April 9, 1963 C. L. SHARP 3,084,946

RECIPROCATING ROD PACKING

Filed July 16, 1959 2 Sheets-Sheet 1

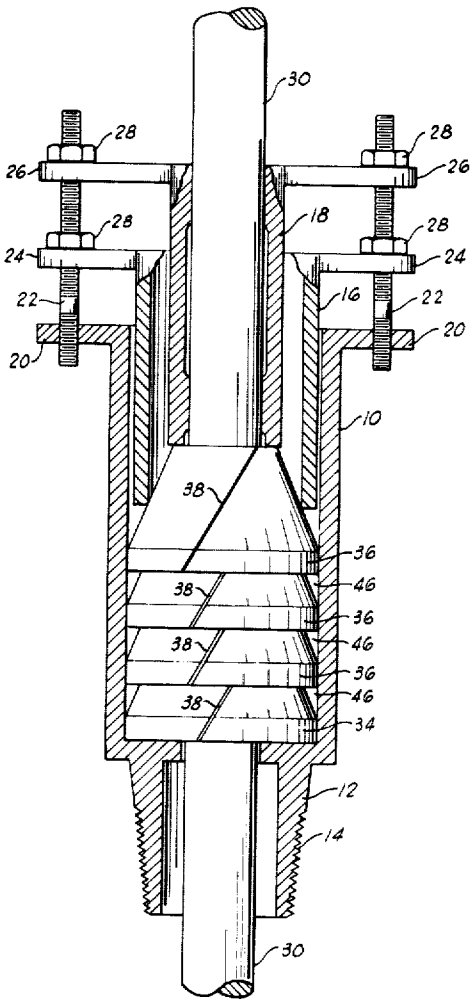


FIG. 1

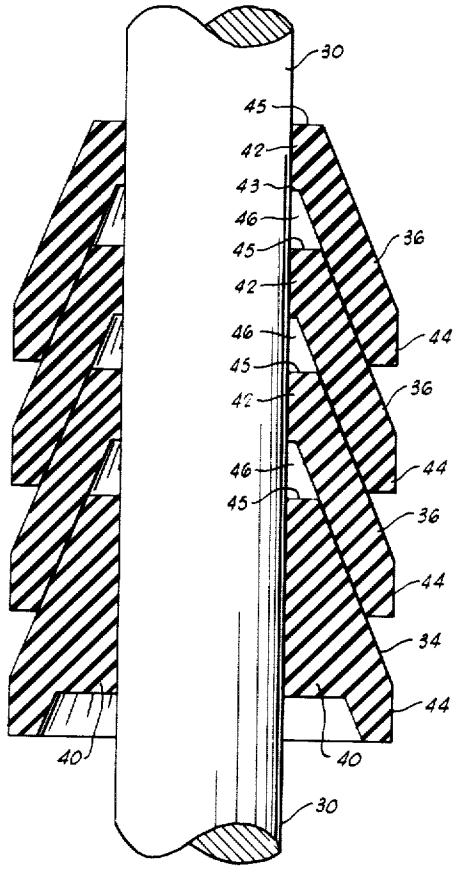


FIG. 2

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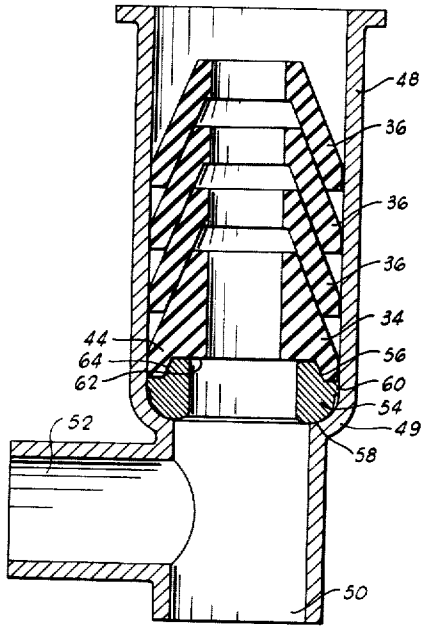


