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G. S. KNOX

3,225,831

APPARATUS AND METHOD FOR PACKING OFF MULTIPLE TUBING STRINGS

Filed April 16, 1962

4 Sheets-Sheet 1

FIG. 1.

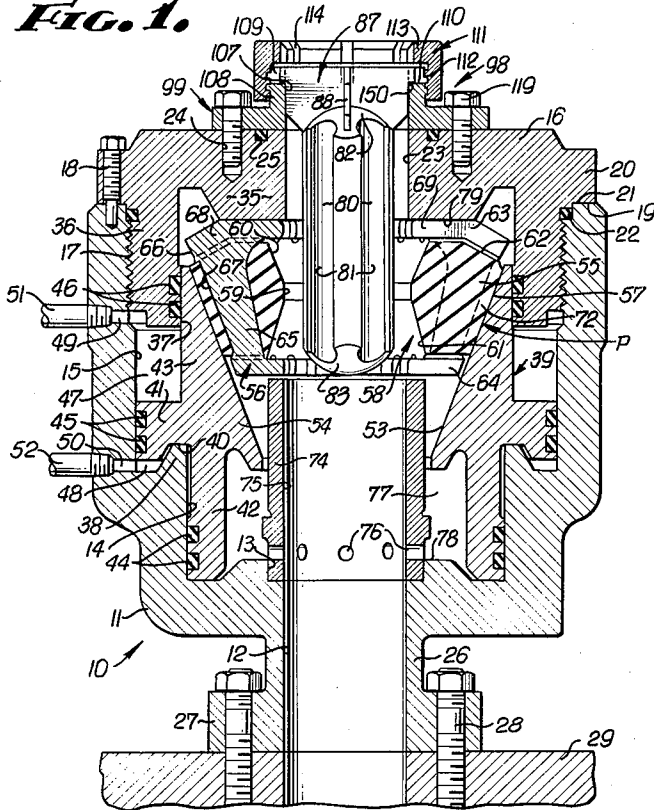


FIG. 4.

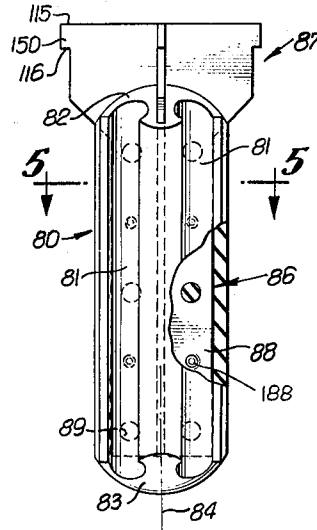


FIG. 5.

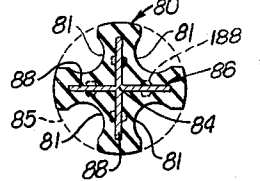


FIG. 2.

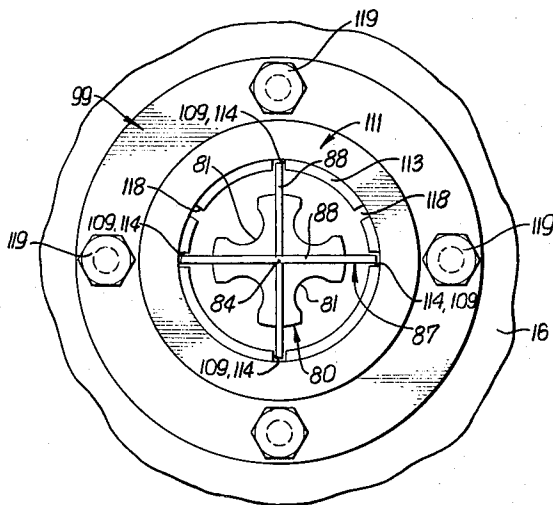
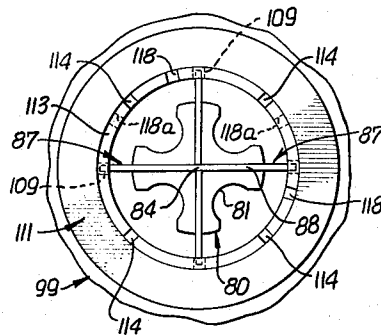


FIG. 3.



INVENTOR
GRANVILLE S. KNOX
BY *White and Naeflyer*
ATTORNEYS.

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G. S. KNOX

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FIG. 6.

