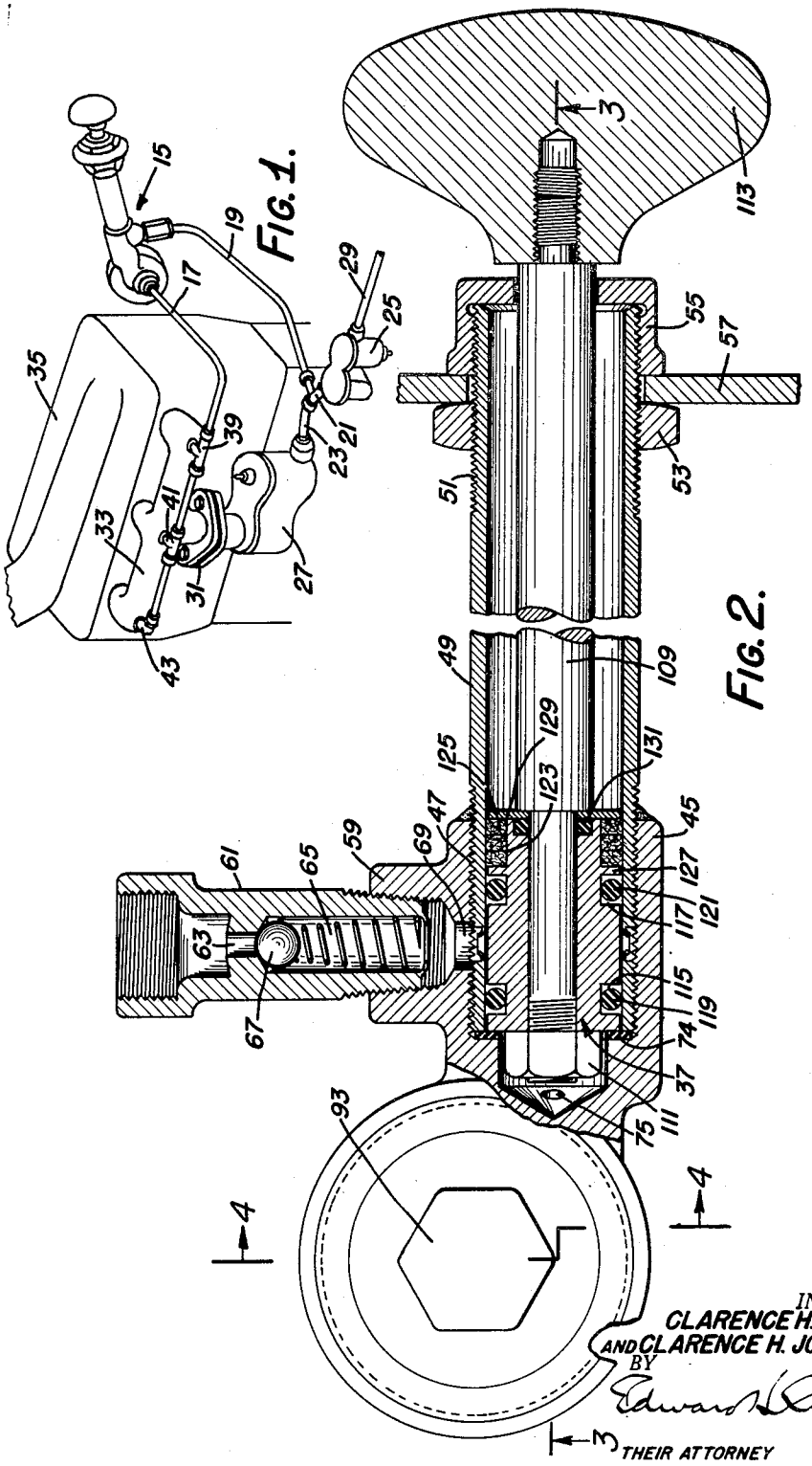
May 10, 1955 C. H. JORGENSEN ET AL 2,707,921

