June 10, 1952 C. R. NEILON 2,600,257

TUBING HANGER PACKING

Filed Oct. 30, 1946 3 Sheets-Sheet 1

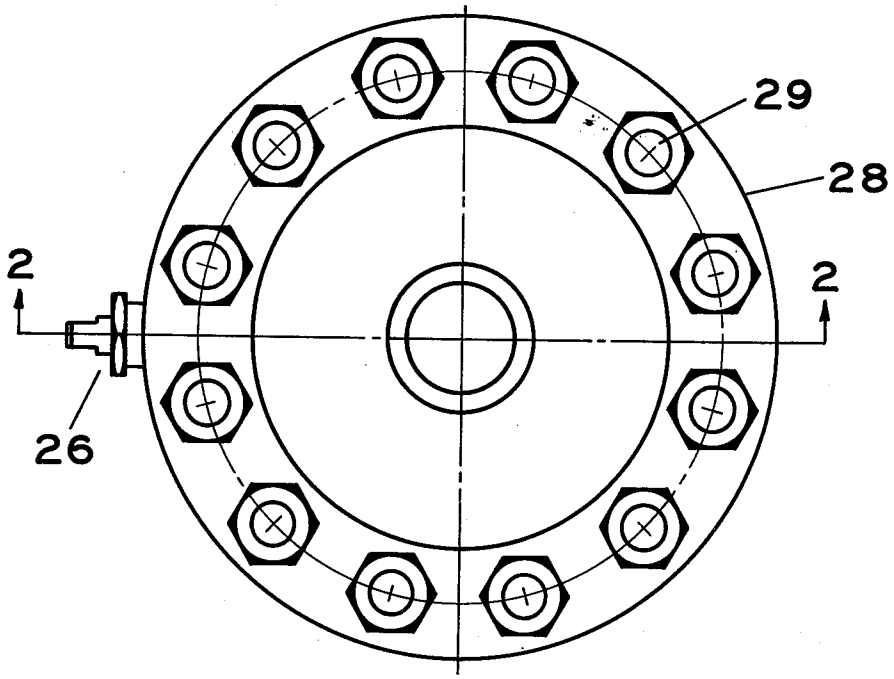

FIG. 1