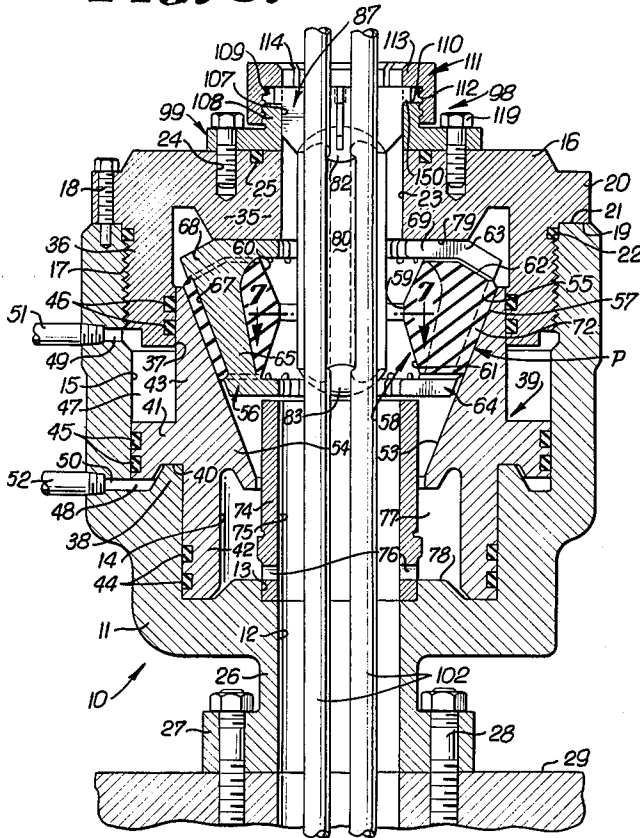


FIG. 11.

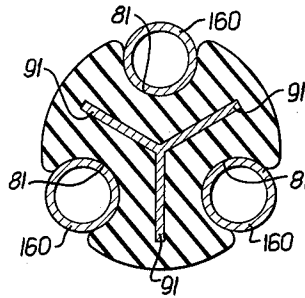


FIG. 12.

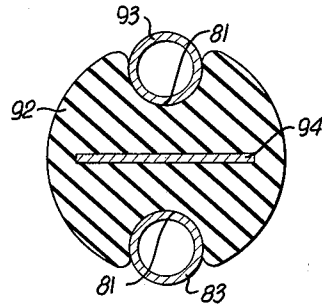


FIG. 7.

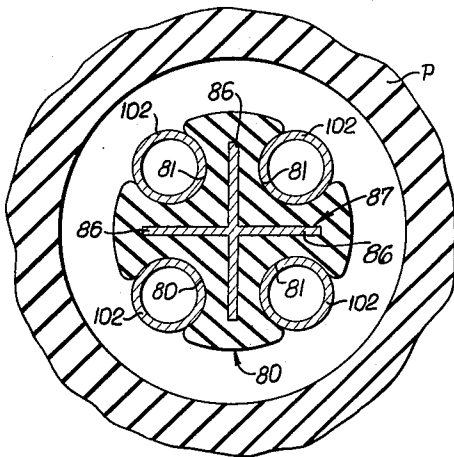
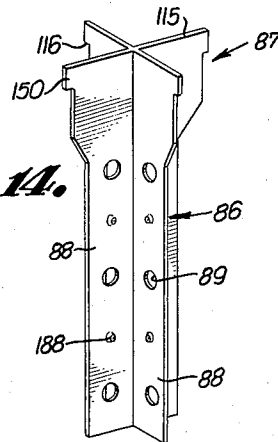


FIG. 14.



INVENTOR.
GRANVILLE S. KNOX
 BY *White and Keefliger*
 ATTORNEYS.

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G. S. KNOX

3,225,831

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FIG. 13.

