Dec. 5, 1961 C. M. O'LEARY 3,011,774

AIR BALANCED OIL WELL EQUIPMENT

Filed Feb. 21, 1958 3 Sheets-Sheet 1

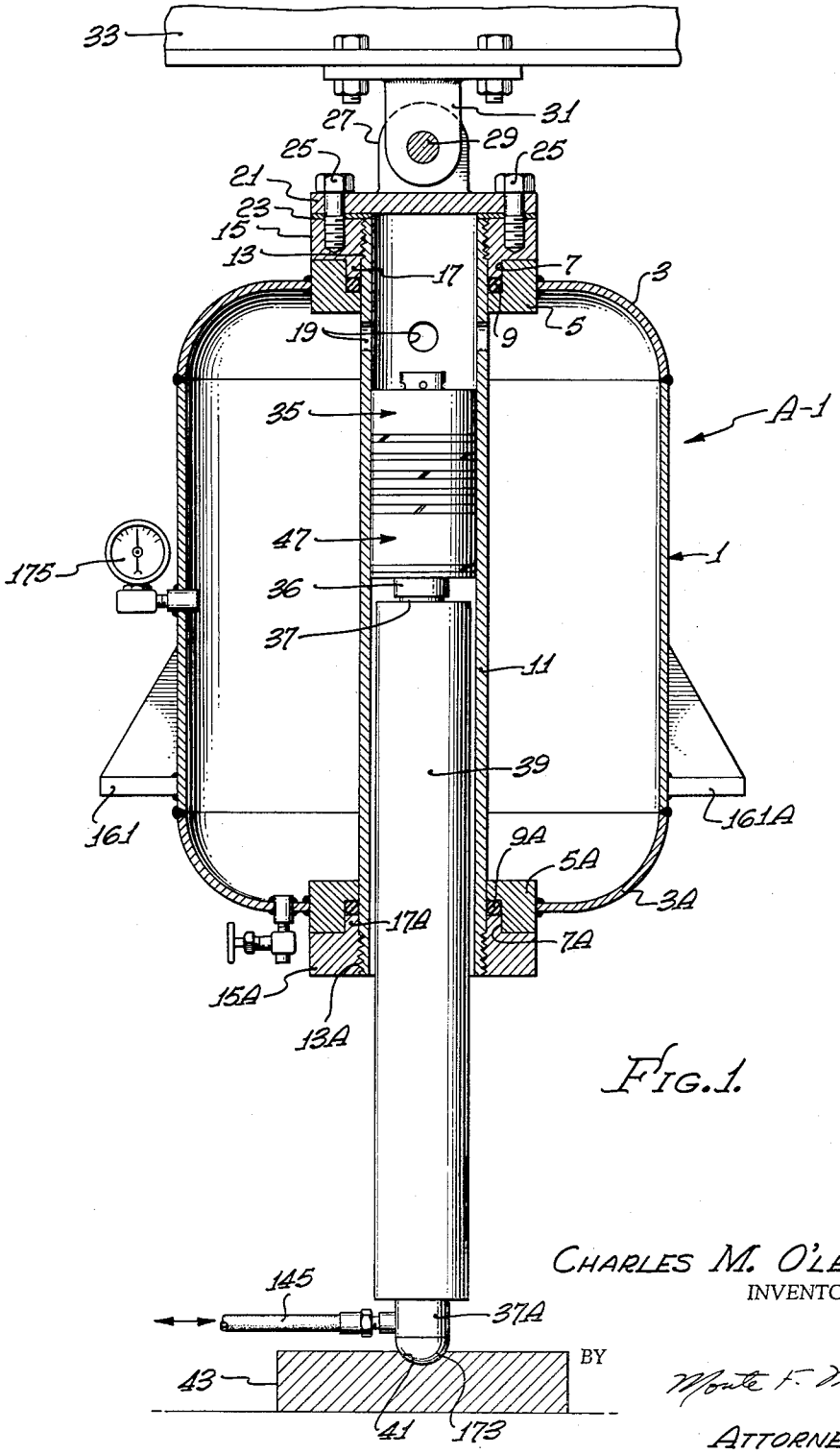


FIG. 1.

