

May 9, 1950

H. C. OTIS

2,506,680

WELL PACKER

Filed June 10, 1944

4 Sheets-Sheet 1

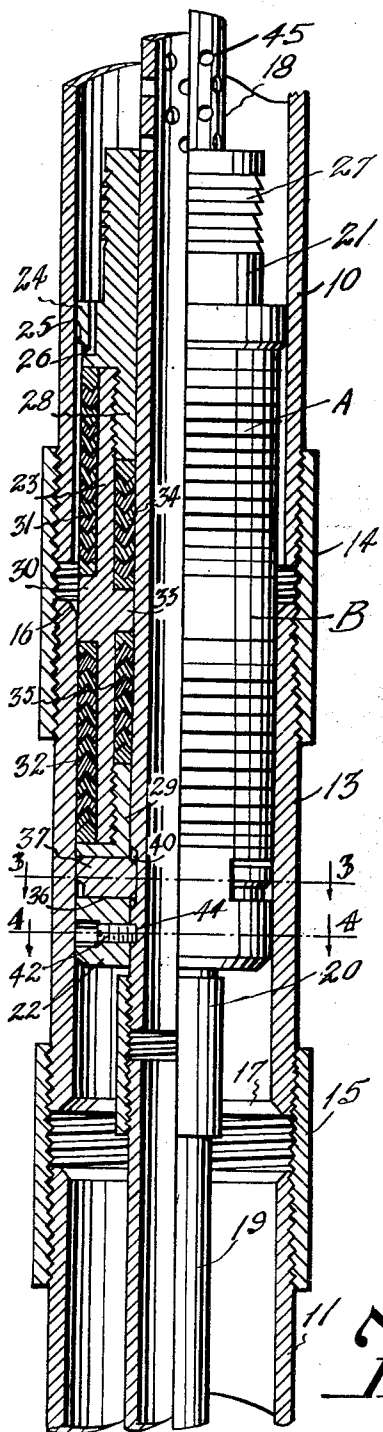


Fig. 1

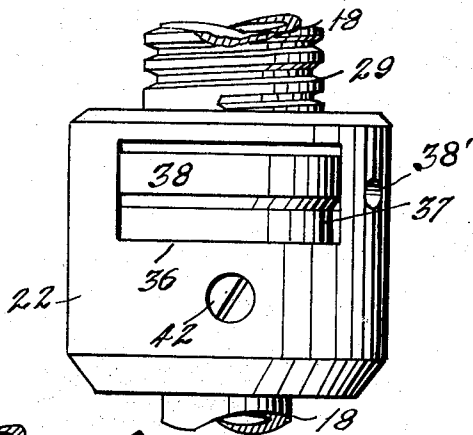


Fig. 5

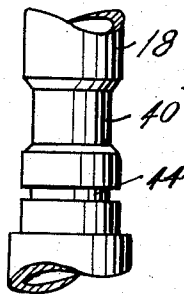


Fig. 6

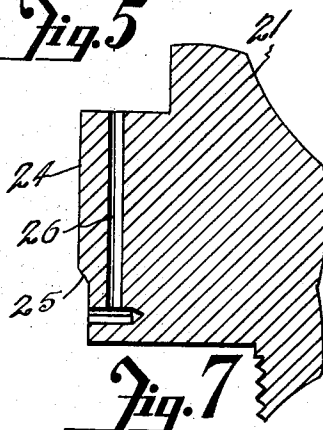


Fig. 7

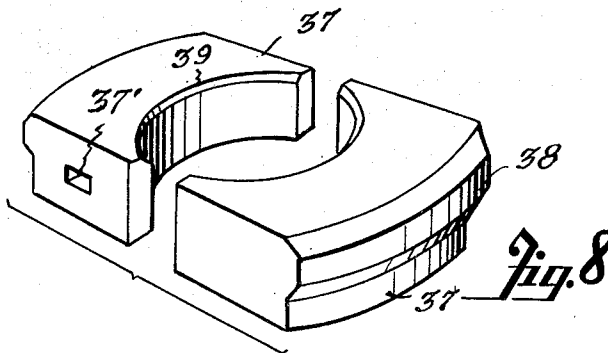