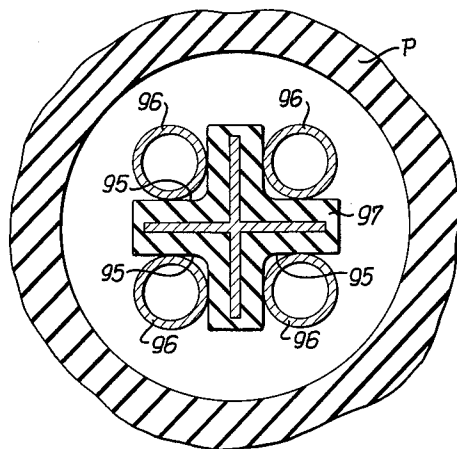
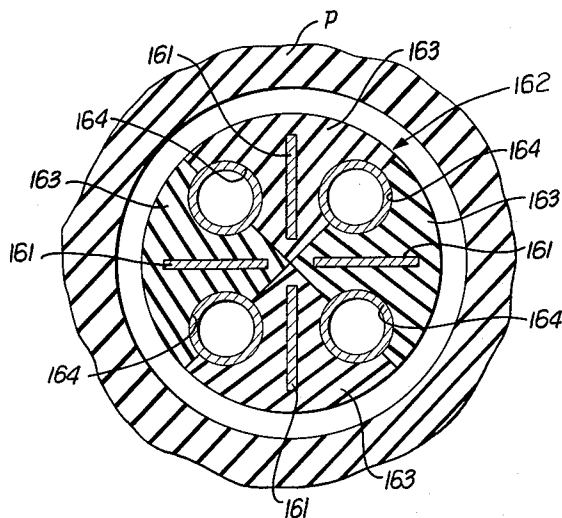


FIG. 15.



INVENTOR.

GRANVILLE S. KNOX

BY

White and Haefliger

ATTORNEYS.

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3,225,831

APPARATUS AND METHOD FOR PACKING OFF MULTIPLE TUBING STRINGS

Granville S. Knox, Glendale, Calif., assignor to Hydril Company, Los Angeles, Calif., a corporation of Ohio
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20 Claims. (Cl. 166-75)

This invention relates generally to so called multiple completion of oil or gas wells, and more particularly concerns novel apparatus and methods for preventing blowouts at the heads of wells wherein multiple tubing strings are utilized for multiple completion purposes.

Within recent years wells in increasing number have been completed using more than one tubing string, in order that well fluids may be produced from different depth zones separately and simultaneously. Briefly, such completion involves the running of multiple tubing strings into the well and to different depths corresponding to the production zones to be simultaneously exploited, and the mutual isolation of such zones as by appropriate well sealing technique. While multiple completion offers the advantages of higher production rates per well, the investment costs per well are obviously higher than ordinary and the protection of such higher investment as by preventing well blow-outs becomes of vital importance. However, the problem of well blow-out prevention in this technological area has not been satisfactorily met, largely because of the difficulty of quickly establishing an extreme pressure seal about parallel tubing strings extending vertically in the well, while accommodating vertical running of the tubing.

Accordingly, it is a major object of the present invention to meet the need for effective well blow-out prevention equipment and methods, adapted to multiple completion techniques. As broadly conceived, the improved equipment comprises well head packed body means forming spaced tube receiving openings extending vertically through the body, with body material proximate the openings being elastomeric and deformable. Further, the body may be characterized as having a running position in which the openings are sized to receive spaced generally parallel well tubing strings being run endwise there-through, and a well sealing position in which the elastomeric extent of the body is deformed tending to reduce the sizes of openings for establishing a high pressure seal in cooperation with the tubing strings.

Another important object of the invention is to provide a packer body in the form of an insert cooperable with another packer body which is annular to establish the desired seal. The annular body may for example be like that illustrated in my U.S. Patent No. 2,609,836, issued September 9, 1952, in which event the usefulness of that form of blow-out prevention equipment is advantageously extended to multiple completion applications.

Other objects and advantages of the invention include the provision of similar insert type packer bodies having different numbers of particularly shaped recesses therein corresponding to the number of tubing strings to be run in the well, each body being further characterized as having means including core structure embedded in the body in spaced relation to the recesses for supporting the body in fixed vertically endwise extending position. Such means projects endwise exteriorly of the body in spaced relation to endwise projections of the recesses for suspending the body therebelow to pass the tubing strings and typically is characterized as vertical plate type framework having terminals which are detachably lockable against vertical displacement by novel mounting structure. Typically, the insert packer as thus mounted is downwardly received within the vertical passage formed

by the annular packer mentioned above, the latter than being constrictable on the insert packer as desired to establish the well pressure seal.

