United States Patent

Hanes et al.

[15] **3,647,245**

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[54] **TELESCOPIC JOINT EMBODYING A PRESSURE-ACTUATED PACKING DEVICE**

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[22] Filed: **Jan. 16, 1970**

[21] Appl. No.: **3,400**

[52] **U.S. Cl.** **285/106**, 61/46, 61/63, 166/.5

[51] **Int. Cl.** **F16j 15/46**, F16l 17/00

[58] **Field of Search** ..... 285/106; 277/34, 34.6, 34.3; 61/46, 46.5, 63; 166/.5, .6

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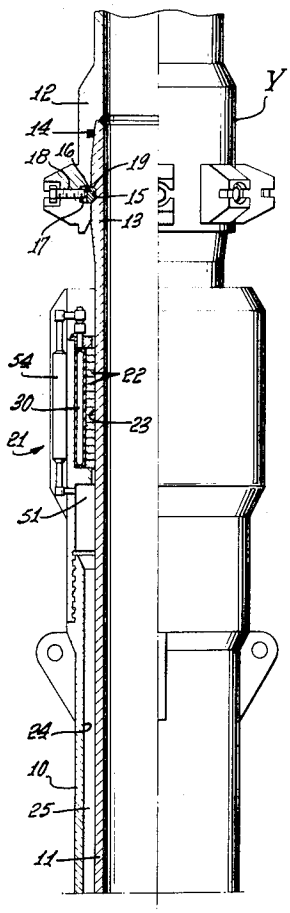
[57] **ABSTRACT**

A telescopic joint embodying inner and outer telescopic members, a packing device effecting a slidable seal between the members and composed of pliable packing material carried by the outer member and forced against the inner member by fluid pressure acting upon an elastic diaphragm or bladder surrounding the packing material and forcing the latter inwardly over substantially its full length against the inner member, the origin of the fluid pressure force being the interior of the telescopic joint.

20 Claims, 5 Drawing Figures



PATENTED MAR 7 1972 3,647,245

SHEET 1 OF 2

FIG. 1.

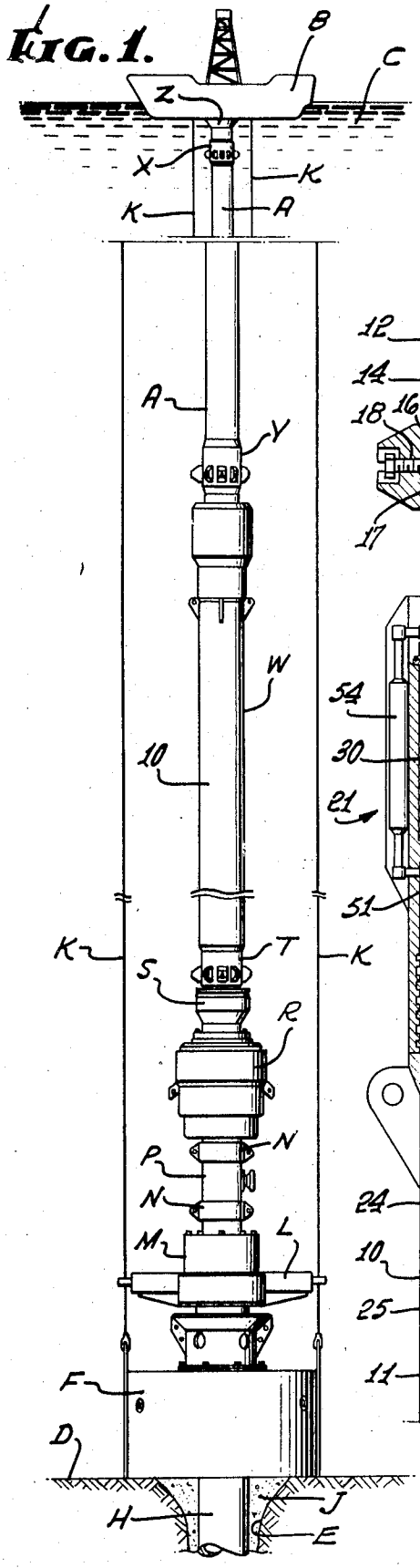


FIG. 2a.

