Oct. 7, 1969 A. G. BURNS ETAL 3,471,156

INFLATABLE PACKING FOR STUFFING BOXES

Filed April 12, 1967 3 Sheets-Sheet 1

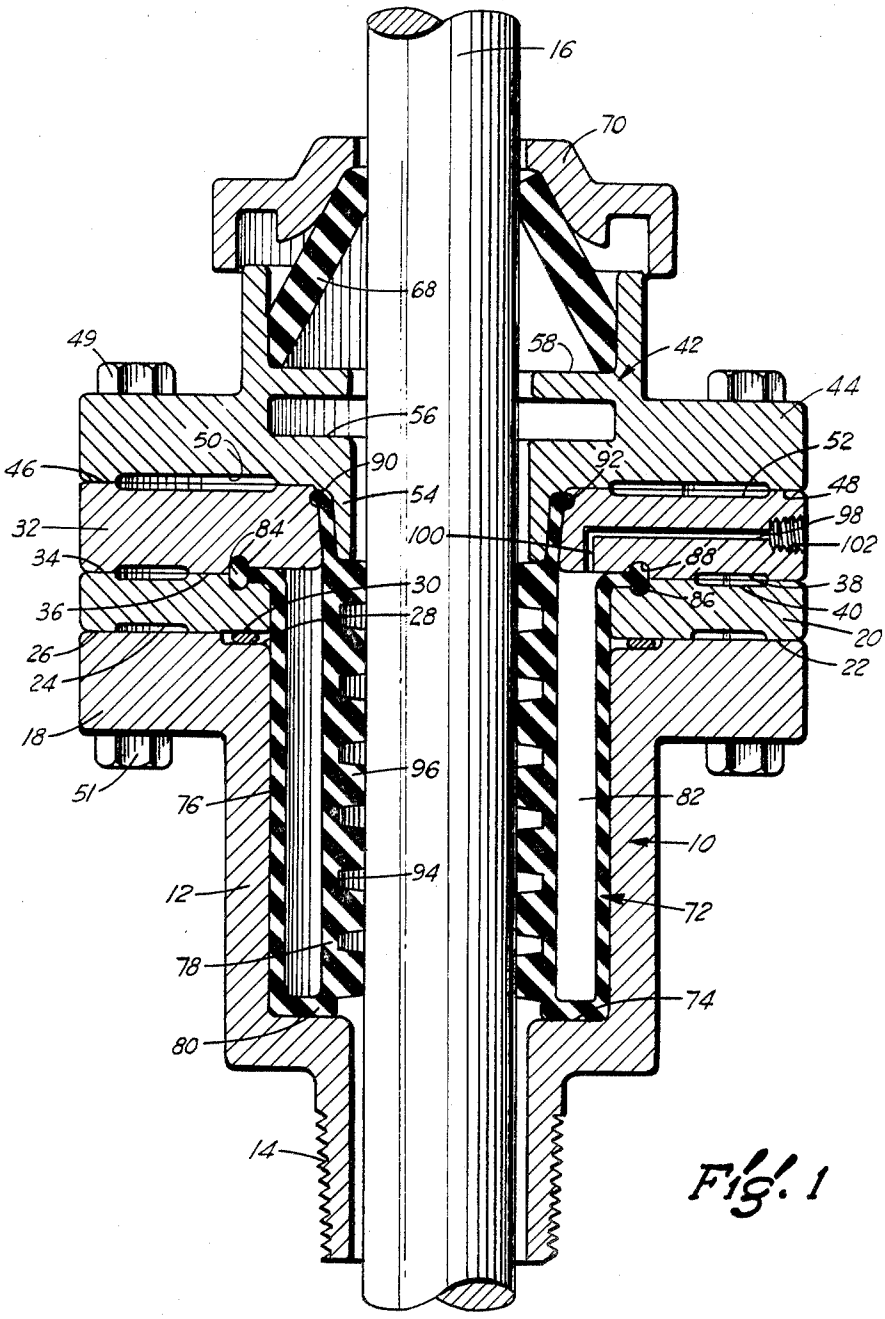


FIG. 1

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Filed April 12, 1967 3 Sheets-Sheet 2

