

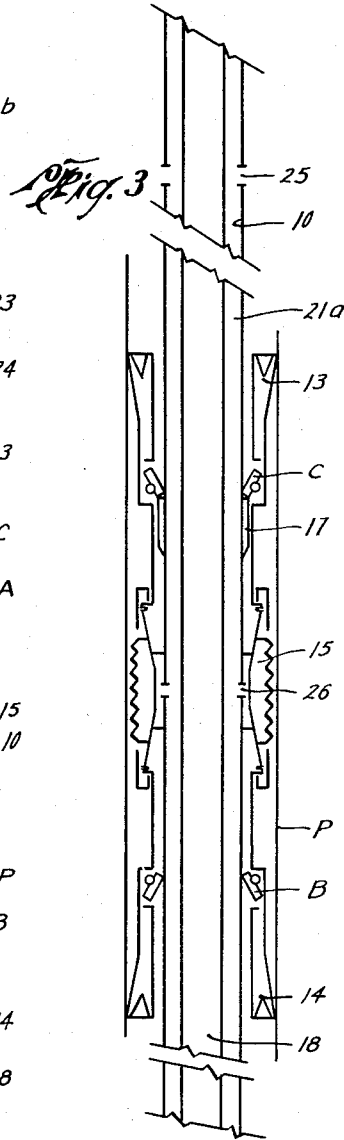
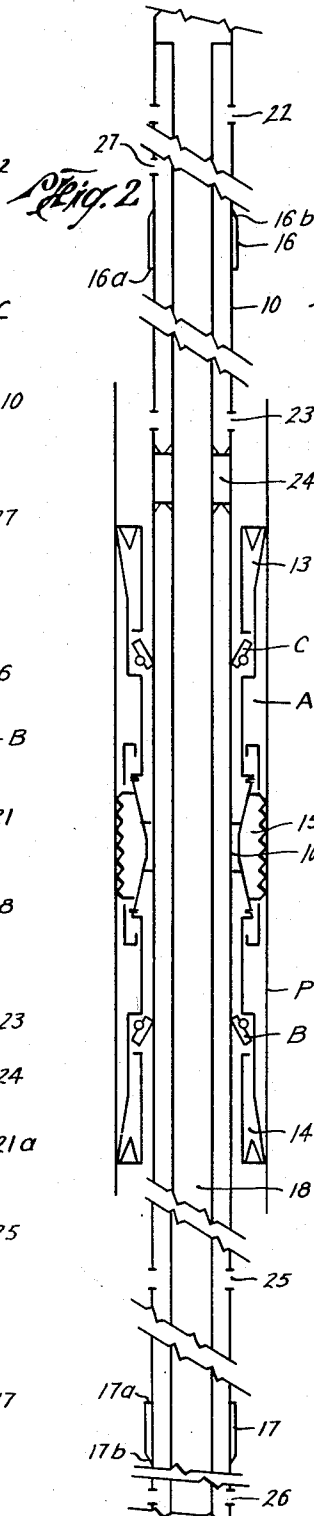
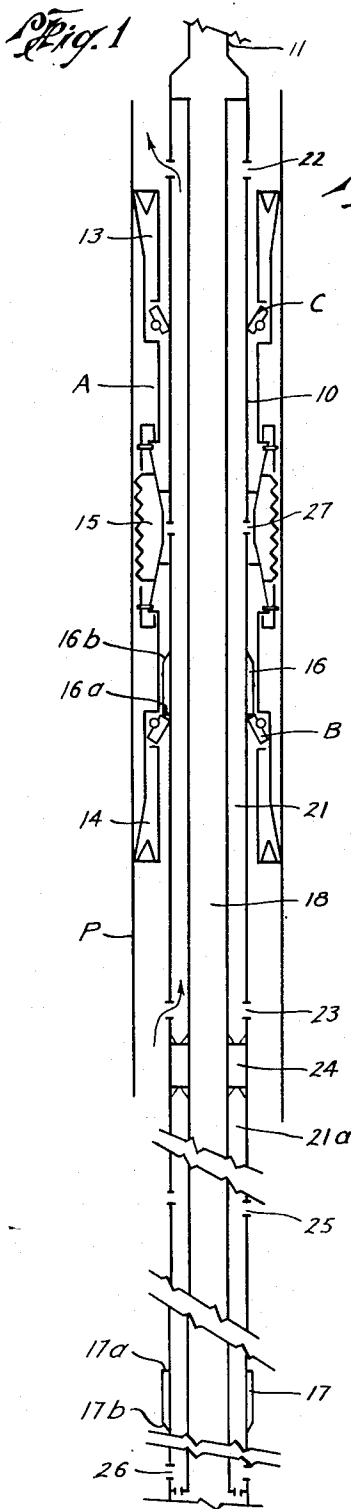
March 22, 1955

C. C. BROWN
WELL PACKERS

2,704,580

Filed March 20, 1951

3 Sheets-Sheet 1



Cicero C. Brown
INVENTOR.

