

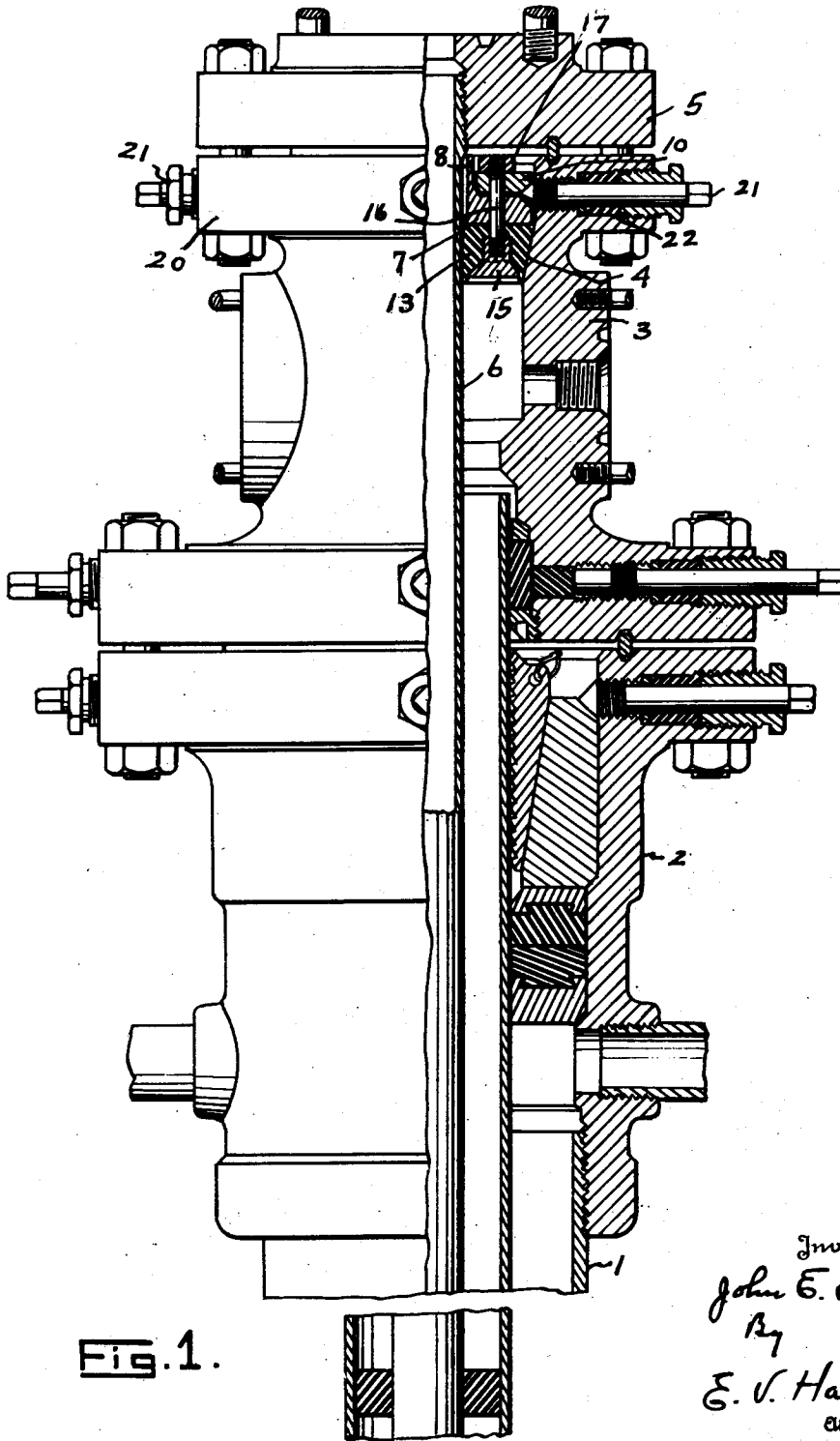
Sept. 16, 1952

J. E. ECKEL
WELLHEAD SEAL

2,610,689

Filed Aug. 19, 1946

3 Sheets-Sheet 1



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3 Sheets-Sheet 2