PRIMER ASSEMBLY

Filed Nov. 28, 1950 2 Sheets-Sheet 1



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PRIMER ASSEMBLY

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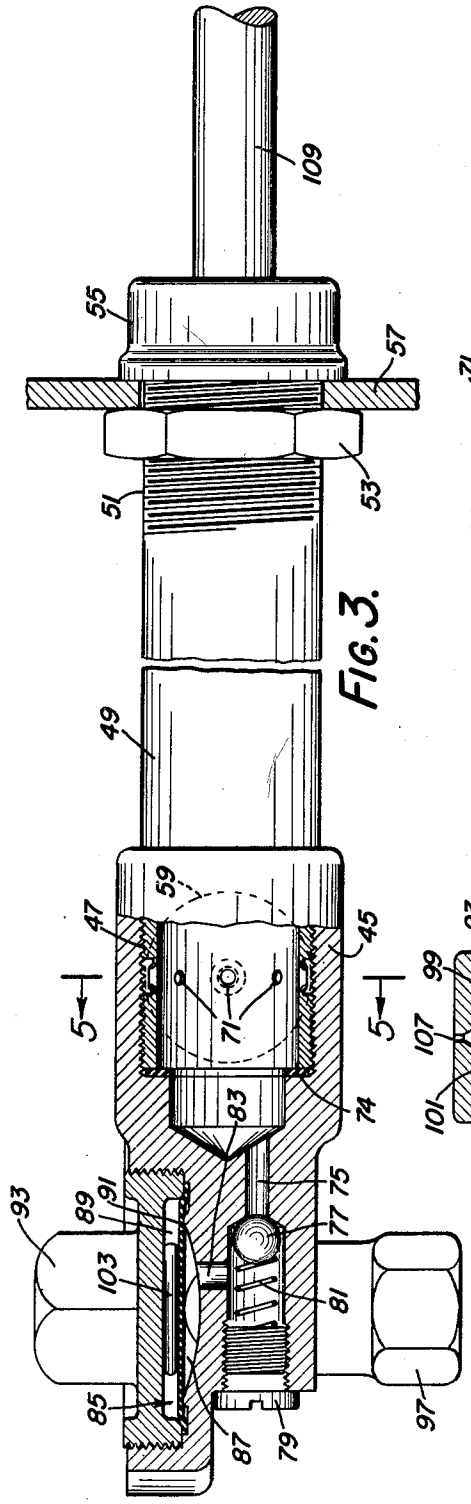


FIG. 3.

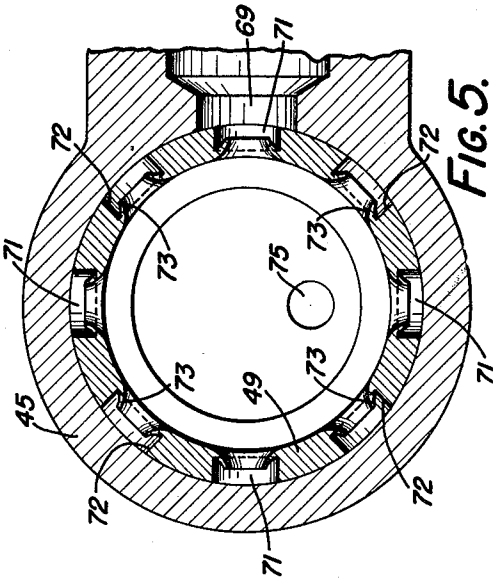


FIG. 5.

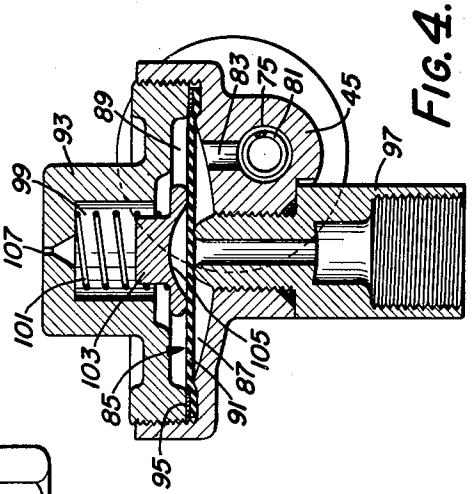


FIG. 4.

