

May 27, 1958

C. C. BROWN

2,836,250

HOLD-DOWN DEVICES FOR WELL PACKERS

Filed Dec. 24, 1952

3 Sheets-Sheet 1

Fig. 1

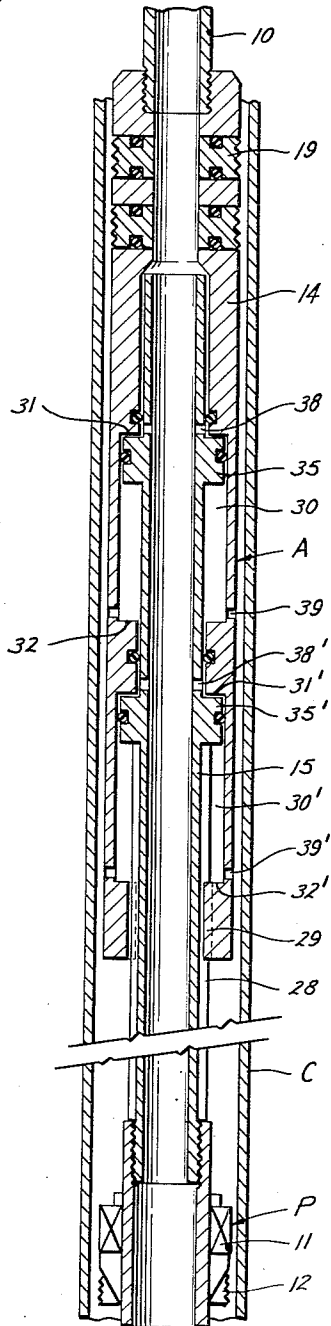
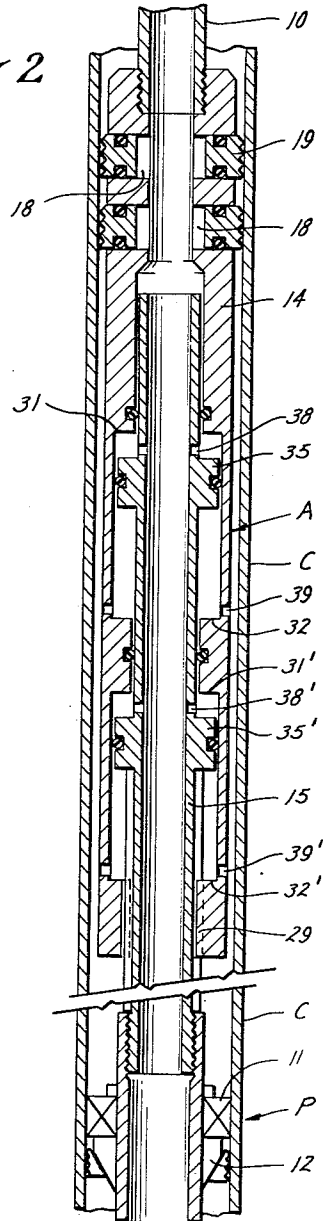