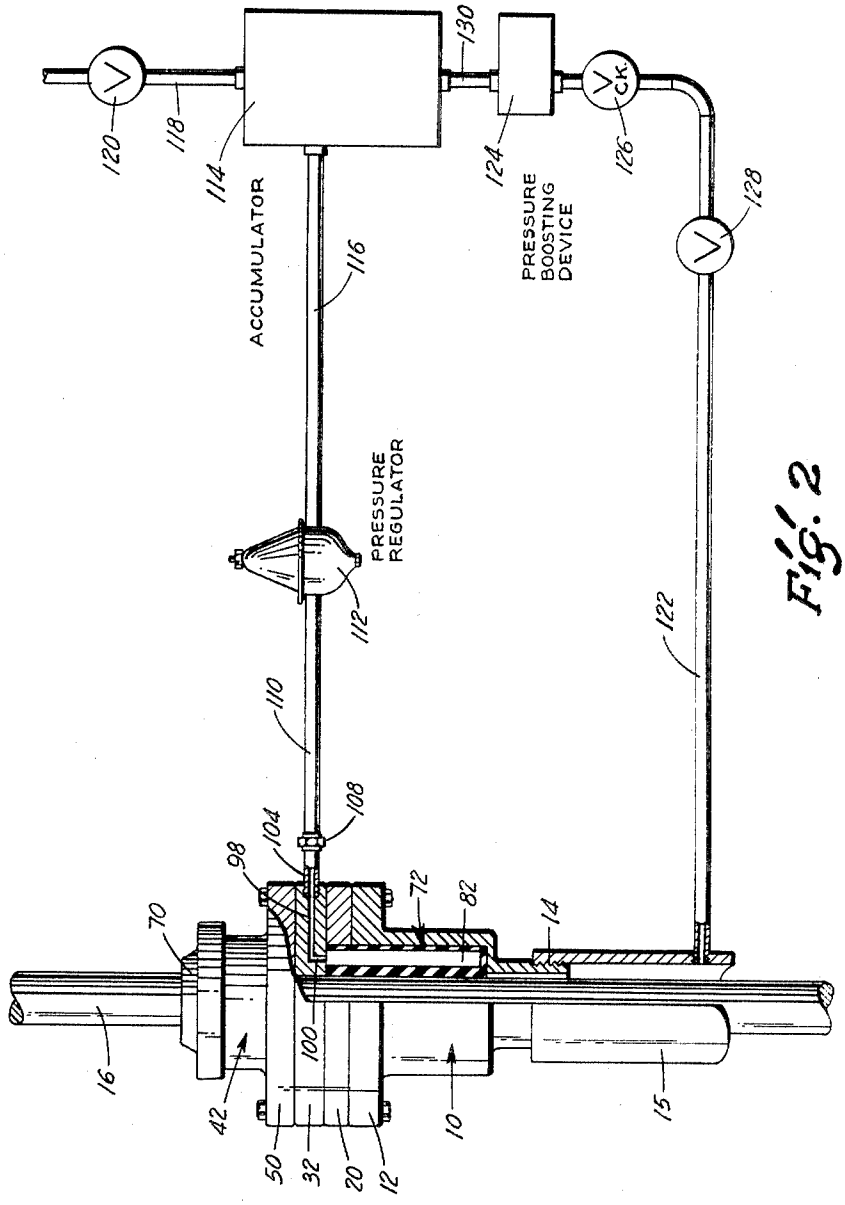


FIG. 2

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Filed April 12, 1967 3 Sheets-Sheet 3

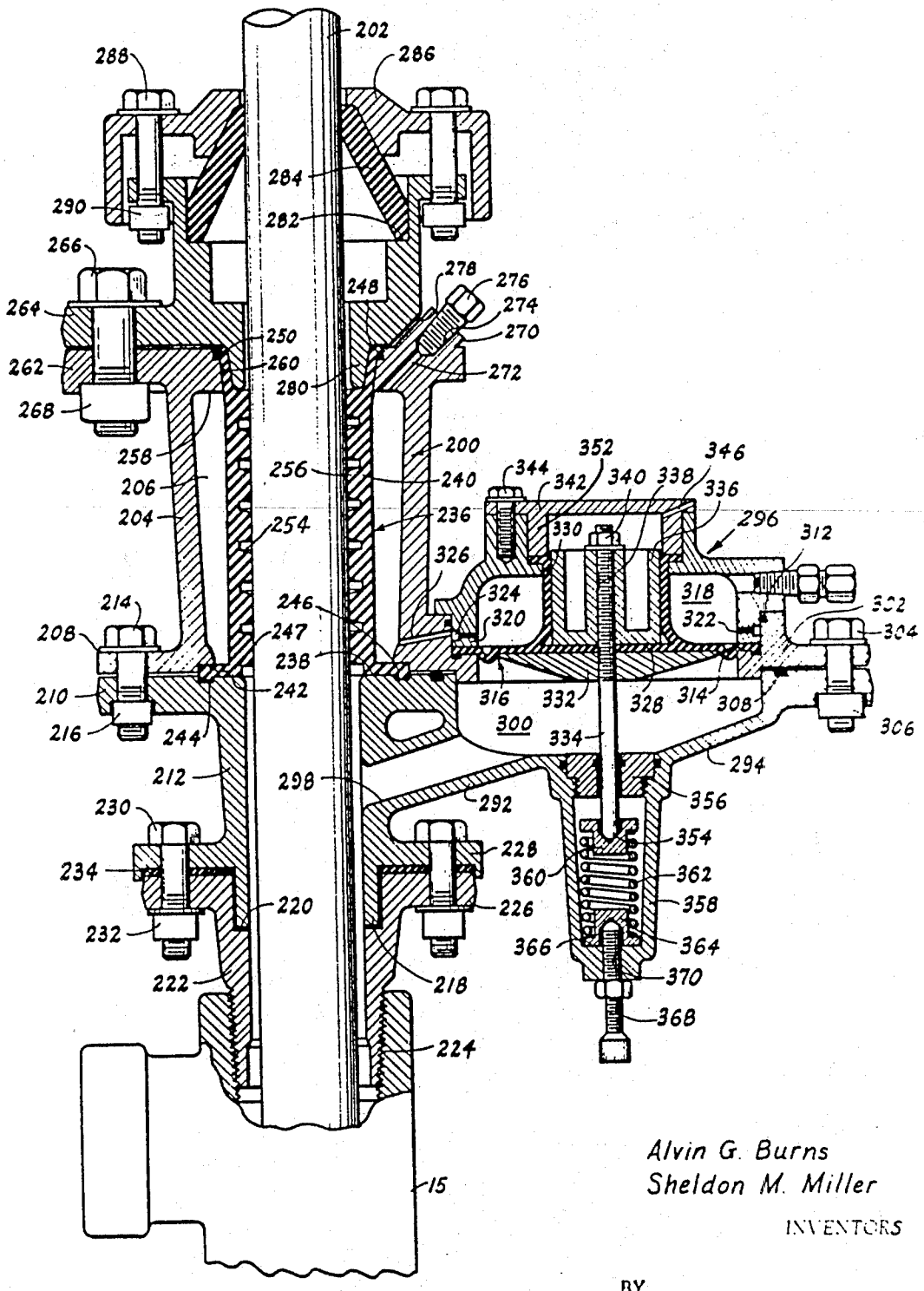


Fig. 3

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3,471,156
Patented Oct. 7, 1969

3,471,156

INFLATABLE PACKING FOR STUFFING BOXES

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Continuation-in-part of application Ser. No. 300,022, Aug. 5, 1963. This application Apr. 12, 1967, Ser. No. 633,667

Int. Cl. F16j *15/40, 15/00, 9/00*

U.S. Cl. 277—3 3 Claims

ABSTRACT OF THE DISCLOSURE

An inflatable packing gland for stuffing boxes utilized around the reciprocal polished rod of a producing oil well wherein the pressure of the packing member against the outer periphery of the polished rod may be automatically maintained at the most desirable level regardless of wear of the inner periphery of the stuffing gland.

