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BLOWOUT PREVENTER

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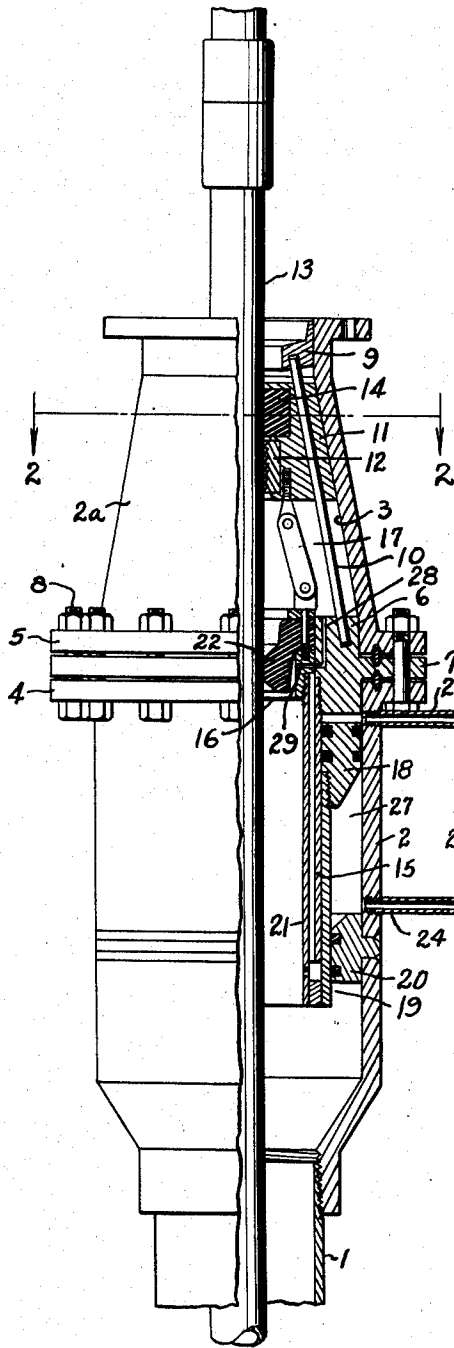


Fig. 1.

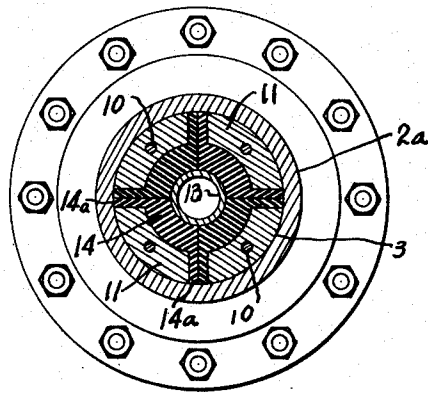


Fig. 2.

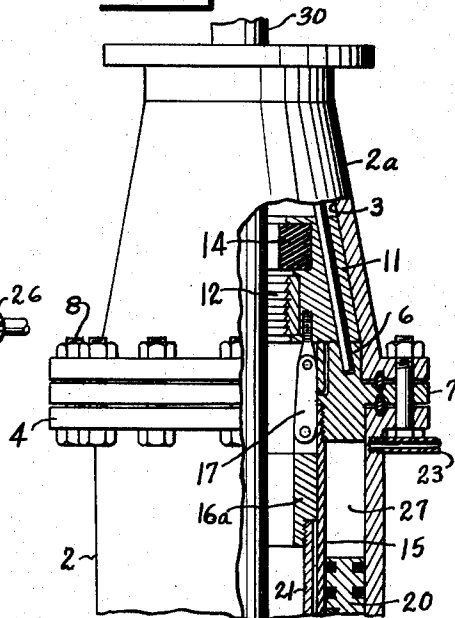


Fig. 3.

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BLOWOUT PREVENTER

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9 Claims. (Cl. 166—14)

This invention relates to a blowout preventer.

An object of the invention is to provide equipment of the character described designed to be attached to the top of a well pipe for use in drilling or while running a tubing into the well in the presence of well pressure and for forming a seal around the tubing or drill stem to prevent a blowout.