Fig. 2



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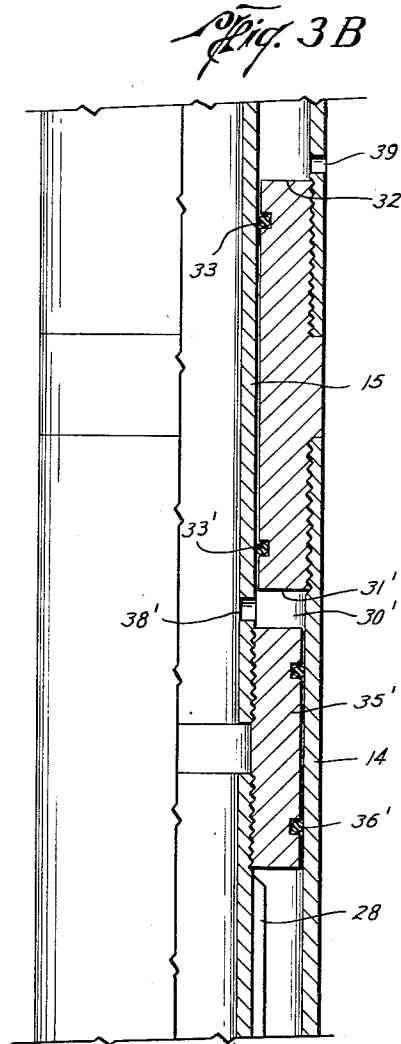
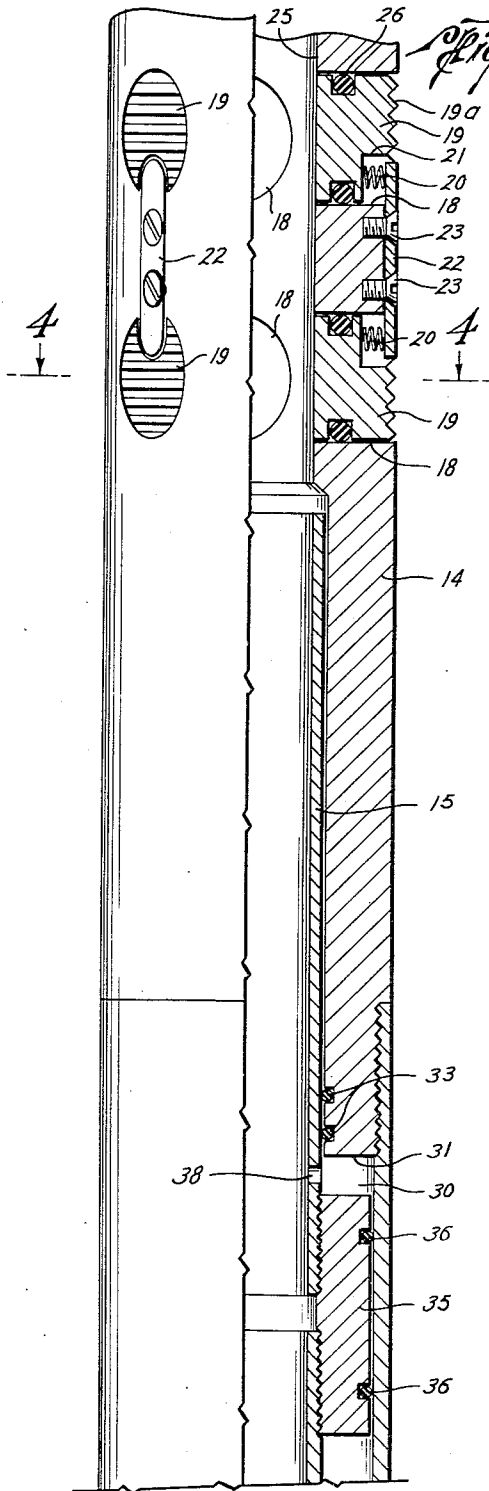
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3 Sheets-Sheet 3

Fig. 3C

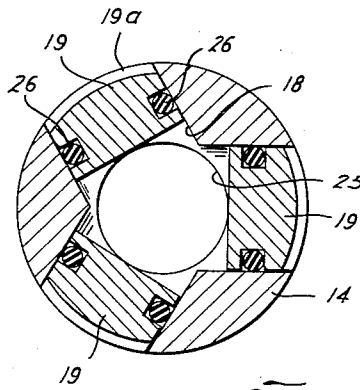
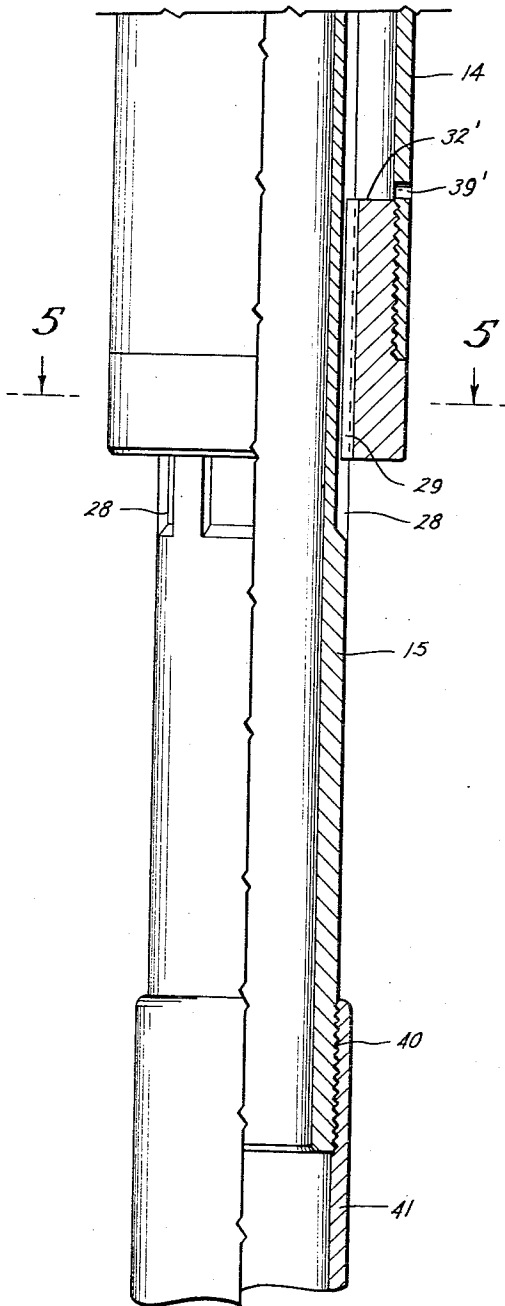
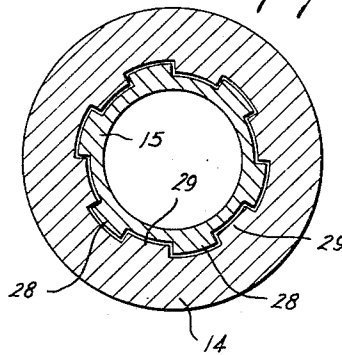


