United States Patent [19]

Tausch et al.

[11] **3,786,865**

[45] **Jan. 22, 1974**

[54] **LOCKOUT FOR WELL SAFETY VALVE**

[75] Inventors: **Gilbert H. Tausch; Fred E. Watkins,** both of Houston, Tex.

[73] Assignee: **Camco Incorporated,** Houston, Tex.

[22] Filed: **Mar. 6, 1973**

[21] Appl. No.: **338,503**

[52] **U.S. Cl.** ..... **166/224 S,** 137/460, 137/495, 251/58

[51] **Int. Cl.** **E21b 43/12**

[58] **Field of Search** 166/72, 224, 226; 137/315, 137/461, 460, 495, 494, 498, 510, 614.11, 614.2; 251/31, 58, 62, 63, 77

[56] **References Cited**

UNITED STATES PATENTS

3,696,868	10/1972	Taylor, Jr.	166/224 S
3,078,923	2/1963	Tausch	166/224 S
R25,471	11/1963	Fredd	166/224 S
3,126,908	3/1964	Dickens	137/460
3,470,903	10/1969	Scott	137/495
3,398,762	8/1968	Fredd	137/498

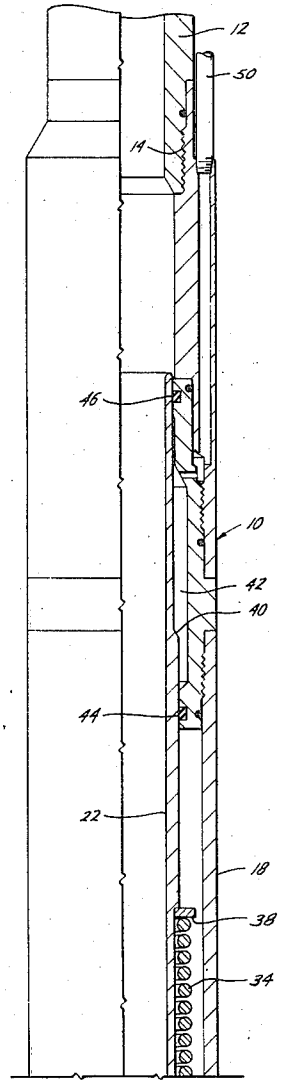
Primary Examiner—James A. Leppink

Attorney, Agent, or Firm—Jefferson D. Giller; James F. Weiler; WIlliam A. Stout

[57] **ABSTRACT**

In a well safety valve for controlling the fluid flow through a well tubing in which the valve closure means is controlled by longitudinal movable tubular member, the improvement of lockout means for locking the valve closure member in the open position by providing a second tubular member axially aligned with the first tubular member and normally positioned below the valve closure member. Means on the second member for moving the second member upwardly for holding the valve closure member open. Holding means for holding the second member in the upward position for locking the valve open. The holding means being releasable for resetting and closing the valve if desired.

