

Aug. 5, 1958

B. S. MINOR

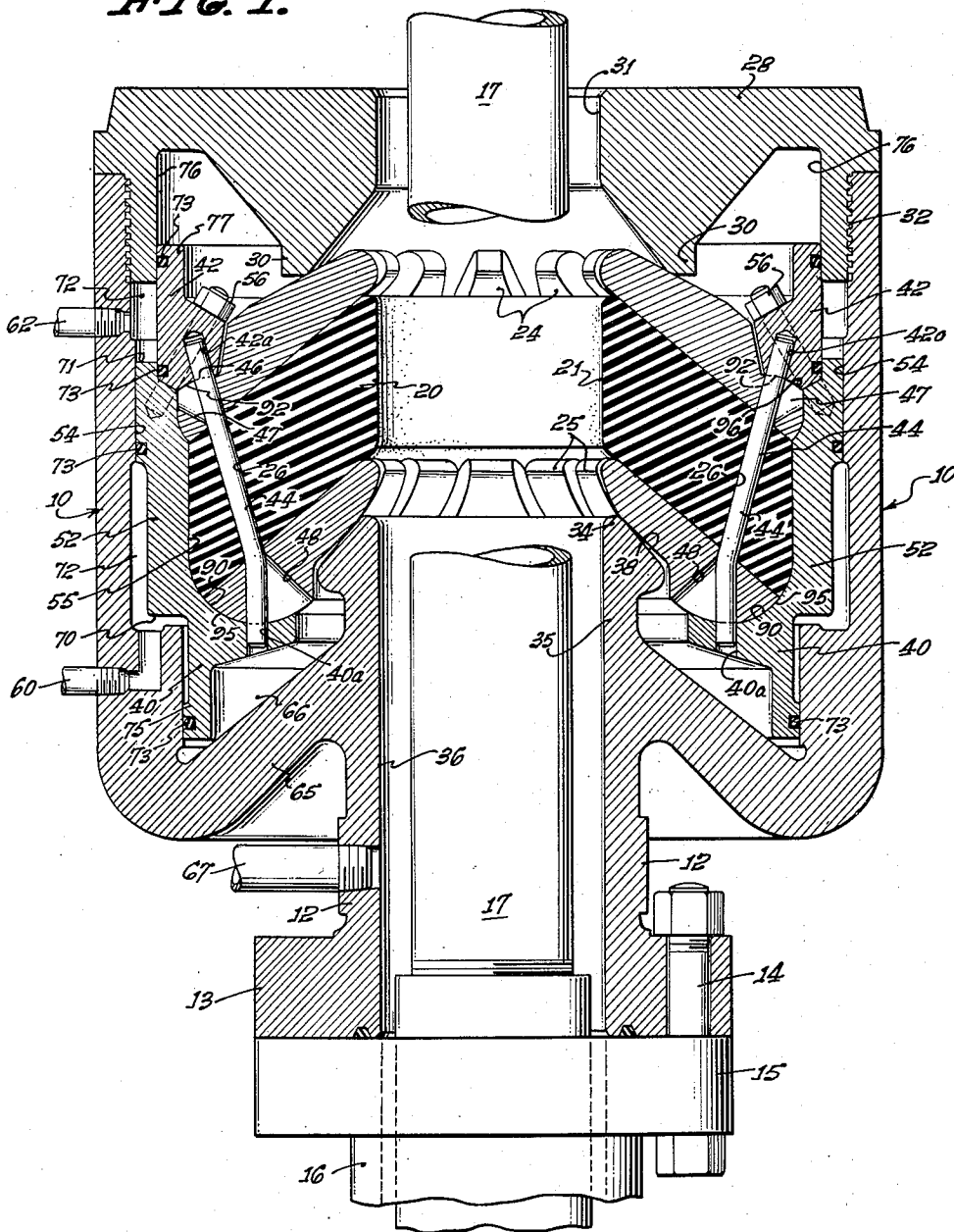
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CONICAL-TYPE BLOWOUT PREVENTER

Filed Jan. 24, 1955

4 Sheets-Sheet 1

FIG. 1.



