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J. O. MINTER ET AL

2,816,613

WELL TUBING STOP

Filed Aug. 15, 1955

2 Sheets-Sheet 1

Fig. 1A

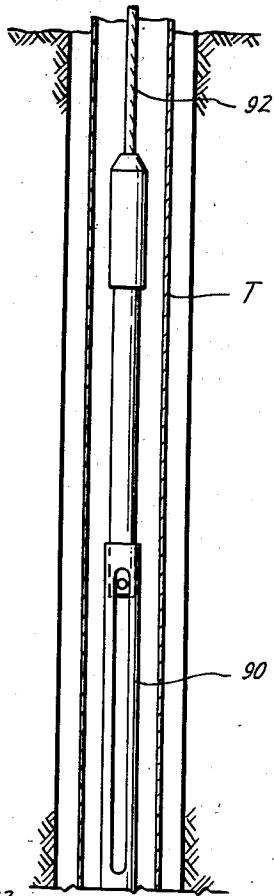
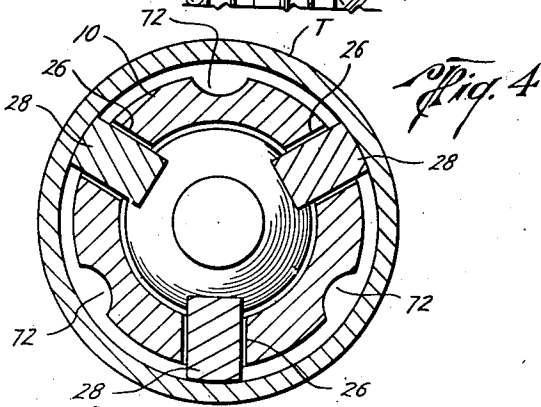
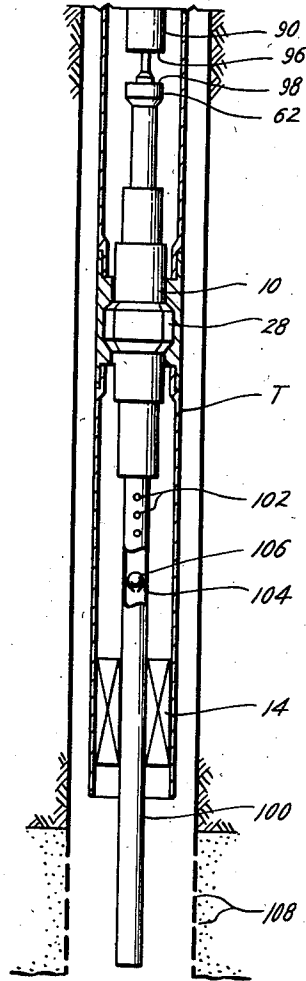