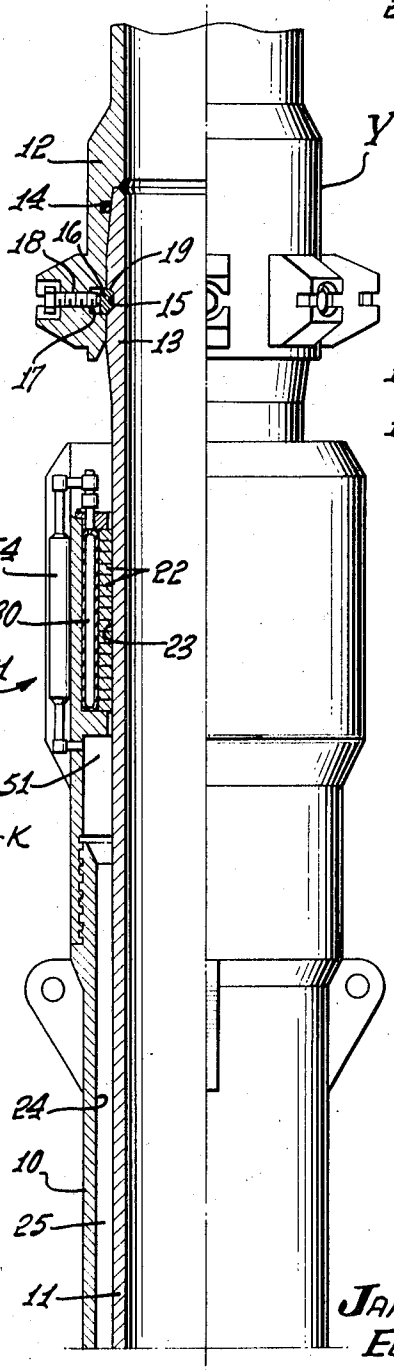


FIG. 2b.

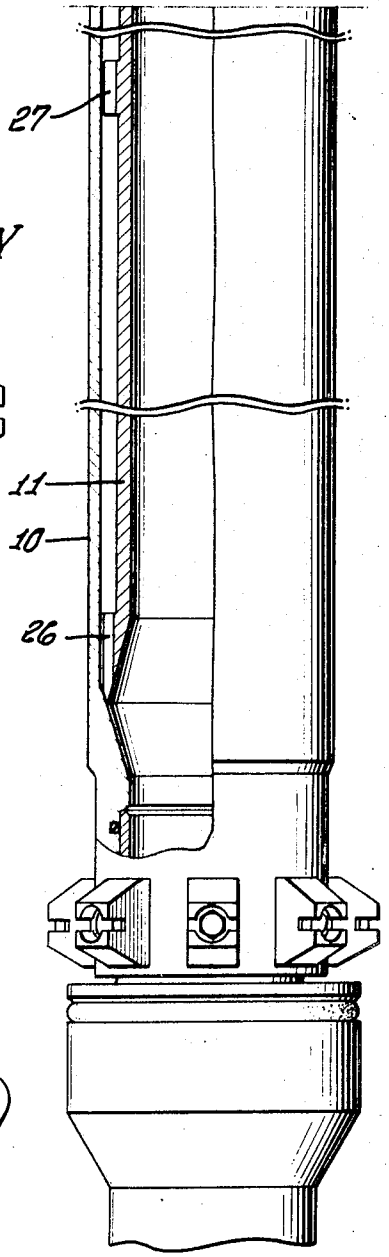


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FIG. 3.