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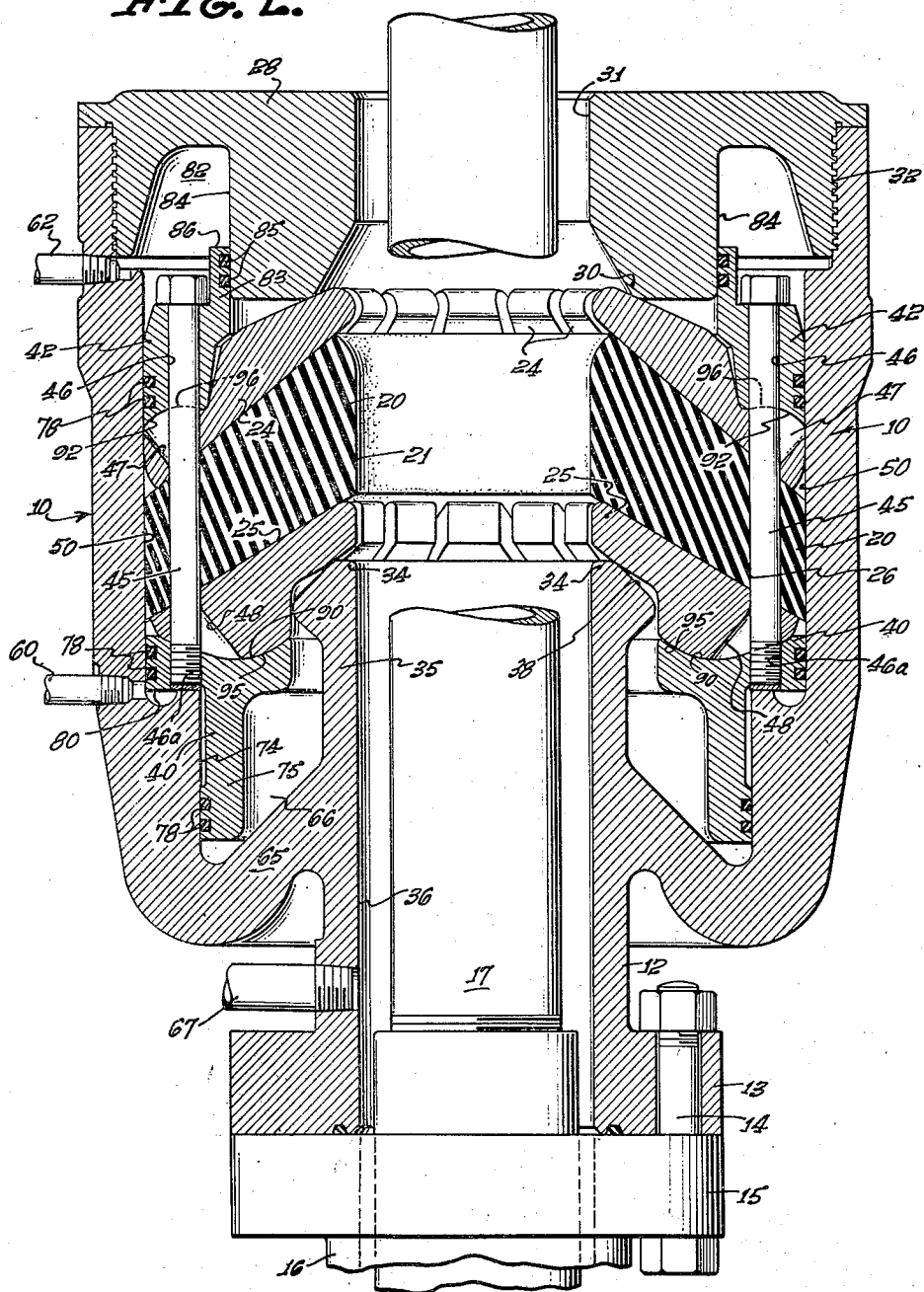
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FIG. 2.



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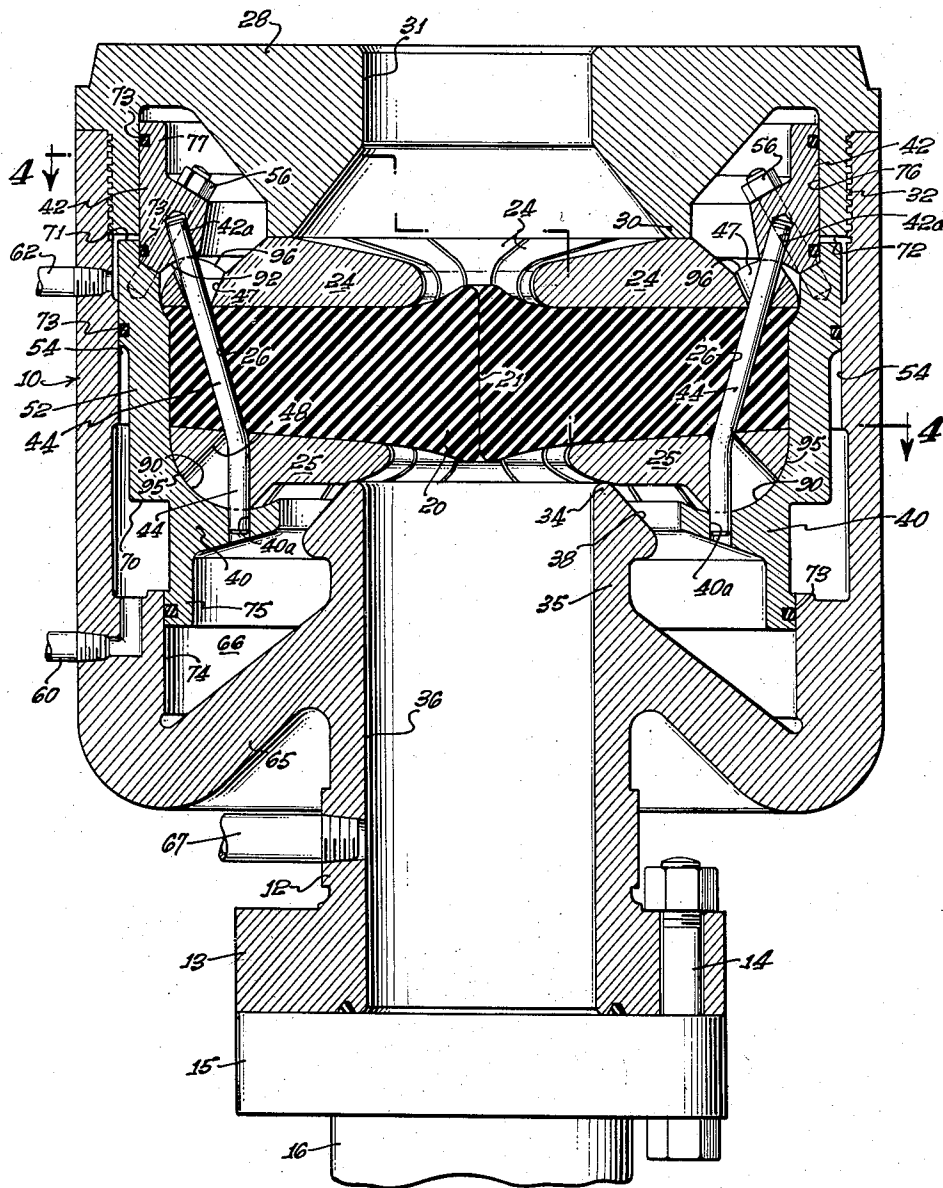
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FIG. 3.



