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Tausch

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[54] **WELL SAFETY VALVE**

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[52] **U.S. Cl.** ..... **166/224 S,** 137/461, 137/463

[51] **Int. Cl.** **E21b 43/12,** F16k 17/02

[58] **Field of Search** 166/224; 137/456, 461, 137/463

[56] **References Cited**

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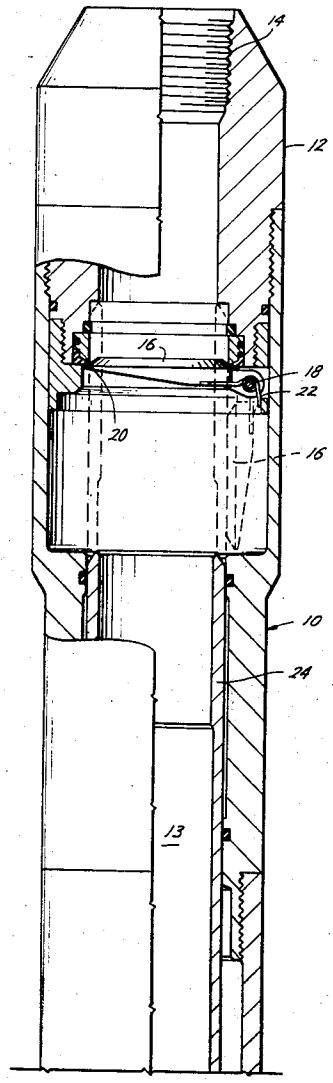
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[57] **ABSTRACT**

A well safety valve for use in a well tubing having a valve for engaging an annular valve seat for opening and closing the valve and operated by a sliding tube telescopically movable in the body and positioned below the valve means. Upward movement of the tube opens the valve and downward movement of the tube closes the valve. Means normally biasing said tube upwardly for holding the valve open and piston means connected to the tube and in communication with the exterior of the valve for moving the tube downwardly for closing the valve on increase in pressure exteriorly of the valve. A flapper valve pivotally connected to the body below the valve seat and movable upwardly into engagement with the seat for closing the valve and movable downwardly away from the seat for opening the valve. The biasing means including a gas chamber having a seal on each side of the chamber between the chamber and the interior of the tubing, and a bleed port leading from the side of each seal remote from the chamber to exteriorly of the body for preventing tubing pressure entering the chamber and providing a fail safe operation of the biasing chamber.

