

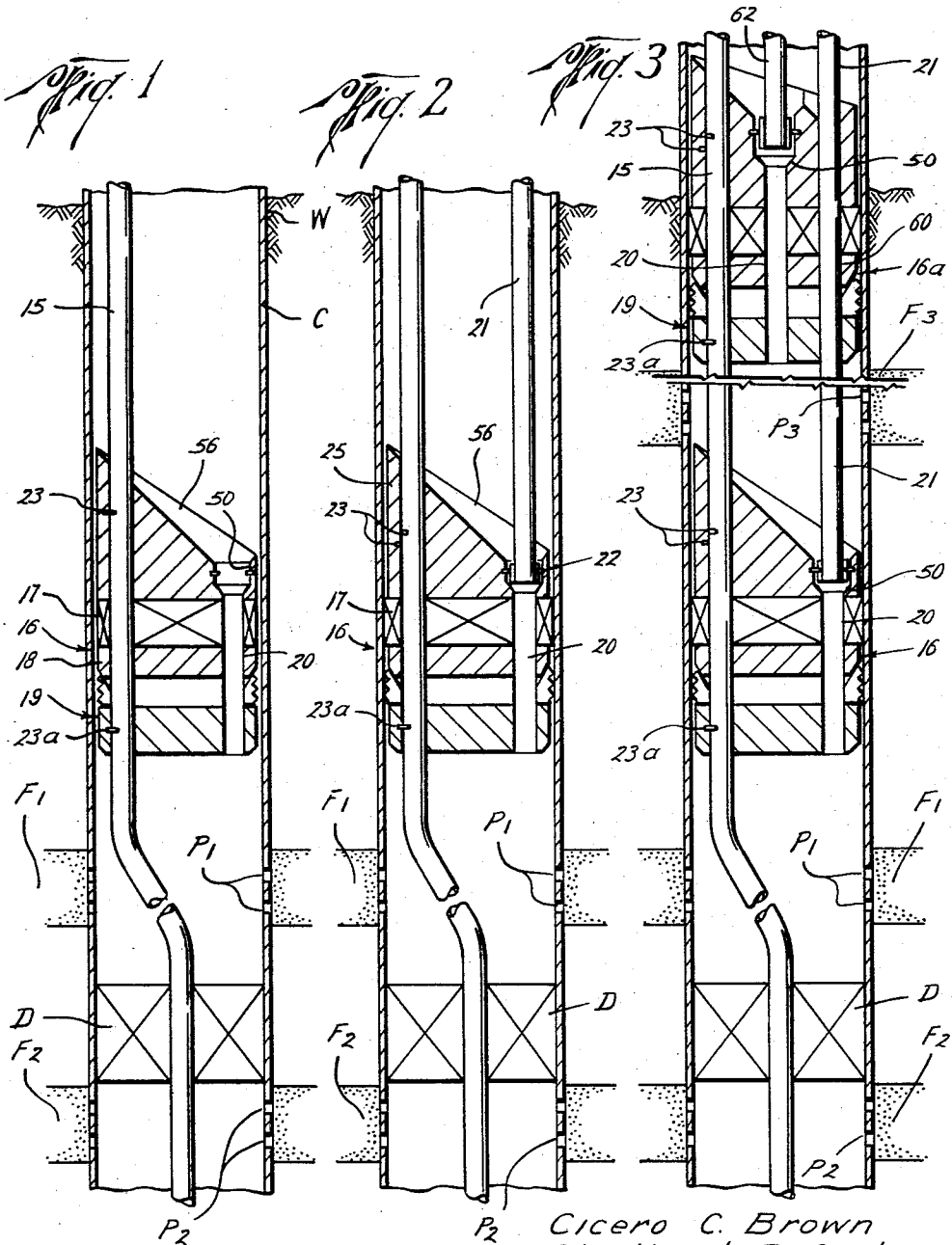
Aug. 30, 1960

C. C. BROWN ET AL  
MULTIPLE STRING WELL PACKERS

2,950,761

Filed Aug. 12, 1957

4 Sheets-Sheet 1



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Aug. 30, 1960

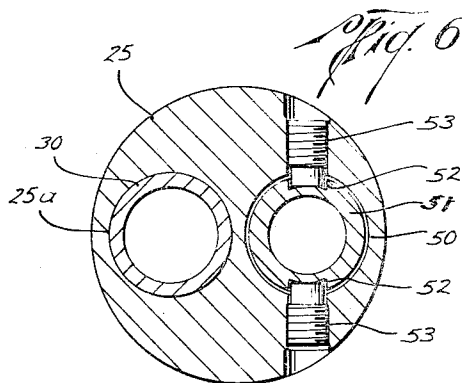
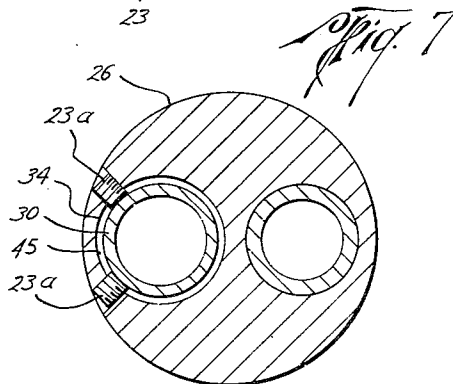
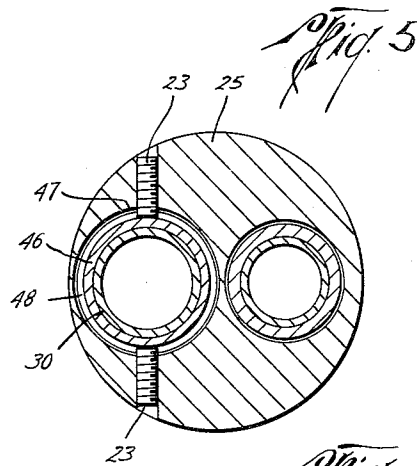