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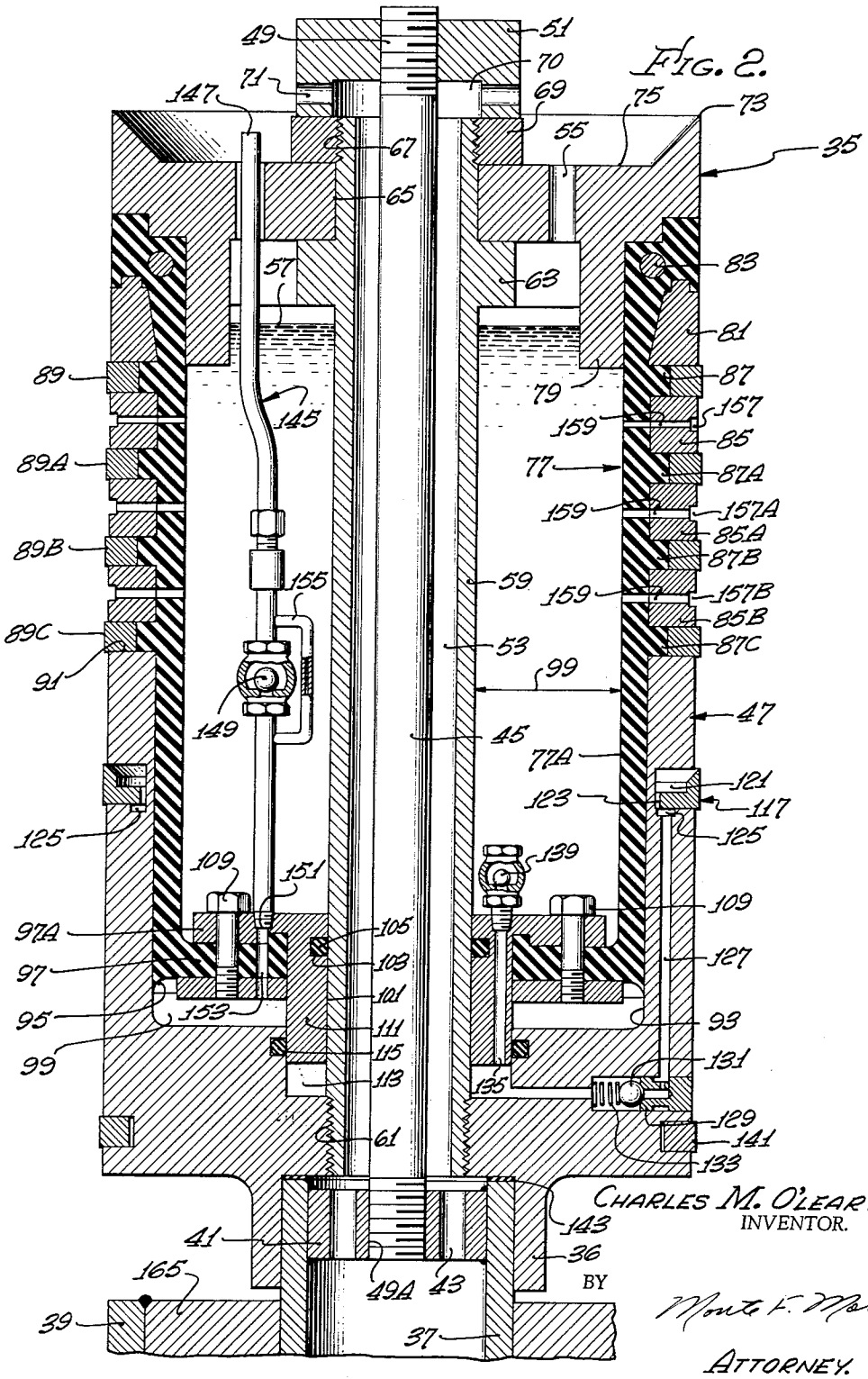
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AIR BALANCED OIL WELL EQUIPMENT

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FIG. 2.



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AIR BALANCED OIL WELL EQUIPMENT

