

Feb. 6, 1945.

C. M. KING

2,368,928

PACKING DEVICE

Filed March 16, 1942

2 Sheets-Sheet 1

Fig. 1.

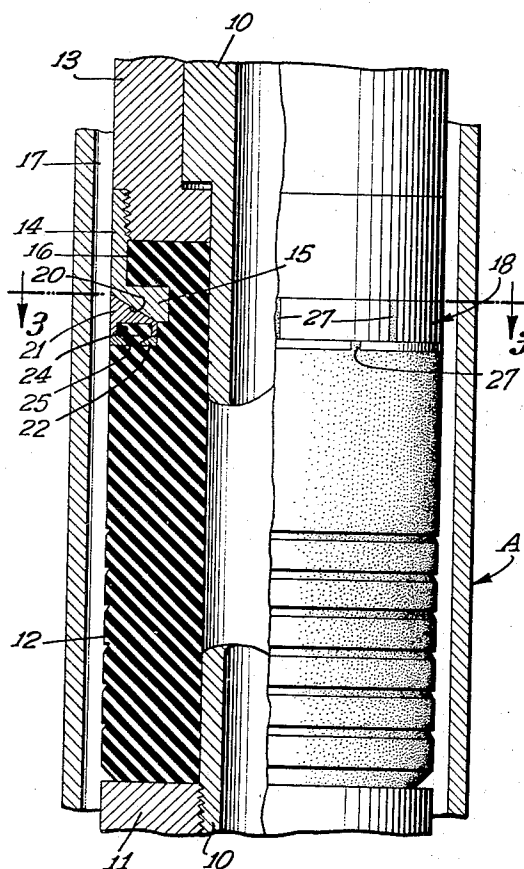


Fig. 2.

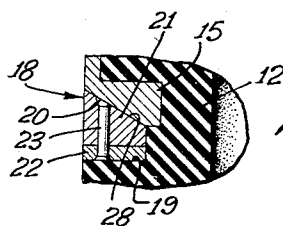
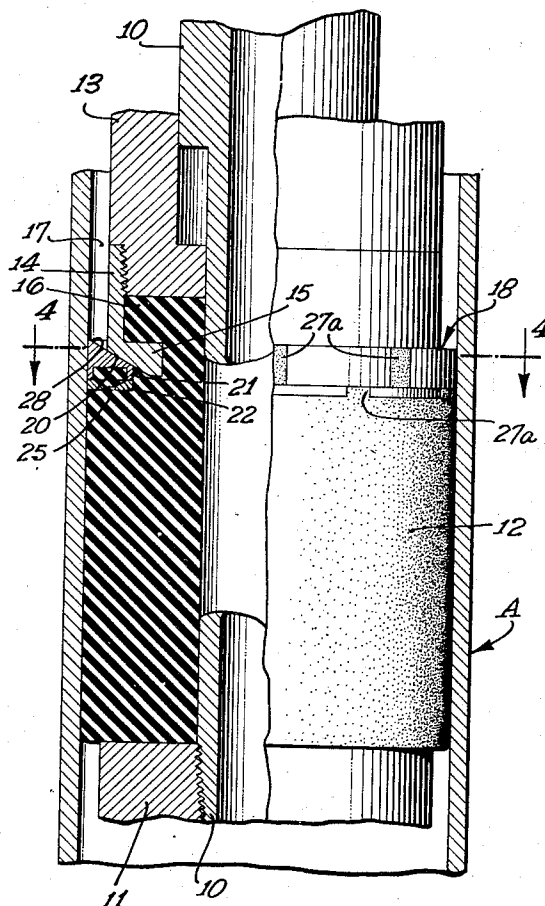


Fig. 6.