BY *Vincent Martin*
and
Joe E. Edwards
ATTORNEYS

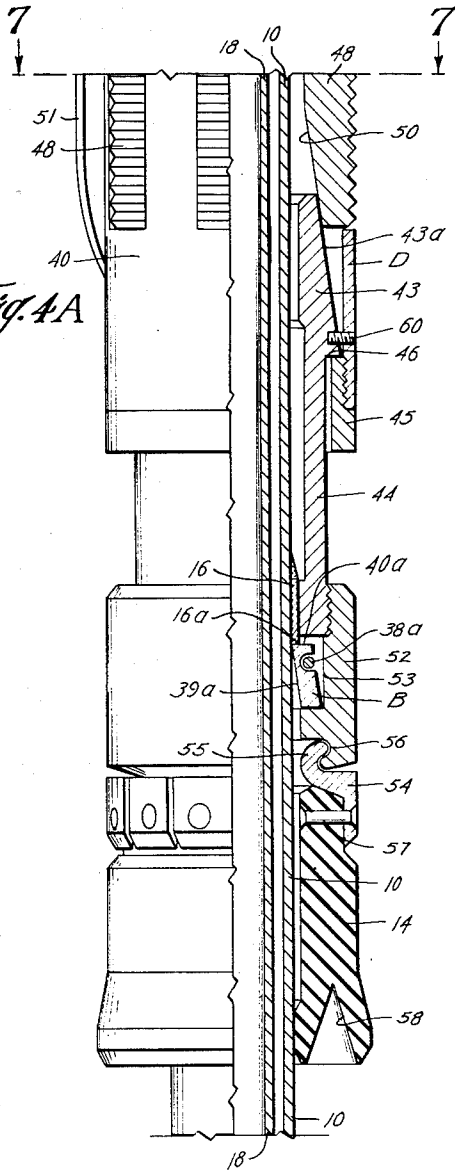
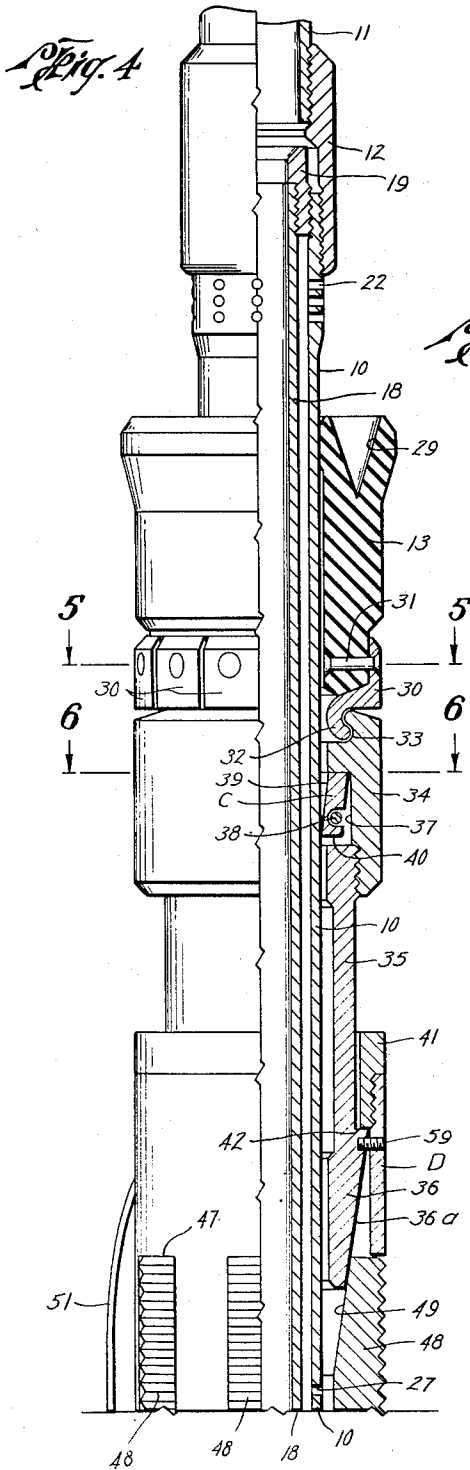
March 22, 1955

C. C. BROWN
WELL PACKERS

2,704,580

Filed March 20, 1951

3 Sheets-Sheet 2



Cicero C. Brown
INVENTOR.

