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[56] References Cited			
UNITED STATES PATENTS			
690,091	12/1901	Barrow	92/244 X
2,857,219	10/1958	Griffith et al.	92/141
3,343,844	9/1967	Leschisin	92/194 X
1,521,759	1/1925	Crider	92/182
1,534,747	4/1925	Timmons	92/182
1,945,151	1/1934	Marsh	92/247 X

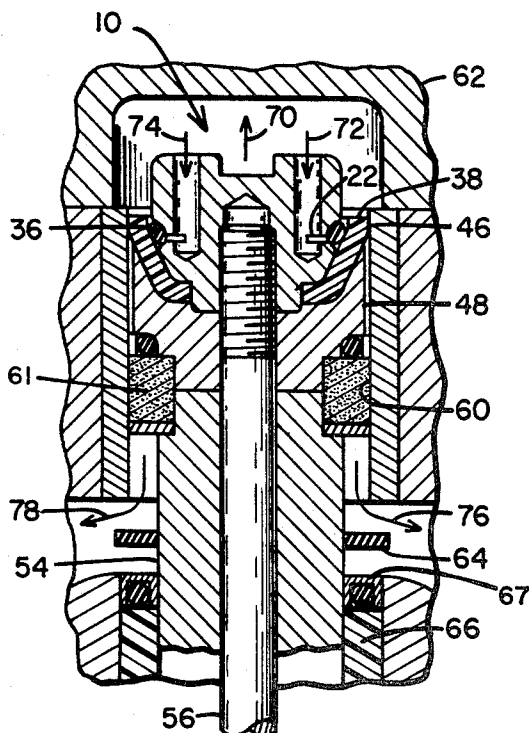
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[54] **EXPANDED PISTON CUP AND IMPROVED SPREADER**

1 Claim, 6 Drawing Figs.

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F16j 15/40
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244

ABSTRACT: An improved spreader for use in an expanded piston cup assembly is shown. A cup spreader having fluid pressure ports in fluid communication with a pressure groove for urging the pressure ring against an inner bearing surface of an expanded piston cup is described. A liquid leakage deflector cooperating with the piston rod is also shown.