Another object of the invention is to provide a blowout preventer of the character described through which a drill stem may be operated while drilling having sealing means which may be normally maintained in inactive position spaced away from the drill stem with means for actuating the sealing means, in case of threatened blowout, into sealing relation with, and around, the drill stem to prevent the escape of fluid under pressure around said stem, said sealing means being provided also with stem engaging means for engaging and maintaining the stem in the well until the pressure is relieved.

The invention also embodies a pressure head shaped to form a seal about the tubing or drill stem connected to the pipe engaging and sealing means and which is effective, in case high pressure develops in the well, to actuate the pipe engaging and sealing means into active position closely around and in engagement with the tubing or stem whereby the tubing or stem is anchored in the well and a fluid tight seal formed therearound.

The invention also embodies means to be actuated by fluid under pressure into active or inactive positions.

With the above and other objects in view the invention has particular relation to certain novel features of construction, operation and arrangement of parts, examples of which are given in this specification and illustrated in the accompanying drawing, wherein:

Figure 1 shows a side elevation of the blowout preventer, shown partly in section, with the tubing engaging and sealing means in active position.

Figure 2 shows a sectional view taken on the line 2—2 of Figure 1, and

Figure 3 shows a fragmentary, elevational view, partly in section, showing the parts in inactive position with the pressure head removed.

Referring now more particularly to the drawing wherein like numerals of reference designate the same parts in each of the figures, the numeral 1 designates a pipe in a well and the numeral 2 designates a cylindrical housing attached to the upper end of said pipe which includes a cap 2a secured on the upper end thereof and having the

inside upwardly converging seat 3. The upper end of the housing 2 has the external annular flange 4 and the lower end of the cap 2a has the external annular flange 5 registering with the flange 4. Within the housing there is an anchor ring 6 having an external annular flange 7 between the flanges 4 and 5 with suitable leak proof gaskets between said flanges and these three flanges are secured together by the common bolts, 8 as shown. Secured within the upper end of the cap 2a there is an anchor ring 9 and the guide rods 10 have their upper and lower ends anchored to the upper and lower anchor rings 9 and 6, said guide rods being approximately parallel with the seat 3 as shown in Figure 1. The numeral 11 designates the segmental slip carriers whose outer sides are shaped to conform to the shape of and to fit closely against the seat 3. They are mounted to slide on the corresponding rods 10. Countersunk into the inner side of each carrier 11 there is a pipe engaging slip 12. The inner sides of these slips are shaped to conform to the shape of and to closely surround an inner tubing 13 and have the inside downwardly pitched teeth to engage said tubing. Above each slip and countersunk into the corresponding carrier there is an arcuate sealing member 14 preferably formed of rubber. The sealing members 14 complement each other so as to form a complete seal around the tubing when the carriers 11 are in their upper, or active, position. The carriers with their slips and sealing members will be referred to as the tubing engaging and sealing means.

As will be noted from an inspection of Figure 2 each sealing member 14 is extended at each end of its segment 11 forming the wings 14a, 14a which overlap the ends of the corresponding carriers so as to form complete seals between the carriers when the pipe engaging and sealing means is in active position. When in inactive position the pipe engaging and sealing means will rest on the annular anchor 6 as shown in Figure 3.

The anchor ring 6 has a depending tubular cylinder 15 whose upper end is attached to said anchor ring and whose lower end is free. Within this cylinder the annular head 16 of Figure 1, or 16a of Figure 2, works. These heads are connected to the carriers 11 above by corresponding links 17 whose ends are flexibly connected thereto.

As is clearly shown by the drawing the guide or cylinder 15 is spaced inwardly from the housing 2 and between it and the housing there is the annular plunger 18 having the outside and inside countersunk packing rings forming fluid tight seals with the housing and with said cylinder.

Attached to and depending from the plunger 18 is the cylindrical guide 19 which works closely through an inside guide ring carrier in the housing. This guide ring has the inside packing which surrounds the tubular guide 19 as shown in Figure 1. As is clearly shown in Figure 1 the guide 19 works closely over the cylinder 15 and extends beneath it and is permanently connected at its lower end to the lower end of a tubular support 21 to the upper end of which the head 16, or 16a, is attached.