Fig. 1B



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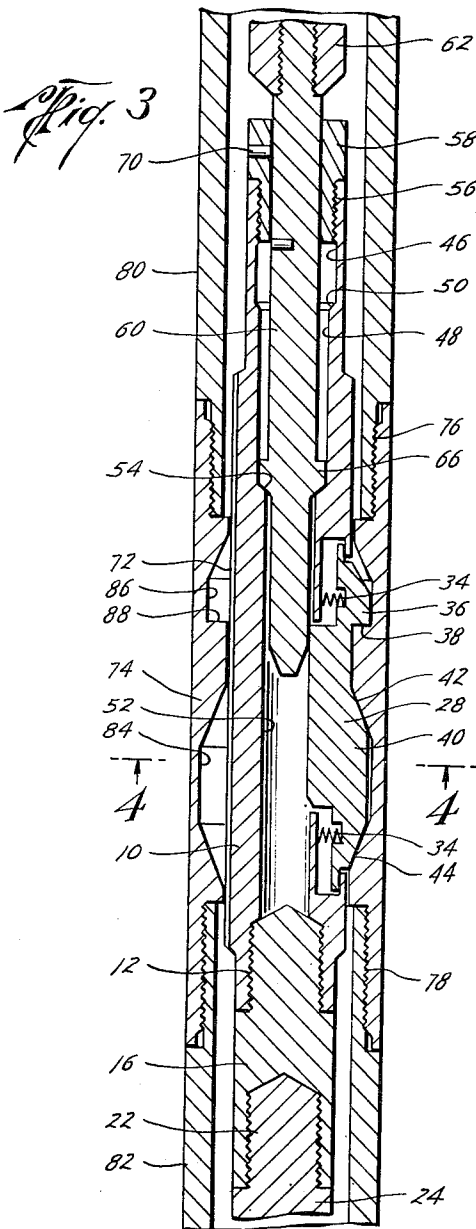
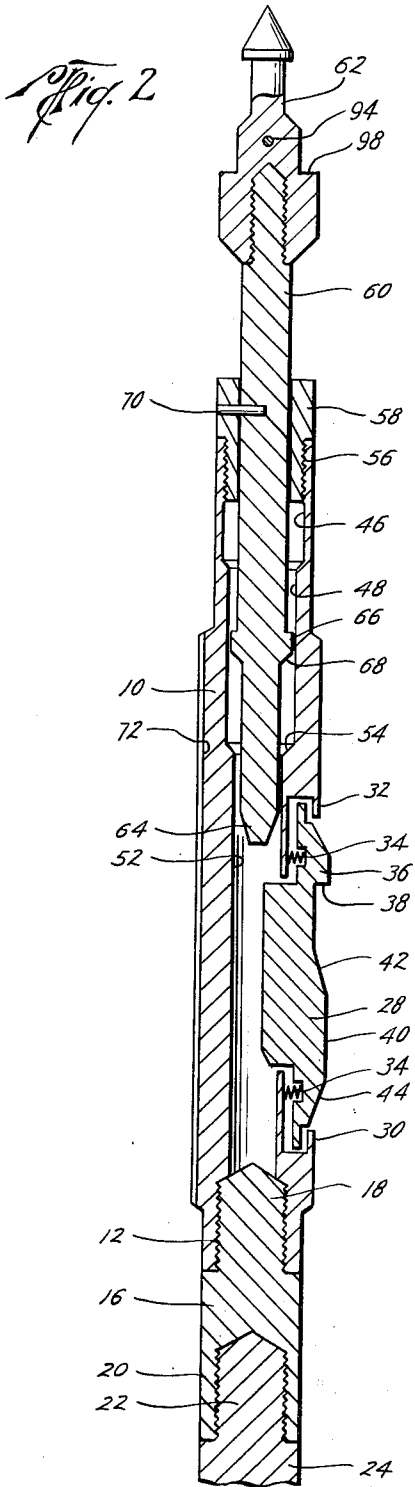
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WELL TUBING STOP

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6 Claims. (Cl. 166—219)

This invention relates to a well tubing stop, and more particularly to a tool for use in oil and gas wells and which is capable of use as a stop or closure device for a well tubing, but which may also be employed as a tubing testing tool or a permanent well completion or cementing tool.

The invention has for an important object the provision of a well tool of the character mentioned which is adapted to be lowered in a well tubing and which may be operated therein to close the tubing to limit the downward movement of objects or equipment in the tubing to prevent the accidental loss of equipment in the well.

Another object of the invention is to provide a well tubing stop which may be lowered into a well tubing and anchored therein against upward or downward movement in the tubing, but which is constructed to permit the circulation of fluid materials, such as cement through the tubing.

A further object of the invention is the provision of a well tool which may be operated in conjunction with well packer equipment in a well tubing to close the tubing to permit the same to be tested under pressure conditions.

Another object of the invention is to provide a well tool of the kind referred to which is adapted for use with other well equipment for introducing cement into a well casing or bore at a desired location to seal perforations or formation and whereby cement may be readily removed from the well at the completion of such cementing operations.

The invention also contemplates the combination with a well tool of the type mentioned of a latch body connected into the well tubing and positioned to coact with the tool to limit downward movement of the tool in the tubing said tool and body also having means which may be operated to latch the tool against upward or downward movement in the tubing and which may be released to permit removal of the tool from the tubing when desired.