Filed Feb. 21, 1958 3 Sheets-Sheet 3

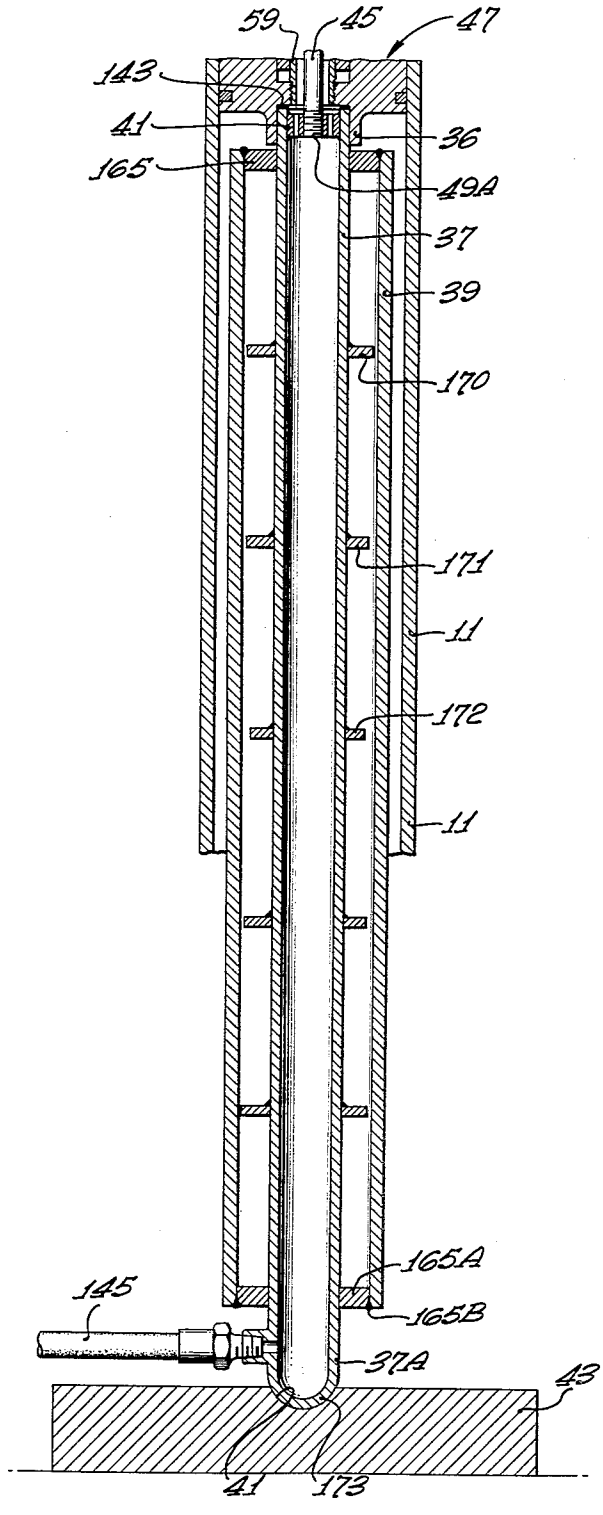


FIG. 3.

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United States Patent Office 3,011,774
Patented Dec. 5, 1961

3,011,774

AIR BALANCED OIL WELL EQUIPMENT

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Filed Feb. 21, 1958, Ser. No. 716,755
6 Claims. (Cl. 267—1)

My present invention relates to air balanced oil well pumping units.

The kinematics of the well pumping structure are well known in the art of air balanced oil well pumping units. The arrangement of the parts to produce reciprocating motion and the support for the air balancing unit and its location, are clearly shown in my Patent 2,325,874, issued August 1943.

It is well known that in the operation of air balanced pumpers it frequently becomes necessary to replace or repair the piston assembly which at the present time necessitates disconnecting the air balance assembly from the beam and laying it on the ground to remove the piston and rod which requires a hoist and several men to make the change, the air balancing assembly which weighs approximately 5,000 pounds. In the present construction the piston assembly is pressed on the piston rod under at least one ton press fit.

It is also well known to those familiar in the art, that all air balanced pumping units manufactured today have an air receiver closed at the top by the air receiver's domed head to which the pivotal-bearing housing is welded. This is a permanent closure of welded construction. The lower end of the air receiver is of full diameter with a heavy reinforcing ring at its lower end. The air receivers vary in diameter from 30 inches to as much as 54 inches. The air cylinder and cylinder heads are made of cast iron. The cylinder head forms the closure for the bottom side of the air receiver. The cylinder heads vary from six (6) to twelve (12) inches thick which is necessary to hold the pressure and come up to the pressure vessel codes.

It is an object of this invention to develop an air balanced cylinder air receiver assembly that is cheaper to make and cheaper to repair, such as replacing an air balance piston.

It is a further object of this invention to support the air receiver between the ends of the air balancing cylinder.

It is the object of this invention to support the weight of the air receiver and the balancing cylinder on a cylinder head which is pivotly connected to a walking beam.

It is an object of this invention to relieve the air receiver from all stresses except the internal air pressure and its variations between the up and down stroke of the pumping unit.

It is an object of this invention to relieve the air balancing cylinder and its attached air receiver from all stress and providing an air balancing assembly that is perfectly balanced internally and with all of the load being on the cylinder head which is attached to the walking beam with the bolted cylinder head forming a closure for the upper end of the balancing cylinder, the stress on the bolted cylinder head being only the weight of the air balancing cylinder and its surrounding air receiver in a downward direction and the air pressure on the cylinder head in the upward direction.