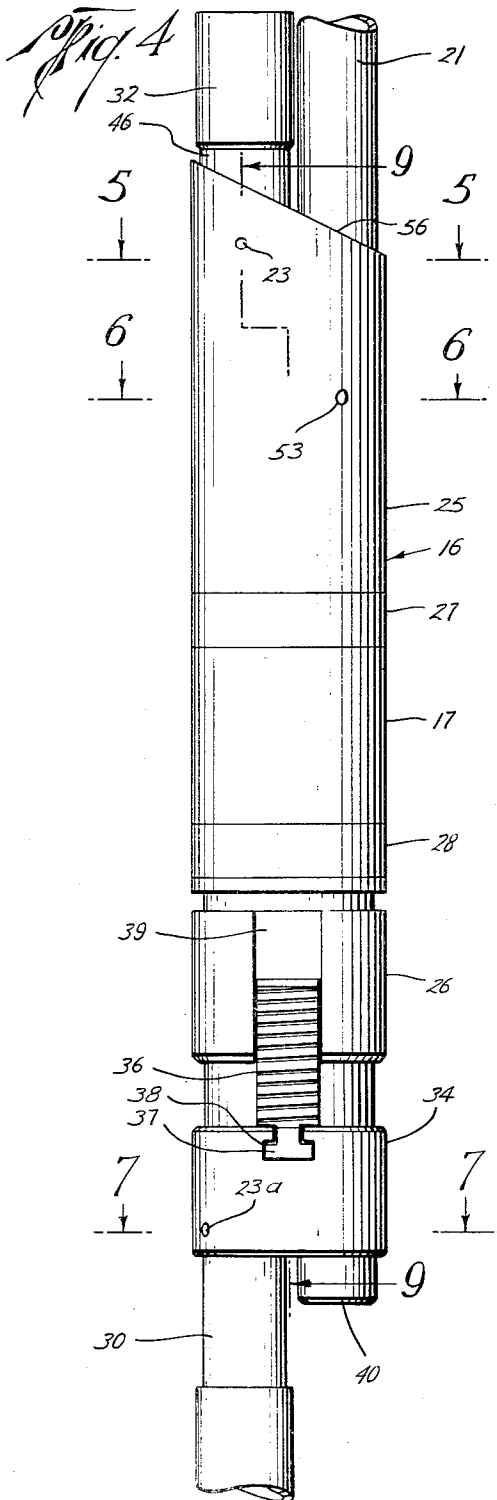
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MULTIPLE STRING WELL PACKERS

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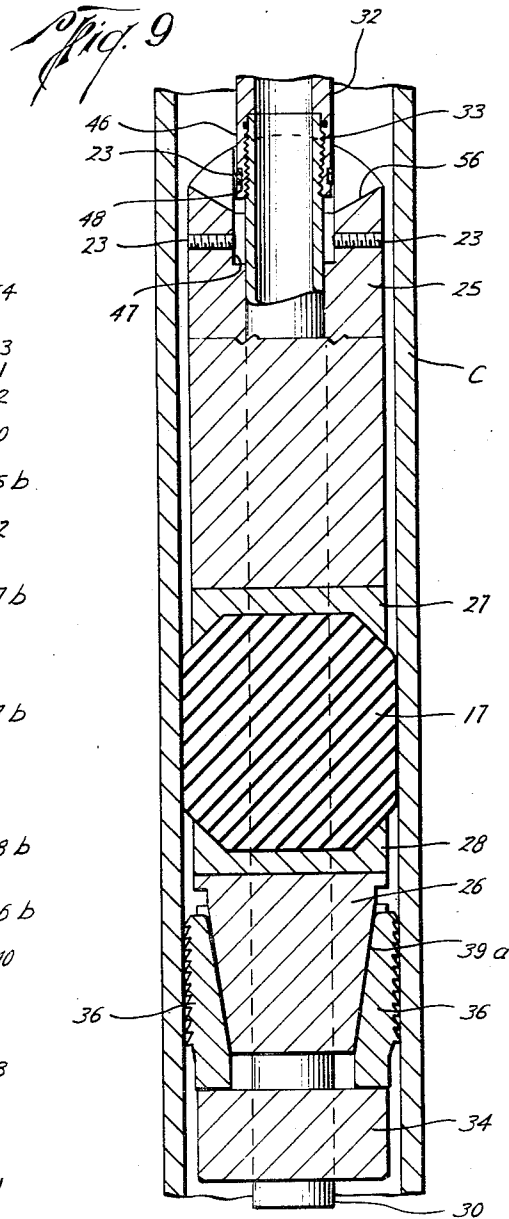
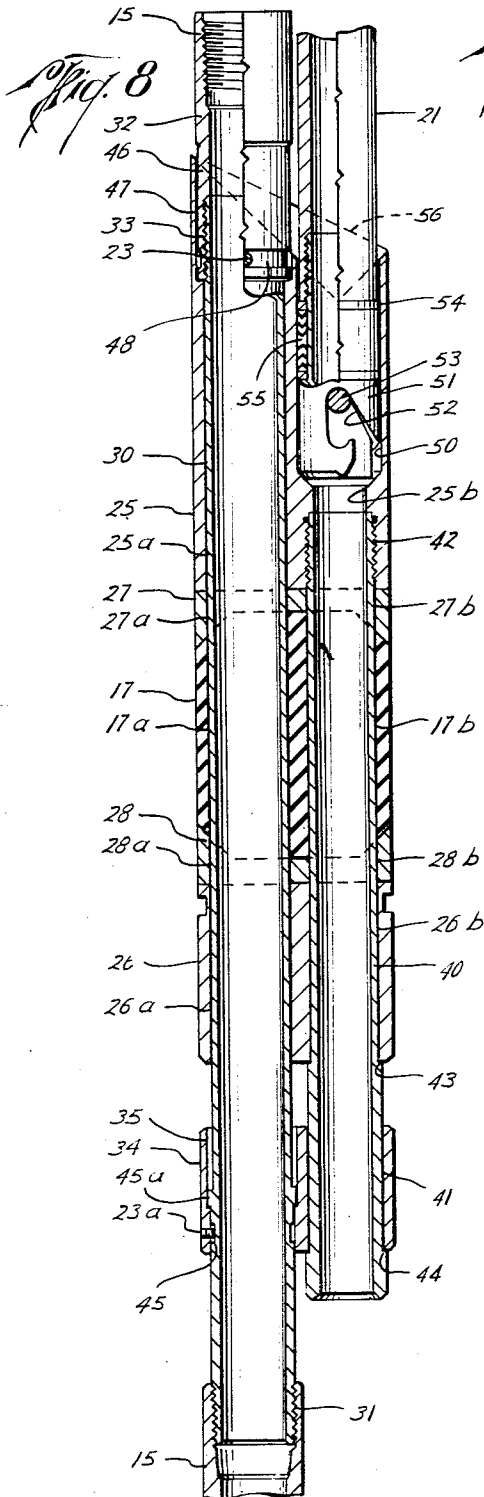
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C. C. BROWN ET AL  
MULTIPLE STRING WELL PACKERS