BY *J. Vincent Martin*
and
Joe E. Edwards
ATTORNEYS

March 22, 1955

C. C. BROWN
WELL PACKERS

2,704,580

Filed March 20, 1951

3 Sheets-Sheet 3

Fig. 4B

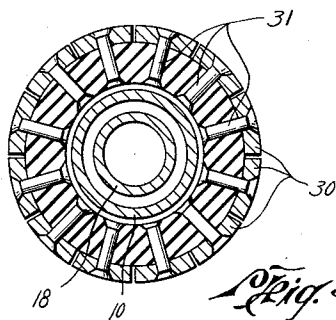
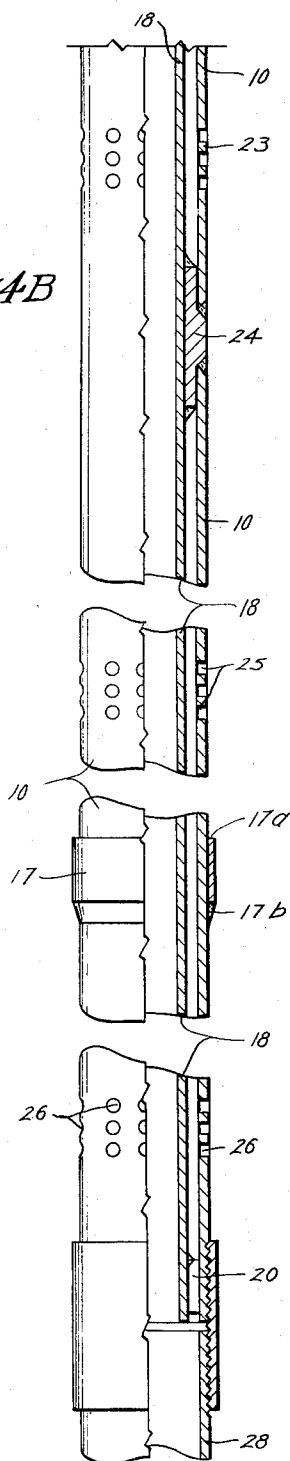


Fig. 5

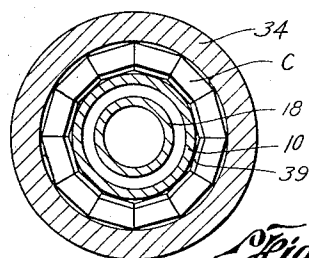


Fig. 6

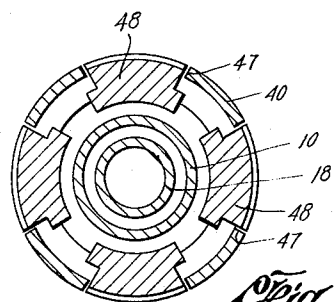


Fig. 7

Cicero C. Brown
INVENTOR.

Vincent Martin
and
Joe E. Edwards
ATTORNEYS

1

2,704,580

WELL PACKERS

Cicero C. Brown, Houston, Tex.

Application March 20, 1951, Serial No. 216,546

9 Claims. (Cl. 166—121)

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

One object of the invention is to provide an improved well packer which may be set and released within the well bore by an axial movement of the lowering pipe or mandrel, whereby rotation of said pipe is not required to effect setting or release of the packer and operation is simplified.

An important object is to provide an improved well packer having a packing element which is moved into packing position by the pressure to which said element is exposed and also having co-acting means on the lowering mandrel and the packing element assembly for controlling setting and release of the packing element in accordance with axial movement of the lowering mandrel.

Another object is to provide a packing assembly which includes upper retractible dogs and lower retractible dogs which are arranged to coact with projections on the lowering mandrel in a manner which allows lowering of the packing assembly without setting thereof so long as the mandrel is moved in a downward direction; upward movement of the mandrel relative to the packing assembly permitting setting of the packing assembly and subsequent continued upward movement of said mandrel beyond a certain point effecting a release of said assembly, whereby all operations are controlled by axial manipulation of said lowering mandrel.

A further object is to provide a well packer, of the character described, wherein the lowering mandrel is reciprocal relative to the packing assembly and wherein said mandrel is formed with by-pass passages which are adapted to be opened and closed by manipulation of said mandrel with respect to the assembly whereby by-pass of fluid past the packing assembly may occur during lowering and raising of the assembly within the well bore but may be shut off past the assembly when the latter is in its set or packing position.

Still another object is to provide a well packer, of the character described, wherein the gripping elements of the packing assembly as well as the packing elements thereof are adapted to be moved into set position by the differential in pressure across the assembly, with the position of the lowering mandrel with respect to said assembly controlling the setting and release of the gripping and packing elements of said assembly to selectively permit setting or release of the assembly by longitudinal movement of the lowering mandrel with respect thereto.

A further object is to provide for an equalization of pressures across the gripping slip and packing assembly during lowering and raising thereof within a well bore, whereby said assembly will not be set during its movement through the bore.

Still another object is to provide a well packer of the character described which may be set within a well at one elevation and then released and reset at another elevation without removal of the packer from the well bore.

The construction designed to carry out the invention will be hereinafter described together with other features thereof.

The invention will be more readily understood from a reading of the following specification and by reference to the accompanying drawings forming a part thereof, wherein an example of the invention is shown, and wherein:

Figure 1 is a diagrammatic view of a well packer, constructed in accordance with the invention and illustrating the same being lowered within a well bore.