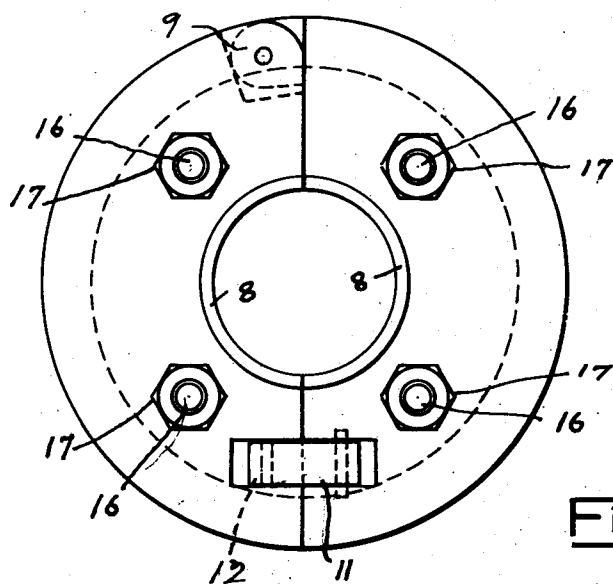


Fig. 2.

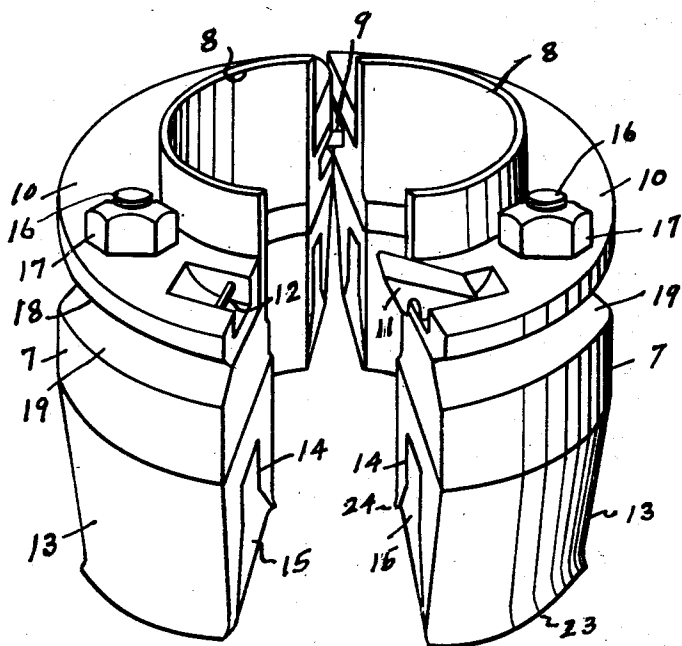


Fig. 3.

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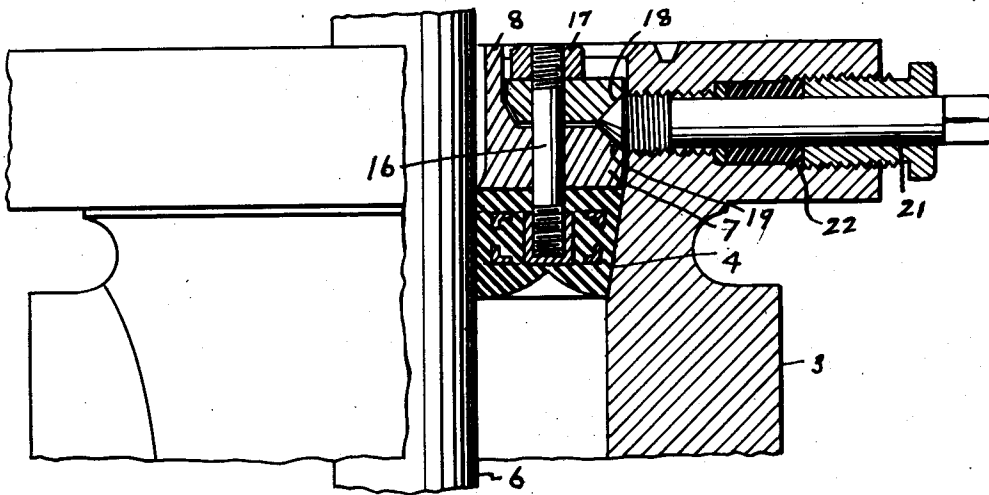


Fig. 5.

