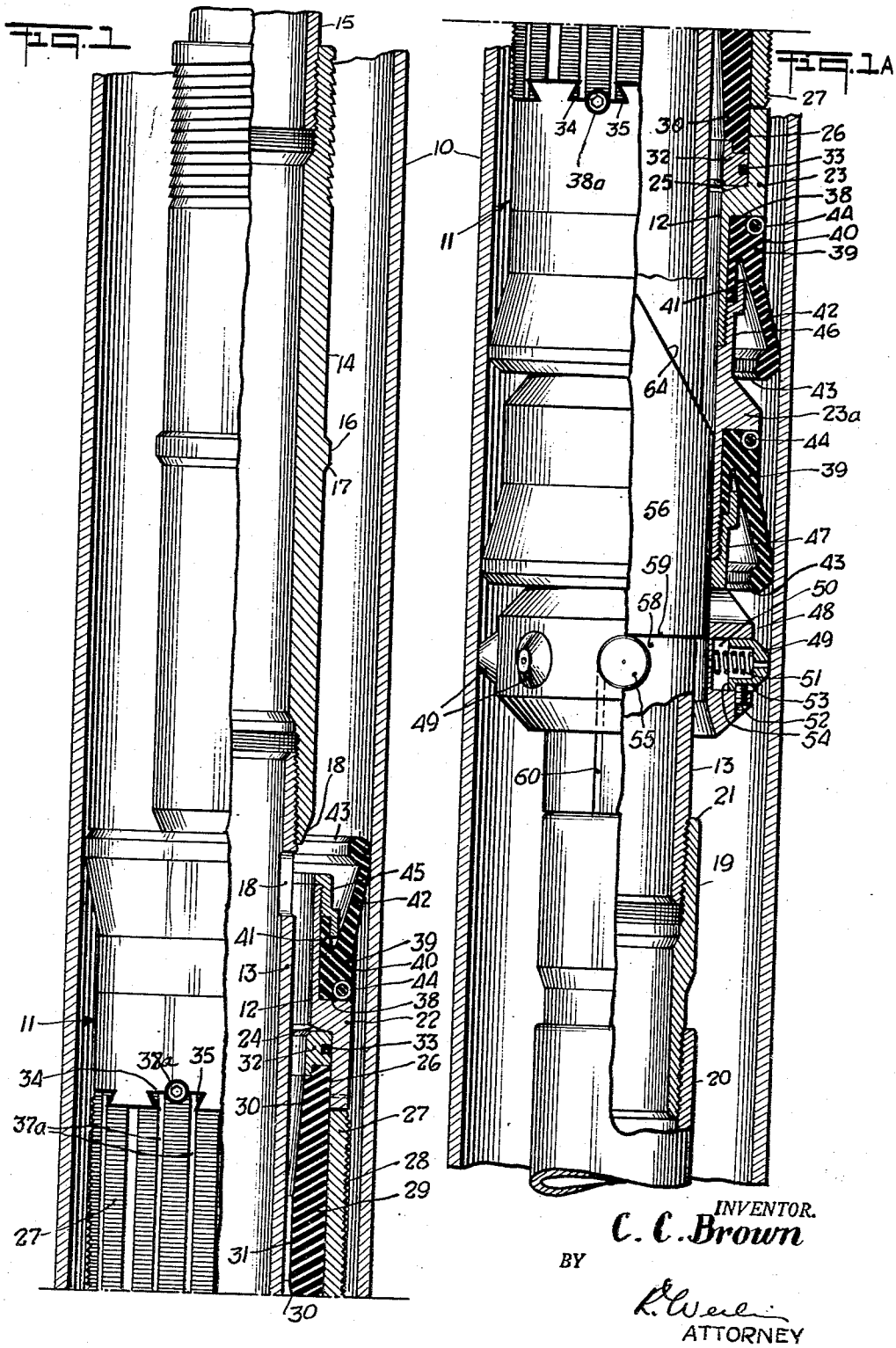
July 20, 1954 C. C. BROWN 2,684,119

WELL PACKER

Filed June 20, 1949

3 Sheets-Sheet 1



INVENTOR.
C. C. Brown
BY
ATTORNEY

