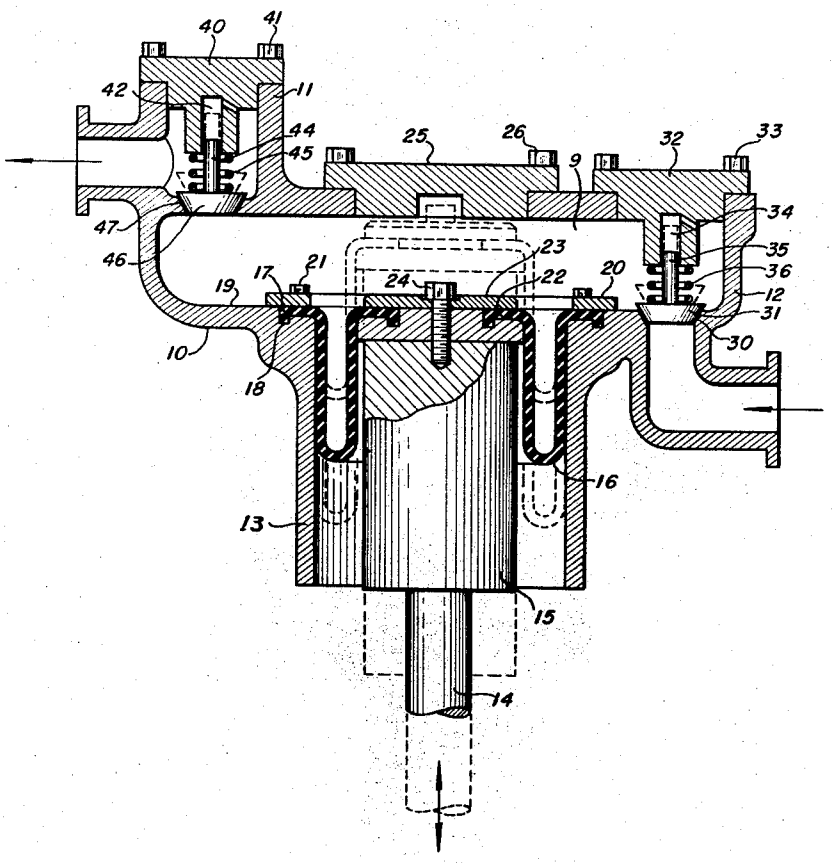
Sept. 16, 1958 D. RAGLAND 2,851,957

DIAPHRAGM PUMP

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DIAPHRAGM PUMP

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1 Claim. (Cl. 103—150)

This invention is directed to a device for transmitting fluid pressure. More specifically it is directed to a device for pumping high pressure abrasive liquids such as drilling muds, and the like.

The life of pistons, rods, liners and rod packing in reciprocating slush pumps used in well drilling operations, is relatively short because of the abrasive, erosive and corrosive materials acting upon the moving parts of the pump.

A diaphragm pump, on the other hand, substitutes a diaphragm and a fluid piston system for the mechanically operated piston of the reciprocating type pump thereby eliminating contact between the piston and the liquids being pumped. However, the use of a fluid piston in practice limits diaphragm-type pumps to low pressure operation as it is difficult to obtain and control high fluid piston pressures necessary to actuate the diaphragm, because of fluid leakage inherent in fluid pump systems. It is also difficult to prevent rupture or other damage to present pump diaphragms since they are not designed for high pressure operation. One object of this invention, therefore, is to provide a high pressure type slush pump wherein the life of the pump elements is substantially lengthened.

Briefly, the invention comprises a pump casing provided with inlet and outlet fluid passages, the passages being provided with valve means whereby the inlet and discharge of fluid through the pump casing is controlled. A piston rod is arranged to reciprocate in the pump casing and a high pressure diaphragm is connected between the pump casing and the piston rod. The advantages of this device reside in maintaining the abrasive liquids being pumped out of contact with the reciprocating piston arm and at the same time utilizing the desirable features of mechanically actuated pistons and high pressure diaphragms. The abrasive liquids herein contact only the diaphragm.

The invention will be more fully described with reference to the drawing wherein the sole figure is a sectional view of the device.

