

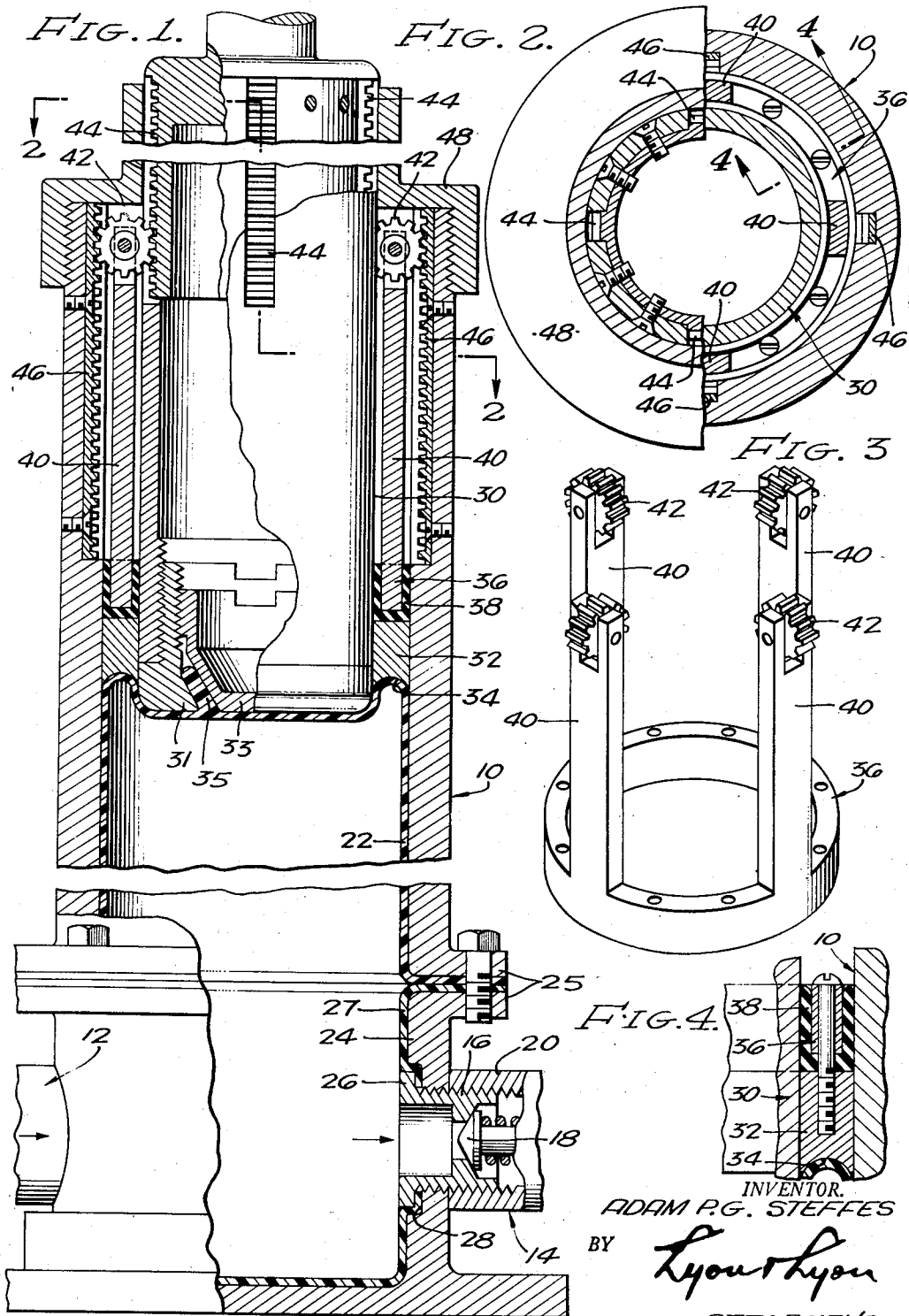
Sept. 13, 1960

A. P. G. STEFFES

2,952,218

PUMP

Filed Sept. 9, 1958



1

2,952,218

PUMP

Adam P. G. Steffes, 1424 Foreman Bldg., 707 S. Hill St., Los Angeles, Calif.

Filed Sept. 9, 1958, Ser. No. 760,024

11 Claims. (Cl. 103—152)

This invention relates to an improved pump.

It is an object of this invention to provide a hermetically sealed pump suitable for moving liquids or gases wherein the material being moved is isolated from the operative parts of the pump at all times.

