March 31, 1964 K. H. KRETZSCHMAR 3,127,197

WELL HEAD HAVING SEAL MEANS ADJUSTABLE AND REPLACEABLE UNDER PRESSURE

Filed Jan. 25, 1960 4 Sheets-Sheet 1

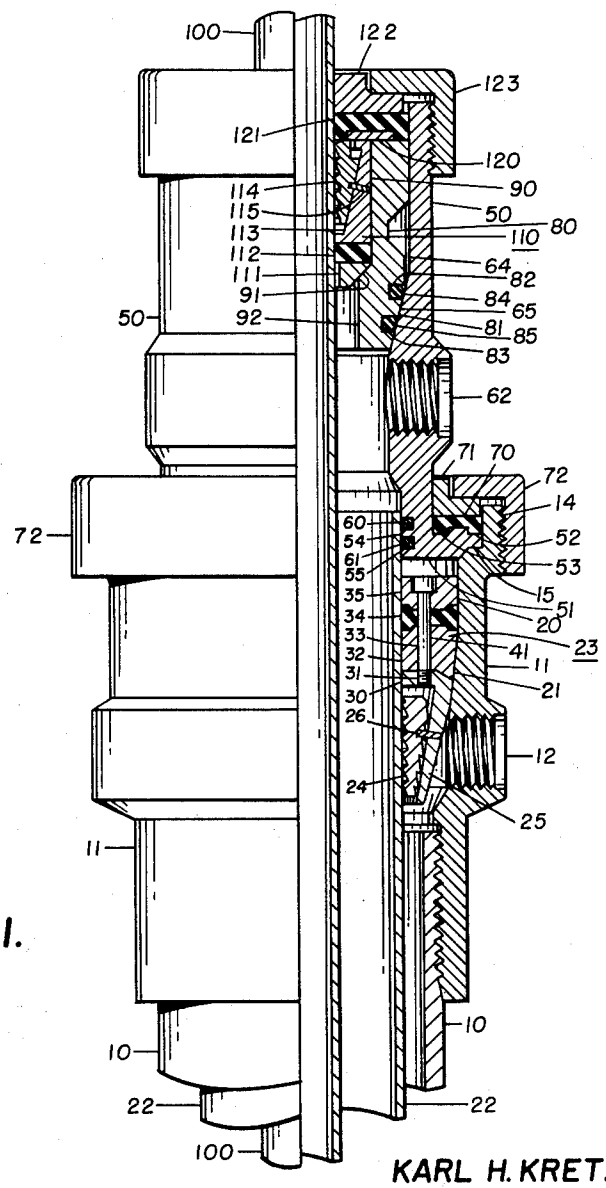

FIG. 1.

KARL H. KRETZSCHMAR
INVENTOR.

BY H. Matthews Garland
ATTORNEY

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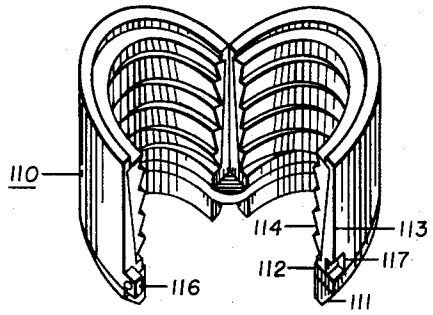

FIG. 2.

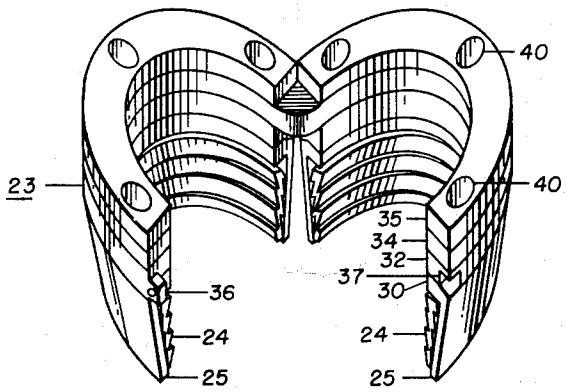

FIG. 3.