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WELL PACKER

Filed June 20, 1949 3 Sheets-Sheet 2

Fig. 2

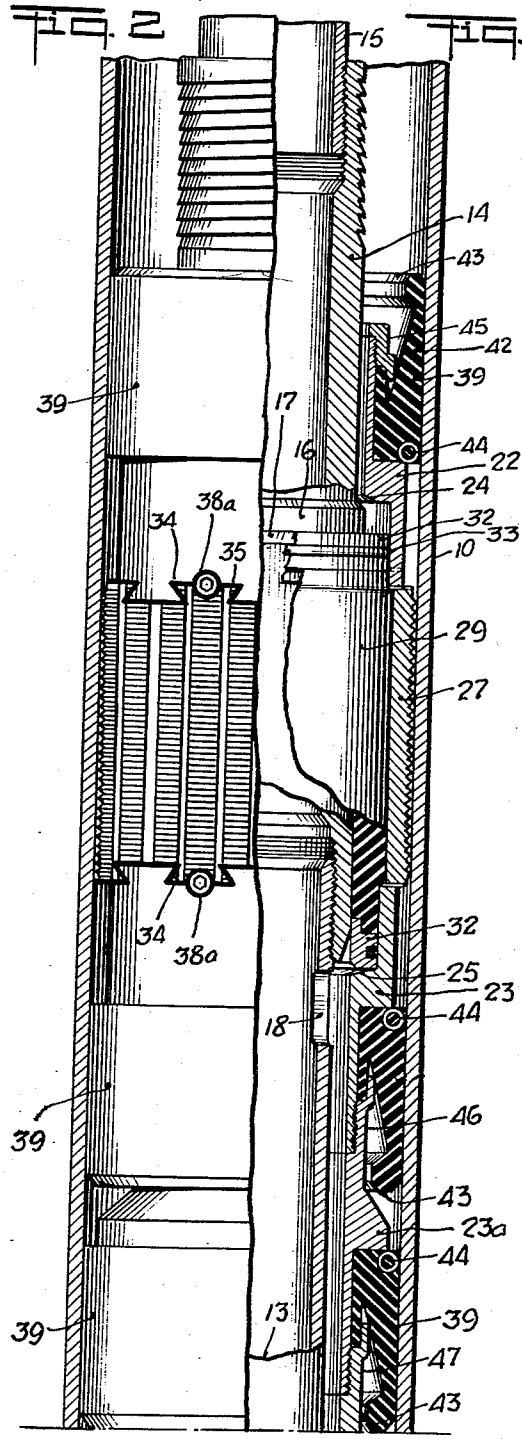
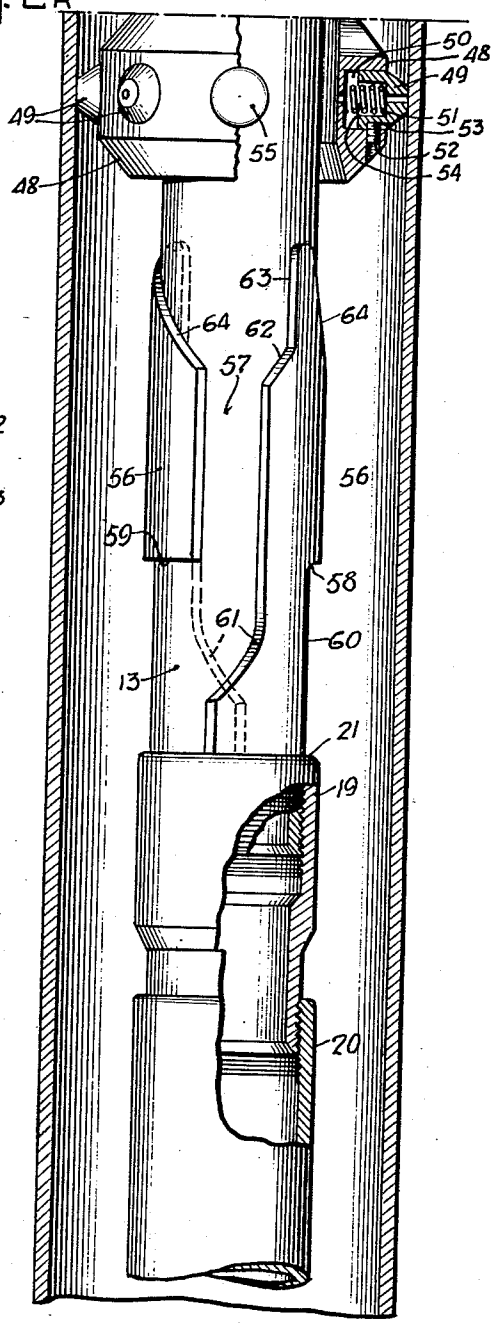