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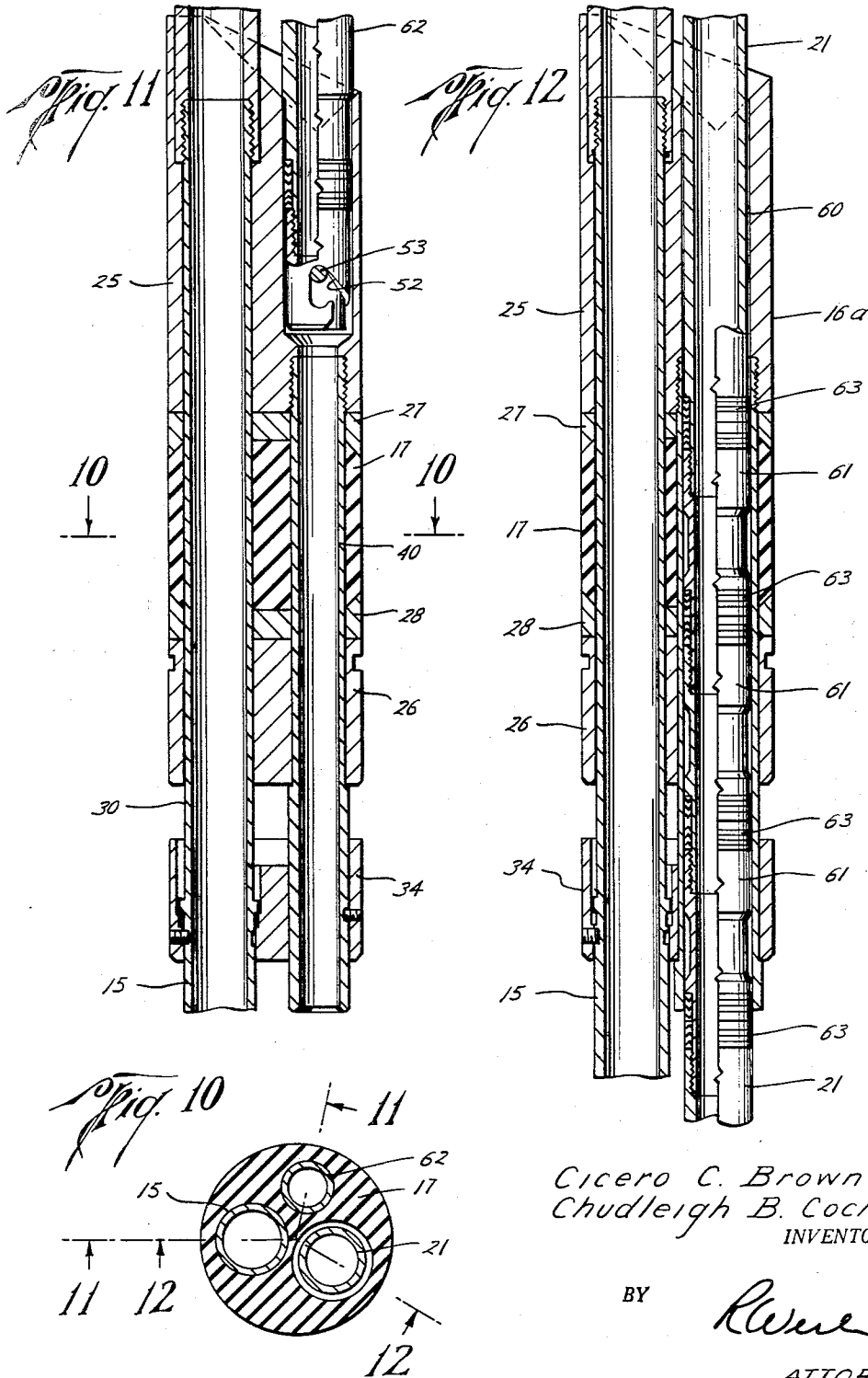
C. C. BROWN ET AL

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MULTIPLE STRING WELL PACKERS

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4 Sheets-Sheet 4



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2,950,761

## MULTIPLE STRING WELL PACKERS

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Filed Aug. 12, 1957, Ser. No. 677,592

12 Claims. (Cl. 166—119)

This invention relates to well packers and more particularly to multiple parallel pipe string packers.

Many wells are presently being completed to flow from several producing zones, usually from two different zones, whereupon they are referred to as "dual-production" or "dual-completion" wells. In some cases, as many as three, and perhaps more, horizons in a well are connected to flow simultaneously, but separately, to the surface.