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PRIMER ASSEMBLY

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6 Claims. (Cl. 103—153)

This invention relates to primer devices or pumps and has particular reference to manually operated priming pumps for use with internal combustion engines for injecting or spraying gasoline or other liquid fuel into the intake manifold so that the starting of the engine may be easily and quickly accomplished. More particularly this invention is an improvement over the primer pump disclosed in the patent to Clarence H. Jorgensen et al., No. 1,668,209.

In the past it has been difficult with primers of this nature to prevent fuel or air being drawn through the priming device and into the cylinders as a result of the suction created by the movement of the engine pistons in the cylinders. Such unintended passage of fuel through the priming device causes an unnecessary wastage of fuel, and as the leakage is not uniform due to the variations in the manifold vacuum, it is impossible to maintain an efficient as well as a correct carburetor adjustment at all engine speeds. Moreover, this leakage often results in more fuel being drawn into the cylinders than will be burned therein and as a result the excess fuel seeps downwardly past the piston rings and into the lubricating oil, destroying its value for lubricating purposes and causing excessive wear of the piston rings and bearings, and the scoring of the cylinders, with the consequent damage to the engine and loss of power.

Primer pumps of known construction have the further disadvantages in that when connected to a source of liquid fuel supplied under pressure by a fuel pump, as is commonly the case with the present day internal combustion engines, the pressure of the incoming fuel tends to cause objectionable leakage around the outer or handle end of the primer plunger which not only wastes the fuel, but also presents a distinct hazard to the health and safety of the operator.

A further disadvantage of primer pumps of known construction is that due to the solvent action of the gasoline or other fluid pumped, the lubricating film between the piston and cylinder is quickly dissolved, making it difficult, if not impossible to maintain the proper lubrication therebetween.

One object of the present invention is to provide an improved primer pump having a more simple, practical and efficient construction.

Another object is to provide a primer pump having an improved construction and a more practical arrangement of parts so that there is no possibility of fluid or air being drawn into the cylinders by the suction of the engine.

Another object is to provide a primer pump having the above advantages, adapted to be connected to a supply of fluid under pressure, and having improved piston and inlet construction whereby the fluid pressure upon the opposite ends of the piston is equalized so that the piston remains in the normal inward or closed position thereof.

Another object is to provide a primer pump of the above nature having an improved piston and inlet construction which prevents the fluid from leaking outwardly along the plunger into the operator's compartment or cockpit.

A further object is to provide a primer pump of the above nature having an improved cylinder and inlet port construction whereby the wall of the cylinder is smooth and free from sharp edges adjacent the inlet for preventing damage to the piston as it is moved past the inlet.

Still a further object is to provide a primer pump having the above advantages in which the source of lubrication for the piston and cylinder is protected against contact with and dissolution by the fluid being pumped.

To these and other ends of the invention resides in certain improvements and combinations of parts, all as will be hereinafter more fully described, the novel features being pointed out in the claims at the end of the specification.

In the drawings:

Fig. 1 is a perspective view of an automobile engine and a primer pump embodying the present invention showing the connections therebetween;

Fig. 2 is a side elevation, partly in section, of the above primer pump showing the piston in the normal inward or closed position thereof;

Fig. 3 is a plan view, partly in section, as indicated by section line 3—3 in Fig. 2, showing the piston in the outer position thereof;

Fig. 4 is a sectional end elevation substantially along line 4—4 in Fig. 2, showing the spring actuated diaphragm in closed position, and

Fig. 5 is an enlarged sectional elevation substantially along line 5—5 in Fig. 3 showing the circumferentially spaced inlet ports.

