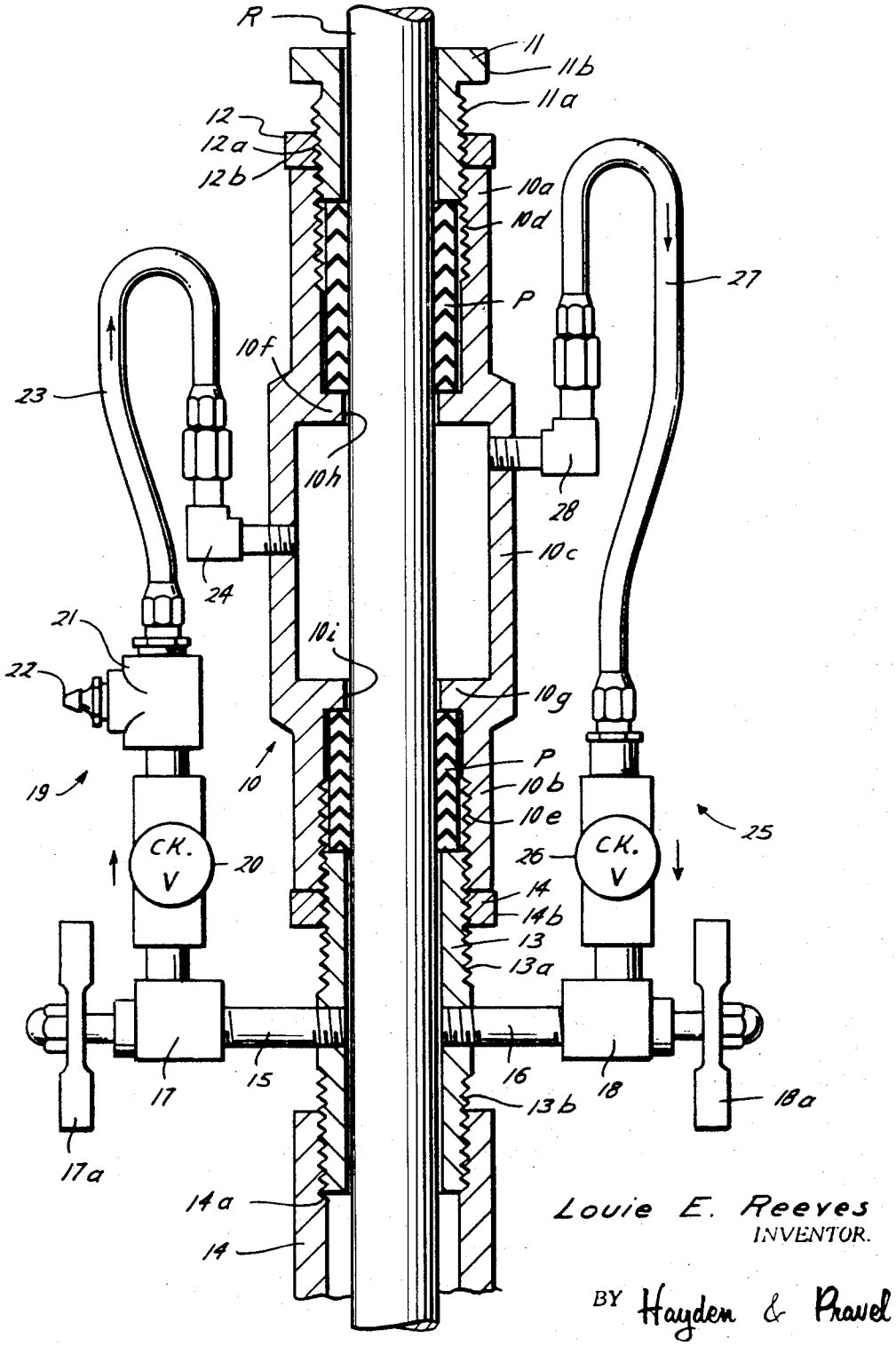
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SELF-COOLED OIL WELL POLISH ROD STUFFING BOX

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SELF-COOLED OIL WELL POLISH ROD STUFFING BOX

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ABSTRACT OF THE DISCLOSURE

A cooling chamber is disposed coaxially between two packing chambers to form a housing adapted to receive a moving polish rod. Input and output supply lines having oppositely opening one-way valves communicate between the cooling chamber and the interior of the production tubing in an oil well to circulate the production fluid through the cooling chamber as the pressure in the production tubing is altered by the pumping motion of the polish rod.

BACKGROUND OF THE INVENTION

Field of the invention

The invention pertains generally to oil well production equipment and in particular to a new and improved oil well polish rod stuffing box employed in oil well pumping installations.

