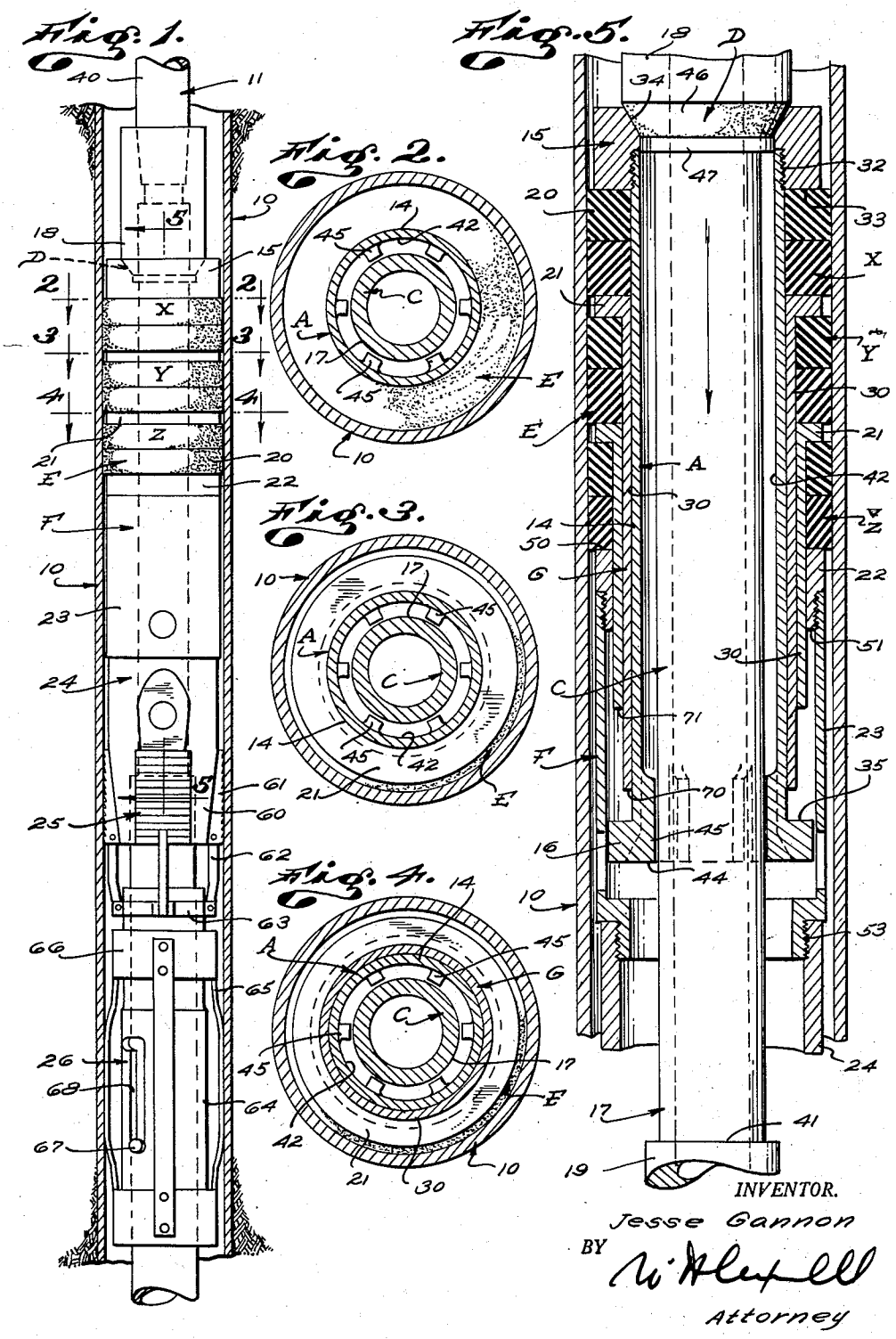
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PACKER FOR WELLS

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Fig. 6.