This is a continuation-in-part application of our copending application Ser. No. 300,022, filed Aug. 5, 1963, and now abandoned, and entitled "Inflatable Packing for Stuffing Boxes." This invention relates to packing glands and more particularly, but not by way of limitation, to an inflatable packing for stuffing boxes, or the like, such as utilized around the polished rod of a producing oil well.

Most producing oil wells today do not have sufficient well pressures to provide for a natural flow of the well fluid and as a result, some means must be utilized for elevating the well fluid to the earth's surface. A majority of the producing oil wells utilize pumping means actuated by a reciprocating rod. The pumping unit itself is normally installed near the bottom of the well bore and is actuated by a string of rods extending downwardly through the well bore from the surface of the ground. The upper most rod which projects from the well head is commonly called the polished rod. A packing gland or stuffing box is usually secured to the well head around the polished rod to prevent a leakage of the pumped oil around the rod. Packing rings of various types are normally disposed within the stuffing box and bear against the outer periphery of the polished rod to provide a sealing engagement therearound.

The reciprocation of the rod with respect to the packing rings wears the inner periphery of the packing rings substantially rapidly, thus, requiring rather frequent manual attendance at the stuffing boxes. Follower members, and the like, are usually provided with these stuffing boxes which may be manually tightened for increasing the sealing engagement of the packing members when they become worn, thus, increasing the useful life thereof. However, this is a mechanical tightening or increasing of the pressure of the packings against the polished rod and it is difficult to ascertain exactly how much pressure is exerted against the polished rod upon tightening of the follower members. If the packing members bear against the polished rod with insufficient pressure, the sealing around the rod will be inefficient. Conversely, if the packing members are too tightly wedged in engagement with the polished rod, the reciprocation of the polished rod will be somewhat hindered and wear of the packing members will be greatly increased, thus, requiring a more frequent replacement of the packing members.

Producing oil wells are frequently situated in remote locations making manual attendance thereto somewhat disadvantageous. As a result, almost all of the operating equipment required for the pumping of the well fluid are automatically controlled, with the exception of the stuffing boxes. The rapid wear of the packing rings in the stuffing boxes requires frequent attention for correction of the sealing pressure or for replacement of the packing rings and it is considered that a reduction of any necessary manual attention to the stuffing box would be of great advantage.

The present invention contemplates a novel inflatable packing member for a stuffing box wherein the pressure of the packing member against the outer periphery of the polished rod may be maintained at the most desirable predetermined level regardless of wear on the inner periphery thereof due to the reciprocation of the polished rod. The novel inflatable packing is disposed within the stuffing box with the inner periphery thereof adapted for sealing engagement with the polished rod and the outer periphery thereof in sealing engagement with the body of the stuffing box. An annular chamber is provided within the packing member for receiving a fluid therein whereby equal pressure will be exerted both radially inwardly and outwardly to assure a constant and efficient sealing between the stuffing box and polished rod. The pressure of the packing against the polished rod may be maintained at a sufficient level for efficiently packing off around the rod without hampering the reciprocation of the rod within the stuffing box.

When wear occurs on the inner periphery of the inflatable packing member, the inner diameter thereof will be slightly enlarged but the pressure of the fluid within the annular chamber, acting radially on the inner wall of the packing member, will constantly urge the inner periphery of the inflatable packing into an efficient sealing engagement with the polished rod. The inner periphery of the novel packing is particularly constructed for facilitating contraction thereof around the rod. The need for follower members, and the like, is eliminated since the inflatable packing member is constantly maintained in sealing engagement with the polished rod with adjustment of the sealing pressure being automatically achieved as wear occurs. It will be apparent that the efficient life of the inflatable packing member is greatly prolonged, thus, reducing the manual attention required. Since it is unnecessary to provide maintenance for the stuffing box for the purpose of tightening follower members, or the like, the need for manual attendance at the well site is greatly reduced. The novel inflatable packing member may be utilized with substantially any existing stuffing box, such as that disclosed in the Sheridan P. Tschappat Patent No. 2,857,183, issued Oct. 21, 1958 and entitled "Reservoir Gland Stuffing Box," but is not limited thereto. The standard body portion of the stuffing box may be utilized in conjunction with adaptor members for securing the packing member thereto. This is an economic advantage in that existing equipment may be utilized with a minimum of alterations to provide an improved stuffing box assembly. It is to be understood that whereas the novel packing member is depicted herein as utilized with an oil well stuffing box, it is anticipated that the packing member may be utilized in any suitable environment requiring this type of sealing.

It is an important object of this invention to provide an improved oil well stuffing box having an inflatable packing member therein for sealing around the polished rod of an oil well pumping device.

It is another object of this invention to provide an inflatable packing member for an oil well stuffing box wherein the sealing engagement between the packing member and the polished rod may be efficiently maintained with a minimum of manual attendance.

It is another object of this invention to provide a novel inflatable packing member for an oil well stuffing box wherein the sealing engagement between the packing

member and the oil well polished rod may be maintained substantially constant as the inner periphery thereof becomes worn through use.

A further object of this invention is to provide a novel inflatable packing ring for an oil well stuffing box, particularly designed and constructed for increasing the overall useful life thereof whereby the frequency of replacement of the packing members is greatly reduced.

Still another object of this invention is to provide a novel inflatable packing member for an oil well stuffing box wherein the inner periphery thereof is particularly designed for radially inwardly contraction as the inner periphery thereof becomes worn, thus, assuring an efficient sealing engagement with the outer periphery of the oil well polished rod for a prolonged period of time.