10 Claims, 4 Drawing Figures



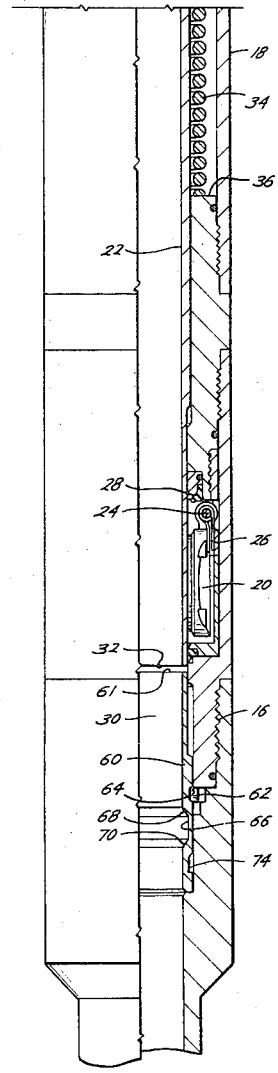


Fig. 1A

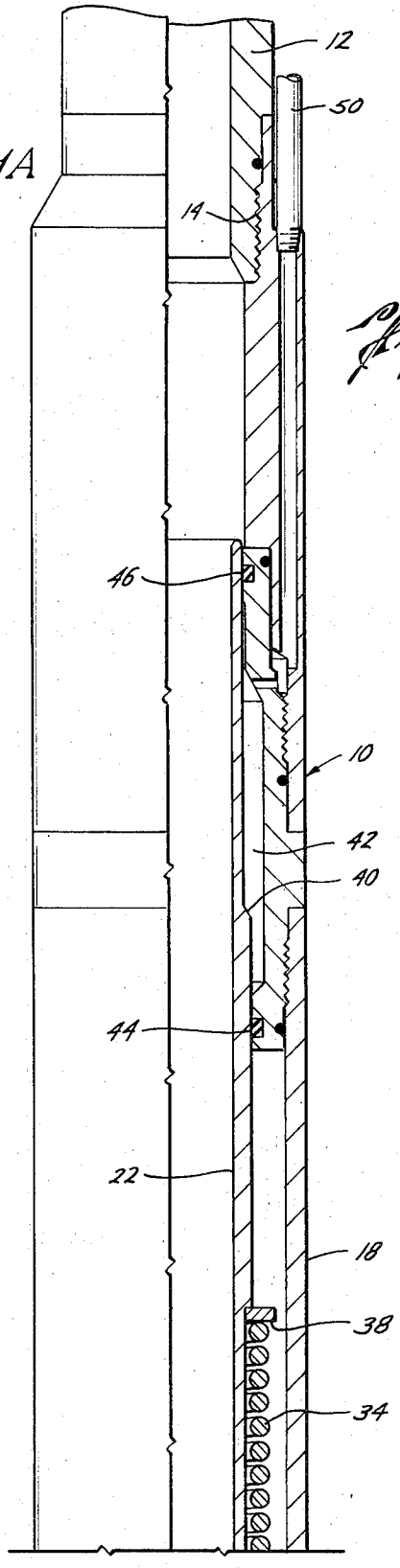

12
50
14
46
10
42
40
44
22
18
38
34

Fig. 1B