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CONICAL-TYPE BLOWOUT PREVENTER

Filed Jan. 24, 1955

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FIG. 4.

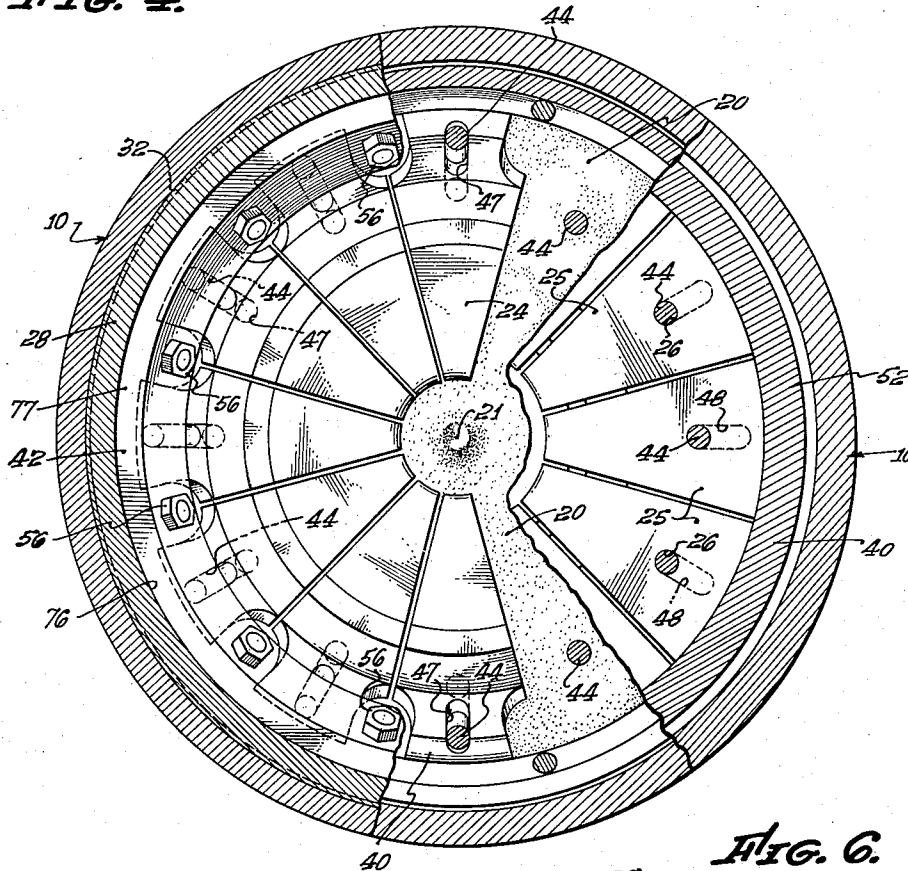


FIG. 5.

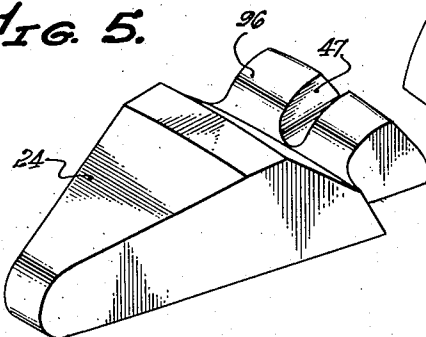
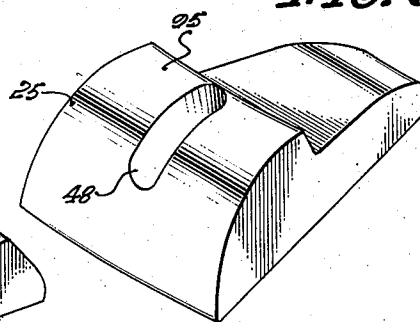


FIG. 6.



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2,846,178

CONICAL-TYPE BLOWOUT PREVENTER

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Application January 24, 1955, Serial No. 483,686

17 Claims. (Cl. 251—2)

This invention relates to blowout preventers of the type commonly used at the tops of oil well casings, especially for wells having high gas pressures.

An object of the invention is to provide a blowout preventer which may employ a single solid piece of tough rubber which is generally tubular in form and is free from incisions or the like which might rupture and pass high pressure gas, so that one end of such solid piece of rubber may be forced radially inward without substantial inward movement of its other end but with axial shortening whereby a flattened condition is obtained (effecting extrusion toward the axis) and without substantial change in wall thickness so as to seal the opening therethrough, or to compress the innermost edges tightly against a pipe, wire line or the like disposed along such axis to seal off the passage of fluid along the pipe or line surface and as a consequence prevent oil and gas leakage.