In all such multiple completion wells, it is ordinarily desirable that the flow from each formation be separately brought to the surface; that is, without inter-mixing the fluids. Present day multiple completions employ separate strings of pipe to connect the respect formations to the well head for independent product therefrom.

In connection with such multiple completion wells, it is necessary to set packers to separate the several producing formations from one another and to lead pipe strings through the several packers by suitable arrangements which will provide the separate and independent flow arrangements desired.

Such multiple pipe string packers generally involve considerable difficulty in manipulation and setting and are usually quite complicated in their construction, giving rise to many difficulties in their employment. Moreover, the constructions heretofore employed generally restrict the diameter of the production pipe strings to relatively small dimensions which prove undesirable, particularly when employed in so-called "permanent completion" arrangements in which it is generally desired to leave the production tubing strings in the well, but to have as large diameter bores as possible in these strings in order to permit passage of various types of tools through the tubing strings in connection with the operations to be conducted in the well.

Accordingly, it is a primary object of this invention to provide packers of a relatively simple form adapted for use with multiple parallel pipe strings, which can be set and released with a minimum of difficulty, and which permit employment of pipe strings of relatively large bore diameters.

An important object of this invention is to provide a multiple parallel pipe string packer which may be run into the well on a first production string and which may then be set or released upon connection of a second pipe string thereto.

A further object is the provision of a multiple pipe string packer which accommodates two or more separate strings of pipe for independently producing a corresponding number of producing zones in the well.

Still another object is to provide a multiple pipe string packer which may be run into the well on a first pipe string which extends to the lowest producing zone so that the well head connections may be put in place without further adjustment, and in which the packer may be set and released by a second string of pipe run through the well head and secured to the packer.

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Still another object is the provision of a multiple pipe string packer of the general form described which will accommodate three parallel strings of pipe for independently producing three separate producing zones.

A more specific object is the provision of a packer structure slidably mounted on a first string of pipe on which it is run into a well, the packer including anchor means mounted on the pipe string for releasably anchoring the packer to the surrounding well wall, said packer structure having a longitudinal passage therethrough paralleling the first pipe string and adapted to receive a second pipe string, and means in the passage engageable by said second pipe string to compress said packer whereby to anchor the same to the well wall and axially compress and thereby expand the sealing elements thereof to form a fluid-tight seal with the well wall.

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

In the drawings:

Fig. 1 is a generally diagrammatic view showing a dual string packer in accordance with one embodiment of this invention, positioned in a well and shown in the unset position;

Fig. 2 is a view similar to Fig. 1, showing a second string of pipe in place and the packer elements actuated to anchor and seal with the surrounding well wall to provide an arrangement for simultaneously and independently producing from two different zones;

Fig. 3 is a generally schematic view similar to Figs. 1 and 2, but showing a triple string arrangement employing two packers of the same general form as that shown in Figs. 1 and 2, both packers being shown in set position to provide an arrangement for simultaneously and independently producing from three different zones;

Fig. 4 is an elevational view of a dual parallel string packer in accordance with this invention;

Figs. 5, 6 and 7 are cross-sections taken, respectively, on lines 5—5, 6—6 and 7—7 of Fig. 4;

Fig. 8 is a generally longitudinal sectional view of the packer illustrated in Fig. 4 showing the parts in the unset positions;

Fig. 9 is a longitudinal sectional view taken generally along line 9—9 of Fig. 4, the parts of the packer being shown in the set position in a well casing;

Fig. 10 is a cross sectional view of a triple string packer taken generally along line 10—10 of Fig. 11;

Fig. 11 is a longitudinal sectional view taken generally along line 11—11 of Fig. 10; and

Fig. 12 is a view similar to Fig. 11 taken along line 12—12 of Fig. 10.

Referring initially to Figs. 1 and 2, there is shown a well casing C which conventionally lines the bore of a well W and extends through at least two producing zones F<sub>1</sub> and F<sub>2</sub>, casing C being provided with perforations P<sub>1</sub> and P<sub>2</sub> communicating, respectively with zones F<sub>1</sub> and F<sub>2</sub>. A first tubing or pipe string 15 is shown extending into the well bore and carrying on its lower portion a packer D, of any conventional form, which is adapted to be set in a well-known manner to seal between pipe string 15 and the wall of casing C between perforations P<sub>1</sub> and P<sub>2</sub> to thereby separate these formations from each other. Pipe string 15 extends below packer D and is in communication with fluids entering casing C from formation F<sub>2</sub> through perforations P<sub>2</sub>. A packer assembly, designated generally by the numeral 16, is mounted on pipe string 15 at a point which will be above perforations P<sub>1</sub> when packer D has been set at the location indicated.

Packer assembly 16, which is constructed in accordance with one embodiment of this invention, includes an

annular resilient seal section 17 which is axially compressible to radially expand the same to seal with casing C, and carries an expander means 18 on its lower end engageable with anchor means, designated generally by the numeral 19, mounted on pipe string 15 and operable in response to relative downward movement of the seal element to anchor the packer assembly to the wall of casing C and to form an abutment against which seal element 17 may be axially compressed to provide the seal with casing C. Packer assembly 16 has a passage 20 extending longitudinally therethrough, generally parallel to pipe string 15, which is adapted to receive a second pipe string 21 (Fig. 2), and is provided with means, indicated generally at 22, by which the weight of pipe string 21 may be applied to the packer structure to actuate the anchor elements and axially compress and thereby radially expand the seal element, as will be more fully described hereinafter. Releasable means, which may be the breakable shear pins 23, provides a releasable connection between the packer assembly and pipe string 15 to initially hold the seal element 17 in retracted position, and are adapted to be broken upon application of a pre-determined weight from pipe string 21 to the packer assembly to release the packer elements for the previously mentioned anchor-engaging and expanding movements.