Fig. 4

Fig. 5



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HOLD-DOWN DEVICES FOR WELL PACKERS

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3 Claims. (Cl. 166—134)

This invention relates to new and useful improvements in hold-down devices for well packers.

An object of this invention is to provide an improved fluid actuated hold-down device for a well packer wherein the hold-down device is adapted to be actuated by a fluid pressure to apply a force to the packer to maintain same in a set position in a well pipe or casing. An important object of this invention is to provide a fluid actuated hold-down device for maintaining a well packer in its set position in a well pipe or casing in which said device has an actuating member with pistons thereon whereby upon an application of fluid pressure to said pistons said actuating member is forced longitudinally to apply a force to the packer to maintain same in said set position.

Another object of this invention is to provide an improved hold-down device for a well packer adapted to be set in engagement with a well pipe or casing by a lowering of the support tubing therefor relative to the packer, wherein said hold-down device provides a slidable connection between said support tubing and said packer, said slidable connection having a means for transmitting the force of a fluid pressure to said packer to prevent the unsetting thereof even when sudden surges of well pressure of extreme well pressures act in a direction tending to unset the packer.

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 drawing forming a part thereof, wherein an example of the invention is shown, and wherein:

Fig. 1 is a vertical sectional view illustrating the hold-down device of this invention connected to a well packer, with the parts in the position for lowering of the hold-down device and the packer to the predetermined point in a well casing.

Fig. 2 is a view similar to Fig. 1 but illustrates the relationship of the parts when the hold-down device has been actuated by fluid pressure to apply a setting force to the well packer.

Figs. 3A, 3B, and 3C are views, partly in section and partly in elevation, which illustrate substantially the complete hold-down device of this invention, with Fig. 3A illustrating the upper portion, Fig. 3B illustrating the intermediate portion, and Fig. 3C illustrating the lower portion.

Fig. 4 is a horizontal sectional view taken on line 4—4 of Fig. 3A.

Fig. 5 is a horizontal sectional view taken on line 5—5 of Fig. 3C.

In the drawings, the letter A designates generally the hold-down device of this invention which has connection with a well packer P which is adapted to be set in a well pipe or casing C. The hold-down device A and the packer P are lowered into the well casing C on a sup-

port tubing 10, with the hold-down device A providing a slidable connection between the tubing 10 and the well packer P. The well packer P may be of any known construction, such as a hook wall packer, and would include a packing element 11 for sealingly engaging the well casing and slips 12 for gripping the casing. The well packer P is shown schematically in the drawings since it may be of any conventional type. The hold-down device A includes a housing 14 and an inner mandrel 15 with the upper end of the housing 14 being connected to the tubing 10 and the lower end of the mandrel 15 being connected to the packer P. The mandrel 15 telescopes within the housing 14 and is movable longitudinally relative thereto and, as will be explained, a fluid pressure may be applied to the mandrel to move same downwardly with respect to the housing 14 to apply a force to the packer to maintain the packer P in its set position in the well casing C.