Fig. 2A



INVENTOR.
C. C. Brown
BY
ATTORNEY

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WELL PACKER

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Fig. 3

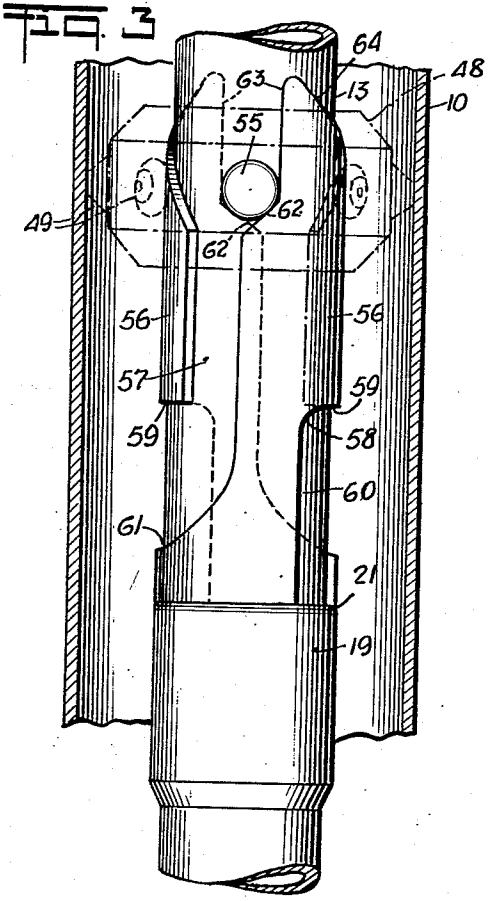


Fig. 4

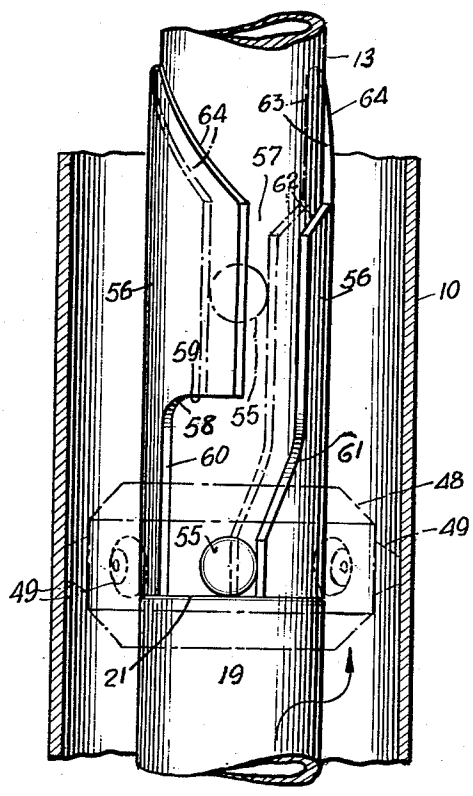


Fig. 5

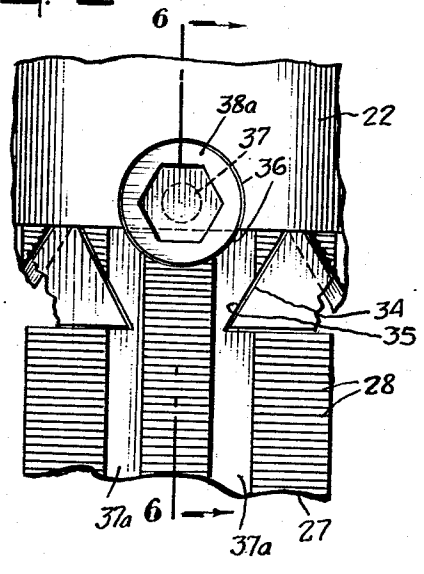
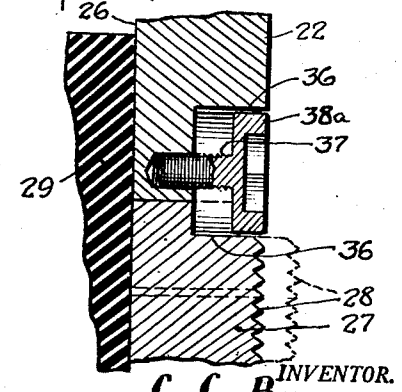


Fig. 6



INVENTOR.
C. C. Brown
BY
ATTORNEY

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UNITED STATES PATENT OFFICE

2,684,119

WELL PACKER

Cicero C. Brown, Houston, Tex.

Application June 20, 1949, Serial No. 100,224

10 Claims. (Cl. 166—128)

1

This invention relates to well packers, and particularly to a well packer which is especially adapted for use in the dual completion of oil and gas wells.

Dual completion of oil and gas wells contemplates the completion and equipping of a well to permit the production of oil or gas, or both, simultaneously from two different producing earth formations or zones traversed by the same well bore, the producing zones being separated from each other ordinarily by a non-producing section of earth strata. In accordance with conventional practice, dual completion is normally effected by installing a suitable sealing means, such as a packer, in the well casing between the two producing zones to isolate one from the other. Communication is then established between both producing zones and the well and the fluids from the two zones are then caused to flow in separate streams through concentric pipes extending into the well, one stream flowing through the inner pipe or tubing, and the other through the annular space between the tubing and the outer pipe or casing.

Satisfactory dual completion of wells has heretofore been difficult to accomplish due to the unavailability of a suitable mechanical seal, which is effective under high pressure differentials in either direction, for effectively isolating the production from one zone from that of the other. So long as the pressure differentials between the producing zones are relatively low, i. e., below about 1000 pounds per square inch, and the upper zone is the high pressure zone, almost any of the conventional production packers will meet the requirements with a reasonable degree of effectiveness. However, when the differential pressures exceed 1000 to 1500 pounds per square inch and the lower zone is the higher pressure zone, isolation of the two zones from each other becomes practically impossible when employing most of the conventional types of production packers. The production type packers which are available which will successfully withstand these higher pressure differentials are of a type which, when once installed in the well bore, are not retrievable, and must be drilled up or otherwise completely destroyed in case their removal is required, a not infrequent occurrence.

Accordingly, this invention has for its principal objects the provision of an improved production packer which is particularly adapted for dual completion of wells; which forms an efficient seal under high differential pressures in either direction; which is readily retrievable from the well; which is of relatively simple construction; and which is operable with relatively little compression load from the tubing string.

2

An important object is the provision of a well packer employing a hydraulic pressure principle for actuating pipe gripping elements in setting and releasing the packer, the actuating pressure being supplied by a resilient material such as synthetic or natural rubber which, under the relatively high pressures effective during operation of the packer, exhibits many of the characteristics of a hydraulic fluid.

Another object is the provision of an auxiliary jarring mechanism of relatively simple form for aiding in the release of the packer under certain conditions.

Other and more specific objects and advantages of this invention will become apparent from the following detailed description when read in conjunction with the accompanying drawings which illustrate one useful embodiment in accordance with this invention.

In the drawings:

Figs. 1 and 1A together illustrate a packer structure in accordance with this invention and showing the packer in the un-set position, as when being lowered into a well casing, some of the parts being broken away for purposes of better illustration;

Figs. 2 and 2A is a view similar to Figs. 1 and 1A showing the packer in the set position;

Fig. 3 is a fragmentary view showing parts of the jarring mechanism at an initial operating stage;

Fig. 4 is a view similar to Fig. 3 showing the parts of the jarring mechanism at the point of jarring impact;

Fig. 5 is a fragmentary elevational view illustrating a form of connection between the pipe-gripping elements and the packer body; and

Fig. 6 is a longitudinal sectional view taken along line 6—6 of Fig. 5.