Fig. 8

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4 Sheets-Sheet 2

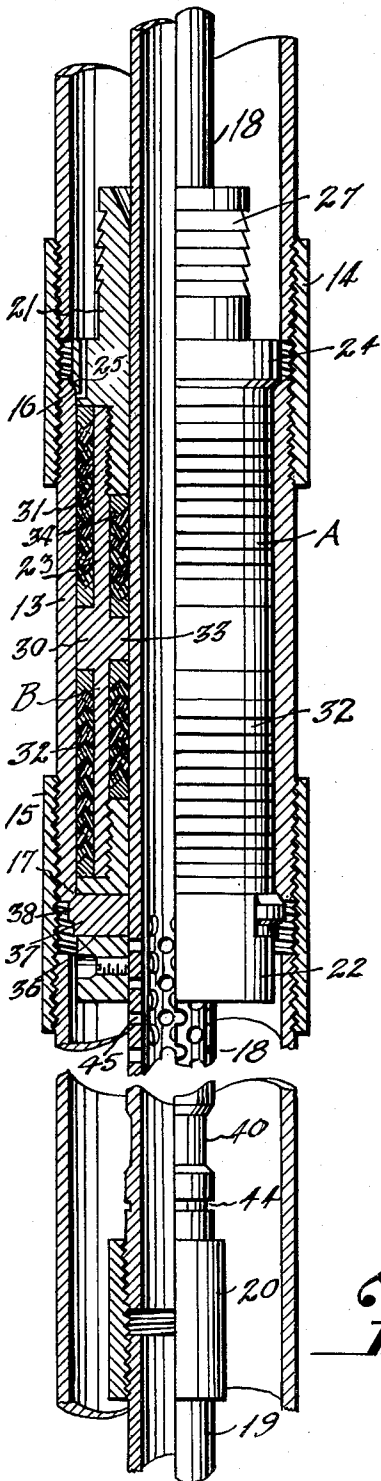


Fig. 2

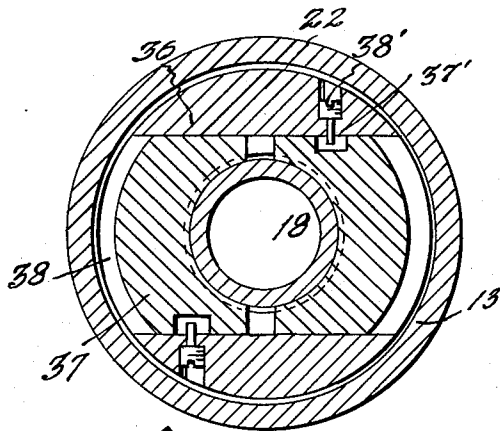


Fig. 3

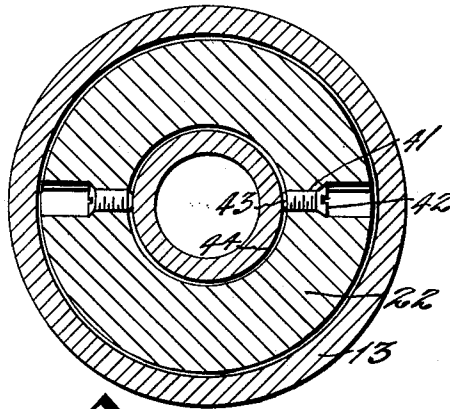


Fig. 4

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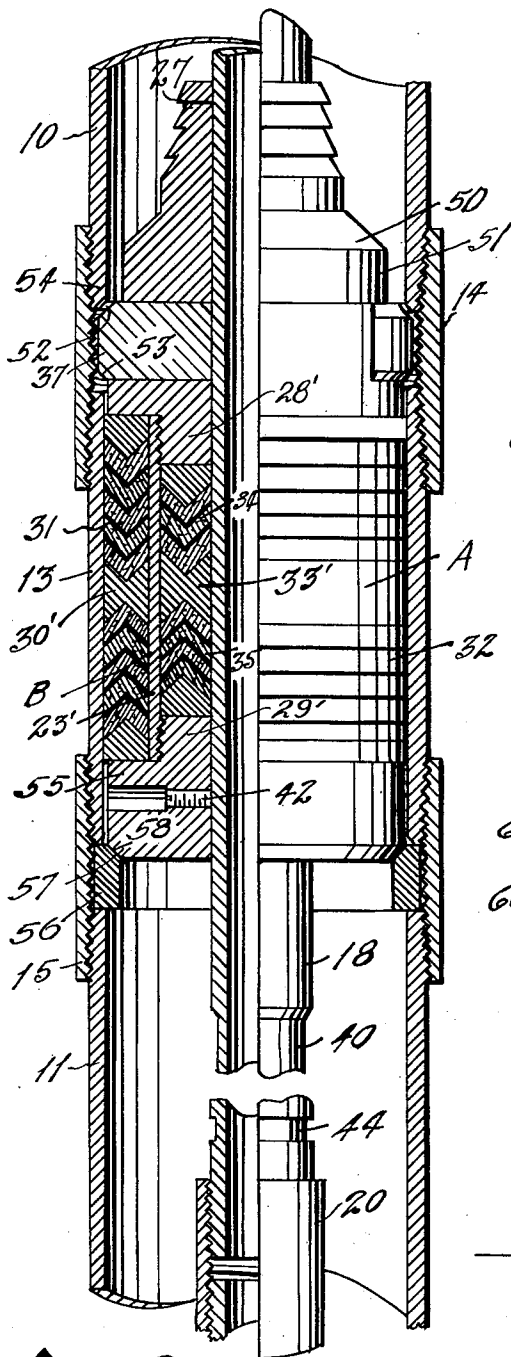