It is an object of this invention to provide a piston and piston rod assembly wherein the piston may be separated from the piston rod by removing one clamping bolt and lifted off.

It is an object of this invention to provide a piston assembly having two fixed heads and a flexible piston ring carrier between the two fixed heads.

A further object of this invention is to provide a flexible self-aligning piston, piston ring assembly between

two fixed heads that will conform to variations in short sections, with the short sections free floating in the cylinder bore so as to adjust themselves to the out-of-parallel or out-of-round of the cylinder to prevent air blow-by of the piston assembly within the length of the piston assembly in the air balancing cylinder bore.

It is also an object of this invention to provide a piston lubrication system that induces lubricant flow past the sealing piston rings into a suction chamber that is isolated from atmospheric pressure.

It is an object of this invention to utilize the difference between the fluctuation of the air pressure between the up and down strokes of the air balancing unit to pump lubricating oil from the exterior of said piston back to the interior of said piston.

It is a further object of this invention to provide a reinforced piston rod.

A further object of this invention is to provide a hollow piston rod with flexure limits.

FIGURE 1 is a section taken through the air-receiver, air-balance cylinder, cylinder head, and pivotal base.

FIGURE 2 is a section through the air-balancing piston.

FIGURE 3 is a section through the reinforced piston rod and the pivotal base and a fragmentary section through the piston and cylinder assembly.

FIGURE 1 in the drawings, that portion defined by the arrows, A–1, defines the air receiver and balancing cylinder assembly that is shown in section in which 1 is the air receiver shell; 3 and 3A represent the air receivers dished heads. Numbers 5 and 5A are welded air receiver flanges; 7 and 7A are packing gland recesses. Numbers 9 and 9A represent packing material. Number 11 is the air balance cylinder; numbers 13 and 13A show a threaded portion on opposite ends of air balance cylinder 11; numbers 15 and 15A represent screwed clamping flanges on said air cylinder 11 which hold the air receiver suspended between the opposite end of air cylinder 11; 17 and 17A are packing gland compression members which are an integral part of the screwed flanges 15 and 15A, and compress packings 9 and 9A into packing gland recesses 7 and 7A to form a seal between air receiver flanges 5 and 5A, and the air cylinder 11 and its connections. This then comprises an air cylinder and air receiver that is sealed pressure tight with the air receiver 1 firmly attached between both ends of the air cylinder 11. In the air cylinder 11 we provide air ports 19 which permits the flow of air from air receiver 1 to the interior of air cylinder 11 and visa versa. The air cylinder's upper end is closed by cylinder head 21. The cylinder head 21 is sealed by the cylinder head gasket 23 which provides an air tight joint between screwed flange 15 and cylinder head 21. Compression bolts 25 maintain the head gasket 23 compressed and air tight. Further, the bolts 25 hold the cylinder head, air receiver and air cylinder connected as a unit with one closed end as described above. The cylinder head 21 carries a roller bearing housing which is inserted in the bore of the upward projecting portion of cylinder head 21 and is designated as 27. The roller bearing is not shown. Pin 29 is supported by the beam pivotal support 31 which is bolted as shown to the walking beam 33. The bearing assembly has been eliminated for brevity and is well known in the art.

We now have an air receiver supported on an air cylinder intermediate its ends, a seal between the opposite ends of said air cylinder and said receiver. Fluid flow ports between the interior of said air receiver and the interior of said air cylinder which permits fluid flow from one to the other, and a fixed closure on one end of the air balancing cylinder which is attached to a walking beam and when under pressure exerts an upward force

against the walking beam to oppose the weight of the sucker rods and the weight of one-half of the fluid column. To accomplish this the lower end of the air balance cylinder must be closed. This is accomplished by a piston and piston rod assembly that is pivotly mounted on a fixed base. Due to the controlled forces exerted the piston and cylinder assembly are caused to move to and from each other by movement of the walking beam. The forces referred to are, namely, the weight of the well attached to the horse head, the pitman arm force and the air pressure in the balancing unit, all of which are not shown but are familiar to any one in the art.

The closure for the lower end of the air balance cylinder includes a piston and piston ring assembly mounted on a piston rod **37**, pivoted at its lower end **41**, on a fixed stationary base **43**, which supports the piston rod assembly. In FIGURE 1, **35** represents the piston, piston ring assembly, which seals off the pressure in the downward direction of the air cylinder. **36** represents the piston assembly connector collar; **37** the piston rod connector shaft and **143** the sealing gasket, all of which will be fully described in FIGURE 2 of the drawings.