Other and further objects and advantageous features of the present invention will hereinafter more fully appear in connection with the detailed description of the drawings in which:

FIGURE 1 is a sectional elevational view of a stuffing box provided with a packing member embodying the invention.

FIGURE 2 is a side elevational view, partly in section, depicting a general schematic arrangement for controlling the pressure supplied to the novel inflatable packing member of the invention.

FIGURE 3 is a sectional elevational view of a stuffing box having a packing member and pressure regulator device in association therewith embodying a modified form of the invention.

Referring to the drawings in detail, reference character **10** generally indicates an oil well stuffing box comprising a cylindrical or tubular lower body portion **12** having the lower end **14** thereof reduced in diameter and externally threaded for connection with a well head **15** (FIGURE 2). The usual polished rod **16** extends longitudinally through the central portion of the stuffing box **10** and reciprocates therein, as will be hereinafter set forth. An outwardly extending circumferential flange **18** is provided at the upper end of the body **12**. It will be apparent that the flange **18** may be a continuous circumferential flange or may comprise a plurality of circumferentially spaced outwardly extending flanges, as desired. A ring **20** is disposed adjacent the upper surface **22** of the flange **18** and it will be apparent that the ring **20** is preferably of a configuration complementary to the flange **18**.

A metal to metal seal is provided between the abutting surfaces of the flange **18** and the ring **20**. As is well known, it is desirable to provide a finished surface for abutting members of this type to increase the metal to metal sealing therebetween, and for purposes of economy, an annular recess or groove **24** may be provided on the surface **26** of the ring **20** to reduce the surface areas which are in sealing contact, thereby reducing the machining costs for construction thereof. In addition, a circumferential recess **28** may be provided on the surface **22** conterminous with the inner periphery of the body **12** for receiving a sealing member **20** for increasing the sealing between the ring **20** and flange **18**.

A second ring member **32** is disposed adjacent the upper surface **34** of the ring **20** and is preferably of a complementary configuration with respect thereto. The lower surface **36** of the ring **32** is in abutting engagement with the surface **34** of the ring **20** and it is preferable to provide a metal to metal seal therebetween. As hereinbefore set forth, a more efficient metal to metal seal is provided if the abutting surfaces are provided with finished machining and in order to reduce the overall machining costs, it may be desirable to provide complementary annular recesses **38** and **40** on the abutting surfaces **34** and **36** for reducing the surfaces which must be machine finished.

An upper body member, generally indicated at **42**, is disposed above the ring **32** and may be of any suitable type as presently used with stuffing boxes. As depicted herein, the upper body **42** is substantially cylindrical and is provided with an outwardly extending circumferential flange **44** of a configuration complementary to the ring **32** and is adapted for disposition thereabove whereby the mating surfaces **46** and **48** provide a metal to metal seal as hereinbefore set forth. It is to be noted that it may be desirable to provide complementary recesses or relief portions **50** and **52** in the abutting surfaces **46** and **48** for reducing the machining costs of the parts. The flanges **18** and **44** and the rings **20** and **32** interposed therebetween may be secured together in any suitable manner, such as a plurality of circumferentially spaced bolts **49** and cooperating lock nuts **51**.

The lower end of the upper body **42** is provided with a downwardly extending neck portion **54** having an outer diameter less than the inner diameter of the ring **32**, and having an inner diameter greater than the outer periphery of the rod **16** for a purpose as will be hereinafter set forth. An annular recess **56** is provided on the inner periphery of the flange **44** to provide a chamber for retaining a suitable lubricant and an annular shoulder **58** is provided above the the recess **56** for supporting a suitable auxiliary packing member **68**, as is well known. A cap or follower member **70** is disposed above the upper body **42** and bears against the packing member **68** for assuring a sealing engagement thereof with the polished rod **16**. The follower member **70** may be of any suitable or well known type, such as that disclosed in the Charles F. Moseley Patent No. 2,833,572, issued May 6, 1958, and entitled "Double Packed Oil Well Stuffing Box." The follower **70** may be adjusted with respect to the body **42** for varying pressure of the packing member **68** against the polished rod **16**. It will be apparent that the oil gland or packing member **68** may or may not be utilized, and it is to be understood that the stuffing box depicted herein is merely illustrative of a structure with which the present invention may be used.

An inflatable packing member, generally indicated at **72**, is disposed within the body **12** and is supported therein by an inwardly directed annular shoulder **74** provided in the lower portion of the body **12**. The packing member **72** may be constructed from any suitable material, such as rubber, neoprene, plastic, or the like, which may be expanded and contracted upon the application of pressure. The packing member **72** comprises an outer sleeve **76** and a concentrically disposed inner sleeve **78** joined at one end by an annular wall **80** whereby an annular chamber **82** is formed therebetween. The opposite end of the chamber **82** is open for a purpose as will be hereinafter set forth. The free end **84** of the outer sleeve **78** is preferably bulbous, as clearly shown in FIGURE 1, and is disposed in complementary annular grooves **86** and **88** provided on the mating surfaces **34** and **36** of the rings **20** and **32**. The bulbous portion **84** functions in much the same manner as the O-ring for facilitating the sealing of the juncture between the rings **20** and **32**. The inner sleeve **78** extends upwardly in the annular space between the inner periphery of the ring **32** and the neck portion **54** and the free end **90** thereof may be bulbous, as clearly shown in FIGURE 1. The bulbous portion **90** may be disposed in a circumferential groove **92** provided on the inner periphery of the ring **32** and functions as an additional sealing element for facilitating sealing between the ring **32** and the upper body **42**. Thus, the packing member **72** may be securely clamped or secured within the stuffing box **10** and functions as sealing means between the various elements of the stuffing box itself.