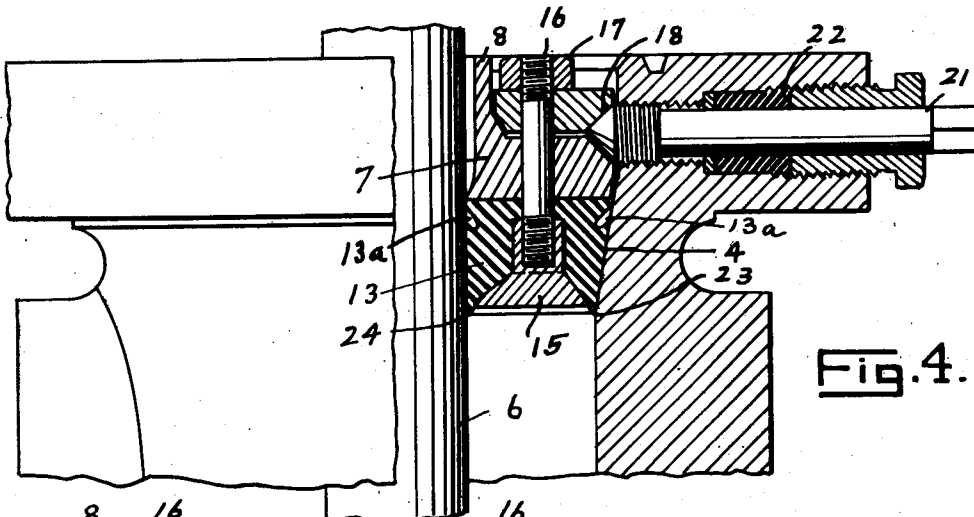


Fig. 4.

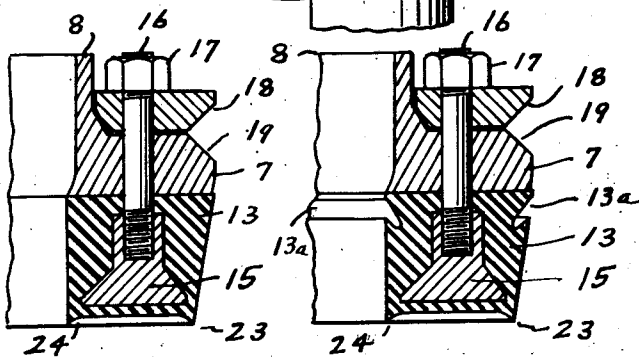


Fig. 6.

Fig. 7.

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2,610,689

WELLHEAD SEAL

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Application August 19, 1946, Serial No. 691,519

16 Claims. (Cl. 166—14)

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This invention relates to a well head seal. An object of the invention is to provide, in a well head, a seal between the head and a pipe extending through the head to prevent the escape of well fluid around the pipe through the head together with novel means for compressing the seal to cause expansion thereof, in case leakage should occur, to form a fluid tight seal.

The novel type of seal herein described is so designed that it may be closed about a tubing, or drill pipe, and may be lowered through a blowout preventer or master valve into the tubing head seat and locked therein by conventional securing means.

It is a further object of the present invention to provide a seal of the character described of such construction that it may be placed under compression, and thereby expanded into sealing relation with the well head and with the pipe therein by convenient means accessible to an operator.

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 drawings, wherein:

Figure 1 is a side elevation, partly in section, illustrating the invention as applied around a tubing suspended from a tubing head bonnet.

Figure 2 is a plan view of the seal shown in closed position.

Figure 3 is a perspective view thereof shown in open position.

Figure 4 is a fragmentary, side view, partly in section, of a well head with the seal therein around the tubing and provided with upwardly diverging external and internal lips.