Referring first to Figs. 1 and 1A, the packer structure is shown inserted inside a conventional well casing 10 in process of being lowered therethrough to the point at which it is to be set. The packer structure comprises a body, indicated generally by the numeral 11, of generally tubular form, having an axial bore 12, and a tubular operating member 13, of smaller diameter than bore 12 and concentrically disposed therein for longitudinal and rotational movement relative to body 11. Operating member 13 is threadedly connected at its upper end to a tubular element

14, commonly termed a "sealing stem," which is of somewhat larger external diameter than member 13 and somewhat smaller in diameter than bore 12 to thereby permit free axial movement of stem 14 therethrough. The upper end of sealing stem 14 is connected to the end of a string of operating pipe or tubing 15 which, it will be understood, is adapted to extend to the surface and is employed to operate the packer. Operating member 13 and sealing stem 14, by means of the described inter-connections, become integral parts of the tubing string 15, their bores being in registration and providing a continuous passageway therethrough. An annular sealing shoulder 16 is provided at an intermediate point along the exterior of sealing stem 14 and has its lower edge inwardly bevelled to provide a sealing surface 17. The lower end of stem 14 is bevelled at 18a inwardly toward the exterior surface of member 13 to aid in guiding stem 14 during its insertion into the packer body, for purposes to be hereinafter described. One or more radial ports 18 are provided in the wall of operating member 13 somewhat below the bevelled end of the sealing stem. The lower end of operating member 13 is threadedly inserted into the upper end of a connecting sub 19, the lower end of which is adapted to be connected to any one of the several conventional tools, indicated at 20, which it may be desired to connect to the lower end of the packer structure in accordance with common practices in this art. In some cases, it will be understood, no other tool may be connected to the lower end of sub 19. The upper edge of sub 19 forms an annular abutment 21 about the lower end of operating member 13 for purposes to be described hereinafter.

Packer body 11 is a structure composed of a pair of axially spaced metallic collar members 22 and 23 having internal shoulders 24 and 25, respectively, facing each other and forming between them a cylindrical recess 26 of somewhat larger diameter than bore 12. Packer body 11 also includes a plurality of elongated slip segments 27 which are circumferentially disposed between the spaced ends of collar members 22 and 23 and are connected thereto for radial movement relative to the collar members. Slip segments 27 may be arcuate in transverse section and may conveniently be formed by longitudinal cutting of a tubular sleeve of suitable internal and external diameters into the desired number of segments, so that when circumferentially disposed in edge-to-edge relation between collar members 22 and 23, the segments will form a substantially continuous ring of slips about the packer body concentric with the inner surface of casing 10. The exterior surfaces of slip segments 27 are provided with outwardly extending teeth 28 or wickers adapted to be embedded into, or to otherwise grip firmly, the inner surface of casing 10 when the slip segments are forced radially thereagainst in operation of the packer structure as will be subsequently described.

The connections between collar members 22 and 23 and slip segments 27 which are adapted to permit radial movement of the slip segments relative to the collar members (see Figs. 5 and 6) are provided by forming a series of dove-tail slots 34 in the ends of the collar members and forming on the ends of the slip segments corresponding tongues 35 slidable radially in grooves 34. Registering circular groove segments 36—36 are provided in the adjacent faces of the tongues and grooves through which studs 37 may be radially inserted and screwed into the bodies of collar members 22 and 23. The heads 38a of the studs thus act as retainers to hold the slip segments in place while permitting the requisite degree of radial movement of the slip segments relative to the collar members. A series of longitudinal channels 37a may be cut in the faces of the slip segments for relief of some of the stresses in the metal when the slip segments are in radial compression and to permit escape of any fluid which may be trapped between the slip faces and the casing.

A tubular sleeve 29, constructed of resilient, compressible, composition material, such as natural or synthetic rubber, is disposed in recess 26, with its outer surface in contact with the rear faces of slip segments 27. The inner surface of sleeve 29 has tapered surfaces 30 extending from each end toward the medial portion 31 thereof which protrudes somewhat into bore 12 toward the exterior surface of operating member 13 but leaving a clearance space therebetween. The opposite ends of sleeve 29 are provided with metal end rings 32 which are adapted to slide over the inner walls of collar members 22 and 23 relative to shoulders 24 and 25 in response to the axial expansion and contraction of sleeve 29. Packing rings 33 are circumferentially seated in the outer faces of end rings 32 to form fluid-tight seals between the rings and the adjacent walls of collar members 22 and 23.

Each of the collar members 22 and 23 has its exterior surface cut away adjacent its outer end to form an annular shoulder 38 on which is seated an annular cup-shaped sealing element 39, constructed of rubber or other similar resilient composition material, the mouth of the sealing element in the case of collar member 22 facing upwardly, while that on collar member 23 faces downwardly. The several sealing elements 39 are substantially identical in construction and the following detailed description of one will be equally applicable to the others. Each sealing element includes a relatively thick annular base portion 40 adapted to be seated on shoulder 38 and dimensioned so that, when in normal or uncompressed condition, its exterior will be substantially flush with the exterior of the collar member on which it is mounted. A relatively short inner lip 41 and a relatively longer outer lip 42 extend from base portion 40 generally toward the outer end of the collar member on which it is mounted. Outer lip 42 flares outwardly from the axis of the sealing element toward casing 10 and is provided at its outer end with a reinforcing bead 43. Inner lip 41 is adapted to fit snugly against the adjacent wall of the collar member. A circular coil spring 44 is molded into the material composing base portion 40 adjacent the outer corner thereof which rests on shoulder 38. Spring 44 is adapted to serve as a reinforcement for the base of the sealing element whereby when pressure is applied to the interior of the sealing element which tends to extrude the resilient material of which the sealing element is composed into the annular space between the exterior of the collar member and the casing, the coil spring, which is made of somewhat larger diameter than this annular space, will form a block across this space and prevent flow or extrusion of the sealing element material through this space. (See Figs. 2 and and 2A.) The sealing element 39 which is mounted on collar member 22 is held in place by means of a suitable retaining ring 45 which