Fig. 3

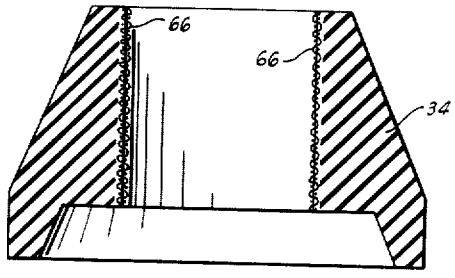


Fig. 4

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RECIPROCATING ROD PACKING

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This invention relates to improvements in stuffing box packing devices.

In a typical oil well pumping application, a string of sucker rods is reciprocated in well tubing by a surface pumping unit. This action operates a pump at the bottom of the well to lift oil up the tubing to the surface of the earth. At the surface a T fitting is provided, terminating the tubing string, to convey the produced oil to proper storage facilities. In order to force the produced oil into the conduit leading to the storage tank, and prevent the oil from discharging out the top of the T, a suitable stuffing box must be provided.

A machined finished rod, usually termed a polished rod, terminates the sucker rod string, and is provided to reciprocate through the stuffing box. The stuffing box has two primary functions. First, it must act to keep the produced oil within the tubing and conduit or lead line connecting to the storage tank, and second, it must be so constructed as to offer the least frictional resistance to the oscillatory motion of the polished rod. A stuffing box which requires the packing be compressed tightly against the polish rod to prevent leaking causes a great loss of horsepower in frictional energy, as well as increasing the wear and decreasing the life of the stuffing box packing.

Much of the crude oil produced by pumping wells comes from the earth mixed with varying quantities of paraffin and contaminated water. The water usually contains a high concentration of dissolved salts and minerals. On each down stroke of the pumping unit a greater part of the polished rod enters the tubing below the stuffing box and contacts the produced oil and contaminated water. On the up stroke of the pumping unit a greater part of the polished rod rises above the stuffing box where it is exposed to the drying effects of the atmosphere. In this manner there is a strong tendency for the deposition of scale and rust on the polished rod. Naturally, this scale and rust accumulation destroys the uniform machined surface originally given the polished rod, with the result of greatly reduced packing life. The commonly used relatively thin, soft, resilient packing necessary to form a leakproof seal around the polished rod does not offer sufficient coercive effect to prevent this scale and rust formation. Efforts to force the packing into tighter gripping relationship causes buckling and failure.

A great expense is encountered in the oil industry in maintaining stuffing boxes. In most instances a pumper must visit each well at least once a day to determine that the stuffing box has not permitted oil leakage which drains upon fittings etc. around the well, as well as upon the surface of the earth where it has a strong sterilant action, rendering soil effete.

It is therefore an object of this invention to provide improvements in stuffing boxes and stuffing box packing, which overcome problems existing with prior apparatus.

Another object of this invention is to provide a frusto-conical shaped packing for stuffing boxes having a low-friction, high surface area contact with polished rods.

Another object of this invention is to provide an arrangement of stuffing box packing which will afford greater lateral support to frusto-conical shaped packing.

Another object of this invention is to provide means associated with stuffing box packing to prevent the formation of scale and other abrasive surface disconfigurations on polished rods.

These and other objects of this invention will be more apparent from further reading of the following description and claims when taken in conjunction with the drawings of which:

FIG. 1 is a side view of a stuffing box taken partly in vertical section showing the arrangement of the packing of this invention.

FIG. 2 is an enlarged view of the packing of this invention shown in association with a polished rod. The packing is shown in vertical cross-section.

FIG. 3 is a cross-sectional view of a modified stuffing box showing the packing of this invention as used in conjunction with an improved type packing seat.

FIG. 4 is a cross-sectional view of an alternate arrangement of this invention showing an integrally formed wire mesh disposed to contact the polished rod surface.