After completion of an oil well, it is usually necessary to pump the oil up from its subsurface deposit through the production tubing. For this purpose, a pump is generally positioned within the tubing below the level of the oil. The pump is driven from the surface by a "pumping jack" through a reciprocating linkage of "sucker rods" moving through the tubing. The upward movement of the sucker rods co-operates with the pump to lift the oil through the tubing and push it into an above surface flow line which is secured to the wellhead by a pumping T. The pumping T is equipped with means which provides packing about the reciprocating sucker rods to permit the sucker rod linkage to communicate between the pumping jack and pump through the pumping tee without the loss of any of the oil which is being produced. That attachment or portion of the pumping T which provides the packing around the reciprocating rod is called a "stuffing box," while that portion of the reciprocating sucker rod linkage which slides through the packing is called a "polish rod."

In many of the known stuffing boxes, the sliding movement of the polish rod through the packing in the stuffing box generates a great deal of harmful frictional heating which may cause leakage through rapid wear or destruction of the packing material and which may also cause damage to the polish rod. Periodic inspection of such stuffing boxes is required to reduce production loss and damage to the pumping equipment which may occur when a rod has been destroyed or the packing begins to leak from wear. The frequent need to inspect and replace damaged rods or worn packing increases production expenses and contributes to costly periods of nonproduction.

Description of the prior art

Certain prior art devices have attempted to reduce the undesirable frictional heating and wear by lubricating the stuffing box. Such prior art devices have generally been relatively complex and have not satisfactorily achieved the desired cooling and lubrication. Some of such devices have required external reservoirs of lubricating fluid which required frequent refilling or have required periodic inspection and attendance due to the relatively complicated apparatus employed. Another drawback in many of the prior art devices which have atempted to reduce frictional

heating and wear has been that the pumping equipment must be shut down for an undesirably long period during the initial installation of the equipment or for any subsequent maintenance.

SUMMARY OF THE INVENTION

The self-cooled stuffing box of the present invention uses the high pressure in the production tubing to cause the production fluid to flow into a cooling chamber through an inlet supply line which is equipped with a one-way valve. A return line is connected to the production tubing to provide an outlet for the fluid contained in the cooling chamber when the well pressure is reduced during the low pressure portion of the pumping cycle. A second one-way valve in the return line co-operates with the valve action in the inlet line to provide circulation of fluid through the cooling chamber to carry away the frictional heat generated in the stuffing box. The stuffing box is also designed to leave a reserve of fluid in the cooling chamber to lubricate the polish rod during periods when the well is pumped dry or when the pump fails or where for any other reason there is no fluid present within the pumping T.

The relative simplicity of the stuffing box of the present invention as well as its use of readily available components reduces the total cost of the box and also assures ease of installation as well as a lower frequency of repair rate. Due to the self-contained aspect of the stuffing box of the present invention, periodic restocking of the lubricating fluid is not required. The stuffing box of the present invention has an increased life and provides a minimum of lost production time during the replacement of the packing or during the repair or initial installation of the equipment.

It is therefore an object of the present invention to provide an improved stuffing box which is self-lubricating and self-cooled. This object and other objects will become more apparent from the following description and drawings.

DESCRIPTION OF THE DRAWING

The figure is an elevation partially in section illustrating the self-cooled oil well polish rod stuffing box of the present invention mounted in position on a pumping T.

DESCRIPTION OF THE PREFERRED EMBODIMENT

As illustrated in the figure of the drawing, the stuffing box of the present invention comprises a hollow metal body or housing indicated generally at **10** which is coaxially mounted about a section of polish rod R. Two packing chambers **10***a* and **10***b* are formed at the axial ends of the housing **10** and a cooling chamber **10***c* is centrally disposed between the packing chambers **10***a* and **10***b*. The packing chambers **10***a* and **10***b* have an interior cylindrical wall with threads **10***d* and **10***e*, respectively, formed at their outermost ends. The innermost ends of the packing chambers **10***a* and **10***b* abut packing stops **10***f* and **10***g*. The stops **10***f* and **10***g* are centrally apertured at **10***h* and **10***i*, respectively, with the openings having diameters greater than the diameter of the rod R to prevent any metal to metal contact between the housing **10** and the moving rod R. The cooling chamber **10***c* is cylindrically shaped with the diameter of the interior cylindrical surface of the chamber **10***c* being greater than the internal diameter of the packing chambers **10***a* and **10***b*.