2

Figure 2 is a similar view, showing the gripping slips and packing elements in a set position,

Figure 3 is a similar view, showing the position of the parts during removal of the packer from the well bore,

Figure 4 is a view, partly in section and partly in elevation of the upper portion of the well packer,

Figure 4A is a continuation of Figure 3, showing the intermediate portion of the apparatus,

Figure 4B is a continuation of Figure 4A illustrating the lowering portion of the apparatus,

Figure 5 is a horizontal, cross-sectional view, taken on line 5—5 of Figure 4,

Figure 6 is a horizontal, cross-sectional view, taken on the line 6—6 of Figure 4, and

Figure 7 is a horizontal, cross-sectional view, taken on the line 7—7 of Figure 4A.

In the drawings, the numeral 10 designates an elongate tubular mandrel which has its upper end connected with the tubing 11 through a suitable coupling 12 (Figure 4).

A packing assembly generally indicated at A in Figures 1 to 3 includes an upper packing element 13, a lower packing element 14 and an anchoring means 15, and the assembly A surrounds the mandrel and is slidable longitudinally with respect thereto. The packing assembly A includes a series of lowering dogs B which will be hereinafter described in detail and which are mounted in the lower portion of the packing assembly. A series of retrieving dogs C are mounted in the upper portion of the assembly and as will be explained, the dogs B and C are utilized in the lowering and retrieving of the packer assembly.

The mandrel is provided with an upper projection or collar 16 which is arranged to coact with the lowering dogs B to lower the assembly A within the well and spaced some distance below the upper collar or projection 16 is a second collar or projection 17 also secured to the mandrel. The lower projection 17 is adapted to coact with the upper retrieving dogs C to effect removal of the assembly.

An elongate production tube 18 is disposed axially within the mandrel 10 and has its upper end secured by means of a collar 19 to the upper end of the mandrel 10 (Figure 4), while the lower end of the tube is secured by spacing block 20 to the lower portion of the mandrel. The annular space 21 between the tube 18 and the mandrel 10 forms an annular by-pass area. The upper portion of the mandrel is formed with ports 22, and spaced below these ports by a distance which is greater than the length of the assembly A is a second series of ports 23. Immediately below the ports 23 is an annular block 24 which closes off the annular space 21 formed between the tube 18 and the mandrel 10. Below the block 24 the mandrel is formed with a third series of ports 25 and nearer its lower end below the lowermost projection or collar 17 is another series of ports 26. Between the two uppermost series of ports 22 and 23 the mandrel is provided with equalizing ports 27, the purpose of which will be hereinafter described.

The packing assembly A which includes the anchoring means 15 is adapted to be set by the differential in pressure thereacross and when the apparatus is being lowered within a well pipe indicated at P in Figure 1, the parts are as shown in this figure. In such position the uppermost projection 16 is in engagement with the lowering dogs B and a downward movement of the mandrel will impart a lowering movement to the assembly A. At this time the ports 22 are above the upper packing element 13 while the ports 23 are below the lower packing element 14 with the result that a free by-pass of fluid through the annular passage 21 and through the packing assembly A may occur. The packing assembly A is of such construction that with the mandrel applying a downward force to the lowering dogs B, the anchoring means is maintained against setting; also, pressures across the packing elements 13 and 14 are equalized through the ports 27 in the mandrel and said packing elements merely ride downwardly on the wall of the pipe P. When the packer is to be set the well pipe 11 and mandrel 10 are raised to the position shown in Figure 2. The frictional engagement of the packing elements 13 and 14 together with friction springs hereinafter described maintain the assembly A substantially stationary until the

3

mandrel can be lifted upwardly to the position shown in Figure 2, in which position the upper projection 16 has moved to a position above the assembly A and the equalizing ports 27 have been moved out of the packing assembly. The differential in pressures across the assembly function to set the anchoring means 15 and to apply sealing pressure to the elements 13 and 14, as will be described. The construction of the retrieving dogs C in the upper end of the assembly A is such that the upper projection 16 may freely pass these dogs and thus, the lower by-pass port 23 may be moved above the packing assembly to close the by-pass area 21. In this position, it will be evident that the assembly A is in its set position, and any production from the area below said assembly will be upwardly through the inner tube 18.

When it is desired to release the packer, it is only necessary to continue the upward movement of the mandrel 10 from the position shown in Figure 2 to the position shown in Figure 3. In this position the lower projection or collar 17 has moved upwardly past the lowering dogs B and has engaged the retrieving dogs C, as shown in Figure 3. This allows an upward pull to be exerted on the packing assembly A which will result in a release of the upper cone of anchoring means 15 and subsequent upward pull will allow removal of the unit from the well. In some instances, as will be hereinafter described in detail, it may be necessary after release of the upper cone of the anchoring means to again lower the mandrel to effect release of the lower cone of said means, after which the parts are returned to the position shown in Figure 3. In such position, the ports 26 in the mandrel 10 have moved opposite the anchoring means to allow equalization of pressures across the packing elements 13 and 14. The ports 25 have been moved upwardly above the uppermost packing so that the annular space 21 below the block 24 becomes a by-pass passage which allows free flow of fluid past the packing assembly A.