Fig. 9

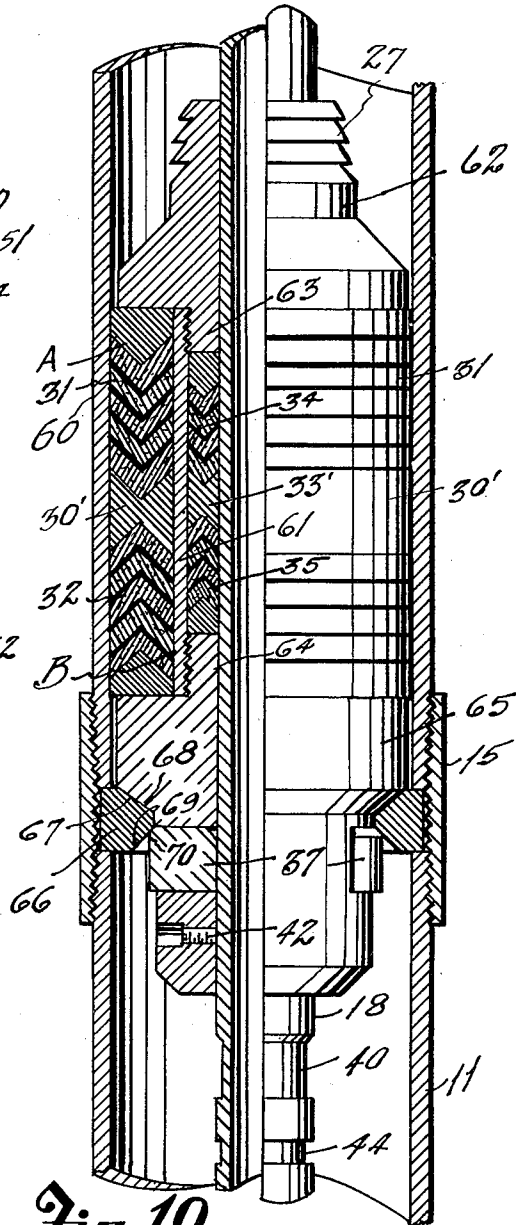


Fig. 10

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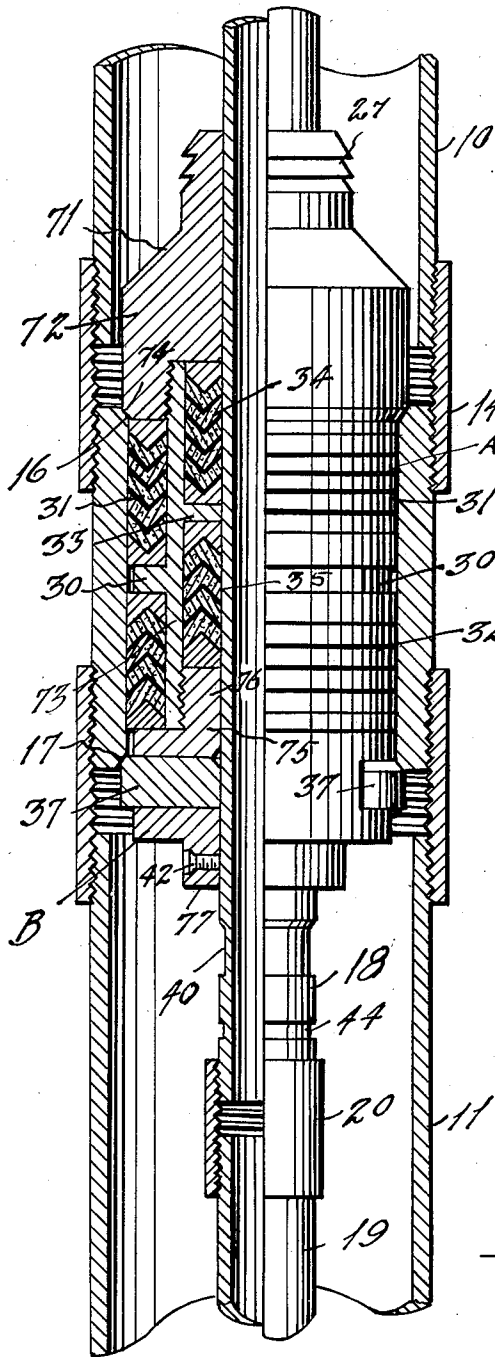


Fig. 11

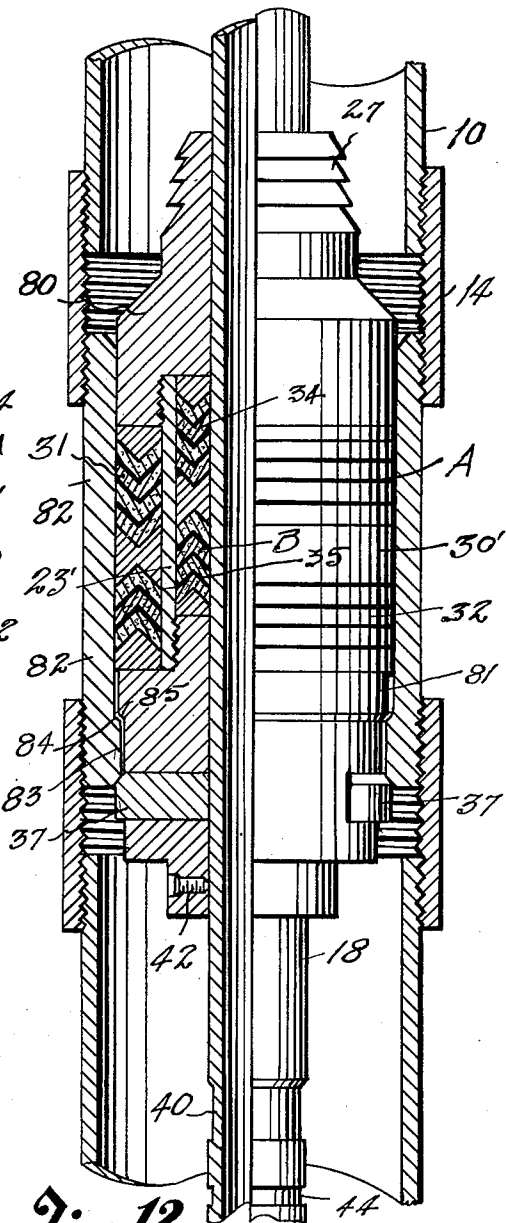


Fig. 12

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UNITED STATES PATENT OFFICE

2,506,680

WELL PACKER

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Application June 10, 1944, Serial No. 539,683

15 Claims. (Cl. 166—10)

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This invention relates to new and useful improvements in well packers.