The packing chambers **10***a* and **10***b* contain several stacked sections of split ring asbestos packing P which firmly engage the polish rod R to form a seal between the moving rod R and the housing **10**. The packing P is held in compression in the chamber **10***a* by a packing collar **11** to force the packing P to bear tightly against the

outer surface of the rod R. The packing collar **11** is equipped with threads **11***a* which mate with the internal threads **10***d* of the packing chamber **10***a*. The collar **11** may be removed from the housing **10** or adjusted to alter the compression of the packing P with the assistance of a wrench or the like acting on a wrench surface which is provided on the collar at **11***b*. A lock ring **12** with internal threads **12***a* engages the threads **11***a* of the collar **11** to prevent undesired movement of the collar **11** with respect to the housing **10**. The lock ring **12** is equipped with an external wrench surface **12***b* to assist in tightening the ring against the housing **10**.

The packing P in the packing chamber **10***b* is held in position with a threaded adapter nipple **13** having threads **13***a* which engage the internal threads **10***e* of the lower packing chamber **10***b*. The adapter nipple **13** is locked in position by a lock ring **14** having threads **14***a* which engage the threads **13***a* of the adapter nipple **13**. The lock ring **14** is provided with wrench surfaces **14***b* to which a wrench may be applied to assist in securing the ring **14** against the housing **10**.

The lower end of the adapter nipple **13** is provided with threads **13***b* which engage internal threads **114***a* formed in the upper end of a pumping T **114**. A central unthreaded body portion of the adapter nipple **13** is tapped by two smaller threaded nipples **15** and **16**. One end of the nipples **15** and **16** communicates with the interior of the adapter nipple **13** to provide an access opening between the fluid contained within the adapter nipple **13** and the cooling chamber **10** while the second ends, respectively, of the nipples **15** and **16** engage the control valves **17** and **18**. The opening through the valve **17** may be adjusted or entirely closed by rotating the handle **17***a*. Similarly, rotation of the handle **18***a* adjusts or closes the valve opening in the valve **18**.

The nipple **15** and valve **17** form the first part of an inlet supply line indicated generally at **19**. The supply line **19** carries the production fluid contained within the adapter nipple **13** to the cooling chamber **10***c*. A one-way check valve **20** is connected between the valve **17** and a small T fitting **21** to permit the production fluid to flow only in the direction of the arrow. The T fitting **21** carries a standard grease fitting **22** for a purpose to be hereinafter described. The upper end of the T fitting **21** is connected to a high pressure, flexible line **23** which in turn is connected to an elbow **24**. The elbow **24** opens into the approximate mid point of the interior of the cooling chamber **10***c*.

The nipple **16** and valve **18** form a portion of a return line, indicated generally at **25**, which conducts fluid from the interior of the cooling chamber **10***c* to the interior of the adapter nipple **13**. The valve **18** is connected to a one-way check valve **26** which permits the production fluid to flow only in the direction of the arrow. The upper end of the check valve **26** is connected to a high pressure flexible line **27** which in turn is connected to an elbow **28**. The elbow **28** opens through the housing **10** into the upper end of the interior of the cooling chamber **10***c*.

In the operation of the self-cooled stuffing box **10** of the present invention, the pump placed in the oil well is driven by a pumping jack (not shown) causing the polish rod R to reciprocate vertically through the box **10**. As the rod R moves on the upward stroke of its cycle, the pressure of the fluid (which includes gas and air bubbles) within the pumping T **114** increases and forces fluid through the check valve **20** in the supply line **19** and into the cooling chamber **10***c*. On the downward stroke of the pumping cycle, the pressure in the pumping T decreases and the higher pressure of the gas and fluid in the cooling chamber **10***c* causes a portion of its contents to flow back into the pumping T.

The fluid in the chamber **10***c* lubricates a section of the rod R as it reciprocates through the chamber. The lubrication is carried along the rod to reduce the friction and resultant frictional heating and wear caused by the rubbing seal action of the packing P against the rod R. The stuffing box **10** and rod R are cooled by fluid from the production tubing which enters the chamber **10***c* through the supply line **19** where it is heated by the frictionally generated heat in the box **10** and rod R and is then carried away from the chamber **10***c* through the return line **25**.

The valves **17** and **18** may be adjusted as desired to regulate the rate of fluid circulation through the cooling chamber **10***c*. If desired, the valves **17** and **18** may be completely closed to permit testing, inspection, or repair.

As illustrated in the drawing, the return line **25** communicates with the upper end of the interior of the cooling chamber **10**. When for any reason the pumping action should fail to provide fluid at the interior of the nipple **13**, the fluid below the level of the upper end of the line **25** in the cooling chamber **10***c* forms a reservoir of fluid which continues to provide lubrication for the moving rod.

