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ANNULAR BLOWOUT PREVENTER

This invention relates to annular blowout preventers.

Annular blowout preventers are used in drilling wells and are designed to provide a full size opening during operations and when actuated to close on the structure extending therethrough or if no structure is present to close on itself, to prevent a blowout and thus control the well.

In prior blowout preventers, metal inserts have been used in the top surface of the annular packer to prevent extrusion and damage to the packer. Some prior metal inserts have been adapted to have an irising action, i.e., the inserts have a compound motion including a pivotal and a radial motion. Two examples of this type of blowout preventer packer are shown in U.S. Patent Nos. 3,572,627 and 4,099,699. Other prior structures have used such metal inserts in annular blowout preventer packers and their motion is a simple radial motion. Two examples of this latter type are shown in U.S. Patent Nos. 3,897,038 and 3,915,424.

One problem which has been encountered with these prior art annular blowout preventers is that when the

annular packer deteriorates as a result of exposure to oil base muds the metal inserts can drop into the well bore and if they are hard cast alloy steel they will junk the hole causing drilling to be directed around them by a whipstock or other suitable means.

An object of the present invention is to provide an improved annular blowout preventer which will not junk the well bore even when the resilient packer deteriorates.

According to the present invention there is provided an annular blowout preventer comprising a body having a central bore therethrough and a packer chamber surrounding and open to said central bore,

an annular packer positioned in said chamber, and

means for moving said annular packer from a relaxed open position radially inward to a position closing said central bore,

said annular packer including

a resilient annulus, and

a plurality of irising metal inserts embedded in said resilient annulus, and characterized by

each of said inserts including

an upper plate having a generally triangular shape having two sides and an outer end with a projection extending from one side and a recess on the

other side,

a lower plate having a generally triangular shape having two sides and an outer end with a projection extending from one side and a recess on the other side, and

a stem connecting between said plates to retain them in general parallel orientation,

the projections of each of said inserts engaging in the recess of the next adjacent insert to form an interengaged structure securing the inserts against total disengagement from each other without undue limitation to the irising movement of the inserts as the packer is moved between open and closed positions;

the irising movement of said inserts being a pivoting movement with the inner ends with respect to the outer ends with interengagement of their projections in the adjacent recesses being maintained during all positions of said irising movements.

The invention will be described now by way of example only with particular reference to the accompanying drawings. In the drawings:-

FIGURE 1 is an elevation view, partly in section, of an improved annular blowout preventer in accordance with the present invention in open position.

FIGURE 2 is a similar view with the preventer

shown in closed position.

FIGURE 3 is a plan view of the annular packer in open position.

FIGURE 4 is a plan view of the annular packer in closed position.

FIGURE 5 is an elevation view of the improved packer insert of the present invention;.

FIGURE 6 is a top view of the insert shown in FIGURE 5.

FIGURE 7 is a bottom view of the insert shown in FIGURE 5.

FIGURE 8 is a plan view of a modified annular packer in open position.

FIGURE 9 is a plan view of the packer of FIGURE 8 in closed position.

FIGURE 10 is an elevation view of the insert of the modified packer.

FIGURE 11 is a top view of the insert shown in FIGURE 10.

FIGURE 12 is a bottom view of the insert shown in FIGURE 10.

Improved annular blowout preventer 10 of the present invention is shown in FIGURE 1 in open position and in FIGURE 2 in closed position. It includes annular body 12 having a central bore 14, flange 16 for connection to a stack, outer upstanding rim 18 and inner rim 20 to which annular plate 22 is secured to form inner portion 24 of piston chamber 26. Cylinder head 23 is mounted in outer upstanding rim 18 to form outer portion 25 of piston chamber 21. Annular piston 26 is positioned in chamber 21 for movement therein responsive to fluid pressure delivered therein through ports 28 and 30. Annular piston rod 32 connects from piston 26 through plate 22 and head 23 to annular wedge actuator 34 having upwardly and outwardly tapered surface 35. Ring 36 is mounted on plate 22 and ring 38 is secured within rim 18 by suitable securing means 40. The interior of ring 38 has a generally cylindrical surface 42 at its lower end and extends upward to the inward and upward tapered surface 44 and then to flat surface 46. Annular packer chamber 49 is formed within surface 42 and between surface 46 and the upper surface of ring 36 and annular wedge actuator 34. Annular packer 50 is positioned in packer chamber 49 within resilient annular actuator ring 48. Resilient actuator ring 48 is positioned against surface 42 and between the upper end of wedge actuator 34 and tapered surface 44.

