May 20, 1958 M. E. TRUE 2,835,329

REINFORCED PACKER

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FIG. 2.

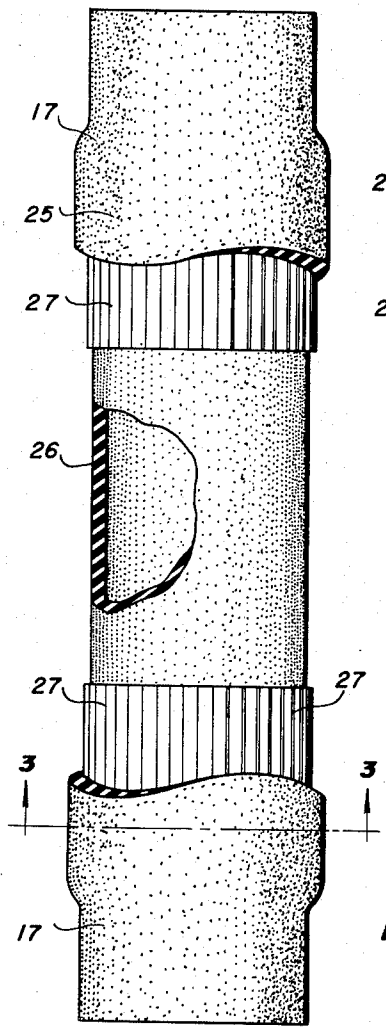
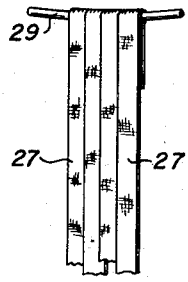


FIG. 4.



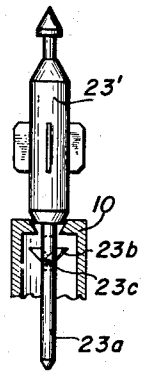
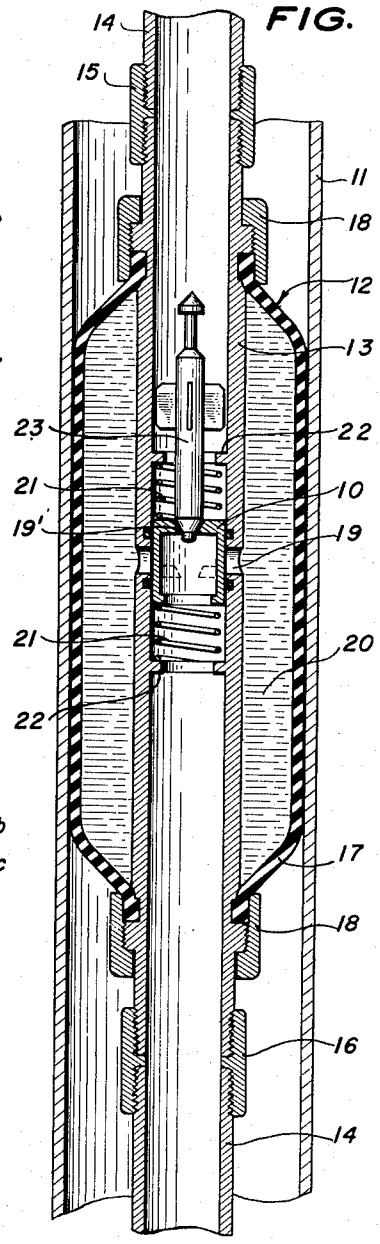


FIG. 1A.

FIG. 1.



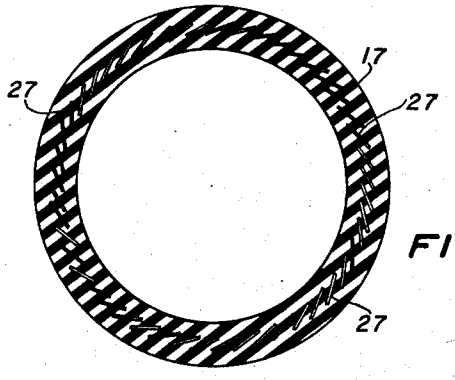


FIG. 3.