It will be apparent that the inner periphery of the inner sleeve **78** may be substantially smooth, if desired, for engaging the outer periphery of the polished rod **16**. However, it is preferable to provide a plurality of longitudinally spaced annular recesses **94** extending radially from

the inner periphery of the sleeve 78. The recesses 94 may be provided with slightly angularly disposed upper and lower sides, as shown herein, or straight upper and lower sides. A plurality of longitudinally spaced ribs 96 are formed between each adjacent pair of recesses 94 and provide a sealing effect similar to that of a plurality of individual sealing rings around the outer periphery of the polished rod 16. The ribs 96, depicted herein, are integral with the inner sleeve 78, but it is to be noted that separate or individual packing rings may be substituted in lieu of the ribs 96. These separate packing rings (not shown) may be of the annular sealing ring type or the chevron type, both of which are well known. When utilizing separate sealing members in lieu of the integral ribs 96, only the individual sealing elements need to be replaced in the event of undue wear during operation of the stuffing box 10. Of course, it is preferable to provide radial slits (not shown) in the individual packing members, if utilized, for facilitating disposition thereof around the polished rod.

The ring 32 is provided with a radial passageway 98 extending into open communication with a longitudinal passageway 100 which is in communication with the open end of the annular chamber 82. The outer end 102 is threaded for receiving a suitable fitting 104 (FIGURE 2) through which any suitable fluid (not shown) may be injected into the chamber 82. The fluid may be injected into the chamber 82 in any suitable manner whereby the desired sealing pressure of the rib members 96 against the outer periphery of the rod 16 may be provided.

Whereas the invention as depicted herein is utilized with a standard stuffing box such as in widespread use today, and this is an important economic advantage of the invention, it is to be understood that the inflatable packing member may be utilized with a new and different stuffing gland (not shown) wherein only one side or sleeve thereof need be compliant, or yielding.

Referring to FIGURE 2, one method for supplying fluid to the chamber 82 is illustrated schematically with the stuffing box 10 and packing member 72, generally depicted therein. The stuffing box 10 is threadedly secured to the well head 15, as is well known and as hereinbefore set forth, for precluding leakage of fluid around the polished rod 16. The fitting 104 is suitably connected at 108 to a conduit 110 in communication with a suitable pressure regulator 112. The pressure regulator 112 is suitably connected to a fluid reservoir or accumulator 114 by a conduit 116, as is well known. The reservoir or accumulator 114 may be connected with any suitable fluid source (not shown) through a conduit 118 and shut-off valve 120 in any well known manner. The fluid source may be an air cylinder connected directly to the accumulator 114, if desired, or may be of any other suitable type whereby a pressure fluid may be admitted into the interior of the accumulator 114.

The fluid from the accumulator 114 is directed to the pressure regulator 112 in any suitable manner and the pressure regulator 112 in turn directs the fluid through the conduit 110 and communicating passageways 98 and 100 for discharge into the chamber 82 at the most desirable predetermined pressure. The inner sleeve 78 of the packing 72 will be constantly urged in a direction toward the outer periphery of the polished rod 16 and upon wear of the inner periphery of the ribs 96, the variance of the inner diameter determined by the ribs 96 will result in an increased volume or size for the chamber 82. When this occurs, additional fluid is admitted into the chamber 82 from the pressure regulator 112 in order to maintain the pressure acting upon the inflatable packing substantially constant at all times. Thus, the sealing pressure of the ribs 96 against the rod 16 may be maintained substantially constant, and at the most desirable level.

In some installations it may be desirable to utilize the fluid pressures of the well bore for facilitating inflation of the packing 72. In such an installation, a suitable conduit 122 may be secured to the well head 15 in such a manner as to be in open communication with the interior thereof. The conduit 122 directs the well fluid (not shown) into a pressure boosting device 124, or the like, through suitable valves 126 and 128. It is preferable that the valve 126 be a check valve to preclude back flow of the well fluid from the pressure boosting device 124 and that the valve 128 be a shut-off valve for selectively closing off communication between the interior of the casing head 126 and the pressure boosting device 124. The pressure boosting device 124 is in communication with the accumulator 114 through a conduit 130 whereby the well fluid may be directed to the accumulator. In this installation the well pressure fluid may be utilized as the pressure force for inflating the packing 72.

OPERATION

The yielding or inflatable packing 72 may be disposed within the stuffing box 10, as hereinbefore set forth, whereby the inner periphery of the rib members 96 are in sealing engagement with the outer periphery of the polished rod 16 and the outer sleeve 76 is in sealing engagement with the body 12. A suitable pressure fluid is admitted or injected into the chamber 82 for charging the chamber with subtantially any desired preselected pressure. The pressure within the chamber 82 acts equally in all directions for urging the ribs 96 into sealing engagement with the polished rod 16, the outer sleeve 76 into sealing engagement with the body 12 and the lower wall 80 into sealing engagement with the shoulder 74. By controlling the pressure within the chamber 82 it is possible to maintain the most desirable sealing engagement pressure between the ribs 96 and the polished rod 16.

As the polished rod 16 reciprocates within the stuffing box 10, a considerable amount of friction occurs between the rod and the ribs 96. In order to provide lubrication therebetween, it is desirable to provide a lubricating fluid around the rod. The lubricant may be disposed within the recess 56 and in the annular space between the neck 54 and polished rod 16. As the polished rod reciprocates within the stuffing box, the outer periphery thereof is lubricated by the lubricating fluid and greatly facilitates the overall operation, as is well known.

During the reciprocation of the polished rod 16, a considerable amount of wear may occur on the inner periphery of the ribs 96, thus, increasing the inner diameter thereof. When this occurs, the pressure within the chamber 82 moves the wall 78 and ribs 96 radially in a direction toward the rod 16 for maintaining a sealing engagement with the outer periphery thereof. This eliminates the necessity of tightening or follower members, and the like, and the mechanical tightening of the sealing engagement inherent with the use of such devices.

The pressure fluid may be stored in the accumulator 114 for delivery into the chamber 82 through the pressure regulator 112, as hereinbefore set forth. When this arrangement is utilized, the pressure within the chamber 82 is maintained at a constant preselected level regardless of wear on the inner periphery of the ribs 96. In fact, it is possible to maintain a substantially constant sealing pressure against the polished rod 16 through a considerable amount of wear of the ribs 96. The ribs 96 may be worn to such an extent that the inner periphery of the wall 78 is substantially smooth, but the inflatable characteristics of the packing 72 will maintain an efficient seal or a packing off around the rod 16.