is screwed down over the outer end of the collar member into clamping relation to inner lip 41. The sealing element on collar member 23 is similarly held in place by means of a retaining ring 46 forming an extension of a second collar member 23a which is otherwise substantially identical in construction with collar member 23 and is similarly fitted with a downwardly facing sealing element 39. The latter is held in place by a retaining ring 47 similar in general shape to rings 45 and 46 but which, in this case, forms an integral extension for a tubular cage 48 which is thereby also rigidly connected to the packer body and forms a unitary part thereof. It will be evident that cage 48 and its connected ring 47 may be connected to collar member 23 in the event collar member 23a is eliminated, as may be desired in some cases. Alternatively, it will also be evident that additional collar members, such as collar members 22, 23 and 23a, together with their sealing elements, may be inserted into the packer body at either end thereof for providing additional sealing elements between the packer body and the well casing, where such additional sealing elements may be required.

Cage 48 comprises a generally annular body, having a bore which is substantially flush with bore 12 and is in general a continuation thereof. A plurality of friction elements 49 are seated in angularly spaced radial recesses 50 arranged in the outer periphery of cage 48 and are normally urged in the outward direction by means of resilient elements, such as coil springs 51, seated in the respective recesses 50 between the bottoms thereof and the inner ends of the friction elements. The latter are retained in their respective recesses by means of suitable set screws 52, each of which extends through a wall of the recess into a longitudinal groove 53 in the related friction element having a terminal abutment 54 at the inner end of the groove. With this arrangement the friction elements may be extended outwardly under the pressure of the coil springs into frictional engagement with the inner wall of casing 10 but are held against complete expulsion from the recesses by the coaction between set screws 52 and abutments 54. Cage 48, with the friction elements 49, provide means for holding packer body 11 stationary in casing 10 while operating member 13 may engage in relative longitudinal and rotational movements as may be required for operation of the packer. It will be understood that various other more conventional forms of friction elements commonly used in packer structures may be employed in lieu of the specific form described.

Cage 48 has rigidly mounted therein a pair of diametrically opposed cylindrical pins 55 which are of relatively heavy construction and extend inwardly from the inner periphery of cage 48 toward the surface of operating member 13, sufficient space being provided between the inner ends of the pins and the exterior of the operating member to permit free longitudinal and rotational movement of the latter between the pins. Pins 55 are adapted to cooperate with a pair of elongated lug plates 56 rigidly mounted on opposite sides of operating member 13. Lug plates 56 are dimensioned to provide a pair of longitudinal guide slots 57 between their adjacent side edges through which pins 55 are adapted to slide when placed in registration therewith. The lower right hand corner of each of the lug plates is cut away to provide a recess 58 having a generally longitudinal wall 60 extending to the lower

end of the lug plate and a generally horizontal wall 59 extending inwardly from an intermediate point along the right hand edge of the plate to its intersection with longitudinal wall 60. Lug plates 56 are disposed on the exterior of operating member 13 so that the lower ends of the lug plates extend to abutment 21 which forms a bottom wall for the recesses. Recesses 58 are adapted to cooperate with pins 55 to lock packer body 11 to operating member 13 to prevent downward movement of the latter relative to the packer body when the pins are engaged in recesses 58 and to release operating member 13 for such movement when the operating member is rotated sufficiently in the clockwise direction to bring guide slots 57 in registration with the pins.

On the side edge opposite recess 58, each of the lug plates 56 is provided adjacent its lower end with an upwardly and inwardly curved surface 61 and adjacent its upper end with an upwardly and inwardly sloping shoulder 62 terminating against a vertical wall 63 extending to the upper end of the lug plate. The latter slopes downwardly and rearwardly at 64 from the upper end of wall 63 to intersection with opposite edge of the lug plate.

The above-described packer structure operates in the following manner: The structure assembled as illustrated in Figs. 1 and 1A, with pins 55 engaged in recesses 58 to lock the packer body to operating member 13, and connected to the operating string of tubing 15, will be lowered into well casing 10 to the position at which it is to be set. At this initial stage of operations, sealing stem 14 will be in the elevated position relative to the packer body, and the annular space open to permit upward displacement therethrough of any fluid present in the well, thereby allowing the packer structure to be lowered through the fluid without hindrance thereby. Friction elements 49 will be in frictional engagement with the casing wall, tending thereby to resist lowering of the packer body through the casing. However, the weight of the operating string will bear on pins 55 and will overcome this frictional resistance developed by elements 49 and will force the entire structure to move downwardly. At the same time lips 42 of the sealing elements 39 will be in wiping engagement with the casing wall but will not be expanded tightly thereagainst by resistance of fluid in the well, by virtue of the passage for the fluid provided through bore 12. The frictional engagement of the friction elements with the casing will also tend to hold pins 55 in place in recesses 58 during the downward movement of the packer structure.