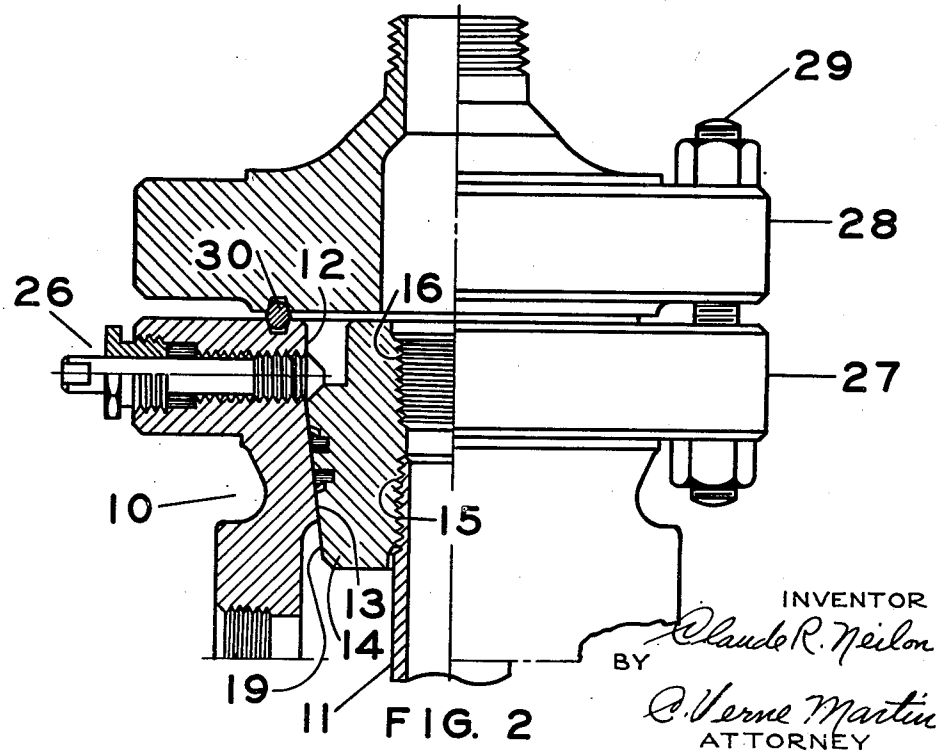

FIG. 2

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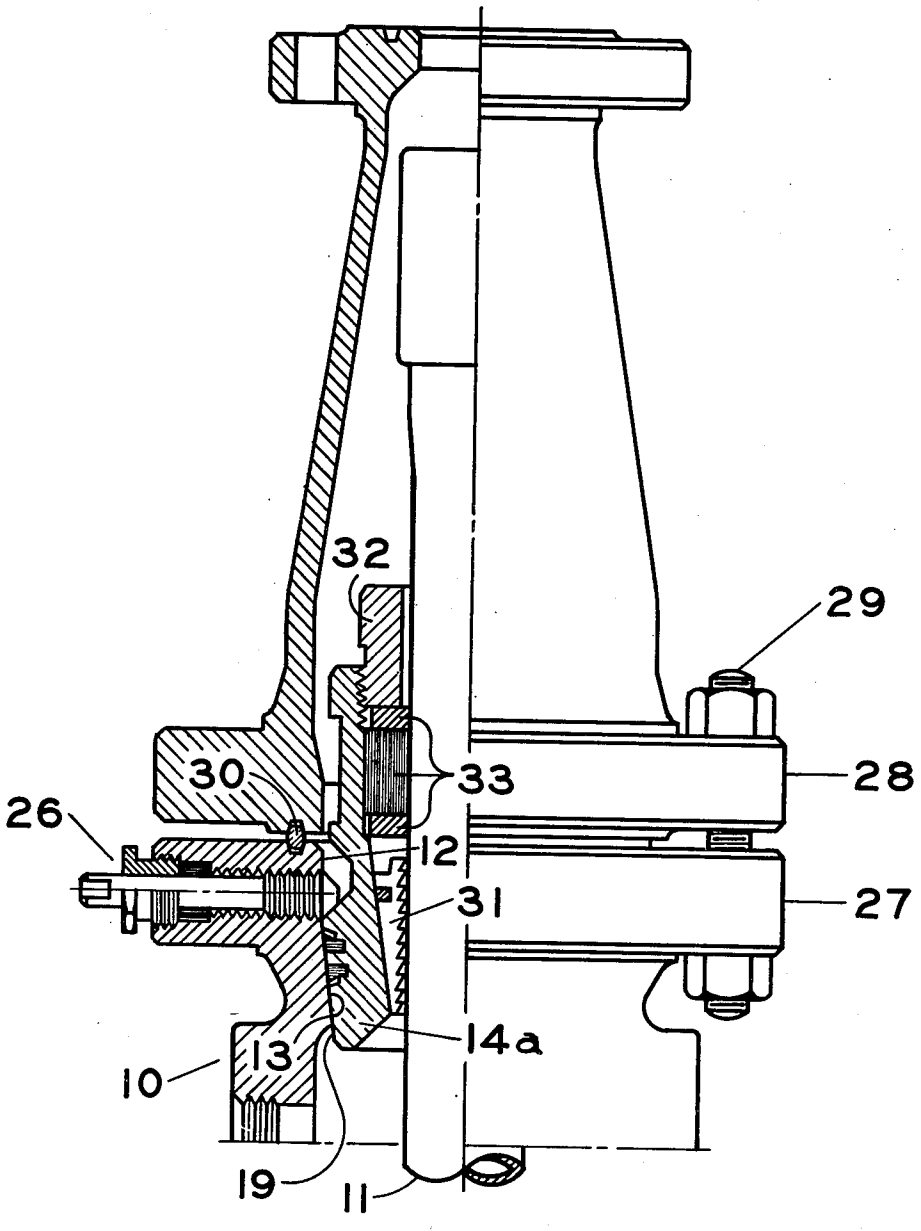

