Oct. 22, 1946. R. G. TAYLOR, JR., ET AL 2,409,811

SETTING AND RELEASING TOOL

Filed April 4, 1941 2 Sheets-Sheet 1

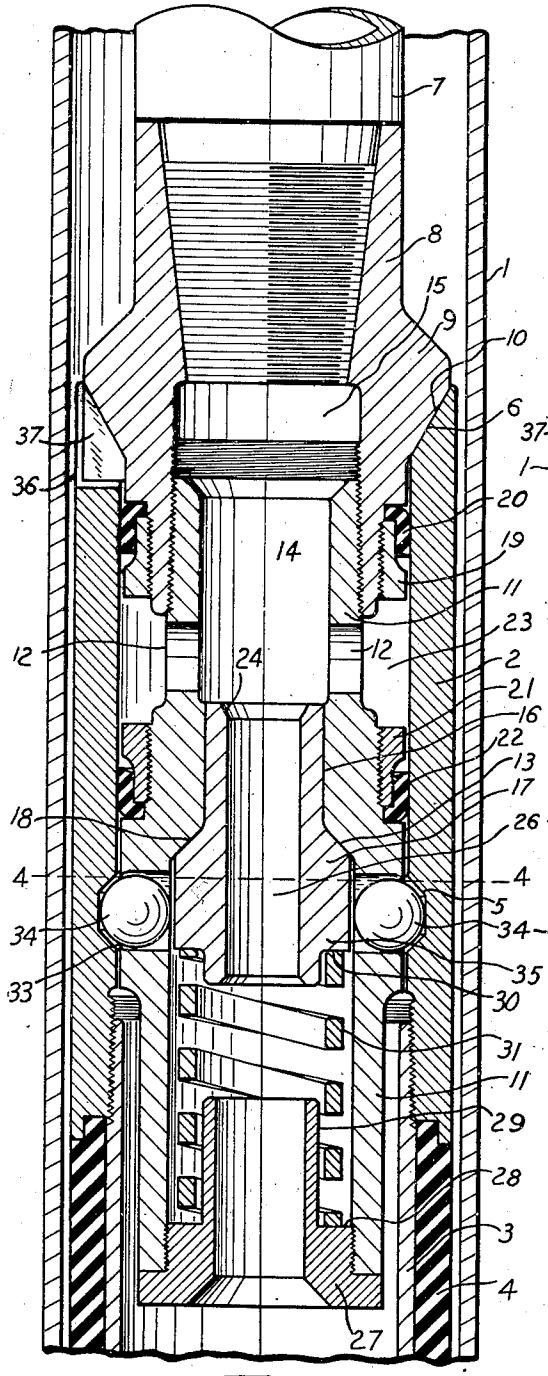


Fig. 1

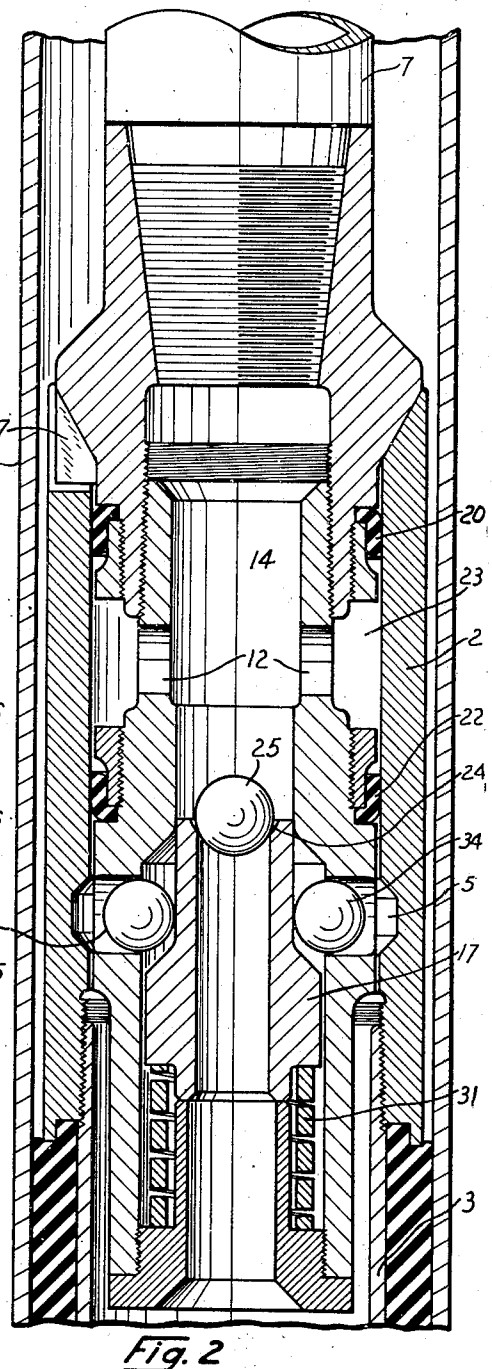


Fig. 2

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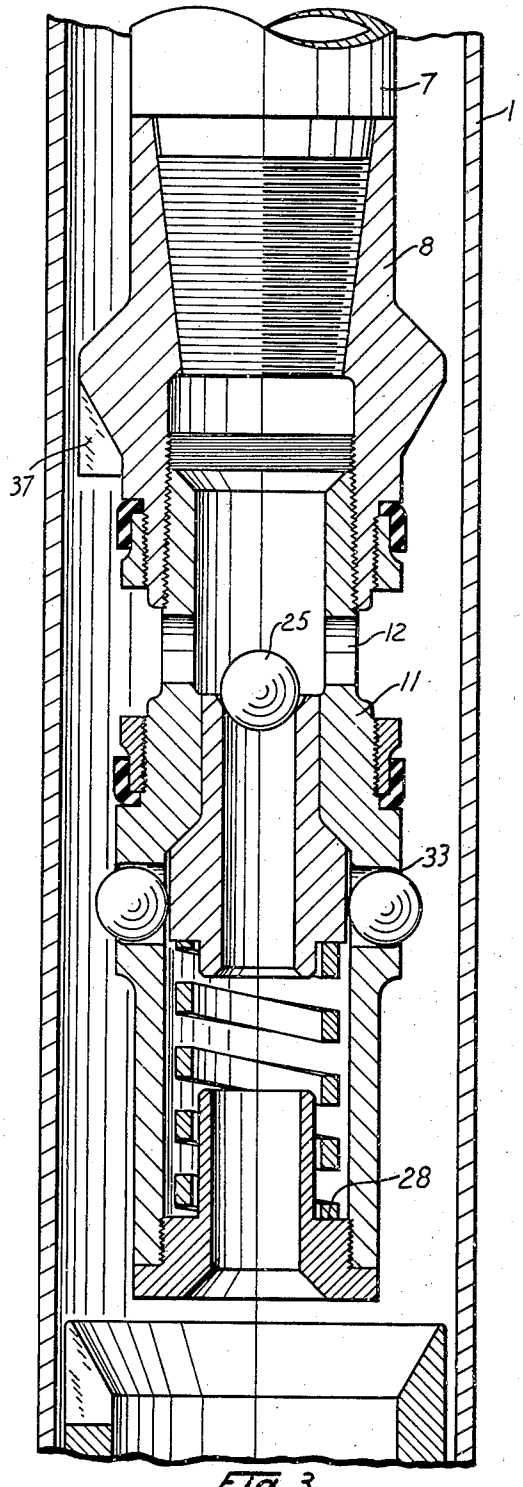


Fig. 3

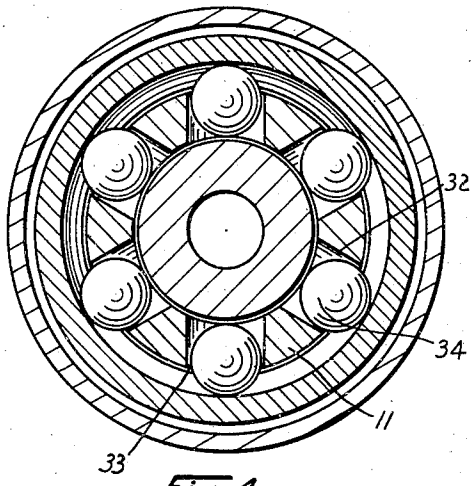


Fig. 4

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SETTING AND RELEASING TOOL

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Application April 4, 1941, Serial No. 386,808

8 Claims. (Cl. 166—10)

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The object of the invention is to provide a highly efficient setting mechanism for any tool or parts which the operator may desire to set in a well. While we have shown the invention in its association with a liner packer, it may be used in conjunction with any other device or mechanism intended to be set and released in a well.