The above and other important objects and advantages of the invention will best be understood from the following detailed description, constituting a specification of the same, when considered in conjunction with the annexed drawings, wherein—

Figure 1A and 1B are fragmentary, somewhat diagrammatic, assembly views, showing the invention in position in a well tubing, Figure 1B being a downward continuation of Figure 1A;

Figure 2 is a fragmentary, longitudinal, central, cross-sectional view of the invention, showing the tool in assembled condition and the relative positions of the parts before the tool is inserted in the well tubing;

Figure 3 is a view similar to that of Figure 2 showing the tool in set position in the well tubing; and

Figure 4 is a cross-sectional view, on a somewhat enlarged scale, taken along the line 4—4 of Figure 3, looking in the direction indicated by the arrows.

Referring now to the drawings in greater detail, the tool of the invention comprises a tubular body 10, which is internally threaded, as indicated at 12, for the attachment thereto of a well packer of any suitable type, such as that indicated at 14, or other desired well equipment to be located beneath the tool. Such packer may conveniently be attached through the intermediation of a connector element 16, having an upper externally threaded end portion 18, to be received in the lower end of the body, and an internally threaded lower end portion 20, into which the upper externally threaded portion 22 of a mandrel 24, or other part of the well packer or other well equipment to be attached to the tool.

The body is provided with a number of side window openings 26, three such openings being shown in the present illustration, within which latch elements 28 are movably positioned, for radial movement inwardly and outwardly of the body. The body may conveniently be provided with upwardly and downwardly extending annular projections 30 and 32, respectively, located below and above the window openings, with which the latch elements are engageable to limit outward radial movement of the elements relative to the body. Resilient means, such as the coil springs 34 may be positioned between each of the elements 28 and the exterior of the body, adjacent the window openings, to resist radial inward movement of the elements.

Each of the latch elements 28 is formed with an externally thickened portion 36 near its upper end, providing a downwardly facing external shoulder 38, and an externally thickened medial portion 40, having upper and lower inwardly tapering external surface portions 42 and 44.

The body is also formed with an upper counterbore 46 at its upper end, which opens into a somewhat smaller lower counterbore 48, there being an inner annular downwardly and inwardly tapering surface 50 between the upper and lower counterbores. The lower counterbore 48 opens at its lower end into the bore 52 of the body and a downwardly and inwardly tapering internal annular surface 54 is provided within the body between the lower counterbore and the bore 52. The body 10 is also internally threaded at its upper end, as indicated at 56, for the reception of an externally threaded tubular cap 58.

The tool includes an inner plunger 60, which is slideably extended through the cap 58, and which is attached at its upper end to a fishing head 62. The lower end of the plunger is provided with a tapered end portion 64, which is positioned to engage the latch elements 28, when the plunger is moved downwardly to its lower position in the body, as shown in Figure 3, to move the latch elements radially outwardly. The plunger is provided mediate its ends with an external enlargement 66, having a lower external, tapered face 68, positioned to engage the internal tapered surface 54 of the body to limit downward movement of the plunger in the body.

The plunger 60 is adapted to be held in its uppermost position in the body, as illustrated in Figure 2, by means of a shear pin 70, which extends through an opening in the cap 58 and into an opening in the plunger.

The body 10 also has external longitudinal grooves 72 therein, through which fluid may flow past the tool, when the same is positioned in a well tubing.

The invention also embodies a tubular latch body 74, illustrated in Figure 3, which is internally threaded at its opposite ends, as indicated at 76 and 78, for connection to the lower end of upper section of well tubing 80 and the upper end of a lower section of well tubing 82, to form a part of the well tubing string. This latch body constitutes a coupling in the well tubing string, and has the same external diameter as that of the tubing.

The bore of the latch body has an internal annular enlargement 84, mediate its ends, shaped to receive the externally thickened portions 40 of the latch elements 28, and into which the latch elements are extended when the plunger 60 is in its lower position in the body 10, as seen in Figure 3, whereby the tool will be securely latched against upward or downward movement in the well tubing. Above the internal enlargement 84 the bore of the latch body is internally enlarged, as seen at 86, to provide an upwardly facing internal annular shoulder 88, positioned to be engaged by the external shoulders 36 of the latch elements 28, to limit downward movement of the tool in the latch body.