A second releasable connection, which may be formed by breakable shear pins 23a which extend between pipe string 15 and anchor means 19, is provided to releasably connect the latter to pipe string 15. Breaking of shear pins 23a, which are designed to require a force of greater pre-determined magnitude than is required to break shear pins 23, will permit release of the anchor means from casing C and allow the pipe string and the packers mounted thereon to be withdrawn from the well, as will be subsequently described.

Referring now to Figs. 4 to 9, packer assembly 16 includes upper and lower body sections 25 and 26, respectively, which are constructed of metal and have mounted between them the resilient seal element 17 which, as previously noted, is radially expandible upon axial compression between the sections 25 and 26. Metal end rings 27 and 28 are interposed between the upper and lower ends, respectively, of seal element 17 and the adjacent ends of sections 25 and 26.

A tubular mandrel 30 extends entirely through the packer body comprising body sections 25 and 26, seal element 17 and end-rings 27 and 28, these parts having coaxial openings 25a, 27a, 17a, 28a, and 26a, respectively, in which mandrel 30 is slidably receivable. Mandrel 30 is adapted to form a part of tubing or pipe string 15, its lower end being connectible by means of a conventional threaded coupling 31 to a lower section of pipe string 15, and its upper end being connectible to an upper section of pipe string 15 by means of a coupling 32 having threaded connection 33 with the upper end of mandrel 30. A slip cage or collar 34 is mounted on mandrel 30 spaced somewhat below the lower end of lower body section 26, collar 34 having a longitudinal passage 35 therethrough in which mandrel 30 is slidably receivable, passage 35 being co-axial with the passages through the packer body elements above enumerated. A pair of toothed slips 36 have their lower ends connected to the upper edge of collar 35 by means of conventional T-head connections 37 which are radially movably secured in correspondingly shaped T-slots 38 provided in collar 34. Slips 36 extend upwardly from collar 34 and are slidably received in slots 39 provided on opposite sides of end section 26, slots 39 having downwardly and inwardly tapering slip expander surfaces 39a, and the inner faces of slips 36 having complementary taper to that of surfaces 39a (Fig. 9).

The parts of the packer assembly and the anchor elements are secured in operative relation to each other by means of a sleeve 40 which is inserted upwardly through a passage 41 in cage 34, which is parallel to

passage 35 and co-axial with passage 20 which extends through the packer assembly. Passage 20 is formed by the registering passages 25b, 27b, 17b, 28b and 26b extending respectively through the several packer elements 25, 27, 17, 28 and 26. The upper end of sleeve 40 is provided with threads 42 by which the sleeve may be screwed into the lower portion of bore 25b in upper body section 25. A pair of longitudinally spaced upwardly facing shoulders 43 and 44 are provided on the lower portion of sleeve 40 which are adapted to respectively engage the lower ends of section 26 and cage 34, as best seen in Fig. 8. By this arrangement, sleeve 40 may be inserted upwardly through the openings in cage 34 and the packer body and when screwed into the upper body section 25, upper shoulder 43 will engage the lower end of body section 26 and draw the body sections together. Lower shoulder 44 will abut the lower end of cage 34 and support it in the desired spaced relation to the lower end of body 26. With this arrangement, upper body section 25 may move downwardly relative to cage 34 and lower body section 26 when slips 36 are in engagement with casing C, as will appear more fully hereinafter. Cage 34 is also secured to mandrel 30 by means of the breakable shear pins 23a which extend through the wall of cage 34 into an annular groove 45 provided in the outer surface of mandrel 30 (Figs. 7 and 8). At a point slightly above groove 45, mandrel 30 is provided with an annular enlargement 45a defining an upwardly facing shoulder which is adapted to abut and engage the lower end of lower body section 26 when shear pins 23a have been broken to release mandrel 30 for upward movement relative to the packer assembly as will be more fully described hereinafter in connection with the operations for release and removal of the packer from the well.

Coupling 32 has its lower end portion 46 reduced somewhat in its external diameter to be slidably insertable in a counterbore 47 provided in the upper end of passage 25a of the upper body section. The lower end of coupling 32 is provided with an annular groove 48 adapted to receive the inner ends of shear pins 23 which are mounted to project from the inner wall of passage 25a into groove 48 (Fig. 5). By means of the shear pins 23, it will be seen that upper body portion 25 of the packer assembly is releasably secured to pipe string 15 and, as noted previously, cage 34 is similarly releasably secured to pipe string 15 by means of the shear pins 23a, the spacing thus provided between cage 34 and the packer being such as to initially hold slips 36 in retracted relation to expander surfaces 39a.

The upper end portion of passage 25b is counterbored to provide the enlarged diameter socket 50 into which the lower end portion of the second pipe string 21 is insertable. The lower end of pipe string 21 carries a nipple 51 provided with J-slots 52 in the wall thereof which open to the lower end of nipple 51 (Figs. 6 and 8) and are adapted to receive J-lugs 53 which are mounted to project radially inwardly from opposite sides of the wall of counterbore 50 (Fig. 6) when the lower end of pipe string 21 is inserted in the counterbore, the bottom of J-slots 52 being adapted to bear downwardly on J-lugs 53. A sealing sleeve 54 carrying packing 55 (Fig. 8) is positioned between the lower end of pipe string 21 and nipple 51, being adapted to form a fluid-tight seal between pipe string 21 and the wall of counterbore 50. With the bayonet-type J-slot and J-lug connection provided between the lower end of pipe string 21 and socket 50, it will be seen that a releasable connection is provided which is engageable upon the insertion of pipe string 21 into socket 50 and which, by slight rotation of pipe string 21 in the clockwise direction, will permit the latter to be withdrawn from socket 50.

When pipe string 21 is inserted in socket 50 and engaged with lugs 53, it will be seen that the weight of

pipe string 21 may be imposed upon upper body section 25 since lugs 53 are directly carried by the upper body section. The upper end of body section 25 is suitably machined to form a downwardly tapering guiding surface 56 adapted to guide the lower end of nipple 51 into socket 50 when pipe string 21 is lowered into the well from the surface and strikes the surface 56.

