May 6, 1947. C. R. CLAUS 2,420,226

OIL WELL PACKER

Filed Nov. 3, 1944

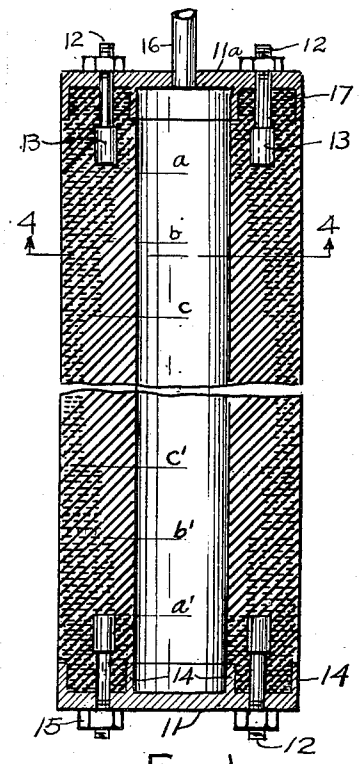


FIG. 1

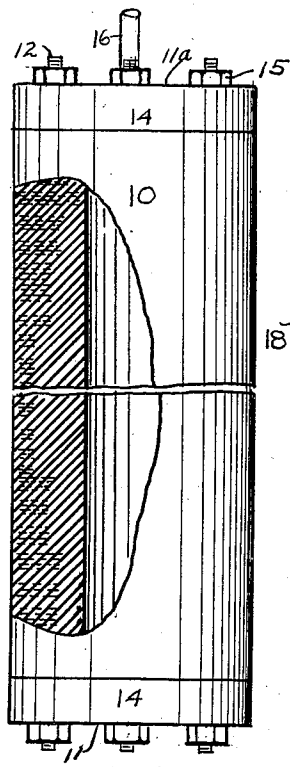


FIG. 2

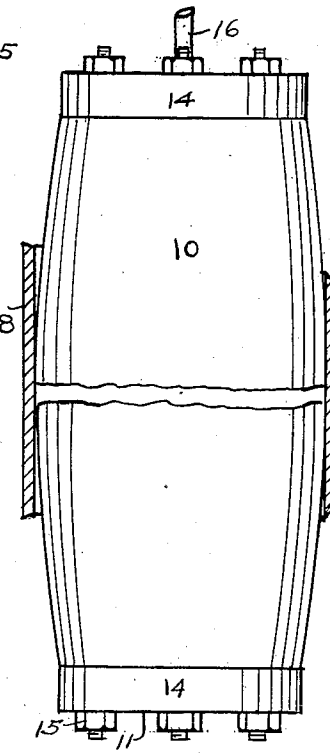


FIG. 3

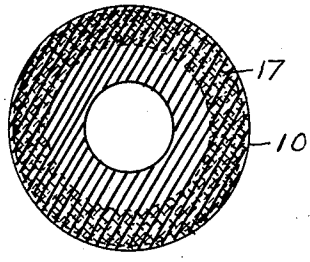


FIG. 4

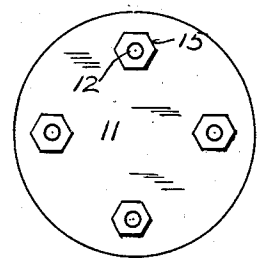


FIG. 5

INVENTOR.

CLYDE R. CLAUS

BY

Martin & Anderson

Patented May 6, 1947 2,420,226

UNITED STATES PATENT OFFICE

2,420,226

OIL WELL PACKER

Clyde R. Claus, Denver, Colo., assignor to Gates Rubber Company, Denver, Colo., a corporation of Colorado

Application November 3, 1944, Serial No. 561,661

4 Claims. (Cl. 166—10)

1

This invention relates to improvements in oil well packers.

In effecting various tests of oil wells and deep water wells, it is necessary to seal off a portion of the well and for this purpose devices usually referred to as "packers" are used; some of these are of such construction that they are expanded, by internal pressure, into contact with the inner surface of the well casing.

It is the object of this invention to produce a packer of the expansible type that shall possess several advantages over present constructions.

Among the objects sought are the following:

To produce a fabric reenforced packer in which the fabric plies are positioned in planes perpendicular to the axes of the packer, whereby maximum strength and longer life are obtained.

To reduce the adhesion which is a major cause of failure in the conventional type packer.

To produce a packer in which the expansion increases progressively from the ends towards the center whereby the danger of trapping mud between the packer and the casing is greatly reduced.

To produce a packer that can be built in segments or as a unit.

To produce a packer of such construction that any degree of flexibility or of rigidity can be obtained.

