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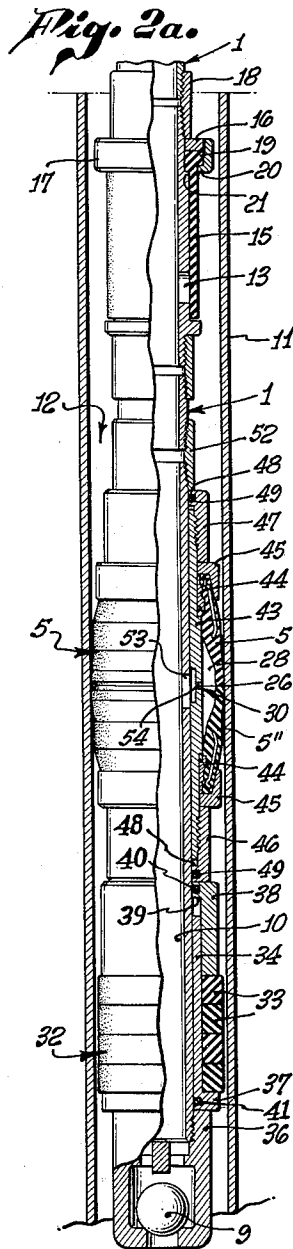
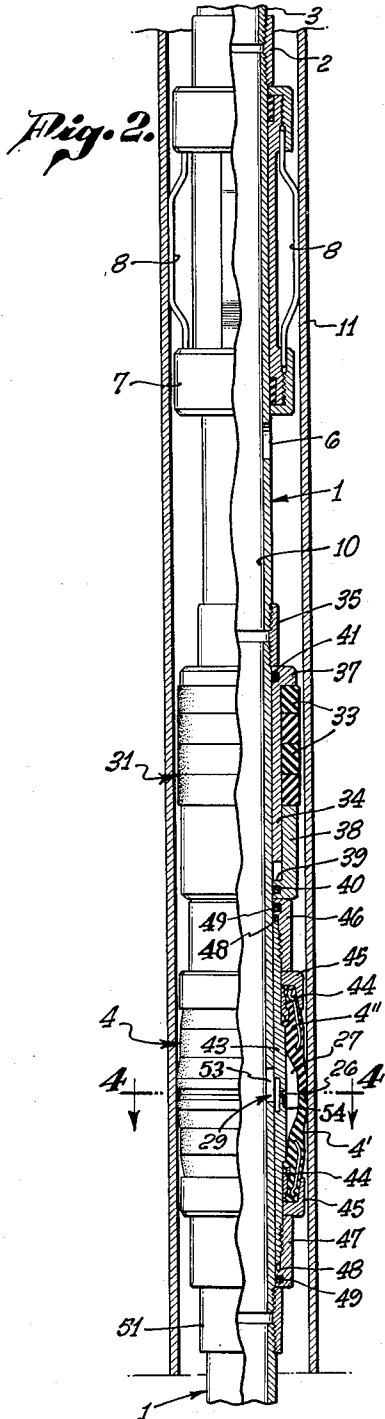
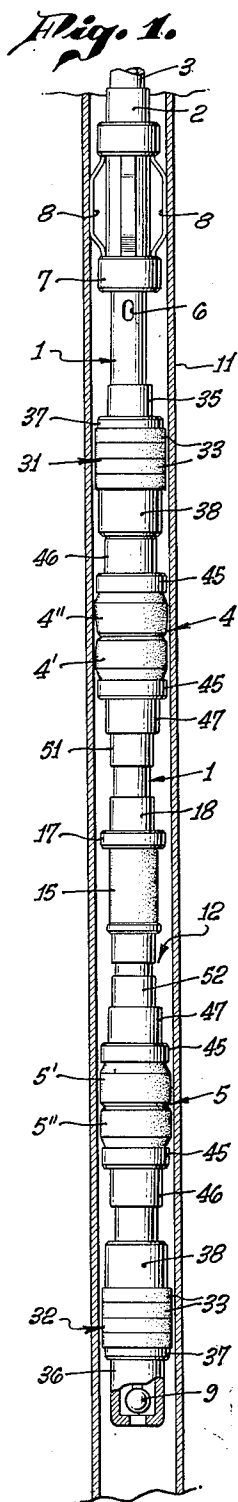
J. S. PAGE