The embodiment of the invention herein disclosed by way of illustration comprises, preferably, a primer pump shown generally at 15 (Fig. 1) connected at the discharge fitting thereof to a pipe 17 and at the inlet fitting thereof to a second pipe 19. Intake pipe 19 is connected at its opposite end to a T fitting 21 located in a fuel line 23 which leads from the discharge side of a fuel pump 25 to a carburetor 27. Fuel pump 25 is connected to a supply of liquid fuel by a pipe 29. Carburetor 27 is connected by a flanged coupling 31 to an engine intake manifold 33 which is secured to an engine 35 by suitable means (not shown), as well understood in the art.

Thus, the fluid in intake pipe 19 is under pressure whenever fuel pump 25 is operating and when the primer pump piston, shown generally at 37 (Fig. 2), is moved outwardly from the position as shown in Fig. 2 to that as shown in Fig. 3, the fluid quickly fills the volume displaced by said piston movement and upon the return of said piston to its initial position, the fluid is forced outwardly through discharge pipe 17, by means to be hereafter more fully described, and enters intake manifold 33 preferably through suitable vaporizing or jet fittings 39, 41 and 43 as well understood in the art.

The primer consists of a body member 45 (Figs. 2 and 3) preferably formed by a die-casting of brass or other suitable material and has a cylindrical threaded socket or bore 47 (Fig. 2) in one side thereof. A cylindrical member 49 is threadedly mounted in socket 47 as shown in Figs. 2 and 3 and is adapted to slidably receive the cooperating piston 37, to be hereafter more fully described. The outer end 51 of cylindrical member 49 is externally threaded and has a check nut 53 positioned thereon with a threaded member 55 on the outer end of the member for clamping said primer to the instrument board or other suitable support 57.

The primer has an inlet or intake means comprising an internally threaded projecting nipple 59 (Fig. 2) located in the lower side of body chamber 45 as viewed in Fig. 1 and opening at the inner end thereof into socket 47. A screw threaded fitting 61 (Fig. 2) is positioned within

nipple 59 and is connected to supply pipe 19 as shown in Fig. 1. Fitting 61 has a bore 63 extending therethrough and an enlarged chamber 65 in the inner portion thereof for receiving an inwardly opening spring actuated ball check valve 67 for preventing fluid flow outwardly through said fitting 61 as well understood in the art. A port 69 (Figs. 2 and 5) is provided at the bottom or inner end of nipple 59 which is in register with one of a series of circumferentially spaced ports 71 (Fig. 5) opening through the walls of cylindrical member 49, as shown in Figs. 3 and 5.

The circumferentially arranged ports 71 are so spaced that the distance between two adjacent ports is less than the width of the inner end of port 69, as shown in Fig. 5, so that regardless of the rotary position of said cylindrical member 49, at least one of said ports will be in partial or complete register with the inner end of port 69. It is important that the internal surface of cylindrical member 49 is smooth and free from sharp or rough edges which would cut into and damage the piston packing rings, to be hereafter described. In order to prevent the formation of any rough or sharp edges at the intersection of the inner ends of ports 71 and the internal surface of cylindrical member 49, said ports are formed by drilling a series of holes 72 which extend inwardly partway through the walls of the cylindrical member 49. This leaves a thin portion adjacent the inside surface of the cylinder walls through which is drilled a second and smaller hole, thereby forming at the inner ends of ports 71 oppositely extending lip portions 73. Lip portions 73 are formed or pressed outwardly into holes 72, by suitable means, thereby providing a smooth and unbroken transition between the internal surface of cylindrical member 49 and ports 71.

A spacing washer 74 positioned at the inner end of socket 47, serves as a stop for the inward movement of cylindrical member 49. Washer 74 also serves as stop for the inward movement of piston 37 so that when said piston is in the normal inward or closed position thereof, ports 71 are substantiailly opposite the center of said piston, for reasons to be hereafter explained.