In the form shown in Figure 1 there is an annular pressure head 22 preferably formed of rubber whose upper end is secured to the head 16 and whose lower end extends axially and inwardly and closely surrounds the tubing 13 so as to form a seal thereabout.

Upper and lower lines 23, 24, for an operating fluid, are connected into the cylinder in which the plunger 18 works above and beneath said plunger. These lines converge and are connected into the valve casing 25 containing the four way valve 26 and a supply line for an operating fluid is also connected into said valve cylinder. When the valve is actuated into one position an operating fluid under pressure may be introduced into said cylinder, as 27, above the plunger 18 and relieved from said cylinder beneath the plunger and when an operating fluid is introduced into the cylinder 27 beneath the plunger the fluid from the cylinder will be relieved from above the plunger. While lowering or elevating the tubing under normal conditions the plunger 18 should be moved downwardly to withdraw the tubing engaging and sealing means from engagement with the tubing and the pressure head 22 will be lowered, with the head 16, a required distance down into the cylinder 15. In case pressure should develop in the well but not sufficiently high to cause a blowout an operating fluid may be introduced through the pipe 23 above the plunger 18 to balance said pressure; however, should a high or dangerous pressure develop in the well it will move the pressure 22 upwardly overcoming the pressure against the plunger 18 and elevating the support 21 as well as the guide 19 and the plunger 18 also operating through the links 17 to elevate the tubing engaging and sealing means. It may be here noted that the sealing members 14 extend radially inwardly beyond the slips 12 so that before said slips engage the tubing the sealing members 14 will have formed a complete seal around the tubing so as to prevent the escape of pressure and a further upward movement of the pressure head 22 and the carriers 11 will cause the slips 12 to then come into engagement with the tubing so as to grip and secure the same against danger of being blown out of the well.

The anchor ring 6 has a by-pass 28 whose lower end is inwardly turned and the head 16 has a by-pass 29. The by-pass 29 registers with the by-pass 28 when the pressure head has moved to its extreme upper position so as to allow the pressure beneath the pressure head 22 and above said pressure head to equalize.

When the equipment is used for drilling the pressure head 22 will not be used as shown in Figure 3. While drilling operations are being carried on the plunger 18 will be moved to its lower position by the introduction of an operating fluid through the line 23 and the carriers 11 will be in their lower position as shown in Figure 3. In case of a threatened blow-out the operating fluid will be relieved through the pipe 23 and simultaneously introduced into

the cylinder 27 through the pressure line 24 and the plunger will thereby be elevated to its upper position carrying the head 16a upwardly with it and elevating the carriers 11 so as to form a seal about the drill stem 30 and to carry the stem engaging slips 12 into secure engagement with the drill stem to prevent the latter from being blown out by the high pressure in the well.

The drawing and description are illustrative merely, while the broad principle of the invention will be defined by the appended claims.

What I claim is:

1. A blowout preventer comprising a housing adapted to be connected to an outer pipe in a well and shaped to receive an inner pipe there-through, a pipe engaging and sealing means in the housing movable to inactive position away from the inner pipe and into active position to engage, and form a seal about, the inner pipe, a pressure head around and in sealing relationship with the inner pipe and connected with said engaging and sealing means and adapted to be actuated by well pressure and to actuate said pipe engaging and sealing means into active position.

2. A blowout preventer comprising a housing adapted to be connected to an outer pipe in a well and shaped to receive an inner pipe there-through, a pipe engaging and sealing means in the housing movable to inactive position away from the inner pipe and into active position to engage, and form a seal about, the inner pipe, a pressure head around and in sealing relationship with the inner pipe and connected with said engaging and sealing means and adapted to be actuated by well pressure and to actuate said pipe engaging and sealing means into active position and means under the control of an operator and adapted to be actuated by an operating fluid and effective to move said pipe engaging and sealing means to inactive position.