2,764,244

WELL TOOL

Filed April 14, 1952

3 Sheets-Sheet 1



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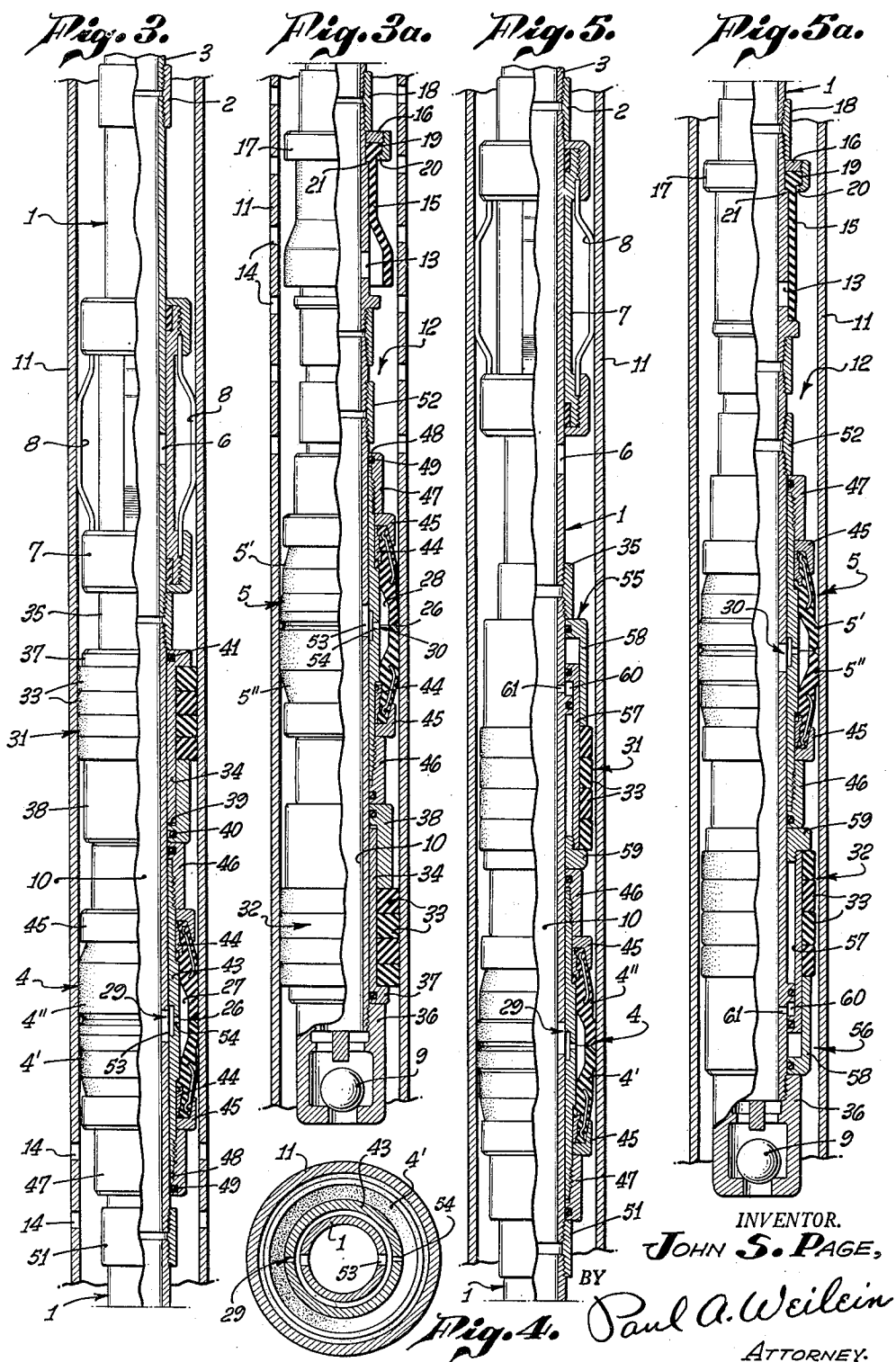
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WELL TOOL