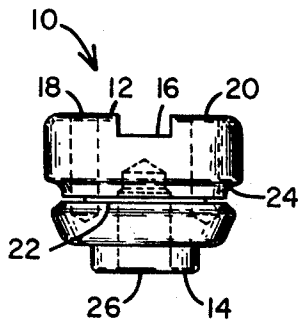


Fig. 1a

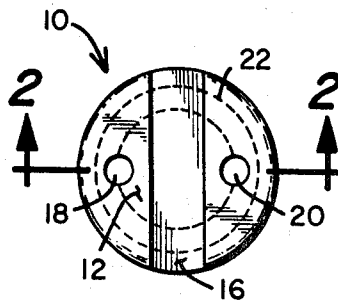


Fig. 1b

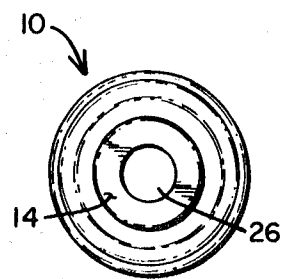


Fig. 1c

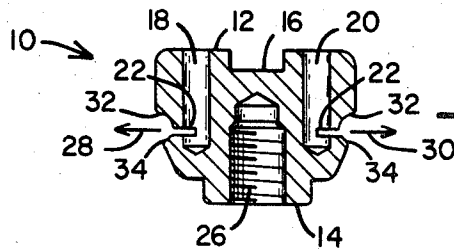


Fig. 2

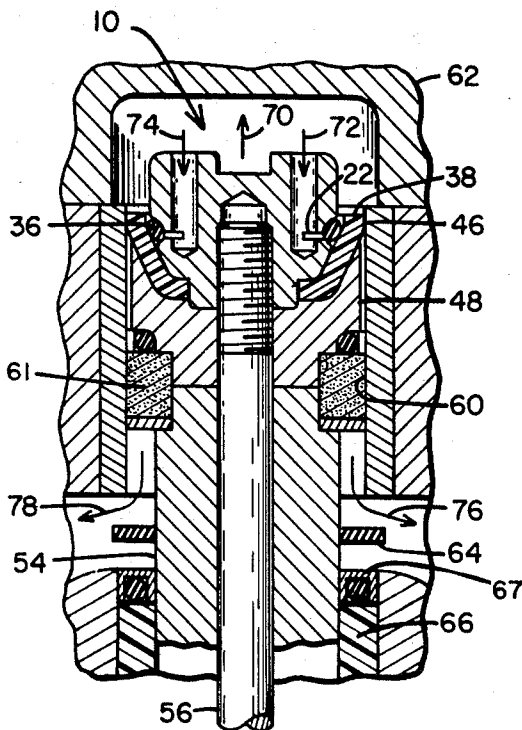


Fig. 4

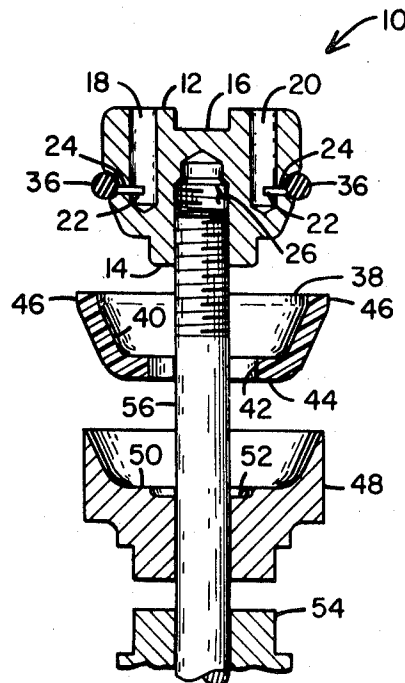


Fig. 3

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EXPANDED PISTON CUP AND IMPROVED SPREADER

This invention relates generally to the field of positive displacement fluid pumps and pistons utilized therein, and more specifically to the field of such pistons utilizing expanded piston cups.

Piston arrangements utilizing expanded piston cups are known in the prior art. An example of such a prior art system utilizes an expanded piston cup in cooperation with a pressure washer. The pressure washer has an annular recessed groove for retaining an O-ring. The O-ring applies a fixed pressure to the expanded piston cup, and causes the slidable seal of the piston cup with the cylinder wall. While such arrangements operate satisfactorily for many purposes, the fixed pressure applied by the pressure washer does not provide adequate pressure to compensate for wear of the expanded piston cup. Further, while there is some response to the fluid pressure on the pressure stroke, the effect is limited by the pressure ring having to be forced further into the expanded piston cup. This movement is inhibited by the friction contact between the expanded piston cup and the pressure ring.

In summary, then, this invention includes an expanded piston cup for use in a pumping cylinder, and an improved spreader for use therewith. More specifically, the improved spreader includes a body portion having fluid pressure ports in fluid communication with an annular pressure groove. A pressure ring is seated in the pressure groove and bears on the expanded piston cup for applying pressure thereto. The pressure on the expanded piston cup increases during the pressure stroke due to fluid pressure existing in the pumping cylinder, the resultant increase in fluid pressure in the pressure groove forcing the pressure ring outwardly against the inner portion of the flexible expanded piston cup.

A primary object of this invention is to provide an improved expanded piston cup assembly, which is constructed so that a pressure ring provides an outwardly directed force or pressure applied to the piston cup, with the outward pressure being increased during the pressure stroke, such that a positive force is maintained against the piston cup of a reciprocating pump.

Still a further object of this invention is to provide an improved spreader for use in an expanded piston cup assembly, wherein the spreader includes fluid pressure ports in fluid communication with a pressure groove for urging a pressure ring against a bearing surface on the expanded piston cup.

Still a further object of this invention is to provide a piston assembly including a liquid leakage deflector for deflecting any liquid leakage away from the oil seals, thereby preventing contamination of the oil in the crankcase of the pump.

These and other more detailed objectives and advantages will become apparent from a review of the following detailed description of one embodiment of the invention along with the accompanying drawing, wherein:

FIGS. 1a, 1b and 1c are, respectively, a side view of the improved expanded piston cup spreader; a top view of the improved expanded piston cup spreader; and a bottom view of the improved expanded piston cup spreader;

FIG. 2 is a sectional view taken along line 2—2 of FIG. 1b.