In FIGURE 2 is shown the flexible self-lubricating piston and ring assembly which is attached to the piston rod **37** and piston rod tube **37**. The piston rod tube **37** is provided with spider **41**, which is welded into piston rod tube **37**, which is drilled with a series of fluid ports **43** and threaded opening **49A**, which received the lower threaded connecting rod **45**. The piston assembly has two stationary heads, the upper piston head **35** and lower piston head **47**. These two heads are held spaced apart by piston rod mandril **59** which is provided with a threaded connection at its lower end indicated at **61**, which screws into the lower piston head **47** and forms a rigid connection to the lower head **47**. The elongated piston head mandril **59** has an enlarged section near its upper end as indicated at **63** to support the upper piston head **35**. The upper piston head **35** is provided with an opening indicated at **65** which permits the upper piston head **35** to rest on piston head mandril **63**.

The upper end of the piston head mandril projects through bore **65** and is threaded at its upper end as indicated at **67** to receive upper piston head lock-nut **69** which spaces and holds the upper piston head **35** and the lower piston head **47** in fixed spaced relationship. The upper end of piston rod connector **45** is threaded at its upper end to receive piston rod connector **51**. The piston rod connector **51** is recessed at its lower end as indicated at **70** and is provided with air ports **71** which permits air passage from air passage **53** to the upper side of the piston assembly, also air passages **43** and the hollow piston rod **37**. We now have an upper and lower piston head held in spaced relationship, an air passage through the piston communicating with the area above the piston and the hollow piston rod.

The upper piston head **35** is provided with an upper lip **73** which scrapes excess oil from the cylinder wall and returns the oil to the dished portion **75** of the upper piston head **35** for return to the oil reservoir **57** through port **55** which serves both an air and oil port.

The space between the upper piston head **35** and the lower piston head **47** is filled with a hollow rubber sleeve **77** which is anchored to the upper piston head extension **79** and wedge guide ring **81** and reinforcing ring **83**, which are vulcanized as a unit when the rubber sleeve **77** is moulded. The piston ring recess steel rings **85**, **85A** and **85B** are also vulcanized in space relationship to each other to permit piston rings to be inserted in the spaces and permit the piston rings to float freely in the grooves. When under pressure the rubber sleeve **77** has projections extending into the ring groove **87**, **87A**, **87B**, **87C** which forms a flexible seal between the air cylinder **11**, the piston rings **89**, **89A**, **89B**, **89C**, under the influence of the air pressure exerted on the oil in the rubber sleeve **77**. The projections **87**, **87A**, **87B**, **87C** seals, respectively, the inner circumferences of piston rings **89**, **89A**, **89B**, **89C**, and prevents air blow-by of the piston rings on the inner diameters thereof.

We now have the rubber sleeve **77** between the upper piston head **35** and the lower piston head **47**. It will be noted that the piston ring assembly is free floating and may adjust itself laterally in the air cylinder **11** to conform to the out-of-parallel or out-of-round sections therein and prevent blow-by of the piston in short sections.

It will be noted that lower piston head **47** has an upper shoulder **91**. The lower piston head-bore houses rubber sleeve **77**'s extension **77A** which projects into the internal bore **93** of lower piston head **47**. The lower end of rubber sleeve **77A** is provided with a cupped shaped seal, indicated at **95**, which seals the area between rubber sleeve projection **77A** and bore **93**. Rubber sleeve **77A** is provided with a flanged section at its lower end as indicated at **97** which, when in cooperation with other parts to be described in detail, forms an air tight closure for rubber sleeve **77** at its lower end. Flanges **97** and **97A** form a seal to prevent the uncontrolled flow of fluid into the interior of the rubber sleeve **77** and air passage **53**. The internal bore **101** of flange **97A** is a running fit-on piston head mandril **59**. Flange **97A** is provided with an O-ring groove **103** and an O-ring seal **105** which forms a fluid tight seal between flange **97A** and the piston head mandril **59**. It is to be noted that the flange **97A** is in sliding relationship with the stationary piston head mandril **59**. It is to be understood that flange **97A** is on the inner side of rubber sleeve extension **77A**. Flanges **97** and **97A** when bolted up by bolts **109** clamp the two firmly together to provide in combination a piston head **111** in a pump chamber **113**. The space **99** represents a cylindrical chamber in which head **111** is free to be reciprocated in, under the influence of pressure changes between the up and down strokes of the walking beam and its associated air balance pumping counter balancing parts. The lower part of piston head **111**, which is of reduced diameter, extends into chamber **113**, which is formed in the lower portion of the lower piston head **47** and is sealed from chamber **99** by seal ring **115**. Chamber **113** is now the oil pumping unit of the cylinder lubricating system, having both intake and discharge port, as will now be described.