Figure 5 is a fragmentary, side view, partly in section, showing a well head with the seal therein and which is provided with a metallic core.

Figure 6 is a fragmentary, sectional view of the seal illustrating another type of expanding core therein; and

Figure 7 is a fragmentary, sectional view of the type shown in Figure 6 with external and internal annular lips therearound.

Referring now more particularly to the drawings wherein like numerals of reference designate similar parts in each of the figures, the

numeral 1 designates a casing, or other pipe, in a well and the numeral 2 designates a casing head thereon.

Mounted on the casing head 2 there is a tubing head 3 whose upper end is formed with a downwardly and inwardly tapering seat 4.

As illustrated in Figure 1 there is shown, mounted on the tubing head, a tubing head bonnet 5 and depending therefrom, there is the well tubing 6.

The seal shown in Figure 1 is more clearly illustrated in Figures 2 and 3, wherein an anchor for the packing, or seal ring, is shown. The numerals 7, 7 designate similar, lower arcuate sections, or halves, of the anchor ring for the resilient sealing material, upstanding from the inner margins of which are the arcuate flanges 8, 8. These sections 7 are hinged together, at one side, by a hinge 9. This anchor also includes the upper arcuate ring sections 10, 10 which coincide with the anchor sections 7 and which are provided, one with a latch 11 and the other with a cross rod 12 engageable by the latch to hold the sections closed about the tubing 6. Any other selected type of latch may be employed.

Depending from the anchor sections 7 are complementary packing ring sections 13, 13 which are preferably formed of rubber or other similar material.

As illustrated in Figures 1, 2 and 3 the lower ends of the packing, or seal ring, sections have the deep, arcuated, downwardly flared grooves 14 in which are seated arcuate cores, or expanders 15, 15 which are formed of metal or other rigid material.

There are the clamp bolts 16 whose lower ends may be threaded into the expanders 15 and these bolts extend up through the anchor ring sections 7, the ring sections 10 and whose upper ends are externally threaded to receive the nuts 17.

As illustrated, there are two of the clamp bolts provided for each section of the well head seal.

The outer margins of the ring sections 10 are beveled upwardly forming the beveled faces 18, 18 and the opposing margins of the anchor sections 7 are beveled downwardly forming the beveled faces 19, 19. The faces 18 and 19 diverge outwardly.

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The seal, in use, is latched about the tubing 6 and may be lowered through a blow-out preventer or master valve, or the like, into the tubing head 3 until it lands on the downwardly tapering seat 4.

In the embodiment illustrated in the drawings the upper end of the tubing head is provided with the conventional external annular flange 20 and extended inwardly through said flange are the screws 21 having threaded connections with the tubing head and whose inner ends are tapered to engage the upper and lower faces 18, 19. The outer ends of said screws are surrounded by suitable stuffing boxes 22 in the flange 20.

When said screws are screwed inwardly the anchor ring sections 7 are forced more tightly into the tapering seat 4 of the tubing head and simultaneously the ring sections 7 are moved upwardly against the nuts 17 thus subjecting the bolts 16 to tension and applying vertical compression to the packing ring sections thus expanding said sections to form fluid tight joints with the tubing 6 and with the seat 4.

The form of packing in Figure 4 is similar to that shown in Figure 1 excepting that each packing ring section 13, 13 has the outer and inner grooves 13a, 13a therearound with upwardly diverging lips fitting closely against the seat 4 and the tubing 6, respectively, to prevent the downward flow of pressure fluid between the tubing and the tubing head.

It will be noted that in the form shown in Figures 1, 3 and 4 that the expanders are exposed beneath, that is they are surrounded by rubber above and on each side while in Figures 6 and 7 they are shown as completely surrounded by rubber.

In the form illustrated in Figure 5, there is an open work metal cage embodied in each section of the packing ring and the bolts 16 are secured, at their lower ends, to said cage.

It is to be further noted that in each of the forms the packing rings, formed of the complementary sections 13, are provided with the outer and inner flared lips 23 and 24 which fit closely against the seat 4 and the surrounded tubing 6.