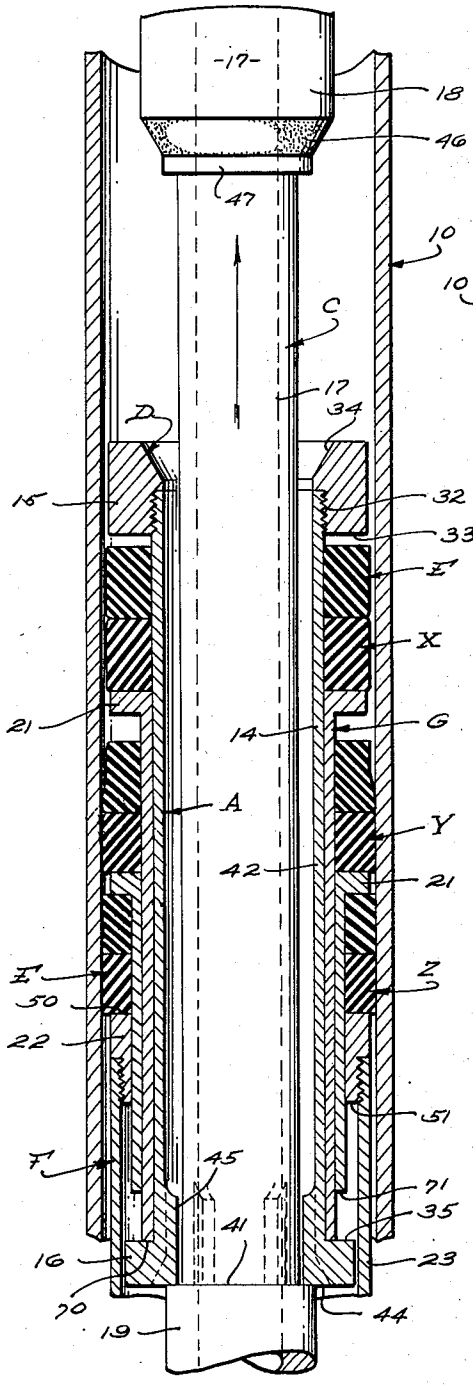
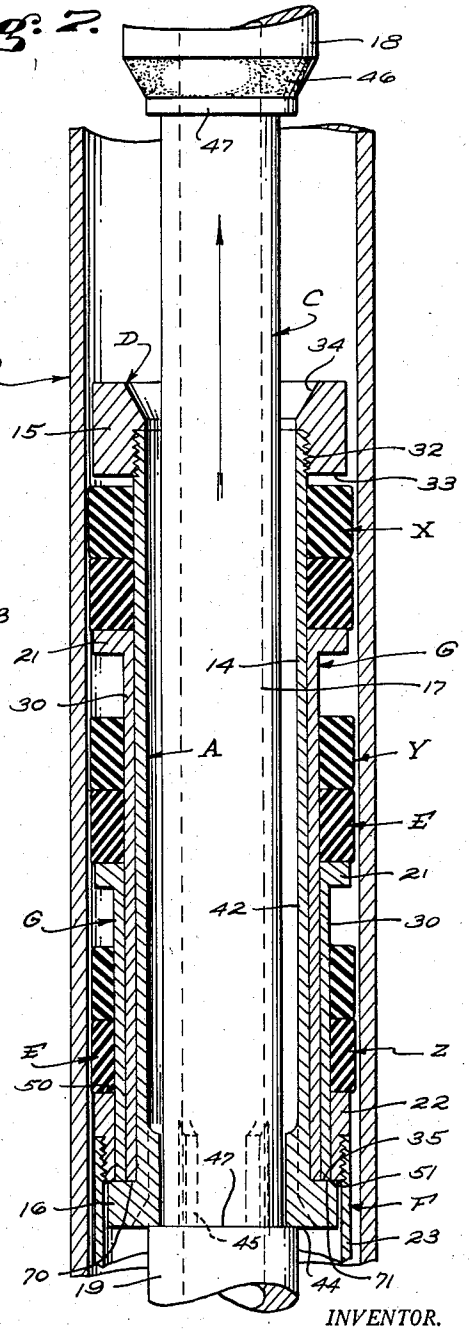


Fig. 7.



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PACKER FOR WELLS

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8 Claims. (Cl. 166—191)

This invention relates to packers for wells, and it is a general object of the invention to provide a simple, practical improved construction for packing between parts or objects in a well and which is such that it can be easily and quickly released or freed when desired.

