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Suter

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[54] **APPARATUS AND PROCESS FOR PREVENTING BLOW-OUTS**

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[52] **U.S. Cl.** **175/38;** 166/75; 175/65

[51] **Int. Cl.**[2] **C09K 7/00;** E21B 41/00

[58] **Field of Search** 175/65, 24, 38; 166/75, 166/80

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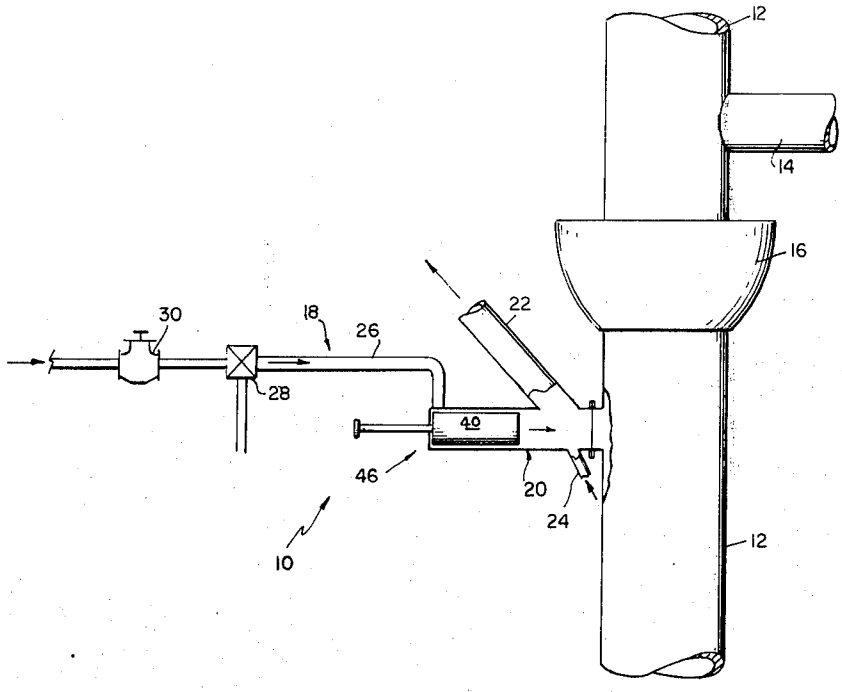
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[57] **ABSTRACT**

Blow-Out Prevention Apparatus for an oil well comprising a surface casing, a mud return means leading from the casing, a blow-out preventor means attached to the casing, and a mud diverter valve means connected with the casing. The valve means includes a cylindrical sleeve having a diverted-mud inlet end which leads into the casing, a biasing end, and a diverted-mud outlet opening in the side wall of the sleeve. A piston is housed in the sleeve which is slideable back and forth between the ends of the sleeve, and the piston has a mud contact end and a biased end. The valve means additionally comprises a mud diverter conduit leading from the sleeve through the outlet opening, and biasing means for resiliently biasing the piston from the biasing end thereof toward the mud-inlet end of the sleeve until the outlet opening thereof is covered by the piston. The process comprises passing diverted mud from the casing axially into the cylindrical sleeve and subsequently discharging the diverted mud from the sleeve through the outlet opening therein.