3 Claims, 2 Drawing Figures



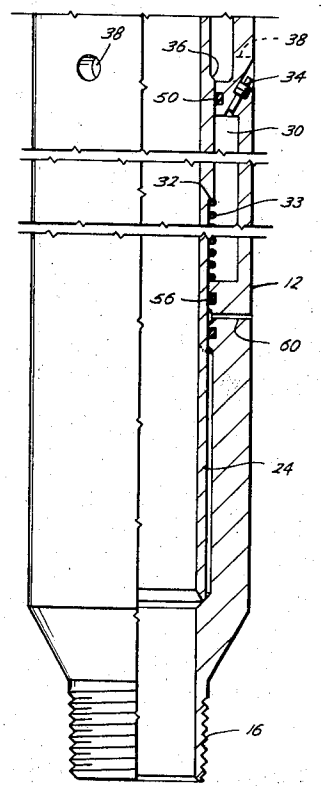


Fig. 1A

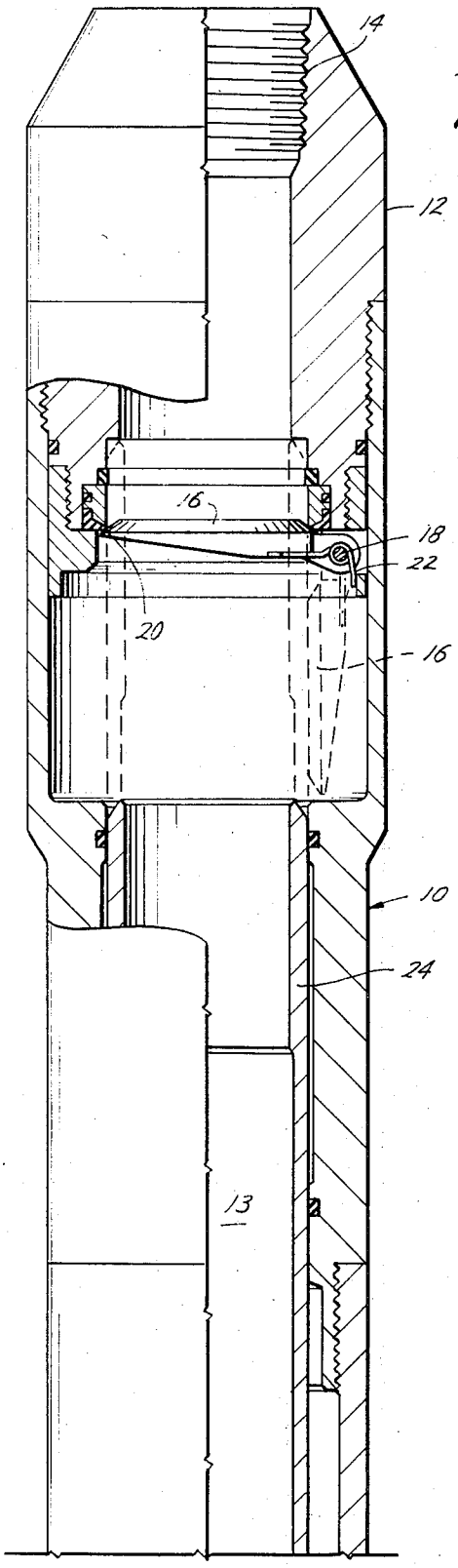
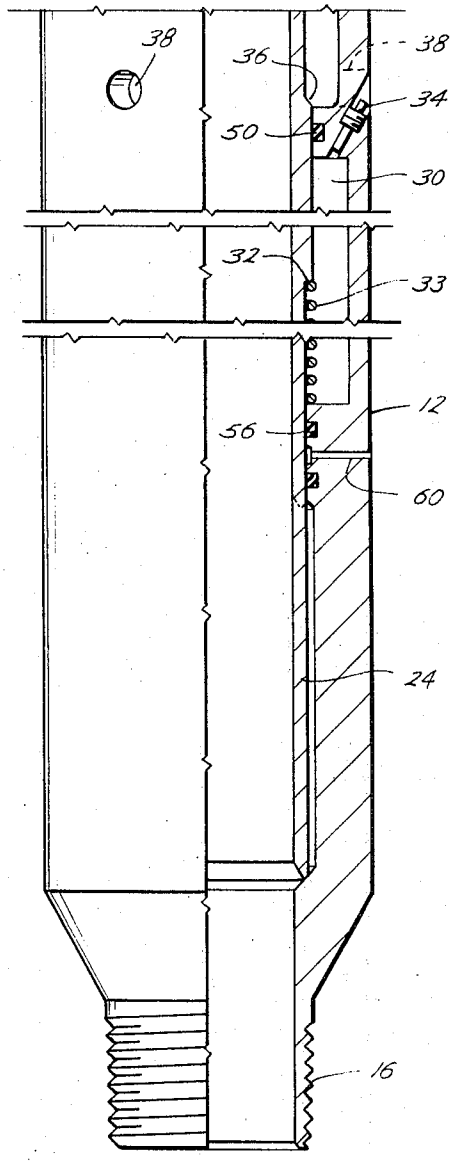


Fig. 1B



WELL SAFETY VALVE

BACKGROUND OF THE INVENTION

Generally, it is old to provide well safety valves such as shown in U.S. Pat. Nos. 3,045,760; 3,078,923; 3,265,134; which generally control the fluid flow in a well through a body actuated by a sliding tube telescopically movable in the body. However, there are several problems that exist with producing oil and gas wells which the present improved well safety valve is directed. One problem is that leaking threads in the well tubing allow high pressure production to enter the annulus between the well tubing and the well casing. The larger diameter well casing is not designed to withstand the high pressure of the oil and gas production flowing in the tube, and therefore the annulus pressure must be constantly monitored and relieved or the casing pipe will be ruptured. Another problem is that when a large diameter well tubing is utilized, such as in the Middle East countries, it is difficult to kill such a well in the case of a well catastrophe. The high flow rates which may occur through large well tubing dilutes and lightens the drilling mud or work-over fluid that is pumped down the well tubing to kill the well. In such situations, it takes a high pump rate and considerable time to finally kill such a well.

The above mentioned problems can be overcome by a well safety valve of the present invention positioned near the lower extremity of the well tubing that closes whenever the pressure exteriorly of the tubing in the annulus between the well tubing and casing increases.

