Aug. 8, 1939. L. E. DAY 2,168,764

BLOW-OUT PREVENTER

Filed Oct. 7, 1938

Fig. 1.

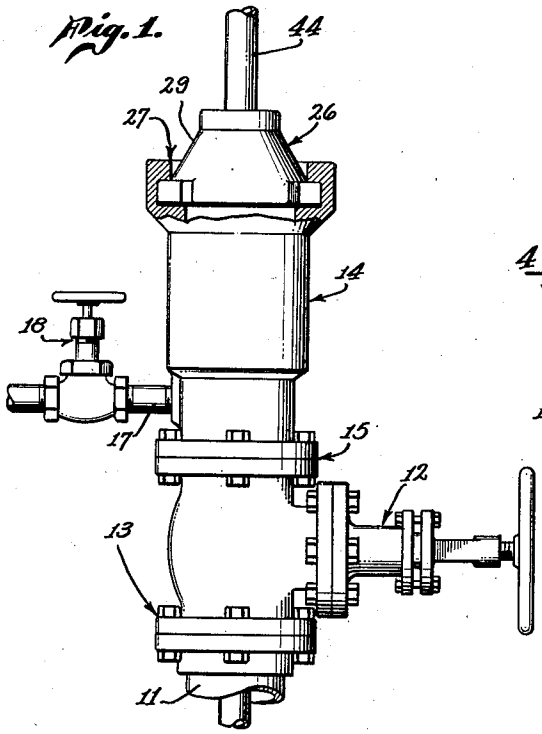


Fig. 2.

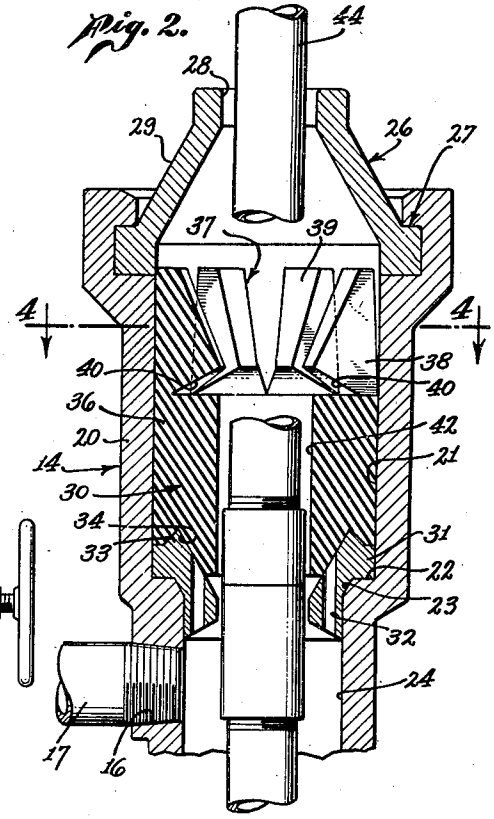


Fig. 3.

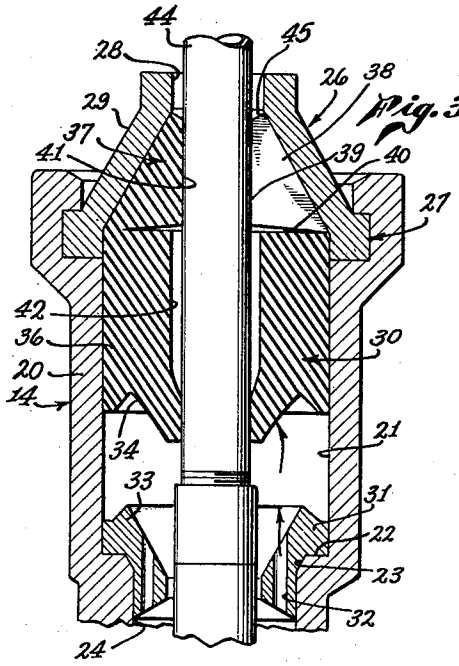
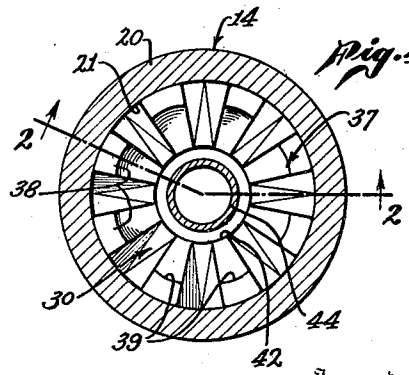


Fig. 4.



Inventor

LEON E. DAY,

By

Attorney

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UNITED STATES PATENT OFFICE

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BLOW-OUT PREVENTER

Leon E. Day, Long Beach, Calif., assignor to Regan Forge & Engineering Company, a corporation of California

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8 Claims. (Cl. 166—15)

This invention relates generally to equipment used in the drilling of oil and gas wells and particularly to devices used to control gas pressures for the prevention of blowouts.

