

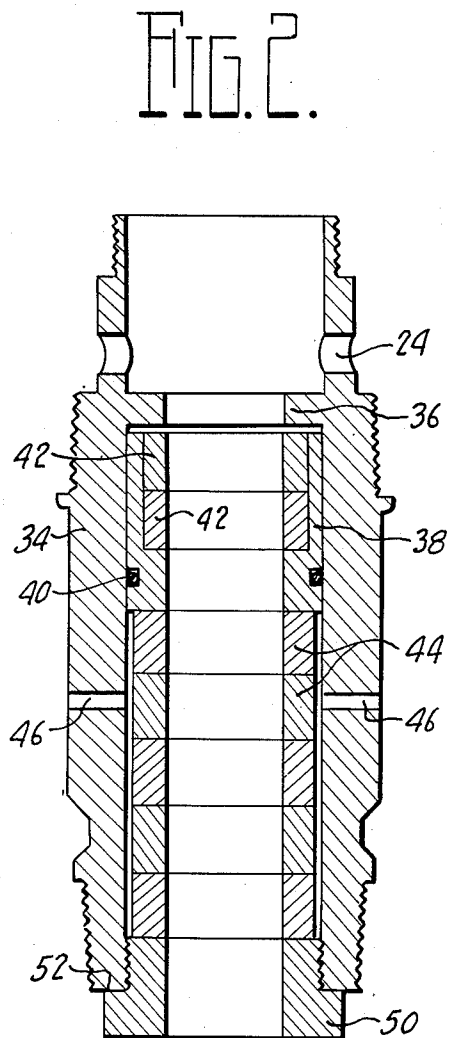
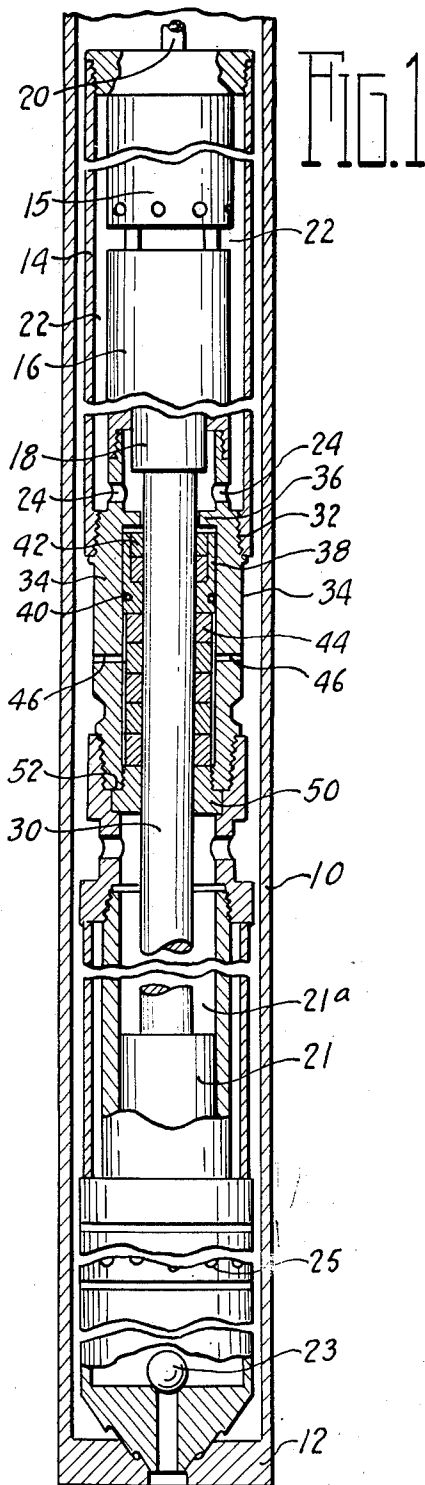
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ROD GUIDE AND PACKING MEANS

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1

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ROD GUIDE AND PACKING MEANS

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This invention relates to rod guide and sealing means and is particularly directed to a guide and seal useful for rods carrying a high compressive force and therefore subject to lateral deflection.

The primary object of the invention is to provide a rod guide and seal that is capable of greatly increased life and that will not score or injure a rod working therethrough.

Briefly, the present invention comprises a housing that is in communication with high pressure fluid at one end and relatively low pressure fluid at the other and which contains a series of rod guiding and packing elements. The guiding elements are fitted around the rod with a sliding fit, and are contained in a holder that is closely fitted to the interior of the housing, a sealing ring being provided between the exterior of the holder and the interior of the housing. A plurality of packing rings are fitted closely around the rod and loosely in the housing beneath the guide rings, so that a fluid seal is provided at the interior of the relatively movable packing rings while the rings themselves are capable of lateral movement, the adjacent flat faces of the rings being held in sealing engagement.