SUMMARY

The present invention is directed to an improved well safety valve having a valve normally biased to the open position by a sliding tube telescopically movable in the body and positioned below the valve in which upward movement of the tube holds the valve in the open position and downward movement of the tube actuates the valve to the closed position.

A further object of the present invention is the provision of piston means connected to the tube and exposed to the pressure in the annulus between the tubing and the casing in which increased annulus pressure moves the tube downwardly closing the valve.

Yet a further object of the present invention is the provision of biasing means including a precharged gas chamber biasing the tube in an upward direction for keeping the valve open and in which tubing pressure is prevented from leaking into the chamber by providing a seal on each side of the chamber between the chamber and the interior of the well tubing. A bleed port is provided leading from each seal on the side of the seals remote from the chamber to the exterior of the body whereby the high pressure in the well tubing will not leak into the chamber to increase the force holding the valve open, but any pressure leak from the chamber may leak to the annulus for allowing the valve to close at a lower annulus pressure.

Still a further feature is the provision of a well safety valve that will lock in the closed position but which may be reopened when casing pressure and other adverse conditions are overcome such as by being reopened with the use of suitable wireline operations.

Other and further objects, features and advantages will be apparent from the following description of a presently preferred embodiment of the invention, given for the purpose of disclosure and taken in conjunction with the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1A is an elevational drawing, partly in cross section, illustrating the top portion of one type of improved well safety valve of the present invention shown in the closed position in solid outline and shown in the open position in the dotted outline, and

FIG. 1B is a continuation of FIG. 1A showing the lower portion of the present well safety valve.

DESCRIPTION OF THE PREFERRED EMBODIMENT

While the present improvements in a well safety valve will be described, for purposes of illustration only in use with a flapper type well safety valve, it is understood that the present invention may be used with other types of well safety valves.

Referring now to the drawing, and particularly to FIGS. 1A and 1B, one type of flapper subsurface well safety valve is shown utilizing the present invention, generally indicated by the reference numeral **10.** The apparatus **10** generally includes a body **12** having threaded connections **14** and **16** adapted to be connected in a well tubing positioned inside of a well casing (not shown) to permit production of oil and gas through the tubing under normal operating conditions but in which the valve **10** may close in response to abnormal conditions such as might occur when the well overproduces, blows wild, the annulus pressure between the tubing and the casing exceeds a desired amount, or in the event of failure in the well equipment.

The well safety valve **10** generally includes an annular valve seat **20** and a flapper valve **16** positioned therebelow and connected to the body **12** by a pivot pin **18.** Thus, when the flapper valve **16** is in the upward position seated on the valve seat **20,** as best shown in FIG. 1A, the safety valve **10** is closed blocking flow therethrough. A spring **22** is provided which yieldably urges the flapper valve **16** toward its seating position on the valve seat **20.** When the flapper valve **16** is held in the open position, as shown in dotted outline in FIG. 1A, the valve is open and production of oil and gas may freely flow through the safety valve **10.**

A sliding tube **24** is telescopically movable in the body **12** and through the valve seat **20.** As best seen in FIG. 1A, when the sliding tube **24** is moved to the downward position, the flapper valve **16** is released and is allowed to move upwardly, closing the valve by the action of the spring **22** and also by the action of fluid flow moving upwardly through the bore **13** of the valve **10.** And as best seen in dotted outline in FIG. 1A, when the sliding tube **24** is held in the upward position, the tube **24** extends past the flapper valve **16** and through the valve seat **20** and the valve **16** is held in the open position so long as the sliding tube **24** is held in the upward position.

Normally, the sliding tube **24** is biased to its upward position holding the flapper valve **16** away from and off of the valve seat **20,** but when abnormal conditions occur, the sliding tube **24** will be moved downwardly al-

lowing the flapper valve **16** to close shutting off flow through the production well tubing.

Referring now to FIG. **1B**, a precharged gas chamber **30** may be provided acting against a downwardly directed piston **32** connected to the sliding tube **24.** Gas pressure may be injected into the chamber **30** through a dill valve **34** to any desired pressure. The pressure in the chamber **30** acts against the piston **32** to bias the tube **24** in an upward or open position. In addition, or in lieu of the pressure chamber **30,** a spring **34** may be utilized acting on the shoulder or piston **32** for biasing the tube **24** upwardly for holding the valve in the open position.