It is common in many situations to employ packers in wells to seal between parts or elements as, for example, between tubing and casing. It is common to employ soft or deformable packers, say for example rubber packers, in situations of this kind. When rubber or rubber-like materials are thus used they are subject to becoming set, making their release or removal difficult and in some cases impossible.

It is a general object of this invention to provide a well packer construction involving a plurality of individual or separate packers adapted to be successively released, the construction provided being such that it is free of parts subject to failure or binding and is such that it can be easily and economically manufactured and handled in the field.

Another object of the invention is to provide a packer of the general character referred to, that is, one wherein a plurality of packers are adapted to be successively released or freed and wherein lifters are provided to effect the release of the packers, which lifters are tubular in form and telescopically related providing a structure wherein the parts are simple and are effectively guided relative to each other.

It is another object of this invention to provide a well packer of the general character referred to having a mechanism for effecting successive release of separate packers, which mechanism is characterized by but a few simple parts and is such that the packers involved may be formed of simple or common annular bodies of packing material.

In a typical application of the invention the structure can be employed to pack between the tubing and the casing, and the structure provided by the invention may be applied to the lower end of a string of tubing or can be connected in a string of tubing. In general, the structure embodying the invention includes a body which is an elongate tubular element with a flange at its lower end. A mandrel operates within the body which is longer than the body and is related or coupled thereto so that limited movement occurs between the body and mandrel longitudinally of the structure. A flow control is provided to seal between the mandrel and body when the mandrel is in its lowermost position relative to the body. A packing means is provided and involves a plurality of simple annular packers surrounding a core and spaced apart longitudinally thereof. The packers are deformable or expansible and are adapted to seal against the interior of the well casing. In accordance with the invention annular rings or spacers occur between adjacent packers. A support is provided for the packing means and is adapted to be engaged by the lowermost packer. In a typical construction the support involves an upper section carrying a collar that may engage the lowermost packer. A lower section of the support carries a gripping means or slip mechanism and a control means for the gripping means. A packer releasing means is provided and is adapted to effect successive lifting or forcing of the packers upwardly following release of pressure from the packers and upon continued upward movement or lifting of the core as by elevation of the tubing. The releasing means is characterized by lifters, preferably tubular elements or sleeves,

slidable one within the other and on the body, there being a sleeve for each spacer of the packing means. The several sleeves are of different lengths and are related so that when the mandrel is picked up, as by elevation of the tubing, the body is engaged and moved upwardly and successively engages the sleeves lifting them one after the other, with consequent lifting of the packers one after the other.

The various objects and features of my invention will be fully understood from the following detailed description of a typical preferred form and application of the invention, throughout which description reference is made to the accompanying drawings, in which:

Fig. 1 is a side elevation of a structure embodying the invention, showing it located in a well casing which is illustrated in section, the structure of the present invention being shown on or coupled in a string of tubing and the parts being shown set or engaged with the several packers in sealing engagement with the interior of the casing. Fig. 2 is an enlarged plan section taken as indicated by line **2—2** on Fig. 1. Fig. 3 is an enlarged plan section taken as indicated by line **3—3** on Fig. 1. Fig. 4 is an enlarged plan section take as indicated by line **4—4** on Fig. 1. Fig. 5 is an enlarged detailed vertical sectional view of a portion of the structure, being a view taken substantially as indicated by line **5—5** on Fig. 1. Fig. 6 is a view similar to Fig. 5, showing the positioning of parts that occur as the mandrel is being elevated to effect successive release of the packers, and Fig. 7 is a view similar to Fig. 6, showing the parts positioned with the lifting means fully actuated so that all of the packers are released.

The structure provided by the present invention is shown in the drawings in a typical situation serving to pack between a well casing **10** and a tubing **11** within the casing. The structure is shown carried by or incorporated in the string of tubing **11**. However, it will be obvious that it may, if desired, be simply carried by or attached to the lower end of a string of tubing, or the like.