The piston ring **117** has a sharp tapered edge facing upwardly and a recess behind the outer periphery of the piston ring **117** indicated as **121**. The piston ring **117** is so designed as to provide a space between the piston ring and the inner wall of the piston-ring groove indicated at **123**. Under the piston ring on the lower side is provided oil collection groove **125** which permits oil to be drawn from behind the piston ring through oil passage **127** which is in communication with piston ring groove **123**, thence through ball seat **129**, intake check-valve **131**, check-valve spring **133**, through pump intake port **135** into pump chamber **113**.

Under the pumping action of the rubber sleeve extension **77A** which is brought about by the fluctuation of pressure in the balancing system between the up-and-down strokes which varies as much as 60 p.s.i. the piston **111** moves up and down in cylinder **113**. On the up stroke of the piston a low pressure is created in cylinder **113** causing check valve **131** to open and draw fluid from behind the piston ring **117** through the chambers, clearances and ports hereinbefore referred to. Piston **111** is ported at **135** to provide a passage from cylinder **113** to the interior of rubber sleeve **77**. The upper end of port **135** is threaded to receive vertical check valve **139**, which permits fluid to be discharged from cylinder **113** but not to be drawn into chamber **113** through check valve **139**.

This then provided a low pressure area to be created in chamber **121**, which is below atmospheric pressure and insures an inducted flow of lubricant by the piston rings. To insure this induced flow we provide piston ring **141** at

the lower end of the lower piston head 47 to seal off the atmospheric pressure from the lubricating system, as any exposure of the lubricating system to atmospheric pressure will reduce the efficiency of the coil circulation system. It is understood that rings 141 may be duplicated to more than one ring to effectively seal off atmospheric pressure from the system.

Piston 111, rubber flange 97, clamping ring 102 and clamping bolts 109, which forms a closed lower end of rubber sleeve extension 77A and forms a compound piston of two different diameters, one of which reciprocates in cylinder 193. Under the influence of air pressure fluctuation between the up and down stroke of the air balance cylinder the smaller diameter piston, which is part of piston 111, reciprocates in cylinder 113 under the influence of the pressure changes in the air system to pump oil as hereinabove described. In most instances the air pressure fluctuation in the air system is from 350 p.s.i. high and 305 p.s.i. low. For deeper well the pressures and the pressure differentials are increased.

It will be noted that the pressures are rather high and that the piston diameters vary from 8 inches to as much as 14 inches, which would exert a tremendous pressure in a downward direction on piston 111 if the chamber 109 were vented to atmosphere.

In the preferred form of this invention the lower side of piston 111 is in communication with the area above the piston assembly through tube 145 and its upper open end 147 which projects above the dished portion 75 of upper head 35.

The tube assembly 145 is provided with a vertical check valve 149 which is intermediate the upper end 147 and the lower end 151 of tube 145. The lower end of tube 145 is threaded at its lower end as indicated at 151, to engage threaded air port 153 which passes through piston 111 and communicates with air chamber 99.

The check valve 149 opens in an upward direction and permits air to flow from chamber 99 but not to enter chamber 99 through check valve 149.

To admit pressure from the top side of piston 111 to chamber 99 which is on the lower side of piston 111, we provide a by-pass line 155 around check valve 149 of a very small diameter or, as an alternative not shown, the seat of check valve 155 may be nicked to provide a limited downward flow of air pressure on the high pressure cycle of the pumping stroke.

The by-pass line 155 permits a limited downward flow of air pressure past check valve 149 to chamber 109 on the downward stroke of the air balance cylinder which is the high pressure portion of the pumping cycle.

On the up stroke of the air balancing system, the pressure reduces permitting check valve 149 to open exposing chamber 109 to the low pressure portion of the pumping cycle which permits the tension in the rubber sleeve 77A to return to its normal position. After the balancing cylinder has reached the top of its stroke and begins to descend on the down-stroke, the pressure beings to build up, closing check valve 149. The pressure build-up on the top side of the piston leaks slowly by check valve by-pass line 155 into chamber 109 through piston port 153 and its attached fluid line 145. The rate of flow is always so restricted that a higher pressure is exerted on the top side of piston 111 than on the lower side of piston 111. The normal pumping cycles are at 20 strokes per minute, which means that the down stroke requires 1½ seconds and the up stroke 1½ seconds.