These and other objects and advantages of the invention, as well as the details of an illustrative embodiment, will be more fully understood from the following detailed description of the drawings, in which:

FIG. 1 is a vertical elevation, taken in section showing the assembly including the insert packer unit in position to receive multiple tubing strings;

FIG. 2 is a fragmentary plan view of the FIG. 1 assembly prior to locking of the packer insert support structure in the assembly;

FIG. 3 is a view like FIG. 2, showing the packer insert support structure locked in the assembly;

FIG. 4 is an enlarged vertical elevation showing the insert packer unit including body and support structure, with the body broken away in part to show the body embedding core portion of the support structure;

FIG. 5 is a section taken on line 5-5 of FIG. 4;

FIG. 6 is a view like FIG. 1, showing the assembly with multiple tubing strings received thereby and being run therethrough;

FIG. 7 is a fragmentary section taken on line 7-7 of FIG. 6;

FIG. 8 is a view like FIG. 6, but showing the assembly including the packer body in actuated condition establishing a high pressure fluid seal at the well head and in cooperation with the multiple tubing strings;

FIG. 9 is a section taken on line 9-9 of FIG. 8;

FIG. 10 is a vertical elevation showing the multiple production zone environment of the invention;

FIG. 11 is a view like FIG. 7 showing a modified insert packer unit;

FIG. 12 is a view like FIG. 7 showing another modified insert packer unit;

FIG. 13 is a view like FIG. 7 showing still another modified insert packer unit;

FIG. 14 is a perspective showing of the body support structure of the insert packer unit as illustrated in FIGS. 1-9; and

FIG. 15 is a further view like FIG. 7 showing an additional segmental type insert packer unit.

Referring first to FIG. 10, a control head 10 is shown directly above a well 100 which is cased at 101, with multiple tubing strings 102a and 102b extending vertically downwardly through the head 10 and into the well casing. Typically, the tubing strings terminate at different production zone levels, generally indicated at 103a and 103b, and the casing is perforated at 104a and 104b to pass production fluid into the well proximate the tubing terminals, for upward flow to the surface. Suitable packers 105 and 106 are provided in the well to pack off one or more of the tubing strings, the primary function of the packers being to isolate the tubing terminals at the different production zones, so that flow from any zone will pass to the surface through only one predetermined tubing string.

Turning now to FIG. 1, and as explained in U.S. Patent 2,609,836 referred to, the control head, generally indicated at 10, includes a body member 11, having concentric bores 12, 13, 14 and 15 which are of progressively increased diameters. Cap 16 is releasably held to the body member by screw thread connection 17, being releasably locked by pilot bolt 18 in such a position that the face 19 of cap flange 20 engages the upper end 21 of the body member 11, the cap and body member being packed off at 22. Cap 16 has a bore 23 which is of the same diameter and is concentric with body bore 12. Sunk in the upper face of cap 16 are bolt holes 24 for the attachment of equipment thereabove. The annular groove 25, in that

upper face, is adapted to receive a sealing ring for sealing engagement with said equipment.

The neck 26 of body member 11 has an attachment flange 27 whereby connection is made through bolts 28 to the plate 29 or any other suitable fitting.

Cap 16 has an internal annular flange 35 which defines the downward continuation of bore 23, and a peripheral flange 36 which defines bore 37, said bore 37 being concentric with all the body-member bores identified above.

At the junction of bores 14 and 15 is an annular, up-standing flange 38 which engages the packing actuating member 39 at 40 to limit the extent of downward movement of said member. The actuator 39 has a piston portion 41, having piston-fit in bore 15, and piston portion 42 which has piston-fit in bore 14. The actuator is extended upwardly at 43, extension 43 having piston fit in the cap-flange bore 37. Sealing rings 44, 45 and 46 are provided between piston portions 42, 41 and 43, respectively, and the respective cylinder defining walls which receive those portions.

Piston 41 divides body bore 15 into upper and lower cylinders or pressure chambers 47 and 48, ports 49 and 50 opening, respectively, from those chambers. External pipes 51 and 52 open to ports 49 and 50, respectively.

The actuator 39 has a downwardly and inwardly tapering conical bore 53, and the actuator portion 54 which defines this bore may be considered broadly as an internal, conical wedge, or as a packer-constricting element.

Packer P includes a massive annulus or sleeve 55 of plastic and, preferably, resilient material such as rubber or neoprene. In most instances, it is intended that a single packer be adapted for repeated opening and closing operations, and therefore it is preferable that it have relatively high resilient characteristics, so it may be self-restoring to open position when the constricting force is removed. From this point on in the description, it will be assumed that the packer has such resilient characteristics; but this assumption is not considered as limitative on my broader claims. It has been found that rubber having a durometer hardness of about 75 is suitable for general use in my packer but, again, this specification of relative hardness is not to be considered as limitative. The packer is shown as an unsplit, continuous annulus, but it will be understood that the disclosure is not limited to a packer wherein there is no split, so long as there is no angularly extending gap interrupting the continuity of the packer at times when it is radially contracted into sealing engagement with members positioned within its bore.