A particular feature of the invention is that the releasing means is controlled by fluid pressure and that no rotation of the supporting means, such as the tubing, is required in order to release the tool to be left in the well.

Another important feature of the invention is that a signaling means is provided to signal to the operator that the tool has been released. This eliminates the possibility that the operator may think that he has released the tool when in fact he has not released it.

Other objects and advantages of the invention will appear in the detailed specification and the claims which follow.

Referring to the drawings,

Fig. 1 is an elevational view largely in cross-section showing the parts in the position in which they would occupy when the tool is run into the well,

Fig. 2 is a similar view with the packer set and the releasing tool in condition to be pulled out of the object to be set.

Fig. 3 is a similar view of the setting and releasing tool pulled out of the object to be set, and

Fig. 4 is a cross-sectional view on the line 4—4 of Fig. 1.

In oil wells it is frequently necessary to set a member in a casing 1. This member may be a piece of casing, a liner, a liner hanger, a packer or any other member or mechanism which the operator may desire to set in the casing. For the purpose of illustration, we have shown the member to be set in the casing as a liner carrying a packer, but it will be understood that the invention is not limited to a liner and packer but would be equally adaptable to any member which it is desirable to set in the casing or in the well. In the illustration shown the liner consists of an upper tubular member 2 screw threaded to a lower tubular member 3 with a liner packer 4 beneath the member 2 and surrounding the member 3. It will, of course, be understood that this packer may be set by conventional slips which form no part of this invention and are, therefore, not shown herein. It is well known, however, that these slips can be released at a desired point and that they operate the control mechanism which prevents the downward movement of the packer and

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that the packer can be compressed so as to provide a tight seal between the liner and the casing. If desired, the slip arrangement shown in the Crowell Reissue Patent 16,577 might be employed.

The tubular member 2 is provided with an annular recess 5 and at its upper end is provided with an inwardly beveled surface 6. All of the above described mechanism is intended to be set in the well and left therein while the setting tool and tubing carrying the same which will now be described may be removed from the well.

The tubing 7 is lowered from the top of the well and it carries the setting tool as well as the member to be set in the well. The tubing 7 has screwed thereto a connection 8 which is provided with a shoulder 9 and an outwardly beveled surface 10 which engages the beveled surface 6. The lower end of the connection 8 is provided with a screw thread which receives a member 11, which may be considered as a body member and which is provided with holes 12 and intermediate its length on the interior thereof is provided with a seat 13. It has a chamber 14 communicating with a passageway 15 in the connection 8 which in turn communicates with the interior of the tubing 7. The lower portion of the member 11 forms a cylinder 16 in which slides a piston 17 which is provided with a seat 18 adapted to engage the seat 13 to limit the upward movement of the said piston. The lower end of the connection 8 is provided with a ring 19 which holds the upper end of a downwardly extending cup packer 20. The member 11 is provided with a ring 21 which presses the lower end of an upwardly extending cup packer 22 against a shoulder of the member 11. It will be noted that the cup packer 20 is above the holes 12 and the cup packer 22 is below the said holes. It will also be noted that there is a chamber 23 between the said packers and inside of the tubular member 2 and outside of the member 11, the said chamber communicating with the chamber 14 by means of the holes 12.

The piston 17 is provided at its upper end with a valve seat 24 adapted to receive a ball 25 which may be dropped through the tubing when it is desired to set the member which is to be left in the well. When the ball 25 is on the said valve seat, it will close a passageway 26 extending vertically through the piston 17.

The member 11 at its lower end has secured thereto a member 27 provided with a shoulder 28 and with an upwardly extending tubular portion 29. The piston 17 when in its lowermost position, as shown in Fig. 2, is adapted to rest upon

the upper end of the tubular portion 29. The piston 17 is provided with a shoulder 30 and a spring 31 is interposed between the shoulder 30 of the piston and the shoulder 28 of the member 27, which spring tends to urge the piston upwardly. The member 11 is provided with a plurality of holes 32, as best shown in Fig. 4, and the member 11 is provided at the outer end of these holes with annular internally extending flanges 33 which serve the function of preventing the balls 34 in the said holes from moving radially out of the said holes. When the enlarged portion 35 forming the lower part of the piston 17 is adjacent the balls 34, the balls are partly positioned within the holes 32 and partly within the annular recess 5 of the tubular member 2 and therefore serve as a means to lock the said parts together. This is the position in which they would be when the assembly is being lowered into the well.