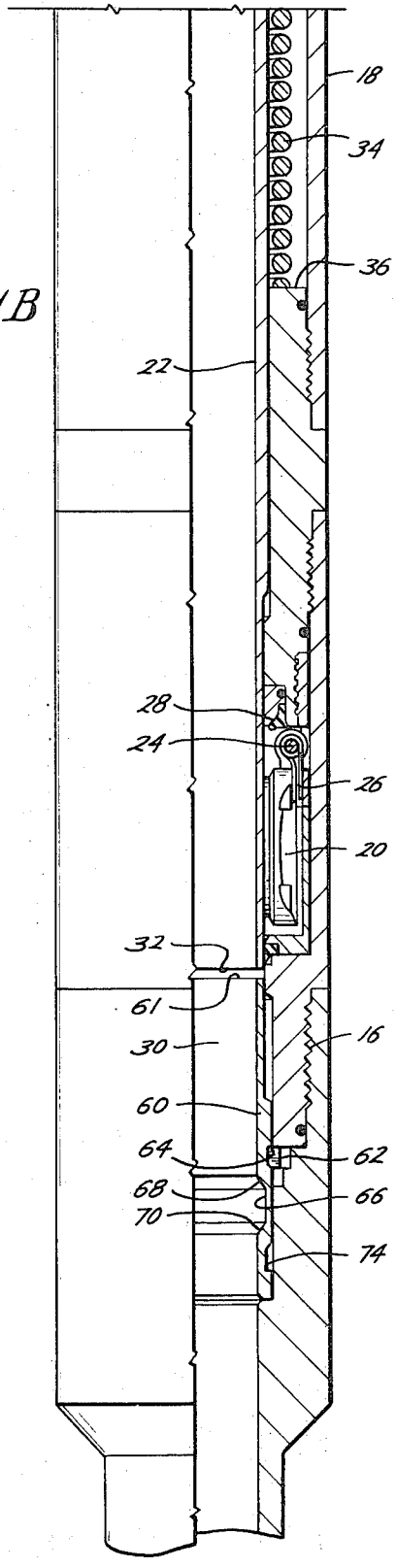

18
34
36
22
28
24
26
20
32
61
30
16
60
64
62
68
66
70
74

Fig. 2

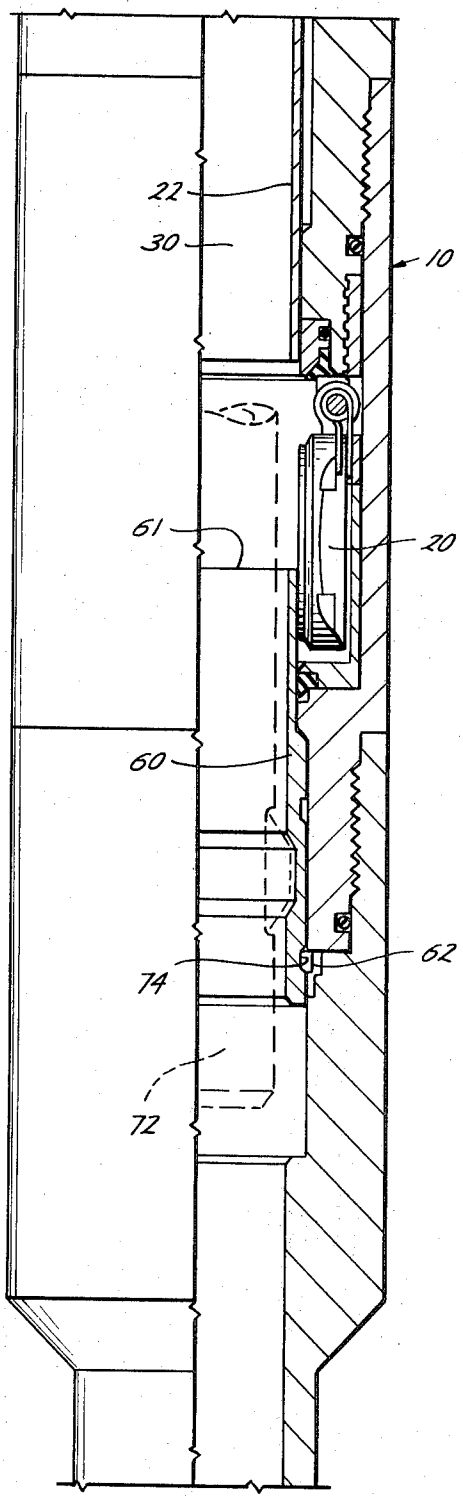
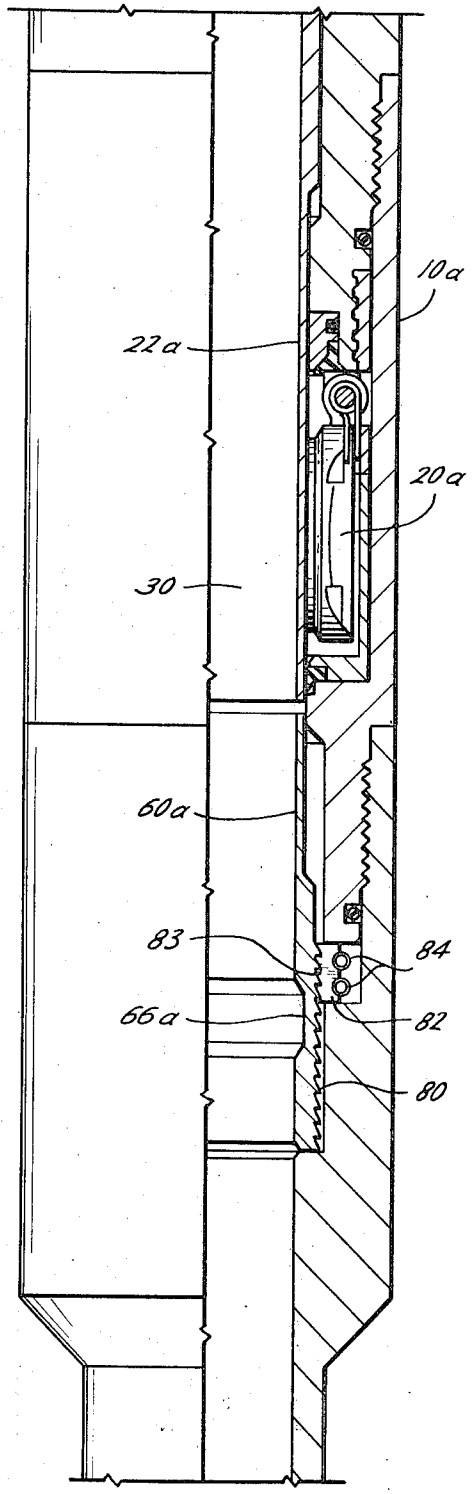