As the depth to which oil wells are drilled has increased, it has been found that the temperatures at the bottoms of the wells have also increased. It has been customary to use packers employing both natural and synthetic rubber packing elements. Due to the increased temperatures, the efficiency of these natural and synthetic packing elements has been materially reduced to the extent that, in some cases, they are found unreliable due to deterioration under such high temperatures. Experiments have been made and a heat-resisting packing, such as asbestos, has been shown to be satisfactory, but such packing possesses a limited flexibility. It is therefore one object of this invention to provide an improved well packer which is especially adapted for use of asbestos and similar heat-resisting packing elements.

A particular object of the invention is to provide an improved well packer especially adapted for the use of heat-resisting packing elements, which elements may be arranged to be expanded into packing position by the pressure of fluids in the well casing.

Another object of the invention is to provide an improved well packer for packing off between the tubing and the casing including pressure expanded packing elements and arranged to be run into the well casing and locked in position therein; such a packer being arranged to be released and optionally removed from the well.

Still another object of the invention is to provide a packer which may be left in the casing and the tubing or drill stem removed; whereby tubing or a drill stem may be again run into the well and through the packer to lock the latter in sealing position, or the packer may be removed after the tubing or drill stem has been lifted from the well.

A further object of the invention is to provide a packer having relatively stiff packing elements, whereby the packer may be lowered into a casing member having a bore less than that of the casing, so that the packing elements will have such a close sliding fit in the lesser bore of said member as not to require fluid pressure to expand them into contact with such lesser bore; and also whereby such intimate contact may provide a seal, at very low pressures, without depending upon fluid pressure to expand said packing elements.

A still further object of the invention is to provide a casing nipple, ring or member which may

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be formed of readily drillable material offering reduced resistance to drilling out its bore, for the passage therethrough of well tools, or which may have a liner of such readily drillable material.

Another object of the invention is to provide a packer having a plurality of external heat-resisting packing rings adapted to engage in sealing relation with the bore of a casing member and internal heat-resisting packing rings, separated from the external rings, adapted to engage in sealing relation with a tubing section, whereby the casing and tubing of a well may be efficaciously packed off in a new and novel manner.

Still another object of the invention is to provide an improved and simple locking means for a well packer, which means may be readily operated by adjustment of the well tubing; the parts of which locking means are capable of sturdy construction and are relatively few in number.

A construction designed to carry out the invention 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, wherein an example of the invention is shown, and wherein:

Fig. 1 is a view partly in section and partly in elevation showing a packer constructed in accordance with the invention in its unlocked or running position in a well casing,

Fig. 2 is a similar view showing the packer locked in a well casing,

Fig. 3 is an enlarged horizontal cross-sectional view taken on the line 3—3 of Fig. 1,

Fig. 4 is an enlarged horizontal cross-sectional view taken on the line 4—4 of Fig. 1,

Fig. 5 is an elevation of the lower packer shoe,

Fig. 6 is an elevation of a portion of the tubing section,

Fig. 7 is a vertical sectional view of a portion of the upper shoe showing the supporting shoulder,

Fig. 8 is perspective view of the locking dogs,

Figs. 9 to 12, inclusive, are vertical sectional views, each of a modified form of the packer, in locked position in the casing.

In the drawings, the numerals 10 and 11 designate respectively, upper and lower lengths of a well casing. A casing member or nipple 13 is interposed between the casing lengths and has its upper end connected to the upper length 10 by a coupling collar 14, while its lower end is connected with the lower casing length 11 by a

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coupling collar 15. While the nipple forms a part of the casing, it may also constitute a part of the packer assembly. It is particularly pointed out that the internal diameter of the nipple 13 is less than the internal diameter of the upper casing length 10. This difference in diameters may be relatively small and in most instances not over $\frac{1}{2}$ of an inch, but is, of course, subject to variation. The nipple 13 is connected in the casing when the latter is made up and run into the well. It is pointed out that the nipple (Figs. 1 and 2) is provided at its upper end with an internal bevelled seat 16 and at its lower end, with an internal bevelled edge 17. These bevelled members constitute internal spaced projections, and in some forms of packer assembly, may be omitted.

The improved packer, which is designated generally by the letter A, is lowered or run into the casing and is adapted to be locked and supported within the nipple 13. The packer includes an axial tubing section 18, which may be connected at its lower end to a tubing length 19 by means of a coupling collar 20. The section 18 may be of any suitable length and its upper end may be connected in the usual tubing string or it may be suitably connected to a well choke such as is shown in my Letters Patent No. 2,246,811.

The body of the packer includes an upper shoe 21 and a lower shoe 22 which are connected by a spacer sleeve 23 and is generally designated by the letter B. The well packer A thus comprises in general, an axial tubing section 18, which is slidable vertically or longitudinally within a body B; while the packer assembly includes these elements and the nipple 13.

The upper shoe 21 is provided with a medial annular flange or collar 24. The lower end of this collar is reduced to provide an overhanging annular shoulder 25, which is preferably beveled. The collar is also provided with a duct 26 leading from its upper side and opening through the reduced portion below the shoulder 25. The purpose of this duct, of which there may be a plurality, is to conduct fluid from above the collar to a point below the shoulder when the packer is set. The upper end of the shoe 21 is provided with a fishing neck 27 which is common in this art. Below the collar the shoe is reduced to form a shank 28 which is externally screw-threaded.