In making use of the tool, constructed as described above, the fishing head 62 may be connected to the lower end of suitable jarring mechanism, indicated at 90, which in turn is connected at its upper end to a wire line or cable 92, whereby the tool may be lowered into the well tubing. The lower end of the jarring mechanism may be attached to the fishing head by means of a shear pin 94, with the lower end face 96 of the jarring mechanism located above the external annular upwardly facing shoulder 98 of the fishing head.

Upon lowering of the tool in the well tubing T, by means of the cable 92 the tool will move downwardly until it reaches the latch body 74, whereupon the shoulders 38 of the latch elements will engage the shoulder 88 of the latch body to limit downward movement of the tool in the tubing. The jarring mechanism may then be accentuated to exert a downward jar on the plunger 60, whereupon the shear pins 70 and 94 will be severed and the plunger will move downwardly in the body 10 to its lowermost position, as seen in Figure 3, to accentuate the latching elements 28 into latching engagement with the latch body 74 in the internal enlargement 84 thereof, to securely hold the tool against upward or downward movement in the tubing. The jarring mechanism may then be removed with the cable 92, leaving the tool in set position in the tubing.

It will be noted that circulation may take place through the tubing through the external grooves 72 of the tool when the tool is in set position in the tubing.

Should it be desired to remove the tool from the tubing, this may be accomplished by lowering any suitable type of fishing mechanism on the cable 92, to connect the cable to the fishing head 62, whereupon the plunger 60 may be moved upwardly in the body 10 until the external enlargement 66 of the plunger engages the lower end of the cap 58, whereupon an upward pull will be exerted on the tool, and the latching elements 28 will be moved inwardly to unlatching position, to permit the tool to be withdrawn.

In the event that it should be desired to use the tool as a cementing or well completion tool, a tubular pipe 100 may be connected to the lower end of the body 10, in place of the coupling 16, suitable well packer mechanism 14, of conventional design being carried by this pipe, and being operable by manipulation of the pipe to set the packer in the tubing prior to the latching of the tool in the latch body 74. The pipe 100 is provided with openings 102, leading from the interior of the pipe to the exterior thereof, and beneath these openings the pipe has an internal valve seat 104, which may be closed by a ball 106 when desired. To operate the tool as a cementing tool, the same is lowered into the well on a cable 92 and the packer 14 is set in the tubing at the desired location, after which the tool may be latched in the latch body 74 to hold the mechanism against upward or downward movement in the tubing. Well cement may then be pumped downwardly through the tubing about the exterior of the tool through the external groove 72, and into the pipe 100 through openings 102, out through the lower end of the pipe 100 to seal off perforations 108 or the like in the well for-

mation below the lower end of the well tubing, the cement returning upwardly about the exterior of the tubing. When the cementing has been accomplished, fluid under pressure may be introduced into the well bore about the exterior of the tubing, to force excess cement back up through the pipe 100, about the exterior of the tool, through the external groove 72 and upwardly through the tubing.

Should it be desired to test the tubing T, this may be accomplished with the apparatus in the condition just described for use as a cementing tool, by inserting the ball 106 to close the valve seat 104, whereupon pressure may be introduced into the tubing above the packer 14, to test the tubing.

The apparatus may be released and removed from the tubing in the same manner as previously described in connection with its use as a tubing stop.

It will thus be seen that the invention provides a combination well tool, which may be used in numerous different ways to accomplish various operations in the production and maintenance of oil wells.

The invention has been disclosed herein in connection with a certain specific embodiment of the same, but it will be understood that this is intended by way of example only, and that numerous changes can be made in the construction and arrangement of the various parts, without departing from the spirit of the invention or the scope of the appended claims.