Fig. 3



LOCKOUT FOR WELL SAFETY VALVE

BACKGROUND OF THE INVENTION

Various safety valves have been used in the past in a well tubing to shut off the production of well fluids from oil or gas wells such as shown in U.S. Pat. Nos. 3,078,923 adn 3,627,042 in which the opening and closing of the valve is controlled by movement of a longitudinal movable tubular member. Generally, the tubular member is generally pressure actuated and requires close tolerances which are subject to binding by deposits such as sand. One cause of safety valve problems is the inability to operate the safety valve due to the binding of the movable tubular member as a result of deposits or interference from accumulated sand that is often found in produced well fluids. Of course, if the movable tubular member becomes stuck, the valve cannot be actuated. If the safety valve is retrievable, it can be removed and repaired, but if it forms a portion of the well tubing, the tubing string must be pulled to perform any safety valve repairs.

Such operations are costly and time consuming. It is sometimes desirable to delay the repair of the safety valve but still work on or produce from the well. To do this the safety valve is locked out, which means it is mechanically moved to the fully opened position, such as for the purpose of producing from the well or performing other work in the tubing below the safety valve. While a lockout of the safety valve will not eliminate the need for pulling the safety valve or tubing for safety valve repair, the lockout will allow the well to stay on production or perform other work functions in the tubing until the safety valve work can be conveniently scheduled. One type of safety valve lockout is shown in U.S. Pat. No. 3,696,868 in which a lockout sleeve is moved downwardly against the top of the longitudinal tubular member for moving the tubular member in a direction to open the valve and lock the valve opened. However, if the cause of the failure is due to the sticking or binding of the tubular member, it may be difficult to obtain a sufficient movement of the tubular member to provide the desired lockout.

The present invention is directed to a lockout for a well safety valve which cannot inadvertently be locked out while the valve is in the open position and which does not require actuation of the actuating longitudinal movable tubular member so that sticking of the tubular member will not prevent operation of the lockout.

SUMMARY

The present invention is generally directed to providing a lockout of a well safety valve that does not require moving the longitudinal movable actuating member of the safety valve.

The present invention is further directed to the improvement in a well safety valve which controls the fluid flow through a well tubing and includes a longitudinal movable tubular member controlling the movement of the valve closure means of a lockout means for locking the valve closure member in the open position by providing a second tubular member axially aligned with the first tubular member and normally positioned below the valve closure member for movement upwardly for holding the valve closure member open.

Yet a further object of the present invention is the provision of a lockout which cannot inadvertently lock out the valve while the valve is in the open position.