The grease fitting **22** is a standard fitting having a one-way action which permits fluid to be introduced into the T fitting **21** and supply line **19** but prevents an opposite escaping flow of the contents of the T. The grease fitting **22** is used to prime the chamber **10***c* with a lubricating fluid after the initial installation of the stuffing box **10**, or it may be employed to supply the cooling chamber **10***c* with a lubricant when there is no production fluid in the nipple **13**.

Replacement of the worn packing P in the upper packing chamber **10***a* is easily effected by simply closing the valve **17** releasing the lock ring **12** and unscrewing the packing collar **11** from the housing **10**. The collar **11** and ring **12** are lifted up along the rod R; the worn packing is removed from the packing chamber **10***a* and replaced with new packing. The packing P is preferably in the form of semicircular ring segments so that the packing may be placed in the packing chamber without removal of the rod R. When the desired number of layers of new packing P have been placed in the packing chamber **10***a*, the collar **11** is threaded back into the housing **10** and secured by the lock ring **12**.

The replacement procedure for the packing P in the lower packing chamber **10***b* requires that the pumping action be stopped, the flow line closed off, and the pressure in the production tubing reduced. The supply line **19** and return line **25** are separated to break the linkage between the adapter nipple **13** and the housing **10**. The lock ring **14** is then loosened and the housing **10** is unscrewed from the threads **13***a* of the adapter nipple **13**. The housing **10** may then be lifted up along the rod R to permit the worn packing P to be replaced. The housing **10** is then rethreaded onto the adapter nipple **13** and secured by tightening the lock ring **14**.

While only the preferred form of the invention has been described herein, it is understood that various changes may be made in its construction by those skilled in the art without departing from the spirit of the invention. Thus, by way of example rather than limitation, by minor adaptation, the nipples **15** and **16** may be connected into the lower portion of the housing **10** rather than the adapter nipple **13** so that the packing in the lower chamber **10***b* may be removed without first separating the supply line **19** and the return line **25**; the elbows **24** and **28** may be introduced into the cooling chamber **10***c* at different levels to alter the amount of fluid exchange during each pumping cycle to thereby change the rate of cooling or the level of the lubricating reservoir. Certain elements of the described structure may be omitted without altering the principle of operation of the device although in the preferred embodiment all of the basic elements described are desirable.

I claim:

1. A self-cooled stuffing box comprising:

(a) housing means disposed above a pumping T for receiving a polish rod reciprocably movable therein;

(b) first and second longitudinally spaced packing chambers formed in said housing means and each having packing therein for sealing engagement with said polish rod;

(c) a central cooling chamber formed in said housing means disposed between said first and second packing chambers;

(d) a supply line having first and second ends with said first end of said supply line communicating with the interior of said cooling chamber and with said second end communicating with the interior of said pumping T for supplying fluid therefrom upon longitudinal movement of said polish rod in one direction;

(e) a return line having first and second ends with said first end of said return line communicating with the interior of said cooling chamber and with said second end communicating with said interior of said pumping T for returning fluid from said chamber to said pumping T upon longitudinal movement of said polish rod in the opposite direction;

(f) one-way check valve means between said first and second ends of said supply line for permitting fluid flow through said supply line in only the one direction from said pumping T to said cooling chamber; and

(g) one-way check valve means between said first and second ends of said return line for permitting fluid flow through said supply line in only the one direction from said cooling chamber to said pumping T.

2. The self-cooled stuffing box as defined in claim 1, including:

(a) adapter nipple means secured to the lower end of said housing means for connecting said housing means for connecting said housing means to said pumping T;

(b) means for communicating said second end of said supply line with the interior of said pumping T through said adapter nipple means; and

(c) means for communicating said second end of said return line with the interior of said pumping T through said adapter nipple means.

3. The self-cooled stuffing box as defined in claim 2, including:

(a) internally threaded surfaces on said first and second packing chambers;

(b) a packing collar having external threads engaging the internal threads of said first packing chamber; and

(c) external thread means formed on said adapter nipple means for engagement with the internal threads of said second packing chamber.

4. The self-cooled stuffing box as defined in claim 3, including:

a control valve means between the first and second ends of said supply line for manually regulating the rate of fluid flow through said supply line.

5. The self-cooled stuffing box as defined in claim 3, including:

a control valve means between the first and second ends of said return line for manually regulating the rate of fluid flow through said return line.

6. The self-cooled stuffing box as defined in claim 4, including:

a control valve means between the first and second ends of said return line for manually regulating the rate of fluid flow through said return line.

7. The self-cooled stuffing box as defined in claim 6, including:

(a) first and second lock rings having internal threads engaging the external threads of said packing collar and the external threads of said adapter nipple means, respectively; and

(b) a grease fitting between said first and second ends of said supply line.

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