It is to be understood that the invention is not limited to the use of an automatic system for maintaining the pressure within the chamber 82 constant at all times. It may be desirable to precharge the chamber 82 with a predetermined pressure wherein the inner periphery of the inflatable packing member 72 will be maintained in constant sealing engagement with the rod 16. However, in this installation the sealing pressure between

the packing 72 and the rod 16 may decrease upon wear on the inner periphery of the ribs 96.

Referring now to FIGURE 3, a modified form of the invention is depicted wherein reference character 200 generally indicates an oil well stuffing box having the usual polished rod 202 extending longitudinally therethrough and reciprocal therein, as is well known. The stuffing box 200 comprises a substantially cylindrical central body member 204 loosely disposed around a portion of the polished rod 202 for providing an annular chamber 206 therearound. The sidewalls of the body 204 may be slightly inwardly and downwardly tapered, as shown in the drawings, but not limited thereto. The sleeve or body 204 is provided with an outwardly extending circumferential flange 208 at the lower end thereof as viewed in FIGURE 3 which is disposed on or supported by an outwardly extending circumferential flange 210 provided on the upper end of a support sleeve or housing 212. The flanges 208 and 210 may be removably secured together in any well known manner, such as by a plurality of circumferentially spaced bolts 214 and complementary nuts 216, or the like.

The lower end of the housing 212 terminates in a cylindrical portion 218 which extends into a central recess 220 provided in an adaptor fitting or sleeve 222. The lower end 224 of the adaptor 222 is externally threaded for connection with the well head 15, pumping tee, or the like, as hereinbefore set forth in the first embodiment of the invention. An outwardly extending circumferential flange 226 is provided at the upper end of the fitting 222 for supporting a complementary outwardly extending flange 228 provided on the outer periphery of the housing 212, and spaced from the lower end thereof. The flanges 226 and 228 may be removably secured together in any well known manner, such as by a plurality of circumferentially spaced bolts 230 and complementary nuts 232, and it is preferable to provide a suitable sealing gasket 234 between the flanges for precluding leakage of fluid therebetween.

A packing member 236, generally similar to the packing member 72, is disposed within the body 204 and is supported therein by the upper end 238 of the support housing 212. The packing member 236 may be constructed from any suitable material, such as rubber, neoprene, plastic, or the like, which may be expanded and contracted upon the application of pressure, as will be hereinafter set forth in detail. The packing member 236 comprises a sleeve 240 concentrically disposed around the outer periphery of the rod 202 and having an outwardly extending circumferential flange 242 provided at the lower end thereof as viewed in FIGURE 3. The flange 238 is disposed on the surface 238 and is provided with an annular bulbous portion 244 around the outer periphery thereof disposed within an annular groove 246 provided in the surface 238.

The flange 242 is secured between the flanges 208 and 210 and performs a dual function; namely, to anchor the packing member 236 in the chamber 206 and to provide a seal between flanges 208 and 210. As shown in FIGURE 3, an annular recess 246 may be provided around the inner periphery of the flange 208 for receiving the flexible flange 242 therein and to cooperate with the recess 244 for securing the flange 242 between the flanges 208 and 210. The bulbous portion 244 functions in much the same manner as an O-ring, or the like, for facilitating the sealing of the juncture between the flanges 208 and 210.

As hereinbefore set forth, the sleeve 240 is disposed around the outer periphery of the rod 202 and extends upwardly in the chamber 206 from the surface 238 to the upper end of the body 204. The upper end of the sleeve 240 is substantially tubular, but may extend slightly upwardly and outwardly, as shown in FIGURE 3, if desired, and for a purpose as will be hereinafter set forth. The uppermost end 248 of the sleeve 240 is bulbous and is disposed in an annular groove 250 provided on the inner periphery of the sleeve 204 for supporting the sleeve 240 in the chamber 206 and for providing a seal between the housing 204 and a follower member 252.

It will be apparent that the inner periphery of the sleeve 240 may be substantially smooth, if desired, for engaging the outer periphery of the polished rod 202. However, it is preferable to provide a plurality of longitudinally spaced annular recesses 254 extending radially from the inner periphery of the sleeve 240. The recesses 254 may be provided with slightly angularly disposed or tapered upper and lower sides, as shown herein, or straight upper and lower sides. A plurality of longitudinally spaced ribs 256 are formed between each adjacent pair of recesses 254 and provide a sealing effect similar to that of a plurality of individual sealing rings around the outer periphery of the rod 202. The ribs 256 depicted herein are integral with the sleeve 240 but it is to be noted that separate or individual packing rings may be substituted in lieu of the ribs 256. These separate packing rings (not shown) may be of the annular sealing ring type or the chevron type, as set forth in the first embodiment, and both of which are well known. Of course, when utilizing separate sealing members in lieu of the integral ribs 256, only the individual sealing elements need be replaced in the event of undue wear during operation of the stuffing box 200.

An inwardly directed annular shoulder 258 is provided on the inner periphery of the sleeve 204 to define the upper end of the chamber 206 and to provide a central bore 260 for receiving the upper end of the sleeve 240 therein. An outwardly directed circumferential flange 262 is provided at the upper end of the body 204 for receiving a complementary outwardly extending circumferential flange 264 provided on the outer periphery of the follower 252. The flanges 262 and 264 may be removably secured together in any well known manner, such as by a plurality of circumferentially spaced bolts 266 and complementary nuts 268. In addition, an upstanding boss member 270, which may be angularly disposed as shown herein, is provided on the uppermost surface of the flange 262 and is provided with a bore or passageway 272 extending therethrough to provide communication between the exterior of the stuffing box 200 and the chamber 206. The passageway 272 is enlarged and threaded at the outer end 274 thereof for receiving a suitable fitting or plug member 276 therein. Of course, the flange 264 is cut-away at 278 to provide clearance for the boss 270.