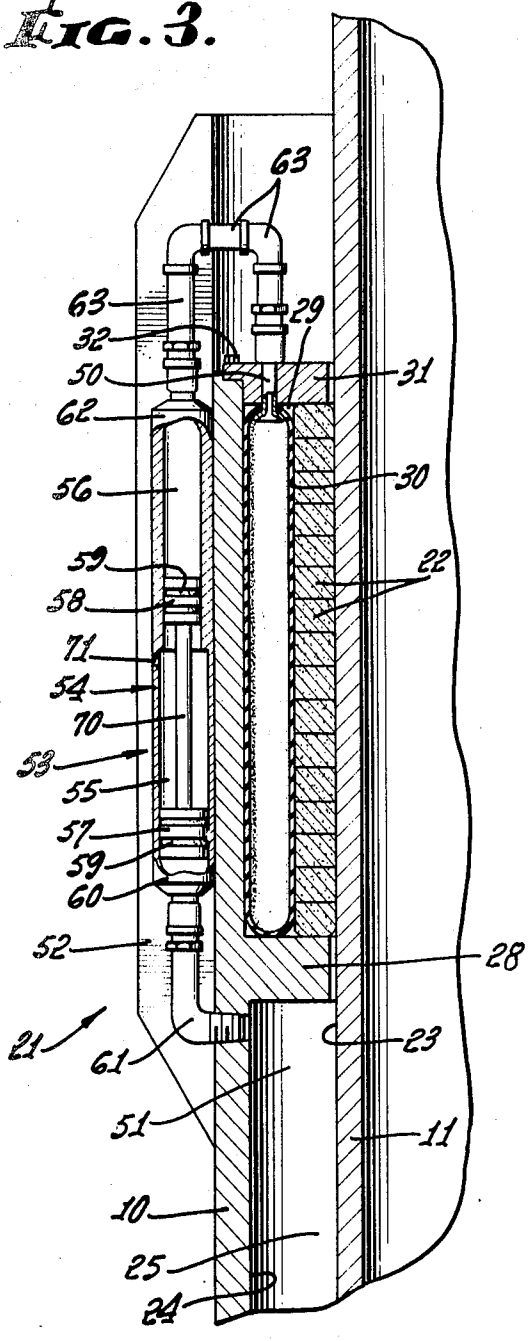
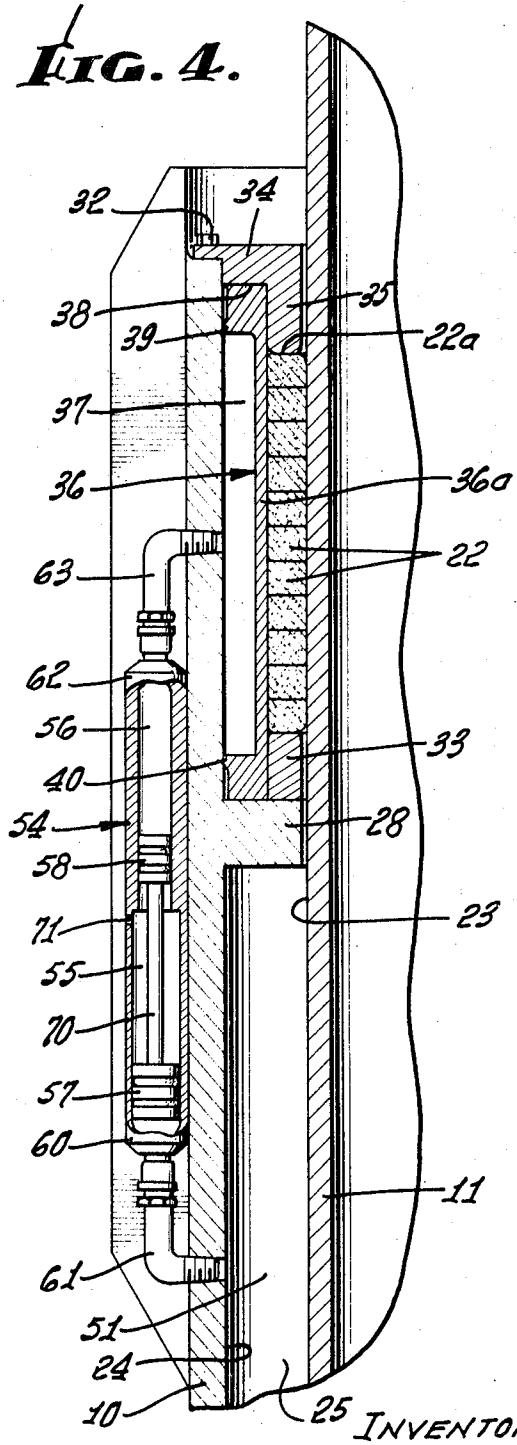


FIG. 4.



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TELESCOPIC JOINT EMBODYING A PRESSURE-ACTUATED PACKING DEVICE

The present invention relates to telescopic joints, and more particularly to tubular telescopic joints used in offshore drilling from a floating vessel.

Telescopic joints are used in offshore drilling from a floating vessel to compensate for the heave of the vessel under wind and wave action. As an example, the telescopic joint is disposed in a marine riser connected at its upper portion to the bottom of a floating drilling ship and at its bottom portion to a wellhead fixed to the ocean bottom at the mudline, or a telescopic joint may be incorporated in a tubular drilling string extending from the floating vessel to the drill bit at the bottom of a well bore being drilled.

The telescopic joints heretofore employed have had packing units incorporated therein to prevent leakage between the interior and exterior of the marine riser or drill pipe string, or other tubular string used in performing an operation in the well bore. Some packing units have utilized the fluid pressure from a suitable source to effect a seal with the inner barrel or member of the telescopic joint. Pressure has been applied to a diaphragm which acts as the sealing element bearing against an external surface of the inner tubular member of the telescopic joint. When wear occurs, replacement of the sealing element has involved substantial expense, both in connection with the cost of the diaphragm unit itself and the time consumed in effecting the replacement. In addition, the internal diameter of the packing element closely conforms to the outside diameter of the inner barrel or member of the telescopic joint, because of the necessity for the packing element to make a relatively close fit against the inner barrel. When such a packing element is to be replaced, a joint in the inner barrel must be disconnected, and such joint is required to have a decreased diameter to permit the packing unit to be moved thereover. In some designs of prior telescopic joints, it is necessary for a portion of the inner barrel to be cut off, as by use of a cutting torch, the worn packing unit removed, a new packing unit installed in its place, and the inner barrel then rewelded. All of the above cases involve considerable time and expense.