When the packer structure has attained the setting position in the casing, the tubing string will be rotated from the top of the well in the right-hand or clockwise direction until guide slots 57 are brought in registration with pins 55, thereby releasing the latter from their engagement with operating member 13. The frictional engagement of cage 48 with the casing will hold packer body 11 stationary while the desired rotation of the operating member is thus effected. The operating string will thus be released for downward movement relative to the packer body and will thereupon be lowered, the frictional engagement of cage 48 with the casing also holding the packer body stationary while this relative downward movement of the operating string is effected. As the operating string is lowered relative to the packer body, sealing stem 14 will

move downwardly through bore 12 and its lower end will enter and move through the bore of sleeve 29. Due to the constriction formed in the sleeve bore by the inwardly protruding portion 31, which thus reduces the bore to a smaller diameter than that of sealing stem 14, the latter, as it moves through the sleeve, will cause the sleeve, by virtue of its plastic composition, to expand radially outwardly, thereby correspondingly pushing slip segments 27 toward casing 10. The downward movement of the operating string will be continued until shoulder 16 comes in contact with upper end ring 32, the tapered surface 17 engaging a correspondingly tapered surface on ring 32 to thereby tightly seal bore 12 against further movement of fluid therethrough. As the weight of the operating string is thus brought to bear on the upper end of sleeve 29, the latter will be placed in longitudinal compression, since lower end ring 32 will be engaged on shoulder 25 thereby preventing downward movement of the sleeve. The compression of the sleeve in this manner will cause additional deformation of the plastic material comprising sleeve 29. As the sleeve is confined on the inside by its engagement with the exterior of the sealing stem and is confined at its lower end by the engagement of lower end ring 32 with shoulder 25 and at its upper end by the sealing engagement of shoulder 16 with the upper end ring 32, and since upper end ring 32 is free to move downwardly relative to collar member 22, the plastic body of sleeve 29 will necessarily be caused to move or be extruded in the outward radial direction, thereby increasing the outward pressure on slip segments 27 sufficiently to drive the teeth 28 strongly into the metal of well casing 10. Since the pressure in the body of sealing sleeve 29 is necessarily exerted in all directions, the sealing pressure of the inner wall of sleeve 29 on the exterior of sealing stem 14 will be correspondingly increased, thereby increasing the tightness of the seal between the sleeve and the sealing stem. Packing rings 33 serve to prevent escape of any fluid between end rings 32 and the adjacent walls of collar members 22 and 23. As will be evident from Figs. 2 and 2A, the application of the weight of the operating string on upper end ring 32 will drive the latter downwardly from its initial contact with upper shoulder 24, in effecting the compression of sleeve 29. It will be seen that end rings 32 constitute a pair of pistons movable toward each other and relative to the packer body, and confining between them what is, in effect, a viscous but elastic fluid which, under axial compression between the pistons, will expand and apply radially directed fluid pressure against the slip segments to drive the latter into gripping engagement with the casing.

The above described operations constitute the primary operation for effecting the setting of the packer in the well casing. However, when communication between the portions of the well bore above and below the packer are cut off by the seating of sealing shoulder 16 on upper end ring 32, the weight of the column of fluid above the packer will now be exerted on upper end ring 32 to additionally increase the compression of sleeve 29 and thereby additionally increase the gripping force of the slip segments on the casing. At the same time the pressure of the upper column of well fluid will be exerted against the interior of the sealing element 39 which is mounted on collar member 22. This will expand out lip 42 tightly against the casing and prevent escape of the fluid downwardly past the packer body. Obviously, the greater the hydrostatic head above the packer, the tighter will be the seal formed by the upper sealing element 39 and the greater will be the radial gripping force exerted by the slip segments. It will be evident, therefore, that only a minimum pressure load on the sealing stem will be required to effectively set the packer and hold it in place against any downward pressure which may be exerted thereagainst, since this pressure load will be effectively supplemented by the hydrostatic load applied by reason of the described construction. The reinforcement of base portion 43 of the sealing element 39 by means of coil spring 44 serves a particularly advantageous purpose in connection with the sealing action of the sealing element. Under the high fluid pressures which may often be exerted against the interior of the sealing element, the latter may be compressed and distorted by virtue of its plastic composition, to a form which may be substantially as illustrated in Fig. 2, for example. The plastic material will tend to flow toward the base portion which, due to the retaining action of shoulder 38, will be caused to bulge outwardly toward the annular space between collar member 22 and casing 10. Coil spring 44, being embedded in the plastic material will expand therewith and move outwardly until it spans this annular space, since, as previously noted, the diameter of its coils will be made greater than the width of the annular space. The coil spring thus forms a dam across the annular space which will effectively prevent extrusion of the sealing element material downwardly through this annular space which might otherwise result in rupture or destruction of the seal by the very high pressures which may be encountered.

When the packer has been set as described and with the passageways through the packer body sealed against passage of fluid therethrough (see Figs. 2 and 2A), it will be evident that any tendency of the packer structure to slip downwardly through forces applied from above will also be resisted by the resistance exerted by any fluid column below the packer which will intrude into the interiors of the downwardly facing sealing elements 39 expanding them more tightly against the casing wall. At the same time, any pressure from below will be exerted against lower end ring 32 and will tend to compress sleeve 29 in the upward direction. This force will, of course, be resisted by the weight and pressure forces being exerted against the upper end of the sleeve with the net result than the latter will tend to additionally expand radially and thereby increase the gripping force applied to the slip segments. Accordingly, irrespective of the direction of the pressure differential applied to sleeve 29, the result will be a tightening of the grip of the slip segments and increasing tightness of the seals formed between the packer body and the casing by the sealing elements 39. Once the packer has been set, therefore, increases in pressure, whether from above or below will serve only to tighten the lodgement and sealing efficiency of the packer structure.