FIG. 3

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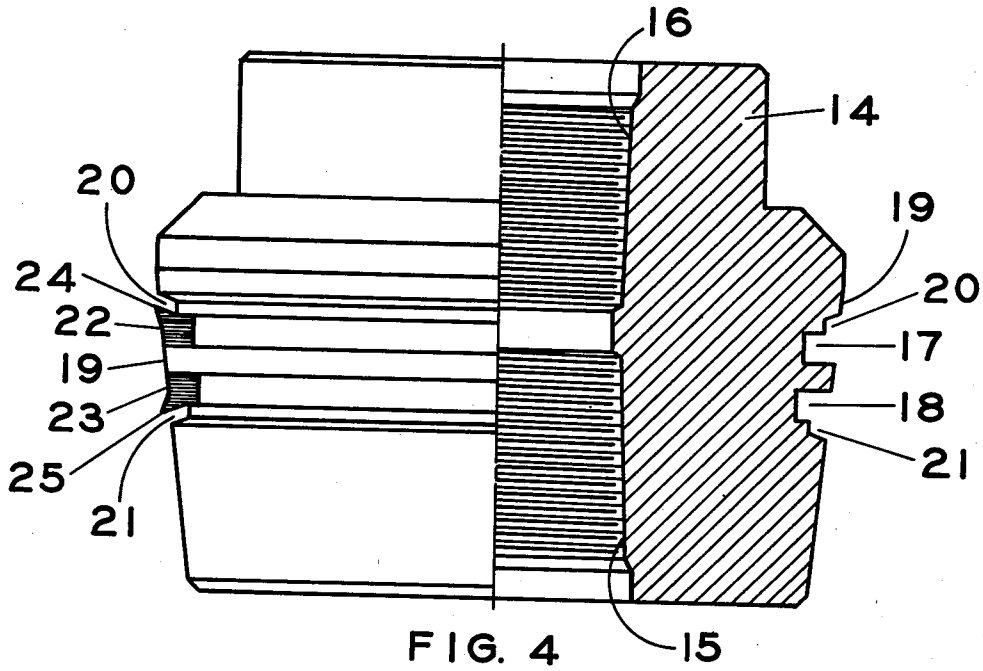

FIG. 4

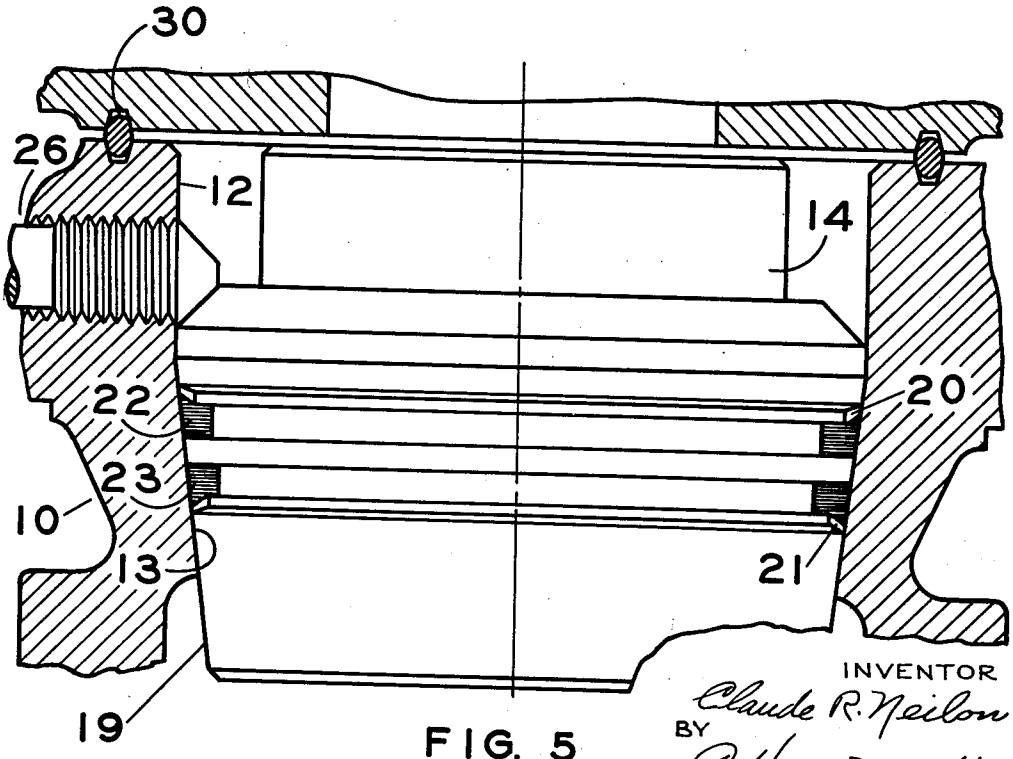

FIG. 5

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UNITED STATES PATENT OFFICE

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TUBING HANGER PACKING

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3 Claims. (Cl. 285—22)

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This invention relates to tubing hangers used in conjunction with well heads for use in oil wells. It embodies a tubing hanger which suspends and supports a string of tubing on the casing or well head at the top of the well by any known means, such as by slips, mandrels, threaded connections, couplings and the like.