Said primer is provided with outlet means which connects socket 47 to the engine intake manifold 33 by discharge pipe 17. Said outlet means comprises a bore 75 (Fig. 3) extending longitudinally through body member 45 and opening in the inner end thereof into the inner end of socket 47 as shown in Fig. 3. Bore 75 is enlarged adjacent the outer end thereof and has a spring actuated ball check valve 77 positioned therein which prevents fluid from entering socket 47 through bore 75. The enlarged outer end of bore 75 is internally threaded for receiving a screw 79 which adjusts the tension on valve spring 81 as well understood in the art.

A port 83 (Figs. 3 and 4) connects the outer portion of bore 75 with a second chamber, located in body member 45 and shown generally at 85 (Fig. 4). Chamber 85 is preferably divided into lower and upper chambers 87 and 89 (Fig. 4), respectively, by a flexible diaphragm 91 of known and suitable material, as for example, neoprene, which extends across said chamber and which is held in position by a threaded cap 93 screwed into body member 45 as shown in Fig. 4. A washer 95 (Fig. 4) is positioned between cap 93 and diaphragm 91. A discharge fitting 97 threadedly engages body member 45 and extends upwardly into the lower portion 87 of chamber 85 as shown in Fig. 4. Cap 93 is centrally formed with a recessed chamber 99 which serves as a seat for one end of a spring 101, the other end of which embraces a member 103 having a curved base flange 105 which is in engagement with the upper side of diaphragm 91 and forces said diaphragm over the correspondingly curved inner end of fitting 97, thereby sealing said fitting and closing said outlet means. Cap 93 has an air vent 107 in the center thereof, and as fitting 97 is connected to the engine intake manifold by pipe 17, it is evident that the suction of the engine will aid spring 101 in normally seating diaphragm 91 over the inner end of bushing 97.

We also provide a novel piston 37 which is adapted to closely fit cylindrical member 49, as well understood in the art and which is fastened to the inner end of a longitudinally extending rod or plunger 109 by a nut 111 (Fig. 2). Rod 109 has at the opposite end thereof a hand knob 113. Piston 37 has adjacent the inner end thereof a circumferentially extending groove 115 and a similar circumferentially extending groove 117 spaced inwardly a short distance from the outer end thereof. Grooves 115 and 117 form seats for positioning packing rings 119 and 121, respectively, which, known in the art as O rings, are circular in cross section, and are composed of known and suitable material, as for example, synthetic rubber.

It is evident from the above description of our improved piston that when the piston is in the normal inward or closed position thereof, as shown in Fig. 2, the inlet ports 71 are approximately opposite the center or midpoint of the piston. Thus, the pressure of the fluid in chamber 65 and the aligned ports 69 and 71 acts with equal force against packing rings 119 and 121 adjacent the inner and outer ends, respectively, of the piston. As these forces act longitudinally along the piston parallel to the direction of movement thereof, and are equal in magnitude, they tend to hold the piston in its normal closed position, until pulled outwardly by the operator, thereby eliminating the objectionable characteristic of prior pumps in which the piston tended to work outwardly due to the fluid pressure thereon.

A further advantage of our construction is that with the piston 37 in the normal closed position thereof, packing ring 119 effectively interrupts and seals off the fluid connection between the inlet and outlet of the pump and thus is a further safeguard against leakage of fuel or air through the primer into the engine. Packing ring 121, on the other hand, prevents the fluid from escaping outwardly along piston 37 and thus eliminates the danger of fuel leakage along the piston rod into the operator's compartment or cockpit and at the same time prevents the fuel being pumped from contacting the lubricating means, to be hereafter described.

A common difficulty with primer pumps of this nature has been in providing the proper lubrication between the piston and cylinder, when used with solvent fuels such as gasoline, which tend to dissolve or wash the lubricant away from both the cylinder walls and piston and to deteriorate the lubricating means all of which resulted in undesirable wearing of the piston and cylinder. We provide a novel self-lubricating means which, in conjunction with our improved piston and packing, provides proper lubrication regardless of the fuel being pumped.

Piston 37 is reduced in diameter adjacent the outer end thereof as at 123 to form a seat for positioning three lubricant impregnated washers 125, preferably of hard felt or other suitable material, which, as the piston is reciprocated, apply a thin coating of oil, graphite, or other known and suitable lubricant to the inner surface of cylindrical member 49. Washers 125 are prevented from moving inwardly along piston 37 by a radially projecting ridge 127, which separates said washers from outer packing ring 121. Washers 125 are prevented from moving outwardly by a metallic washer 129 which is held in position against the outer end of piston 37 by a shoulder on piston rod 109. A gasket 131 (Fig. 2) of known and suitable material, preferably synthetic rubber, is positioned adjacent the outer end of piston 37 for preventing leakage between piston rod 109 and piston 37.

Thus, it is evident that our improved piston not only has the advantages pointed out above, but also that said piston prevents the fluid being pumped from contacting the lubricating washers or rings 125, thereby preventing both the deterioration of the washers and the washing away of the lubricating material. Although a small amount of fluid is trapped between packing rings 119

and 121 and will be carried back and forth by the piston and will initially remove a certain amount of the lubricant from the cylinder walls, it is to be noted that this fluid is small in quantity and tends to become saturated with the lubricant and lose its ability to further dissolve the lubricant so that thereafter the lubricating film is substantially unimpaired by the contact with this trapped fluid.

In operation, therefore, with the primer connected to the source of fuel and engine manifold as shown in Fig. 1, it is only necessary to pull knob 113 outwardly moving piston 37 to the right from its position as shown in Fig. 2 to its position as shown in Fig. 3, which causes a supply of fluid to flow through the inlet check valve 67 into the cylinder of the pump. Thereupon the piston is pushed inward by the operator, increasing the pressure in the pump and forcing ball valve 67 against its seat. This increased pressure forces the fluid through bore 75 to open valve 77 and through port 83 into the lower portion 87 of chamber 85. The fluid spreads out underneath the diaphragm 91 in chamber 85 with the effect of hydraulic action thereon and forces diaphragm 91 away from the inner end of fitting 97 against the combined action of spring 101 and suction of engine 35, if running. This allows the priming fluid to pass outwardly through discharge pipe 17 and into the manifold of the engine.

It will thus be understood that the forcing of the liquid into the lower portion of chamber 85 underneath diaphragm 91 unseats the diaphragm and allows the fluid to pass through the primer and into the engine, and thereafter the diaphragm is seated by the combined action of spring 101 and the suction of the engine, if running, so that the primer is sealed against leakage of air or fuel into the engine except when the fluid pressure beneath diaphragm 91 is made to exceed the above combined pressures. This occurs only when piston 37 is moved inwardly from right to left in the above pumping stroke.

It is evident that the greater the suction of the engine, the greater would be its tendency to open outlet check valve 77 and draw in fluid from the primer. However, this tendency is counteracted by the fact that greater engine suction serves to increase and improve the sealing action of diaphragm 91 and thus the sealing action of the diaphragm varies to match the varying tendency of the engine to draw in excess fluid through the pump. In addition to the above suction action, diaphragm 91 is held in sealing engagement by spring 101 so that at full throttle operation, when the suction is at a minimum, diaphragm 91 is still held in sealing engagement with discharge bushing 97.

If for any reason, such as high altitude or low temperature operation, either the inlet or outlet check valve spring break, it would not affect either of the three remaining sealings, and even if all of the springs should fail, packing rings 119 would still prevent leakage through the pump into the engine at all speeds, and diaphragm 91 would still exert a sealing action in proportion to the suction of the engine. Thus, the above primer is especially well adapted for use in aircraft or similar vehicles where fuel economy, reliability and safety of operation are of primary importance.

It will be understood that in certain installations it may be desirable to omit diaphragm 91 and spring 101. Although this removes one safety feature, the function of which is to prevent fuel or air from being drawn through the primer, it does not mean that the suction of the engine will now be resisted only by the tension within outlet valve spring 81. If, under the above circumstances, the engine suction succeeds in opening outlet valve 77, it will then act directly against the inner end of piston 37 and will in effect tend to draw the piston more tightly into the closed piston, in which position packing ring 119 effectively interrupts and seals off the fluid connection between the inlet and outlet of the pump thereby preventing the engine from drawing fuel or air through the primer.