From the foregoing it will be seen that the apparatus is adapted to be lowered into position, after which the mandrel may be raised to permit the differential of pressures across the packing assembly A to set the same. Release of the packing assembly and removal of the same from the well bore is accomplished by a subsequent upward movement of the mandrel beyond the movement which was required to allow setting of the assembly. No rotation of the mandrel is required and the setting and release is carried out by the longitudinal or axial movement of the mandrel.

The construction of the apparatus is shown in detail in Figures 4 to 4B, and as shown in Figure 4, the upper end of the mandrel 10 has connection through the coupling 12 with the well pipe. The mandrel extends downwardly a desired distance below the packing assembly A and may have its extreme lower end connected with a tail pipe 28 (Figure 4B). The packing assembly which is clearly shown in Figures 4 and 4A includes the upper packing element 13 which is in the form of a packing sleeve having upwardly directed sealing lips 29. The lower end of the packing element 13 is connected with a plurality of metallic confining segments 30 by means of suitable pins 31. The lower portion of each segment is formed with a hook portion 32 which engages within a complementary recess provided in the upper portion of a collar 34. The inter-engagement of each hook portion 32 with the recess 33 permits the segments to undergo a limited pivoted or swinging movement when the packing element 13 is placed under stress. The outward swinging of the segments function to close the annular space between the packing assembly and the wall of the well pipe P to prevent extrusion or excessive deformation of the packing element 13. The details of the packing element mounting forms the subject of my co-pending application filed concurrently herewith.

The collar 34 has its lower end connected to the upper end of a sleeve 35 which has a slip expanding cone 36 made integral with its lower end. The collar is internally recessed to provide an annular cavity 37 and the upper retrieving dogs C are mounted within this cavity. As illustrated in Figure 6, the dogs C are segmental and are maintained in annular relationship by an annular spring 38 which urges the dogs C inwardly of the mandrel 10. The inner surface 39 of each dog C is inclined outwardly toward its upper end and the spring 38 is located nearer the lower end of the dogs whereby the lower end of each

4

dog is maintained in contact with the mandrel. It will be evident that with this arrangement the bottom or lower surface 40 of each dog presents a downwardly facing shoulder. Because the dogs are resiliently maintained in contact with the mandrel, said dogs are radially expandable and retractable.

The lower projection 17 which coacts with the retrieving dogs C has a square shoulder 17a on its upper end and it will thus be evident that when the projection is moved upwardly the upper edge 17a of said projection will engage the annular shoulder presented by the retrieving dogs C. After engagement of the projection 17 with the retrieving dogs, further upward movement of the mandrel will impart an upward movement to the packing assembly A. The lower edge 17b of the lower projection 17 is beveled or inclined to by-pass the lower dogs B, as will be explained. The upper projection 16 has its lower end 16a square to present a square shoulder while its upper edge is beveled or inclined as shown at 16b. It will thus be evident that when the upper projection or collar 16 is moved upwardly into engagement with the retrieving dogs C, the beveled upper edge 16b of said collar or projection will coact with the dogs C to radially expand said dogs and permit the collar or projection to move past said dogs. On the downward movement of the collar 16 past the dogs C, the square lower edge 16a will strike the lower inclined surface 39c of each dog C and through the cam action will radially expand said dogs to allow a downward passage of the upper collar or projection past the dogs C. It is thus apparent that the upper projection 16 may pass the retrieving dogs C in either direction, while the lower projection 17 cannot pass upwardly through said dogs.

As has been noted the upper expanding cone 36 is preferably made integral with the sleeve 35 to which the collar 34 is connected. An annular slip carrier D has its upper portion surrounding the expanding cone 36 and a supporting collar 41 threaded into the upper end of the carrier is adapted to rest upon a shoulder 42 formed on the expander cone 36. The lower portion of the slip carrier D surrounds a lower expanding cone 43 which is made integral with the upper end of a sleeve member 44 and a retaining collar 45 threaded into the lower end of the carrier is adapted to abut a shoulder 46 formed on the lower cone 43. A plurality of slots or openings 47 are formed in the slip carrier (Figure 7) and radially expandable gripping slips 48 are movable within these openings. Each gripping slip 48 has an upper expanding surface 49 coacting with the inclined surface 36a of the upper cone and a lower expanding surface 50 coacting with the lower expanding surface 43a of the lower cone. It will thus be evident that when the expanding cones 36 and 43 are moved toward each other their inclined surfaces will coact with the gripping slips 48 to radially expand such slips. A plurality of bowed friction springs 51 are secured to the carrier.

The sleeve 44 which extends from the lower expanding cone 43 has its lower end secured within a collar 52 similar to the collar 34 of the upper packing element unit. The collar 52 is provided with a cavity 53 which receives the lowering dogs B. The dogs B are constructed in exactly the same manner as the dogs C except that they are reversed. The dogs are maintained in engagement with the outer surface of the mandrel 10 by an annular spring 38a. The inner surface 39a of each dog B is inclined outwardly toward its lower end, and thus the upper ends 40a of each dog B present an upwardly facing shoulder which surrounds the mandrel.