Included in the makeup of the packer is a series of rigid, rubber-flow-control elements 56. These elements may take different forms and still lie within the scope of my broader claims, but I will first describe the preferred form of elements which has individual features of advantage.

These rigid control elements are individually movable bodily with the rubber in its movement of radial contraction and expansion and also, to a limited extent, movable individually with respect to the rubber as will later appear. Taken together, the rigid control elements may be considered as a radially expandable and contractable armature embedded within annulus 55.

Molded annulus 55 has an outer conical face 57 which is complementary to actuator bore 53, and a bore 58 which has a central, substantially cylindrical portion 59 and oppositely inclining upper and lower portions 60 and 61, respectively; the outward flare, in each case being toward the associated end of the annulus. The outer portion of the annulus, at its upper end, is preferably beveled off, as at 62. The significance of these shape-characteristics will be made apparent later.

It will be seen that each element 56 comprises top and bottom plates 63 and 64, respectively, rigidly connected by vertical rib 65, the outer faces 66 of the plates and the outer face 67 of the rib having substantially the same degree of taper as bore 53 and annulus face 57. Or

plates 63, 64 may be considered as transverse flanges on rib 65. The "heel" 68 of the upper plate preferably inclines downwardly and outwardly in accordance with bevel 62. The rib is inset from all bounding edges (viewing the element 56 in plan) of both plates. Elements 56, which may be of steel, bronze, or any other suitable rigid material, are preferably positioned in the rubber at the time of molding and, preferably, the rubber and the elements are bonded together by the use of suitable adhesive during the molding process. The plates of the control elements are sectorial in shape, as viewed in plan, and are arranged in a circular series, with spaces left between the opposing side edges 69 of the plates, both top and bottom. The plates are so sized that the two opposed side edges 69 of adjacent elements are spaced apart, it following that as the elements move radially inward, the spaces between them, from end to end, diminish equally in width, so there is no premature interference of the plates at their inner ends and so the rubber which may flow between the plates during the constriction of the annulus will not be pinched off at the radially inward ends of the plates.

The annulus 55 is molded so its outer annular portion 72 projects radially outward beyond the outer faces 66 of the plates, it following that these metallic faces do not engage the wall of actuator bore 53. For purposes of later description, I will consider annular portion 72 as being that portion which extends radially from face 57 to the outer faces 67 of ribs 65.

The packer is lowered, while cap 16 is detached, into the position of FIG. 1, the annulus 55 nicely fitting the upper portion of bore 53 without requiring appreciable radial constriction of the annulus. For positively limiting the downward movement of the annulus, I provide a stop in the form of tube 74 which has press fit in housing bore 13. The upper end of the tube provides the packer stop. The bore 75 of this tube is of the same diameter as bores 12 and 23, and the tube is annularly spaced from both piston portion 42 and the lower end of actuator wedge-portion 54. Ports 76 open from bore 75 to chamber 77, which later is annularly defined by the tube and the piston portion 42, while it is defined endwise by body wall 78 and the lower end of the packer.

When cap 16 is subsequently secured in place, its horizontal under-surface 79 provides a stop for limiting upward movement of the packer, the upper plates 63 of control elements 56 sliding over this surface as the packer is radially constricted or expanded. Tube end and cap surface 79 thus form vertically spaced stops which prevent appreciable vertical movement of the packer with relation to the body member 11.

It will be seen that the radial constriction of the packer is accomplished by virtue of relative vertical movement between the packer and the actuator. While the illustrated embodiments show this relative movement as brought about by holding the packer against vertical movement with respect to the body member and then moving the actuator vertically with respect to the housing and packer, it will be understood the arrangement and operation may be reversed.

Referring now to FIGS. 4 and 5, the insert packer unit to be combined as shown in FIG. 1 comprises a packer body 80 of elastomeric material, typically the same or similar to that of the packer P previously described. The body is vertically elongated and has spaced generally parallel recesses or openings 81 extending between opposite ends of the body, these being open to the exterior of and along the body extent between the ends 82 and 83 in offset relation to the body axis 84. As will be further described, the recesses are sized to receive spaced generally parallel well tubing strings, such as were previously referred to at 102, which strings are run endwise through the recesses when the packer body is free of externally imposed body material deforming constriction, it being understood that the body 80 is deformable by

constriction to engage and seal off against the tubing strings.