FIG. 3 is an assembly view in cross section of the expanded piston cup and the improved spreader; and,

FIG. 4 is a cross-sectional view of the assembled expanded piston cup and improved spreader assembly, disposed within a cylinder, and including a liquid leakage deflector.

In FIGS. 1a, 1b, and 1c there is shown a side, top, and bottom view, respectively, of the improved expanded piston cup spreader of this invention. Considering these views together, its construction can readily be seen. The spreader 10 has an upper surface 12 and a lower surface 14. The upper surface 12 includes a slot 16 that can be utilized to receive a tool, such as a screwdriver, for turning the spreader 10 onto a retaining bolt. A pair of fluid pressure ports 18 and 20 extend downwardly into the body of the spreader 10. The fluid pressure ports 18 and 20 are in fluid communication with an annu-

lar pressure groove 22. An annular retaining groove 24 is in fluid communication with the pressure groove 22. The retaining groove 24 is utilized for retaining an O-ring (not shown) as will be described in more detail below. A tapped mounting hole 26 extends upwardly through lower surface 14 into the body of spreader 10 and is utilized to mount to a bolt that is secured to the piston rod, as will be described in more detail below.

The operational portions of the improved spreader 10, can clearly be seen in FIG. 2, which is a cross-sectional view taken along line 2—2 in FIG. 1b. Here it can be seen that the annular pressure groove 22 is in fluid communication with the fluid pressure ports 18 and 20. Here it can be seen that pressure applied downwardly in fluid pressure ports 18 and 20 will result in an outward pressure at the pressure groove indicated by arrows 28 and 30, it being understood that the pressure behind the O-ring (not shown) will extend entirely around the pressure groove 22. The retaining groove 24 can be seen to have an upper portion 32 for cooperating with the upper portion of the O-ring and a lower portion 34 for cooperating with the lower portion of the O-ring. The lower portion 34 operates to prevent scuffing of the O-ring on the downward stroke of the piston assemblage.

The improved spreader can be constructed of ceramic, metal, plastic, Teflon, or the like, with the material selected depending upon the nature of the fluids intended for the pump.

Next turning to a consideration of FIG. 3, which is an exploded assembly view in cross section of the expanded piston cup assembly, there is shown the improved spreader 10 as illustrated and discussed in FIG. 2. In FIG. 3, the O-ring 36 is shown retained in retaining groove 24, and in cooperation with pressure groove 22. The expanded cup 38 has an inner surface 40 adapted to substantially conform to the lower portion of spreader 10. An opening 42 is arranged to allow the neck of spreader 10 to pass therethrough beyond the lower surface 44. The expanded piston cup has a bearing surface 46 that cooperates in a slidable relationship with the interior of a cylinder. This can be more clearly seen in FIG. 4 and will be discussed in more detail below. The expanded piston cup 38 can be constructed of various materials including Teflon, ceramic, leather, viton, or the like, with the selection of the structural material depending upon the nature of the pump in which the piston assembly will be utilized.

A backer element 48 has a recess 50 which conforms substantially to the under portion of the expanded piston cup 38. The backer 48 also has a recess 52 that supports the lower surface 14 of the spreader 10. The backer 48 is annular in shape, but has a diameter slightly less than the diameter of the piston cup 38, whereby bearing surfaces 46 are permitted to extend slightly beyond the extremities of backer 48. Backer 48 is constructed of a material substantially harder and stiffer than that of the expanded piston cup 38. For instance, the backer will be constructed of metal, fiberglass, or the like. A lower surface of backer 48 is adapted to cooperate with an upper surface of connecting rod 54. A connecting bolt 56 runs through the connecting rod 54, through the backer 48, through the expanded piston cup 38, and into the tapped opening 26 in spreader 10, thereby holding the entire assembly together. Connecting rod 54 is in contact at its free end with an eccentric or driving cam in order to impart reciprocatory motion to the piston assembly.