Operation of the above-described packer structure is conducted as follows: Packer D will have been installed on pipe string 15 and, as indicated previously, may be of any generally well-known or conventional construction which is settable and releasable by manipulation of string 15. A type of packer suitable for this purpose is illustrated in my U.S. patent application Serial No. 561,321, filed January 25, 1956. This packer will be mounted on pipe string 15 so that packer D will be positioned between perforations  $P_1$  and  $P_2$ , thereby separating from each other the fluids coming into casing C from formations  $F_1$  and  $F_2$ , respectively. Packer assembly 16 will also have been mounted on pipe string 15 before the string is run into the well and will be positioned thereon at a point relative to packer D such that the packer assembly will serve, when set, to seal between pipe string 15 and casing C at a point above perforations  $P_1$ . At this time, shear pins 23 and 23a will be unbroken thereby securing the packer assembly in its unset position relative to the anchor elements, so that packer assembly 16 may be freely moved into the well bore on pipe string 15.

When packer D has been positioned at the point at which it is to be set, it will be set and anchored to the casing by an appropriate manipulation of pipe string 15. When that has been accomplished, packer assembly 16 will still be in its unset condition, but further downward movement of pipe string 15 will have been halted by the setting of packer D, thereupon the second pipe string 21 will be inserted in the bore of casing C and lowered into the well until the lower end of nipple 51 engages surface 56 and is guided thereby into socket 50 wherein lugs 53 will be received in and engaged by J-slots 52. Pipe string 21 will, of course, be lowered from the surface under control of lowering devices commonly employed for this purpose, and when its lower end has been received in socket 50 and engagement with lugs 53 effected, the hoisting equipment connected to pipe string 21 will be slacked off sufficiently to apply a pre-determined amount of weight of the pipe string to lugs 53 and thence to upper section 25 of the packer body. The amount of weight thus exerted on upper section 25 will be as much as is required to break shear pins 23 (Figs. 2 and 9). Downward movement of upper portion 25 can now occur by reason of the compressibility of packer element 17. When shear pins 23 have been broken, the weight of pipe string 21 on upper section 25 will be exerted through packer element 17 and will move lower section 26, carrying expander surfaces 39a, downwardly relative to slips 36 and cage 34, which will be held stationary by means of shear pins 23a which, as indicated previously, will be made considerably stronger than shear pins 23. For example, shear pins 23 may be designed to break at 6000 pounds, while shear pins 23a may be designed to break at 12000 pounds. Thus by regulating the amount of weight applied through pipe 21, shear pins 23 may be broken while shear pins 23a are unaffected.

As upper section 25, packer element 17 and lower section 26 move downwardly relative to slips 36, the latter will be moved radially outwardly in slots 39 until they engage the wall of casing C which will effectively stop further downward movement of the packer sections. The weight applied to upper body section 25 through pipe string 21 will then act to compress packer element 17 against lower body section 26 producing radial expansion of the sealing element to form a fluid-tight seal between pipe string 15 and casing C. Packing 55 on sealing nipple 54 will be effective to prevent fluid

leakage through passage 20 between the second pipe string 21 and the packer elements.

By the manipulations above described, it will be seen that packer assembly 16 may be set to form a seal between the two pipe strings 15 and 21 and casing C above perforations  $P_2$ . By connecting pipe strings 15 and 21 to suitable outlets at the surface (not shown), fluids entering the casing through perforations  $P_2$  and  $P_1$  may be separately and independently delivered to the surface through pipe strings 15 and 21, respectively.

When it is desired to remove the pipe strings and packers from the well, pipe string 21 will be rotated clockwise sufficiently to release its connection between nipple 51 and J-lugs 53, whereupon pipe string 21 may be withdrawn from the well, releasing the downward compression on sealing element 17 which is thus freed to retract to its initial position and to release the expansive force on slips 36. An upward pull may then be applied to pipe string 15 of sufficient force to break shear pins 23a. Thereupon upward movement of pipe string 15 will serve to lift mandrel 30 through cage 34 until shoulder 45a engages the lower end of section 26. This will serve to pull the packer body away from slips 36 and release the packer assembly and anchor elements for withdrawal from the well on pipe string 15. The latter may now also be manipulated to release packer D and the entire string may then be withdrawn from the well.

It will be evident from the foregoing that a dual-string packer is provided which can be set simply by imposing weight of a second pipe string on the packer and released by retracting the weight of the second pipe string. Hence, a minimum amount of manipulation is required to set and release the packer and a dual string packer of relatively simple construction is thereby provided.

The principles embodied in the dual string packer previously described may be employed for setting multi-string packers designed for more than two strings of pipe.

Figs. 3 and 10 to 12 illustrate a triple string packer in which a second packer assembly 16a is mounted on pipe string 15 above a lower packer assembly corresponding to assembly 16 of the previously described embodiment. Packer assembly 16a is secured to pipe string 15 in exactly the same manner as previously described, being secured thereto by means of shear pins 23 (shown broken, the packer being shown in the set position in Fig. 3), and by means of shear pins 23a connecting pipe string 15 to the anchor elements 19. Instead of two parallel passages through the packer structures, as in the case of the previously described embodiment, packer assembly 16a has three parallel passages, the third one being designated by the numeral 60. The latter is adapted to pass pipe string 21 entirely through the packer assembly so that the lower end of pipe string 21 may be received in socket 50 of the lower packer assembly. When pipe string 21 is inserted through passage 60 in packer assembly 16a and its lower end engaged in socket 50 sufficient weight will be applied through pipe string 21, as previously described, to set packer assembly 16, just as described above. At this stage, therefore, packer D having been set previously, as also described above, packers D and 16a will be set, the latter being set above perforations  $P_1$ . Packer assembly 16a will have been mounted on pipe string 15 at an elevation to place it above perforations  $P_3$  which communicate with formation  $F_3$ . As in the previous example, production will be conducted to the surface from formation  $F_2$  through pipe string 15 and from formation  $F_1$  through pipe string 21. Packer assembly 16a will have a passage 20 having the socket 50 in its upper end just as in the earlier described embodiment. The latter is adapted to receive a third pipe string 62 provided at its lower end with bayonet-type connections operable in exactly the same manner as in the case of packer assembly 16 to permit imposition of the weight of pipe

string 62 on packer assembly 16a in an amount sufficient to break the upper shear pins and set packer assembly 16a in exactly the same manner as described for packer assembly 16. Production from formation F<sub>3</sub>, entering the casing through perforations P<sub>3</sub>, may be conducted to the surface through pipe string 62 separately and independently of the production flowing upwardly through pipe strings 15 and 21.