The structure including the present invention is characterized by an elongate tubular body A with a main section **14**, a head **15** on the upper end of section **14**, and a flange **16** on the lower end of section **14**. A mandrel C, preferably tubular in form, is located in and extends through the body A. The mandrel has a main section **17** longer than the body and has a stop or abutment **18** at the upper end of section **17** and an abutment **19** at the lower end of section **17**. A flow controlling means D operates to seal between the stop **18** and the head **15** when the mandrel is in a down or lowered position relative to the body. A packing means E is provided and is characterized by a plurality of simple annular packers **20** spaced apart axially of the structure by spacers **21**. A packer supporting means F is provided and is characterized by a collar **22** engaged under and supporting the lowermost packer **20**. The collar **22** is on an upper section **23** of means F while a lower section **24** of means F depends below the body and mandrel and carries the casing gripping means **25** and control means **26** for the gripping means **25**. A packer releasing means G is provided and is characterized by a plurality of tubular lifters or sleeves **30** which are connected to or carry the spacers **21** and which are cooperatively related to the flange **16** provided at the lower end of body A.

The body A, as above pointed out, is characteristically an elongate tubular element and in practice is preferably of sectional construction. In the case illustrated, the main section **14** of the body A is a simple elongate tubular element, round in cross-section. The head **15** is preferably formed separate from section **14** and is releasably connected thereto as by a threaded connection **32**. It will be noted that the head **15** is threaded onto the upper end of the main section **14** and presents a downwardly facing shoulder **33**. The upper inner portion or corner of the head **15** is finished, preferably beveled, to form a seat **34**. The flange **16** provided at the lower end of the body section **14** is shown as integral with section **14** and projects radially outward therefrom, establishing an upwardly facing lift shoulder **35** at the lower end of the body.

The mandrel C is preferably a sectional structure and

is shown as an elongate tubular element. The main section 17 of the mandrel C fits through the main section 14 of body A with clearance, and it is considerably longer than the body as will be apparent from the drawings. the abutment 18 provided at the upper end of the main section 17 of the mandrel is in the nature of an enlargement at the upper end of the mandrel overlying the body. In the case illustrated the abutment 18 is threaded onto the upper end of section 17, and this element of the mandrel may be employed, as shown in the drawings, as a coupling by which the structure provided by the present invention is connected to the tubing section 40, (see Fig. 1).

The abutment 19 at the lower end of section 17 of the mandrel is in the nature of an enlargement presenting an upwardly facing shoulder 41 adapted to engage or cooperate with the lower end of body A. In the case illustrated, the section 17 of the mandrel is considerably smaller in diameter than the bore or opening 42 through the body section 14, and the shoulder 41 is adapted to engage the lower ends 44 of an annular series of ribs 45 provided in the body at the lower end portion thereof. The ribs 45 guide and centralize the mandrel section 17 within the body section 114.

With the construction thus far described, the body A and mandrel C are coupled or related for limited relative movement lengthwise of the structure. Assuming the body to be stationary the abutment 18 engages head 15 when the mandrel is lowered, whereas the shoulder 41 engages the lower end of the body when the mandrel is elevated.

The flow control means D is provided to seal between the mandrel and body when the core is in a down position relative to the body. In the case illustrated the means D is shown as involving an annular ring or body of packing 46 located at the lower end of abutment 18 and held between the abutment 18 and a ring 47 provided on and projecting from the section 17 of the mandrel. The packing ring 46 is adapted to engage and seal with the seat 34 of head 15 provided on the body A.

The packing means E provided by the present invention is characterized by a plurality of simple annular packers surrounding the body and engageable with the interior of the casing 10. The several packers are spaced apart axially of the structure by the spacers 21 and in practice the number of packers can be varied as circumstances require. In the case illustrated there are but three packers, an upper packer X, a lower packer Y, and an intermediate packer Z. A feature of the present invention is the construction which makes possible the use of packers of simple construction, and as shown in the drawings each packer is made up of simple annular bodies or rings of packing material free of apertures or other special features of construction or formation. In a typical carrying out of the invention, the rings employed in the packers may be rings of rubber or rubber-like material as circumstances require.

The supporting means F involves the collar 22 that surrounds the body and is slidable on the outermost lifter 30 of means G. In the case illustrated the collar 22 is shown screw-threaded onto the upper end of the upper section 23 of means F, and it has an upwardly facing shoulder 50 engageable with the lower end of the lower packer Y and a downwardly facing shoulder 51 adapted to cooperate with the lifted shoulder 35, as will be hereinafter described.