In setting certain types of liner packers, it is necessary to rotate the tubing and packer. If such a type of mechanism is employed which is operated from the liner, it is necessary to rotate the liner and we provide a means for doing this by providing the member 2 with a slot 36 adapted to receive a key 37 forming a part of the connection 8.

The operation is as follows. The mechanism is assembled on the surface of the ground before it is lowered in the well and the parts would be in the position shown in Fig. 1 when they are being run into the well. To assemble the tool it would be necessary to push the piston 17 downwardly. The piston would then be in the position shown in Fig. 2 and the balls 34 would be in the position shown in said Fig. 2. The member 11 may now be inserted in the tubular member 2 and the operator would then release the piston and allow the spring 31 to move the piston upwardly so that the beveled surface forming the seat 18 would move the balls 34 outwardly, projecting them into the annular recess 5. The parts would then be in the position shown in Fig. 1 with the setting and releasing tool locked to the member 2 by means of the balls 34. The tool and the tubular member or whatever is carried by the releasing member would now be lowered into the well and the fluid in the well would pass upwardly through the interior of the mechanism as well as around the same. When the packer or other device was lowered to the proper depth at which it was desired to set the same, it would be set in the conventional manner so as to compress the packer 4 so as to make a fluid-tight connection with the casing. The operator would now drop the ball 25 and it would fall by gravity through the tubing 7 through the connection 8 and through the passageway 14 until it seated on the valve seat 24. The operator would now force fluid downwardly through the tubing 7 and this fluid would attempt to pass through the holes 12 and to find some escape from the chamber 23. However, the fluid cannot escape from the chamber 23 because of the cup packers 20 and 22 and the entire force therefore of the fluid would be against the ball 25 and the upper end of the piston 17, thereby forcing the piston 17 downwardly into the position shown in Fig. 2 and compressing the spring 31. The enlarged portion 35 of the piston therefore moves below the balls 34 and there is, therefore, nothing to hold the balls in the annular recess 5. The setting and releasing tool may now be pulled upwardly leaving the member to be set in the well. As soon as the cup packer 20 moves out of the cylinder portion

of the member 2, the chamber 23 no longer forms a closed chamber and the pressure in the tubing will instantly fall for the fluid under pressure therein may escape through the chamber 14, holes 12, chamber 23 and outwardly above the upper end of the member 2. The operator is thereby given notice that the tool has been released from the member to be set. The pressure in the tubing being now relieved, the spring 31 of course moves the piston upwardly to the position shown in Fig. 3 and as the tubing 7 is pulled out of the well the fluid therein may flow out of the holes 12.

It would be noted that we have provided a simple means to accomplish the setting and releasing of the member or mechanism to be set and that we eliminate all shearing means. Particular attention is also called to the fact that we do not have to unscrew any parts and that when the signal is given that the part to be released has been released, we know that it has been released.

For instance, in the patent to Reed 1,878,538 patented September 20, 1932, when the latching dog 22 is moved inwardly relative to the piston 14 and the tubing is then moved downwardly relative to the housing 4 so as to bring the ports 33 and 35 into alignment, a signal is given to the operator on account of the reduced fluid pressure but the tool to be released has not been released at this time and will not be released until the operator unscrews the threaded connection 10. We eliminate all this unscrewing and signal the operator that the tool to be released has in fact been released. This feature is one of the important points of novelty in our invention.

We realize that many changes might be made in the specific form of the invention which is shown herein by way of illustration and not by way of limitation and we therefore desire to claim the same broadly except as we may limit ourselves in the appended claims.

Having now described our invention, we claim:

1. In a setting and releasing tool adapted to lower a member to be set into a well and to release the same, a body having radially extending channels therein, balls in said channels and adapted to be projected into a recess in the member to be set so as to lock the tool to the member to be set, a piston to hold the balls in the recess when the piston is in one position and to release the balls so as to allow the balls to move out of locking engagement with the member to be set when the piston is in another position, a spring acting on said piston to move it in one direction and the piston being movable in the other direction by fluid pressure.

2. In a setting and releasing tool adapted to lower a member to be set into a well and to release the same, said member having a recess therein, a body having radially extending channels therein, balls in said channels and adapted to be projected into the recess in the member to be set so as to lock the tool to the member to be set, a piston to force the balls into the recess when the piston is in one position and to release the balls so as to allow the balls to move out of locking engagement with the member to be set when the piston is in another position, means to operate said piston, a vertically extending passageway through the body and piston whereby well fluid may pass upwardly through the tool when the tool is lowered into the well, and a ball which may be dropped into said tool and seat on

the piston to close said passageway and prevent a downward flow therethrough.