In the drilling of oil and gas wells it is common to unexpectedly encounter formations or pockets where there is an extremely high gas pressure. Some provision must be made at the upper end of the drill hole to prevent the increased gas pressure from blowing the tools and rotary mud from the hole in order to prevent loss of the hole, injury to the workmen and the possibility of a serious gas fire. I am aware that various types of blowout preventers have been used, but to the best of my knowledge these devices often fail to function quickly enough or they interfere with the drilling of the well or with the insertion or withdrawal of tools and tubing.

Therefore, it is a primary object of this invention to provide a means for automatically shutting off and controlling high gas pressures which may be suddenly and unpredictably encountered in the drilling operation to prevent the possibility of blowouts. In this connection it is a particular object to provide a blowout preventer for controlling any sudden high gas pressure which may develop during the insertion or withdrawal of drill pipe or other objects.

It is also an object of this invention to provide a blowout preventer or closure means which can be utilized during cementing and testing operations.

It is a particular object of this invention to provide a blowout preventer which can be adapted to accommodate various sizes of pipe and also to accommodate wire line. In this connection it is an object of the invention to provide a blowout preventer which will permit coupled pipe to be inserted against pressure. It is also an object of this invention to provide a closure means for use at the top of an oil well casing which may be manually operated.

These and other objects will be apparent from the accompanying drawing and the following description thereof. Referring to the drawing which is for illustrative purposes only:

Fig. 1 is an elevation partly broken away of the device of this invention showing it in relation to the well casing and associated parts;

Fig. 2 is a sectional elevation of the upper and operative part of the blowout preventer of this invention and showing the blowout preventer means in inoperative position, the section being taken on the line 2—2 of Fig. 4;

Fig. 3 is a view similar to Fig. 2 but showing the blowout prevention means in operative position; and

Fig. 4 is a sectional plan view on line 4—4 of Fig. 2, showing the packer in top plan view.

More particularly describing the invention, reference numeral 11 generally indicates the outer casing of an oil well which may be considered as extending down into a bore hole in the earth. Mounted on the upper end of this casing is a conventional gate valve generally indicated by reference numeral 12 secured thereto by any ordinary flanged joint such as at 13. The blowout preventer of this invention, generally indicated by reference numeral 14 is mounted by means of a flanged joint 15 on the upper end of the gate valve 12. The blowout preventer is provided with a laterally threaded opening 16 which is adapted to accommodate an outlet conduit 17 for the return flow of the rotary mud which is normally pumped into a well during the process of drilling. This conduit 17 is preferably provided with a manual control valve 18.

Referring particularly to Figs. 2 and 3 for the details of construction and the operation of the blowout preventer, reference numeral 20 indicates the main body of the blowout preventer. This main body is provided with an upper bore 21 which terminates at its lower end in a shoulder 22 and a bevelled surface 23 which separate the upper bore from a lower bore 24 of reduced diameter. This bore 24 is preferably approximately the same diameter as the inner diameter of the casing 11. The body member 20 is provided with a cap member 26 which is detachably secured in place by means of an ordinary breech lock mechanism generally indicated by reference numeral 27. The cap 26 is provided with a central opening 28 of sufficient size to accommodate any coupled pipe which it is desired to pass through the blowout preventer. The cap member 26 is provided with frustroconical sides 29 the purpose of which will subsequently be apparent.

The blowout prevention means of the invention comprises a packer member generally indicated by reference numeral 30. This packer is adapted to rest upon a base ring 31 which has a plurality of circularly disposed passageways 32 therethrough. The base ring is provided with an annular ridge 33 which extends into a V groove 34 in the lower end of the packer.

The packer 30 is formed of rubber or some other suitable resilient substance and comprises an annular body portion 36 and a segmented

upper portion 37. The segmented upper portion 37 comprises a plurality of portions 38 which will be termed fingers. These fingers at their outer periphery form a segmented continuation of the periphery of the annular body portion 36 when in normal position such as is shown in Fig. 2. The inner face 39 of each finger is preferably slightly transversely curved and disposed at an inwardly converging angle with respect to the longitudinal axis of the packer. Each of the fingers is undercut at 40 in order to permit the fingers to be deflected inwardly to the position in which they are shown in Fig. 3. When in an inwardly deflected position the inner surfaces 39 of the fingers cooperate to form a bore 41 (Fig. 3) which is of less diameter than the bore 42 in the main body of the annular body portion 36.