Filed April 14, 1952

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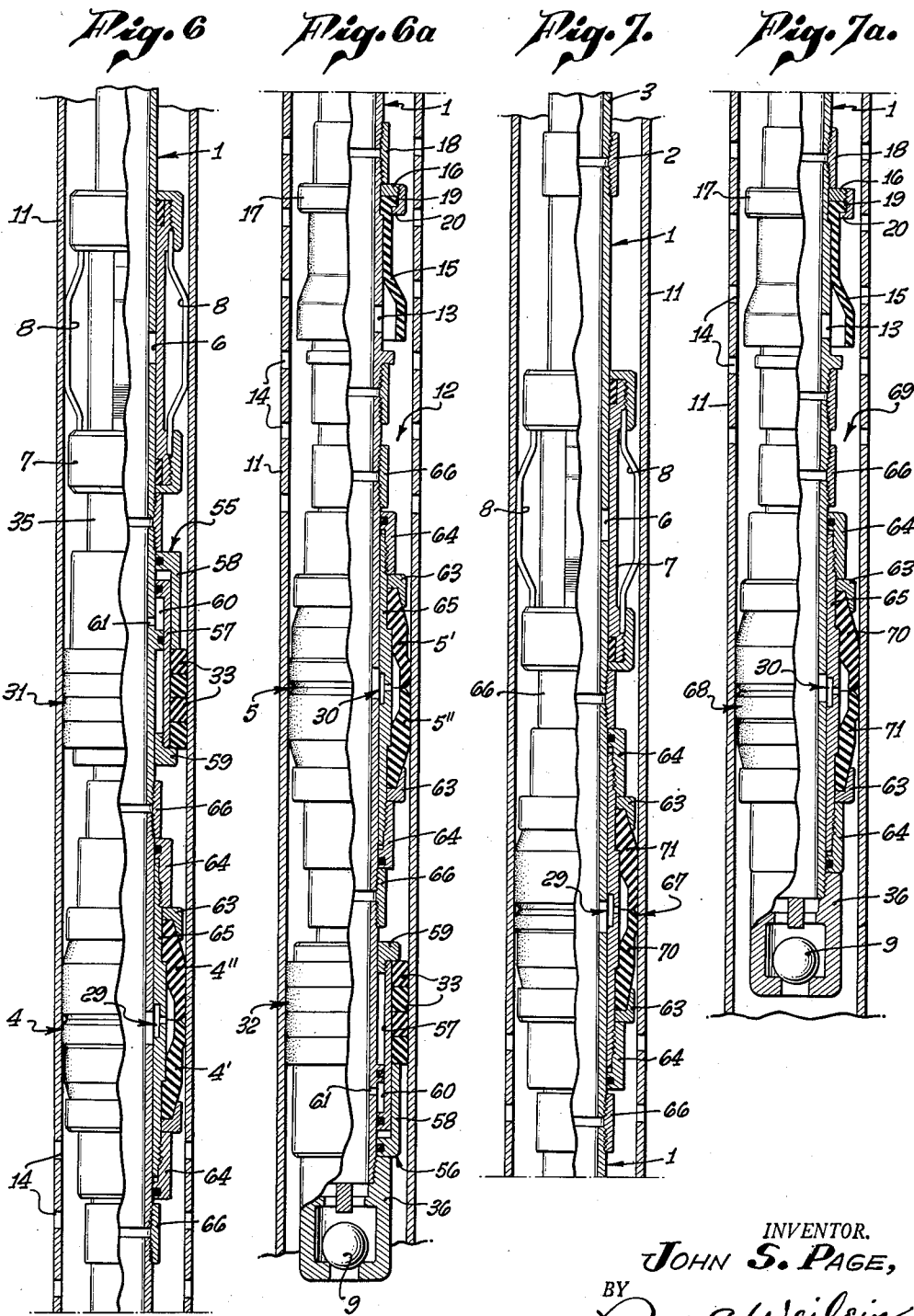
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WELL TOOL

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3 Sheets-Sheet 3



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2,764,244

WELL TOOL

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Application April 14, 1952, Serial No. 282,166

7 Claims. (Cl. 166—187)

This invention relates to well tools, particularly tools having spaced packing means for defining therebetween in a well, a zone to be treated by the application of cement slurry or fluid under pressure.

It is known that tools of this character have employed axially spaced, fluid pressure inflatable packing means for sealing against the wall of the well to define between them a well zone into which fluid under pressure is pumped from the tool. In these tools, the spaced packing means permit fluid to pass them when moving the tool in either direction through fluid in the well. In consequence, it is necessary to cause the fluid under pressure to inflate the packing means before passing into the zone between the packing means, as otherwise, the pressure within and without the inflatable packing means would be equalized and prevent inflation necessary to form the seals with the well wall. Therefore, a spring loaded valve is employed to prevent the flow of fluid under pressure into the zone between the packing means until the packing means have been actuated to seal against the wall of the well. Such a valve causes the flow passage through the tool to be obstructed and prevents the flow of a large volume of fluid under high pressure, as sometimes desired in the operation of these tools.

It is an object of the present invention to provide an improved tool of the character described, which when fluid under pressure is pumped into the tool for actuating the packing means, will cause the pressure to be applied and maintained for actuating the packing means without the use of a valve as heretofore employed, thereby assuring the desired large flow volume through the tool.

It is another object of this invention to provide a tool such as described, wherein a pair of normally relaxed packing means which are adapted to be expanded into sealing contact with the wall of the well to define between them a zone in the well to be treated, are actuated by means of a pair of fluid pressure responsive packing units without requiring the use of a valve means to cause the desired actuating pressure to be applied to such units.

It is another object of this invention to provide an improved tool having novel packing units of a particular construction for forming multiple seals at axially spaced points on the wall of the well for defining a pressure chamber therebetween, with assurance that positive seals will be maintained under the high temperature and the high pressure conditions which in some instances cause failure of packers as heretofore used, thereby making the tool of this invention subject to efficient and reliable use under extremely high pressures and high temperatures.

It is a further object to provide a tool which is an improvement over similar tools heretofore used, by reason of the use of pairs of axially spaced packing cups in a new and advantageous arrangement.

It is another object of this invention to provide a tool such as described, wherein multiple packing units permit fluid to pass them freely in moving the tool in either

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direction through fluid in the well, thereby making possible a quick and easy positioning, operation and removal of the tool.

It is another object of this invention to provide in a tool such as described, a novel form of check valve arranged exteriorly of the tool body and between the packing units which define the zone to be treated, to permit fluid to enter the zone from the tool body and to restrain fluid from passing from said zone into the tool body.

It is another object of this invention to provide a tool such as described, in which a plurality of packing means are sequentially operated to form seals straddling a zone into which fluid under pressure is to be confined, there being a pair of packing units located between the packing means for forming initial seals responsive to fluid pressure applied through the tool, and thereby causing differential pressures to be developed and applied for effecting the operation of the other packing units.