KARL H. KRETZSCHMAR
INVENTOR.

BY W. Mathews Garland
ATTORNEY

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Filed Jan. 25, 1960 4 Sheets-Sheet 3

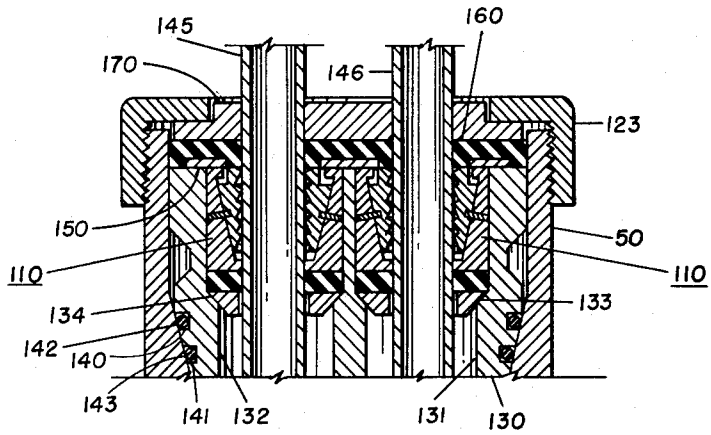

FIG. 4.

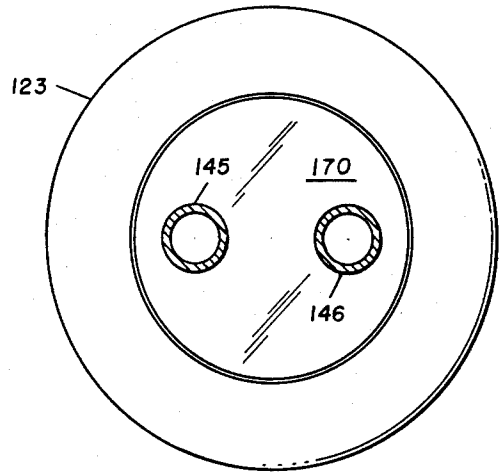

FIG. 5.

KARL H. KRETZSCHMAR
INVENTOR.

BY H. Matthews Garland
ATTORNEY

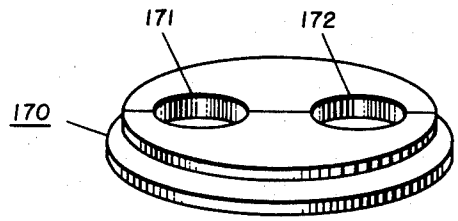

FIG. 6.

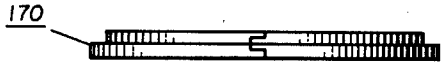

FIG. 7.

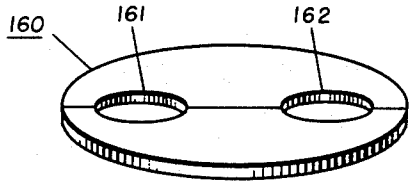

FIG. 8.

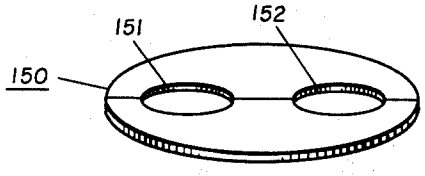

FIG. 9.

KARL H. KRETZSCHMAR
INVENTOR.
BY W. Matthews Garland
ATTORNEY

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3,127,197

WELL HEAD HAVING SEAL MEANS ADJUSTABLE AND REPLACEABLE UNDER PRESSURE

Karl H. Kretzschmar, Calgary, Alberta, Canada, assignor to Socony Mobil Oil Company, Inc., a corporation of New York

Filed Jan. 25, 1960, Ser. No. 4,386
4 Claims. (Cl. 285—137)

This invention relates in general to well heads and specifically to a combination tubing and casing head.

In connection with the drilling and operation of wells, it is conventional practice to secure at the surface to the upper end of casing and tubing an assembly commonly known as a well head, which serves sealing and supporting functions and as a connecting link between the casing and tubing and surface equipment.