More particularly it is an object of the invention to employ as a packing member a solid rubber annulus, such as above indicated, which is frusto-conical in shape normally, or otherwise expressed is in the form of a frusto-conical tube, so that flattening of the frustum results in complete closure of the central opening where radially outward movement of the periphery is prevented and movement axially is prevented.

An additional object is to provide a blowout preventer which is highly efficient, even under pressures of such magnitude that prior blowout preventers have not been efficient, and which structure is at the same time comparatively easy and not particularly costly to construct and assemble.

Another object is to produce a blowout preventer construction which specifically provides for forceable or positive return of the compressed rubber packing member to its initial position and conditions.

The features of construction of this invention, and the high efficiency inherent therein, hinge upon the facts that: first, a rubber body, whether natural or synthetic, produced from a type of rubber adequate for blowout preventer purposes, having been deformed from a normal condition, will not of itself return fully to the normal position upon mere release of the mechanical or other pressure applied to deform it usually referred to as permanent deformation, but must be mechanically returned if its normal condition is to be restored; second, a body of such rubber of hollow or tubular frusto-conical configuration having substantial wall thickness and having substantial dimension radially between its innermost and outermost edges will, upon flattening, be compressed or extruded inward toward its axis (while preventing radially outward expansion and axial expansion), the inward extension or extrusion under such compression and flattening being adequate to seal the inner wall portions of the rubber at its central opening tightly against an axially disposed pipe or wire line or the like whereby to prevent all passage of liquid or gas along the outer wall of such pipe or line, complete sealing together of the

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inner wall portions of the central opening taking place in the absence of pipe or wire line, it being merely necessary to have in the latter instance a sufficient rubber body volume to reach the axis upon compression and flattening of the cone structure; and third, when so closed, any pressure confined within the well beneath the rubber will further act upon the rubber to effect a greater degree of flattening effecting intensified sealing action.

Other objects of the invention than those above indicated, and various features of construction employed in embodiments of the invention will be apparent to those skilled in the art upon reference to the following specification and the accompanying drawings wherein:

Fig. 1 is a vertical section through a blowout preventer of one embodiment of this invention, the parts being shown in idle positions;

Fig. 2 is a vertical section similar to that of Fig. 1 showing a somewhat simplified form of construction;

Fig. 3 is a vertical section through the structure of Fig. 1 showing the parts in position completely closing the vertical passage through the structure, this view being also generally representative of the position of the parts in the form of Fig. 2 when in a similar closing position;

Fig. 4 is a cross section taken on the staggered line 4—4 of Fig. 3;

Fig. 5 is a perspective view of one of the upper series of actuators; and

Fig. 6 is a perspective view of one of the lower series of actuators, the device being shown in position inverted from that of Fig. 1.

Referring first to the structure shown in Fig. 1, this comprises a somewhat enlarged tubular body or housing 10 whose intermediate portion serves as a cylinder for contained parts operating in piston fashion. The lower end of the housing 10 has a reduced neck 12 integrally connected therewith and provided with a connecting flange 13 at its lower extremity adapted to be bolted at 14 to a flange 15 connected with a well casing or the housing of a gate valve or the like, as may be desired, such as is indicated at 16, for the purpose of passing any appropriate drill pipe 17 or the like. Disposed within the middle portion of the housing 10 is a one-piece, solid tough rubber packer 20 which is frusto-conical in shape and has provided axially therethrough a bore or passage 21 adapted to pass the drill pipe 17 when required, and to be sealed against the outer wall of the drill pipe 17, when necessary, through the medium of pressure applicator means and influences to be described. In the forms illustrated, the lower outermost portion of the packing 20 is directed downward and the inner and uppermost portion is directed upward. Overlying the frusto-conical packer 20 is an annular series of upper actuator segments 24 of metallic or other rigid construction, and underlying the rubber packer 20 is a lower series of metallic actuator segments 25, one of the upper actuator segments 24 being illustrated in Fig. 5 in perspective view and one of the lower actuator segments being illustrated in Fig. 6 in perspective view. The upper and lower faces of the solid packer 20 are flat and continuous to receive flat faces of the blocks or segments 24 and 25. The only interruptions are tightly fitting openings 26 for positioners to be described.

Overlying the upper series of actuator segments 24, is a setting ring or positioning cap 28 which is provided between its periphery and its axis with an annular fulcrum or bearing seat 30 engaged by upper face portions of the upper actuator segments 24. The cap 28, which is provided with a central opening 31 for the passage of the drill pipe 17 or the like, is appropriately anchored in the upper end of the housing 10 as by means of suitable threads 32. Under portions of the lower actu-

ator segments 25 bear upon an annular fulcrum seat 34 which is provided at the top of an upstanding sleeve member 35 integral with the reduced neck 12 of the housing 10 and disposed generally in line with the opening 31 through the positioning cap 28 at the top of the housing 10. Thus, the inner wall of the reduced neck 12 and of the upstanding sleeve 35 constitute a continuous inner cylindrical passage 36 to accommodate the drill pipe 17 and appropriate collars and other devices commonly carried thereby. The seat 34 is curved at its top and slopes outward and downward as indicated at 38, so that the sloping or conical surface portion of the seat provides a bearing zone for the under sides of the actuator segments 25 when they are in the idle position of Fig. 1, the extreme top of the bearing or seat 34 providing an approximately horizontal annular fulcrum surface for adjacent portions of the actuator segments 25 when they are in the closing position of Fig. 3, as more fully to be described, it being apparent that the inner portions of the segments 25, which are wedge-shaped as indicated, closely approach each other when raised to the position of Fig. 3, as indicated in Fig. 4. Similarly the upper actuator segments 24 are wedge-shaped and likewise closely approximate each other when moved into the approximately horizontal position seen in Fig. 3.