The present invention further includes releasable holding means for engaging and holding the second member in an upward position for locking the valve open, but allowing the lockout tubular member to be moved out of the valve holding position for allowing the valve to be reset and closed.

Still a further object of the present invention is the provision of a lockout means that includes a recess having beveled edges at both ends and designed so that accidental operation may not occur when wireline or pump-in operations are being performed.

In addition, a lockout mechanism is provided that has a straight through streamline flow configuration.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1A is an elevational view, partly in cross section, of the top portion of a tubing retrievable safety valve,

FIG. 1B is a continuation of FIG. 1A showing the bottom portion of the safety valve and the lockout mechanism of the present invention shown in the inactive position,

FIG. 2 is a fragmentary elevational view, partly in cross section, illustrating the actuation of the lockout mechanism for holding the valve closure member in the open position, and

FIG. 3 is a fragmentary elevational view, in cross section, of a modified lockout mechanism of a permanent type as compared to the resetting type of FIGS. 1 and 2.

DESCRIPTION OF THE PREFERRED EMBODIMENT

For purposes of illustration only, the present invention will be described in connection with a tubing retrievable flapper type safety valve. However, it is to be recognized that the present lockout mechanism may be used with other types of safety valves including those having different valve closure means.

Referring now to the drawings, in particular to FIGS. 1A and 1B, the reference numeral **10** generally indicates a well safety valve of the tubing retrievable type adapted to form a portion of the well tubing **12** by being connected therein by a suitable threaded connections **14** and **16.** The safety valve **10** is provided to control the fluid flow thorugh the bore **30** of the well tubing **12** and valve **10.** Under normal flow conditions the safety valve **10** is in the open position. The safety valve **10** is closed in the event of equipment failure or other undesirable conditions to shut off well production.

The safety valve **10** generally includes a valve body **18,** a valve closure member such as a flapper valve **20,** and a longitudinal movable tubular member **22** for controlling the movement of the flapper valve **20.** The flapper valve **20** is carried about a pivot **24** and may include a spring **26** for yieldably urging the flapper valve **20** about the pivot **24** and on to an annular valve seat **28** for closing the valve and blocking upward flow of fluid through the bore **30** of the valve **10** and tubing **12.**

The tubular member **22** is longitudinally movable in the valve body **18** and when the lower end **32** of the member **22** is moved downwardly, the end **32** contacts the flapper **20** moving flapper **20** off of the valve seat **28** and into a downward and open position, as shown in FIG. 1B, thereby permitting fluid flow through the bore **30.** However, when the tubular member **22** is

moved upwardly and its lower end **32** is moved above the valve seat **28**, the spring **26** and/or fluid flow upwardly through the valve **10** closes the flapper **20**.

Any suitable control means for controlling movement of the tubular member **22** may be used. For example, a biasing spring **34** may be provided positioned between a shoulder **36** on the valve body **18** and a shoulder **38** on the tubular member **22** for biasing the tubular member **22** upwardly and in a direction allowing the flapper **20** to close. In order to provide means for moving the tubular member **22** in a downward direction, a piston **40** may be provided on the tubular member **22** for movement in a cylinder **42** formed by seals **44** and **46** between the member **22** and the valve body **18**. A control line **50** may be provided leading to the well surface for supplying a fluid therein which communicates with the cylinder **42** for controlling the movement of the piston **40** and thus of the tubular member **22**. If fluid pressure is applied through the line **50** and into the cylinder **42**, the piston **40** and the tubular member **22** is moved downwardly overcoming the spring **34** and opens the flapper **20**. The flapper **20** is closed by reducing the fluid pressure in the control line **50** and thus in the chamber **42** allowing the spring **34** to move the tubular member **22** upwardly releasing the flapper valve **20**. The above described safety valve is generally conventional.

The safety valve **10** may fail for some reason. Of course, if it fails with the tubular member **22** held in the downwardly extended position then there is no need for a lockout.