Well heads which are currently employed in the industry utilize forms of seal arrangements which do not lend themselves to adjustment or replacement while the well is under pressure. In order to adjust or replace seals in presently employed well heads, it is generally necessary that the well be killed or shut down. This requires taking the well off stream and bringing in a drilling rig. Also, the presently employed well heads generally are provided with bolt-type ring flanges, which are sometimes known as API flanges. An API flange is expensive to construct and maintain because it involves metal to metal contact at sealing points which requires very accurate machining. Great care must be taken in handling API flanges in order to avoid damaging the accurately machined surfaces.

It is an object of this invention to provide a combination tubing and casing head. It is another object of this invention to provide a combination tubing and casing head which does not employ API flanges. It is a further object of this invention to provide a combination tubing and casing head which has seal arrangements which may be adjusted or replaced without the necessity of taking a well off stream.

In accordance with the invention, there is provided a well head which comprises the combination of a casing head and a tubing head. Both the casing head and the tubing head are provided with internal seals and external seals with the external seals being adjustable or replaceable without the necessity of disturbing the status of the well. Both the tubing head and the casing head are provided with threaded connections, rather than API flanges.

In the drawings:

FIGURE 1 is a view partially in section and partially in elevation of a combination casing and tubing head, constructed in accordance with one embodiment of the invention.

FIGURE 2 is a perspective view of a tubing hanger and seal assembly employed in the apparatus of FIGURE 1. The tubing hanger is shown in open position.

FIGURE 3 is a perspective view of a casing hanger and seal assembly employed in the apparatus of FIGURE 1. The casing hanger is shown in open position.

FIGURE 4 illustrates in cross section a tubing head portion only of another embodiment of the invention which is adapted to accommodate two strings of well tubing.

FIGURE 5 is a top plan view of the embodiment of the invention illustrated in FIGURE 4.

FIGURE 6 is a view in perspective of a retainer ring which is employed with the dual tubing embodiment of the invention illustrated in FIGURE 4.

FIGURE 7 is a side view in elevation of the retainer ring shown in FIGURE 6.

FIGURE 8 is a view in perspective of a form of external packing which is employed with the dual tubing embodiment of the invention illustrated in FIGURE 4.

FIGURE 9 is a view in perspective of a form of packing plate which is employed with the dual tubing embodiment of the invention illustrated in FIGURE 4.

In the drilling of a well, particularly an oil well, it is common practice to first drill down and set what is ordinarily known as surface casing, which extends downwardly from the surface for a distance that may be as much as several hundred feet. The surface casing will have the largest diameter of all the casing used in any particular well. Referring to FIGURE 1, reference numeral 10 denotes the upper end of a string of surface casing. After the surface casing has been properly set, it is cut off at the upper end at the desired distance above the surface of the ground. Casing head 11 is secured to the upper end of surface casing 10. The connection between the casing head and the surface casing may be either a threaded, as shown in FIGURE 1, or a welded joint. Casing head 11 is a cylindrical one-piece unit which is provided with a plurality of internally threaded side outlets 12. The particular casing head illustrated in FIGURE 1 is provided with two side outlets spaced apart 180°. Side outlets 12 permit the connection of the necessary conduits to allow flow into or out of the surface casing. The upper end of casing head 11 is provided with an integral, upwardly extending, flange 14 which is externally threaded. Formed within the upper end of the casing head is an inwardly extending flange or seat 15. Provided within the casing head is a vertically extending straight portion 20 which connects with a downwardly and inwardly sloping bowl portion 21.