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REINFORCED PACKER

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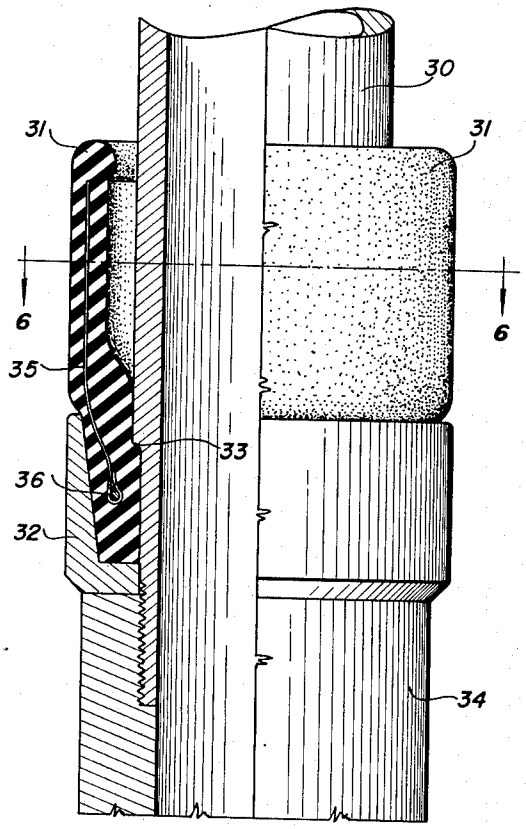


FIG. 5.

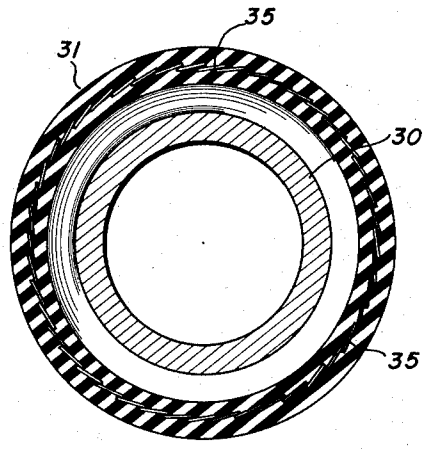


FIG. 6.

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2,835,329

REINFORCED PACKER

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Application June 23, 1955, Serial No. 517,474

1 Claim. (Cl. 166—187)

The present invention is directed to a reinforced packer. More particularly, the invention is directed to a packing or sealing member which is adapted to be used in a well bore. In its more specific aspects, the invention is directed to a packer which contains internal reinforcement which prevents ruptures of the resilient or expandable member of the packer.

The packer of the present invention may be briefly described as comprising a mandrel and an internally reinforced resilient member carried by the mandrel for sealing engagement with the wall of the well bore. The resilient member is internally reinforced with a plurality of longitudinally extending overlapping woven fiber ribbons.

It is contemplated that the overlapping ribbons may either be separated one from the other by a layer of the resilient material or the overlapping ribbons may be in contact one with the other.

The packer of the present invention may suitably be a cup-type packer, a swab cup or an inflatable or expandable packer. The packer of the present invention may suitably be used as a production packer and may be carried by a mandrel forming part of a tubing string or it may be a wire line device and may be used in a well testing tool, and the like.

The woven fiber making up the ribbons of the diaphragm of the present invention may be constructed of either synthetic or natural fibers. Nylon is an excellent synthetic fiber for use in the packer of the present invention. Cotton and other naturally occurring fibers such as linen, silk, ramie, and the like, may be employed. Other synthetic fibers, such as rayon, Orlon, Dacron, and the like may also be used in the ribbons employed in the practice of the present invention.