Having thus clearly shown and described the invention, what is claimed as new and desired to secure by Letters Patent is:

1. In well apparatus the combination with a tubular connector member adapted to be connected at its opposite ends to the adjacent ends of two sections of a well tubing to connect the sections together and having an internal enlargement mediate its ends, of a tubular body having an opening mediate its ends from the interior of the body to the exterior thereof, said body being insertable in said member through said tubing to position said opening opposite said enlargement, latch means movably positioned in said opening for movement to a latching position extending into said enlargement when the opening is opposite the enlargement, said latch means being engageable with said member in said enlargement to hold the body against longitudinal movement in the member, yieldable means positioned to coact with said body and latch means to yieldingly urge the latch means toward latching position and means movably mounted on the body and movable into and out of a position to hold said latch means in latching position.

2. In well apparatus the combination with a tubular connector member adapted to be connected at its opposite ends to the adjacent ends of two sections of a well tubing to connect the sections together and having an internal enlargement mediate its ends of a tubular body having an opening mediate its ends from the interior of the body to the exterior thereof, said body being insertable in said member through said tubing, latch means movably positioned in said opening for movement inwardly and outwardly of the body, yieldable means positioned to coact with said body and said latch means to yieldingly urge the latch means outwardly, means on said member positioned for engagement with said latch means to arrest downward movement of the body in the member upon outward movement of the latch means when said opening reaches a position opposite said enlargement, said latch means being engageable with the member in said enlargement upon outward movement of the latch means relative to the body when said opening is opposite the enlargement to latch the body against longitudinal movement relative to the body, and means for moving the latch means into latching position.

3. In well apparatus the combination with a tubular connector member adapted to be connected at its opposite

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ends to the adjacent ends of two sections of a well tubing to connect the sections together, of a tubular body insertable in the member through the tubing and having an opening mediate its ends from the interior of the body to the exterior thereof, latch means movably positioned in the opening for movement inwardly and outwardly of the body, means on the member positioned for engagement with said latch means upon outward movement of the latch means to hold the body against longitudinal movement in the member, yieldable means positioned to coact with the body and latch means to exert a force against said latch means tending to move said latch means outwardly and plunger means movably mounted in the body and movable therein to one position in engagement with said latch means to hold the latch means outwardly of the body and to another position out of engagement with the latch means to permit the latch means to be moved inwardly of the body against the outward force of said yieldable means.

4. In well apparatus the combination with a tubular connector member adapted to be connected at its opposite ends to the adjacent ends of two sections of a well tubing to connect the sections together, of a tubular body insertable in the member through the tubing and having an opening mediate its ends from the interior of the body to the exterior thereof, latch means movably positioned in the opening for movement inwardly and outwardly of the body, yieldable means positioned to coact with the body and latch means to yieldingly urge the latch means outwardly, means on the member positioned for engagement with said latch means upon outward movement of the latch means to hold the body against longitudinal movement in the member, plunger means movably mounted in the body and movable therein to one position in engagement with said latch means to hold the latch means in outward position and to another position out of engagement with the latch means to permit the latch means to move inwardly of the body, and means for releasably holding the plunger means out of engagement with said latch means.

5. In well apparatus the combination with a tubular connector member adapted to be connected at its opposite

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ends to the adjacent ends of two sections of a well tubing to connect the sections together, of a tubular body insertable in the member through the tubing and having an opening mediate its ends from the interior of the body to the exterior thereof, latch means movably positioned in the opening for movement inwardly and outwardly of the body, yieldable means positioned to coact with the body and latch means to exert a force on said latch means to yieldingly urge the latch means outwardly, means on the member positioned for engagement with said latch means upon outward movement of the latch means to hold the body against longitudinal movement in the member, plunger means in the body movable therein in one direction to engage said latch means to hold the latch means outwardly of the body and in the other direction to disengage the latch means to permit the latch means to move inwardly of the body against the outward force of said yieldable means.

6. In well apparatus the combination with a tubular connector member adapted to be connected at its opposite ends to the adjacent ends of two sections of a well tubing to connect the sections together, of a tubular body insertable in the member through the tubing and having an opening mediate its ends from the interior of the body to the exterior thereof, latch means movably positioned in the opening for movement inwardly and outwardly of the body, means on the member positioned for engagement with said latch means upon outward movement of the latch means to hold the body against longitudinal movement in the member and means for actuating said latch means outwardly of the body, said body having an external longitudinal groove positioned to permit the flow of fluid through the tubing through said member when the body is in the member.

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