By virtue of the present invention, an initial close fit of the packing against the inner barrel is not necessary, since a pressure force is applied thereto to automatically hold the packing unit along substantially its entire length in slidable sealing engagement with the inner barrel or inner tubular member, thereby permitting its telescopic movement with respect to the outer barrel or member of the telescopic joint. A diaphragm surrounds the packing elements, and a force derived from the interior of the telescopic joint is availed of to contract the diaphragm against the packing unit and hold it in firm sealing engagement with the inner barrel. This diaphragm has a much larger inside diameter then the outside diameter of the inner barrel, so that it is readily passed over comparatively large diameter connections, such as a standard marine riser pin connector, found in the tubular string depending from the floating drilling vessel. The packing element itself is in such form that it is easily replaced and placed in a position surrounding the inner barrel, and without requiring any disconnection of portions of the inner barrel itself. Accordingly, the packing elements are readily replaced in a very few minutes, and such elements are comparatively inexpensive.

In the event that the internal pressure in the tubular string embodying the telescopic joint may not exceed the external pressure by too great a value, the invention contemplates the incorporation of a pressure multiplier in the telescopic joint, such that the pressure applied to the diaphragm and the packing unit can be multiplied over the pressure existing within the telescopic joint. Thus, if the weight of the drilling mud or other fluid within a marine riser is not deemed to exceed the weight of the surrounding body of water sufficiently, then the pressure multiplier will increase the pressure applied to the diaphragm, and, consequently, the sealing force of the packing unit against the inner barrel or inner tubular member of the telescopic joint.

A further objective of the invention is to provide a telescopic joint embodying a packing structure that is compressed against the inner tubular member in a uniform manner to improve its sealing effectiveness against the inner member, and also to minimize its wear.

Another objective of the invention is to relate the compression of the packing against the opposed sealing surface of the telescopic joint to the pressure of the fluid medium passing through the telescopic joint, in order to maintain an appropriate relation between the compression of the packing structure against the opposed sealing surface of the telescopic joint to the internal pressure within the telescopic joint, thus exerting increasing or decreasing compression pressures on the packing unit when the internal pressure within the joint increases or decreases. Accordingly, the packing unit will have a much longer life than the prior devices, since excessive pressures are avoided when the internal pressure within the telescopic joint is at a lower value.

This invention possesses many other advantages, and has other objects which may be made more clearly apparent from a consideration of several forms in which it may be embodied. Such forms are shown in the drawings accompanying and forming part of the present specification. These forms will now be described in detail for the purpose of illustrating the general principles of the invention; but it is to be understood that such detailed description is not to be taken in a limiting sense.

Referring to the drawings:

FIG. 1 is a diagrammatic side elevational view of an embodiment of the invention illustrated in connection with a floating drilling vessel and a well bore underlying the ocean or other body of water in which the drilling vessel is floating;

FIGS. 2*a* and 2*b* together constitute a combined longitudinal section and side elevational view of a telescopic joint and associated parts of a marine riser illustrated in FIG. 1, with the inner tubular member or barrel of the joint fully telescoped within the outer tubular member or barrel of the joint, FIG. 2*b* being a lower continuation of FIG. 2*a*;

FIG. 3 is an enlarged fragmentary vertical section through the packing unit illustrated in FIG. 2*a*; and

FIG. 4 is a view similar to FIG. 3 of a modified form of packing unit embodied in the telescopic joint.

As illustrated in FIG. 1, a marine riser A extends between a drilling vessel B floating in an ocean or other body of water C and a location adjacent to an ocean floor or mudline D from which a well bore E is being drilled. A guide base F is secured to the formation underlying the ocean floor, in a known manner, and embodies concentric casing hangers therein (not shown) from which casing strings H depend into the well bore. For simplicity of illustration, a surface casing H is illustrated as extending downwardly from the guide base F into the well bore, being held therein by a suitable surrounding body of cement J. Guide lines K are attached to the guide base and extend upwardly to the drilling vessel, a guide frame L being secured to a suitable connector M attached to one of the casing hangers, the frame being adapted to slide along the guide lines. The connector M is attached through suitable couplings N and a drilling spool P to a blowout preventer R, which, in turn, is secured to a flexible joint S, permitting limited angular movement of the marine riser A thereabove with respect to the blowout preventer, this flexible joint being secured by means of a suitable connector T to the outer tubular member or outer barrel **10** of a telescopic joint W of any suitable length, which, for example, may be about 20 to 30 feet.