In the specification and claims where the term "ribbon" has been employed, ribbon is used in the sense as defined in Webster's New International Dictionary, second edition, unabridged (1936), and in the sense it is used in the textile industry; for example, Carmichael, Linton and Price, Callaway Textile Dictionary, first edition, Callaway Mills, La Grange, Georgia, 1947, define ribbon as follows: "Ribbon: a fillet or narrow woven fabric of varying widths—commonly ¼ to 3 inches—having selvage edges, principally of rayon, silk or velvet and used for trimmings, decorations, etc."

The deformable, resilient, or expandable member may be constructed of natural or synthetic rubber depending on the fluid to which it is exposed. Rubbers of the general Hycar type may suitably be used. Other synthetic rubbers which may be employed include Buna, Butyl, and the like, which do not acquire a permanent set.

The present invention will be further illustrated by reference to the drawing in which:

Fig. 1 is a sectional view of an expandable packer of the present invention;

Fig. 1A is a fragmentary view of a releasing device for the packer shown in Fig. 1;

Fig. 2 is a view with parts cut away of the resilient member of Fig. 1;

Fig. 3 is a view taken along the lines 3—3 of Fig. 2;

Fig. 4 illustrates means for anchoring the ribbons of Fig. 2;

Fig. 5 is a partial sectional view of the invention applied to a cup packer; and

Fig. 6 is a view taken along the lines 6—6 of Fig. 5.

Referring now to the drawing, in which identical numerals will be employed to designate identical parts, numeral 11 designates a well bore or well casing arranged in a well bore (not shown). Arranged within the well bore or casing is a packer generally designated by the numeral 12 and comprised of a packer mandrel 13 which is adapted to be connected to a tubing string 14 by coupling members 15 and 16. It is to be understood, however, that the packer mandrel 13 may suitably be connected into and form part of a wire line tool.

Carried on the external surface of the mandrel 13 is a resilient or expandable packing member 17 which is clamped or held against the mandrel 13 by clamping means 18. As shown clearly in the drawing, the member 17 is of substantially uniform cross-sectional thickness throughout its length.

The mandrel 13 is provided with a plurality of ports 19 for inflating the resilient member 17 by introducing fluid into the space 20 enclosed by the resilient member 17.

The ports 19 are normally closed by a sleeve valve member 10 which is normally biased to a central position to close the ports 19 by springs or biasing members 21 which bear against the upper end and the lower end of the sleeve 10 and are supported or arranged on the internally projecting shoulders 22.

The sleeve valve 10 has an opening 19' to allow fluid passage through the mandrel 13 and tubing 14 when the resilient member 17 is not being employed.

Other types of valve means for opening and closing the ports 19 may be used. For example, the valve may suitably be a check valve which will allow flow in one direction and prevent flow in a different direction. Likewise, one port may be used to inflate the packer and another port may be used to deflate the packer.

When it is desired to inflate the packer, for example, to pack off the lower section of a well bore to allow investigation or treatment of an upper section, a removable plug 23 may be inserted through the tubing 14 and the mandrel 13 to seat in the opening 21 of the sleeve valve 10. By exerting fluid pressure on the sleeve 10, it is caused to move to a second position indicated by the dotted lines to open the ports 19 and allow filling of the space 20 to inflate the resilient member 17.

Fig. 1A illustrates a releasing member 23' which is similar to the unit 23 of Fig. 1. Member 23' is provided with an extending prong 23*a* which is provided with spring biased dogs 23*b*. The member 23' is lowered on a wire line (not shown) until the dogs 23*b* are below the top of sleeve 10. Sleeve 10 is pulled upwardly until ports 19 are exposed, thereby bleeding fluid from the space 20. Continued upward pull on member 23' causes shearing of the pin 23*c* to which dogs 23*b* are pivoted and the member 23' is retrieved. The springs 21 bias the sleeve back into the closed position with the packer deflated.