The upper section 23 of means F is shown connected to the lower section 24 by a threaded connection 53, and the lower section 24 depends a substantial distance below the body A and may depend below the core C.

The gripping means 25 provided on or carried by the lower section 24 may be of any suitable form or construction. Means 25 is illustrated in the drawings as including a wedge element 60 carried by section 24, slips 61 cooperating with and adapted to be expanded by the wedge 60 to engage the casing 10, and links 62 coupling the slips 61 to a ring 63.

The control means 26 may in practice be of any suitable form or construction. In the case illustrated, means 26 is shown as including a tubular shell 64 slidable on the lower section 24 and carrying the ring 63. A plurality of outwardly bowed springs 65 have their lower ends anchored to the shell 64 while their upper ends are carried by a collar 66 slidable on the shell. A pin 67 projects from the section 24 and operates in a bayonet

slot 68 provided in the shell 64. This type of control and the type of gripping means 25 above described are merely typical of mechanisms of this character commonly employed in structures of this general character.

The lifting means G provided by the present invention is characterized by a plurality of lifters 30. In the preferred form of the invention, there is a lifter for or attached to each spacer 21. The lifters 30 are in the form of sleeves slidable one within the other and the innermost of the sleeves is slidable on the section 14 of body A. In the preferred arrangement illustrated in the drawings, the uppermost spacer 21, that is, the spacer between packers X and Y, is fixed to the upper end of the innermost lifter 30 and this lifter is slidable on the body section 14. The spacer 21 between packers Z and Y is fixed to the upper end of the next or outermost lifter and this lifter is slidable on the one first mentioned, that is, the one carrying the spacer engaged by the packers X and Y.

The parts hereinabove described are related and proportioned so that when the mandrel C is down relative to the body A, with the means D engaged or sealing between the mandrel and the body, the flange 16 of the body is well below the collar 22 of the supporting means F, and the several packers are under compression between the collar 22 of supporting means F and the head 15 of the body so that they are expanded and are effectively held in sealing engagement with the interior of casing 10. When it is desired to release the packing means it is merely necessary to elevate the tubing 11 so that the mandrel C is lifted. Initial lifting of the mandrel releases the means D, and continued lifting of the mandrel causes shoulder 41 to engage the ends 44 of ribs 45 following which shoulder 35 engages the lower end 70 of the lifter which is slidably engaged on section 14 of body A. As a result of this operation the packer X is released while the other packers remain undisturbed. As the mandrel moves up the spacer 21 between the packers X and Y moves up carrying packer X with it and freeing packer Y so that when the shoulder 35 engages the end 71 of the lifter carrying the spacer beneath packer Y so that packer Y is moved up and packer Z is released. Further or continued elevation of the mandrel results in the shoulder 35 engaging the shoulder 51 of collar 22 with consequent lifting of the released lowermost packer Z. It will be apparent that as a result of the action just described, when the mandrel C is elevated from the position shown in Fig. 5 to that shown in Fig. 7, the several packers of means E are successively released, the uppermost first, the intermediate one next, and the lowermost one last. In the course of this operation, the lifting pressure or force on the mandrel is utilized in breaking or freeing but one packer at a time, with the result that desired freeing of the packing means is effected and the danger of a frozen packer construction is minimized, if not completely eliminated.

When the structure is being lowered into a well, that is, downwardly through the casing 10, the control means 26 is set or positioned with the ring 63 held down so that the slips 61 are down or retracted relative to the wedge 60. When the packer has reached the desired position in the casing, the tubing 11 is rotated releasing the pin 67 so that lowering of the tubing results in the slips 61 being wedged out or expanded by the wedge 60, thus setting the supporting means F against downward movement in the casing. Further lowering of the tubing will then operate the structure from a released position, such as is shown in Fig. 7, to a set or actuated position, such as is shown in Fig. 1. As hereinabove described, release of the structure occurs when the tubing is merely lifted vertically, and as the structure is released the several packers of means E are successively released.

Having described only a typical preferred form and application of my invention, I do not wish to be limited or restricted to the specific details herein set forth, but wish to reserve to myself any variations or modifications that may appear to those skilled in the art and fall within the scope of the following claims.