The lower packing element 14 is connected with the collar 52 in the same manner as the upper packing element 13 is connected with its collar 34. Thus, a plurality of segments 54 have connection through hook portions 55 with an annular recess 56 provided in the collar 52. The segments are connected by pins 57 with the upper end of the packing element 14 and the lower end of the packing element has downwardly facing sealing lips 58.

Because of the disposition of the dogs B, it will be evident that the upper projection or collar 16 on the mandrel cannot pass downwardly past said dogs since the flat lower end 16a of said collar or projection will engage the shoulder 40a formed by said dogs. However, the lower projection 17 on the mandrel may freely by-pass the lowering dogs B because upon upward movement of

5

the projection 17 the square upper edge 17a will enter the bore of the dogs and through the cam action will radially expand the same to permit by-pass of the projection; upon a downward movement the bevelled lower end 17b of the projection will coact with the dogs B to spread the same and allow downward movement of said projection with respect to the assembly.

The packer is normally assembled as shown in Figures 4 and 4A, and it may be desirable to connect the slip carrier D to the upper expanding cone 36 through a relatively weak shear pin 59 and to also connect said carrier to the lower cone through a relatively weak shear pin 60. These shear pins will tend to assure that the expanding cones will not move toward each other until unequalized pressures are applied above and below the packing assembly. When the shear pins 59 and 60 are broken, a differential of pressure across the assembly and acting on the two packing elements 13 and 14 will move the expanding cones toward each other to radially expand the anchoring slips 48. It is noted that the shear pins are not actually required but are provided merely as an additional safety feature.

The operation of the apparatus is believed evident from the foregoing. The parts are assembled as shown in Figures 4, 4A and 4B, and upon a lowering of the mandrel 10 with respect to the packing assembly such lowering can continue until the upper collar or projection 16 engages the upper ends of the lowering dogs B. The frictional engagement of the friction springs 51 on the slip carrier D will tend to hold the slip carrier stationary and since the downward force is applied to the assembly A through the dogs B, a downward pull will be transmitted to the slip carrier through the engagement of the shoulder 46 on the lower cone 43 with the collar 45 of said carrier. This means that the lower cone is maintained downwardly with respect to the gripping slips. The upper cone will tend to remain stationary because of the frictional engagement of the packing element 13 with the wall of the pipe, and thus downward pull will be applied thereto from the slip collar 41 engaging the shoulder 42 of the upper cone 36. It is thus apparent that so long as the mandrel is moving downwardly and is applying downward force to the assembly A through the lowering dogs B, the anchoring slips will be in a retracted position. At this time pressures are equalized on opposite sides of the packer through the equalizing ports 27 (Figures 1 and 4) and a by-pass of fluid through the packing occurs through ports 23, annular passage 21 and ports 22. When it is desired to set the packers it is only necessary to lift upwardly on the mandrel 10 and move said mandrel to the position shown in Figure 2. The slip carrier will be held stationary at this time by the frictional engagement of the springs 51 together with the frictional engagement of the packing elements 13 and 14, and as soon as the equalizing port 27 moves upwardly above the upper packing element 13, the differential of pressures across the assembly A will result in moving the expanding cones 36 and 43 toward each other. If the shear pins 59 and 60 are employed the pressure differential across said assembly shears said pins to set the slips and thereafter pressure maintains the packing elements in sealed position. It is noted that the upward movement of the mandrel to the position shown in Figure 2 is permitted because, as explained, the upper projection 16 can pass upwardly past the upper retrieving dogs C. As the projection or collar 16 moves into engagement with the lower portions of the dogs C, the bevelled edge 16b functions to expand said dogs and allow a by-pass of the collar past said dogs. When the packer is in its set position, as shown in Figure 2, the lower by-pass port 23 of the mandrel has moved above the upper packing element to close the annular by-pass passage 21. The block 24 which shuts off the annular passage 21 is also in a position above the upper packing element. The parts remain in this position until it is desired to release the packer.

When release of the packer is to be carried out, it is only necessary to continue the upward movement of the mandrel 10 to the position shown in Figure 3. This moves the lower projection or collar 17 upwardly past the lowering dogs B and into engagement with the retrieving dogs C. This locates the lower equalizing passage 26 opposite the anchoring means whereby pressures

6

may equalize on opposite sides of both of the packing elements 13 and 14. A subsequent upward pull on the mandrel will transmit an upward pull through the dogs C to the upper expanding cone 36, whereby the cone is pulled upwardly relative to the slips. Since pressures across the packer are equalized a continued upward pull will return the parts to the position shown in Figures 4 and 4A and the packer is thus released and may be removed from the well bore.