The details of the hold-down device A can be seen in Figs. 3A-5 of the drawings. At the upper end of the housing 14 and below the connection of the housing 14 to the support tubing 10, a plurality of radial or lateral slots or openings 18 are provided for receiving a piston gripping member 19 in each of the slots 18. Each of the piston gripping members 19 has gripping teeth 19a formed on its arcuate outer surface for contact with the well casing C. Each piston gripping member 19 is radially slidable in its slot 18 and is normally confined within the gripping teeth in a retracted position substantially flush with the exterior of the housing 14 by means of a coil spring 20 disposed in a notch 21. A retainer plate 22 is disposed in front of each of the coil springs 20, with one plate 22 serving to hold the springs 20 for two of the piston gripping members 19 which are disposed in the same vertical plane. These retaining plates 22 may be connected to the housing 14 by screws 23 or any suitable means. The pistons 19 are moved outwardly against the action of the springs 20 by a fluid force which acts against each rear face 25 of each piston gripping member 19 so as to move the members 19 into gripping contact with the well casing C. Each piston gripping member 19 is circular in construction and has disposed around its circumference a circular sealing ring 26 which provides a seal between the member 19 and the wall of the slots or openings 18 so that the full effect of the fluid pressure acting on the face 25 will be obtained. It will be observed that the ring 26 in each member 19 is of a rubber material or a similar elastic material which offers sufficient resistance to the inward movement of the piston members 19 to prevent their inward movement beyond the bore wall of the housing 14.

The lower end of the housing 14 is open to receive the mandrel 15 which extends through the open end upwardly into the housing 14. A splined connection is provided at the lower end of the housing 14 for connecting the mandrel 15 to the housing 14 so that they may move longitudinally relative to each other but may not move rotatively relative to each other. The splined connection includes keys or splines 28 on the mandrel 15 which interfit with keys or splines 29 on the housing 14.

The housing 14 has an upper annular recess or fluid chamber 30 in its inner surface. The housing 14 extends radially inwardly to provide an upper end 31 for the recess 30 and a lower end 32 therefor. The inner wall of the fluid chamber 30 is formed by the mandrel 15. Sealing rings 33 are provided above and below the recess 30 between the mandrel 15 and the housing 14 whereby the fluid chamber 30 is sealed off. The mandrel 15 has a piston or radial projection 35 which extends into the fluid chamber 30 and is annular as is the chamber 30, but is of a shorter length than the chamber 30 so that it can

move therein. Seal rings 36 are provided on the exterior of the piston 35 for sealing engagement with the inner surface of the housing 14. An opening 38 is provided in mandrel 15 for establishing communication between the bore of the mandrel 15 and the chamber 30 above the piston 35. An opening 39 is provided in the housing 14 at the lower end of the fluid chamber 30 for establishing communication between the exterior of the housing 14 and the portion of the fluid chamber 30 below the piston 35. Thus, the mandrel 15 may be moved relative to the housing 14 by a fluid pressure interior of the mandrel or exterior of the housing, depending on which of the pressures is the greater.

Below the recess 30 in the housing 14, there is a similar recess 30' which has an upper wall 31' and a lower wall 32' which are radial projections extending inwardly from the housing 14 in the same manner as the projections 31 and 32. The mandrel 15 also has a lower piston or radial enlargement 35' which is adapted to move longitudinally in the fluid chamber 30' with an opening 38' being provided above the piston 35' to supply fluid pressure above the piston 35' from the bore of the mandrel 15. An opening 39' in the housing 14 is provided at the lower end of the lower fluid chamber 30' to establish communication between the exterior of the housing 14 and the fluid chamber 30'. Seal rings 33' are provided above the chamber 30' and the interengaging keys or splines 28 and 29 are provided therebelow.

The lower end of the mandrel 15 has a threaded connection at 40 (Fig. 3C) with the usual mandrel 41 which extends through the conventional hook wall packer. Other types of connections could, of course, be provided if different types of packers are employed.

In the operation of the hold-down device of this invention, the parts are lowered in the position illustrated in Fig. 1, with the shoulders 31 and 31' bearing against the upper end of the pistons 35 and 35', respectively, to carry the mandrel 15 and the packer therebelow downwardly as the tubing 10 is lowered into the well to a predetermined point in the casing C. When the predetermined point in the casing is reached, the well packer P is set in the usual manner, depending upon the type of packer employed, such packer being set either by rotation or straight downward movement or any other known means so that the packing element 11 sealingly engages with the inner surface of the well casing and the slips 12 grip the casing to prevent further downward movement of such packer P. After the well packer P has been set, then the hold-down device of this invention is utilized. To actuate the hold-down device of this invention, fluid under pressure is applied through the tubing 10 to the bore of the mandrel 15 so as to initially force the piston gripping members 19 radially outwardly into gripping engagement with the well casing to provide an anchoring means for the housing 14. Thereafter, the fluid pressure acts against the upper end of the pistons 35 and 35' by entering the fluid chambers 30 and 30', respectively, to force downwardly on the upper ends of the radial pistons 35 and 35' (Fig. 2). The fluid pressure which is supplied to the hold-down device through the tubing 10 must be greater than the fluid pressure in the casing so as to overcome any force of the fluid pressure which is acting upwardly on the lower ends of pistons 35 and 35' through the openings 39 and 39'. The movement of the mandrel 15 with respect to the housing 14 serves to apply a downward force to the packer P to maintain same in its set position with the packing element 11 in sealing engagement with the casing and the slips 12 gripping the casing. The pressure acting downwardly on the pistons 35 and 35' can be sufficiently great to maintain the well packer P in its set position even though the pressures acting upwardly against the packer from the well are greater than would normally be necessary to unset such packer if only the weight of the tubing were relied upon to maintain the packer in its set position.