It is another object of this invention to provide a tool such as described, wherein expandable packing means for defining therebetween the well zone to be treated, are expanded into sealing contact with the wall of the well by a mechanically applied force derived from a pair of fluid pressure responsive packing units which first seal against the wall of the well and cause the development of differential fluid pressures above and below them, and then move to apply the actuating forces to said expandable packing units.

This invention possesses many other advantages and has other objects which may be made more easily apparent from a consideration of several embodiments of the invention. For this purpose there are shown several forms in the drawings accompanying and forming part of the present specification. These forms will now be described in detail, illustrating the general principles of the invention; but it is to be understood that this detailed description is not to be taken in a limiting sense, since the scope of the invention is best defined by the appended claims.

Referring to the drawings:

Fig. 1 is a side elevation of a well tool embodying the present invention, as it would appear when being run into a well;

Fig. 2 is a fragmentary half sectional view on an enlarged scale, of the upper portion of the tool as it would appear when stationary in the well preliminary to being operated to pack off a zone to be treated;

Fig. 2a is a continuation view of Fig. 2, showing the lower portion of the tool;

Fig. 3 is a fragmentary half sectional view of the upper portion of the tool as it would appear when operated to pack off a zone in the well;

Fig. 3a is a continuation view of Fig. 3, showing the lower portion of the tool;

Fig. 4 is a cross section taken on the line 4—4 of Fig. 3;

Fig. 5 is a fragmentary half section of the upper portion of a modified form of this invention, as it would appear when stationary in the well and before actuation of the packing means;

Fig. 5a is a continuation view of Fig. 5, showing the lower portion of the tool;

Figs. 6 and 6a are complementary vertical sectional-elevational views of another modified form of this invention, respectively showing upper and lower portions of the tool as they would appear when the packing means are actuated; and

Figs. 7 and 7a are complementary sectional-elevational views of another modification of this invention, respectively showing the upper and lower portions of the tool

as they would appear when the packing means are actuated.

The present invention is embodied in a tool which includes a sectional tubular body member 1 adapted to be connected by means of a coupling 2 with a tubing string 3 for positioning in a well, whereby axially spaced packing units 4 and 5 thereon, of special construction and arrangement, may be actuated to confine the application of cement slurry or other fluid under pressure, to a zone of the well between the packing units.

The body member 1 is provided with the usual circulation port 6 controlled by a sleeve valve 7 having bowed springs 8 thereon adapted to frictionally engage the well wall, whereby the valve may be opened and closed upon raising and lowering the tool in a manner and for the purposes well known in this art.

At its lower open end, the tubular body member 1 is provided with a check valve 9, which opens to permit flow of fluid upward through the passage 10 in the body member but closes responsive to fluid pressure directed downwardly in this passage.

As here shown, the tool is positioned in a well casing 11 with the packing units 4 and 5 adapted to seal against the casing to define a pressure chamber 12, there being a port 13 between these units to permit fluid under pressure for example, cement slurry to be directed through the pressure chamber and perforations 14 (see Fig. 3) in the casing, into the well zone to be treated.

While the tool is here shown as being operated in cased wells, it is to be understood that it may also be operated in uncased wells where the well bores are such that the sealing means 3 and 4 are capable of sealing thereagainst.

A valve 15 in the form of a sleeve of resilient material is secured at one end to the body member 1 so as to overlie the port 13. A ring 16 and a clamping collar 17 hold the valve 15 in place. The ring 16 abuts a coupling 18 of the sectional body member 1 and is threadedly connected with the collar 17 for clamping the flanged end 19 of the sleeve valve 15 between the ring 16 and an inwardly directed flange 20 on the collar. A portion of the flanged end 19 seats on an annular shoulder 21 on the body. This shoulder, the ring 16 abutting the coupling 18, and the flange 20 on the collar 17, hold the sleeve valve 15 against axial movement on the body member 1. It will now be apparent that the valve 15 will yield outwardly to permit flow of fluid from the passage 10 through port 13 into the pressure chamber 12, but will close the port 13 and prevent flow from the chamber 12 into the passage 10, should the pressure in the chamber 12 exceed that in the passage 10 as takes place in cleaning the tool. In locating the valve 15 outside the passage 10, the latter is unrestricted and will provide for the desired large volume flow of fluid through the tool.

It is desired in accordance with this invention, to provide a straddle tool which may be operated efficiently under extremely high fluid pressures and high temperatures. It is also desired that the tool be easily movable through fluid in the well without depending upon a bypass passage in the tool. Further, it is desired that these results be attained with fluid pressure actuated packing means without necessitating the use in the tool, of a valve for causing actuation of the packing means, as without this valve it becomes possible, quickly to pass the desired large volume of fluid through the tool.

It should be noted that the packing units 4 and 5 correspond to packing units disclosed and claimed in my copending application Serial No. 282,165, filed April 14, 1952, for Well Packer. As used in the present invention the units 4 and 5 make possible attainment of the above noted desired results in a manner which will be hereinafter fully described.