The telescopic joint includes an inner tubular member or inner barrel **11** adapted to move longitudinally within the outer barrel **10** as the drilling vessel B rises and falls, this inner member being attached through a suitable connector Y to a string of marine riser sections A extending upwardly to the drilling vessel. At its upper end, the marine riser is secured by a suitable connector X to a nipple Z attached to the bottom of the drilling vessel.

One of the connectors Y is illustrated by way of example in FIG. 2*a*, although it is to be understood that any suitable detachable connection can be employed. As shown at the upper portion of FIG. 2*a*, the detachable connector includes a box **12** at the lower end of a section of the marine riser telescoped over a pin **13** constituting the upper end of the inner barrel **11**, the box having a suitable seal ring **14** sealingly engaging the pin which has an external peripheral groove **15** receiving a split, inherently expandable lockring **16** disposed partially within the external groove and also partially within an internal groove **17** in the box member **12**. A plurality of radial screws **18** is threaded in the box and engage the ring **16** to hold it within the external groove for the purpose of coupling the pin and box members **13**, **12** to one another. However, when the screws **18** are threaded outwardly of the box, an upward strain taken on the marine riser A will cause the upper internal tapered surface **19** on the ring to engage the pin **13** and be expanded from the pin groove **15**, thereby permitting disconnection of the box from the pin. The assembled connection between the box and pin is made readily with the screws **18** unthreaded from engagement with the lock ring **16**, the box merely being slipped over the pin with the ring disposed fully within the internal groove **17**. When the upper end **20** of the pin engages the box, the grooves **15**, **17**, are in alignment, permitting radial inward threading of the screws **18** to dispose the lockring **16** partially within the pin groove **15**.

As the drilling vessel B rises and falls, the telescopic joint W permits the marine riser A and inner barrel **11** connected thereto to rise and fall with respect to the outer barrel **10** of the telescopic joint. To prevent leakage of fluid between the inner and outer barrels, a packing unit **21** is carried by the upper portions of the outer barrel, which is threadedly attached to the main lower portion of the outer barrel, as disclosed in FIG. 2*a*. This packing unit includes a plurality of split rings **22**, or a single spiral or helical ring, made of flexible sealing material, such as braided flax or asbestos, impregnated with a lubricant, such as graphite, fluorocarbon (Teflon), or the like, of an overall extended length and with its inner surface bearing against the cylindrical periphery **23** of the inner tubular member **11**, which is disposed in spaced relation to the inner wall **24** of the outer tubular member **10** to provide an annular space **25** therebetween. The lower end of the inner barrel has centering ribs **26** projecting therefrom which extend outwardly toward the inner wall of the outer barrel, so as to center the inner barrel within the outer barrel. Such centering action is assisted by another set of centering ribs **27** extending from the inner barrel **11** toward the inner wall **24** of the outer barrel. The spaces between the centering ribs provide passages for fluid under pressure within the telescopic joint to pass into the annular space **25** between the inner and outer barrels.

As disclosed in FIGS. 2*a* and **3**, the lower end of the inner packing structure **22** rests upon an internal flange **28** of the outer barrel, the exterior of the inner packing structure being spaced radially from the inner wall of the outer barrel to provide an annular space **29** therebetween in which a pressure actuated elastomer membrane **30** is disposed. As shown in FIGS. 2*a* and **3**, this membrane is in the form of a toroidally shaped pliant, elastic bladder or bag surrounding the inner packing structure **22** and extending from the flange **28** to an upper retainer ring **31** secured to the outer barrel by screws **32**, or the like, and extending inwardly to the periphery **23** of the inner barrel and overlying and bearing against the upper end of the inner packing structure **22**. Fluid under pressure directed to the interior of the tubular bladder **30** will cause the latter to expand inwardly against the inner packing structure **22**, forcing the latter along its whole length against the periphery **23** of the inner tubular member **11**, the pressure being uniformly applied by the bladder along substantially the entire length of the inner packing structure **22**.

In the form of invention illustrated in FIG. **4**, the lower end of the inner packing **22** rests upon a filler or abutment ring **33** supported on the lower flange or seat **28** of the outer tubular member or barrel **10**, the upper retainer member **34**, which may be in two halves, being secured to the outer barrel by screws **32**, or the like, and extending toward the periphery **23** of the inner barrel, this upper retainer member having a depending skirt **35** laterally spaced inwardly from the inner wall **24** of the outer barrel and bearing against the upper end **22***a* of the inner packing structure. The upper retainer member **34** and the lower abutment ring **33** may be made of steel, or other suitable metal.