With the packer set in the manner described, it will be seen that fluid from formations below the packer structure may enter the tubing string either through suitable openings in tools 20 or through ports 18, which will now be below the seal formed by sleeve 29, or through both, and may flow to the surface through the bore of tubing string 15. At the same time fluid from forma-

tions above the packer may flow upwardly to the surface through the annular space between the tubing string and casing 10.

When it is desired to release the packer for removal from the well, the operating string will be drawn upwardly, guide slots 57 being first placed in registration with pins 55 in the manner previously described for releasing the packer and as illustrated in Fig. 2A. As the operating stem carrying lug plates 56 moves upwardly, the pins will pass downwardly through guide slots 57 and ride over curved surfaces 61 producing a camming action thereon which forces the operating stem to rotate in the anti-clockwise direction, as indicated by the arrow in Fig. 4, the lug plates rotating correspondingly from the initial position shown in broken lines to a position as indicated by the solid lines in Fig. 4. As thus illustrated, the resulting rotation of the operating stem and the attached lug plates will be sufficient to bring horizontal walls 59 over the pins and thereby automatically position the pins for engagement in recesses 58 and thus in position to again lock the packer body to the operating member. As the operating string is drawn upwardly relative to the packer body, abutment 21 comes up against pins 55 thereby lifting the packer body upon continued upward movement of the operating string. At the same time, as the operating string is moved upwardly, sealing stem 14 will be withdrawn from the bore of sleeve 29, allowing the sleeve to contract to its normal position to relieve the radial pressure on the slip segments. Shoulder 16 will contemporaneously be lifted off of upper end ring 32 opening bore 12 for the movement of fluid therethrough. Continued upward pull on the operating string will be exerted through pins 55 upon the packer body and the entire structure may now be drawn upwardly through the casing. Since the pressure has been removed from the slip segments, the latter, unless deeply embedded or "frozen" to the casing, will pull loose from their grip on the casing to permit the upward movement, or if desired, downward movement of the packer structure. In cases where a substantial pressure differential exists across the packer, hydraulic fluid, such as drilling mud, may be pumped through the interior of the operating string into the portion of the well below the packer, or into the annular space above the packer, depending upon the direction of the pressure differential, in order to equalize the pressures above and below the packer, in order to thereby aid in releasing the packer. This equalization of pressures may be accomplished either immediately before or contemporaneously with the performance of the packer-releasing operations.

In cases where the packer will not release easily by the above described operations, which condition may occur particularly when the packer has been in place for a considerable period of time, as a result of the accumulation of detritus about the exterior of the packer or because the slip segments have become deeply embedded in the casing wall or "frozen" thereto by corrosive action, jarring action may be resorted to for effectively releasing the packer. For this purpose, the construction and cooperative arrangement of lugs 56, pins 55 and abutment 21 provide a unique arrangement for producing heavy axially directed jarring blows which will assure release of the packer.

When release cannot be effected in the normal manner, the operating string will be rotated in the clockwise direction to again place slots 57 in registration with pins 55. Thereupon the string is lowered until sloping shoulders 62 are below pins 55. The string is then rotated additionally to the right or clockwise direction to position shoulders 62 beneath the pins (see Fig. 3) whereupon the string is drawn upwardly to bring these shoulders into engagement against the undersides of the pins. Additional upward pull is applied to operating string until sufficient force is applied to force shoulders 62 to slip past the pins. The slope of the shoulders acting on the pin surfaces under the applied tension produces a camming action which forces reverse rotation of the operating string sufficient to cause the shoulders to thus slip from under the pins while strong tensile forces are stored up in the operating string in overcoming the friction between the pins and the shoulders. Upon release of the pins from shoulders 62, the energy stored in the operating string will be suddenly released, causing the operating stem to move upwardly at high speed relative to pins 55, causing abutment 21 to strike the pins with great force thereby imparting a strong upwardly directed jarring blow to the packer body which will cause its release from the casing. As the lugs move upwardly relative to the pins, the latter will ride over curved surfaces 61, spinning the operating member to the right and the pins will therefore, be placed in latching position in recesses 58 substantially simultaneously with the impact of abutment 21. Longitudinal shoulder 60, which extends to abutment 21, forms a stop to limit the reverse rotation of the operating stem produced by the movement of the pins over curved surfaces 61 and will confine the pins within recesses 58. Fig. 4 illustrates the relative positions of pins 55, lug plates 56 and abutment 21 at successive stages of the jarring operation after release of the pins from shoulders 62. These positions are the same as those occupied by the parts in effecting the previously described operations for locking the packer body to the operating stem. Repeated jarring blows may be struck, if necessary, by repeating the above described operations for producing the jarring action. As noted, upon the completion of each jarring blow, pins 55 will be automatically positioned for engagement in recesses 58 and it is only necessary to apply upward pull on the operating string in order to withdraw the packer structure from the well once it has been released from engagement with the casing.

It will be understood by those skilled in the well tool art that, in so far as the locking and release functions performed by pins 55, recesses 58 and guide slots 57 are concerned, these elements correspond to the ordinary J-slot-and-pin or bayonet-type connections commonly used in more conventional well packers or other well known well tools and may be replaced thereby if the automatic locking and jarring features described above are not desired. It will also be evident that more conventional jarring structures may be embodied in the packer structure herein described without substantial modification of the basic structural features thereof.

From the foregoing, it will be evident that a packer structure has been provided which is highly effective for making a tight seal in dual completion of wells, irrespective of the direction or magnitude of the pressure differentials which may exist therein and which is readily retrievable for re-use.

It will be understood that various alterations

and modifications may be made in the details of the illustrative embodiment within the scope of the appended claims but without departing from the spirit of this invention.