17 Claims, 3 Drawing Figures



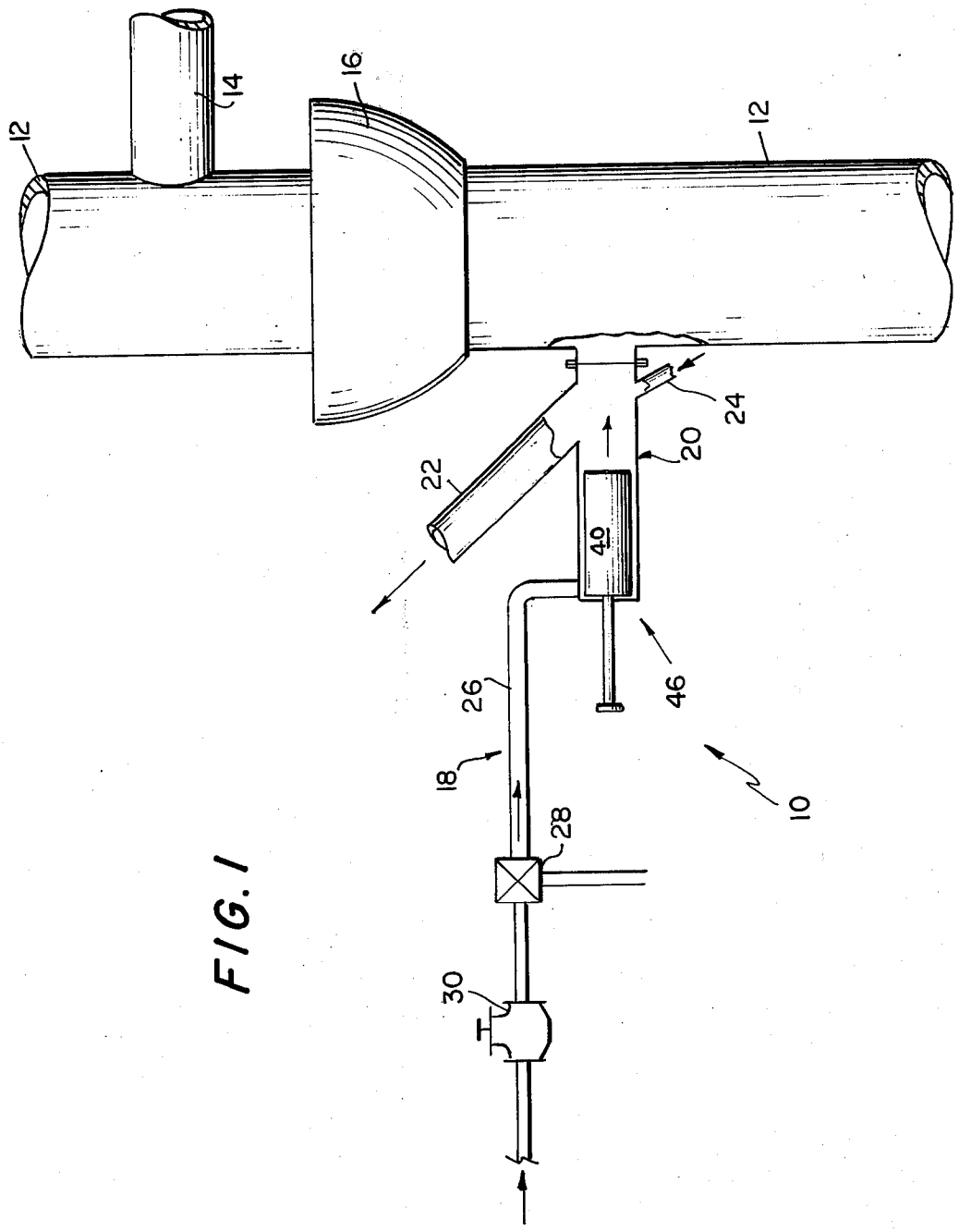


FIG. 1

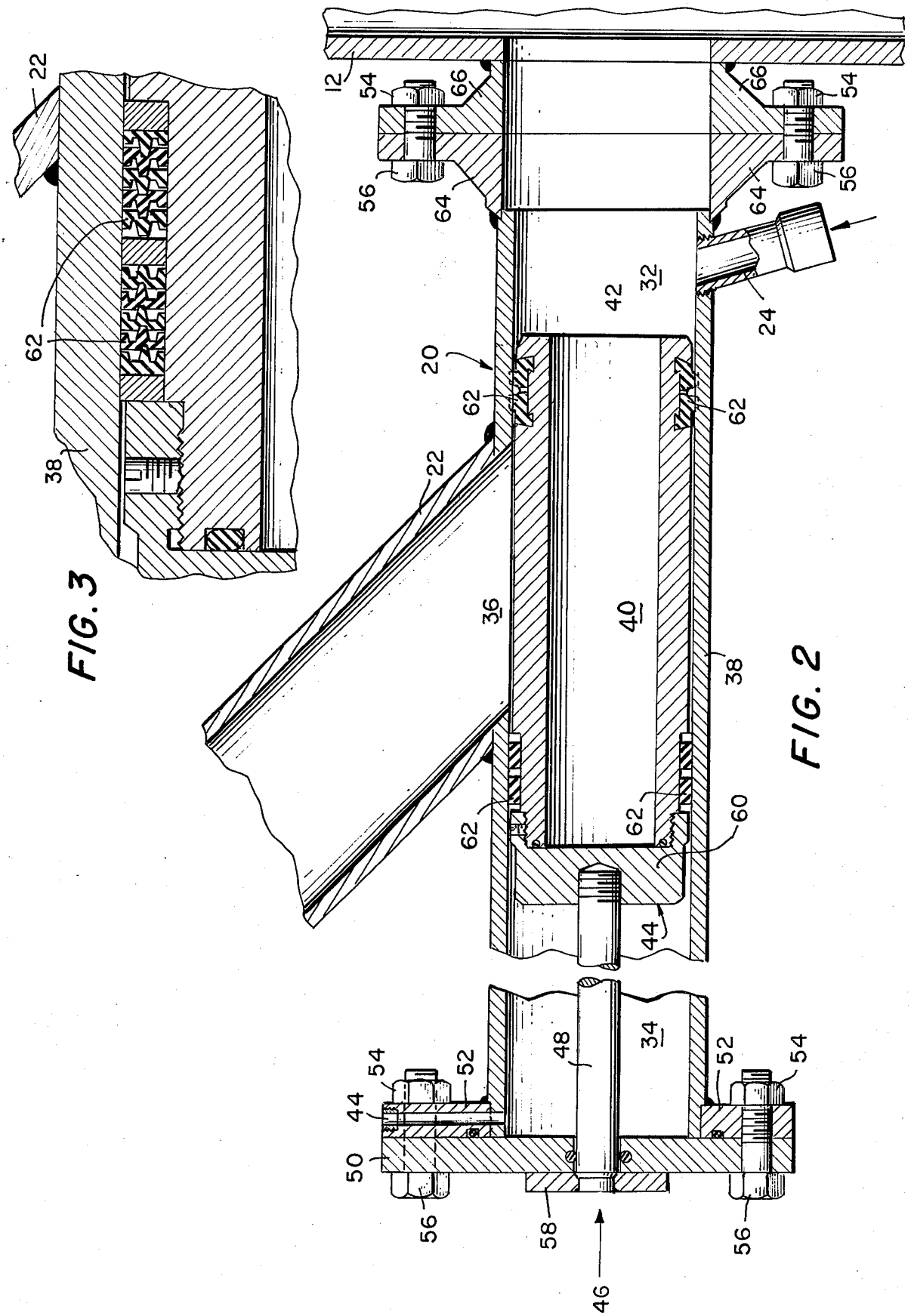


FIG. 2

FIG. 3

APPARATUS AND PROCESS FOR PREVENTING BLOW-OUTS

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a blow-out prevention apparatus and process. More specifically, this invention provides a diverter valve means and process for preventing blow-out of an oil well from underneath, around or through a surface casing, or the like, of the well.

2. Description of the Prior Art

When drilling shallow in the Gulf Coast area, high pressure gas sands are often encountered. This is a particularly dangerous situation because if the well is shut in during the kick the pressure will break down the casing shoe and a blow-out can occur around the outside of the casing. To prevent such blow-outs around the casing, a well is generally allowed to flow through lines which carry the gas and drilling mud away from the rig until the flow can be safely controlled. Such a system for diverting the flow of mud away from the rig is called a mud diverter system and normally includes a manually operated butterfly valve for controlling flow of the mud. These conventional diverter systems rely on human promptness in preventing a breakdown of the casing shoe and blow-out around the outside of the casing. They are also not fail-safe, non-automatic, and are easily plugged by the drilling mud. Therefore, what is needed and what has been invented by me is a diverter system which avoids the foregoing deficiencies of the prior art.