The packing unit 4, as here shown, comprises a pair of flexible and resilient packing cups 4' and 4'' of a well

known type surrounding the body member 1. Likewise, the packing unit 5 comprises a pair of similar flexible resilient packing cups 5' and 5'' surrounding the body member 1. The cups of each of the units 4 and 5 are mounted with the beveled lips 26 of the annular wall portions thereof closely related to form in the unit 4 an expansion chamber 27, and in the unit 5 an identical expansion chamber 28. As here shown the lips 26 contact one another so as to close the chambers 27 and 28. However, these lips and adjacent wall portions of the cups of each pair are relatively movable laterally. Normally these wall portions contact the well wall, but will yield toward the body member 1, when the tool is moved in either direction through fluid in the well, thereby allowing fluid to pass the cups while the lips remain in sealing contact with one another and prevent transverse flow therebetween. This inward flexing of the lips of the cup of each pair is assured as the cups have a greater fluid pressure-responsive area exteriorly than interiorly. Thus, if the fluid pressure against the interior and exterior of the cups is equal, the greater area exteriorly thereof causes the abutting lips of each pair to flex inwardly whereby the tool may be freely moved through fluid in the well.

Port means 29 and 30 in the tool open into the expansion chambers 27 and 28 respectively for applying fluid pressure to the cups of the units 4 and 5.

It will now be apparent that the resilient cups 4', 4'', 5' and 5'' will move, due to the resiliency thereof, into contact with the well wall upon cessation of movement of the tool through fluid in the well. In consequence, when a fluid pressure for operating the packing units 4 and 5 is developed in the passage 10 of the body member 1, as by pumping cement slurry down the tubing string to the tool, the pressure is applied alike through the port 13 to the casing space or outside the body member between the inner cups 4' and 5', and through the port means 29 and 30 to the expansion chambers 27 and 28 of the units 4 and 5. As the check valve 9 and the circulation valve 7, which is then closed, prevent this pressure from being applied between the tool body member and the well wall, against the exterior of the outer cups 4'' and 5'', it is seen that a greater pressure is developed against the interior of the outer cups 4'' and 5'' than against the exterior thereof, while an equal pressure is applied against the exterior and interior of the inner cups. Thus, the outer cups 4'' and 5'' are urged by this greater pressure into sealing contact with the well wall for defining the chamber 12 from which fluid is applied for treating the selected zone of the well.

In this connection, it should be noted that in the forms of this invention shown in Figs. 1 through 5a, the units 4 and 5 serve not only as packers for sealing against the well wall, but as actuators for other packing means, while in the forms of this invention shown in Figs. 6 through 7a these units serve only as packing means for sealing against the casing as will be hereinafter fully described.

Accordingly, in the tool shown in Figs. 1 through 4, additional packing means is provided on the tool body 1, outside the space between the units 4 and 5 and in axially spaced relation thereto. These packing means include like units 31 and 32, each comprising a plurality of packing rings 33 of compressible and resilient material, mounted one upon the other on a sleeve 34 surrounding the body member 1. The outer end of the sleeve 34 of the unit 31 abuts a coupling 35 on the body member 1, whereas the outer end of the sleeve 34 of the unit 32 abuts the valve cage 36 for the check valve 9 at the lower end of the body member 1, thereby restraining movement of these sleeves in directions away from the units 4 and 5.

The groups or stacks of rings 33 are confined between flanges 37 on the outer ends of the sleeves 34 and thimbles 38 slidable on the body member 1. These thimbles

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telescope the inner ends of the sleeves 34 and when moved toward the rings, cause them to be expanded from relaxed position free of contact with the well wall, into sealing contact therewith. Flanges 39 on the thimbles 38 contact the tool body member 1 and are provided with ring seals 40 engaging the body member. Similar ring seals 41 are provided at the outer ends of the sleeves 34 to seal against the body member.

In order that the packing units 4 and 5 may operate as actuators for expanding the packing rings 33 of the units 31 and 32 into sealing contact with the well wall, means are provided for mounting the cups of the units 4 and 5 for movement axially of the body member 1. These means, as here shown, are in the form of sleeves 43 slidable on the body. The packing cups 4', 4'' and 5', 5'' are disposed between the ends of the sleeves 43, being fixed thereto by means of the clamping rings 44 and thimbles 45, which clamp the outer ends of cups in sealing contact with the sleeves and against axial movement relative thereto. The thimbles 45 are forced into clamping engagement with the cups by means of collars 46 and 47 screwed onto the ends of the sleeves 43. These collars have flanges 48 on the outer ends slidably contacting the body member 1, there being ring seals 49 in the flanges 48 for sealing against the body member. The collars 46 on the outer ends of the sleeves 43 abut the slidable thimbles 38 for transmitting forces for expanding the sealing rings 33 of the units 31 and 32, responsive to movement of the slidable sleeves 43 and the cups thereon, toward the packing units 31 and 32. Movement of the sleeves 43 and the cups thereon from the normal positions thereof in which the rings 33 are relaxed, in directions away from the units 31 and 32 is restrained by the collars 47 on the inner ends of the sleeves 43 abutting couplings 51 and 52 on the body member 1.