It is to be noted that the down stroke is the compression-cycle and the up stroke is the expansion cycle of the pumping cycle and that the rubber sleeve extension 77A responds to this fluctuation of pressures and that the valve and by-pass lines as above described exert and release alternately the forces exerted on piston 111 to cause a reciprocating motion which pumps fluid from chamber 121 and returns it to oil reservoir 57 within the piston structure.

The steel rings 85, 85A and 85B carry oil grooves 157, 157A and 157B. The oil port 159 communicates with oil groove 157 through steel ring 85 and rubber sleeve 77 to oil reservoir 57 to provide external oil lubrication to the piston and ring assembly. The oil port 159 may be extended to any number of the steel rings as required for good lubrication of the piston and cylinder walls.

In the construction of the piston and piston rod assembly, the piston is held clamped to the tubular piston rod by bolt 45, which screws at its lower end into spider 41 which is welded to piston rod 37. The lower piston head 47 carries a collar 36 which is recessed to receive piston rod 37 and a sealing gasket 143 which makes an air tight joint between the lower piston head 47 and hollow piston rod 37.

The upper end of connecting rod 45 is threaded at 49 and forms a screwed connection with piston rod connector 51 which engages piston head lock nut 69 to hold the piston 35 on hollow piston rod 37 and sealing gasket 143.

To remove the piston from the cylinder a post (not shown) is placed under the walking beam 33 to support it. Jacks (not shown) are placed under jack brackets 161 and 161A on air receiver 1 as shown in FIGURE 1 cylinder head bolts 25 are removed from cylinder head 15. The air receiver 1 is lowered by the jacks until the air piston 35 is accessible. Then piston rod connector 51 is unscrewed which permits the piston assembly to be removed for inspection and service. To replace the unit it is only necessary to place the piston back over the piston rod connector 45, make up the piston rod connector 51 which pulls the piston down on gasket 143 shown in FIGURE 2 to make an air-tight connection between piston 35 and hollow piston rod 37. The air receiver 1 is then raised by the jacks as hereinbefore mentioned but not shown, pressing up on lifting flanges 161 and 161A shown in FIGURE 1 until the screwed flange 15 contacts cylinder head 21. Then compression bolts 25 are made up tightening cylinder head gasket 23 forming an air-tight connection at the upper end of cylinder 11. Air pressure is then admitted to the system from a pressure source not shown through air pressure line 145 which communicates with the interior of hollow piston rod 37. The pressure in the air receiver 1 and balancing cylinder 11 through ports 19 builds up a force which will balance the weight of the air cylinder 11 and air receiver 1 and walking beam 33. The post (not shown) but hereinabove referred to may then be removed. The polish rod clamp not shown may be clamped in position and the necessary air pressure to counterbalance the well may then be admitted to the balancing unit so that pumping operations can be continued. The automatic maintenance of the air pressure in the balancing system is well known in the art, and therefore is not a part of this invention.

FIGURE 3 is a section through the reinforced piston rod 39 as shown in FIGURE 1 in which 39 is an outer reinforcing tube for hollow piston rod 37 which is closely spaced to cylinder wall 11 to provide the maximum columnar strength to the piston rod 37. The piston rod's reinforcing sleeve 39 is held in spaced relationship with hollow piston rod 37 by flange 165 which is welded or otherwise installed so as to form a spaced relationship between the hollow piston rod 37 and the reinforcing sleeve 39. The lower flange 165A is spaced between reinforcing sleeve 39 and the piston rod 37 at its lower end as indicated at 165B by welding or other suitable means to hold piston rod 37 and the reinforcing sleeve in spaced relationship at its lower end.

The hollow piston rod 37 carries spacer rings 170—171 and 172 which are welded to hollow piston rod 37.

The spacer ring 170 is spaced from the reinforcing sleeve 39 approximately ⅛" on the diameter; and spacer ring 171 is spaced approximately ¼" on the diameter from the reinforcing sleeve 39. Spacer ring 172 is spaced approximately ⅜" on the diameter from reinforcing

sleeve 39. The two rings, not numbered, are spaced approximately ¼" and ⅛" respectively, as indicated by the drawing, which will permit a limited flexure between the hollow piston rod 37 and the reinforcing sleeve 39.

It is to be understood that on air balanced pumpers having stroke length of approximately 84" and under, the spacer rings 170, 171, 172 may be dispensed with. However, for longer stroke lengths up to 20 feet, the spacer rings are very necessary to prevent undue wear on the piston and cylinder.