The particular packer body 80 shown in FIGS. 4 and 5 has four recesses 81 which are spaced at generally equal intervals in circular sense about the body axis 84. The major extents of these recesses lie inwardly of an axially extending cylinder 85 defined by the outermost peripheral extents of the undeformed packer body, as is clear from FIG. 5. In addition, the maximum transverse dimension of each recess, which happens to be in diametral sense in FIG. 5, is less than the radius of the cylinder 85.

The insert packer unit also includes means for supporting the body in fixed vertically endwise extending position, such means including core structure 86 embedded in the body in a corresponding body opening and in spaced relation to the recesses 81, the core structure framework also projecting exteriorly of the body as shown generally at 87 and at the upper end thereof in spaced relation to endwise projection of the recesses 81 for suspending the body therebelow to pass the well tubing strings. Such core structure framework typically includes metallic plates extending endwise of the body and vertically, the plates being indicated at 88 may have apertures 89 or outstanding lugs or ribs 188 to provide means for anchoring the body elastomeric material, the latter having endwise facing interior shoulders exposed to the core ribs. The plates and elastomeric material are preferably bonded together by the use of a suitable adhesive during the molding process. FIG. 14 shows the core framework in greater detail.

FIGS. 11 and 12 respectively show insert packer units for handling three tubing strings and two tubing strings, whereas the FIGS. 4 and 5 packer unit is adapted to handle four tubing strings. The unit of FIG. 11 has three recesses 81 shown as receiving three tubing strings 160 being run therethrough at 120° spaced intervals about the unit axis 90. In this embodiment the core framework incorporates three vertical plates 91 preferably joined along central axis 90 and arranged as a spider to project away from the axis 90 and transversely between pairs of recesses 81. In FIG. 12 two diametrically opposed recesses 81 are formed by the packer body 92, and two well tubing strings 93 are shown received by the recesses to be run therethrough. A single core plate 94 extends vertically and transversely between the recesses 81 for supporting or anchoring the packer body against dislodgement from the core, this function also being characteristic of the core structure in each of the packer units described and illustrated.

FIG. 13 shows still another form of insert packer unit wherein the recesses 95 for receiving the well tubing strings 96 do not conform as closely to the circular exteriors of the tubing strings 96, but on the other hand have walls defined by the packer body material 97 which extends proximate the tubing strings. Such proximity is sufficient to provide the sealing effect to prevent the well blow-out as will be described. With the exception of the difference in recess outline, the structure of the FIG. 13 insert packer unit is essentially the same as described in connection with FIGS. 4 and 5.

Referring back to FIG. 1, the insert packer unit 80 is shown in combination with the control head 10, with the packer body 81 inserted downwardly into the passage formed by the packer P, and in spaced relation to the bore portions 59, 60 and 61 thereof. In this position, the framework 86 of its extensions 87 from the insert packer unit 80 are mounted by structure 98, and the annular packer P is also supported by mounting structure previously described, and typically including the cap 16 which supports the structure 98. The latter is shown to include a base 99 having a bore 107 for receiving the lower stepped portions of the outer terminals of the four plate extensions 87. The base also incorporates a ring shaped boss 103 containing vertical slots 109 opening inwardly to bore 107 and having upwardly facing stop shoulders 110 for

receiving and positioning the outer terminals 150 of the welblike extensions 87 of the plates 88.

The mounting structure 98 also includes a head 111 which is coupled to the base for blocking or resisting the upward displacement of the outer terminals of the extensions 87. As shown, the head is in the form of a nut threaded on the base at 112 for rotation therearound as desired. The head is flanged at 113 to overlie the base slots 109 and web outer terminals, and the head flange also contains slots 114 vertically registrable with the base slots 109 to vertically receive the web outer terminals during downwardly insertion of the insert packer unit. Upon completion of such insertion, the head 111 is rotated, typically as shown in FIG. 3, to move the slots 114 in the head out of registration with the base slots 109, whereby the flange 113 then overlies the base slots and the web outer terminals of the core structure 86. At this time the flange 113 and stop shoulders 110 provide rigid members interengageable with the upper and lower shoulders 115 and 116 of the welblike extensions 87, for blocking vertical displacement of the core framework and the packer body 80 relative to the mounting structure 98.