The port means 29 and 30 for the packing units 4 and 5 are alike, each comprising registering ports 53 and 54 in the body members 1 and sleeves 43 respectively and which are formed so as to maintain the chambers 27 and 28 in communication with the passage 10 in the body member 1 at all times.

Operation

In positioning the tool in a well, the well fluid will pass freely between the relaxed rings of the packing units 31 and 32, as shown in Fig. 1, and likewise flow freely past the pairs of cups of the packing units 4 and 5, as these cups will yield from contact with the well wall while the tool is being moved in either direction through the fluid.

Upon cessation of movement of the tool through fluid in the well, the resilient cup packers 4', 4'' and 5', 5'' of the packing units 4 and 5 will move back into contact with the well wall, as shown in Figs. 2 and 2a, while the rings 33 of the units 31 and 32 remain relaxed and free from sealing contact with the wall of the well.

After the usual manipulation of the tubing string for closing the circulation valve 7, fluid under pressure for example, cement slurry may be pumped into the passage 10 of the tool body 1. As the check valve 9 is closed at this time, the fluid pressure will be applied through the port 13 and the port means 29 and 30, to the pressure chamber 12 between the inner packing cups 4' and 5', as well as applied to chambers 27 and 28 of the packing units 4 and 5.

It should be noted that when the fluid under pressure (cement slurry) reaches the tool, it passes through the port means 29 and 30 into the chambers 27 and 28 formed by the cups before the valve 15 yields to open the port 13. Thus, when the fluid passes through the port 13 into the chamber 12 between the inner cups 4' and 5', the fluid pressure becomes equal against the inner and outer surfaces of these inner cups but is greater against the inner surfaces of the outer cups 4'' and 5'', thereby causing these outer cups to seal against the casing. At

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this time the lips of the inner cups 4' and 5' are relaxed but tend to flex inwardly due to the greater area exteriorly thereof exposed to the pressure in the chamber 12. Should at this time any of the fluid in the pressure chamber 12 pass between the lips of the cups of each pair, this will not affect the sealing action of the outer cups 4'' and 5'', as the check valve 9 and circulation valve 7 are closed.

At the same time the cups 4'' and 5'' are urged into sealing contact with the casing they are moved with the cups 4' and 5' and sleeves 43 axially of the body member 1 in opposite directions toward the packing units 31 and 32 respectively.

It should be noted that the pressure of the fluid in the chamber 12 after passing through the port 13 is sufficiently great to move the packing units 4 and 5 along the body 1 of the tool to thereby compress and expand the packing means 31 and 32. When the packing units 4 and 5 are moved in this manner, the sleeves 43 push against the slidable thimbles 38, which in turn crowd the sealing rings 33 so that they are caused to expand into sealing contact with the well wall. In this manner dual seals are provided at opposite ends of the pressure chamber 12. Any fluid trapped between the rings 33 and the cups 4'' and 5'' will serve as liquid seals.

It should be noted that the packing units 4, 5, 31 and 32 sequentially provide for the formation of the dual seals at opposite ends of the pressure chamber 12, the units 4 and 5 reacting first to the fluid pressure, to form seals with the well wall and thereafter causing the packing means 31 and 32 to seal against the well wall. The dual seals assure that an effective pressure chamber will be maintained, and make it possible to operate the tool efficiently under extremely high pressures and high temperatures. In this connection, the packing rings 33 are made of a comparatively durable and stiff material, capable of withstanding greater pressures and greater heat without failure, than the more flexible packing cups, so that if the latter should fail, the rings 33 would remain effective as seals. In fact the rings 33 after being set, would be maintained in sealing contact with the well wall by the pressure of the fluid between the units 31 and 32, in the event the cups of units 4 and 5 fail to hold the pressure.

It should be noted that as the cups of each pair have greater fluid pressure-responsive area exteriorly than interiorly, the lips of the cups will yield or flex alike, inwardly responsive to pressure of the well fluid in lowering the tool through the well fluid, although the pressure interiorly and exteriorly is the same due to the valve 9 being open at this time. Thus, the uppermost cups of each pair are prevented from acting as swabs and interfering with the lowering of the tool.

After a cementing operation, the excess cement may be forced back to the top of the well and thus removed from the tool and the string by forcing fluid down the casing annulus past the pairs of cup packers, thence through the lower end of the tool and up the tubing string. In this operation the abutting lips of the cups of each pair are caused to yield or flex inwardly by the pressure of the back scuttling fluid pumped down the casing annulus, due to the aforesaid greater fluid pressure-responsive area on the exterior of the cups. Moreover, in lifting the tool out of the well or in raising the tool, the greater area of the exterior of the cups causes the lips to yield inwardly whereby the cups will not interfere with free movement of the tool.