Having described my invention, I claim:

1. A well packer including an elongate tubular body having a head at its upper end and projecting therefrom, and a flange at its lower end and projecting therefrom, a vertically movable mandrel extending through the body and projecting above the head, the mandrel having upper and lower abutments at its ends engageable with the

head and flange and spaced apart a distance greater than the length of the body thereby providing for relative movement between the mandrel and body, sealing means adapted to seal between the mandrel and body when the mandrel is in a predetermined position relative to the body, a plurality of packers surrounding the body and supported therefrom, the packers being one above the other and the uppermost packer being engageable under the head, spacers between adjacent packers, a support adapted to support the lowermost packer in a well against downward movement therein, and lifters engaging the spacers and depending therefrom and adapted to be successively engaged by the flange at the lower end of the body and lifted thereby upon upward movement of the body relative to the support, the lower abutment being engageable with the flange on the body upon upward movement of the mandrel.

2. A well packer including an elongate tubular body having a head at its upper end and projecting therefrom, and a flange at its lower end projecting radially outward therefrom, a vertically movable mandrel extending through the body and projecting above the head, the mandrel having upper and lower abutments at its ends engageable with the head and flange and spaced apart a distance greater than the length of the body thereby providing for relative movement between the mandrel and body, sealing means adapted to seal between the mandrel and body when the mandrel is in a predetermined position relative to the body, a plurality of packers surrounding the body and carried thereby, spacers between adjacent packers, a support adapted to support the lowermost packer in a well against downward movement therein, and lifters engaging the spacers and depending therefrom and adapted to be successively engaged by the flange at the lower end of the flange and lifted thereby upon upward movement of the body relative to the support, the lower abutment being engageable with the flange on the body upon upward movement of the mandrel.

3. A well packer including an elongate tubular body having a head at its upper end and projecting therefrom, and a flange at its lower end and projecting therefrom, a vertically movable mandrel extending through the body and projecting above the head, the mandrel having upper and lower abutments at its ends engageable with the head and flange and spaced apart a distance greater than the length of the body thereby providing for relative movement between the mandrel and body, sealing means adapted to seal between the mandrel and body when the mandrel is in a predetermined position relative to the body, a plurality of packers surrounding the body and supported therefrom, the packers being one above the other and the uppermost packer being engageable under the head, spacers between adjacent packers, a support adapted to support the lowermost packer in a well against downward movement therein, lifters engaging the spacers and depending therefrom and adapted to be successively engaged by the flange at the lower end of the body and lifted thereby upon upward movement of the body relative to the support, the lower abutment being engageable with the flange on the body upon upward movement of the mandrel and a second sealing means adapted to seal between the body and mandrel and including, a packing ring carried by the abutment at the upper end of the core and engageable with the head of the body when the mandrel is lowered relative to the body.

4. A well packer including an elongate tubular body having a head at its upper end and projecting therefrom, and a flange at its lower end and projecting therefrom, a vertically movable mandrel extending through the body and projecting above the head, the mandrel having upper and lower abutments at its ends engageable with the head and flange and spaced apart a distance greater than the length of the body thereby providing for relative movement between the mandrel and body, sealing means adapted to seal between the mandrel and body when the mandrel is in a predetermined position relative to the body, a plurality of packers surrounding the body and supported therefrom, the packers being one above the other and the uppermost packer being engageable under the head, spacers between adjacent packers, a support adapted to support the lowermost packer in a well against downward movement therein, lifters engaging the spacers and depending therefrom and adapted to be successively engaged by the flange at the lower end of the body and lifter thereby upon upward movement of the body relative to the support, the lower abutment being engageable with the flange on the body upon upward movement of the mandrel the support including a member surrounding the lifters and movable relative thereto and engaged under the lowermost packer, a gripping means supporting the mandrel in the casing and adapted to engage and grip a casing, and a control means adapted to actuate the gripping means into engagement with the casing.