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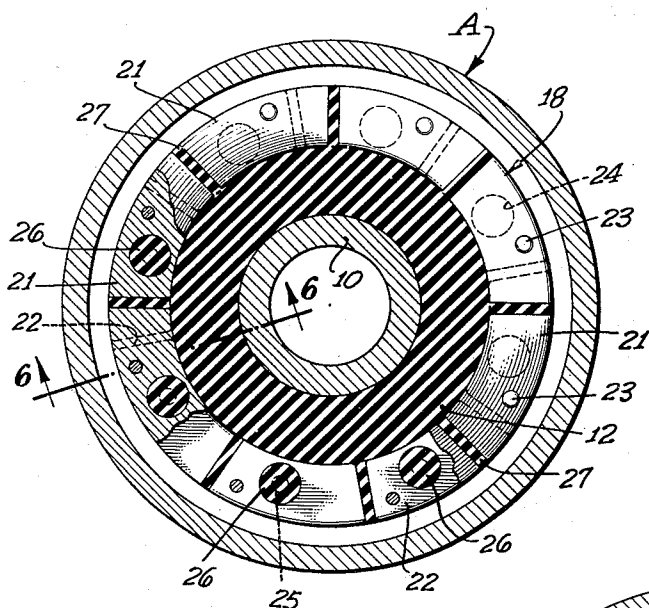


Fig. 3.

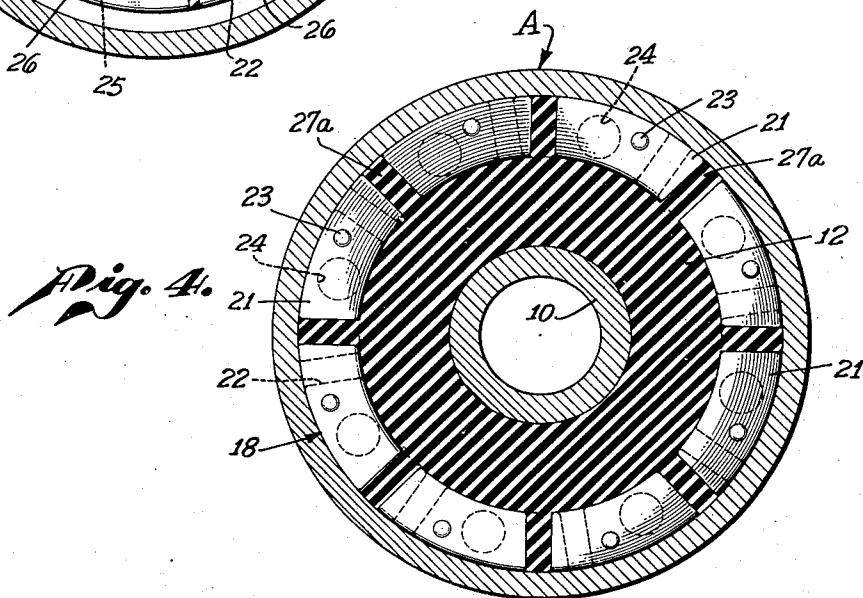


Fig. 4.

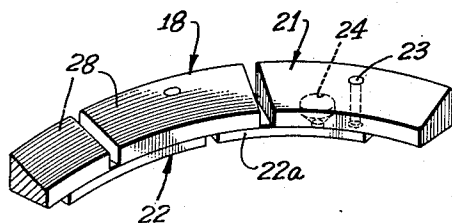


Fig. 5.

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2,368,928

PACKING DEVICE

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Application March 16, 1942, Serial No. 434,922

9 Claims. (Cl. 166—10)

This invention relates to packings of the flexible and pliable type, and particularly to packings whose supporting members have material clearance with the wall of a confining enclosure. An example of this arrangement is a well packer movable through a string of casing to a particular location where its packing member is sealed off against the casing.

As pointed out in United States Patent No. 2,204,648, the substantial clearance that must be allowed between the supporting or retaining member for a pliable packing and the wall of a casing provides an open annulus through which the packing member can flow upon being subjected to high pressures or temperatures within the well casing. Such cold flowing has been prevented by encircling the packing with a lead ring adjacent the supporting member. The ring is initially spaced inwardly from the packing walls, but is capable of deformation or stretching outwardly by the stress induced in the packing into position across the annular space and in contact with the wall of the casing, so as to form a bridge or barrier to the flow of the packing material through this annular space.