A modified form of this invention, as shown in Figs. 5 and 5a, provides additional fluid pressure actuating means for packing units corresponding to the packing units 31 and 32 shown in Figs. 1-4. As in all other respects, this modified tool is identical with the tool shown in Figs. 1 through 4, the same reference characters are applied thereto with the exception of the reference characters identifying the additional actuating means.

Accordingly, in this form of the invention, the additional actuating means comprises hydraulically operated actuators 55 and 56 for operating the ring packer units 31 and 32 respectively in conjunction with the operation of the latter by slidable packing cup units 4 and 5.

The actuators 55 and 56 are alike, being mounted exteriorly of the body member 1 in operative association with the packing units 31 and 32.

Thus, each actuator comprises a sleeve piston 57 on which the packing rings 33 are mounted and retained between a stationary thimble 58 on the body member 1 and an annular member 59 slidable on the body member and threadedly mounted on the inner end of the sleeve piston. This annular member 59, at all times abuts the collar 46 of the associated slidable packing cup unit.

The piston 57 operates in an annular chamber 60 formed between the thimble 58 and the body member 1. A port 61 in the body member provides for conducting fluid under pressure into this chamber for moving the piston so as to compress the rings 33 between the thimble 58 and the member 59 and cause the rings to expand into sealing contact with the casing.

This modification operates in the same manner as the tool shown in Figs. 1-4 except that the piston type actuators 55 and 56 operate conjunctively with the slidable cup units 4 and 5 to expand the rings 33 of the units 31 and 32, into sealing contact with the well wall.

In some wells and under certain pressure and heat conditions it may be preferable to use this modified tool, in view of the added hydraulically responsive actuators 55 and 56 aiding the slidable cup packer units in expanding the packing rings 33 of the units 31 and 32 into sealing contact with the wall of the well.

Another modified form of this invention, as shown in Figs. 6 and 6a, is identical with the tool shown in Figs. 5 and 5a, except that the packing cup units are not slidable on the body member and serve only as sealing means which will create differential pressures in the same manner as in the tool shown in Figs. 1-5a.

Accordingly, in Figs. 6 and 6a the same reference characters are employed as in Figs. 1-5, to identify identical parts, only the differently constructed mounting means for the packing cup units being identified by distinguishing reference characters. Thus, the cups 4', 4'', 5' and 5'' are secured by thimbles 63 and collars 64 on sleeves 65 surrounding the body member 1 and held against any appreciable relative axial movement thereon by the collars 64 abutting the couplings 66. This tool operates in the same manner as the other tools shown in Figs. 1 through 5a, except that the units 4 and 5 do not serve as actuators, the actuation of the packing ring units being effected solely by the piston type actuators 55 and 56.

Another modified form of this invention, as shown in Figs. 7 and 7a is of the same construction as the tools shown in Figs. 1 through 4 except that it provides but two packer units 67 and 68 identical with the packing cup units 4 and 5 shown in Figs. 6 and 6a, in that they are stationary and do not serve as actuators, the packing ring units being omitted. Thus, the units 67 and 68 are solely depended upon to form a pressure chamber 69 corresponding in purpose to the chamber 12 shown in Figs. 1 through 4. In forming this chamber, the pairs of cups 70 and 71 being constructed and relatively arranged as are the cups of the units 4 and 5, will cause differential pressures to be applied for forming seals with the well wall in the manner described in connection with the tool shown in Figs. 1 through 4, except that they do not act as actuators. This form of tool may be preferred for certain shallow or low pressure wells and in all uses will provide the advantage of forming effective seals with the wall of the well without depending upon a valve, as well as other advantages of this invention provided by the other forms of this invention.

I claim:

1. In a well tool adapted to be positioned in a well on a

tubing string, a tubular body member, a pair of packing units axially movable on said body member adapted to seal against the wall of the well to provide a pressure chamber therebetween, said body member having a port opening exteriorly thereof between said packing units, each of said packing units comprising a pair of resilient packing cups and means mounting said cups with their lips in contact with one another to form a chamber in which fluid pressure is effective to urge at least one of the lips into sealing contact with the wall of the well, said lips yielding and allowing fluid to flow past them when moving the body member in either direction through fluid in the well, said body having ports for applying fluid under pressure to the chambers of said units and moving said units axially; resilient fluid pressure actuated packing members mounted on the body in outwardly spaced relation to said pair of units being normally spaced from contact with the well wall and adapted to be expanded into sealing contact with said wall, means on the body member for expanding said packing members into sealing contact with the wall of the well responsive to said axial movement of said units, and fluid pressure actuated means on said body cooperable with said last named means for expanding said packing members, said body having additional ports for applying fluid under pressure for operating said fluid pressure actuated means.

2. In a well tool adapted to be positioned in a well on a tubing string, a tubular body member, a pair of packing units axially spaced on said body member adapted to seal against the wall of the well to provide a pressure chamber therebetween, said body member having a port opening exteriorly thereof between said packing units, each of said packing units comprising means forming a pair of separate flexible and annular wall portions forming with the body member an expansion chamber in which fluid pressure is effective to move at least one of the wall portions into sealing contact with the well wall, said wall portions yielding to permit fluid to flow past them when moving the body member in either direction through fluid in the well, said body member having ports for conducting fluid under pressure into the expansion chambers of said units, normally relaxed and resilient packing units mounted on the body member above and below said pair of units, and means operating responsive to actuation of said first named units for moving said normally retracted units into sealing contact with the well wall.