To produce a packer construction that can be varied so as to obtain any desired expansion for any given pressure and whereby strength can be built into those portions that are most liable to failure.

The above and other objects that may become apparent as this description proceeds are attained by means of a construction and an arrangement of parts that will now be described in detail and for this purpose reference will be had to the accompanying drawing in which the invention has been illustrated in its preferred form, and in which:

Figure 1 is a diametrical section through the improved packer;

Figure 2 is a side elevation with a portion thereof shown in section and illustrates a slightly modified form of construction;

Figure 3 is a side elevation showing the packer expanded into sealing position with a well casing;

Figure 4 is a section taken on line 4—4, Figure 1; and

Figure 5 is an end elevation.

The packer body consists of a tubular cylindrical member that has been designated by reference numeral 10. The outside and the inside diameter, as well as the length, can be varied to suit various conditions. The body 10 is made principally from some suitable rubber composition and the rubber may be either a natural rubber or one of the several rubber-like synthetics, as well as any other material that might be found suitable and desirable.

2

The ends of the tubular member are closed by means of caps 11 and 11*a* that are secured in place by means of bolts 12 that have enlarged end portions 13 positioned within the walls of the tubular member as shown in Figure 1. The end closures are provided with two concentric cylindrical flanges 14 that overlap ends of the tubular member and are preferably positioned in rabbets provided in the inner and outer surfaces for their reception. Nuts 15 hold the end closures in place as shown in the drawing. The two end closures are duplicates with this exception that the one at the top, which has been designated by reference numeral 11*a*, has a threaded opening for the reception of a pipe 16 through which some fluid, either air or liquid can be pumped into the interior of the tubular member for the purpose of expanding the latter. In order to give the tubular member the required strength and to reenforce it and in order to further control the manner in which it expands, suitable fabric rings 17 are positioned in the rubber composition in concentric relation to the opening therein. These rings are preferably formed from rubberized woven fabric and are positioned with their planes perpendicular to the axis of the tubular member.

It will be observed from Figure 1 that at the ends of the tubular member the reenforcing rings 17 are much closer together than they are in the intermediate portion of the packer. The purpose of this close arrangement of the rings at the ends is to give the material there great strength and rigidity so that it will resist forces tending to move the end closures outwardly. Instead of fabric rings, it is permissible, and some times desirable, to employ woven metal fabric as reenforcing members at these points because between the flanges 14 the material cannot expand when the tubular member is subjected to internal pressure. Beginning at or about the upper ends of the enlargements 13, the reenforcing rings can be spaced farther apart, although no material expansion is to take place until a point at the innermost ends of enlargements 13 has been reached. It will be seen from the drawing that between the two lines designated by ref-

erence characters *a* and *b* the reenforcing rings are provided with openings somewhat larger than the opening in the tubular member. Beginning at point *b* and terminating at point *c* the openings in the rings are of still greater diameter and between the points *c* and *c'* the rings have still greater openings. The corresponding groups of rings on the two sides of the middle plane are of the same internal and external diameters as clearly illustrated in Figure 1. The result of this decrease in the width of the rings is that when a fluid under pressure is introduced into the chamber at the center of the tubular member, that portion between lines *c* and *c'* will expand more and at a faster rate than the two sections between *c* and *b* and between *c'* and *b'* and the sections between points *a* and *b* and *a'* and *b'* will expand at a lesser rate so that when the packer is expanded the greatest expansion will take place at the middle and therefore this part of the packer will contact the well casing **18** first, and as the pressure increases the zone of contact will widen. The result of this is that any mud that is positioned between the casing and the outer surface of the packer will be squeezed upwardly and downwardly so as to produce a close contact between the packer and the inner surface of the casing. This contact will offer great resistance to relative movement than if a layer of mud were positioned between the two surfaces. In the drawing no means has been shown for supplying the fluid under pressure but it is to be understood that a reservoir containing air or water under pressure or a pump is connected with the pipe **16** and that a suitable valve control mechanism is provided in the pipe connection. When the packer is to be released the interior of pipe **16** is put in communication with the atmosphere or if a liquid is used, with a suitable container whereupon the fluid within the packer will escape due to the contractile force of the packer body which tends to bring it back to its original shape. After the pressure has thus been reduced and the diameter correspondingly reduced, the packer can be removed or merely moved to a different position.

In Figure 1 the reenforcing rings between the points *a* and *a'* have been shown as equally spaced. In Figure 2 the rings have been shown as positioned in groups which are spaced short distances apart. The number of rings in each group can be varied to suit the requirements of any particular case.