Lead and similar types of pliable and inelastic materials are effective devices for maintaining the packing at the region where it is to perform its sealing function against the casing walls. However, these materials achieve a permanent deformation or set, and remain in engagement with the casing after having been distorted by the rubber or other pliable packing. Their use is therefore limited, and they cannot be employed effectively in a well packer of the retrievable type, especially those capable of repeated setting and release without removal from the well casing.

It has been proposed to prevent cold flowing of plastic packing material through the annular space above referred to by providing a flow preventing ring composed of a plurality of small segments encircling and embracing the end of the packing, as described in the application of Reuben C. Baker, Serial No. 374,471, filed January 15, 1941, for "Packing devices," now Patent No. 2,295,770, granted September 15, 1942. This segmental ring is expanded outwardly by the packing material to bridge the annular space between the well packer and wall of the casing, in which position comparatively small spaces exist between adjacent segments of too small an extent to permit flow of packing material there-through. It is an object of the present invention to prevent cold flowing of plastic packing

material around apparatus such as a well packer, without impeding the removability of the apparatus from a set position, by means of a ring composed of a plurality of segments that separate upon expansion of the packing material without forming a space through which the plastic packing material might tend to flow.

It is a further object of the invention to provide a packing structure specifically designed for use in a well tool, such as a retrievable well packer, in which longitudinal compression or movement of the packing material assists radial expansion of plastic flow preventing segments into engagement with the wall of the casing.

Still another object of the invention is to employ a packing flow preventer around a packing, which is movable into engagement with a well casing by the expansion of the packing without leaving intervening spaces through which the packing material might flow, and movable from engagement with the casing by the packing to its initial position upon retraction of the latter, in order to permit free longitudinal movement of the well packer within the casing after it has been set and sealed therewithin.

This invention has other objects that will become apparent from a consideration of the embodiment shown in the drawings accompanying and forming part of the present specification. This embodiment will now be described in detail, but it is to be understood that such detailed description is not to be taken in a limited sense, since the scope of the invention is best defined by the claims appended hereto.

Referring to the drawings:

Figure 1 is a combined sectional and elevational view of a portion of a well packer, with its packing elements disclosed in retracted position;

Figure 2 is a view similar to Figure 1, with the packing elements in expanded condition;

Figure 3 is a cross section taken generally along the line 3—3 in Figure 1;

Figure 4 is a cross section taken generally along the line 4—4 in Figure 2;

Figure 5 is a perspective of a portion of the flow preventing segments employed in the packer; and

Figure 6 is a partial section taken along the line 6—6 in Figure 3.

An example of the invention is disclosed in the drawings as forming part of a well packer, which can be of the design described and claimed in the application of Reuben C. Baker, Serial No. 419,061, filed November 14, 1941, for "Releasable well packers." This particular packer includes

a tubular body 10 to which is threaded or otherwise secured a packing actuator 11 in the form of a guide member. This packing actuator engages the lower end of a packing sleeve 12 surrounding the body, whose upper end is engageable with the lower end of an expander 13, on which is threaded a packing retainer or abutment 14 having an intumed flange 15 spaced from the end of the expander to form a groove in which is received an outwardly directed flange 16 extending from the upper end of the packing sleeve 12.

Whenever the packing is to be engaged with the wall of the casing A, the expander member 13 is held stationary by any suitable means, such as casing engaging slips (not shown) specifically described in the application referred to, and an upward strain taken on the tubular body 10 to move its actuator 11 longitudinally toward the expander 13, and thus shorten the packing sleeve 12, so as to expand it radially outwardly against the wall of the confining casing and effect an annular seal between it and the packer body.

It is to be noticed that the expanded packing material bridges the comparatively large annular space 17 between the depending retainer 14 or expander 13 and wall of the casing A, and might flow upwardly through this space under the influence of high pressures or temperatures, with the possibility that substantially all of the packing material would be dissipated and non-available for effecting its sealing function between the packer body and casing wall. Such possible dissipation is prevented by employing a segmental ring 18 adjacent the retainer 14 capable of bridging the annular space 17 upon expansion of the packing, so as to act as a barrier to the cold flowing of packing material therethrough. This ring 18 has a retracted diameter substantially equal to that of the packing sleeve 12, and is positioned in a circumferential groove 19 formed by a circumferential recess in the packing and the bottom surface 20 of the retainer.