Turning now to a consideration of FIG. 4, which is a cross-sectional view of the assembled piston cup assembly of FIG. 3, the elements being shown and disposed within a cylinder, there is illustrated within a pumping cylinder and disposed in normal operating relationship. In this illustration, the annular bearing surface 46 of the expanded piston cup 38 is illustrated in slidable contact with cylinder wall 60, graphite guide 61 also being in contact with wall 60. Bolt 56 secures spreader 10 firmly in expanded piston cup 38 with the distended resilient O-ring 36 in contact with the inner surface thereof. The pump housing 62 is shown partially broken away.

Arranged around connecting rod 54 is a deflector baffle ring 64 which surrounds the rod 54. The leakage ring 64 is immediately above crankhouse oil seal 66 and functions to deflect any liquid that may leak along cylinder wall 60 away from the oil seal 66 and its retainer 67 thereby eliminating any contamination of lubricants that are utilized in the drive mechanism of the pump. The deflector ring 64 is in the weep hole area of the pump and the liquids draining along cylinder wall 60 will be discharged in the direction of arrows 76 and 78.

Having described the structural relationship of the elements of the improved piston cup assemblage, the improved modes of operation can readily be understood.

Considering the pressure stroke of the pumping cycle, that is, when the assemblage is moving in the direction of arrow 70, there will be a fluid force exerted by the liquid in fluid ports 18 and 20 as indicated by arrows 74 and 72, respectively. This fluid force is in fluid communication with pressure groove 22. The force in pressure groove 22 will be applied to the annular O-ring 36, and will in turn apply an outward force against the inner surface of expanded piston cup 38. This outward force will tend to urge the annular bearing surface 46 into a tight sliding relationship with cylinder wall 60. This tight sliding fit provides a minimal leakage along the cylinder wall 60 and optimizes the pumping efficiency.

Next considering the suction or inlet stroke of the pumping cycle, that is, when the assemblage moves in the direction opposite of arrow 70, it will be seen that the fluid pressure in fluid ports 18 and 20 is relaxed. In this portion of the cycle, any tendency for the upper bearing portion 46 of the expanded piston cup 38 to deform inwardly so as to allow fluid to pass along the cylinder wall 60 is counteracted by the distended resilient O-ring 36 which provides a soft cushion for biasing the cylinder contacting portion of the expanded piston cup 38 outwardly to maintain contact with the cylinder wall 60.

It can be seen, therefore, that the novel spreader and O-ring combination results in improved piston operation during both the pressure stroke and suction stroke portions of the pumping cycle.

What is claimed is:

1. An expanded piston cup assemblage for use in the

cylinder of a pump comprising:

- a. resilient annular expanded piston cup means having an annular bearing surface for slidably engaging the wall of the cylinder, an inner cup portion, and a lower surface;
- b. backing means engaging said lower surface for providing backing strength to said cup means, said backing means having an outer dimension slightly smaller than that of said cup means and out of contact with the wall of the cylinder, said backing means further including a closed internally threaded bore;
- c. spreader means disposed in said inner cup portion for exerting pressure on said inner cup portion for maintaining the slidable engagement between said bearing surface and the cylinder wall, said spreader means including body means having a predetermined depth dimension, an annular outer surface, and upper and lower surfaces, said lower surface adapted to substantially conform to said inner cup portion of said piston cup means, said body means including two diametrically opposed fluid ports extending a predetermined depth into said body means from said upper surface for permitting flow therein, a first annular groove having a generally arcuately shaped annular surface formed about the surface of said spreader means, an annular pressure groove formed inwardly of said first annular groove and being in fluid communication with said fluid ports, and an annular distended biasing O-ring with substantial resiliency being retained in said first annular groove and having portions thereof extending radially outwardly beyond the annular outer surface of said first annular groove, said O-ring being forced outwardly from said first annular groove in response to fluid under pressure disposed in said fluid ports and said pressure groove for exerting increased outward pressure on the surface of said inner cup portion for urging said annular bearing surface against the cylinder wall during the pressure stroke portion of a pumping cycle, said O-ring providing a resilient biasing force on said surface of said inner cup portion for preventing said bearing surface from flexing inwardly out of contact with the cylinder wall during the suction stroke portion of the pumping cycle; and
- d. coupling rod means connected to said internally threaded bore for coupling said piston cup means, said backing means, and said spreader means together.

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