3. In a well tool, a tubular body member adapted to have one end connected with a tubing string for positioning in a well, a pair of packing units axially spaced on said body member and adapted to seal against the wall of the well, said body member having a port opening exteriorly thereof between said packing units, said body member having a port at the other end thereof, a downwardly closing check valve controlling the second mentioned port, each of said packing units comprising a pair of resilient packing cups, means mounting said cups for axial movement relative to the body member with the cups forming a chamber between the interior thereof and the body member, said cups yielding and allowing fluid to pass them upon moving the tool in either direction through fluid in the well and moving into contact with the wall of the well upon cessation of such movement, port means operable to apply fluid under pressure from the body member to the chambers of said packing units, a pair of fluid pressure actuated packing units on said body members axially spaced from said first mentioned units, and means responsive to axial movement of said cups for urging said last named units into sealing contact with the wall of the well.

4. In a well tool adapted to be positioned in a well on a tubing string, a tubular body member, a pair of normally relaxed packing units axially spaced on said body member and adapted to be expanded into sealing contact with the wall of the well, a pair of fluid pressure respon-

sive packing units axially spaced on said body member, slidable between said first mentioned units and normally contacting the wall of the well and yielding to allow fluid to pass them upon moving the tool in either direction through fluid in the well, said body member having a passage therethrough and a port opening exteriorly thereof between the second mentioned units, a check valve permitting upward flow of fluid through the lower end of said body member and preventing flow in the opposite direction through said end, means for applying fluid under pressure from said passage to said second mentioned units simultaneously with the application of fluid under pressure through said port into the space between said second named units for urging the latter into sealing contact with the wall of the well and effecting sliding movement thereof, means actuated by fluid under pressure applied from said passage for expanding said first named units into sealing contact with the wall of the well, and means on the body member operating responsive to said sliding movement for also expanding said first named units into sealing contact with the wall of the well.

5. In a well tool adapted to be positioned in a well on a tubing string, a tubular body member, a pair of normally relaxed packing units axially spaced on said body member and adapted to be expanded into sealing contact with the wall of the well, a pair of fluid pressure responsive packing units, means mounting said second mentioned units for sliding movement on the body member between the first named units, said body member having a passage therethrough and a port opening exteriorly thereof between said slidable units, a check valve permitting upward flow of fluid through said passage from below the tool and excluding downward flow from the lower end of said passage, each of said second named units including a pair of resilient packing cups with their lips contacting one another and forming with the body member a chamber, said lips being arranged to normally contact the wall of the well and to yield from such contact and permit flow of fluid past them upon moving the tool in either direction through fluid in the well, said body member having ports for applying fluid under pressure to the chambers of said slidable units whereby fluid under pressure will urge the cups against the well wall and cause sliding movement of the sliding units, and means responsive to said sliding movement for expanding the first named units into sealing contact with the well wall.

6. In a well tool adapted to be positioned in a well on a tubing string, a tubular body member, a pair of normally relaxed packing units axially spaced on said body member, and adapted to be expanded into sealing contact with the wall of the well, a pair of fluid pressure responsive packing units, means mounting said second mentioned units for sliding movement on the body member between the first named units, said body member having a passage therethrough and a port opening ex-

teriorly thereof between said slidable units, a check valve permitting upward flow of fluid through said passage from below the tool and excluding downward flow from the lower end of said passage, each of said second named units including a pair of resilient packing cups forming with the body member a chamber, said cups facing each other and being arranged to normally contact the wall of the well and to yield from such contact and permit flow of fluid past them upon moving the tool in either direction through fluid in the well, said body member having ports for applying fluid under pressure to the chambers of said slidable units to urge the cups against the well wall and cause sliding movement of the sliding units, and means operatively connecting said sliding units with the first named units for expanding the latter into sealing contact with the wall of the well responsive to said sliding movement.

7. In a well tool adapted to be positioned in a well on a tubing string, a tubular body member, a pair of packing units axially spaced on said body member, each of said units including a sleeve surrounding said body member and having a shoulder thereon, a thimble slidable on the body member, a plurality of resilient packing rings mounted on said sleeve between said shoulder and said thimble for expansion into sealing contact with the wall of the well responsive to sliding movement of said thimble toward said shoulder, a pair of fluid pressure responsive packing units axially spaced between said first named units, said body member having a port opening exteriorly thereof between the second named units, each of the second named units including a member slidable on the body member, packing means mounted on said slidable member for movement therewith and forming thereon a chamber for reception of fluid under pressure for expanding said packing means into sealing contact with the wall of the well and moving said slidable member in a direction toward said first named units, said sliding members when moved toward said first named units contacting and moving said thimbles for expanding said rings into sealing contact with the wall of the well, said body member and said sliding member having cooperable ports for applying fluid under pressure to the chambers of the second named units.

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