A detailed description of the preferred embodiment is contained in the following specification from which other objects and advantages will become apparent, reference being made to the accompanying drawings in which:

Fig. 1 is a diagrammatic vertical sectional view with parts in full, and parts broken away, of a downwell pump in which the present invention is used; and

Fig. 2 is a somewhat enlarged diagrammatic sectional view of the rod guide and packing means alone.

The present invention is particularly useful for guiding and packing relatively long and thin rods that are subject to high compressive forces so that the tendency of the rod to move laterally creates a problem. One use in which such conditions are present is in the field of hydraulically actuated downwell pumps where fluid under high pressure is delivered to a hydraulic cylinder located near the producing strata of an oil well and directly connected to a reciprocating pump which may be either single or double acting. The power required for reciprocation of the pump is delivered through the long thin rod that directly connects the engine and pump pistons. The rod may be several feet long and of very small diameter, in the order of one inch. In the drawings, 10 represents the tubing of an oil well in which a downwell pump is seated on a suitable packer indicated at 12.

The pump comprises a housing 14 in which is disposed a valving 15 for the purpose of properly directing high pressure power oil or working fluid to an engine cylinder 16 in which an engine piston 18 reciprocates. The filtered and treated power oil or high pressure fluid may be delivered from the surface in a macaroni string 20 and the valving may conveniently be such as to maintain high pressure in the annular space 22 between the housing 14 and the engine cylinder 16. Ports 24 connect the engine cylinder with the annular space 22 so that a continuous

2

high pressure is exerted on the lower side of the engine piston, and reciprocation of the piston is caused by alternately applying and removing pressure from the upper side of the engine piston. When the pressure on the upper and lower sides of the engine piston is equalized the piston moves down due to the difference in area between the upper and lower surfaces. Such action is well known and forms no part of the present invention and is explained only for the reason that the constant high pressure in the lower end of the engine cylinder acts against the upper end of the guiding and sealing elements with which the present invention is concerned.

As above noted the engine piston 18 is connected to a pump piston 21 for the purpose of driving the latter and the rod connecting the two pistons is designated 30. The present invention is primarily concerned with guiding and packing the rod to prevent lateral deflection in use, to increase its life under the severe reciprocating conditions in which it is called upon to work and to prevent leakage of high pressure oil from the lower end of the engine cylinder 16. The pump piston 20 works in a pump barrel 21a and operates to draw oil in past a standing valve 23 and to discharge it past any suitable discharge valving to openings 25 from which it can flow to the surface in the annular space around the pump or in a separate tubing provided for this purpose.

Below the engine cylinder, and preferably attached thereto by a threaded end 32 is the guiding and sealing means of the present invention. The device comprises a housing 34 having a web 36 across its upper end, the web having a central opening to receive the pump rod 30.

The pump rod 30 fits rather loosely in the central opening of the housing web 34 so that the high pressure of the power oil in the lower end of cylinder 16 is communicated to the interior of the upper end of the housing. Therefore provision is made for sealing the space at the periphery of the housing to prevent, so far as possible, leakage of power oil and dissipation of the working pressure along the interior wall of the housing. For this purpose, a cup 38 is provided, having an O-ring 40 in its exterior wall. The interior of the cup 38 carries a plurality of superimposed guide rings 42 which may be pressed into the cup 38 and which have a running fit around the rod 30. The guide rings have a clearance with respect to the rod of approximately .002 inch and, due to their length, provide a substantial sealing effect from their top to bottom. This, coupled with the sealing effect on the underside of the cup 38 permits the cup to act as a piston and exert a force downwardly on the entire assembly as hereinafter described.

The guide rings 42 are made of a much harder metal than the rod 30 and are preferably of cemented tungsten carbide. Such rings show little wear and retain their original dimensions over a long period and if properly ground and fitted initially exhibit no tendency to score the rod as it reciprocates.

Sealing at the exterior of the cup 38 prevents leakage of power oil at this point, but there would still be the possibility of oil leakage along the surface of the rod even though the guide rings 42 are fitted very closely to the rod member. For this reason, the present invention provides an additional packing means which will reduce the oil flow along the rod but which is so mounted as to be capable of some lateral movement if required while retaining a close sealing fit with the rod surface. It will be appreciated that in view of the pressure drop from the upper to the lower portion of the rod that whatever flow of oil exists is downwardly from the engine cylinder 16 to the upper portion of the pump barrel and that this flow may serve as a lubricant for the rod itself. Further, the small flow of oil downwardly along the rod prevents the ingress of corrosive pumped fluid to

the packing elements and reacting therewith. Thus if the pumped fluid contains substantial quantities of sand and is acidic in nature it is prevented from damaging the packing by the small flow of oil downwardly along the rod.