SUMMARY OF THE INVENTION

This invention accomplishes the desired objects through an improvement in a blow-out prevention apparatus of the type which generally comprises a surface casing for a well, a mud return means leading from the casing, a blow-out preventor means attached to the casing, and a mud diverter valve means connected with the casing. In accordance with the present invention the valve means has a cylindrical sleeve with a diverted-mud inlet end which leads into the casing, a biasing end, and a diverted-mud outlet opening in the side wall of the sleeve. A piston is housed in the sleeve which is slideable back and forth between the ends of the sleeve, and the piston includes a mud contact end and a biased end. The valve means additionally includes a mud diverter conduit leading from the sleeve through the outlet opening, and a biasing means for resiliently biasing the piston from the biasing end thereof toward the mud-inlet end of the sleeve until the outlet opening thereof is covered by the piston. This invention also accomplishes the desired objects by improvements in the general process for preventing blow-out of an oil well from underneath, around or through a surface casing of the well. Accordingly, I have provided an improved method of diverting mud flow from the casing which comprises passing diverted mud from the casing axially into an elongated mud diverting channel which leads from the casing, the mud being diverted from the casing when the pressure therein exceeds a predetermined limit. Subsequently, the diverted mud is discharged from the channel through an outlet opening therein, and the mud flow from the opening is in a direction which is substantially transverse with respect to the longitudianal axis of the channel.

Normally, the outlet opening of the channel is covered by a movable obstruction member in the diverting channel, and the member is urged to move in one direction along the longitudianal axis of the channel by pressure exerted on one end of the member from within the casing, but the member is resiliently biased with a biasing pressure from the other end and urged to move in the opposite direction along the longitudianal axis of the channel and cover the outlet opening when the biasing pressure on the member exceeds a pressure within the casing which is below the predetermined limit; and whereupon development of a casing pressure which exceeds the limit, the obstruction member is caused to move within the channel so that the outlet opening is uncovered.

It is therefore an object of this invention to provide a diverter system which avoids the aforesaid deficiencies associated with the prior art.

It is another object of this invention to provide a process and means for preventing blow-out of an oil well from underneath, around or through a surface casing, or the like, of the well.

It is yet another object of this invention to provide a process and means for preventing high pressure formations from breaking down the casing shoe of an oil well as would result in a blow-out around the outside of the casing.

These, together with the various ancillary objects and features of the present invention will become apparent as the following description proceeds. Preferred embodiments of my novel apparatus and process for preventing blow-outs will be described with reference to the accompanying drawings, by way of example only, wherein:

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic detail view showing the diverter system of the present invention;

FIG. 2 is a fragmentary vertical sectional view of the diverter valve of the invention; and

FIG. 3 is an enlarged partial vertical sectional view showing the plurality of packing means attached to the circumference of the piston of the diverter valve of FIG. 2.

DETAILED DESCRIPTION OF THE INVENTION

With reference to the drawings, wherein like reference numerals designate similar or identical parts throughout the various views, and in particular to FIG. 1, there is seen a diverter system, generally illustrated as **10**, consisting of a surface casing **12** which has a mud return bell nipple **14** leading therefrom and a blow-out preventer **16** attached thereto. A mud diverter valve means, generally illustrated as **18** is connected with the casing **12** and essentially comprises a diverter valve **20** having a mud diverter conduit **22** and a wash conduit **24** attached thereto. The mud diverter valve means **18** additionally includes a conduit **26** leading from the valve **20** to an air accumulator (not shown in the drawings). A regulator **30** and an automatic dump valve **28** are located in conduit **26** between the air accumulator and the valve **20**. The blow-out preventer **16** is located between the bell nipple **14** and the mud diverter valve means **18**.

Referring in particular now to FIG. 2 and FIG. 3, there is seen the diverter valve **20** including a cylindrical sleeve **38** and having a diverted-mud inlet end **32**

which leads directly into the casing **12**, a biasing end **34**, and a diverted-mud outlet opening **36** in the side wall of the sleeve **38**. A piston **40** is housed in the sleeve **38** and is slideable back and forth between the ends of the sleeve. The piston **40** has a mud contact end **42** and a biased end **44**. The mud diverter conduit **22** leads from the sleeve **38** through the outlet opening **36** in proximity to the mud inlet end **32**. The wash conduit **24** leads from the sleeve **38** opposite the mud outlet opening **36**. A biasing means for resiliently biasing the piston **40** from the biasing end **34** thereof toward the mud-inlet end **32** of the sleeve **38** is in communication with the biasing end **34** via a port **44** situated in a flange **52** attached to the biased end **34** of the sleeve **38**. This biasing means may be any suitable biasing means such as a spring (not shown in the drawings), or a fluid. In a preferred embodiment the biasing means **46** is pneumatic.