Subsequent to the setting of the surface casing and the connection of casing head 11 to the upper end of the surface casing, drilling of the well is continued until it has reached the desired depth, at which time a string of internal casing 22 is set through the surface casing to provide a liner for the well from the surface to the bottom of the well. In FIGURE 1, only the upper end of casing 22 is illustrated. Prior to the actual beginning of the drilling of the well below the lower end of the surface casing, what is commonly referred to as a blowout preventor is normally installed on casing head 11 by screwing the blowout preventor to externally threaded flange 14. The blowout preventor forms no part of the invention and is not shown in FIGURE 1. The blowout preventor is a safety device in the form of a valve through which drilling may be carried on and which may be suddenly closed in order to keep a well under control in the event a high-pressure zone is encountered during drilling. After the well has reached the desired depth, the string of internal casing 22 is lowered through the blowout preventor until the lower end of the string of casing is at the bottom of the well. Casing hanger and seal assembly 23 is then dropped through the blowout preventor into engagement with internal casing 22 and casing head 11 for the purpose of providing surface support for the string of internal casing and an internal seal between the external surface of the casing and the casing head 11. Casing hanger and seal assembly 23 is best illustrated in FIGURE 3 which shows the assembly in an open position prior to its being secured around internal casing 22 and dropped into its operating location within casing head 11. Assembly 23 is a conventional, unitized, wrap-around hanger and seal assembly which may be formed of two or more hinged segments. The particular assembly illustrated is formed of two hinged segments, thus permitting it to be secured around the internal casing on the rig floor without the necessity of disconnecting the casing from the hoisting mechanism of the rig.

Hanger and seal assembly 23 is of the type which once in place around the casing within the casing head will automatically become engaged with the casing and effect a seal between the casing and the casing head and support

the casing upon release of the weight of the casing from the hoist in the drilling rig. The specific details of assembly 23 are as follows. Segmented slips 24 are provided with a series of internal and external tooth-like grooves. The internal grooves of these slips engage the external surface of casing 22, while the external grooves of the slips engage slip support 25. The external surface of slip support 25 is formed at such an angle that it will properly rest within and be supported by bowl 21 of casing head 11. The upper end of slip support 25 is provided with an inwardly extending flange 30 in which is formed a plurality of internally threaded bolt holes 31. Slips 24 are held to slip support 25 by a plurality of shear pins 26 which are designed to break and release the slips when the weight of internal casing 22 is placed upon the slips. Resting on the upper end of slip support 25 is internal seal support 32 which is provided with a plurality of smooth-surfaced holes 33 which are spaced to register with holes 31. Resting on the upper surface of support 32 is internal seal 34 which is the element which provides the internal seal between the external surface of casing 22 and the internal surface of casing head 11. Seal 34 is made of rubber or some other satisfactory sealing material. Secured above seal 34 is a seal retainer ring 35 which is provided with a plurality of bolt holes 40 which are spaced to register with holes 33 in support member 32. Support 32, internal seal 34, and ring 35 are secured to flange 30 on slip support 25 by means of bolts 41. Bolts 41 are threaded at their lower ends in order that they will engage internally threaded holes 31 in flange 30. Holes 33 and 40 are slightly larger in diameter than the diameter of bolts 41 in order that the bolts may freely slip in the holes for reasons which will be explained hereinafter. Seal 34 serves also as a hinge, as shown in FIGURE 3, to hold the two segments of assembly 23 together and permit it to be wrapped around the casing. Tongue 36 and slot 37 are provided in support 32 to hold the segments of the assembly together and in alignment when it is placed around the casing. Tongue 36 engages the slot and is held in the slot by a screw. When the weight of casing 22 is placed upon the casing hanger and seal assembly, the tooth-like portions of slips 24 engage the external surface of the casing and the internal surface of slip support 25 effecting a downward force on the slip support. Since the lower ends of bolts 41 are threadedly engaged with flange 30 on slip support 25, the downward force exerted by the slips on the slip support is also exerted on the bolts, causing the bolts to be urged in a downward direction. The downward forces being exerted upon bolts 41 cause retainer ring 35, seal 34, and support ring 32 to be urged downwardly until ring 32 becomes wedged between the casing and the inwardly inclined surface of bowl 21. After ring 32 is wedged into an immobile position between the casing and the bowl of the casing head, further downward forces on the bolts permit the bolts to continue downward movement because of the sliding relation between the bolts and ring 32. This further downward movement of the bolts urges retainer ring 35 downwardly toward the wedged ring 32, effecting expansion of seal 34 into sealed relationship with the external surface of casing 22 and the internal surface of the casing head. Thus the weight of casing 22 on the casing hanger and seal assembly properly sets the slips to support the vertical weight of the casing and expands internal seal 34 to effect a sealed relationship between the casing and the casing head.

