 having an annular series of perforations therein and which is, of course, embedded in the packing member 26.

The operation of this form is substantially the same as that of the first herein described form. After the device has been lowered into the well tubing and the upstroke thereof is begun, the well fluid will enter the ports 31 in the cap 27 and flow into the annular space or well 30 in the upper end portion of the packing member 26. The pressure of this fluid will first distort the upper portion of the packing member 26 into engagement with the tubing wall. After such distortion has occurred the pressure of the fluid is then exerted on the lower portion of the packing member 26. The sleeve 32 will act upon the lower portion of the packing member 26 exactly as the bushing 18 acts upon the packing member 14 in the first form, whereby the lower portion of the member 26 is longitudinally compressed and radially distorted into engagement with the tubing. As is clearly shown in Figure 5, when the lower end of the sleeve 32 strikes the thimble 25, further distortion of the packing member 26 is prevented.

In Figures 7 to 9, I have shown still another form of the invention. This form is very similar to that shown in Figures 1 to 3 and includes a mandrel 10 having the shoulder 11. A thimble 12' similar to the thimble 12 is supported on the shoulder 11. The lower end of a packing member 14' is supported within the thimble. The structure of the packing member 14' is very similar to the structure of the member 14 except that it is slightly longer in proportion to the diameter. A bushing 18' is molded within the member 14', and an annular well or space 17' is provided within the upper portion of the member 14'. The only material difference between the form shown in Figure 1 and this last described form is that the packing member 14' is confined within a vertical cage 40, said cage including a plurality of rods 41 which engage in longitudinal grooves 42 provided in the outer periphery of the member 14'. The cage serves to reinforce and further brace the packing member 14'. The operation of this form, however, is exactly the same as that of the form shown in Figures 1 to 3 as to the initial engagement of the upper portion of the packing member 14' and subsequent engagement of its lower portion with the well tubing or casing A.

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

1. A well swab including, a support, an elastic packing member carried by the support, the upper portion of said member being annularly

cupped whereby it may be expanded into packing position by the pressure of the well fluid thereabove, means for longitudinally compressing and radially expanding the lower portion of said member into packing position under pressure of the well fluid after engagement of the upper portion of the packing member with the well tubing, and means for preventing the distortion of said member beyond its elastic limit in operation.

2. A well swab including, a support, an elastic packing member carried by the support, a metallic liner bushing molded within the packing member for reinforcing the same, the upper portion of the packing member being annularly cupped whereby it may be expanded into packing position by the pressure of the well fluid thereabove, said liner bushing being movable longitudinally on the support and acting to longitudinally compress and radially expand the lower portion of the packing member into packing position under pressure of the well fluid thereabove after expansion of the upper portion of the packing member, and means for limiting the longitudinal movement of said liner bushing whereby the distortion of the packing member beyond its elastic limit is prevented.

3. A well swab including, a support, an elastic packing member carried by the support and having an annular open space in its upper portion whereby the well fluid entering said space under pressure from above will distort and radially expand the upper portion of the member into packing contact with the well tubing, a liner bushing slidably fitted on said support and having an outwardly offset annular upper end portion embedded in said packing member for distorting the lower portion of said packing member and expanding it into packing contact with the well tubing, and means for limiting the endwise movement of said liner bushing whereby to prevent the distortion of the packing member beyond its elastic limit.

4. A well swab including, a mandrel, an annular thimble sleeved and supported on said mandrel, a tubular elastic packing member sleeved on said mandrel and having its lower end portion supported in the thimble, said packing member having an annular open space in its upper portion whereby fluid may enter said space to expand the upper portion of said member, and a metallic liner bushing slidably fitted on said

mandrel and embedded within the packing member and having an outwardly offset annular upper portion located at the lower end of said open space whereby said bushing is subjected to the pressure of the fluid within said open space and moved thereby downwardly to longitudinally compress and radially expand the lower portion of said packing member.

5. The well swab structure as set forth in claim 4, wherein the downward movement of the liner bushing is limited by the thimble on the mandrel whereby to prevent distortion of the packing member beyond its elastic limit.

6. A well swab including, a mandrel, a tubular elastic packing member sleeved on the mandrel, the member having an upper bore portion of a greater diameter than the lower end portion affording an annular fluid receiving chamber, a liner bushing in the lower portion of said packing member and slidably fitted on said mandrel, the upper end portion of the bushing being located at the bottom of said fluid receiving chamber and being formed with an outwardly offset annular portion which is embedded in the packing member, and an annular thimble sleeved and supported on said mandrel to receive and support the reduced lower end portion of said packing member.

7. A well swab including, a mandrel, a tubular elastic packing member sleeved on the mandrel, the member having an upper bore portion of a greater diameter than the lower end portion affording an annular fluid receiving chamber, a liner bushing in the lower portion of said packing member and slidably fitted on said mandrel, the upper end portion of the bushing being located at the bottom of said fluid receiving chamber and being formed with an outwardly offset annular portion embedded in the packing member, an annularly cupped thimble sleeved and supported on said mandrel to receive and support the reduced lower end portion of said packing member, and an inverted annularly cupped thimble sleeved slidably on said mandrel in opposed relation to said supported lower thimble to fit over the reduced upper end portion of the packing member, said upper thimble having openings therein to admit well fluid from above to the fluid receiving chamber of the packing member.

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