The spacer sleeve 23 is internally screw-threaded at its upper end to receive the shank 28, and the shank 28 is screwed into the upper end of the sleeve until the collar 24 comes to rest thereon. The lower end of the spacer sleeve 23 is also internally screw-threaded and receives the external screw-threads of a reduced shank 29 formed on the upper end of the lower shoe 22. The shank 29 is screwed into the sleeve 23 until the lower end of the sleeve abuts the annular body of the shoe 22.

The spacer sleeve 23 is provided with a medial external collar 30. It will be observed that, while the body of the lower shoe 22 and the collar 30 each have an external diameter providing for a loose sliding fit in the nipple 13, the upper portion of the collar 24 has an overall diameter greater than the internal diameter of the nipple 13 so that, when the packer A is lowered from the position shown in Figure 1 to the position shown in Fig. 2, the shoulder 25 will come to rest on the upper seat 16 of the nipple 13 and thereby prevent further downward movement of the packer.

Upwardly facing packing rings 31, which snugly surround the sleeve 23, are confined between

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the collar 30 and the collar 24 of the upper shoe 21; while similarly mounted downwardly facing packing rings 32 are confined between the collar 30 and the body of the lower shoe 22. The spacer sleeve is also provided with an internal annular collar 33, which preferably has substantially the same internal diameter as the upper and lower shoes so that the tubing section 18 may have a free sliding fit therein. Between the collar 33 and the upper and lower shoes, upwardly and downwardly facing packing rings 34 and 35, respectively, are confined.

The packing rings illustrated are of the well known V-type and are adapted to be expanded by fluid pressure. The rings 31 and 34 are disposed to expand and pack off between the nipple 13 and tubing section 18 when subjected to fluid pressure from above; while the rings 32 and 35 are disposed to expand and pack off between the nipple and casing section, when subjected to fluid pressure from below. Owing to the fact that the rings may be made of such diameters as to snugly engage the inner wall of the nipple 13 and the outer surface of the tubing section 18, without fluid-pressure expansion, as well as to the fact that they are composed of asbestos or other heat resisting material, which makes them stiff, they are somewhat loosely confined longitudinally of the body B. This loose mounting of the rings permits the pressure fluids to more readily enter between individual rings and expand them.

Other types of V-shaped rings, now in common use may be used. Packing rings, which are also V-shaped and generally known under the name "Chevron," even when made of asbestos, because of their construction, are more flexible than the ordinary V-type illustrated in the drawings. Thus, if Chevron rings are employed, and they may be, expansion of the packing rings into contact with the nipple and tubing by pressure fluid could be relied upon, and such rings may not contact, or intimately contact, the nipple and tubing section, until subjected to expansion by pressure fluid. Thus, it is to be understood that the invention includes heat-resisting packing rings which have a relatively tight fit in the bore of the nipple 13 and which will engage the tubing section 18 in a like manner, thereby forming a seal at very low pressures, as for instance less than 50 lbs. per sq. in., with or without the aid of pressure fluid expansion. The invention also includes heat-resisting packing rings which, while initially engaging the surfaces to be packed off, do not thereby form seals, as well as such packing rings which do not initially engage the surfaces and which depend upon pressure fluid to expand them into contact with the surfaces; both types depending upon pressure fluid to expand them into sealing positions.

It is to be noted that the sealing and locking of the packer, as well as the construction of the nipple 13, are subject to considerable variation. For instance by use of structures, such as are hereinafter described, instead of the nipple 13, an ordinary section of casing may be used, and instead of the bevels 16 and 17, one or both may be omitted and other structures substituted.

A very important feature of the invention is the means for locking the packer in the nipple 13, whereby it is held against both upward and downward movement. The body of the lower shoe 22 is provided with a transverse slot 36, as is best shown in Fig. 3. The tubing section 18 passes through the center of the slot 36 and locking dogs 37 are slidably mounted in the slot

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on opposite sides of said tubing section. Each dog has on its outer edge an arcuate lip or boss 38 which is provided with upper and lower bevelled edges as is shown in detail in Fig. 8. It will also be noted that each dog has an arcuate bevel 39 on its inner upper edge. To limit the inward and outward sliding movements of the dogs 37, each has a short recess 37' (Figs. 3 and 8) for receiving a stud 38' screwed into the shoe 22 and projecting into the slot 36.

The tubing section 18 is provided with an external annular recess 40 beveled at its upper and lower ends, as is shown in Figs. 2 and 6. The dogs 37 are each of such a length that, when the tubing recess 40 is in registration therewith, their inner ends may be slid into said recess, whereby the lips 38 will not extend beyond the outer surface of the body of the shoe 22, and this will permit the packer to be passed downwardly into the nipple 13. When the overhanging shoulder 25 of the upper shoe 21 comes to rest upon the upper bevel 16 of the nipple 13, the dogs 37 will be so located that, if moved outwardly, their lips 38 will engage under the lower edge 17 of the nipple. With the packer in this position, it is obvious that by moving the tubing section 18 downwardly the dogs will be displaced from the recess 40; the outer surface of the tubing riding between said dogs, forces them outwardly into locking position. Likewise, if the tubing is moved upwardly to register the recess 40 with the dogs, an upward pull on the packer will cause the edge 17 to displace the dogs inwardly and thereby release the packer.