Subsequent to the setting of casing 22 as described above, the upper end of the casing is cut off at a point slightly below the upper end of the casing head 11, as shown in FIGURE 1. With casing 22 cut off at the proper height, the blowout preventor is removed from casing head 11 and tubing head 50 is installed on the casing head as illustrated in FIGURE 1. Tubing head 50 is a substantially cylindrical, unitary structure provided at its lower end with an outwardly extending flange 51 which rests in part upon surface 15 of casing head 11. The upper end of tubing head 50 is externally threaded. The upper surface of flange 51 is substantially flat and bounded by lips or grooves 52 and 53. Provided within the lower end of tubing head 50 are a plurality of internal grooves 54 and 55 into which are placed O-ring seals 60 and 61 which function to effect a seal between the external surface of the upper end of casing 22 and the internal surface of the lower end of tubing head 50. It will be recognized that the O-ring seals must be placed in the grooves prior to the installation of tubing head 50 within casing head 11 over the upper end of casing 22. Tubing head 50 is provided with a plurality of internally threaded outlets 62 to permit connection to the tubing head of conduits leading to surface equipment. In the particular embodiment illustrated, two outlets 62 are spaced 180° apart. Extending from the upper end of tubing head 50 within the tubing head is a straight portion 64 which connects with an inwardly inclined surface or bowl portion 65. The function of bowl 65 provided within the tubing head will be explained hereinafter. Positioned on the upper surface of flange 51 of the tubing head is an external packing or seal 70 which serves to prevent leakage between the upper end of casing head 11 and the lower end of tubing head 50. Packing 70 is of the split-ring type and is formed of rubber or any other satisfactory packing material which may be readily placed around the tubing head after the head is in proper operating position. Resting on the upper surface of packing 70 is a split retainer ring 71 which is formed of metal and is a two-piece, interlocking type ring which may be readily placed around the tubing head. Ring 71 resembles the ring shown in FIGURES 6 and 7 except that ring 71 has only a single opening which fits around tubing head 50. One-piece, internally threaded cap 72 is placed over tubing head 50 and engaged with the upper end of casing head 11 to hold retainer ring 71 and packing 70 in position. Tightening of cap 72 forces the retainer ring downwardly and expands packing 70 to effect a seal between the tubing head and the casing head. With the tightening of cap 72, packing 70 expands into lips 52 and 53 to provide a more effective seal between the tubing head and the casing head. Packing 70 serves as an external or secondary casing head seal which may readily be adjusted or replaced without the necessity of disturbing the operation of the well. Should a leak be detected which is believed to be originating from internal seal 34 and external packing 70, the first step to be taken is the tightening of cap 72 to further expand the external seal to stop the leak. If this step is not effective in correcting the leakage from the casing head, cap 72 may be disengaged and lifted upwardly to permit replacement of packing 70. Because both packing 70 and ring 71 are of the segmented or split type, they may be readily replaced without the necessity of disturbing other portions of the apparatus. It will be recognized, therefore, that packing 70 may be replaced or adjusted while continuing normal operation of the well.

Subsequent to the installation of tubing head 50 on casing head 11 as described above, spider 80 is placed within the tubing head where it is supported by bowl portion 65 as illustrated in FIGURE 1. Spider 80 is a one-piece, substantially cylindrical, unitary structure which may be readily dropped into position through the upper end of tubing head 50. The lower portion of spider 80 is provided with an inwardly sloping external surface 81 which rests in bowl 65 of the tubing head to support the spider. Surface 81 of the spider is provided with grooves 82 and 83 into which are fitted packing rings 84 and 85, respectively, to effect a seal between the lower external surface of the spider and the bowl portion of tubing head 50. Spider 80, as shown in FIGURE 1, is provided with a first internal straight bore 90 extending from its upper end and terminating at inwardly inclined

surface or shoulder 91 which connects with a second straight bore 92 which is of less diameter than bore 90. Surface 91 functions as a supporting surface as will be explained hereinafter.