Piston **40** additionally has a piston position indicator, generally illustrated as **46**, secured thereto. The piston position indicator **46** comprises a rod member **48** attached to the biased end **44** of the piston **40** and a stop plate **58** secured to the end of the rod member **48** which extends outside of the sleeve into the atmosphere. The rod member **48** slideably extends through a sealing plate **50** which removably connects to the flange **52** by nuts **54** and bolts **56**. The sealing plate **58** encloses the biasing end **34** of the sleeve **38** and engages the stop plate **58** to prevent the piston **40** from sliding too far toward the mud-inlet end **32** after the outlet opening **36** is covered by the piston **40**.

Biasing end **44** of piston **40** includes a cap member threadably attached to piston **40**. Rod member **48** threadably engages the cap member **60**. A plurality of packing means **62** is attached to the circumference of the piston **40**. A flange member **64** is integrally bound to the diverted-mud inlet end **32** of the sleeve **38**. The casing **12** has a flange member **66** attached thereto at the point where the diverted-mud inlet **32** leads into the casing **12**. Flange **64** and flange **66** interconnect via nuts **54** and bolts **56** to connect the diverter valve **20** with the casing **12**.

With continuing reference to the drawings for operation of the invention, surface casing **12** is set in a shallow, high pressure gas sand. A drill string (not shown in the drawings) is being turned inside of the surface casing **12**, and drilling mud is circulating through bell nipple **14** to remove the drill cuttings. Pneumatic pressure within conduit **26** and behind the biased end **44** of the piston **40** within the cylindrical sleeve **38** is a little greater than the hydrostatic pressure than that which exist in the region between the bell nipple **14** and the diverter valve **20**. When high pressure is encountered by the drill bit and the hydril blow-out preventer **16** is closed in an attempt to prevent a blow-out. In order to prevent the well from blowing-out around the casing as the pressure continues to build-up and exceeds the hydrostatic head between the bell nipple **14** and the diverter valve **20**, mud is diverted through the mud inlet **32** and against the mud contact end **42** of the piston **40** to cause the piston to slide towards the biasing end **34** of the sleeve **38**. As the piston **40** moves away from the mud-inlet end **32**, air becomes pressurized within the biasing end **34** and the pneumatic conduit **26**, thus causing the automatic dump valve **28** to commence bleeding-off air. Over pressured drilling mud continues to drive the piston **40** toward the biasing end **34** to permit continued passage of mud through outlet opening **36** and into mud diverter conduit **22**. As the pressure in the well subsides and the well is brought under control, the regulator valve **30** releases more air to pressurize the conduit **26** and the biasing end **34** of the sleeve **38** to cause the piston **40** to begin sliding towards the mud-inlet end **32**. The piston **40** is driven by pressurized air towards the mudinlet end **32** until the stop plate **58** engages the sealing plate **50**. In this position the piston **40** has closed-off outlet opening **36**. Periodically, mud-inlet end **32** and conduit **22** may be washed by the introduction of wash fluid via wash line **24**.

While the present invention has been described herein with reference to particular embodiment thereof, a latitude of modification, various changes and substitutions are intended in the foregoing disclosure, and it will be appreciated that in some instances some features of the invention will be employed without a corresponding use of other features without departing from the scope of the invention as set forth.

I claim:

1. Blow-out prevention apparatus for an oil well comprising:

A. a surface casing,

B. a mud return means leading from said casing,

C. a blow-out preventer means attached to said casing,

D. a mud diverter valve means connected with said casing, said valve means comprising:

a. a cylindrical sleeve having a diverted-mud inlet end which leads into said casing, a biasing end, and a diverted-mud outlet opening in the side wall of the sleeve

b. a piston housed in said sleeve which is slideable back and forth between said ends of the sleeve, said piston having a mud contact end and a biased end

c. a mud diverter conduit leading from said sleeve through said outlet opening, and

d. biasing means for resiliently biasing said piston from the biasing end thereof toward said mud-inlet end of the sleeve until said outlet opening thereof is covered by said piston.