In order to hold the packer body B in position on the tubing section 18 while the packer is being lowered into the well and set, the body of the lower shoe 22 is provided with diametrically opposite screw-threaded bores 41 adapted to receive set screws 42. These screws are provided on their inner ends with frangible studs 43 adapted to engage in an annular groove 44 on the tubing section 18 just below the recess 40. These screws may be referred to generally as "shear pins." When the packer has reached its setting position, the weight of the tubing, when moved downwardly, will be sufficient to shear the studs 43 and thus permit free movement of the tubing section 18 longitudinally of the packer body B.

When the packer parts are in the position shown in Fig. 1, perforations 45, in the tubing section 18, providing by-pass ports, will be located above the fishing neck 27 of the upper shoe 21. These ports will permit fluid to pass through the tubing section 18 and escape above the packer when it is being lowered into the casing. When the tubing section 18 is moved downwardly to the position shown in Fig. 2, these ports are then below the packing rings 34 and 35. By moving the tubing section 18 downwardly a sufficient distance, the lowermost ports 45 may be located below the packer and provide a tubing inlet at this point. When the tubing section 18 is connected to a choke device such as is shown in my aforesaid Letters Patent, the by-pass ports may be omitted because the fluid will pass through the ports of the patented device.

When the tubing is moved upwardly from the position shown in Fig. 2 to release the dogs 37, the coupling collar 20 will engage the lower shoe 22 and thereby the packer may be removed from the well casing with the tubing. If it should be desired to leave the packer in the nipple 13, and if the tubing members 18 and 19 are of the flush joint type, it is obvious that the tubing may be

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lifted and pulled from the well without disturbing the setting of the packer. Under such conditions the packer would be supported by the shoulder 25 on the seat 16 and the central opening, left by the removal of the tubing or drill stem, would permit a free upward flow so that pressure from below would not dislodge the packer although the dogs 37 would not be positively held in locking position. The drill stem or tubing string could be again run into the casing and through the packer. If for any reason it was desired to remove the packer, a suitable fishing tool could be lowered in the casing and engaged with the fishing neck 27.

In using the packer (Figs. 1 and 2), the packer body B is made up as shown in the drawings and fastened on the tubing section 18 by means of the set screws 42, which establishes the relation shown in Fig. 1. The tubing is then run into the well until the shoulder 25 comes to rest on the upper seat 16 of the nipple 13. Further downward movement of the tubing will shear the studs 43, and continued downward movement of the tubing will cause the dogs 37 to be displaced from the recess 40 and moved under the edge 17 of the nipple 13. This will securely lock the packer in the nipple. When it is desired to remove the packer, it is simply necessary to elevate the tubing until the coupling collar 20 engages the lower shoe 22 and continued upward movement of the tubing will cause the edge 17 to displace the dogs 37 inwardly so as to release the locking device, since when the coupling collar 20 engages the lower shoe 22, the recess 40 is registered with the dogs 37.

In Fig. 9 a form of packer assembly is shown wherein the elements 16 and 17 are omitted from the nipple 13. The structure of the packer body B is somewhat changed. The upper shoe 50 is provided with the locking dogs 37, instead of mounting them in the lower shoe. The upper portion of the shoe 50 is reduced at 51 and sufficient clearance is left between the lower portion of said shoe and the bore of the nipple to permit pressure fluid to reach the rings 31 and 34.

The lower edge of the upper casing section 10, is spaced sufficiently above the upper edge of the nipple to permit the outer ends of the dogs 37 to enter therebetween in the coupling 14. The lips 38 of the dogs are omitted and the upper and lower outer edges of said dogs are provided with edges 52 and 53, respectively. The lower edge of the upper casing section is beveled to form a shoulder 54 to receive the beveled edges 52 of the dogs 37 and lock the packer against upward displacement.

The packing rings 31, 32, 34 and 35 are substantially the same in Fig. 9 as they are in Figs. 1 and 2; however, instead of the integral collars 30 and 33, loosely disposed spacer collars or rings 30' and 33' are employed. The spacer rings are shaped on their upper and lower sides to receive the V-shaped packing rings. The sleeve 23' is similar to the sleeve 23 and receives the screw-threaded shank 28' of the upper shoe.

A modified lower shoe 55 has an upstanding screw-threaded shank 29' which is screwed into the lower end of the sleeve 23'. The lower shoe carries the shear pins 42.

In order to support the packer, a seat ring 56 is fastened between the lower edge of the nipple 13 and the upper edge of the lower casing section 11. The inner upper edge of the ring is beveled at 57 and the lower outer edge of the shoe 55

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has an inclined shoulder 58 adapted to seat on the edge 57.

The operation is similar to that of Figs. 1 and 2, and the packer illustrated in Fig. 9 is in its locked position. When the tubing section 18 is lowered in the casing, the studs 43 of the shear pins 42 are engaged in the groove 44. When the shoulder 58 comes to rest upon the edge 57 of the ring 56, the dogs 37 will be within the coupling 14. Upon shearing the pins and moving the tubing section 18 downwardly, the dogs 37 will be expanded so that the edges 52 will engage under the shoulder 54 and the packer thus locked in place.

Another form is illustrated in Fig. 10, wherein a casing member 60 is employed instead of the nipple 13. It is to be understood the term "casing member" as used herein is intended to cover either a nipple or a tubular member, adapted in all instances to be connected in and form a part of the casing string. The casing member 60 may be an ordinary length of casing.