The flow preventer is composed of adjacent upper segments 21 and adjacent lower segments 22 encircling and embracing the packing to form the composite ring 18. The lower segments 22 are staggered with respect to the upper segments 21 so as to lap over from one upper segment to the other upper segment and extend across their adjacent ends. For the purpose of maintaining this staggered or lapped arrangement, each of the upper and lower segments are secured to one another, as by a pin or rivet 23, in such manner as to have the unsecured or free end 22a of the lower segment extend under the next adjacent upper segment. In effect, the composite flow preventer ring 18 consists of a plurality of stepped segments having upper and lower portions overlapping one another to eliminate longitudinal spaces between the segments extending completely therethrough.

One method of producing the packing structure disclosed in the drawings is to place the retainer 14 in a rubber mold and assemble the stepped segments 21, 22 in overlapping relation therein in abutment with the lower end 20 of the retainer to form a substantially continuous ring of the proper retracted diameter. The proper amount of rubber or other packing material is then placed in the mold and vulcanized under heat and pressure to the desired initial, retracted shape (as disclosed in Figure 1). During the molding operation, the rubber packing material

is forced around the intumed flange 15 of the retainer to form an external flange 16, and also into aligned holes 24, 25 provided in the upper and lower segments. The hole 24 through the upper segment is preferably larger than the one 25 through the lower segment to form an enlarged button 26 of rubber in the upper segments, which prevents inadvertent disassembly of the segments from the rubber packing member. After the molding operation, the packing assembly, consisting of the packing sleeve 12, segments 21, 22, and retainer 14 can be slipped over the body 10 and threaded on the expander 13.

The ends of the adjacent upper segments 21 and adjacent lower segments 22 practically contact one another when in retracted position. At the most, only an extremely small circumferential space 27 (exaggerated in Figures 1 and 3) remains between the adjacent segments in each row, and this, if present, is filled with rubber or other packing material during the molding operation. Upon distorting the rubber packing sleeve 12 into engagement with the casing by pressure, such as is created by pulling up on the body 10 to move the actuator 11 toward the expander 13, the expansion of the packing material itself forces the segments 21, 22 of the flow preventer ring 18 radially outward into engagement with the wall of the casing, to bridge the annular space 17 between the retainer and casing. In moving to this latter position of greater diameter, the stepped segments 21, 22 necessarily separate from one another to create a slight circumferential space 27a between the ends of the lower segments and the ends of the upper segments (exaggerated in Figures 2 and 4). This space 27a is of too small an extent to permit passage of the packing material, but even should this tendency occur, the rubber material can do no more than fill the space so created, as is apparent from the fact that the spaces between the lower segments 22 are bridged by the upper segments 21, and the spaces between the upper segments are bridged by the lower segments. In other words, a continuous path does not exist through which the packing material can flow longitudinally from one end of the flow preventer ring 18 to its other end. As a result, the packing material remains at the desired sealing point in the casing, regardless of the well temperatures or pressures to which it is subjected.

Upon relieving of the pressure on the packing sleeve, as by lowering the body 10 and packing actuator 11, the inherent contractability of the packing sleeve 12 moves it inwardly to its initial retracted position, and because of its coupling to the segments by the buttons 26, the segments are also moved inwardly along the bottom end 20 of the retainer to retracted position, in which material clearance prevails with respect to the wall of the casing, allowing movement of the packer through the casing without restraint and without damage, especially to its packing parts.

For the purpose of assisting radial outward expansion and inward radial contraction of the flow preventer segments 21, 22, the bottom end 20 of the retainer is bevelled in an upward and outward direction, and the upper sides 28 of the flow preventer segments are correspondingly bevelled. This inclined or bevelled engagement between the upper segments and retainer causes an upward pressure or strain on the packing material to produce longitudinal movement of the segments 21, 22 upwardly along the retainer bevel

20 and outwardly into engagement with the wall of the casing. Correspondingly, retraction of the packing sleeve 12 toward its initial position causes return longitudinal movement of the segments and their radial inward movement to initial position. This retraction of the segments is made positive by the interlocking of the packing sleeve to the segments through the agency of the buttons 26.