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

1. A well packer, comprising, a pair of axially spaced collar members, wall-gripping elements extending between said collar members and connected to said collar members for radial movement relative thereto, a compressible resilient sleeve element disposed interiorly of said wall-gripping elements and concentric therewith, the opposite ends of said sleeve element extending into axially slidable concentric relation with respect to the interior surfaces of said collar members, rigid metal end rings mounted on the ends of said sleeve element, an internal shoulder element in the lower collar member axially engageable by the lower end ring, tubular means movable longitudinally through the bore of said sleeve element to confine said sleeve element against inward radial expansion, shoulder means carried by said tubular means axially engageable with the upper end ring on said sleeve element for applying axial compression to said sleeve element, and ports in said tubular means below said shoulder means.

2. A well packer, comprising, a pair of axially spaced collar members, wall-gripping elements extending between said collar members and connected to said collar members for radial movement relative thereto, a compressible resilient sleeve element disposed interiorly of said wall-gripping elements and concentric therewith, the opposite ends of said sleeve element extending into axially slidable concentric relation with respect to the interior surfaces of said collar members, rigid metal end rings mounted on the ends of said sleeve element, tubular means insertible through the bore of said sleeve element to confine said sleeve element against inward radial expansion, shoulder means carried by said tubular means axially engageable with the upper end ring on said sleeve element for applying axial compression to said sleeve element, and shoulder members mounted interiorly of said collar members adjacent the end rings on opposite ends of said sleeve element to limit outward axial movement of said sleeve element in either direction with respect to said collars.

3. A well packer, comprising, a pair of axially spaced collar members, wall-gripping elements extending between said collar members and connected to said collar members for radial movement relative thereto, a compressible resilient sleeve element disposed interiorly of said wall-gripping elements and concentric therewith, the opposite ends of said sleeve element extending into axially slidable concentric relation with respect to the interior surfaces of said collar members, rigid metal end rings mounted on the ends of said sleeve element, sealing rings disposed between the adjacent surfaces of said end rings and said collar members, an internal shoulder element in the lower collar member axially engageable by the lower end ring, tubular means movable longitudinally through the bore of said sleeve element to confine said sleeve element against inward radial expansion, said tubular means carrying an external shoulder axially engageable with the upper one of said end rings to apply axial compression to said sleeve element.

4. A well packer, comprising, a pair of axially spaced collar members, wall-gripping elements extending between said collar members and connected to said collar members for radial movement relative thereto, a compressible resilient sleeve element disposed interiorly of said wall-gripping elements and concentric therewith, the opposite ends of said sleeve element extending into axially slidable concentric relation with respect to the interior surfaces of said collar members, rigid metal end rings mounted on the ends of said sleeve element, and a cylindrical operating member insertible through the bore of said sleeve element to confine said sleeve element against inward radial expansion, said operating member carrying an external shoulder engageable with the upper one of said end rings to apply axial compression to said sleeve element, and an internal shoulder element in the lower collar member axially engageable by the lower end ring.

5. A well packer, comprising, a pair of axially spaced collar members, wall-gripping elements extending between said collar members and connected to said collar members for radial movement relative thereto, annular outwardly flaring oppositely opening cup-shaped sealing elements mounted on the outer ends of said collar members, a compressible resilient sleeve element disposed interiorly of said wall-gripping elements and concentric therewith, the opposite ends of said sleeve element extending into axially slidable concentric relation with respect to the interior surfaces of said collar members, rigid metal end rings mounted on the ends of said sleeve element, and a cylindrical operating member insertible through the bore of said sleeve element to confine said sleeve element against inward radial expansion, said operating member carrying an external shoulder engageable with the upper one of said end rings to apply axial compression to said sleeve element, and an internal shoulder element in the lower collar member axially engageable by the lower end ring.

6. In a well packer according to claim 5, an annular friction member connected to the lower one of said collar members frictionally engageable with a well casing in which said packer is inserted.

7. In a well packer according to claim 5, an annular friction member connected to the lower one of said collar members frictionally engageable with a well casing in which said packer is inserted and cooperating pin- and J-slot type latch elements arranged between said friction member and said operating member releasably engageable by relative rotational movement between said members.

8. In a well packer according to claim 5, an annular friction member connected to the lower one of said collar members frictionally engageable with a well casing in which said packer is inserted, and cooperating pin- and J-slot type latch elements arranged between said friction member and said operating member releasably engageable by relative rotational movement between said members, said latch elements forming abutments engageable by relative longitudinal movement to produce jarring impacts between said members.

9. A well packer, comprising, a pair of axially spaced metal collars, a plurality of arcuate slips extending between the collars, radially slidable connections between the ends of the slips and the collars, a rubber sleeve disposed interiorly of said slips and concentric therewith, the opposite ends of said sleeve extending into said collars and freely slidable relative to the inner

walls of said collars, rigid metal end rings on the outer ends of said sleeve, internal shoulders in said collars adjacent said rings to limit outward movement of said sleeve relative to said collars, a tubular operating stem insertible through the bore of said sleeve to confine said sleeve against inward radial expansion, and an external shoulder on said stem axially engageable with the upper one of said end rings to apply axial compression to said sleeve.

10. In a well packer according to claim 9, annular oppositely opening, outwardly flaring, sealing cups mounted on the outer ends of said collars.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
2,241,561	Spencer	May 13, 1941
2,327,092	Botkin	Aug. 17, 1943
2,343,075	Otis	Feb. 29, 1944
2,370,832	Baker	Mar. 6, 1945
2,373,005	Baker	Apr. 3, 1945