However, in the event the safety valve becomes inoperative when the tubular member **22** is in the upward or partially upward position, it may be desirable to lock out the safety valve. That is, the safety valve **10** is locked out by holding valve closure **20** in the fully opened position for purposes of allowing well production or performing various types through tubing work until the safety valve may be conveniently retrieved and repaired. One cause of safety valve problems is the inability to operate the safety valve due to the binding of the tube **22** against the valve body **18** and seals **44** and **46** as a result of deposits such as accumulated sand that is often found in producing well fluids. If the failure is due to the binding or sticking of the tubing **22**, then it is difficult to utilize lockout mechanisms that require movement of the tubular member **22** for opening and locking out the valve **20**.

As best seen in FIG. **1B**, the present invention utilizes a lockout means for locking the valve closure member **20** in the open position by providing a second tubular lockout member **60** telescopically positioned in the valve **10** below the valve **20**. Normally, the lockout member **60** is held in a downward position by a suitable means such as a detent **62** engaging a notch **64** on the lockout member **60**. Suitable means are provided on the lockout member **60** for moving the lockout member **60** upwardly or downwardly, if desired, such as a recess **66** having upper and lower beveled edges **68** and **70**.

As best seen in FIG. **2**, any suitable type of tool such as shown in dotted outline **72**, such as a Z-lock of Camco, Incorporated, may be utilized to be moved down the well bore **30** by either conventionally wireline or pump-down operations, open the valve **20** and engage the recess **66**. Upward movement of the tool **72** will move the lockout member **60** upwardly whereby the upper end **61** of the member **60** will engage and hold the flapper valve **20** in the upper postion. The detent **62** will engage a lower notch **74** on the lockout member **60** holding the lockout member **60** in the upper position for holding the valve **20** open. The beveled edges **68** and **70** on the recess **66** are designed to avoid catching on shoulders of well tools passing down the bore **30** and through the safety valve **10** so that accidental operation of the lockout member **60** will not occur when normal wireline or pump-in operations are being performed through the safety valve **10**.

Furthermore, it is to be noted that lockout member **60** is normally positioned with the upper end **61** of the member **60** adjacent the lower end **62** of the operating tubular member **22** when the tubular member **22** is in the downward position holding the valve **20** open. This prevents inadvertent actuation of the lockout member **60** while the valve is held in the open position. That is, even if a well tool accidentally engages member **60**, the member **60** could not be moved upwardly against the hydraulic force holding the member **22** downwardly or if member **60** were moved upwardly, the pressure in the control line **50** would increase indicating such movement. It is undesirable to allow the lockout member to be inadvertently actuated while the valve **20** is held in the open position since this would thereafter prevent the valve **10** from preforming its normal safety function.

Normally, the lockout member **60** need not be resettable to a downward position so that the valve **20** can close since the safety valve **10** would normally be retrieved and repaired as soon as possible. However, the detent **62** and notches **64** and **74** allow the lockout member **60** to be re-engaged by the tool **72** and moved to the downward position for resetting and allowing closure of the valve **20** if desired.

Of course, other and further modifications of the present invention may be utilized. Referring now to FIG. **3**, a further embodiment of the present invention is shown wherein like parts to those of FIGS. **1A**, **1B** and **2** are shown with like numbers and the addition of the suffix "*a*." In the embodiment of FIG. **3**, the lockout member **60***a* includes a plurality of downwardly directed ratchet teeth **80** on the exterior of member **60***a* for coacting with a ratchet clutch **82** having a plurality of upwardly directed teeth **83**. The ratchet member **82** is urged inwardly by one or more garter springs **84**. Thus, as the lockout member **60***a* is moved upwardly by a suitable tool, the ratchet teeth **80** on the lockout member **60***a* will ratchet past the teeth **83** on the clutch **82** for holding the lockout member **60***a* in the upward position for locking the valve **20***a* in the open position. The coacting teeth **80** and **83** will allow the lockout member **60***a* to be held in whatever upward position it is carried by the tool **72**. In addition, the coacting teeth **80** and **83** will to some extent hold the member **60***a* initially in the downward position. The ratchet type teeth **80** and **83** normally provide a permanent lockout although, of course, the teeth **80** and **83** may be made shearable if desired for resetting the lockout member **60***a*.