It will also be noted from FIG. 2 that the head 111 and the base 99 contain slots 118 and 118a which are separated by an interval of 120° from each other and form one of the previously described sets of slots 109 and 114. This construction accommodates insertion of the insert packer unit embodiment shown in FIG. 11, in that the outer terminals of the plates 91 are provided with three extensions similar to those shown at 87 in FIG. 4. FIGS. 1 and 2 also show the bolts or other fasteners 119 holding the base 99 of the mounting structure onto the cap 16.

FIG. 6 is like FIG. 1 with the exception that it shows the multiple tubing strings 102 run downwardly through the control head 10, and particularly through the recesses 81 formed by the packer body 80. In other words, the equipment is shown in running position with the recesses 81 sized to receive the spaced, generally parallel well tubing strings which are run endwise therethrough. At the same time, the locating of the packer body 80 as shown in FIG. 6 may be regarded as constituting one way of fulfilling the step of substantially filling the space between the tubing strings in a zone within the passage defined by annular packer P with elastomeric insert packer material characterized as being subject to deformation to establish a well pressure seal about substantially the entire peripheral extents of the tubing strings at said zone.

FIG. 8 illustrates the well sealing position of the annular packer P and the insert packer unit 80, which condition is further illustrated in FIG. 9. In this regard, it is assumed that a "blow-out" occurs or some other reason arises for closing the packer P about the insert packer unit and the tubing strings 102. Such closing is effected by causing the flow of fluid under pressure into the chamber 48 as indicated by the arrow 120 in FIG. 8, thus elevating the actuator 39 and causing constriction of the packer P. It will be noted that the packer body is radially constricted from end to end, causing the rubber to flow or extrude as a plastic, the mass of rubber assuming somewhat the shape illustrated in FIG. 8. The direction of extrusion is mainly radially inward, plates 63 and 64 of the control members 56 confining the rubber extending vertically between those plates, against vertical extrusion.

Constriction of the rubber of the packer P against the packer body 80 causes the material of the latter to deform typically as shown in FIG. 9 to sealingly engage the peripheries of the well tubing strings for establishing the desired high pressure seal at the well head. At the same time, the outwardly facing peripheral extents of the well tubing strings 102 are pressurally engaged by portions 121 of the packer P. Since the elastomeric material of the packer P and the material of the packer body 80 are respectively anchored by the members 56 and by the core structure 86, the deformed packer material cannot pull free of these anchoring devices in response to well pressure exertion

against the material, and accordingly a highly effective blow-out prevention seal is established. In this connection, equivalent arrangements of packer material may be substituted so long as they perform the functions of the deformable packer material described, which functions include the spacing and passing of the tubing strings under normal running conditions and the peripheral sealing thereof when a blow-out threatens.

During the continuance of well blow-out conditions, well pressure is applied through the ports 76 of the tube 74 to the underside of the actuator 54, thereby to urge it upwardly and maintain the packer P and the insert packer unit 80 in deformed or energized condition for maintaining the seal. After removal of well blow-out pressure conditions, the pressure is relieved and actuating pressure may be applied to the chamber 47 for urging the actuator downwardly, thereby relieving the annular packer P. Accordingly, the body of the insert packer unit 80 then returns to undeformed state to allow the well tubing strings to be run vertically as formerly.

While I have illustrated and described preferred embodiments of my invention it will be understood that various changes in design, structure and arrangements are contemplated. For instance the vertical plates 161 comprising the core framework of the packer body 162 may be spaced apart and the packer itself may be segmented as indicated by the sector shaped body segments 163 in FIG. 15. Furthermore, while it is highly advantageous to have the generally parallel recesses open to the exterior of the packer body, this feature is not an absolute requirement, for as is clear from FIG. 15 the recesses 164 are formed by adjacent interfitting portions of the sector shaped segments 163.

I claim:

1. Equipment of the character described, comprising a packer body of elastomeric material having spaced generally parallel recesses extending between opposite ends of the body and which are open laterally to the exterior of and along the body extent between said ends in offset relation to the body axis, said recesses being sized to receive spaced generally parallel well tubing strings which are run endwise therethrough when the packer body is free of externally imposed body material deforming constriction, said body being deformable by constriction to sealingly engage said tubing strings, said body forming an interior opening spaced generally inwardly of said recesses to receive core structure embedding and supporting the body in vertically endwise extending relation said opening projecting throughout the major length of said body, the body having endwise facing interior shoulders exposed to said opening at intervals along the opening length.