A membrane **36** of elastomer material, such as rubber, illustrated in FIG. **4**, is disposed in the annular space **37** between the exterior of the inner packing **22** and the inner wall **24** of the outer tubular member or barrel, its lower end resting upon the flange or seat **28** in encompassing and sealed relation against the exterior of the abutment ring **33**, with its upper end surrounding and sealing against the skirt **35** of the upper retainer **34** and also bearing against the upper shoulder **38** of the retainer at the upper end of the skirt. The membrane has an upper lip seal **39** sealingly engaging the inner wall **24** of the outer member **10**, and also a lower lip seal **40** sealingly engaging the inner wall of the outer member or barrel, providing a confined annular space into which fluid under pressure can be introduced extending along the entire length of the elastomer membrane **36** between its upper and lower lip seal portions. Fluid under pressure introduced to the confined space will cause the lip seals **39**, **40** to seal against the inner wall **24** of the outer member and also against the peripheries of the skirt **35** and abutment ring **33** and will urge the thinner intermediate portion **36***a* of the membrance to move inwardly and exert a force on the inner pliable packing structure **22**, pressing it against the periphery **23** of the inner barrel uniformly along its entire length. The inner barrel **11** can slide along the packing structure **22** during its telescopic movement within the outer barrel **10**, with assurance that a leakproof seal is provided between the inner and outer barrels.

The fluid pressure introduced into the toroidal membrane **30** of the form of invention illustrated in FIG. **3**, or into the chamber **37** of FIG. **4** for action upon its membrane **36**, is derived from the interior of the telescopic joint W. Such pressure is greater than the pressure externally of the telescopic joint, since the fluid therein has a much higher specific gravity than the sea water surrounding the telescopic joint. The marine riser A may be full of drilling mud, or other drilling fluid, and this fluid will provide a hydrostatic pressure imposed on the elastic diaphragm **30** or **36** greater than the hydrostatic head of the sea water externally of the telescopic joint W, insuring a differential pressure or force urging the diaphragm inwardly against the inner packing unit **22** and insuring continuous pressure or forcing of the packing unit laterally inwardly against the periphery **23** of the inner tubular member or barrel **11**. Although the drawings illustrate a pressure booster arrangement (described hereinbelow) between the interior of the telescopic joint below the packing structure **21** and the diaphragm **30** or **36** for imposing fluid pressure upon the latter, suitable tubular fittings and piping can be employed extending from a point below the lower flange **28** and communicating with the chamber **37**, in the form of invention illustrated in FIG. **4**, or with a fitting **50** passing through the upper retainer member **31**, of the form of invention illustrated in FIG. **3**, which communicates with the interior of the toroidal diaphragm **30** and which is in appropriate sealing relation therewith. As shown in FIG. **2**, the tubing and fitting connections extend from a point **51** just below the lower flange **28**, being located within a suitable elongate opening or cavity **52** in the external portion of the outer barrel and running to the elastic diaphragm. Actually, however, as illustrated in FIG. **3**, a portion of the fluid conductor arrangement just described constitutes a pressure booster **53**.

The pressure booster is disclosed in both FIGS. **3** and **4**. It includes a cylinder **54** disposed in the side opening **52** in the outer barrel and having a large internal diameter cylindrical portion **55** and a smaller internal diameter cylindrical portion **56**. A large piston **57** is disposed in the large diameter portion

and a small piston **58** is disposed in the small cylinder portion, there being suitable piston rings **59** thereon for slidable leak-proof sealing against the respective cylinder walls. The head end **60** of the large diameter cylinder is connected through a suitable fitting **61** with the annular space **25** between the inner and outer barrels below the lower flange **28**, the head end **62** of the small diameter cylinder **56** being connected through suitable outlet fittings **63** with the fitting **50** sealed against the elastomer tube **30** of FIG. **3**, or in the case of the FIG. **4** embodiment, the fitting **63** communicates with the annular chamber **37** in which the elastomer membrane **36** is located.

The large and small pistons **57**, **58** are interconnected by a piston rod **70**. The rod end of the large diameter cylinder **55** has a suitable bleeder vent or port **71** communicating the interior of the cylinder with the sea water externally of the telescopic joint. The large cylinder **55** and large piston **57** constitute a fluid motor; whereas, the small piston **58** and small cylinder **56** constitute a fluid pump, the small cylinder **56**, its associated fittings **63**, and the membrane **30** or chamber **37** being filled with a suitable liquid, such as oil. The pressure in the telescopic joint W passes through the inlet fitting **61** into the large diameter cylinder **55**, exerting a force thereon and tending to shift the large piston **57** in a direction toward the small cylinder **56** and shifting the small piston **58** in the small cylinder **56**, the latter developing a pressure in the liquid in the small cylinder and the small cylinder fittings and membrane. Such pressure is increased or multiplied by the ratio of the cross-sectional area of the large piston **57** to the area of the small piston **58**. Accordingly, by appropriate selection between relative diameters between the large and small pistons, the unit pressure force available for action upon the diaphragm **30** or **36** may be increased several times with respect to the unit fluid pressure within the telescopic joint W. Accordingly, the uniform force applied against the inner packing unit **22** along its entire length is increased several times, insuring against leakage between the interior and exterior of the telescopic joint through the packing structure **21**.