As is apparent from Figs. 1 and 3 that, when the actuator segments 24 and 25 are both moved into the horizontal positions seen in Fig. 3, they serve to flatten the frusto-conical packer 20 so that the effective inward extrusion of the body portion of the packer 20 surrounding the passage 21 has the effect, by reason of deformation of such body, to compress the same against the drill pipe 17, or a much smaller pipe, or even to produce complete closure without the presence of any pipe or other object at all as seen in Fig. 3. Movement of the actuator segments 24 and 25 into the horizontal positions illustrated (with consequent flattening of the one-piece packer 20 and movement of it into the position also illustrated in Fig. 3) is effected through the medium of a lower annular piston element 40, and a connected upper annular piston element 42. The actuating annular pistons 40 and 42 are used in the form of Figs. 1 and 3 and also in the form of Fig. 2, and in both instances they are connected with a limited amount of play by means of rigid guide rod or bolt means which extend through snugly fitting openings 26 in the one-piece frusto-conical packer 20 as previously described. In the form of Figs. 1 and 3 such connecting means is in the form of bent guide rods 44 whose upper ends seat in corresponding openings 42a in the upper annular piston 42 and whose lower ends seat in corresponding openings 40a in the lower annular piston 40. In the form of Fig. 2 the connecting means are in the form of guide bolts 45 which are straight and whose upper ends may move in openings 46 in the upper annular piston 42 and whose lower ends may be anchored at 46a in threaded openings in the lower annular piston 40. In both forms, the upper portions of the rods 44 or bolts 45 extend through flared passages 47 in the outer ends of all the upper actuator segments 24, and lower portions of such rods or bolts extend through flared passages 48 in the outer ends of all the lower actuator segments 25.

The principal difference between the construction of Figs. 1 and 3 and the construction of Fig. 2 is that, in Fig. 2, the peripheral portions of the packer 20 and of the upper and lower actuating segments 24 and 25 operate as a piston unit against the same cylindrical inner wall 50 of the housing 10 as do the outer piston walls of the annular pistons 40 and 42; whereas, in the form of Figs. 1 and 3 an upstanding piston skirt 52 is integrally carried by the lower annular piston 40, thus making a hollow piston 40, 52, the skirt 52 working within an inner cylinder wall 54 in the housing 10, with the one-piece frusto-conical rubber packer 20 and its actuating segments 24 and 25 bearing in appropriate annular seats on the

inner face 55 of the piston skirt 52. With this construction of Figs. 1 and 3, it may be desirable to tie the upper annular piston 42 to the piston skirt 52, and for this purpose appropriate screws or bolts, such as indicated at 56, may be employed.

With these constructions, the packing means consisting of the frusto-conical packer 20 with the upper actuator segments 24 and the lower actuator segments 25 are adapted to be actuated positively upward by reason of applied extraneous fluid pressure introduced as through a line 60 in both forms to move the packing means upward into the closing or packing position of Fig. 3, such packing means being also actuatable downward as by pressure fluid applied in both forms through a line 62, whereby to attain positively the open positions of Figs. 1 and 2.

It will be appreciated that with both the structures of Figs. 1 and 2, well pressure, entering between the actuator segments 25, is applied to both the upper and lower sides of the annular piston 40 and to the under sides of the segments 25 and the packer 20. Such pressure is confined by an integral sloping connecting wall 65 between the housing 10 and its neck 12, these parts enclosing a chamber 66 in which the lower annular piston 40 works. A pipe 67 shown as entering the neck 12 is conventional and provides means for the introduction or take-off of well fluids, or for the passage of mud in drilling operations, or the like.

For positive actuation of the packing means upward in the form of Fig. 1, the lower annular piston 40 with its piston skirt 52 provides an annular lower shoulder 70 of substantial cross-sectional area to receive actuating pressure from the line 60. Similarly, to actuate the packing mechanism positively downward, the skirt 52 provides an annular upper shoulder 71 of sufficient cross-sectional area for such downward actuation under influence of fluid pressure from the line 62. Such pressures will be applied to the lines 60 and 62 as necessary to accomplish the required action, considering also pressures that might exist in the well. To seal off the respective chambers 72, appropriate packings 73 are used to engage the respective cylinder walls, including the cylinder wall 54, a lower cylinder wall 74 cooperating with a lower-most piston skirt 75 of the lower annular piston 40 in the chamber 66, and an upper cylinder wall 76 in the cap 28 co-operating with an upstanding piston skirt of the upper annular piston 42.