Referring more specifically to Figs. 10, 11 and 12, it will be seen that pipe string 21 in this embodiment carries a plurality of sealing nipples 61—61 equipped with external packing 63 so as to effectively provide a fluid-tight seal between the portion of pipe string 21 which extends through upper packer assembly 16a and passage 20.

Thus with the arrangement illustrated in Figs. 3 and 10 to 12, it will be seen that three different fluid-containing earth strata may be produced simultaneously and separately and independently through a single well bore, and that packer structures are provided which are quite simple in construction and may be easily installed and removed. In the case of the embodiment illustrated in Fig. 3, it will be seen that when it is desired to remove the several packers and pipe strings from the well, pipe string 62 will first be removed to release the weight on packer assembly 16a, thereafter pipe string 21 will be withdrawn from the well to relieve the weight on packer assembly 16. Subsequently an upward pull may be applied to pipe string 15 sufficient to break the shear pins 23a of both packer assemblies, thereby freeing both packer assemblies 16 and 16a and permitting manipulation of pipe string 15 to release packer D, after which the entire string may be withdrawn from the well.

It will be understood that numerous modifications, alterations, and changes may be made in the details of the illustrative embodiments within the scope of the appended claims but without departing from the spirit of this invention.

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

1. A multiple pipe string well packer, comprising in combination with a first pipe string, a packer body having a first longitudinal passage therethrough for slidable mounting on the first pipe string and including a resilient seal portion adapted to be radially expanded by axial compression to seal with a surrounding well wall, a downwardly and inwardly tapering expander means carried by the body beneath the seal portion and movable downwardly therewith, radially movable anchor elements mounted on the first pipe string below the expander means engageable by said expander means in response to relative downward movement of the packer body to engage the well wall whereby further downward movement of the packer body will produce said axial compression of the seal portion, said packer body and seal portion having at least one additional longitudinal passage therethrough in laterally spaced parallel relation to the first pipe string and adapted to receive a second pipe string, and means in said additional passage engageable by the second pipe string to cause application of the weight of the second pipe string to the packer body whereby to effect said downward movement and said axial compression of said seal portion.

2. A multiple pipe string well packer, comprising in combination with a first pipe string, a packer body having a first longitudinal passage therethrough for slidable mounting on the first pipe string and including a resilient seal portion adapted to be radially expanded by axial compression to seal with a surrounding well wall, means releasably securing the packer body in retracted position on the first pipe string, said means being releasable by downward movement of the packer body relative to the first pipe string, a downwardly and inwardly tapering expander means carried by the body beneath the seal

portion and movable downwardly therewith, radially movable anchor elements mounted on the first pipe string below the expander means engageable by said expander means in response to relative downward movement of the packer body to engage the well wall whereby further downward movement of the packer body will produce said axial compression of the seal portion, said packer body and seal portion having at least one additional longitudinal passage therethrough in laterally spaced parallel relation to the first pipe string and adapted to receive a second pipe string, and means in said additional passage engageable by the second pipe string to cause application of the weight of the second pipe string to the packer body whereby to effect said downward movement and said axial compression of said seal portion.

3. A multiple pipe string well packer, comprising in combination with a first pipe string, a packer body having a first longitudinal passage therethrough for slidable mounting the packer body about the first pipe string and including an annular resilient seal portion adapted to be radially expanded by axial compression to seal between said first pipe string and a surrounding well wall, means releasably securing said packer body in retracted position on said first pipe string, said means being releasable by downward movement of the packer body relative to said first pipe string, a downwardly and inwardly tapered expander means carried by the packer element and movable downwardly therewith, radially expandable anchor elements mounted on the first pipe string engageable by said expander means in response to relative downward movement of said packer body to anchor the packer body to the well wall, at least one additional longitudinal passage through the packer body in laterally spaced parallel relation to the first pipe string and adapted to receive a second pipe string, means in said additional passage engageable by the second pipe string to permit application of the weight of the second pipe string to the packer body whereby to effect said downward movement and axial compression of said packer element, and means forming a fluid-tight seal in said additional passage about said second pipe string.

4. A multiple pipe string well packer, comprising in combination with a first pipe string, a packer body having a first longitudinal passage therethrough for slidable mounting on the first pipe string and including a resilient seal portion adapted to be radially expanded by axial compression to seal with a surrounding well wall, a downwardly and inwardly tapering expander means carried by the body beneath the seal portion and movable downwardly therewith, radially movable anchor elements mounted on the first pipe string below the expander means engageable by said expander means in response to relative downward movement of the packer body to engage the well wall whereby further downward movement of the packer body will produce said axial compression of the seal portion, said packer body and seal portion having a second longitudinal passage therethrough in laterally spaced parallel relation to the first pipe string and adapted to receive a second pipe string, and means in said second passage engageable by the second pipe string to cause application of the weight of the second pipe string to the packer body whereby to effect said downward movement and said axial compression of said seal portion, and means initially securing the packer body to the first pipe string to hold said seal portion in retracted position, said means being releasable by said application of the weight of the second pipe string to the packer body.