The packer body B includes a sleeve 61 similar to the sleeve 23 (Fig. 9) and the spacer rings 30' and 33' are also used. The upper shoe 62 in this form is slightly less in size than the integral casing diameter and has a reduced screw-threaded shank 63 which screws into the upper end of the sleeve; while the reduced shank 64 of a lower shoe 65 screws into the lower end of said sleeve.

While the packing rings are indicated by the same numerals 31, 32, 34 and 35, respectively, the outer rings 31 and 32 should be of the "Chevron" type, because they must be expanded by pressure fluid into contact with the inner wall of the casing member 60. This is necessary in order to permit the outer rings to freely slide in the casing and not become injured.

In place of the ring 56 of Fig. 9, a dual purpose ring 65 is fastened within the coupling 15. This ring has an inner upwardly facing bevelled seat 67 and an inner downwardly facing bevelled shoulder 69. The shoe 65 has an inclined shoulder 68 adapted to rest upon the seat 67 and support the packer; while the dogs 37 have their outer upper edges beveled at 70 to lock under the shoulder 69. The ring thus holds the packer against both upward and downward displacement.

Fig. 11 sets forth a further form which, in general structure, is very similar to Figs. 1 and 2, and is, in many respects, the preferable packer. The nipple 13, packing rings 31, 32, 34 and 35, respectively and the collars 30 and 33, are the same as in Figs. 1 and 2.

An upper shoe 71 has a marginal depending flange 72 at its lower end which is internally screw-threaded to receive the upper end of the sleeve 73, which in other respects is the same as the sleeve 23. The nipple 13 is provided at its opposite ends with the beveled elements 16 and 17 and the upper shoe 71 has an annular shoulder 74 on its lower outer edge, seating on the seat 16.

The lower shoe 75 has an upstanding shank 76 externally screw-threaded and screwed into the lower end of the sleeve 73; and also carries a depending flange 77 surrounding the tubing section 18 and carrying the shear pins 42. The dogs 37 are substantially the same as in Fig. 10, but lock under the edge 17, as in Fig. 2.

Still another form is shown in Fig. 12, which except for the upper shoe 80, the lower shoe 81 and the nipple 82, is the same as in Fig. 11. The upper shoe 80 is like the upper shoe 71 of

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Fig. 11, except it is given an overall diameter permitting it to telescope the upper end of the nipple, with sufficient clearance to permit pressure fluid to reach the upper packing rings 31; and the shoulder 74 is omitted.

The bore of the lower end of the nipple is reduced at 83 to provide a beveled projection or inclined annular seat 84. The lower shoe 81 has an overhanging inclined shoulder 85 and, therebelow, is of such size as to pass freely through the reduced bore 83. The lower edge of the bore 83 has the annular edge 17 for receiving the locking dogs 37. The shoulder 84 and the edge 17, function similarly to the dual purpose ring 66 of Fig. 10.

The upper shoes in Figs. 9 to 12, inclusive, each have the fishing neck 27. The rings 56 and 66 and the nipples 13 (Fig. 11) and 82 may all be made of readily drillable material. It is not believed necessary to describe the operation of the packers shown in Figs. 10, 11 and 12. It is obvious that in each packer assembly, herein illustrated, some form of seat or projection must be provided to support the packer in the casing. This projection or seat may be the nipple bevel 16, the ring elements 57 and 67, or the seat 84. Whether the seat or projection is an integral part of the nipple or casing member or separate therefrom, the function of supporting the packer B is the same.

As hereinbefore stated, the nipples or casing members 13, 60 and 82 form part of the casing and the rings 56 and 66, whether integral with, or separate from the member, may be considered a part thereof, so far as locking the packer in place is concerned; and the term "casing" as used herein is intended to broadly include the nipple or casing member. The elements 16, 57, 67 and 84 may be referred to as supports or seats; while the elements 17, 54, 69 and 83 may be referred to as internal means, stops or projections to be engaged by the locking dogs or elements.

The foregoing description of the invention is explanatory thereof and various changes in the size, shape and materials, as well as in the details of the illustrated construction may be made, within the scope of the appended claims, without departing from the spirit of the invention.

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

1. A well packing apparatus including, a casing nipple adapted to be connected in a string of casing and provided with internal spaced projections, a tubing section movable through the nipple, and a packer detachably mounted on the tubing section and movable into the nipple, said packer having means for engaging one of the projections of the nipple, whereby it is supported in said nipple, and locking means engageable with the other projection of the nipple to lock said packer against upward displacement in the nipple.

2. A well packing apparatus including, a casing member connected in a string of casing, a tubing section connected in a tubing string and extending through the casing member, a packer through which the tubing section is slidable, said packer having packing elements for sealing off between the casing member and the tubing section, a ring mounted in the casing string adjacent said casing member for supporting the packer within the casing member, and locking means carried by the packer having movable locking elements, the tubing section having means for moving the locking elements into locking engagement with the cas-

ing member upon longitudinal movement of said section.

3. A well packing apparatus including, a casing member having a seat and a stop therein and adapted to be connected in a string of casing having a greater internal diameter than the internal diameter of the casing member, a packer movable into the casing member supported on the seat thereof and having an axial bore there-through, external fluid-pressure responsive packing rings carried by the packer having a free sliding movement in the casing and a snug sliding fit in the casing member, internal fluid-pressure responsive packing rings carried by the packer and exposed in the bore thereof, a tubing section adapted to be connected in a tubing string and movable through the bore of the packer having a snug sliding fit in the internal packing rings, said rings sealing off between the casing member and the tubing section at low pressures, and expansible locking means carried by the packer for engaging the casing member stop, the tubing section having means for expanding said locking means into locking engagement with the casing member stop.