When it is desired to release the hold-down device, the pressure inside thereof may be reduced and thereafter the well packer P may be released in the known manner, for example, by lifting upwardly on the tubing 10. When the well packer has been released from its set position, or during the release thereof, the support tubing 10 is raised to raise the housing 14 until the shoulders or radial projections 32 and 32' contact the lower ends of the piston 35 and 35', respectively, whereby the mandrel 15 will be pulled upwardly with the housing 14 and will carry therewith the well packer P.

As will be understood, either of the pistons 35 and 35' may be employed separately if desired, or more than these two pistons may be employed under certain circumstances.

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.

What is claimed is:

1. A hold-down device for maintaining a well packer which has been previously set in position in a well casing in such set position, comprising a hollow tubular support member longitudinally axially disposed with respect to said well casing, a hollow tubular housing suspended downwardly from said support member and secured thereto in fluid-tight relation and extending downwardly in said casing to a point therein spaced from said previously set packer, said tubular housing having an axial bore extending completely therethrough and a tubular mandrel, the bore of said tubular housing being formed with counter-bore portions which receive said mandrel and being provided with fluid seals whereby said mandrel is disposed in fluid tight relation with the walls of the counterbore portions, the bore of said tubular housing being provided further with a piston chamber within which a piston secured to said mandrel is movable, said mandrel being secured at its lower end to said packer and telescoping with said housing, fluid pressure operated gripping means in the upper portion of said housing which when under influence of fluid pressure conducted thereto by said hollow tubular support and said axially disposed bore are adapted for radially outwardly projection from said housing for engagement with the inner wall of the well casing for steadying and suspending said housing in said casing, said tubular mandrel being provided with a lateral fluid port above said piston and said housing being provided with a lateral fluid port below said piston, whereby application of fluid pressure downwardly through said support member and said hollow mandrel and above said piston will cause the same to move downwardly within said piston chamber thereby causing said mandrel to move downwardly to exert a holding force upon said previously set packer.

2. The combination as set forth in claim 1 wherein said hollow tubular housing is provided further interiorly throughout the portion adjacent its lower terminal end with spaced vertically disposed splines and said mandrel is provided further exteriorly throughout the portion adjacent its terminal end adjacent said housing lower terminal end with spaced vertically disposed splines adapted to move longitudinally within the splines in said housing, whereby said housing and mandrel can move only longitudinally with respect to each other.

3. A hold-down device for maintaining a well packer which has been previously set in position in a well casing in such set position, comprising a hollow tubular support member longitudinally axially disposed with respect to said well casing, a hollow tubular housing suspended downwardly from said support member and secured thereto in fluid-tight relation and extending downwardly in said casing to a point therein spaced from said previously set packer, said tubular housing having an axial

5

bore extending completely therethrough and a tubular mandrel, the bore of said tubular housing being provided further with a plurality of spaced piston chambers within each of which a piston secured to said mandrel is movable, said mandrel being secured at its lower end to said packer and telescoping with said housing, fluid pressure operated gripping means in the upper portion of said housing which when under influence of fluid pressure conducted thereto by said hollow tubular support and said axially disposed bore are adapted for radially outwardly projection from said housing for engagement with the inner wall of the well casing for steadying and supporting said housing in said casing, said tubular mandrel being provided with a lateral fluid port above each of said pistons and said housing being provided with a lateral

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fluid port below each of said pistons, whereby application of fluid pressure downwardly through said support member and said hollow mandrel and above said pistons will cause the same to move downwardly within said piston chambers thereby causing said mandrel to move downwardly to exert a holding force upon said previously set packer.

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