Improved annular packer 50 includes resilient annulus 52 and a plurality of irising metal inserts 54 embedded in the resilient annulus 52 as hereinafter described. Each insert 54 includes upper triangular shaped plate 56, lower triangular shaped plate 58 and stem 60 between plates 56 and 58 and

integral therewith, or otherwise secured to such plates. Plates 56 and 58 are positioned with their acute or sharp ends 62 and 64 facing around and near the inner periphery 51 of resilient annulus 52 as shown in FIGURE 3. Upper plate 56 has recess 66 on one side facing upward and starting a short distance from end 62 and extending back to a point to the rear of the mid point of that side. Projection 68 extends outward from the side of plate 56 opposite recess 66 and is positioned to be in the outer portion of the recess 66 in the adjacent insert plate 56 when annular packer 50 is in its open position as shown in FIGURES 1 and 3. Also projection 68 is positioned in the inner end of recess 66 of the adjacent insert plate 56 when annular packer 50 is in its closed position as shown in FIGURES 2 and 4. Plate 58 is slightly smaller than plate 56 and is similarly positioned but is the reverse image with respect to plate 56 since it is generally aligned therewith as can best be seen in FIGURE 7. Plate 58 includes a side recess 70 facing downward and projection 72 which is positioned to ride in the recess 70 of the adjacent insert plate 58 in the same manner as described above in relation to plate 56. It is preferred that inserts 54 be integrally cast alloy steel.

Recesses 66 and 70 are shown facing away from resilient annulus 52, to ensure that the material of resilient annulus 52 is excluded from the recesses. The preferred position of the projections and recesses is as shown in FIGURES 1 to 7. In this position the irising action of inserts 54 does not damage resilient annulus 52 nor does the resilient material prevent free movement of the projections in their respective recesses.

The closing of annular packer 50 is accomplished by supplying pressure below annular piston 26 so that it moves upward and such motion moves annular wedge actuator 34 upward against resilient annular actuator ring 48. The upper tapered surface 35 on actuator 34 and tapered surface 44 on ring 38 urge actuator ring 48 inward which moves annular packer 50 to its closed position shown in FIGURES 2 and 4. The inner portion of resilient annulus 52 is forced inward and such movement pivots inserts 54 to move ends 62 and 64 a greater radial distance than the radial inward movement of the outer portion of plates 56 and 58. In the closed position projections 68 and 72 are positioned in the inner area of recesses 66 and 70. In either open or closed position inserts 54 are so interengaged that even the deterioration of substantial portions or all of resilient annulus 52 does not free them sufficiently to allow them to drop through bore 14 into the well bore below. Also, the movement of inserts 54 does not cause any pinching or damage to resilient actuator ring 48.

A modified form of the annular packer of the present invention is shown as packer 80 in FIGURES 8 to 12. Packer 80 includes resilient annulus 82 and a plurality of irising metal inserts 84 each of which includes upper triangular plate 86, lower triangular plate 88 and stem 90 joining plates 86 and 88. Each of plates 86 include recess 92 extending along the outer portion of one side thereof and facing away from stem 90 and projection 94 extending from the outer edge of its other side. As shown with respect to inserts 54, lower plates 88 may be smaller than upper plates 86. Lower plates 88 have recesses 96 and projections 98 and recesses 96 facing away

from stem 90. Projections 94 and 98 engage in recesses 92 and 96 respectively of adjacent plates 86 and 88 as previously explained and ensure that inserts 84 do not fall from their position into the well bore.

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CLAIMS

1. An annular blowout preventer comprising a body having a central bore therethrough and a packer chamber surrounding and open to said central bore,

an annular packer positioned in said chamber, and

means for moving said annular packer from a relaxed open position radially inward to a position closing said central bore,

said annular packer including

a resilient annulus, and

a plurality of irising metal inserts embedded in said resilient annulus, and characterized by

each of said inserts including

an upper plate having a generally triangular shape having two sides and an outer end with a projection extending from one side and a recess on the other side,

a lower plate having a generally triangular shape having two sides and an outer end with a projection extending from one side and a recess on the other side, and

a stem connecting between said plates to retain them in general parallel orientation,

the projections of each of said inserts engaging

in the recess of the next adjacent insert to form an interengaged structure securing the inserts against total disengagement from each other without undue limitation to the irising movement of the inserts as the packer is moved between open and closed positions;

the irising movement of said inserts being a pivoting movement with the inner ends with respect to the outer ends with interengagement of their projections in the adjacent recesses being maintained during all positions of said irising movements.

2. An annular blowout preventer according to Claim 1 wherein,

said plates have similar shapes and are oriented similarly for identical irising action.

3. An annular blowout preventer according to Claim 1 or Claim 2 wherein,

said recesses are open to the sides of said plates away from said resilient annulus and said projections on adjacent plates are received in said recesses,

said recesses having a sufficient length to allow full movement of the inserts with the opening and closing movement of said resilient annulus.

4. An annular blowout preventer according to any preceding claim wherein,

said recesses and projections are positioned to prevent disengagement of the inserts.

5. An annular blowout preventer according to any preceding claim wherein,

the material of said resilient annulus is excluded from said plate recesses.

6. An annular blowout preventer according to Claim 5 wherein,

said recesses face away from said resilient annulus.

7. An annular blowout preventer according to any preceding claim wherein,

said recesses extend from a point spaced from the inner ends of their plates to a point past the mid point of the side, and

said projections are positioned slightly forward of the mid point of their sides.

8. An annular blowout preventer according to any one of Claims 1 to 6 wherein,

said recesses extend from a point outward of the mid point of their side to the outer end of their side, and

said projections extend from the outer end of their sides.

9. An annular blowout preventer according to any

preceding claim wherein,

said inserts are integral cast alloy steel.

10. An annular blowout preventer substantially as hereinbefore described with reference to and as shown in the accompanying drawings.