Referring more particularly to the drawing, wherein identical numerals designate identical parts, numeral **10** designates a pump casing enclosing a pump chamber **9**. Valve pots **11** and **12** are arranged on each side of the pump casing. The center portion of one side of the pump casing forms a cylindrical sleeve **13**. A piston rod **14**, provided with an enlarged head portion **15**, is arranged for reciprocating movement in the pump casing **10**. Piston rod head **15** is spaced from sleeve **13**, as shown, and is of smaller diameter than the annular sleeve. For example, the sleeve **13** may be 7½ inches in diameter and the rod head **15**, 5½ inches in diameter. Other dimensions for the sleeve and the rod head may be used provided a ratio about or approximating that for the specific example given is used. Such ratios provide the required clearance for operation. The outer periphery **17** of an annular high pressure diaphragm **16** which is provided with a central portion U-shaped in cross-section is connected into a recessed portion **18** of the lower wall **19** of the pump casing. This outer end **17** may be secured by means of an annular plate member **20** and bolts **21**. The inner periphery **22** of the annular high pressure diaphragm **16** may be secured to the enlarged head portion **15** of piston rod **14** by means of a plate member **23** and a bolt **24**. The diaphragm is preferably made in accordance with the disclosure in U. S. Patent No. 2,678,065, issued to

Robert R. Crookston, May 11, 1954, in which a deformable circular U-shaped base member has molded thereon at least a layer of overlapping woven fiber ribbons. This diaphragm is designed to provide long life at high pressure operations. High pressure as defined herein means pressures of 3500 pounds per square inch or greater. The preferred operating pressure range is 3500 to 5400 pounds per square inch although the diaphragm will operate efficiently with pressures as low as 200 pounds per square inch.

A removable valve chamber plug **25** is positioned on the opposite side of the pump casing **10** from sleeve **13** and is secured to the pump casing **10** by means of bolts **26**. The inlet valve pot **12** is provided with a valve seat **30** upon which a valve member **31** is adapted to seat. A removable valve pot plug **32** is arranged on the pump casing **10** and is secured thereto by means of bolts **33**. The plug **32** is provided with a recessed portion **34** into which extends a connecting rod **35** attached to valve member **31**. Suitable biasing means such as spring **36** engages with the surface of valve member **31** and plug **32** and is adapted to normally bias the valve member **31** against the seat **30**. Similarly, the discharge valve pot **11** is provided with a plug member **40** secured to the pump casing **10** by means of bolts **41** and is provided with a recessed portion **42** into which extends a rod **44** attached to valve member **46**. Biasing means such as spring **45** biases valve member **46** against valve seat **47** formed in valve pot **11**.

In operation, reciprocation of piston rod **14** by means of any desirable type prime mover, not shown, mechanically connected thereto, opens and closes the inlet and discharge valves **30** and **46** to provide the pumping action for the pump device. For example, as shown by the lower dotted lines in Fig. 1 designating the intake position of piston rod **14**, valve **30** opens, as shown in dotted lines, and valve **46** closes under the bias of spring **45**. Upon upward movement, shown by the upper dotted lines in the drawing designating the exhaust position of piston rod **14**, valve **31** seats on valve seat **30** and valve element **46** moves upwardly against the bias of spring **45** as shown in dotted lines, thereby exhausting the high pressure fluid contained in the pump chamber **9** of the pump casing **10**.

Having fully described the elements, objects and operation of my device I claim as my invention:

A fluid pump comprising a housing formed to provide a chamber therein, said chamber being provided with a fluid inlet and a fluid outlet, valve means arranged in said inlet and said outlet for controlling the flow of fluid through said chamber, said housing having a cylindrical sleeve member formed thereon, a reciprocable cylindrical rod member spaced from and arranged interiorly of said sleeve member, a reinforced high pressure diaphragm having a portion U-shaped in cross-section connected at its outer periphery to said housing and at its inner periphery to said rod member, said U-shaped portion of said diaphragm being positioned between said sleeve member and said rod member, said diaphragm being arranged such that said U-shaped portion thereof is retained in the space between said sleeve member and said rod member during reciprocation of said rod member, portions of said diaphragm other than said U-shaped portion being supported by said sleeve member and said rod member.

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