For positive actuation of the packing means of Fig. 2, similar structural arrangement of the piston means is provided, and various packings 78 similar to the packings 73 are employed. As in the form of Fig. 1, the lower annular piston 40 is provided with a depending skirt 75 working along the same outer cylinder wall 74 of the chamber 66. The annular piston 40 is provided with a packed outer piston wall which engages the cylinder wall 50 of the body 10 on a circumference somewhat greater than that of the cylinder wall 74, the under side of this annular portion of the piston 40 presenting a peripheral pressure-receiving shoulder 80 corresponding generally with the shoulder 70 of the form of Fig. 1 and receiving pressure fluid from the line 60, the packings 78 of the mentioned portions of the piston 40 sealing off the corresponding pressure fluid chamber. Similarly the packing 78 on the outer wall of the upper annular piston 42 engaging the cylinder wall 50 acts to seal off the lower portion of a pressure chamber 82 within the cap 28 and in which there works an upstanding inner piston skirt 83 packed against an inner cylinder wall 84 of the cap 28, additional packing means 85 being provided for this purpose. Thus, the upper annular piston 42 provides an upper annular shoulder 86 against which the pressure fluid from the line 62 is effective when applied.

When it is desired to actuate the packing device of either form, fluid pressure will be applied through the line 60 to raise the lower annular piston 40 from the positions shown in Figs. 1 and 2 to approach the posi-

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tion seen in Fig. 3, where the entire central passage 36 is to be closed, or to an intermediate position if sealing is to be effected about the outer wall of the drill pipe 17 or other pipe or a wire line or the like. When the annular piston 40 is raised, it raises the outer ends of the lower actuator segments 25 which, operating as pressure blocks or fingers, raise the peripheral portions of the solid rubber, frusto-conical packer body 20 upward toward the position of Fig. 3, the inner, originally separated ends of the blocks or segments 25 moving upon the upper bearing portion 34 of the upstanding sleeve 35 as a fulcrum, the corresponding uppermost portions of the upper actuator segments 24 similarly moving about the annular seat 30 of the cap 28 as a fulcrum. During movement of the lower actuator blocks or segments 25 from the position of Figs. 1 and 2 toward the position of Fig. 3, the under sides of the outer portions of the segments 25 move in arcuate seats 90 in the upper faces of the annular pistons 40. Where the passage 36 is to be entirely closed off as indicated in Fig. 3, such movement of the under portions of the segments 25 will continue until the lower segments 25, as well as the upper segments 24, are in substantially the horizontal positions of Fig. 3. The exact position will approach that of the horizontal depending upon the surplus percentage of required volume of rubber, to be more fully described. Otherwise such movement will cease at any intermediate position representing contact of the bore wall 21 of the packer 20 with a pipe 17, a wire line, or the like. As the lower segments 25 are raised from the positions of Figs. 1 and 2 toward that of Fig. 3, the lower ends of the positioning and guide rods 44 of the structure of Fig. 1 or the lower ends of the bolts 45 of the structure of Fig. 2 in the passages 48 serve as hinge connections in the outer portions of the segments 25 from the position of Figs. 1 and 2 toward the position of Fig. 3. A similar movement of the upper portions of the rods 44 or bolts 45 occurs in the passages 47 in the upper segments 24. At the same time, the outer ends of the segments 24 work at their upper sides in seats 92 in the under sides of the respective upper annular piston 42. Upon reference to Fig. 6, it will be noted that the under side of the outer end of each segment 25 is curved as indicated at 95 to accommodate the respective seats 90 in the lower annular piston 40, and upon reference to Fig. 5 it will be seen that the upper side of the outer end of each segment 24 is likewise curved as indicated at 96 to accommodate the corresponding seat 92 in the under side of the upper annular piston 42.

When it is desired to move the packing mechanism 20, 24, 25 from the sealing position of Fig. 3, or from any intermediate sealing position, fluid pressure is applied through the line 62 for the purpose of positively forcing down the upper annular piston member 42 and the connected parts thereunder. Thus positive return of the entire packer mechanism to the starting position of Figs. 1 and 2 is effected. The rods 44 of Fig. 1 and rods 45 of Fig. 2 serve to withdraw the rubber packer 20 to overcome permanent deformation.

Since the under face of the solid packer 20 is continuous and free from incisions of any type, there is no possibility of rupture beyond incisions or the like which, under high gas pressure, would result in leakages. The tight fit of the openings 26 about the rods or bolts 44 and 45 insures against leakages in those regions and the engagement of the periphery of the packer 20 with the cylindrical wall 50 or the cylindrical wall 55 similarly avoids leakages.

From the standpoint of movement of the actuator segments 24 and 25 as they are moved from the inoperative positions of Figs. 1 and 2 to the horizontal sealing position of Fig. 3, or any intermediate position, it is apparent that the innermost end portions of the segments 24 and 25 are moved from positions approximately in line with the cylindrical wall 36 of the neck 12 and its

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integral sleeve 35 to a position somewhat more radially inward whereby to support the packer 20 at correspondingly advanced positions. Also, by reason of the somewhat greater elongation of the upper segments 24 with respect to the lower segments 25 and further by reason of the fact that the lower segments 25 move in their seats 90 somewhat radially outward as they are advanced to horizontal position, the inner ends of the segments 24 extend farther radially inward when in such horizontal positions than do the inner ends of the segments 25. As a consequence a greater proportion of the thick packer 20 is supported above at its innermost position of extrusion by the segments 24 than is underlain by the inner ends of the segments 25. Because such farther inward projection of the segments 24, high well pressure applied against the under sides of the segments 25 and the packer 20 is better resisted by the sealing portion of the packer 20.