Referring now to Fig. 2, it will be seen that the resilient member 17 is comprised of an outer layer of resilient material 25 which may be rubber and an inner layer 26 which also may be rubber. Longitudinally arranged between the inner and outer layers 25 and 26 on each end of the member 17 are a plurality of overlapping woven fiber ribbons 27 which are spaced away from one another and separated by the resilient material. The

ribbons 27 are arranged such that the central portion of the resilient member 17 is not reinforced therewith. In other words, the ribbons 27 reinforce each end of the member 17 as shown in the drawing. This is desirable because most of the stress in forming a seal is adjacent the end of the member 17.

As shown more clearly in Figs. 3 and 4, the ribbons may be arranged between the layers of rubber and anchored therein by lapping the ribbons over a circumferentially extending member such as a steel cable 29 which is embedded in the resilient member 17. The steel cable or the circumferentially extending member may be arranged in either or both ends of the resilient or expandable member 17.

Referring now to Figs. 5 and 6, a mandrel 30 has a resilient member, such as a cup packer 31, arranged thereon and clamped thereto by a clamping means 32, the resilient member 31 being held by the clamping member 32 and by an outwardly projecting shoulder 33 of the mandrel 30. A collar 34 which is threadedly connected to the mandrel 30 serves to wedge the resilient member 31 against the shoulder 33. Embedded within the resilient member 31 are a plurality of overlapping woven fiber ribbons 35 which in this particular embodiment are in contact one with the other.

It is to be noted that the ribbons are arranged on a circumferentially extending member 36 which may be a steel cable embedded in the resilient member, the ribbons being arranged over and overlapping the steel cable 36.

In employing the device of Figs. 5 and 6, the packer 31 would be run in on a mandrel 30 which suitably may form part of a tubing string or testing tool and pressure exerted against the cup 31 to cause same to extend into sealing engagement with the wall of a well bore or the wall of a casing. The cup packer 31 may be expanded by fluid forced down the annulus of a well bore or fluid flowing upwardly in the well bore. In the latter case the cup packer 31 would be facing downwardly in the well.

The present invention is of considerable utility and is advantageous in that the internal reinforcement with the ribbons prevents the rupture of the resilient member by flow between the reinforcing members. By virtue of employing a plurality of layers of woven fiber ribbons extending longitudinally of the packer at each end thereof, it is possible to reinforce packers embodying a resilient member to the extent of providing a sealing member of increased resistance toward destruction. A packer embodying a sealing member constructed of resilient or expandable material provided with internal reinforcements comprised of woven fiber ribbons may be employed satisfactorily under high pressures without separation of the reinforcing ribbons and without destruction of the sealing member. The woven fiber ribbons of the present invention may suitably be vulcanized in and form part of the resilient or expandable packing member.

The nature and objects of the present invention having been completely described and illustrated, what I wish to claim as new and useful and to secure by Letters Patent is:

A packer adapted for use in a well bore which comprises an elongated tubular mandrel, an internally reinforced resilient member carried by said mandrel for sealing engagement with the wall of the well bore, the thickness of the resilient member being of substantially uniform cross-sectional thickness throughout its length, means for inflating the resilient member, said resilient member being internally reinforced circumferentially on each end with a plurality of longitudinally extending overlapping and contacting woven fiber ribbons, said ribbons being maintained in overlapping contact one with the other on expanding said resilient member, the ribbons on each end of the resilient member having one end arranged on a circumferentially extending member embedded in each end of said resilient member and said ribbons extending longitudinally only to a point adjacent the central portion of the resilient member, such that the central portion of the resilient member is free of reinforcement.

References Cited in the file of this patent

UNITED STATES PATENTS

820,149	Spang	May 8, 1906
1,502,372	Callanan	July 22, 1924
2,133,462	McManis	Oct. 18, 1938
2,236,512	Boynton	Apr. 1, 1941
2,449,514	Scoville	Sept. 14, 1948
2,643,722	Lynes et al.	June 30, 1953
2,723,721	Corsette	Nov. 15, 1955
2,778,432	Allen	Jan. 22, 1957