The assembly and disassembly of the packing structure is easily accomplished in a minimum of time, and without requiring any structural changes to either the inner or outer tubular members **11**, **10**. This is true despite the fact that the pin end **13** of the connector Y may be of a somewhat greater diameter than the periphery **23** of the inner telescopic joint. In disassembling the packing portion of the telescopic joint, it is only necessary to back the screws **18** out to permit the marine riser stand A to be elevated to raise its box **12** off the pin **13**, whereupon the screws **32** fastening the upper retainer member **34** of FIG. **4** can be removed, allowing the retainer member to be elevated completely off the inner tubular member **22**, since its inside diameter is slightly greater than the maximum outside diameter of the pin **13**. The membrance **36** and packing structure **22** can then be elevated along the inner member **11** toward its pin **13**, the membrane being elevated along the inner packing elements and removed from the pin since its internal diameter is much greater than the diameter of the pin. The inner pliable packing **22** can also be easily removed, since it is either made of split rings or constitutes a spiral which is easily unwound partially to provide an internal diameter greater than the pin diameter.

In the case of the structure illustrated in FIG. **3**, the inner packing **22** can also be readily removed in essentially the same manner as described above in connection with FIG. **4**. All that need be done is to disconnect the outlet fittings **63** from the fitting member **50** secured to the bladder **30**, whereupon the screws **32** securing the upper ring **31** to the outer barrel are removed, such ring and the bladder connected thereto then being elevated out of the outer barrel, with the ring **31** passing over the pin **13** of the connector Y, whereupon the sealing material **22** can be removed from the inner barrel very readily, if such material is of the split ring type, or by uncoiling the packing material to a small extent, if spirally wound.

Replacement of the inner packing structure **22** in both forms of the invention is also readily accomplished by reversing the above procedure.

If the inner packing structure **22** is of the split ring type, or of the spiral type, it is placed around the outer barrel below the pin **13**, whereupon the diaphragm **36** is placed around it, such combination being lowered into the annular space **37** between the inner and outer barrels until the membrane and filler and abutment ring **33**, in the case of the FIG. **4** embodiment, engage the flange **28**, whereupon the upper retainer **34**, which may be made in two parts, is placed into the upper end of the outer barrel and in the location illustrated in FIG. **4**, its attachment to the outer barrel being made by the screws **32**.

The same procedure is followed in connection with the form of invention illustrated in FIG. **3**.

Inasmuch as the diaphragm themselves are only subject to fluid pressure and do not bear against the inner barrel **11**, they are not subject to wear and have a long effective life. The packing **22** which is subject to the wear incident to reciprocation of the inner barrel **11** in the outer barrel **10**, is readily replaced, although it has a long effective life in view of the fact that it is uniformly pressed against the periphery **23** of the inner barrel over an extended length. Leakage is prevented without the necessity for subjecting the membrane **30** or **36** to high pressure differentials to produce a corresponding great compressive force applied by the membrane against the inner packing structure **22**. Great economies are effected, since seal replacement, when required, need only be made of the inner sealing structure **22** which is of comparatively low cost.

We claim:

1. In a joint: first and second members disposed one within the other and movable with respect to each other; slidable seal means between said members comprising a pliable packing carried by said first member and slidably and sealingly engaging said second member while said members move with respect to each other to prevent fluid leakage therebetween, a fluid-pressure-responsive pliant, elastic diaphragm carried by said first member and disposed around and engaging said packing along substantially its entire length, said diaphragm being responsive to fluid pressure to apply a uniform force to said packing along substantially its entire length to uniformly force said packing along substantially its entire length against said second member while said members move with respect to each other to prevent fluid leakage therebetween.

2. In a joint as defined in claim **1**; said first member being an outer member and said second member being movable within said outer member, said diaphragm encompassing said packing and being urged inwardly by fluid pressure to force said packing laterally inwardly against said second member.

3. In a joint as defined in claim **1**; said first and second members being movable longitudinally with respect to each other.

4. In a joint as defined in claim **1**; said diaphragm being a toroidal bladder bearing against said first member and packing.

5. In a joint as defined in claim **1**; said diaphragm having end portions provided with lip seals sealingly engaging said first member and an intermediate portion between said end portions bearing against said packing.