2. For combination with a radially constrictable sealing annulus having a bore forming a vertical passage therethrough for passing parallel well tubing strings, a packer body of elastomeric material sized for free insertion downwardly into said passage, said body having spaced apart generally parallel recesses extending generally vertically between opposite ends of said body and which are open generally toward said bore and along the body extent between said ends in offset relation to the body axis, said recesses being sized to receive spaced generally parallel well tubing strings which are run endwise therethrough when the packer body is free of body material deforming constriction imposed by said annulus, and said packer body being sized to deform and sealingly engage said tubing strings when the body is constricted by said annulus.

3. The body of claim 2 having means including core structure embedded in said body in spaced relation to said recesses for supporting said body in fixed vertically endwise extending position.

4. The invention as defined in claim 3 in which the major extents of said recesses lie inwardly of an axially extending cylinder defined by the outermost peripheral extents of said packer body.

5. The invention as defined in claim 4 in which the maximum transverse dimension of each recess is less than the radius of said cylinder.

6. The invention as defined in claim 3 in which said core includes metallic plate structure extending endwise of said body and containing apertures into which said body elastomeric material is molded.

7. The invention as defined in claim 5 in which said plate structure also extends transversely between pairs of said recesses.

8. The invention as defined in claim 3 in which said means projects exteriorly of said body at one end thereof and in spaced relation to endwise projections of said recesses for suspending said body therebelow to pass said well tubing.

9. The invention as defined in claim 3 in which said body has two recesses at diametrically opposite sides of the body axis.

10. The invention as defined in claim 3 in which said body has three recesses spaced at generally equal intervals in circular sense about the body axis.

11. The invention as defined in claim 3 in which said body has four recesses spaced at generally equal intervals in circular sense about the body axis.

12. In combination, a radially constrictable sealing annulus having a bore forming a vertical passage therethrough, for passing parallel well tubing strings, and a packer body of elastomeric material inserted downwardly into said passage, said body having spaced apart generally parallel recesses extending generally vertically between opposite ends of said body and which are open generally toward said bore and along the body extent between said ends in offset relation to the body axis, said recesses being sized to receive spaced generally parallel well tubing strings which are run endwise therethrough when the packer body is free of body material deforming constriction imposed by said annulus, and said packer body being sized to deform and sealingly engage said tubing strings when the body is constricted by said annulus.

13. The invention as defined in claim 12 including support means for supporting said body in downwardly inserted position in said passage.

14. The invention as defined in claim 13 in which said support means includes metallic framework embedded in said body in spaced relation to said recesses and also projecting transversely above said body in offset relation to upward extensions of said recesses, and mounting structure for said annulus and framework, said mounting structure and framework having interengageable shoulders for blocking vertical displacement of said framework and body relative to said mounting structure.

15. The invention as defined in claim 13 in which said mounting structure includes a base having downwardly tapered seat means for seating the framework outer terminals and a head coupled to the base for blocking upward displacement of said outer terminals, said head and base forming an upper passage for passing said body and framework vertically.

16. The invention as defined in claim 15 in which said framework includes vertically planar webs and said base contains vertical slots opening inwardly to said upper passage for receiving the web outer terminals.

17. The invention as defined in claim 16 in which said head is flanged to overlie said base slots and web outer terminals, the head flange containing slots vertically registerable with the base slots to receive the web outer terminals and the head being rotatable to bring the head flange into and out of overlying relation to the base slots and the web outer terminals therein.

18. The invention as defined in claim 13 including means for effecting said radial constriction of said annulus.

19. Well sealing equipment, comprising a first packer body forming a vertical passage therethrough for passing parallel well tubing strings and a second packer body inserted in said passage, said second body having spaced

apart generally parallel recesses extending generally vertically between opposite ends thereof, both said bodies being deformable, said equipment having a running position in which said recesses are sized to receive spaced generally parallel well tubing strings which are run endwise therethrough, and a well sealing position in which said bodies exert pressure for establishing a well pressure seal in cooperation with said tubing strings, both bodies being generally laterally constricted in said second position.

20. The invention as defined in claim 19 including well tubing strings extending vertically through said recesses.

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CHARLES E. O'CONNELL, Primary Examiner.