In some instances, the release of the upper expanding cone 36 and equalization of pressures across the packer may not be sufficient to release the lower expanding cone 43 and in such case, it is only necessary after the upper cone is released to again move the mandrel downwardly so that the upper projection 16 may be utilized to jar downwardly on the lower cone 43 to effect its positive release. Thereafter, the mandrel is again raised to the position shown in Figure 3 and removal of the apparatus accomplished.

If it is desired to reset the packer without removing the same from the well bore, this, too, can be accomplished, because it is only necessary to again lower the mandrel downwardly through the assembly A. The frictional engagement of the friction springs, together with the engagement of the packing elements, will maintain the assembly A stationary and the lower projection 17 may move downwardly past the lowering dogs B. Thus, the parts can be returned to the position shown in Figure 1 and a resetting of the device at a different elevation may thus be accomplished. The apparatus requires no rotation of the lowering pipe or mandrel and the anchoring means and packing assembly is controlled in its actuation solely by longitudinal movement of the mandrel with respect to said assembly. The various ports which allow a by-pass of fluid when the packer is being lowered or raised and which close any by-pass of fluid when the packer is set are automatically controlled by the manipulation of the mandrel. In other words, when the mandrel is moved in order to set or release the assembly the by-pass is closed or opened as conditions require.

As described and shown in the drawings the tubular mandrel 10 is illustrated as having the upper projections 16 and as having the lower projections 17 secured thereto. The upper projections coact with the lower dogs B to move the packing assembly downwardly within the well pipe, while the lower projections 17 coact with the upper dogs C to effect removal of the packing assembly. It is pointed out that it might be desirable to remove the mandrel 10 after the packer is set so as to replace the mandrel with an ordinary tubing string. In such case the mandrel 10 may carry only the upper projection 16 which would permit lowering of the packing assembly and setting thereof in the manner hereinbefore described. Thereafter, the mandrel having only the projection 16 may be removed and replaced with a tubing. When it is desired to remove the packing assembly, a retrieving mandrel having the lower projection 17 thereon would be lowered and engaged with the dogs C in the manner hereinbefore described to effect removal. Actually, in this modification the operation would be the same except that a running-in mandrel having the projection 16 thereon is utilized to lower the packing assembly A into position and a separate retrieving mandrel having the projection 17 is subsequently lowered to effect removal.

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

Having described the invention, I claim:

1. A well packer for use in a well bore including, a mandrel adapted to be disposed in the well bore with an annular space therebetween, an annular packing assembly surrounding the mandrel and slidable thereon for sealing off the annular space between the mandrel and the wall of the well bore, said packing assembly comprising an upper annular packing element, a lower annular packing element, an anchoring means disposed between the packing elements and including gripping slips adapted to grip the wall of the well bore, expander means forming part of the anchoring means and connected to the packing

7

elements for longitudinal movement relative to said slips, said expander means being operable to move said gripping slips into gripping engagement with the wall of the well bore when said elements are moved longitudinally toward each other and to release said gripping slips from engagement with the wall of the well bore when said elements are moved longitudinally away from each other, a lowering dog connected to the lower packing element and extending into the bore of the annular packing assembly, and a lug on said mandrel adapted to engage said lowering dog when the mandrel is moved longitudinally in a downward direction within the well bore to urge said lower packing element downwardly relative to said gripping slips, said upper packing element being engageable with the wall of the well bore to resist downward movement thereof during such lowering of the lower packing element so that said packing elements are urged longitudinally away from each other to position said gripping slips out of engagement with the wall of the well bore, whereby upon lowering of the mandrel in the well bore said packing assembly is lowered therewith while maintaining the gripping slips out of engagement with the wall of the well bore.

2. The structure set forth in claim 1, including a retrieving dog connected to the upper packing element, and a second lug on said mandrel adapted to engage said retrieving dog when the mandrel is moved longitudinally in an upward direction within the well bore to urge said upper packing element upwardly relative to said gripping slips, said lower packing element being engageable with the wall of the well bore to resist upward movement thereof during such raising of the upper packing element so that said packing elements are urged longitudinally away from each other to position said gripping slips out of engagement with the wall of the well bore, whereby upon raising of the mandrel in the well bore with said second lug and said retrieving dog in engagement said packing assembly is raised therewith while maintaining the gripping slips out of engagement with the wall of the well bore, co-acting means on said first lug and said retrieving dog for permitting said first lug to move past said retrieving dog, and co-acting means on said second lug and said lowering dog for permitting said second lug to move past said lowering dog.

3. The structure set forth in claim 1, together with a fluid-conducting by-pass channel in the mandrel and extending inside of and through the packing assembly to by-pass fluid through said assembly when the lug is in engagement with the lowering dog during the lowering of the mandrel and packing assembly, said channel having a lower port therein which is closed when said mandrel is moved upwardly relative to the packing assembly to position the port above said lower packing element.