3. A blowout preventer comprising a housing adapted to be connected to an outer pipe in a well and shaped to receive an inner pipe there-through, a pipe engaging and sealing means in the housing movable to inactive position away from the inner pipe and into active position to engage, and form a seal about, the inner pipe, a pressure head around and in sealing relationship with the inner pipe and connected with said engaging and sealing means and adapted to be actuated by well pressure and to actuate said pipe engaging and sealing means into active position, said blowout preventer having a by-pass permitting equalization of the well pressure above and beneath the pressure head when said pipe engaging and sealing means is in active position.

4. A blowout preventer comprising a housing adapted to be connected to an outer pipe in a well and shaped to receive an inner pipe there-through and having an upwardly converging seat, carriers on the seat, inside seals on the carriers, said carriers being movable upwardly on the seat into active position to form a seal about the inner pipe, a cylinder, a plunger in the cylinder, means connecting the plunger to the carriers, means for applying an operating fluid to the plunger to actuate the carriers into active or inactive position, a pressure head on said actuating means forming a seal about the inner pipe and subject to the internal well pressure and effective to be actuated thereby to move the carriers into active position.

5. A blowout preventer comprising a housing

adapted to be connected to an outer pipe in a well and shaped to receive an inner pipe there-through, sealing means in the housing movable to inactive position away from the inner pipe and movable into active position to engage, and form a seal about the inner pipe, a pressure head within the housing around and in sealing relationship with the inner pipe and adapted to be actuated by the well pressure and effective, when so actuated to actuate said sealing means into active position to form a seal with the housing and with the inner pipe.

6. A blowout preventer comprising a housing adapted to be connected to an outer pipe in a well and shaped to receive an inner pipe there-through, pipe engaging means in the housing movable into inactive position away from the inner pipe and into active position to engage and anchor the pipe, a pressure head around and in sealing relationship with the inner pipe and connected with said pipe engaging means and adapted to be actuated by well pressure within the outer pipe and effective when so actuated to actuate the pipe engaging means into said active position in engagement with the inner pipe.

7. A blowout preventer comprising a housing adapted to be connected to an outer pipe in a well and shaped to receive an inner pipe there-through, said housing having an upwardly converging seat, segmental slip carriers on the seat, pipe engaging means on the inner sides of the carriers, an annular anchor within the housing, a tubular cylinder depending from the anchor, an annular head within the cylinder operatively connected with the carriers, an annular plunger around the cylinder, a cylindrical guide attached to and depending from the plunger, a guide ring secured to the housing beneath the plunger through which said guide works and forming a chamber in which the plunger moves, means for connecting the guide to said head and means for introducing an operating fluid into said chamber on opposite sides of the plunger alternately to

actuate the plunger, head and carriers to move the pipe engaging means into and out of engagement with the inner pipe at will.

8. A blowout preventer comprising a housing adapted to be connected to an outer pipe in a well and shaped to receive an inner pipe there-through, said housing having an upwardly converging seat, segmental slip carriers on the seat, pipe engaging and sealing means on the inner sides of the carriers, an annular anchor within the housing, a tubular cylinder depending from the anchor, an annular head within the cylinder operatively connected with the carriers, an annular plunger around the cylinder, a cylindrical guide attached to and depending from the plunger, a guide ring secured to the housing beneath the plunger through which said guide works and forming a chamber in which the plunger moves, means for connecting the guide to said head and means for introducing an operating fluid into said chamber on opposite sides of the plunger alternately to actuate the plunger, head and carriers to move the pipe engaging and sealing means into and out of engagement with the inner pipe at will.

9. A blowout preventer comprising a housing adapted to be connected to an outer pipe in a well and shaped to receive an inner pipe there-through, a pipe engaging and sealing means in the housing movable to inactive position away from the inner pipe and to active position to engage and form a seal about the inner pipe, an annular head in the housing, a closed cylinder within the housing, a plunger in the cylinder, means connecting the plunger to the head, means connecting the head to the pipe engaging and sealing means and means for introducing an operating fluid into the cylinder on opposite sides of the plunger alternately to actuate the plunger and head and to thereby move the pipe engaging and sealing means into active or inactive position at will.

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