2. Apparatus as in claim **1** wherein said biasing means includes a fluid pressure supply means leading into said biasing end of the sleeve and further including means for regulating the pressure at which fluid is supplied to the biasing end.

3. Apparatus as in claim **2** wherein said blow-out preventer means is positioned between said mud return means and said diverter valve means.

4. Apparatus as in claim **3** wherein the mud inlet end of said sleeve leads directly into said casing and the mud diverter conduit leads into said sleeve in the proximity of the mud inlet end thereof.

5. Apparatus as in claim **4** wherein said means for resiliently biasing comprises pneumatic means including a conduit for a pneumatic fluid which leads into said biasing end of said sleeve, a pneumatic regulator in said conduit, and a dump valve in communication with said pneumatic conduit.

6. Apparatus as in claim **5** and additionally including a plurality of packing means attached to the circumference of said piston.

7. Apparatus as in claim **6** and additionally including a piston position indicator secured to said piston.

8. Apparatus as in claim 7 wherein said piston position indicator comprises a rod member attached to said biased end of said piston, said rod member slideably extending through said biasing end of said sleeve into the outside atmosphere.

9. Apparatus as in claim 8 additionally including a wash conduit leading into said sleeve opposite said mud outlet opening therein.

10. Apparatus as in claim 9 wherein said rod member of the position indicator additionally includes a stop plate attached thereto on the outside of said sleeve, said stop plate engaging the outside of said biasing end of said sleeve to stop said piston from sliding further within said mud-inlet end after said outlet opening is covered by said piston.

11. Apparatus as in claim 10 wherein said dump valve is an automatic dump valve which upon closure of the blow-out preventer means dumps pneumatic fluid and thus reduces pressure at the biasing end of said sleeve, enabling said piston to slide toward said biasing end to open said diverted-mud outlet.

12. Apparatus as in claim 11 wherein said diverted-mud inlet end of said sleeve includes a flange member, said casing has a flange member attached thereto at the point where said diverted-mud inlet leads into said casing, and said connection of said mud diverter valve means with said casing is effected by the mating and connecting of said flange member of said mud-inlet end and said flange member of said casing.

13. Apparatus as in claim 12 wherein said biasing end of said sleeve includes a flange member attached to the circumference thereof, a sealing plate removably connected to said biasing end flange member for enclosing the biasing end of said sleeve, said sealing plate having a structure defining an aperture wherethrough said rod member slides, and said stop plate engages the outside of said sealing plate to stop excess sliding travel of the piston within the mud-inlet end.

14. In a process for preventing blow-out of an oil well from underneath, around or through a surface casing of the well, the improved method of diverting mud flow from the casing which comprises:

a. passing diverted mud from said casing axially into an elongated mud diverting channel which leads from the casing, said mud being diverted from the casing when the pressure therein exceeds a predetermined limit,

b. subsequently discharging said diverted mud from said channel through an outlet opening therein, the mud flow from said opening being in a direction which is substantially transverse with respect to the longitudinal axis of the channel,

c. said outlet opening being coverable by a movable obstruction member in said diverting channel, said member being urged to move in one direction along the longitudinal axis of said channel by pressure exerted on one end of said member from within said casing, but which is resiliently biased with a biasing pressure from the other end and urged to move in the opposite direction along the longitudinal axis of said channel and hence cover said outlet opening when the biasing pressure on said member exceeds a pressure within said casing which is below said predetermined limit, and whereupon development of a casing pressure which exceeds said limit, said obstruction member is moved within said channel and said outlet opening is uncovered.

15. A method as in claim 14 wherein the biasing pressure applied to the other end of the obstruction member is a fluid pressure.

16. A method as in claim 15 wherein the biasing pressure is a pneumatic pressure.

17. A method as in claim 16 wherein said diverting channel is washed to remove residual mud following the diversion of mud through said channel and prior to recovering said outlet opening with said obstruction member.

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