After the positioning of spider 80 within tubing head 50, a blowout preventor, not shown, is threadedly engaged to the upper end of the tubing head to provide emergency control of the well during subsequent operations. By means of the hoisting mechanism in the drilling rig being employed, not shown, tubing string 100 is now lowered into the well through the blowout preventor and the tubing and casing head assembly until the tubing string is at the desired location within the well. In FIGURE 1, only the upper end of tubing string 100 is shown. With tubing string 100 in proper position within the well, the upper end of the tubing string may be secured and sealed off within tubing head 50 in the following manner. Tubing hanger and seal assembly 110 provides both support for the upper end of tubing string 100 and an internal seal around the tubing string within the tubing head. Assembly 110 is shown in partial cross section in FIGURE 1 and in open position in perspective in FIGURE 2. Assembly 110 is a conventional wrap-around type hanger and seal assembly which is formed of hinged segments, as best illustrated in FIGURE 2, in order to permit the assembly to be secured around the tubing without the necessity of disconnecting the hoisting mechanism of the drilling rig from the tubing, inasmuch as at this stage of the procedure the weight of the tubing must be supported by the hoisting mechanism. Assembly 110 is affixed around the tubing above the blowout preventor and dropped through the blowout preventor into spider 80 where the assembly comes to rest and is supported on inwardly inclined surface 91 within the spider 80. Assembly 110 comprises ring member 111, internal seal 112, slip support 113, and slips 114 which are provided with internal grooves to permit frictional engagement with the external surface of tubing 100. Slips 114 are secured to support 113 by means of shear pins 115 which are designed to break when the load of the tubing string is placed upon the slips. The shear pins function to temporarily hold the slips within the assembly 110 until such time as the slips actually become engaged with the tubing when the assembly is in operating position within tubing head 50. Internal seal 112 may be formed of rubber or any other satisfactory sealing material. In addition to its sealing function, seal 112 acts as a hinge to hold the two segments of assembly 110 together so they may be wrapped around the tubing. Tongue 116 and slot 117 in support 113 co-operate to lock the segments of the assembly together and keep them in alignment. After the assembly is placed around the tubing, tongue 116 is placed in slot 117 and secured by a screw.

When assembly 110 is in operational position within spider 80, the hoisting mechanism of the drilling rig may be relieved of the weight of drill string 100 and slips 114 will engage the external surface of the tubing string. The frictional force between the external surface of the tubing string and the tooth-like grooves on the slips effects shearing of pins 115 to permit the slips to slide downwardly. As the slips slide downwardly, slip support member 113 also is forced downwardly toward ring member 111 which is held in fixed position by inwardly inclining surface 91 within the spider. The relative motion of support member 113 and ring member 111 toward each other causes expansion of internal seal 112 to provide sealed relationship between the external surface of tubing string 100 and the inside of spider 80. With the tubing string 100 being supported by assembly 110 and internal seal 112 in expanded position, the external sealing of the tubing head around the tubing string may be effected. Packing plate 120 is placed on the upper end of spider 80 and assembly 110 to provide support for external packing ring 121 which rests on the packing plate. Packing plate 120 and external packing ring 121 are both of the split type to permit them to be placed in operating position around the tubing string, rather than having to be placed over the upper end of the tubing string and lowered into operating position. By employing the split form of construction for these members, they may be replaced without shutting down the well and disconnecting whatever conduits may be secured to the upper end of the tubing string during the operation of the well. Placed on the top surface of packing ring 121 is a retainer ring 122 which is also of the split form of construction to permit its replacement during operation of the well. Threadedly engaged to the upper end of tubing head 50 is a retaining cap 123 which holds retainer ring 122 against the packing ring. Retaining cap 123 is a one-piece member which is adjusted to exert sufficient force on the retainer ring to expand packing ring 121 into sealed relationship with the external surface of tubing string 100 and the internal surface of tubing head 50 to provide a secondary or external seal between the tubing string and the tubing head. If a leak should develop from the well around the tubing string within the tubing head, packing ring 121 may be tightened by manipulation of retaining cap 123. If this step does not correct the leakage, it is possible to replace packing ring 121 without the necessity of shutting the well down. Retaining cap 123 is disengaged and lifted upwardly a sufficient distance to permit the removal of retainer ring 122 and packing ring 121. The packing ring is replaced with new material, the retainer ring is placed back in position, and cap 123 is reengaged and tightened until a seal is effected around the tubing string.