5. A well packer including an elongate tubular body having a head at its upper end and projecting therefrom, and a flange at its lower end and projecting therefrom, a vertically movable mandrel extending through the body and projecting above the head, the mandrel having upper and lower abutments at its ends engageable with the head and flange and spaced apart a distance greater than the length of the body thereby providing for relative movement between the mandrel and body, sealing means adapted to seal between the mandrel and body when the mandrel is in a predetermined position relative to the body, a plurality of packers surrounding the body and supported therefrom, the packers being one above the other and the uppermost packer being engageable under the head, spacers between adjacent packers, a support adapted to support the lowermost packer in a well against downward movement therein, lifters engaging the spacers and depending therefrom and adapted to be successively engaged by the flange at the lower end of the body and lifted thereby upon upward movement of the body relative to the support, the lower abutment being engageable with the flange on the body upon upward movement of the mandrel the lifters being arranged one within the other, and the support including a tubular structure with a collar surrounding the lifters and engaged under the lowermost packer, a slip mechanism supporting the mandrel in the casing and carried by said structure, and control means adapted to actuate the slip mechanism into engagement with the casing.

6. A well packer including an elongate tubular body having a head at its upper end and projecting therefrom, and a flange at its lower end and projecting therefrom, a vertically movable mandrel extending through the body and projecting above the head, the mandrel having upper and lower abutments at its ends engageable with the head and flange and spaced apart a distance greater than the length of the body thereby providing for relative movement between the mandrel and body, sealing means adapted to seal between the mandrel and body when the mandrel is in a predetermined position relative to the body, a plurality of packers surrounding the body and supported therefrom, the packers being one above the other and the uppermost packer being engageable under the head, spacers between adjacent packers, a support adapted to support the lowermost packer in a well against downward movement therein, and lifters engaging the spacers and depending therefrom and adapted to be successively engaged by the flange at the lower end of the body and lifted thereby upon upward movement of the body relative to the support, the lower abutment being engageable with the flange on the body upon upward movement of the mandrel the lifters being tubular telescopically related members, the innermost of which surrounds and is slidable on the body and carries the uppermost spacer while the outermost is engaged through the lowermost packer and carries the spacer adjacent the upper end of the lowermost packer.

7. A well packer including an elongate tubular body having a head at its upper end and projecting therefrom, and a flange at its lower end and projecting therefrom, a vertically movable mandrel extending through the body and projecting above the head, the mandrel having upper and lower abutments at its ends engageable with the body and spaced apart a distance greater than the length of the body thereby providing for relative movement between the mandrel and body, sealing means adapted to seal between the mandrel and body when the mandrel is in a predetermined position relative to the body, a plurality of packers surrounding the body and supported therefrom, the packers being one above the other and the uppermost packer being engageable under the head, spacers between adjacent packers, a support adapted to support the lowermost packer in a well against downward movement therein, and lifters engaging the spacers

and depending therefrom and adapted to be successively engaged by the flange at the lower end of the body and lifted thereby upon upward movement of the body relative to the support, the lower abutment being engageable with the flange on the body upon upward movement of the mandrel the lifters being tubular members engaged one within another with the innermost lifter engaged around the body, the uppermost packer being engaged around and supported directly on the body and by the spacer on the innermost lifter and the other packers being engaged on the other lifters.

8. A well packer including an elongate tubular body having a head at its upper end and projecting therefrom, and a flange at its lower end and projecting therefrom, a mandrel longer than the body and extending therethrough and projecting from the ends of the body, and having upper and lower abutments at its ends projecting therefrom and engageable with the head and flange, a packing ring carried by the abutment at the upper end of the mandrel and adapted to engage and seal with the head when the mandrel is down relative to the body, a plurality of packers surrounding the body, a support collar engaged under the lowermost packer, an element depending from the collar to a point below the body, a slip mechanism supporting said element and adapted to be operated to engage a casing, a control means adapted to control the slip mechanism, spacers between adjacent packers, and tubular lifters telescopically related to each other and surrounding the body and each carrying a spacer, the lifters being adapted to be successively engaged by the flange at the lower end of the body and lifted by the flange upon the mandrel being moved upwardly to lift the body relative to the collar, the uppermost packer being in direct engagement with the body and the head of the body and the other packers being carried on the lifters in engagement therewith.

References Cited in the file of this patent

UNITED STATES PATENTS

1,925,016	Wells	Aug. 29, 1933
2,074,912	Hutto	Mar. 23, 1937
2,216,336	Barnes et al.	Oct. 1, 1940
2,216,358	Spencer	Oct. 1, 1940
2,418,493	Allen	Apr. 8, 1947