The packing means for the rod preferably comprises a series of similar rings 44 disposed in the housing below the cup 38 and having as much as ten or fifteen thousandths of an inch between the periphery and the interior of the housing 34. The housing is provided with one or more holes 46 opening into the bore of the tubing surrounding the pump which contains oil under relatively low pressure, equal to the static head of oil standing between this level and the surface of the ground.

It will be seen that because of the clearance between the sealing rings and the housing the rings are free to move slightly laterally and will accommodate themselves to the position of the rod 30 and are incapable themselves of taking a lateral reaction. Thus, if the rod must bend slightly due to any misalignment of the engine and pump cylinders, the rings will continue to maintain a seal with the adjacent surfaces of the rod, but will float very slightly laterally. The seal formed by the rings is a function of the fit around the rod and the longitudinal extent of the contacting surfaces, the length giving rise to a fluid packing effect.

The sealing rings 44 and cup 38 are held in the housing by a simple threaded gland nut or follower 50 which has a shoulder 52 thereon which seats against the lower end of the housing 34. With the follower 50 fully engaged, with its shoulder against the end of the housing, there is still a small space between the upper end of the cup 38 and the housing web 36. Because of this construction it is not possible to bind the parts in the housing by tightening the follower, and the high pressure of the working fluid in the power cylinder is relied on to prevent longitudinal displacement of the several sealing rings and guide ring containing cup during reciprocation. For example, if the working fluid pressure in the engine cylinder is 5000 p. s. i. and the exhaust pressure is 2000 p. s. i., the force acting down on cup 38 is 3000 times the annular area of the cup. (It is assumed that the engine exhaust pressure is equal to the static head of fluid standing between the discharge of the pump and the surface of the ground.) Such pressure is ample to maintain the parts against longitudinal displacement as the rod reciprocates.

It will thus be seen that the present invention provides a substantial guide means for the rod 30 in the form of the hard rings 42 and that sealing against leakage is provided at the exterior of the cup 38 and at the interior of packing rings 44. Such guiding and packing means have been found to give excellent results in service.

While the invention has been described in conjunction with a specific form and disposition of the parts it should be expressly appreciated that numerous modifications and changes may be made therein without departing from the spirit of the appended claims.

What I claim is:

1. Guiding and sealing means for a reciprocating rod having one end working in a chamber containing high pressure fluid and its opposite end working in a chamber containing relatively low pressure fluid, comprising a housing, a series of annular sealing rings in said housing surrounding said rod with a sealing fit, said rings being loosely fitted within said housing to allow for lateral accommodation, a cup in said housing around said rod at the end of said housing adjacent said chamber containing high pressure fluid, means to establish a fluid seal between the exterior of said cup and the interior of said housing, and a plurality of guide rings carried by said cup and surrounding said rod with a sliding fit.

2. Guiding and sealing means for a reciprocating rod having one end working in a chamber containing high pressure fluid and its opposite end working in a chamber containing relatively low pressure fluid, comprising a housing, a series of annular sealing rings in said housing surrounding said rod with a sealing fit, said rings being loosely fitted within said housing to allow for lateral accommodation, a cup in said housing around said rod at the end of said housing adjacent said chamber containing high pressure fluid, means to establish a fluid seal between the exterior of said cup and the interior of said housing, and a plurality of hard metal guide rings carried within said cup and surrounding said rod with a sliding fit.

3. Guiding and sealing means for reciprocating rod having one end working in a chamber containing high pressure fluid and its opposite end working in a chamber containing relatively low pressure fluid, comprising a housing, a series of annular sealing rings in said housing surrounding said rod with a sealing fit, said rings being loosely fitted within said housing to allow for lateral accommodation, a cup in said housing around said rod at the end of said housing adjacent said chamber containing high pressure fluid, means to establish a fluid seal between the exterior of said cup and the interior of said housing, and a plurality of tungsten carbide guide rings carried within said cup and surrounding said rod with a sliding fit.

4. Guiding and sealing means in accordance with claim 1 in which said cup is subjected to said high fluid pressure, and a follower to retain said cup and sealing rings in said housing, said fluid pressure preventing longitudinal displacement of said guide rings and said sealing rings as said rod reciprocates.

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