For simplicity the term "tubing" is to be construed to include pipe, casing or any other hollow body that might be used to suspend and support or be suspended and supported in a well.

In deep wells, say 10,000 feet or more, the tubing string may weigh as much as several tons, which weight must be suspended and supported from the surface. The suspension and supporting means must be strong enough to withstand this heavy load and at the same time provide a fluid tight seal against the escape of pressure from the well through the surrounding casing string through which the tubing passes. The hanger must also be capable of providing a seal against the escape of well pressure through the open end of the tubing. In the case where several concentric strings of casing are used, the well pressure is prevented from escaping between strings and to the atmosphere by the use of stacked or nesting heads provided with hangers which must effectively suspend and support these strings as well as provide a fluid tight seal at their respective points of suspension.

There have been many types of suspension and seals used heretofore, several of which depend upon the packing to take the heavy weight of the tubing string as well as to provide the seal, the theory being that the weight of the tubing string assists the packing in more intimately contacting the usually tapered bore of the well head supporting the suspension means. Within the limits of the load capacity of the packing this system works out advantageously but when excessive loads of several tons are imposed upon the packing (hydraulic or any other type) the packing may fail, destroying the seal and endangering property and life from the resultant blowout.

The principal object of my invention is to eliminate such hazards and provide a fluid tight seal for a tubing hanger with a string of tubing suspended therefrom in which the weight of the tubing string is supported independently of the packing and wherein the packing will positively withstand excessive well pressures to maintain a fluid tight seal between the hanger and the body of the well head in which the hanger is seated.

Another object of my invention is to provide a fluid tight seal against the escape of well pressure through the upper end of the tubing and/or between the tubing suspending means or hanger and the body of the casing or well head, and in the case of stacked heads, to prevent leakage of

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well pressure from one string to the next succeeding string of casing or tubing.

Another object of my invention is to provide a metal to metal seal between the tubing hanger and the body of the well head supplemented by flexible lip type sealing rings mounted in the hanger body and adapted to seal the joint against pressure in any direction.

Another object of my invention is to provide a tubing hanger with a plurality of molded resilient lip type packing rings mounted in grooves in the hanger, such that the body of the rings snugly engage the recesses while the protruding lips are free to be depressed into clearance spaces adjacent the lips when the hanger is seated in the tapered bore of the well head, the said lips exerting an initial sealing action against the tapered bore and an intensified sealing action when excessive well pressure acts upon said lips.

Other objects and advantages of my invention will become apparent during the course of the following description and appended claims in connection with the accompanying drawings illustrating the constructional embodiments of my invention wherein like parts are designated by like numerals.

Fig. 1 is a top plan view of a portion of a well head assembly incorporating my improved sealing means for a tubing hanger.

Fig. 2 is a side elevation, partly in section, taken along the line 2—2 of Fig. 1 illustrating my improved sealing means as applied to a tubing hanger of the mandrel suspension type.

Fig. 3 is a side elevation, partly in section, of a view similar to Fig. 2 illustrating my improved sealing means as applied to a tubing hanger of the slip suspension type.

Fig. 4 is an enlarged view, partly in section, of my tubing hanger, the right half showing the construction of the annular packing grooves and the annular clearance spaces in section, while the left half shows the molded resilient lip type packing rings mounted in the annular grooves, the lips being shown in their unrestricted position, protruding beyond the normal peripherial surface of the hanger body.

Fig. 5 is an enlarged view, partly in section, similar to Fig. 4 but showing the molded resilient lip type packing rings confined within the tapered bore of the well head and in initial sealing position.

In the drawings the numeral 10 designates a well head body having a vertical opening therethrough for the passage of a string of casing or tubing 11. The vertical opening 12 merges into a downwardly tapering or conical bore 13 to receive an externally tapered or conical shaped tubing hanger 14 adapted to form a metal to metal contact seal with the tapered bore. The lower end of the hanger is internally threaded as at

15 to support the tubing 11 while a lowering nipple thread 16 is provided at its upper end.

Annular packing grooves 17 and 18 are provided in the periphery of the tapered portion 19 of the tubing hanger body 14. Annular clearance space 20 is formed integral with the upper packing groove 17 adjacent its upper end while annular clearance space 21 is formed integral with the packing groove 18 adjacent its lower end. These grooves are adapted to receive annular molded resilient lip type packing rings 22 and 23 respectively. Ring 22 has a protruding flexible lip 24 at its upper end to be freely received in clearance space 20 while packing ring 23 has a protruding flexible lip 25 at its lower end to be freely received in clearance space 21.