Referring first to FIG. 1, a typical stuffing box body **10** is shown having an integrally cast neck **12** with threads **14** for connection into the top of a typical pumping T, not shown. An outer follower **16** and an inner follower **18** are provided as a means by which a proper pressure may be applied to the packing to prevent the stuffing box for leaking. Integrally cast flange **20** on the stuffing box body **10** is provided for receiving studs **22**. Ears **24** and **26**, integrally cast with the outer follower **16** and inner follower **18**, respectively, are provided, having holes through which threaded studs **22** protrude. By turning nuts **28** on studs **22** the tension of the outer follower **16** and inner follower **18** may be varied.

A polished rod **30** extends through the stuffing box **10** to be connected at its lower extremity with a string of sucker rods, not shown. The upper extremity of the polished rod **30** would connect to the surface pumping unit, also not shown.

An important feature of this invention concerns the novel configuration of the packing, which is best disclosed in FIG. 2. The packing is composed of resilient, oil resistant material, such as a synthetic rubber produced and sold under the trademark "Hycar" and comprises two portions—first, a lower frusto-conical packing ring **34**, and second, one or more upper packing rings **36**. The upper packing rings **36** are of a frusto-conical shape and can be molded in this shape or cut from flat and cylindrical material. The frusto-conical shape of the upper packing rings **36** is achieved from flat material by first cutting a disc and then extracting a wedge-shaped segment at the radial split **38**.

The lower packing ring **34** has a thick shoulder section **40** extending through the major portion of the length of the ring which serves to afford a larger contact area with the polished rod **30** and also gives lateral support to the upper packing rings **36**. Others have provided stuffing box packing utilizing frusto-conical shaped packing rings which has worked successfully, but their failure to provide lateral support has resulted in a reduced life of the packing and a higher degree of stuffing box failures.

Flat surface areas **42** are provided at the peak portions where the upper packing rings **36** contact the polished rod **30** to afford greater protection from fluid leakage. Each area **42** may be extended by forming a circumferential lip **43** around the lower end of the area **42** if desired. Also, a flat skirt area **44** is provided on the upper packing rings **36** and lower packing ring **34** around the lower peripheral portions thereof where contact is made with the stuffing box body **10** to assure a more efficient seal.

The top surface **45** of the peak portion of each of the packing rings **34** and **36** is formed transversely with respect to the areas **42** and **44** to provide lubricant cavities

46 between adjacent rings and assure constant lubrication of the polished rod 30. This multiplicity of lubricant cavities collects and holds oil applied to the stuffing box 10 and distributes it evenly on the surface of the polished rod 30.

The present packing construction may also be used in an open type of stuffing box (see FIG. 3) having an internal diameter of a size for the passage of various tools etc. through the box. A typical stuffing box of this type is illustrated in FIG. 3 and comprises a tubular housing 48 slightly reduced in diameter at 49 to form a tubing section 50 which in turn connects with the well tubing. A line pipe section 52 extends transversely from the tubing section 50 for connection with a flow line to convey produced crude oil to storage facilities. It will be apparent that the smallest internal diameter of the housing 48 is in the tubing section 50 which is normally the same diameter as the well tubing to permit the passage of various tools (such as the subsurface pumping unit used in the lower end of the well tubing) through the stuffing box only by removing the packing. With such a stuffing box construction, it is common practice to use a metal seating ring 54 in the portion 49 of the housing 48 to support the packing. The upper end 56 of the seating ring 54 is tapered downwardly and outwardly to guide the packing concentrically in the housing 48, and the lower end 58 of the ring 54 is rounded to seat on the mating reduced diameter portion 49 of the housing 48. A flange 60 is normally formed around the ring 54 and is of a size to slidingly fit in the housing 48 to form a shoulder on which the packing may rest. It will also be understood that the stuffing box shown in FIG. 3 also has a suitable follower assembly similar or equivalent to the followers 16 and 18 shown in FIG. 1 to hold the packing in place in the housing 48.