It is to be noted that the opposing faces of the upper segments 24 and the lower segments 25 may normally be approximately parallel as seen in Fig. 1 or a few degrees out of parallelism as seen in Fig. 2. Their exact relationship in the closed position indicated in Fig. 3, that is whether such opposing faces are substantially parallel or somewhat out of parallelism as seen in Fig. 3, will depend upon the exact disposition of the curved seats 90, of the lower annular pistons 40 and the curved under sides 95 of the lower actuator segments 25. With this design of support for the segments, it is possible actually to effect some axial compression of the rubber packer 20 which will increase the displacement. Such a construction is indicated in Fig. 2 where the inner portions of at least one of the series of actuator blocks are tapered to reduce the vertical dimensions as the blocks extend inward, so that, as such blocks are moved upward by piston action, the innermost portions of the rubber packer 20 are compressed in vertical dimension, thereby augmenting the extrusion of the rubber inward as the actuator blocks are moved toward the position of Fig. 3.

Regardless of the exact angular relationship between the under faces of the upper actuator segments 24 and the upper faces of the lower actuator segments 25, there is nevertheless an adequate surplus of rubber in the frusto-conical packer 20 when in the inoperative positions of Figs. 1 and 2 to provide for complete closing when in the position of Fig. 3. Thus, in a specific instance the area of each of the upper and lower faces of the frusto-conical shaped packer 20 is 815 square inches, whereas the cross-sectional area on the same horizontal diameter (31 inches) is about 755 square inches, thus providing 60 square inches of rubber to be flattened and which will thereby be extruded into the space along the axis of the device to completely seal the passage. The thickness of the packer 20 between its upper and lower faces usually approximates one-half the diameter of the passage 21 through the open packer. Also, the diameter of the axial opening in the open packer normally approximates one-third the outside diameter of the packer, or in other words is approximately equal to the cross-sectional dimension on a median plane between the outer wall of the packer and the inner wall thereof at the axial opening. Since the thickness of the packer is relatively great and its axial dimension remains substantially constant whatever the position of the packer parts, a complete and adequate seal is effected with a packer produced from adequately tough rubber or the like. For example, in the case of a packer having an overall outer diameter of the mentioned 31 inches, its thickness may be in the order of 6 inches to 7 inches. As to the rubber material employed for the packer 20, this is a very tough rubber body well known in the industry and similar to tough automobile tire tread stock. It may be produced from natural rubber or from synthetic rubbers, such as neoprene which is oil resistant, as is well understood in the art. With such a rubber, where a wall thickness of 6 or 7 inches is employed as

above mentioned, the face length of the packer between its outer edge and its inner edge at the opening or passage 21 is commonly only about twice the mentioned wall thickness. Ordinarily the pitch of the upper and lower faces of the packer, with respect to the horizontal, is around 30° to 40°. In any event, the frustum is relatively shallow and at least one of the walls is definitely frusto-conical. A 40° pitch of both faces, which are thus parallel, is very desirable, somewhat as indicated in Fig. 1. Or, the upper face might have a pitch of 40°, for example, and the lower face a pitch of 30°, with a median line pitch of about 35°, somewhat as illustrated in Fig. 2. An over-all practical range of pitches of these faces would probably be in the order of 25° to 45° to the horizontal. With dimensions of the indicated character having face pitches such as stated, an adequate surplus of body rubber is provided so as to adequately provide for the extrusion volume required nearest the axis. Thus, whereas a surplus of 60 square inches of packer face area was obtained, as above indicated, in a 31-inch structure, such as that of Fig. 2, a surplus of about 75 square inches was obtained in a 29-inch structure where the cone face area was about 735 square inches and the area along the corresponding true diameter was about 660 square inches. Such surplus of about 75 square inches amounted to approximately 11%. The angularity of the frusto-conical packer is determined by the following equations:

Where the angular faces are parallel,
 Area of major diameter +

$$\frac{\text{area of major diameter}}{\text{about } 10} = \text{area of angular face}$$

Where the faces are not parallel,
 Area of major diameter +
$$\frac{\text{area of major diameter}}{\text{about } 10} = \frac{\text{area top angular face} + \text{area bottom angular face}}{2}$$

The divisor (10) represents the surplus which is necessary for full closure but is approximate depending upon the characteristics of the rubber as to axial extrusion in the unsupported opening and may be varied within practical limits to suit. Thus, the indicated divisor limits may vary between about 8 and about 12.

As to the dimensional relationships of the parts providing for the raising of the packing mechanism, it will be appreciated that the annular area outside the fulcrum seat 34 and under the packer mechanism will be such as to provide an adequate closing advantage over the area of the closed packer aligned with the passage 36 being closed when the parts are in the position of Fig. 3. For example, an appropriate advantage would be in the order of 20%, as where the outer annulus mentioned is about 60% of the total area and the area inside the circular fulcrum seat in the passage 36 is about 40%. With this relationship, any confined well pressure, when the central bore is closed as shown in Fig. 3, will act upon the rubber in a manner to effect more movement of the assembly to approach horizontal position with more inward extrusion of rubber, thus resulting in greater sealing effect.