6. In a joint as defined in claim **1**; said first member being an outer member and said second member being movable within said outer member; said diaphragm being a toroidal bladder encompassing said packing and bearing against said first member and packing, said bladder being urged inwardly by fluid pressure to force said packing laterally inwardly against said second member.

7. In a joint as defined in claim **1**; said first member being an outer member and said second member being movable within said outer member; said diaphragm encompassing said packing and having end portions provided with lip seals sealingly engaging said first member and an intermediate portion between said end portions urged inwardly by the fluid pressure to force said packing laterally inwardly against said second member.

8. In a telescopic joint: an outer tubular member; an inner tubular member disposed within said outer member; said members being longitudinally movable with respect to each other; slidable seal means between said members comprising a pliable packing slidably and sealingly engaging the outer sur-

face of said inner member while said members move longitudinally with respect to each other, a fluid-pressure-responsive pliant, elastic diaphragm carried by said outer member and encompassing said packing along its entire length and engaging the exterior of said packing to apply a uniform inwardly directed force against said packing along substantially its entire length to uniformly force said packing along substantially its entire length inwardly against the outer surface of said inner member while said members move longitudinally with respect to each other.

9. In a telescopic joint as defined in claim 8; said diaphragm being a bladder bearing against said outer member and packing.

10. In a telescopic joint as defined in claim 8; said diaphragm having end portions provided with lip seals sealingly engaging said outer member and an intermediate portion between said end portions bearing against said packing.

11. In a telescopic joint as defined in claim 8; and means for subjecting said diaphragm to a fluid pressure force derived from the fluid pressure in the telescopic joint.

12. In a telescopic joint as defined in claim 8; and pressure booster means communicating with said diaphragm and interior of the telescopic joint for subjecting said diaphragm to a unit fluid pressure greater than the fluid pressure in the unit telescopic joint.

13. In a telescopic joint adapted to be incorporated in a tubular string used in underwater well bore operations and extending downwardly from a vessel floating in the water: an outer tubular member; an inner tubular member disposed within said outer member; at least one of said members having a connection for securing said one member to an adjacent portion of the tubular string; said members being longitudinally movable with respect to each other; slidable seal means between said members comprising an elongate pliable packing slidably and sealingly engaging the outer surface of said inner member while said members move longitudinally with respect to each other, a fluid-pressure-responsive pliant, elastic elongate diaphragm carried by said outer member and engaging said packing along substantially its entire length to apply a uniform inwardly directed force to said packing along substantially its entire length to uniformly force said packing along substantially its entire length inwardly against the outer surface of said inner member.

14. In a telescopic joint as defined in claim 13; and means for subjecting said diaphragm to a fluid pressure force derived from the fluid pressure in the telescopic joint.

15. In a telescopic joint as defined in claim 13; and pressure booster means communicating with said diaphragm and interior of the telescopic joint for subjecting said diaphragm to a unit fluid pressure greater than the unit fluid pressure in the telescopic joint.

16. In a telescopic joint: an outer tubular member; an inner tubular member disposed within said outer member and having an upper end connector of a greater external diameter than the diameter of the outer surface of said inner tubular member; slidable seal means between said members comprising a pliable packing slidably and sealingly engaging the outer surface of said inner member while said members move longitudinally with respect to each other, a fluid-pressure-responsive pliant, elastic diaphragm carried by said outer member and encompassing said packing along its entire length and engaging the exterior of said packing to apply a uniform inwardly directed force against said packing along substantially its entire length to uniformly force said packing along substantially its entire length inwardly against the outer surface of said inner member while said members move longitudinally with respect to each other, the inside diameter of said diaphragm being greater than the external diameter of said connector.

17. In a telescopic joint as defined in claim 16; said diaphragm being a bladder bearing against said outer member and packing.

18. In a telescopic joint as defined in claim 16; said diaphragm having end portions provided with lip seals sealingly engaging said outer member and an intermediate portion between said end portions bearing against said packing.

19. In a telescopic joint as defined in claim 16; means for subjecting said diaphragm to a fluid pressure force derived from the fluid pressure in the telescopic joint.

20. In a telescopic joint as defined in claim 16; and pressure booster means communicating with said diaphragm and interior of the telescopic joint for subjecting said diaphragm to a unit fluid pressure greater than the unit fluid pressure in the telescopic joint.

* * * * *

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,647,245 Dated March 7, 1972

Inventor(s) JAMES W. E. HANES ET AL

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 7, line 25, before "fluid" (last occurrence) insert --unit--; line 25, cancel "unit" (last occurrence).

Signed and sealed this 5th day of September 1972.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents