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EXPANDED PISTON CUP ASSEMBLY

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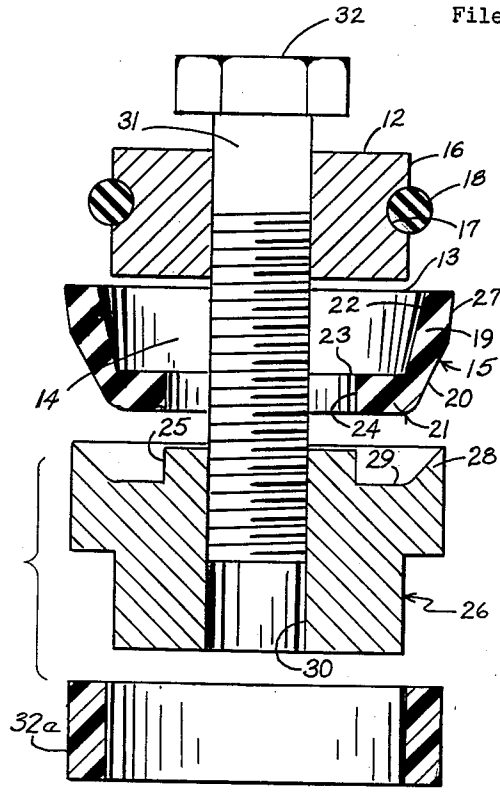


Fig. 2

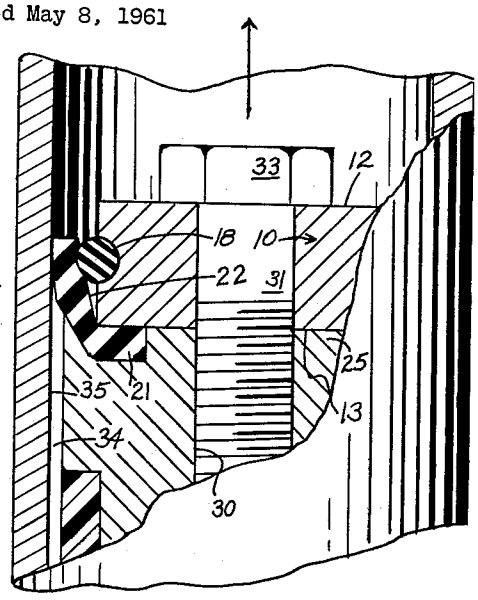


Fig. 3

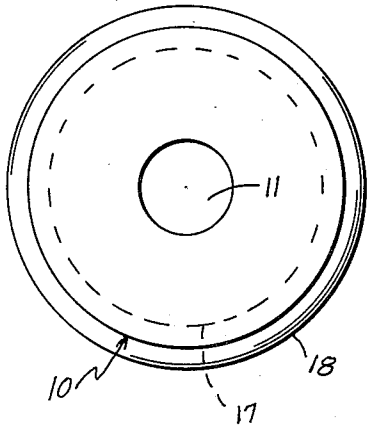


Fig. 1

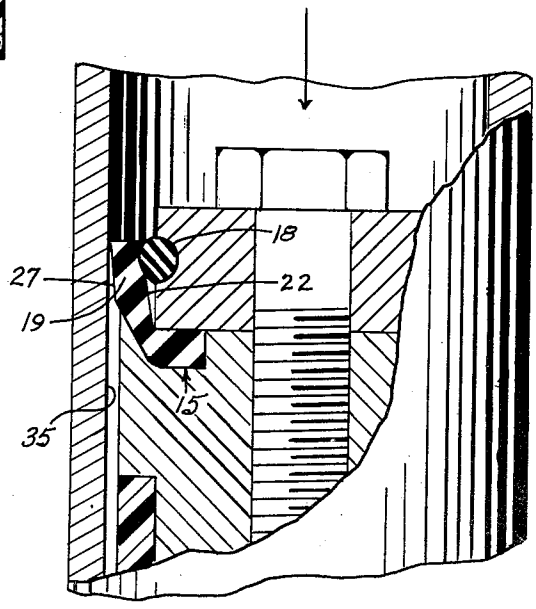


Fig. 4

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EXPANDED PISTON CUP ASSEMBLY

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This invention relates to piston seals and more particularly to an expanded piston cup assemblage.

An object of this invention is to provide a piston cup assemblage which will maintain high efficiency and positive action when pumping fluid under a wide range of pressures which may even include pressures less than atmospheric.

Another object is to provide a piston cup assemblage as explained above, which is so constructed than an O-ring provides outward pressure at preselected areas of the assemblage such that a positive action is maintained in a reciprocating pump without appreciable increase in friction between piston and cylinder walls.

A further object of this invention is to provide a piston cup assemblage as set forth above which is inexpensive as to initial cost and to replacement repair cost.

In general, the resilient piston cup constructions of the conventional type available nowadays are adaptable for only one purpose. That is, several types are suitable for low drawing and low pressure pumping forces only. They utilize a reslient piston cup which has light sealing pressure on the cylinder side walls. There is also the type specially adapted for pumping high pressures from a low pressure or low vacuum inlet source, and these pistons also have a resilient cup construction but also have an appreciable and substantially fixed sealing pressure exerted against the cylinder side walls.

None of the above referred to pump pistons have a piston cup assemblage which is specially adapted for drawing fluids from a substantial vacuum or head of fluid and accordingly our invention does supply this much desired feature as will become evident subsequently.

These and other objects and advantages of our invention will more fully appear from the following description, made in connection with the accompanying drawing, wherein like reference characters refer to the same or similar parts throughout the several views and in which:

FIGURE 1 is a top view of our special pressure washer;

FIGURE 2 is an assembly view in cross-section of the head end of our expanded piston cup assemblage;

FIGURE 3 is an enlarged cross-sectional view of the assembled piston cup assemblage, disposed within a cylinder, as it would appear during the pressure pumping stroke; and

FIGURE 4 is a similar view to that of FIGURE 3 but showing the relation of the piston elements during the drawing action.

Referring to FIGURE 1, we show the general configuration of a pressure washer which provides the novel results of our expanded piston cup assemblage. The pressure washer referred to generally as **10** is annular in shape and has a concentric mounting hole **11** adapted for receiving a bolt as shown in FIGURE 2.

Referring to FIGURES 1 and 2, the pressure washer **10** is provided with a substantial thickness between the upper surface **12** and bottom surface **13** which is comparable to the open recessed portion **14** of annular piston cup **15**. The side wall **16** of the pressure washer **10** has a recessed groove **17** which is annular with respect thereto. Seated within the groove **17** is a small distended and conventional O-ring **18** that is resiliently secured thereto.

The annular cup **15** as shown, has an upper riding portion **19** which is continuous with a corner portion **20** and a base portion **21**. The recessed portion **14** is formed by the inner side wall **22** and upper surface **23**. The bottom base portion **21**, having an upper surface **23**, has an annular opening **24** for receiving the annular boss **25** of the backer **26**. The outer surface **27** of riding portion **19** is slightly tapered inwardly as the surface **27** approaches the corner portion **20**. The taper thereby causes a greater radially outward force at the upper end of the upper riding portion as will become apparent subsequently.

The backer **26** has a flange **28** which defines a recess **29** between the flange **28** and boss **25** for receiving the base portion **21** of the piston cup **15**. The backer **26** also has a bore **30** for receiving the shank **31** of the bolt **32**. Bolt **32** is threadably securable to an operating rod (not shown) and related means, such as bushing **32***a*, all of which form no part of the present invention.

In actual use of our expanded piston cup assemblage, the elements of FIGURE 2 would be assembled with their parts interfitting as seen in FIGURE 3. The O-ring **18** causes the inner side wall **22** to be forced outward a very slight amount and the O-ring is thus referred to as being in its relaxed position.

As may also be seen in FIGURE 3, the bolt shank **31** is journaled through the backer bore **30** and engaged into elements not shown whereby to tighten the head **33** down upon the upper surface **12** of the pressure washer **10**. By so tightening the bolt **32**, the bottom surface **13** of the pressure washer **10** is gently forced against the boss **25** of backer **26** thereby causing no appreciable squashing pressure on the base portion **21** of the piston cup **15**.

The assembling of the elements as shown, will cause the base portion **21** and corner portion **20** to seat in the recess **29** of the backer **26** whereby the flange portion **28** of the backer will provide the necessary backing to the annular cup to prevent substantial deformity of the upper riding portion **19** during the operation of the piston. As noted in FIGURE 3, the backer **26** is of small enough diameter so that there is some amount of clearance **34** between it and the cylinder side wall **35**.

The use and operation of our expanded piston cup assemblage will now be explained with reference to FIGURES 3 and 4, however, it is to be noted that in actual practice the resilient piston cup actually does not separate from the frictional engagement with the cylinder side wall **35**, as shown in FIGURE 4. The drawing indicates a separation since the functions of the O-ring **18** and piston cup **15** have been over emphasized to more clearly explain and show the actions and reactions during the drawing portion of the pumping cycle.

During the pressure or exhaust stroke, the piston assemblage, while moving in the direction of the arrow as seen in FIGURE 3, would have the shown relation between components. That is, the O-ring is substantially undeformed in the relaxed position and the piston cup outer surface **27** is normally flexed with slight pressure against the inside surface of the cylinder wall **35** as explained above. During the pumping of a fluid in the cylinder chamber above the piston assemblage, the pressure built up would tend to aid the outward force of the piston cup thereby causing increased sealing properties, the amount of increased pressure depending upon the resilience of the piston cup material. This reaction will be readily understood by those skilled in the art.

Referring now to FIGURE 4, the piston assemblage is represented as traveling in the direction of the arrow or in the drawing or intake action of the pumping cycle. The elements of the piston cup assemblage are shown in their over emphasized acting and reacting relation as ex-

plained above. In this portion of the piston cycle there would be a tendency for the upper riding portion **19** of the piston cup **15** to deform readily inward so as to allow fluid to pass from the area below the backer, between the outer surface **27** and the side wall **35**, and into the chamber area above the pressure washer and piston cup. At this point, the novelty of our invention becomes more readily apparent. As the drawing force is increased, the deformity of the piston cup **15** is increased, however, the O-ring **18** provides a soft cushion and reinforced backing to keep the side wall **22** of the piston cup urged outwardly and in frictional engagement with the side wall **35** at all times regardless of any reasonable drawing force. The O-ring is now shown deformed in the unrelaxed or reacting condition. Thus the conventional pumping characteristics of the piston cup during the pumping cycle are not substantially impaired as the drawing characteristics of the piston cup are substantially preserved even though increased drawing forces are required, for example, when a large head of water is encountered.

By providing an O-ring as a resilient backing element to the inner side wall **22** of the piston cup, we have found that the resilient characteristic of the piston cup is still preserved during the drawing portion of the piston cycle whereas, had the backing material been of a rigid material, the important resilient qualities would have been substantially lessened.

An added advantage of our invention is that the O-ring, when worn out or otherwise rendered unsatisfactory for use, may be easily and economically replaced to again restore the pumping characteristics of the expanded piston cup assemblage when encountering high drawing forces.

It will, of course, be understood that various changes may be made in the form, details, arrangements and proportions of the parts without departing from the scope of our invention as set forth in the appended claims.

What is claimed is:

1. An expanded piston cup assemblage comprising, a resilient piston cup having an upper riding portion and a base defining a recessed portion with inner side walls, a relatively stiffer backer encircling said piston cup rearwardly of said upper riding portion and having an outer diameter no greater than that of said upper riding portion, a rigid means lying within the upper riding portion of said resilient piston cup, and a distended biasing O-ring held outwardly by said rigid means in supporting relation against said inner side wall, whereby to maintain said upper riding portion in continual contact with the side wall of a cylinder, whereby said piston assemblage will cause substantial drawing forces as well as pressure forces during a pumping cycle.

2. A combination comprising, a pump cylinder and an expanded piston cup assemblage having a conventional resilient annular piston cup, a backer for portions of said piston cup, a rigid means lying within said resilient piston cup, and an annular distended biasing O-ring encircling the edges of said rigid means and extending radially outwardly thereof for maintaining annular portions of said piston cup in continual contact with said pump cylinder when high drawing forces are encountered.

3. A combination comprising, a pump cylinder, and an expanded piston cup assemblage having a conventional resilient piston cup, a backer for portions of said piston cup, an annular pressure washer and an annular distended biasing O-ring encircling said pressure washer and extending radially outward thereof for exerting pressure on and maintaining annular portions of said piston cup in continual contact with said pump cylinder during a pumping cycle, said biasing means further exerting only slight biasing pressure during the exhaust stroke and exerting greater biasing pressure during the intake stroke, the biasing pressure increasing when drawing forces are encountered during the intake stroke.

4. An expanded piston cup assemblage comprising, a resilient body having a circular base portion and an annular upper riding portion joined thereto to define a recessed portion, said upper riding portion being tapered inwardly and rearwardly, a rigid backer held against said base portion in supporting relation thereto and having an outer diameter less than that of said upper riding portion, and a pressure washer disposed within said recessed portion having a distended resilient O-ring disposed between said pressure washer and said piston cup, whereby to maintain said upper riding portion in continual contact with a cylinder wall to prevent said upper riding portion from flexing radially inward when substantial drawing pressures are encountered during a pumping cycle.

5. An expanded piston cup assemblage comprising, a resilient annular piston cup having an annular upper riding portion adapted for frictional engagement with a cylinder side wall and a base portion, a backer engaging in supporting relation to said piston cup base portion, a pressure washer disposed concentrically within said annular upper riding portion of said piston cup, said washer having an annular groove therearound, and a distended resilient toroid having portions seated in said annular groove and remaining portions extending outwardly thereof in interfitting contact between said pressure washer and said piston cup annular upper riding portion, whereby said toroid will provide a soft and resilient annular force to urge said annular upper riding portion outwardly for positive frictional engagement thereof with a cylinder side wall, whereby operation of said piston cup will not be substantially impaired when said piston encounters high drawing forces.

6. An expanded piston cup assembly comprising, a resilient piston cup having an upper riding portion adapted to frictionally engage with the side walls of a fluid pump cylinder and a base portion secured to said upper riding portion, said base portion and upper riding portion defining a recess, said base further having an annular opening therethrough, a rigid backer having an upper surface held in abutting support to said piston cup, said backer also having a boss on the upper surface thereof for interfitting in said piston cup annular opening, a pressure washer disposed within said recess of said piston cup and secured against said boss, and a distended resilient O-ring interfitted between said pressure washer and said upper riding portion, whereby to exert counteractant and increasing radially outward force upon said upper riding portion when said upper riding portion tends to deform radially inward due to increased drawing forces encountered during a pumping cycle.

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