The follower member 252 may be of any conventional type and as disclosed herein comprises a centrally disposed downwardly extending substantially tubular member 280 adapted to be inserted with the upper end of the sleeve 240. The member 280 and flange 264 cooperate with the body 204 for clamping the sleeve 240 securely at the upper end of the body 204, and for effecting an efficient sealing between the body 204 and follower 252.

An inwardly directed annular shoulder 282 is provided on the inner periphery of the follower 252 for supporting a suitable auxiliary packing member 284, similar to the packing member 68, and as is well known. A cap or follower member 286 is disposed above the follower member 252 and bears against the packing member 284 for assuring a sealing engagement thereof with the polished rod 202. The follower member may be of any suitable type, such as the member 70, or the like, and may be adjustably secured to the follower member 252 in any well known manner, such as by a plurality of circumferentially spaced bolts 288 and cooperating nuts 290.

The interior of the fitting 224 and support housing 212 are open to the interior of the well bore (not shown) for receiving fluid pressure therefrom. An outwardly extending boss 292 is provided on the outer periphery of the housing 212 and terminates in a lower housing portion 294 of a pressure regulator device generally indi-

cated at 296. A passageway 298 extends through the boss 292 to provide communication between the interior of the housing 212 and the lower chamber 300 of the pressure regulator 296.

The pressure regulator 296 comprises the lower housing 294 and a central substantially annular housing portion 302 which, as depicted herein, is integral with the body 204, and is removably secured to the lower housing 294 by means of a plurality of spaced bolts 304 and cooperating nuts 306. Of course, a suitable sealing ring 308 may be interposed between the housing portions 294 and 302 for precluding leakage of fluid therebetween. An upper housing portion 310 is disposed above the central housing 302 and may be secured thereto in any well known manner (not shown). A suitable sealing ring 312 is interposed between the housings 310 and 302 for precluding leakage of fluid therebetween. In addition, an inwardly directed annular shoulder 314 is provided on the inner periphery of the central housing 302 for supporting a diaphragm member 316 which provides an upper chamber 318 above the chamber 300. A downwardly depending cylindrical portion 320 of the upper housing 310 bears against the upper surface of the diaphragm 316 in the proximity of the outer periphery thereof for securely retaining the diaphragm in position on the shoulder 214.

A plurality of radial bores or passageways 322 are provided in the upper housing 310 to provide communication between the chamber 318 and an annular groove 324 provided on the outer periphery of the housing 310. A passageway 326 is provided in the sidewall of the body 204 to provide communication between the chamber 206 and the annular groove 324, thus establishing communication between the chambers 206 and 318 for a purpose as will be hereinafter set forth.

The diaphragm 316 is of a particular configuration, and comprises a substantially flat or disc-shaped portion 328 having an upwardly extending substantially cylindrical portion 330, as viewed in FIGURE 3. The usual weight member 332 is secured in any suitable manner (not shown) to the under surface of the flat portion 328, and a vertically extending rod 334 (as viewed in the drawings) extends slidably through the weight 332 and upwardly through the sleeve portion 330. A cup member 336 is disposed within the sleeve portion 330 and disposed adjacent the upper surface of the flat portion 328. A central bore 338 is provided in the cup member 336 and slidably receives the rod 334 therethrough. A nut member 340 is threadedly secured to the upper end of the rod 334 whereby upward movement of the cup 336 will be transmitted to the rod 334, and downward movement of the rod 334 will be transmitted to the cup 336 for a purpose as will be hereinafter set forth. Of course, a suitable cover or cap member 342 is removably secured to the upper housing 310 by means of threaded members 344, or the like, and a bleed port 346 is provided in the cap member 342 for exhausting and admitting fluid pressure above the cup 336.

Of course, the upper end of the sleeve 330 may be provided with an outwardly extending circumferential lip or flange 348 for resting on an inwardly directed annular shoulder 350 provided in the housing 310 whereby the upper end of the sleeve 330 will be firmly supported. The cover member 342 may be provided with a downwardly extending centrally disposed sleeve portion 352 for engaging the lip 348 and securely retaining the lip on the shoulder 350.

The lower end 354 may be rounded, if desired and extends slidably through an apertured guide member 356 threadedly secured in a downwardly extending projection portion 358 of the lower housing 294. A flanged cup member 360 engages the end 354 of the rod 334, and the cup 360 is constantly urged upwardly within the projection member 358 by a suitable helical spring member 362 which is disposed between the cup member 360 and a similar but oppositely disposed cup member 364 which rests on the bottom 366 of the projection portion 358. A threaded adjusting member 368 extends through a bore 370 provided in the end portion 366 for engaging the lower cup 364 in order that the pressure of the spring 362 may be adjusted, as is well known.

The operation of the stuffing box 202 depicted in FIGURE 3 is generally similar to that disclosed in connection with the first embodiment of the invention. The pressure present in the chamber 206 acts on the outer periphery of the packing member 236 and constantly urges the inner periphery of the packing member 236 into a tight sealing engagement with the outer periphery of the reciprocating rod 202, regardless of wear on the inner periphery of the packing member.

In order to maintain the pressure in the chamber 206 at the desired level, the well fluid pressure is directed from the interior of the support housing 212 through the passageway 298 and into the chamber 300 of the pressure regulator device 296. When the pressure in the chamber 300 increases, the flat portion 328 of the diaphragm 316 is urged in an upward direction and the pressure within the chamber 318 is forced into the chamber 206 through the passageways 320 and 326 to increase the pressure or force acting on the outer periphery of the packing member 236. Thus as the pressure requirements for sealing around the rod 202 increase, the force of the sleeve or packing member 236 around the rod automatically increases. Conversely, in the event the pressure in the chamber 300 falls below the pressure within the chamber 318 combined with the upward force of the spring 362, the diaphragm portion 328 will be flexed downwardly, and pressure in the chamber 206 will flow into the chamber 318, thus reducing the pressure on the outer periphery of the packing member 236.