Due to the fact that the reenforcing rings are of fabric and that they are positioned in planes perpendicular to the axis of the packer, they can expand and contract due to the diagonal arrangement of the threads at different parts of the ring. If the reenforcement were effected by means of rubberized fabric rolled concentrically around the tubular member, the expansion would be practically zero, because fabric cannot expand in the direction of its warp or woof threads.

The arrangement of the rings in planes perpendicular to the axis of the packer also has other advantages. In the first place, by this construction the strength of the walls can be arranged so as to produce a predetermined shape of the outer surface due to the expanding fluid. Another advantage is that the fabric positioned in this manner is more effective for resisting compressive strains than if it were concentric with the axis.

A still further advantage of this construction is that the packer body can be built in sections. For example, those portions between the ends and

planes *a* and *a'* can be assembled with the end closures and bolts before being attached to the remaining portions of the body. Those portions between planes *a* and *b* and *a'* and *b'* can be cut from a long tubular member that has the same size rings throughout its entire length. The portions between *b* and *c* and *b'* and *c'* can likewise be cut from a long length of tubing having reenforcing rings of the particular size shown and the same is true with the center section between *c* and *c'*. The several sections can be assembled while the material is in its uncured state and positioned in a mold where it is given the required heat treatment to effect a welding of the adjacent ends of the several sections and a proper curing of the material.

With this construction greater rigidity and flexibility can be obtained through variations of the fabric contents and the dimensions of the rings and it is therefore possible to design packers that expand in a predetermined manner.

Another advantage is that strength can be built into the tubular body at the points where desirable. To have the inside opening in each ring different from that of the others so as to produce a gradual variation in resistance. However, such a fine gradation is not believed to be necessary and has not been shown because it would greatly complicate the drawing.

In the above parts of the specification several advantages due to the positioning of the reenforcing rings have been pointed out. However, it is believed that this construction has other advantages that may become more apparent during the use of such packers. Any and all of these advantages are believed to be due to the fact that the reenforcing rings are positioned in planes perpendicular to the axis of the tubular body; and to the further fact that the reenforcements are so related to each other that the greatest expansion will take place near the center and diminish towards the ends. By increasing the amount of pressure in the interior of the tubular body the width of the zone or contact can be varied in the manner above pointed out.

Due to the variation in the reenforcing means the strains developed adjacent the edges of the flanges **14** are reduced in intensity from what they would be if the reenforcing means were uniform throughout the entire length of the body.

Having described the invention what is claimed as new is:

1. A well packer comprising a tubular cylindrical body formed in part from rubber composition, end closures therefor, one of which has an opening for the admission of a fluid under pressure, and reenforcing elements in the wall of the body, said elements comprising flat rings of woven fabric of larger inside diameters than the opening in the body, positioned in concentric relation to the cylindrical body, the rings being spaced substantially uniformly throughout the length of the body, the width of the rings decreasing from the ends towards the center, whereby the body will expand at a greater rate at the middle than at any other point in its length.

2. An expansible element for use in a well packer, comprising a tubular cylindrical body formed from resilient elastic material, the wall of the body having incorporated therein a plurality of equidistantly spaced rings of woven fabric positioned in planes perpendicular to the axis of the body and in concentric relation thereto, the proportion of the reenforcing material relative to

the body, per unit length of the latter, decreasing from the ends toward the center.

3. An expansible element for use in a well packer comprising a tubular cylindrical body of resilient elastic material, the wall having incorporated therein a plurality of reenforcing rings of woven fabric positioned in substantially uniformly spaced relation, the planes of the rings being perpendicular to the axis of the body, the width of the rings decreasing from the ends towards the middle, whereby when the interior is subjected to a fluid pressure the middle can expand at a faster rate than portions nearer the ends.

4. A well packer comprising a tubular cylindrical body formed in part from rubber composition, end closures therefor, one of which has an opening for the admission of a fluid under pressure, and reenforcing elements in the wall of the tubular body, said elements comprising rings of woven cotton fabric of larger inside diameter than the opening in the body, positioned in substantially equidistantly spaced planes perpendicular to the axis of the body, and in concentric relation thereto, the density of the reenforcements being

greater at the ends than at any intermediate point whereby the body will expand at a faster rate adjacent the center than at any other point in its length.

CLYDE R. CLAUS.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,642,273	Standlee	Sept. 13, 1927
2,313,762	Midgett	Mar. 16, 1943
2,177,601	Smith	Oct. 24, 1939
2,331,185	Gordy	Oct. 5, 1943
808,775	Ostrander	Jan. 2, 1906
2,189,839	Sharp et al.	Feb. 13, 1940
1,190,790	Moser	July 11, 1916
2,254,060	Crickmer	Aug. 26, 1940

FOREIGN PATENTS

Number	Country	Date
22,409	British	1913