I claim as my invention:

1. In a blowout preventer structure: a housing providing a cylindrical chamber on a vertical axis and having upper and lower wall means providing upper and lower axial passages through said structure; lower fulcrum bearing means around said lower axial passage and upper fulcrum bearing means around said upper axial passage; an annular yieldable frusto-conical rubber packer disposed in said chamber about said axis and having an opening therethrough on said axis, and normally providing upper and lower frusto-conical faces around said opening; an upper annular series of divided rigid actuator segments angularly tipped toward said axis and providing faces bearing on the upper frusto-conical face of

said packer, upper side portions of said segments bearing on said upper fulcrum means; a lower annular series of divided rigid actuator segments angularly tipped toward said axis and providing faces bearing on the lower frusto-conical face of said packer, lower side portions of such lower segments bearing on said lower fulcrum means; lower annular piston means vertically movable within said chamber and having seat means in which outer end portions of said lower segments bear; and upper annular piston means vertically movable within said chamber and having seat means in which outer end portions of said upper segments bear, said segments rocking on said fulcrum means upon movement of said pistons.

2. A structure as in claim 1 wherein said lower piston provides lower pressure surfaces for application of fluid pressure to raise such piston and the outer ends of said segments with the outer portion of the intervening frusto-conical packer, and said upper piston provides upper pressure surfaces for application of fluid pressure to return the parts to their original lower positions.

3. A structure as in claim 2 including passage means to supply pressure from said lower axial passage to the under sides of said packer and said lower actuator segments.

4. A structure as in claim 1 including passage means to supply pressure from said lower axial passage to the under sides of said packer and said lower actuator segments.

5. A structure as in claim 1 wherein said upper and lower frusto-conical faces of said packer are substantially continuous for provision of uninterrupted bearing faces for said segments.

6. A structure as in claim 1 wherein rod means connect said upper and lower annular piston means and extend through snug-fitting passages in said packer.

7. A structure as in claim 6 wherein the outer end portions of said segments are provided with flaring openings receiving end portions of said rod means and which swing upon such rod portions as said pistons are moved.

8. A structure as in claim 1 wherein rod means connect said upper and lower annular piston means, such piston means having openings in which corresponding end portions of said rod means move as said pistons are moved.

9. A structure as in claim 1 wherein means are provided for limiting movement of said segments and packer outward radially, and said segments swing on said fulcrums and are forced radially inward to flatten said packer and extrude its central portion inward towards its axis.

10. In a blowout preventer: a vertical housing providing a chamber therein disposed on a vertical axis, said housing having upper and lower end wall means provided with axial passages for movement of an object axially therethrough; an upper annular series and a lower annular series of tapered actuator blocks normally disposed in tipped relation with respect to said axis with their inner ends spaced and vertically movable at their outer ends toward horizontal positions to bring their inner ends together; fulcrum means provided adjacent said axis for positioning of said blocks thereon; upper and lower annular piston means contained in said chamber and engaging the outer ends of said blocks to move the latter vertically; and a frusto-conical rubber packer providing an axial opening aligned with said passages and disposed between said upper and lower series of tipped blocks and having upper and lower frusto-conical faces respectively engaged by said tipped blocks, said frusto-conical packer being flattened by said block series upon movement thereof by said piston means, inner portions of the packer being thereby pressed inward for closure of said passages, said housing providing means restraining radially outward movement of the packer.

11. A blowout preventer as in claim 10 including positioning means for the outer ends of said actuator blocks.

12. A blowout preventer as in claim 11 wherein said

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positioning means pass through said outer block ends and are connected with said piston means.

13. A blowout preventer as in claim 10 wherein the thickness of said packer between its opposite frusto-conical walls approximates one-half the diameter of the axial opening of the packer.

14. A blowout preventer as in claim 10 wherein the inner portions of at least one of said annular series of actuator blocks have the faces of such blocks remote from the rubber packer tapered with respect to the other faces of such blocks to provide inner vertical dimensions of such blocks less than the vertical dimensions at the fulcrum-engaging positions thereof whereby to compress said packer vertically as said blocks are moved toward said horizontal positions by said piston means.

15. In a blowout preventer: a housing providing a vertical axis and a chamber about said axis; a solid rubber annular packer having an inclined face and an axial passage therethrough to receive drill pipe and the like; an annular fulcrum provided by said housing; an annular series of elongated actuator fingers swingable on said fulcrum and engaging said inclined face of said packer in their intermediate portions to swing said face and the innermost portion of said packer inward toward said axis; and piston means engaging said fingers radially offset from their fulcrums and bearing upon portions of said fingers to swing said fingers inward on said fulcrum and compress said packer face inward.

16. In combination in a blowout preventer: a deform-

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able frusto-conical solid tough rubber packer body providing a vertical axis and having an axial opening therethrough for passing an elongated structure, and having substantially uniform thickness between its outer and inner frusto-conical walls; tubular housing means for retaining the outer periphery of said packer body; annular fulcrum means carried internally in said housing means; means fulcrumed on said fulcrum means and engaging the outer wall of said frusto-conical packer body and movable toward the axis of said housing means for flattening said deformable packer body into a disc-like deformed condition; and means to pivotally move said fulcrumed means about said fulcrum to deform said body.

17. A combination as in claim 16 wherein said fulcrumed means for flattening said frusto-conical packer body includes fulcrumed means arranged approximately parallel and disposed on opposite sides of said packer body to move in approximate parallelism and maintain approximately equal thickness of such packer body between its upper and lower frusto-conical walls during deformation.

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