With the assembly shown in Figure 1 wherein the upper end of the tubing is connected to the tubing head bonnet 5, the Christmas tree manifold may be moved vertically for the purpose of setting packers or moving packer valves or similar operations and the tubing will slide through the seal in sealing contact therewith; one of the major uses of this type of tubing head seal being in connection with the setting of packers and the washing and completing of wells. It also serves as a blow-out preventer while running the tubing into the well.

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

What I claim is:

1. In combination, a tubular well head having a supporting seat therein, and having a well pipe extending therethrough, a sealing assembly for sealing off between the well pipe and the inside wall of the well head and including an annular support adapted to engage the seat within the well head and surrounding the well pipe, an annular expansible sealing member below the support, pressure-applying means having a portion thereof connected to the sealing member and slidably extending upwardly through the support, an upper ring overlying

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the support and movable relative thereto and secured to the pressure-applying means, and operating means mounted in the well head and movable substantially radially inwardly between the annular support and the upper ring coacting with the support and said pressure-applying means to simultaneously lock said support against upward displacement and to urge the upper ring and the pressure-applying means attached thereto upwardly with respect to the support and sealing member, whereby an upward pressure is applied to the sealing member by the pressure-applying means to deform said member into sealing engagement with the well head pipe and head below the support.

2. The combination as set forth in claim 1 wherein the radially movable operating means is accessible from the exterior of the well head.

3. The combination as set forth in claim 1, wherein the radially movable operating means comprises a plurality of radially extending screws mounted within the well head and having their inner ends tapered to effect a separation of the support and upper ring upon inward movement of said screws.

4. An annular seal comprising, an anchor formed of arcuate sections, seal ring sections formed of resilient material depending from the respective anchor sections, each anchor section being composed of upper and lower arcuate parts, an expander in each seal ring section, securing means extending through the lower arcuate part of each anchor section and connected to one of the expanders and also connected to the corresponding upper part of the anchor section to fasten the expanders to the upper parts of the anchor section, whereby upon relative movement of said upper part with respect to the lower part in a direction separating said upper and lower parts, said seal ring sections will be placed under compression and laterally expanded.

5. An annular sealing assembly comprising, an annular anchor formed of rigid material and composed of upper and lower ring sections movable relative to each other, an expansible seal ring beneath the anchor, an expander in the seal ring, securing means extending through each lower ring section and connected to the expander and also connected to the corresponding upper ring section to fasten the expander to the upper ring sections whereby upon movement of the upper ring section relative to the lower ring section in a direction separating the sections, the seal ring will be placed under compression by the expander to cause expansion thereof.

6. An annular sealing assembly as set forth in claim 5, wherein said assembly is formed of complementary sections which are hinged together.

7. In combination, a tubular head having an inwardly and downwardly converging seat and shaped to receive an inner pipe therethrough, an annular sealing assembly with a downwardly converging periphery fitting into said seat, and having an annular anchor formed of rigid material and composed of superposed upper and lower ring sections, a sectional expansible seal ring beneath the anchor, an arcuate rigid expander section in the lower portion of each section of the seal ring, securing means extending movably through the lower ring sections and through the seal ring sections and connected to said expander section and also to the upper anchor ring section to fasten the expander sections

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to the upper anchor ring sections, means extending radially through the head and engageable between the upper and lower ring sections for wedging between the upper and lower ring sections to apply pressure to, and to clamp, the seal ring against the anchor to expand the seal ring.

8. An annular sealing assembly comprising, an annular anchor formed of rigid material and having upper and lower sections, a seal ring beneath said anchor and formed of resilient material, a connecting means having its upper end secured to the upper anchor section and extending loosely through the lower anchor section and having its lower end secured to the seal ring, movement of the upper and lower anchor sections in a direction separating the sections resulting in the seal ring being urged upwardly against the anchor by said connecting means, said seal ring having outer and inner annular grooves in its outer and inner peripheries respectively, said grooves forming annular upwardly directed lips.