The lower end of hollow piston rod 37—indicated at 37A—carries a spherical head 173, which seats in a spherical seat 41, on the fixed base 43. The spherical head 173 moves with the hollow piston rod 37 and is fixedly attached thereto, and pivots in seat 41 of the fixed base 43 under oscillatory motion of the walking beam and the air balancing unit.

From the foregoing description, it is believed that it is evident that a material difference exists in the construction and arrangement of the parts, to be distinguishable over the prior art of record.

What is claimed is:

1. An air balanced pumper assembly comprising a connecting means releasably attached to a reciprocating walking beam for supporting structure; an air receiver on and releasably supported by said means; an air cylinder within the air receiver and being of constant internal diameter from end to end of said air receiver; said cylinder having ports intermediate the ends thereof that communicate with said receiver; a base supported and hollow piston rod assembly that extends into said air cylinder; a ported and hollow piston assembly releasably attached to said rod assembly that is in communication with said air cylinder and said rod assembly; a resilient piston for the pumping of fluid, attached to the interior of said piston assembly; said piston assembly and resilient piston defining a cylinder chamber in communication with the interior of said piston assembly and a pump chamber; and a fluid supply and return conduit connected to said rod assembly.

2. A piston assembly comprising a pair of piston heads and a sleeve, the latter being telescoped within one and over the other; said sleeve being made of resilient material, a portion of which is adapted to reciprocate relative to one of said heads for the pumping of fluid; a liquid lubricant in said sleeve; ported rings on the sleeve that register with ports in said sleeve; a sealing means on one of said piston heads that are adapted to prevent fluid flow; a cylinder chamber between said sleeve and pair of piston heads; a wiper ring on one of said piston heads; collecting means, between said sleeve and one of said heads, in communication with said wiper means into which lubricant is directed; and pumping structure, between one of said heads and sleeve, in communication with said collecting means for returning said lubricant to said sleeve.

3. A piston assembly comprising a pair of piston heads and a sleeve, the latter being telescoped within one and over the other; said sleeve being made of resilient material, a portion of which is adapted to reciprocate relative to one of said heads for the pumping of fluid; a liquid lubricant in said sleeve; ported rings on the sleeve that register with ports in said sleeve; a sealing means on one of said piston heads that are adapted to prevent fluid flow; a cylinder chamber between said sleeve and pair of piston heads; a wiper ring on one of said piston heads; collecting means, between said sleeve and one of said heads, in communication with said wiper means into which lubricant is directed; and pumping structure, between one of said heads and sleeve, in communication with said collecting means for returning said lubricant to said sleeve; said sealing means being a piston ring.

4. A piston assembly comprising a pair of piston heads and a sleeve, the latter being telescoped within one and over the other; said sleeve being made of resilient material, a portion of which is adapted to reciprocate relative to one of said heads for the pumping of fluid; a liquid lubricant in said sleeve; ported rings on the sleeve that register with ports in said sleeve; a sealing means on one of said piston heads that are adapted to prevent fluid flow; a cylinder chamber between said sleeve and pair of piston heads; a wiper ring on one of said piston heads; collecting means, between said sleeve and one of said heads, in communication with said wiper means into which lubricant is directed; and pumping structure, between one of said heads and sleeve, in communication with said collecting means for returning said lubricant to said sleeve.

5. A piston assembly comprising a pair of piston heads and a sleeve, the latter being telescoped within one and over the other; said sleeve being made of resilient material, a portion of which is adapted to reciprocate relative to one of said heads for the pumping of fluid; a liquid lubricant in said sleeve; ported rings on the sleeve that register with ports in said sleeve; a sealing means on one of said piston heads that are adapted to prevent fluid flow; a cylinder chamber between said sleeve and pair of piston heads; a wiper ring on one of said piston heads; collecting means, between said sleeve and one of said heads, in communication with said wiper means into which lubricant is directed; and pumping structure, between one of said heads and sleeve, in communication with said collecting means for returning said lubricant to said sleeve; said collecting means being a lubricant receiving chamber.

6. A piston assembly comprising a pair of piston heads and a sleeve, the latter being telescoped within one and over the other; said sleeve being made of resilient material, a portion of which is adapted to reciprocate relative to one of said heads for the pumping of fluid; a liquid lubricant in said sleeve; ported rings on the sleeve that register with ports in said sleeve; a sealing means on one of said piston heads that are adapted to prevent fluid flow; a cylinder chamber between said sleeve and pair of piston heads; a wiper ring on one of said piston heads; collecting means, between said sleeve and one of said heads, in communication with said wiper means into which lubricant is directed; and pumping structure, between one of said heads and sleeve, in communication with said collecting means for returning said lubricant to said sleeve; said structure being a passage and ball check valve.

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