FIGURES 4 through 9 illustrate an alternative arrangement of the apparatus of the invention to provide for the accommodation of two strings of tubing within a well. FIGURE 4 illustrates only the upper or tubing head portion of a combination tubing and casing head constructed in accordance with the invention to accommodate two strings of tubing. The lower portion or casing head portion of this embodiment of the invention is identical to the single tubing embodiment of the invention illustrated in FIGURE 1. In order to accommodate two strings of tubing, it is necessary to modify only the spider which is placed within the tubing head and the external or secondary seal arrangement on the tubing head. That is to say, in the case of a dual tubing installation, only the spider, the packing plate supported on the spider, the external packing ring, and the retainer ring require modification from the structure illustrated in FIGURE 1. All other elements of the apparatus of the invention are identical to the showings of FIGURES 1 through 3.

In the instance of the dual tubing embodiment of the apparatus of the invention, all of the procedures previously described up through and including installation of tubing head 50 on casing head 11 are carried out. In FIGURES 4 and 5, reference numerals identical to those employed in FIGURES 1–3 are used for those parts of the dual tubing embodiment of the invention which are identical to the single tubing embodiment disclosed in FIGURES 1–3. Subsequent to the installation of tubing head 50 on casing head 11, a spider 130 is placed within the tubing head where it rests on and is supported by inwardly and downwardly inclined bowl surface 65. A blowout preventor, not shown, is installed on the upper end of the tubing head in the same manner and for the same reasons as previously described. Spider 130, which will be referred to hereinafter as a dual spider, is identical in design to spider 80, which is employed in the single tubing embodiment of the invention, with the exception that spider 130 is provided with two internal bores 131 and 132 for the purpose of accommodating two strings of tubing. Each of the bores 131 and 132 within spider 130 is adapted to accommodate a tubing hanger and seal assembly 110 for the purpose of supporting and sealing the strings of tubing. The tubing hanger and seal assemblies

used in this dual tubing embodiment are identical to the tubing hanger and seal assembly employed in the single tubing embodiment and, thus, are referred to by the same reference numeral **110**. Each of the straight portions of the bores of the dual spider terminate in an inwardly and downwardly inclined surface **133** and **134**, respectively. Around the lower outside surface of the dual spider are parallel grooves **140** and **141** into which are fitted packing rings **142** and **143**, respectively. After spider **130** is in proper position within tubing head **50** and a blowout preventor is installed on the tubing head, each of the strings of tubing **145** and **146** is run into the well to the desired depth, secured within the tubing head, and internally packed off by means of hanger and seal assemblies **110** in a manner identical to that previously described in connection with the embodiment illustrated in FIGURES 1 through 3. Subsequent to the securing and internal sealing of the strings of tubing within the tubing head, a packing plate **150**, as best illustrated in FIGURE 9, is placed around the strings of tubing on the upper end of spider **130** and assemblies **110** to provide a support for the external or secondary seal. Plate **150** is formed in two half-circular portions, as shown in FIGURE 9, and is provided with apertures **151** and **152** in order that it may be fitted around the tubing strings within the tubing head, rather than having to be placed over the ends of the tubing strings which would be required if the plate were a unitary structure. External or secondary packing **160**, as illustrated in FIGURE 8, is placed on packing plate **150**. Packing **160** may be made of rubber or any other satisfactory gasket material. Packing **160** is split in form and provided with apertures **161** and **162** to permit the packing to be installed around the tubing strings within the tubing head. Retainer **170**, which is split in form and provided with apertures **171** and **172**, is placed within the tubing head around the tubing strings on top of the packing and is retained in place by threadedly engaging retaining cap **123** to the upper end of tubing head **50**. The retaining cap is tightened in order to expand the packing into sealed relationship with the external surfaces of the tubing strings and the internal surface of the tubing head. In the event a leak is found to exist from around the tubing strings, the retaining cap may be further tightened to further expand the external or secondary packing. Should further tightening of the retaining cap not result in stopping the leakage, the external or secondary seal may be completely replaced. In replacing the seal, retaining cap **123** is first disengaged from the tubing head and lifted sufficiently to provide access to retaining ring **170** and external packing **160**. In view of the split form of construction of the retainer ring and the external seal, they may be removed from around the tubing strings, the external packing replaced, the retainer ring reinstalled, and the retaining cap re-engaged on the tubing head and tightened to expand the external seal into sealed relationship with the tubing head and the tubing strings. Both ring **170**, as shown in FIGURE 6, and plate **150** are designed so that the half portions of each member interlock with each other.