3. In a setting and releasing tool adapted to lower a member to be set into a well and to release the same, a body, means to lock the body to the member when the member is being lowered and set, a chamber in the upper portion of the body forming a passageway for well fluid when the tool is being lowered into the well, a second chamber between the body and the member to be set, ports connecting said chambers, a tubing communicating with said chambers and extending to the surface of the ground and through which fluid under pressure may be introduced into said chambers, means to close the lower end of the first chamber to trap the fluid, and means actuated by the fluid to release the locking means so that the tool may be pulled out of the member to be set.

4. In a setting and releasing tool adapted to lower a member to be set into a well and to release the same, a body, means to lock the body to the member when the member is being lowered and set, a chamber in the upper portion of the body forming a passageway for well fluid when the tool is being lowered into the well, a second chamber between the body and the member to be set, ports connecting said chambers, a tubing communicating with said chambers and extending to the surface of the ground and through which fluid under pressure may be introduced into said chamber, means to close the lower end of the first chamber to trap the fluid and means actuated by the fluid to release the locking means so that the tool may be pulled out of the member to be set, the pressure in the tubing and chambers being suddenly reduced when the tool is raised sufficiently to expose a portion of the second chamber above the member to be set.

5. In a setting and releasing tool carried by a tubing and adapted to lower a member to be set into a well and to release the same, a body forming a cylinder, said body forming a part of the tool, a locking means to lock the body to the member to be set, a piston slidable in the cylinder and projecting therein in all of its positions so as to prevent fluid flowing between said body and piston, said piston having a passageway therethrough, said piston serving as a means to lock or unlock the locking means, a ball which may be dropped through the tubing and adapted to close the passageway through the piston, a pressure chamber in the body above the piston, said chamber being adapted to trap fluid under pressure introduced therein through the tubing so that the fluid will move said piston when the ball closes the said passageway and thereby release the locking means.

6. In a setting and releasing tool adapted to lower a member to be set into a well and to release the same, a hollow body adapted to be initially positioned in said member and having radially extending channels therein adapted to be positioned opposite a recess in the member, balls in said channels, a piston slidable in the body and having an enlargement thereon, a spring tending to move the piston so as to bring the enlargement into engagement with and move the balls partly out of said channels so that they project into said recess in the member to be set and means limiting movement of said piston by said spring, said piston being movable by fluid pressure to move the enlargement out of engagement with the balls and thereby release the balls to free the setting and releasing tool from the member to be set.

7. In a setting and releasing tool carried by a tubing and adapted to lower into a well a member to be set and to set the same in the well, a body adapted to be initially positioned in said member and having radially extending slots adapted to be positioned opposite a recess in the member and a cylindrical interior, balls in said slots, a piston slidable in the cylindrical interior of the body and having an enlargement thereon adapted to engage said balls and move them partly into said recess in the member to be set, a spring urging the piston into position whereby the enlargement will engage and move the balls, means limiting movement of said piston by said spring, a passageway through the body and the piston, a valve to close the passageway through the piston, the passageway in the body above the piston forming a chamber for fluid under pressure when the valve is closed, the fluid pressure serving to move the piston so as to remove the enlargement thereon away from said balls so as to release the tool from the member to be set.

8. In a setting and releasing tool carried by a tubing and adapted to lower into a well a member to be set and to set the same in the well, a hollow body adapted to be initially positioned in said member and having radially extending slots adapted to be positioned oposite a recess in the member, balls in said slots, a piston slidable in the hollow of said body and having an enlargement thereon adapted to engage said balls and move them partly into said recess in the member to be set, a spring urging the piston into position whereby the enlargement will engage and move the balls, means limiting movement of said piston by said spring, a passageway through the body and the piston, a valve to close the passageway through the piston, the passageway in the body above the piston forming a chamber for fluid under pressure when the valve is closed, the fluid pressure serving to move the piston so as to remove the enlargement thereon away from said balls so as to release the tool from the member to be set, and a by-pass leading from the chamber and adapted to be closed by the member to be set as long as the tool and member are locked together, said by-pass being opened to relieve the pressure in the chamber when the tool is pulled out of the member to be set.

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