5. A multiple pipe string well packer, comprising in combination with a first pipe string, a packer body having a first longitudinal passage therethrough for slidable mounting on the first pipe string, said packer body including upper and lower body sections and a resilient seal element positioned between the sections and adapt-

ed to be radially expanded by axial compression between said sections to seal with a surrounding well wall, a downwardly and inwardly tapering expander means carried by the lower body section and movable downwardly therewith, radially movable anchor elements mounted on the first pipe string below the expander means engageable by the expander means in response to relative downward movement of the packer body to anchor the lower section of the packer body to the well wall whereby further relative downward movement of the upper portion of the packer body will produce said axial compression of the seal element, said packer body having a second longitudinal passage therethrough in laterally spaced parallel relation to the first pipe string and adapted to receive a second pipe string, and means in said second passage engageable by the second pipe string to cause application of the weight of the second pipe string to the packer body whereby to effect said downward movements and said axial compression of said seal element.

6. Apparatus for use in a multiple completion well, comprising in combination with a first pipe string, first and second packers having a first longitudinal passage through which said first pipe extends, said packers being slidably mounted at spaced points on the first pipe string, each of said packers including an annular resilient seal portion adapted to be radially expanded by axial compression to seal with a surrounding well wall, anchor means mounted on the first pipe string beneath each of said packers, each of said anchor means being operable in response to relative downward movement of the respective packers to anchor the packers to the well wall and to produce said axial compression of the seal portions, each of said packers having a second longitudinal passage therethrough in laterally spaced parallel relation to said first pipe string adapted to receive a second pipe string, the upper one of said packers having a third longitudinal passage therethrough in laterally spaced parallel relation to the first and second passages adapted to receive a third pipe string, and means in the second passage in the lower one of said packers and in said third passage in the upper packer engageable respectively by the second and third pipe strings to cause application of the weight of said pipe strings to the respective packers whereby to effect said downward movement and said axial compression of the seal portions thereof.

7. A multiple pipe string well packer, comprising in combination with a first pipe string, a flexible resilient packer element mounted about the first pipe string and adapted to be radially expanded by axial compression to seal between said first pipe string and a surrounding well wall, means comprising a breakable shear pin of predetermined breaking strength releasably securing said packer element in retracted position to said first pipe string, said means being releasable in response to force of pre-determined magnitude applied by downward movement of the packer element relative to said first pipe string, expander means carried by the packer element and movable downwardly therewith, radially expandable anchor elements mounted on the first pipe string engageable by said expander means in response to relative downward movement of said packer element, a longitudinal passage through the packer element in laterally spaced parallel relation to the first pipe string and adapted to receive a second pipe string, and means in said passage engageable by the second pipe string to permit application of the weight of the second pipe string to the packer element whereby to effect said downward movement and axial compression of said packer element.

8. A multiple pipe string well packer, comprising, a body insertible in a well bore, said body including upper and lower rigid body sections and an annular resilient sealing element disposed between the body sections to be radially expanded by axial compression between said sections, a tubular mandrel slidably extending longitudi-

nally through said body and adapted for connection into a first pipe string, an anchor assembly positioned on the mandrel below the body operable by relative downward movement of the body to engage the well wall to anchor the lower body section thereto, means releasably securing the upper body section to said mandrel to initially hold said body in retracted position relative to the anchor assembly, said means being releasable by downward force on said upper body section, a tubular sleeve extending through said body in parallel laterally spaced relation to said mandrel, said sleeve being slidable through the lower body section and said sealing element and having its upper end secured to said upper body section and adapted to receive a second pipe string, and means in the upper body section engageable by said second pipe string to transmit downward pressure from said second pipe string on said upper body section whereby to effect release of said releasable means and thereby actuate said anchor assembly and compress said sealing element.

9. A multiple pipe string well packer according to claim 8 wherein said releasable means comprises shear pins breakable at a predetermined force.

10. A multiple pipe string well packer according to claim 8 having second shear pin means releasably securing said anchor assembly to said mandrel, said second shear pin means being breakable by a force substantially greater than that required to break said first-mentioned shear pins.

11. A multiple pipe string packer according to claim 8 having a second means releasably securing said anchor assembly to said mandrel, said second means being releasable by relative longitudinal movement between said mandrel and said anchor assembly under a force substantially greater than that required to effect release of said first releasable means.

12. A multiple pipe string well packer, comprising in combination with a first pipe string, a packer body slidable on the first pipe string and including a resilient seal portion adapted to be radially expanded by axial compression to seal with a surrounding well wall, a first means releasably securing the packer body in retracted position on the first pipe string, said first means being releasable by downward movement of the packer body relative to the first pipe string, anchor means mounted on the first pipe string below the packer body operable in response to relative downward movement of the packer body to anchor the packer body to the well wall and to produce said axial compression of said seal portion, said packer body having at least one longitudinal passage therethrough in laterally spaced parallel relation to the first pipe string adapted to receive a second pipe string, means in said passage engageable by the second pipe string to cause application of the weight of the second pipe string to the packer body whereby to effect said downward movement and said axial compression of the seal portion, and a second means releasably securing said anchor means to the first pipe string, said second means being releasable by relative longitudinal movement between the first pipe string and said anchor means under a force substantially greater than that required to effect release of said first releasable means.

#### References Cited in the file of this patent

##### UNITED STATES PATENTS

|           |         |                |
|-----------|---------|----------------|
| 1,014,272 | Waitz   | Jan. 2, 1912   |
| 1,050,689 | Pierce  | Jan. 14, 1913  |
| 1,530,783 | Mack    | Mar. 24, 1925  |
| 2,253,092 | Pranger | Aug. 19, 1941  |
| 2,467,801 | Baker   | Apr. 19, 1949  |
| 2,605,637 | Rhoades | Aug. 5, 1952   |
| 2,764,243 | Page    | Sept. 25, 1956 |
| 2,791,277 | Ilfrey  | May 7, 1957    |