Of course, the spring 362 is adjusted to a minimum pressure wherein the diaphragm 316 cannot flex downwardly below a preselected position for maintaining at least a minimum pressure in the chamber 318 and 206 at all times. Thus, should any vacuum conditions exist within the well bore, there will be no complete withdrawal of the packing member 236 from engagement with the outer periphery of the rod 202.

With regard to the annular ribs 256 and spaces 254 therebetween (as well as the ribs 96 and annular spaces 94) it is to be noted that under the normal operating pressures encountered in a producing well, the spaces will never be filled with rubber, but will always remain open, thus reducing the amount of pressure necessary for efficiently sealing the sleeve 236 against the rod 202.

Furthermore, it is to be noted that the passageway 298 is sufficiently large with respect to the quantity of fluid passing therethrough into the chamber 300, and is so disposed and located with respect to the chamber 300 as to permit a complete draining or flushing of the chamber upon each pump stroke during the producing operation. This flushing action substantially eliminates any possibility of trapping of liquids in the chamber 300 which might freeze, and further, precludes any accumulation of sludge or other solid particles within the chamber 300. This greatly increases the operating efficiency of the pressure regulator 294.

From the foregoing it will be apparent that the present invention provides a novel inflatable packing member for a stuffing box, or the like, and is particularly designed and constructed for maintaining the most desirable sealing engagement around an oil well polished rod at all times during utilization of the stuffing box. The novel inflatable packing eliminates the need for follower members, and the like, which provide for a mechanical tightening of the packing members. In addition, the pressure acting on the inflatable packing member is automatically adjusted to the most desirable condition corresponding to the pressure conditions of the well, thus reducing manual attendance required for maintaining an efficient operation of the stuffing box and assures the most efficient sealing pressure at

all times for greatly prolonging the useful life thereof. The novel packing member and stuffing box is simple and efficient in operation and economical and durable in construction.

Changes may be made in the combination and arrangement of parts as heretofore set forth in the specification and shown in the drawings, it being understood that any modification in the precise embodiment of the invention may be made within the scope of the following claims, without departing from the spirit of the invention.

What is claimed is:

1. In combination with a stuffing box adapted to be loosely disposed around a reciprocal rod, a pressure sensitive yieldable packing member comprising an elongated body portion having an inner periphery of a normal substantially straight through cylindrical configuration and of an unflexed diametric size whereby the inner periphery is in normal constant sealing engagement with the outer periphery of the reciprocal rod, said body portion being provided with a substantially cylindrical wall spaced from and concentric with the inner periphery thereof, said body portion being flexible radially inwardly in response to fluid pressure differentials acting directly on the cylindrical wall for maintaining a continuous sealing engagement of a predetermined force around the reciprocal rod regardless of wear of the inner periphery of the body portion, and including pressure regulating means secured directly on said stuffing box and in communication with the body portion to provide a unitary device wherein pressure acting on the body portion is automatically maintained at the optimum pressure in accordance with variable operating conditions, said pressure regulating means including a housing secured directly to the stuffing box, a diaphragm secured within the housing and having one side thereof open to pressure existing below the body portion and the opposite side thereof open to the pressure existing around the cylindrical wall of the body portion, said diaphragm being responsive to pressure differentials acting thereon for regulating the pressure acting on the cylindrical wall of the body portion in accordance with the pressure conditions existing therebelow.

2. A stuffing box for an oil well reciprocal polished rod comprising a substantially tubular shaped body member loosely disposed around the polished rod, a pressure sensitive yieldable packing member provided in the body and surrounding the rod, said packing member comprising a substantially cylindrical sleeve having the inner periphery thereof of a normally straight through cylindrical configuration and of a diametric size complementary with the outer diameter of the rod whereby the said inner periphery of the sleeve is in constant sealing engagement with the rod in the unflexed condition of the sleeve, a pressure chamber provided in the body member and surrounding the sleeve, and pressure regulating means secured to the body member for automatically regulating the pressure in the pressure chamber for providing the optimum sealing pressure of the sleeve against the rod at all times, said pressure regulating means comprising housing means secured to the tubular body member, a diaphragm member secured within the housing and having a first side open to the pressure chamber surrounding the sleeve and a second side open to variable pressure in the oil well, said diaphragm being responsive to pressure differentials acting thereon for automatically maintaining the pressure in the chamber surrounding the sleeve at an optimum for maintaining the most efficient sealing engagement of the sleeve against the rod in accordance with the pressure existing in the oil well.

3. A stuffing box for an oil well reciprocal polished rod as set forth in claim 2 wherein the pressure regulating housing means is a sectional housing having the diaphragm member secured between the sections thereof, the first of said housing sections being secured directly to the tubular body member and disposed radially outwardly with respect thereto, complementary passageway means being provided in the tubular body member and the first of said housing sections to provide communication between the pressure chamber and the said first diaphragm side, the second housing section including a tubular member loosely disposed around the rod and secured to the first tubular body member in substantial axial alignment therewith, passageway means being provided in said second housing section to provide communication between the said second diaphragm side and the variable pressure in the oil well, and said tubular member of said second housing section cooperating with the first tubular body member for securing the packing member in position around the rod.

References Cited

UNITED STATES PATENTS

1,772,210	8/1930	Dale	277—28
1,836,470	12/1931	Humason et al.	277—34 X
2,186,139	1/1940	Hild	285—97
2,193,587	3/1940	Fortune et al.	277—34
2,746,709	5/1956	Minor	277—34 X
2,806,721	9/1957	Fagg et al.	277—34 X
2,841,422	7/1958	Badger	277—34
3,145,995	8/1964	Adamson et al.	277—28
2,307,575	1/1943	Davis	277—34 X

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U.S. Cl. X.R.

277—28, 34, 208