The two rings 22 and 23 are positioned in their respective packing grooves prior to assembling the hanger in the well head 10. As recited above the tapered periphery 19 of the hanger 14 is seated in metal to metal sealing contact with the tapered or conical bore 13 of the well head 10. In order to supplement the metal to metal seal the flexible lips 24 and 25 of the sealing rings are deformed and forced into the clearance spaces 20 and 21 adjacent the grooves 17 and 18 as the hanger is seated in the bore where they form an initial sealing contact with the tapered bore 13 of the head 10.

An outside adjustable pressure packed hold down means 26, acting through the flanged top 27 of the well head 10, is adapted to forcibly urge and firmly secure the tapered peripherial portion 19 of the tubing hanger 14 upon its seat in the tapered bore 13. A flanged bonnet 28 is secured to the flanged top 27 of the well head 10 by double end bolts 29 and their accompanying nuts and sealed against leakage of well pressure by ring joint gasket 30.

In Fig. 3 the tubing 11 is shown suspended by slips 31 mounted in the hanger body 14*a*. The slips are secured within the hanger body by the adjustable packing gland 32 and sealed against leakage of well pressure by the packing element 33. The balance of the elements shown in Fig. 3 function identically with the corresponding elements in Fig. 2.

As the well pressure surges upward between the tubing 11 and the head 10 it tries to escape and is prevented by the metal to metal seal between the conical shaped tubing hanger and the tapered bore of the well head. Should the pressure get past the metal to metal seal it will come in contact with the flexible lip 25 of the packing ring 23 and tend to push this lip out against the bore 13 of the well head and thus intensify the sealing action at this zone.

If the well pressure in the tubing 11 should get into the space above the well head and within the space sealed off by the ring joint gasket 30 it will have a tendency to work down around the upper portion of the opening 12 in the well head and on down to the metal to metal seal between the tapered peripherial portion 19 of the hanger 14 and the tapered bore 13. Should this seal fail to hold, the pressure will then exert itself against the flexible lip 24 of the packing ring 22, which in turn will be deflected outwardly against the conical bore 13 of the well head and consequently intensify the sealing action at this zone.

Thus it will be apparent that my flexible lip type packing rings will effect and maintain a fluid tight seal between the outer periphery of the tubing hanger and the tapered bore in the well head even if the metal to metal contact forming the primary seal at this surface should fail, and yet the weight of the tubing string will not be imposed upon these packing rings. This salient feature provides for a more effective and durable packing than has been used heretofore.

While only the preferred form of my invention has been disclosed and described herein, I do not wish to be limited or restricted to the specific details set forth and wish to reserve to myself any further embodiments, modifications and variations that may appear to those skilled in the art or come within the scope of the appended claims.

Having fully described my invention, what I claim as new and desire to secure by United States Letters Patent is:

1. An externally tapered hanger for suspending a string of tubing in the tapered bore of a well head, said hanger being normally held in metal to metal primary sealing contact with said bore by the weight of said suspended tubing, said hanger being further provided with a resilient supplemental seal normally cooperating with said metal to metal primary seal and actuated by excessive well pressure into intimate sealing contact with said bore comprising, annular grooves in the external surface of said hanger, annular lip type packing rings provided with a main body portion secured in said grooves and a flexible lip portion protruding in its free position beyond the outer surface of said body portion and annular clearance space adjacent the outer portion of said groove and forming an integral part therewith to freely receive said lip portion when said hanger is inserted into said bore.

2. An externally tapered hanger for suspending a string of tubing in the tapered bore of a well head, said hanger being normally held in metal to metal primary sealing contact with said bore by the weight of said suspended tubing, said hanger being further provided with a resilient supplemental seal normally cooperating with said metal to metal primary seal and actuated by excessive well pressure into intimate sealing contact with said bore comprising, annular grooves in the external surface of said hanger, annular lip type packing rings provided with a main body portion secured in said grooves and a flexible lip portion protruding in its free position beyond the outer surface of said portion and annular clearance space forming an integral part of said groove and in the same transverse plane with said lip portion to freely receive said lip portion when said hanger is inserted into said bore.

3. The combination of claim 1, plus hold-down means to secure said hanger and suspended tubing against an up-thrust of well pressure.

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