It will thus be seen that the invention accomplishes its objects and while it has been herein disclosed by reference to the details of a preferred embodiment, it is to be understood that such disclosure is intended in an illustrative rather than a limiting sense, as it is contemplated that various modifications in the construction and arrangement of the parts will readily occur to those skilled in the art, within the spirit of the invention and the scope of the appended claims.

We claim:

1. A primer pump comprising a body member formed with a threaded bore, a cylinder having an end in threaded engagement with said bore, inlet means in said member opening into said bore adjacent to and spaced from an end of the same for connecting said pump to a supply of liquid, said cylinder being formed with a series of circumferentially spaced ports adjacent to and spaced from said end thereof for communicating with said inlet means in any position of angular rotation of said cylinder when threadedly engaged in said bore, a piston movably mounted in said cylinder and adapted when positioned at said end of said cylinder to overlie and close said circumferentially spaced ports, outlet means in said member opening from said bore, and valve means in said member for maintaining unidirectional flow of said liquid in said pump.

2. A primer pump comprising a body member provided with a cylinder, inlet means in said member opening at its inner end into said cylinder adjacent to and spaced from an end of said cylinder for connecting said pump to a supply of liquid under pressure, a substantially cylindrical piston movably mounted in said cylinder and having packing means adjacent the opposite ends thereof, said piston being adapted when positioned at said end of said cylinder to close the inner end of said inlet means and seal the same with said packing means positioned on opposite sides thereof for equalizing the liquid pressure on said packing means longitudinally of said piston, lubricating means mounted on and movable with said piston, said lubricating means being impregnated with a lubricant and located adjacent the end of said piston opposite its liquid contacting end and between said end and the adjacent packing means for preventing the pumped liquid from contacting and dissolving said lubricant, outlet means in said member opening from said cylinder, and valve means in said member for maintaining unidirectional flow of said liquid in said pump.

3. A primer pump comprising a body member formed with a threaded bore, a cylinder having an end in threaded engagement with said bore, inlet means in said member opening into said bore adjacent to and spaced from an end of the same for connecting said pump to a supply of liquid, said cylinder being formed with a series of circumferentially spaced ports for communicating with said inlet means in any position of angular rotation of said cylinder when threadedly engaged in said bore, a substantially cylindrical piston movably mounted in said cylinder, packing means on said piston adjacent the inner and outer ends thereof, said piston being movable inwardly to bring the inner end thereof and the inner packing means past said circumferentially spaced ports to overlie and close the same, lubricating means impregnated with a lubricant and mounted on said piston between the outer packing means and the outer end of said piston for movement with said piston out of contact with said liquid in said pump for preventing deterioration of said lubricant by the liquid pumped, outlet means in said member opening from said cylinder, and valve means in said member for maintaining unidirectional flow of said liquid in said pump.

4. The combination comprising a cylinder provided with an inlet port opening through a side wall thereof,

and a piston slidable in said cylinder to cover and uncover said inlet port, said piston having packing rings thereon, the wall of said cylinder having a relatively thin portion adjacent said inlet port and having said portion flared outwardly for providing a smooth inner cylinder surface adjacent said port for contact with said packing rings.

5. A cylinder having a side wall and a series of circumferentially spaced inlet ports extending therethrough, said wall having relatively thin portions adjacent said inlet ports and having said portions flared outwardly for providing a smooth inner surface for said wall adjacent said inlet ports.

6. The method of forming a cylinder member for pumps and the like having a smooth inner surface and a port opening through a wall thereof comprising the steps of forming a recess extending from the outside partially through the wall of said cylinder member, boring an opening through the remaining wall of said cylinder member substantially concentric with the center of said recess, said opening being smaller in diameter than said recess for leaving a lip portion of reduced thickness around said opening, and flaring said lip portion outwardly into said recess for forming the cylinder member with a smooth inner surface adjacent said port.

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