When using the present packing assembly in a stuffing box of the type shown in FIG. 3, the lower ring 34 fits closely over the seating ring 54 to efficiently support the upper packing rings 36. It will be observed that the lower face 62 of the shoulder section 40 of the ring 34 is formed at a right angle to the area 44 to rest on the upper end of the ring 54 and facilitate the support of the upper packing rings 36 against collapse. Also, the area 64 of the ring 34 between the flat portion 62 and lower end of the skirt forming the flat area 44 is tapered to conform with the tapered portion 56 of the ring 54 and prevent collapse of the skirt when excessive pressure is applied on the packing. The flat areas 44 of all the rings 34 and 36 seal against the inner periphery of the housing 48 in the same manner as previously described.

Another embodiment of this invention is shown in FIG. 4. The lower packing ring 34 is provided with an integrally formed abrasive inner surface 66. The abrasive inner surface scours the polished rod, not shown, as it reciprocates within the stuffing box. As rust and scale tend to form, the scouring, attrition action of the abrasive inner surface prevents accumulations which would deform the surface of the polished rod and ultimately cause increased wear on the upper packing rings 36.

The material comprising the abrasive inner surface 66 is of a hardness less than the polished rod and is preferably a metallic meshed or woven material, such as copper, formed integrally with the lower packing ring 34 during the vulcanizing or molding process. However, any material having a hardness greater than the resilient material forming the ring 34, but a hardness less than the polished rod, will provide a beneficial abrasive action.

As the abrasive inner surface 66 wears away, the tension applied on the stuffing box packing, as by tightening outer follower 16 or inner follower 18, will urge the abrasive inner surface 66 against the polish rod 30 to maintain a continuous scouring action over a long period.

Although this invention has been described in the manner in which it would be applied to oil well pumping, it is within the purview of this invention that the principles involved are equally applicable to any type of reciprocating rod packing device.

Although I have described this invention with a certain degree of particularity it is manifest that many changes may be made in the details disclosed without departing from the spirit or scope of the invention as taught by the claims.

I claim:

1. A reciprocating rod packing device comprising:

an annular body surrounding the rod having an upper end and a lower end and arranged concentrically around the rod;

an upper, hollow, substantially frusto-conical resilient packing ring in the body around the rod having a lower and outer peripheral surface engaging the inner surface of the body and having its inner and upper cylindrical surface at its peak portion sealingly engaging the rod, the upper and lower surfaces of said peak portion joining the upper and lower ends of said cylindrical surface being extended horizontally from the rod to form a horizontally extending flexible lip sealingly engaging the rod;

follower means adjustably secured to the upper end of the body and arranged to force the inner and outer portions of the packing ring downwardly in the body to increase the seal of the peak portion of the packing ring around the rod and accommodate wear of the peak portion of the packing ring; and

a lower, resilient supporting packing ring in the body around the rod underneath the upper packing ring to prevent collapse of the upper packing ring, said lower packing ring having a frusto-conical upper and outer surface acting with the inner frusto-conical surface of the upper packing ring from the lower outer end of the upper packing ring into proximity with the peak portion of the upper packing ring, and having a cylindrical inner surface in contact with the rod from the lower end of the upper packing ring into proximity with the peak portion of the upper packing ring to support the upper packing ring from the rod and prevent collapse of the upper packing ring, the upper end of said lower packing ring being substantially flat and terminating in downwardly spaced relation from the peak portion of the upper packing ring to provide a lubricating reservoir between the upper and lower packing rings around the rod and to provide a space for downward flexing of the peak portion of the upper packing ring upon downward movement of the follower means.

2. A reciprocating rod packing device as defined in claim 1 characterized further to include a plurality of said upper packing rings.

3. A reciprocating rod packing device as defined in claim 1 characterized further to include an abrasive material formed integrally in the cylindrical inner surface of the lower packing ring to scrape the rod.

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