It will again be recognized here that the steps of either tightening the external seal or completely replacing it may be carried out while the well is continued in operation without the necessity of disconnecting the tubing strings from the surface equipment employed in the operation of the well.

Thus the invention provides a combination casing and tubing head which will accommodate one or more strings of well tubing. The combination tubing and casing head of the invention is provided with internal seals and external seals for the prevention of leaks around both the casing and the tubing to which the head is secured. The external seals on the well head may be adjusted or may be removed and completely replaced without the necessity of killing the well.

While the invention has been described in the light of the embodiments disclosed, it is recognized that variations and modifications will occur to those skilled in the art and it is intended that the invention be limited only within the scope of the appended claims.

I claim:

1. In a well head for supporting at least two tubes telescopically arranged one within the other the combination which comprises a casing head, casing supporting and sealing means within said casing head for supporting a string of casing and effecting an internal seal between said casing head and casing string, a tubing head, means securing said casing head to said tubing head, said means including an axially facing supporting surface at the upper portion of said casing head, said tubing head being provided with supporting means at the lower portion thereof supporting said tubing head on said axially facing supporting surface of said casing head, tubing supporting and sealing means within said tubing head for supporting a string of tubing within said casing string and effecting an internal seal between said tubing head and tubing, a first radially split-type packing positioned above said tubing head supporting means for sealing engagement with said casing head and tubing head, means for adjusting said first packing and being removable while said well head is under pressure to permit replacement of said first packing, second radially split-type packing means positioned above said tubing supporting and sealing means for sealing engagement with said tubing head and said tubing, and means for adjusting said second packing and being removable while said well head is under pressure to permit replacement of said second packing.

2. Apparatus as claimed in claim 1 in which said means for adjusting said first packing includes a one-piece threaded retaining cap engaged on said casing head and said means for adjusting said second packing includes a one-piece threaded retaining cap engaged on said tubing head.

3. Apparatus as claimed in claim 2 in which said means for adjusting said first packing and said means for adjusting said second packing each includes a split-type retainer ring adapted to contact said split-type packings.

4. Apparatus as claimed in claim 1 in which said means within said tubing head is means for supporting at least two parallel strings of tubing within said casing string.

References Cited in the file of this patent

UNITED STATES PATENTS

1,861,726	Trout	June 7, 1932
1,887,865	Archer	Nov. 15, 1932
1,900,260	Shaffer	Mar. 7, 1933
2,073,890	Tschappat	Mar. 16, 1937
2,090,213	Madely	Aug. 17, 1937
2,175,648	Roach	Oct. 10, 1939
2,185,478	Tschappat	Jan. 2, 1940
2,237,683	Minor	Apr. 8, 1941
2,284,869	Hinderliter	June 2, 1942
2,426,371	Penick	Aug. 26, 1947
2,589,483	Eckel et al.	Mar. 18, 1952
2,617,485	Thatch	Nov. 11, 1952
2,768,007	Brenner	Oct. 23, 1956
2,887,754	Johnson	May 26, 1959
3,004,778	Williams	Oct. 17, 1961

FOREIGN PATENTS

1,168,941	France	Sept. 8, 1958