A piston **36** may be provided on the sliding tube **24** and directed upwardly and exposed to pressure exteriorly of the body **12** through one or more ports **38** and is therefore responsive to pressure in the annulus between the well tubing and the casing. When the pressure exteriorly of the body **12** increases sufficiently, and acts on the piston **36,** the sliding tube **24** is moved downwardly away from the valve seat **20** and disengages from the flapper valve **16** allowing the flapper to move upwardly to the closed position on the valve seat **20** thereby shutting off oil and gas production through the valve **10** and the well tubing. Therefore, when pressure is applied in the annulus between the well tubing and the casing, exteriorly of the body **12** and through the port **38,** and against the piston **36,** the tube **24** will be moved downwardly closing the valve. This may occur if the well production flowing through the tubing and safety valve **10** escapes from the tubing by leaking through threads in the tubing to the exterior of the safety valve **10** thereby protecting the casing. Or in the event that some other problem occurs in the well, pressure can be increased in the annulus between the tubing and the casing exteriorly of the safety valve **10** to increase the pressure which is communicated through the ports **38** and to the piston **36** for closing the safety valve **10.**

It is to be noted that once the valve closes, the valve **10** is locked in the closed position and may be reopened only when the pressure exteriorly of the valve **10** is reduced. The valve **10** may be suitably reopened and reactivated by suitable wireline operations.

It is to be further noted that a seal **50** is provided on one side of the pressurized chamber **30** and between one side of the chamber **30** and the bore **13** of the tubing. A bleed port is provided leading from between the side of the seal **50** remote from the chamber **30** to exteriorly of the body **12,** such as ports **38,** so as to be in communication with the pressure exteriorly of the body **12.** Similarly, a seal **56** is provided at the lower end of the chamber **30** and between the chamber **30** and the bore **13** and a bleed port **60** is provided on the side of seal **56** remote from the chamber **30** leading from the seal **56** to exteriorly of the body **12.** Therefore, tubing pressure in the bore **13** cannot leak into the chamber **30** to increase the pressure therein and hold the valve in the open position in the event of a catastrophe. On the other hand, any failure of the seals **50** and **56** allows the pressurized gas in the chamber **30** to leak to the lower pressure exteriorly of the body **12** thereby causing the valve **10** to close at a lower external pressure flowing through the ports **38** and provide a fail safe operation.

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 a presently preferred embodiment of the invention has been given for the purpose of disclosure, numerous changes in the details of construction and arrangement 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. A well safety valve for use in a well tube comprising,

a body having an annular valve seat,

valve means for engaging said seat for opening and closing said valve,

a sliding tube telescopically movable in the body positioned below said valve means and movable through the valve for holding the valve open when the tube is in the upward position and downward movement of the tube closes said valve,

means for biasing said tube upwardly for opening said valve, said biasing means includes a gas chamber, and including,

a seal on each side of the chamber between the chamber and the interior of the tubing, and

a bleed port leading from the side of each seal remote from said chamber and to the exterior of the body,

piston means connected to the tube, and

passageway means in communication between the piston and exteriorly of the body for moving the tube downwardly for closing said valve.

2. A well safety valve for use in a well tubing positioned in a well casing comprising,

a body having an annular valve seat, said body including connections for attachment in the well tubing,

a flapper valve pivotally connected to the body below the seat and movable upwardly into engagement with the seat for closing the valve and movable downwardly away from the seat for opening the valve,

a sliding tube telescopically movable in the body and through the seat and positioned below the valve,

biasing means for moving the tube upwardly holding the flapper valve away from the seat, said biasing means includes a gas chamber, and including,

a seal on each side of the chamber and the interior of the tubing, and

a bleed port leading from the side of each seal remote from said chamber seals and to the exterior of the body,

upwardly directed piston connected to the tube,

passageway means in communication between the piston and the exterior of the body for applying tubing casing annulus pressure on the piston for moving the tube downwardly for closing the valve.

3. A well safety valve for use in a well tubing positioned in a well casing comprising,

a body having an annular valve seat, said body including threaded connections for attachment in the well tubing,

a flapper valve pivotally connected to the body below the seat and movable upwardly into engagement with the seat for closing the valve and movable downwardly away from the seat for opening the valve,

a sliding tube positioned below the valve and telescopically movable in the body and through the valve for holding the valve open when the tube is in the upward position and allowing the valve to close when the tube is moved downwardly,

biasing means for yieldably holding the tube upwardly for holding the flapper valve away from the seat,

an upwardly directed piston connected to the tube, and

passageway means in communication between the piston and the exterior of the body and tubing whereby a predetermined increase in pressure in the tubing casing annulus on the piston moves the tube downwardly for closing the valve.

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