Referring to Figs. 2 and 3 for the operation of the device there is shown in position therein a tubing or drill pipe 44 extending through the blowout preventer. If the blowout preventer is to be used in a drilling operation the drill pipe with a bit attached to the lower end is first passed through the upper portion of the blowout preventer until the bit is positioned in the bore 24 or at a slightly lower point. The annular ring 31, and packer 30 are then positioned in the body member 20 in the position in which they are shown in Fig. 2 and the cap member 26 secured to the top. The drill pipe may then be run downwardly through the blowout preventer, the ring 31 serving as a guide for the pipe. After the drill has been positioned at the bottom of the hole circulation of the rotary mud is then started down through the pipe and is returned up through the casing 11 and outwardly through conduit 17. As long as the valve 18 is open and the volume of the return circulation of the mud is not in excess of what can easily pass through the conduit 17, the packer 30 will remain in the position in which it is shown in Fig. 2. However, should a pocket of gas be drilled into of sufficient pressure to overcome the hydrostatic head of the drilling fluid and cause an increase in the return flow of the mud, then the increased return flow will cause fluid pressure to be exerted against the lower end of the packer 30, the fluid having access thereto through the openings 32 in the ring 31 and through the central opening in that ring. The pressure will force the packer 30 upwardly into the cap member 26, into the position in which it is shown in Fig. 3 and by reason of the fact that the finger members 38 are jambed into the converging conical sides of the cap member, they are inwardly deflected and caused to tightly engage the drill pipe 44 and effect a packing-off thereof. In this connection it should be pointed out that the V groove 34 in the bottom of the packer permits the fluid pressure to cause the inward deflection of the lower end of the packer until it tightly engages the pipe 44 as shown in Fig. 3 thereby converting the packer into a piston which will move upwardly under influence of fluid pressure below it.

If it is desired to close the blowout preventer in the absence of gas pressure during the ordinary circulation of drilling fluid, this may be accomplished by closing the valve 18 during circulation of the drilling fluid, thereby building up the pressure against the lower end of the packer and causing same to pack off or seal the pipe as is shown in Fig. 3.

It should be apparent that pipe can be run in the hole against pressure inasmuch as when a coupling engages the upper end of the fingers the assembly is caused to move downwardly allowing the fingers to deflect sufficiently for the passage of the coupling. To facilitate this operation the upper ends of the fingers are provided with inwardly converging surfaces 45.

It should be apparent from the above description and the accompanying drawing that a blowout preventer is provided which will automatically function to seal off pipe or other objects within the blowout preventer upon any sudden increase in pressure. In this connection it is of course evident that extra packers 30, rings 31, and cap members 26 may be provided of various internal dimensions for different size tubing or apparatus to be run in the hole. In this connection even wire line might be accommodated and protection provided against blowout.

While the invention has been shown and described with reference to a particular construction, it is not intended to limit the invention to the exact construction illustrated and described, but it is intended to cover such modifications as may come within the scope of the claims.

I claim as my invention:

1. A blowout preventer adapted to be used in combination with a well casing having a string of tools extending thereinto comprising: a hollow body member; a hollow centrally apertured cap member removably mounted on said body member, said cap member having an upwardly converging interior wall portion; and an annular resilient packer slidably positioned in said body member, said packer comprising a solid annular body portion and a segmented annular upper portion, said segmented portion being comprised of a plurality of inwardly deflectable fingers adapted to form a tight closure about the string when in inwardly deflected position.

2. A blowout preventer adapted to be used in combination with a well casing comprising: a hollow body member having an inwardly extending shoulder between its ends; a hollow frustoconical cap member detachably mounted on said body member; a ring seated on said shoulder, said ring extending below said shoulder and having an annular ridge on its upper end, said ring being apertured inwardly of said ridge; and an annular resilient packer normally seated on said ring, said packer having an inverted V groove in its lower end to accommodate said ridge of said ring, said packer having an upper segmented portion consisting of inwardly deflectable fingers.

3. For use in a blowout preventer of the type described, a packer member comprising: a member formed of a resilient material, said member having a solid annular body portion and a segmented annular upper portion, said segmented portion being formed of inwardly deflectable fingers.

4. For use in a blowout preventer of the type described, a packer member comprising: a member formed of a resilient material, said member having a solid annular body portion and a segmented annular upper portion, said segmented portion being formed of inwardly deflectable fingers which when so deflected, form a bore of less diameter than the diameter of the bore of the body portion.

5. For use in a blowout preventer of the type described, a packer member comprising: a rubber member having a solid annular body portion and a segmented upper portion, said segmented upper portion consisting of a plurality of fingers forming a continuation of the outer surface of said

body portion, said fingers each being undercut to permit inward radial deflection.

6. For use in a blowout preventer of the type described, a packer member comprising: a rubber member having a solid annular body portion and a segmented upper portion, said segmented upper portion consisting of a plurality of fingers forming a continuation of the outer surface of said body portion, said fingers each being undercut to permit inward radial deflection, said fingers each having an inner face angularly disposed with relation to the outer surface.

7. For use in a blowout preventer of the type described, a packer comprising: a rubber member having an annular solid body portion and a segmented upper portion, said segmented upper portion consisting of a plurality of inwardly deflectable fingers, said fingers being so shaped as to form a bore of less diameter than the bore in said body portion when said fingers are in inwardly deflected position.

8. A blowout preventer adapted to be used in combination with a well casing comprising a hollow body member; a hollow centrally apertured cap member removably secured to the top of said body member, said cap member having an upwardly converging interior wall portion; and an annular resilient packer slidably positioned in said body member having a bore normally larger than a tubular member or the like extending through said blowout preventer and normally of sufficient size to permit passage of couplings or enlarged portions of said tubular member therethrough, said packer having deflectable end portions adapted to be deflected inwardly to engage said tubular member and effect a seal thereof.

LEON E. DAY.