4. A well packer for use in a well bore including, an elongate tubular mandrel adapted to be disposed in the well bore with an annular space therebetween, an annular packing assembly slidable on the mandrel for sealing off said annular space, said packing assembly including an upper annular packing element, a lower packing element, anchoring slips disposed between said packing elements and adapted to engage the wall of the well bore, slip expander means slidably connected with said anchoring slips and adapted to urge said anchoring slips into engagement with the wall of the well bore, said packing elements being secured to said slip expander means to move said expander means longitudinally relative to and toward said slips upon a longitudinal movement of said elements toward each other to thereby move the slips into engagement with the wall of the well bore, said packing elements being movable longitudinally toward each other when a differential in fluid pressures in the well bore exists across the packing assembly, lowering dogs connected to the lower packing element and extending into the bore of the assembly, a first projection on the mandrel adapted to engage and coast with the lowering dogs so that when the mandrel is moved downwardly said lower packing element is moved downwardly away from said upper packing element whereby said slip expander means is moved longitudinally relative to and away from said slips to permit said slips to move out of gripping engagement with the wall of the well bore, said packing elements moving longitudinally toward each other by a differential in fluid pressures in the well bore when the mandrel is moved upwardly to release the engagement of the lower-

8

ing dogs and the first projection, retrieving dogs connected to the upper packing element and extending into the bore of the packing assembly, and a second projection on the mandrel below said first projection adapted to engage said retrieving dogs when the mandrel is moved upwardly a predetermined distance with respect to the packing assembly to move the upper packing element longitudinally away from the lower packing element whereby said packing assembly can be removed from the well bore, co-acting means on said first projection and said retrieving dogs for permitting said first projection to move past said retrieving dogs, and co-acting means on said second projection and said lowering dogs for permitting said second projection to move past said lowering dogs.

5. A well packer as set forth in claim 4, wherein the lowering dogs are radially expandable, means on the second projection for coacting with the lowering dogs to expand the same and allow said second projection to move past said lowering dogs in either direction, said retrieving dogs being radially expandable, and means on the first projection coacting with said retrieving dogs for expanding the same to allow the first projection to move past said retrieving dogs in either direction.

6. As a subcombination in a well packer, a well packer assembly including, an upper annular packing element normally substantially engaging the surrounding well wall when unexpanded, a lower annular packing element normally substantially engaging the surrounding well wall when unexpanded, an anchoring means disposed between the packing elements and including gripping slips adapted to grip the wall of the well bore into which the packer is lowered, expander means forming part of the anchoring means and connected to the packing elements for longitudinal movement relative to said slips, said expander means being operable to move said gripping slips into gripping engagement with the wall of the well bore when said elements are moved longitudinally toward each other and to release said gripping slips from engagement with the wall of the well bore when said elements are moved longitudinally away from each other, a retractible lowering dog mounted in the lower packer and projecting inwardly into the bore through the assembly, and an upper retractible retrieving dog mounted in the upper packing element and projecting inwardly into the bore through the assembly.

7. A well packer assembly as set forth in claim 6, wherein the lowering dog presents an upwardly facing shoulder within the bore of the assembly, and the retrieving dog presents a downwardly facing shoulder within the bore of said assembly.

8. A well packer for use within a well pipe including a mandrel adapted to be disposed in the well pipe with an annular space therebetween, an annular packing assembly surrounding and slidable on said mandrel and fluid pressure actuable into sealing engagement with the surrounding well pipe for sealing off said annular space, a series of retractible lowering dogs mounted in the lower portion of the assembly and normally engaging the outer surface of the mandrel, a series of retractible retrieving dogs mounted in the upper portion of the assembly and normally engaging the outer surface of the mandrel, an upper projection on the mandrel including means therewith for retracting said retrieving dogs as said mandrel is lowered whereby said upper projection is movable downwardly past the retrieving dogs, and means on said upper projection engageable with the lowering dogs for lowering said packer assembly into the well pipe as the mandrel is lowered therein; a lower projection on the mandrel including means therewith for retracting said lowering dogs as said mandrel is lifted whereby the lower projection is movable upwardly past the lowering dogs, and means on said lower projection engageable with the retrieving dogs for lifting and removing said packer assembly from the well pipe; said annular packing assembly including means for frictionally engaging the well pipe and maintaining the assembly stationary in the well pipe when the upper projection is out of engagement with the lowering dogs and the lower projection is out of engagement with the retrieving dogs.

9. A well packer as set forth in claim 8, together with a fluid-conducting by-pass channel inside of the mandrel and extending through the packing assembly and means for maintaining said by-pass channel in an open position when the upper projection on the mandrel is in engage-

ment with the lowering elements to thereby equalize the fluid pressure above and below said packing assembly during the lowering of the assembly in the well pipe.

References Cited in the file of this patent

5

UNITED STATES PATENTS

2,343,076 Otis et al. ----- Feb. 29, 1944

2,384,192

2,442,529

2,578,900

2,582,700

2,585,706

Otis et al. ----- Sept. 4, 1945
 Clark ----- June 1, 1948
 Ragan ----- Dec. 18, 1951
 Jones ----- Jan. 15, 1952
 Ware ----- Feb. 12, 1952