9. A sealing assembly for sealing the annular space between a well head and a tubular member extending through the head, said assembly including, a support shaped to surround the tubular member and adapted to seat in the well head, an elastic sealing means below the support shaped to surround said tubular member to form a seal between the well head and the tubular member, means connected with the sealing means and having its upper portion extending through the support and movable relative to the support to apply pressure to the sealing means to urge the sealing means against the support to distort the elastic sealing means into sealing position, an upper actuating ring forming part of the assembly connected to the upper end of the pressure applying means, and means mounted in the well head for radial movement and accessible to an operator from exteriorly of the head, said last named means being engageable upon radial movement with the support and with the actuating ring to move said support and ring in opposite directions to thereby urge the support and sealing means in one direction and at the same time urge the pressure applying means in an opposite direction to apply pressure to the sealing means.

10. A sealing assembly for sealing the annular space between a well head and a tube extending through the head, said assembly including, a support shaped to surround the tube and adapted to seat in the well head, an expansible sealing member below the support shaped to surround said tube and to form a seal between the well head and the tube, means connected with the sealing member and having its upper portion extending through the support and movable relative to the support, to apply pressure to the sealing member to urge the sealing member against the support to distort the elastic sealing means into sealing position, an upper actuating ring forming part of the assembly connected to the upper end of the pressure applying means, and means mounted in the support for radial movement and accessible to an operator from exteriorly of the support, said last named means being engageable upon radial movement with the support and with the actuating ring to move said support and ring in opposite directions to thereby lock the sealing member against movement in the head and to also move the pressure applying means relative

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to the support to apply pressure to the sealing member deforming the same into sealing relation with the tube and head.

11. An annular sealing assembly comprising, an annular anchor formed of rigid material and composed of upper and lower ring sections whose outer margins diverge to form an annular groove between the sections of the anchor, said sections being movable relative to each other, an expansible seal ring below the lower ring section, an expander means extending through the lower ring section connected to the seal ring and also connected to the upper ring section whereby upon movement of the ring sections relative to each other in a direction away from each other said expander means acts upon the seal ring to place the seal ring under compression to cause expansion thereof.

12. An annular sealing assembly as set forth in claim 11, wherein said assembly is formed of complementary ring sections which are hinged together.

13. In combination, a well head having a well pipe extending therethrough, a sealing assembly including an annular support and an elastic annular sealing member supported on said support within the well head surrounding the pipe and sealing the annular space between the pipe and head, a movable expander-actuating means above said support and sealing member, an expander below the sealing member, a connection extending through the support and sealing member for connecting the expander-actuating means to the expander, whereby when said expander-actuating means is urged in a direction away from the sealing member and support, an upward pressure will be applied to said member, and radially movable means mounted in the well head and arranged to move between the support and the expander-actuating means to simultaneously lock the support against upward movement in the head, and to move the expander upwardly with respect to the locked sealing member to deform the same into sealing position.

14. A sealing assembly for sealing the annular space between a well head and a pipe extending through said head, said assembly including a well head having a seat, an annular support adapted to seat on said seat within the well head, an annular expansible sealing means below the support forming a seal between the well head and the pipe extending therethrough, pressure-applying means having a portion thereof connected with the sealing means and slidably extending through the annular support, said pressure-applying means being adapted, upon movement thereof relative to the support, to apply upward pressure to the sealing means to urge said sealing means against the support and thereby distort the sealing means into an expanded sealing position and an operating means mounted in the well head and movable radially with respect to the assembly and engageable with the support and also with the pressure-applying means to act simultaneously upon the support and upon the pressure-applying means in opposite directions, whereby said operating means urges the support in one direction and urges the pressure-applying means in an opposite direction to apply pressure to said sealing means.

15. A sealing assembly as set forth in claim 14, wherein the operating means consists of a plurality of screw members whose inner ends

are tapered and adapted to engage the support and pressure-applying means.

16. The combination as set forth in claim 14, wherein the pressure-applying means consists of a ring overlying the support and bolts having their lower ends connected with the sealing means and their upper ends connected with said ring and also wherein the operating means consists of a plurality of radially extending screws having their inner ends tapered to engage between said ring and support to separate these parts upon inward movement of the operating means.

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