4. A well packing device including, a casing nipple adapted to be connected in a string of casing and provided with an internal seat and an internal stop spaced from said seat, a tubing section movable into the nipple, a packer detachably mounted on the tubing section and movable into the nipple, said packer having means for engaging on the seat of the nipple, whereby it is supported therein, and expansible locking means carried by the packer for engaging the stop of the nipple to lock said packer against upward displacement in the nipple.

5. A well packing apparatus including, a tubular packer member having internal and external packing elements, expansible locking means carried by the packer member, a tubular casing member adapted to be connected in a string of well casing and having a bore for receiving the packer member, seat means at one end of the casing member for supporting the packer member within said casing member, a locking stop associated with the casing member and located to be engaged by the packer member locking means, and a tubing section adapted to be connected in a tubing string movable longitudinally in the packer member and having means to engage the locking means to displace said locking means to engage the locking stop, whereby the packer member is locked against displacement from the casing member and the packing elements are disposed to seal between the exterior of the tubing section and the interior of the casing member.

6. A well packer including, a sleeve, annular members secured to each end of the sleeve, external packing surrounding the sleeve between said members, internal packing within the sleeve confined between said members, said packer having a longitudinal bore in which said internal packing is exposed, laterally movable locking dogs in one of the members having their inner ends exposed in the packer bore, and a tubing section slidable in said packer bore in engagement with the internal packing, said tubing section having means for moving said dogs outwardly upon longitudinal movement of the tubing section.

7. A well packer including, upper and lower annular shoes, a sleeve rigidly connecting the shoes and having a bore greater than the bores of the

shoes, internal packing rings confined within the sleeve between the shoes, external packing rings surrounding the sleeve and confined between said shoes, and expansible locking means carried by one of the shoes.

8. A well packer including, upper and lower annular shoes, a sleeve rigidly connecting the shoes and having a bore greater than the bores of the shoes, internal packing rings confined within the sleeve between the shoes, external packing rings surrounding the sleeve and confined between said shoes, and expansible locking means carried by one of the shoes, one of said shoes having an annular bevelled edge.

9. A well packing apparatus including, a casing having therein a seat and a stop, a tubing section movable longitudinally in the casing, a packer mounted on the tubing section having shear means engaging the tubing section for initially holding said packer in position on the tubing section, said packer sealing off between the tubing section and the casing and having external packing engaging the casing and internal packing engaging the tubing section, the packer engaging on the casing seat, and locking means carried by the packer, the tubing section having means moving the locking means into locking engagement with the casing stop, the casing seat and stop engaging the packer and its locking means, whereby the packer is held against both upward and downward displacement in the casing when the shear means is broken and the tubing section is moved longitudinally in the packer.

10. A packing apparatus as set forth in claim 9, wherein the external and internal packings are fluid-pressure responsive and are exposed to the pressure fluids acting upwardly and downwardly between the casing and the tubing section.

11. A packing apparatus as set forth in claim 9, wherein the tubing has an external recess and the locking means is exposed to the tubing section, said locking means being movable into said recess when the tubing section is longitudinally adjusted to register said recess with the locking means, whereby the packer is released from the casing stop.

12. A packing apparatus as set forth in claim 9, wherein the casing includes a tubular member having the seat and stop therein and a bore wall of readily drillable material.

13. A well packing apparatus including, a casing member adapted to be connected in a string of well casing, a tubing section adapted to be connected in a well tubing string and to extend through said casing member, said casing member having a bore of less diameter than the internal diameter of the casing string in which it is connected, a packer through which said tubing section may be slid detachably fastened on said tubing section, said packer having fluid-pressure responsive rings adapted to be expanded by pressure fluid to seal off between the bore of said casing member and said tubing section, a seat at one end of said casing member for supporting the packer in the bore of said casing member, and expansible locking means carried by the packer movable outwardly from said packer, said tubing section having means moving the locking means outwardly into locking engagement with said casing member upon longitudinal movement of said tubing section.

14. A well packing apparatus including, a stationary member having screw threads at its upper and lower ends for connecting it in a casing

string in a well, a tubing section adapted to be connected in a tubing string and to extend through said casing member, a packer mounted on said tubing section detachably fastened to the latter, said tubing section being slidable through the packer when released therefrom, said packer having packing elements for sealing off both said casing member and said tubing section, means at one end of said casing member for supporting the packer therein against downward displacement, and locking means carried by the packer and having movable locking elements, said tubing section having means moving the locking elements into engagement with said casing member upon longitudinal movement of said tubing section.

15. A tubular well packer including, a spacer sleeve, an upper shoe mounted on the upper end of the sleeve, internal heat-resisting packing rings disposed within the sleeve between the shoes adapted to be expanded by fluid pressure, some of said internal rings facing in one direction and others of said rings facing in the opposite direction, external heat-resisting packing rings mounted externally on the sleeve between the shoes and adapted to be expanded by fluid pressure, some of said external rings facing in the

opposite direction, also some of said external rings surrounding some of the internal rings, and laterally movable locking means carried by one of the shoes having outer ends exposed on the exterior of the packer and inner ends exposed at the interior of the packer.

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