The present invention, therefore, is well adapted to carry out the objects and attain the ends and advantages mentioned as well as others inherent therein. While presently preferred embodiments of the invention have been given for the purpose of disclosure, numerous changes in the detail of construction and ar-

rangement of parts may be provided, without departing from the spirit of the invention and the scope of the appended claims.

What is claimed is:

1. In a well safety valve for controlling the fluid flow through a well tubing, the valve adapted to be positioned in the well tubing and having a housing and having a valve closure member moving between open and closed positions, a first longitudinally movable tubular member for controlling the movement of the valve closure member, first means for moving the tubular member in a first direction, second means for moving the tubular member in a second direction, the improvement of lockout means for locking the valve closure member in the open position comprising,

a second tubular member axially aligned with the first tubular member and normally positioned below the valve closure member,

means on the second member for moving the second member upwardly for holding the valve closure member open, and

holding means for engaging and holding the second member in the upward position for locking the valve open.

2. The apparatus of claim 1 wherein the upper end of the second tubular member is normally positioned to be adjacent the lower end of the first tubular member when the first tubular member is in its fully extended downward position thereby preventing inadvertent locking out of the valve closure member when the valve is in the open position.

3. The apparatus of claim 1 including releasable holding means for initially holding the second member in the downward position.

4. The apparatus of claim 1 wherein the means for moving the second member upwardly includes,

a tool engaging recess on the interior of the second member.

5. The apparatus of claim 4 wherein the recess includes beveled edges on the both ends of the recess for preventing accidental acutation of the second member.

6. The apparatus of claim 1 wherein the holding means is releasable.

7. In a well safety valve for controlling the fluid flow through a well tubing, the valve adapted to be positioned in the well tubing and including a housing and a valve closure member moving between open and closed positions, a first longitudinally movable tubular member for controlling the movement of the valve closure member, spring means for biasing the tubular member in a first direction for closing the valve closure member, a piston and cylinder assembly for moving the first tubular member in a direction for opening the valve closure member, the improvement in lockout means for locking the valve closure member in the open position comprising,

a second tubular member axially aligned with the first tubular member and normally positioned below the valve closure member,

releasable holding means for initially holding the second member in the downward position,

a tool engaging recess on the interior of the second member for moving the second member upwardly for holding the valve closure member open, and

locking means between the second member and the housing for locking the second member in the upward position for locking the valve open.

8. The apparatus of claim 7 wherein the upper end of the second tubular member is normally postioned to be adjacent the lower end of the first tubular member when the first tubular member is in its fully extended downward position thereby preventing inadvertent locking out of the valve closure member when the valve is in the open position.

9. In a well safety valve for controlling the fluid flow through a well tubing, the valve adapted to be positioned in the well tubing and including a housing and a flapper valve closure member moving between open and closed positions, a first longitudinally movable tubular member for controlling the movement of the flapper valve member, spring means for biasing the tubular member in a direction for closing the flapper closure member, a piston and cylinder assembly for moving the first tubular member in a direction for opening the flapper closure member, the improvement in lockout means for locking the flapper closure member in the open position comprising,

a second tubular member axially aligned with the first tubular member and normally positioned below and out of engagement with the flapper closure member,

engaging means on the second member for allowing movement of the second member upwardly for engaging and holding the flapper member open, and

holding means for engaging and holding the second member in the upward position for holding the valve open.

10. The apparatus of claim 9 wherein the upper end of the second tubular member is normally positioned to be adjacent the lower end of the first tubular member when the first tubular member is in its fully extended downward position thereby preventing inadvertent locking out of the valve closure member when the valve is in the open position.

* * * * *