It is thus apparent that effective means have been provided for preventing plastic flow of the packing material from the desired sealing region without impairing the retrievability or removability of the well device. The packing 12 can be set and released repeatedly with the small segments 21, 22 moving into and out of engagement with the casing wall from and to their initially retracted position

I claim:

1. A packing structure, including a normally retracted non-metallic packing adapted for outward expansion into engagement with the wall of a confining enclosure, abutment means at one end of said packing to prevent substantial longitudinal movement of said packing end with respect to said abutment means, and a segmental ring encircling and embracing the end of said packing adjacent said abutment means while said packing is in retracted position as well as expanded position, said segments overlapping one another so as to extend across the ends of adjacent segments.

2. A packing structure, including a normally retracted non-metallic packing adapted for lateral expansion, abutment means at one end of said packing to prevent substantial longitudinal movement of said packing end with respect to said abutment means, and a ring composed of a plurality of small stepped segments encircling and embracing the end of said packing adjacent said abutment means while said packing is in retracted and expanded positions, each of said segments comprising upper and lower steps overlapping lower and upper steps, respectively, of adjacent segments.

3. A packing structure, including a non-metallic packing adapted to engage the wall of a well casing, abutment means at one end of said packing to prevent substantial longitudinal movement of said packing end with respect to said abutment means, said packing being provided with a circumferential recess adjacent said abutment means to form a circumferential groove therewith, and a ring in said groove composed of a plurality of small overlapping segments encircling and embracing said packing to prevent its longitudinal passage through said ring.

4. A packing structure, including a normally retracted non-metallic packing adapted for lateral expansion, abutment means secured to one end of said packing, and a ring circumscribing said packing adjacent said abutment means both while said packing is in retracted and expanded positions, said ring comprising upper and lower abutting segments arranged in overlapping relation so that the lower segments extend across the ends of adjacent upper segments.

5. A packing structure, including a non-metallic packing, abutment means secured to one end of said packing, said packing being provided with a circumferential recess adjacent said abutment means to form a circumferential groove therewith, and a ring in said groove encircling and embracing said packing, said ring comprising upper and lower small abutting segments arranged in overlapping relation so that the lower segments extend across the ends of adjacent upper segments.

6. A packing structure, including a non-metallic packing, abutment means at one end of said packing to prevent substantial longitudinal movement of said packing end with respect to said abutment means, and a ring encircling and embracing said packing adjacent said abutment means, said ring comprising upper and lower segments molded to said packing and arranged in overlapping relation so as to extend across the ends of adjacent segments.

7. A packing structure, including a non-metallic packing adapted to engage the wall of a well casing, means secured to one end of said packing to retain the same, said packing being provided with a circumferential recess adjacent said retaining means to form a circumferential groove therewith, and a ring in said groove encircling and embracing said packing, said ring comprising upper and lower small segments molded to said packing and arranged in overlapping relation so that the lower segments extend across the ends of adjacent upper segments.

8. A well packer, including a non-metallic packing adapted to engage the wall of a well casing, means secured to one end of said packing to retain the same, said packing being provided with a circumferential recess adjacent said retaining means to form a circumferential groove therewith, and a ring in said groove encircling and embracing said packing, said ring comprising upper and lower small segments molded to said packing and arranged in overlapping relation so that the lower segments extend across the ends of adjacent upper segments, the end of said retaining means forming said groove having a bevelled surface inclined in an outward and upward direction and said upper segments having a corresponding bevel abutting therewith.

9. A packing structure, including a non-metallic packing, abutment means at one end of said packing to prevent substantial longitudinal movement of said packing end with respect to said abutment means, said abutment means having a bevel surface, said packing having a circumferential recess adjacent said abutment means to form a circumferential groove with said bevel surface, and a ring in said groove composed of a plurality of segments encircling and embracing said packing, the segments of said ring having bevel surfaces engaging the bevel surface of said abutment means.

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