It is a further object of this invention to provide a pump where chemicals or impurities such as sand and the like, cannot cause any damage, corrosion or excessive wear to the pump.

It is a further object of this invention to provide a pump where the material being moved can be completely isolated from the metal parts of the pump so that the material will not be affected, tainted or contaminated by the metal of the pump or the lubricants used therewith.

It is still a further object of this invention to provide a pump wherein a diaphragm is utilized to shield the moving parts and provide a long pumping stroke, without leakage, even if operated at the slowest speed.

It is still a further object of this invention to provide a pump wherein a hermetically sealed diaphragm is utilized to prevent any loss or leakage whatsoever of the material being moved, even under the highest pressures.

It is still a further object of this invention to provide means for equally distributing the pressure on every part of the diaphragm during pumping.

It is a further object of this invention to provide a perfectly sealed piston for use in hydraulic or pneumatic controls, presses, lifts, jacks, etc.

It is still a further object of this invention to provide a means of measuring accurately hydraulic and pneumatic pressures directed into the cylinder and against the piston and the grooved side of the annular ring surrounding it.

It is a further object of this invention to provide a sealed air cushion shock absorber under constant pressure supporting the piston and weight resting upon it.

It is a further object of this invention to provide a pump which operates with a minimum of friction and requires a minimum of lubrication for its moving parts.

Other objects and advantages will be readily apparent from the following description:

In the drawings:

Figure 1 is an elevation in section of a pump embodying this invention.

Figure 2 is a section taken along line 2—2 of Figure 1.

Figure 3 is a perspective of the secondary driving mechanism cage.

Figure 4 is a section taken along line 4—4 of Figure 2.

A cylindrical casing 10 is provided.

A flexible diaphragm 22 is secured within casing 10, the extremity of said diaphragm being clamped between the casing 10 and cylinder head 24 to which said casing is secured by flanges 25. Said cylinder head, in a pump, may have an inlet 12 and an outlet 14. The outlet is formed by a threaded nipple 16 which screws into a suitable opening in head 24 and projects therefrom forming a valve seat. A spring loaded valve 18 mounted in tubing 20 seats against said valve seat and permits flow outwardly through the outlet only. The inlet and outlet may

2

be installed together in the base plate of cylinder head 24, as well as in the side wall, as shown, or separately in any desired arrangement. The nipple 16 projects through the cylinder head liner 27 and has a shoulder 26 formed thereon which fits into a suitable recess 28 in cylinder head 24 clamping the liner 27. A similar seal may be provided at inlet 12 to avoid leakage. The inside of the base plate may also be insulated by liner 27 as seen in Figure 1, if it is intended to isolate completely the material being moved from these metal parts.

The diaphragm 22 projects upwardly within casing 10 and a primary drive mechanism in the form of a piston 30 engages same and is securely fastened to the upper side of the closed end of the cylindrical diaphragm by a suitable adhesive or the like. Piston 30 in the embodiment of Figure 1 is formed of three parts, an outer-sleeve into which plug 31 screws; a second plug 33 which screws into plug 31 and clamps a portion 35 of diaphragm 22 securing same to the piston. The piston 30 is reciprocated in casing 10 by any suitable motivating source. A secondary driving mechanism comprises an annular ring 32 having a groove 34 on the under or diaphragm engaging side thereof. The distance between the cylinder wall and piston should be approximately three times the thickness of the diaphragm material. A cage 36 is positioned in the annulus between piston 30 and casing 10 above ring 32 and ring 32 is bolted thereon with sealing ring 38 clamped between ring 32 and the annular base of cage 36. The vertical arms of the cage will be long enough so that when the piston is completely retracted, the upper rim of the sealing ring will not come in contact with the lower ends of the cylinder racks. In this embodiment four arms 40 project upwardly from the base of cage 36, each of which is forked at its free extremity and has a pinion 42 rotatably mounted between said forks.

A pair of racks of equal length are provided for each pinion, one 44 is secured to piston 30 and the other 46 to the inner face of casing 10. A bonnet 48 screws onto casing 10 to secure the parts in the desired assembly.

When piston 30 is lowered in casing 10 the pinions 42 are driven by engagement between racks 44 and 46. By means of the racks and pinions, the cage 36 and ring 32 are descending at exactly one-half the rate of descent of piston 30 thereby accommodating distortion of diaphragm 22 upon descent of piston 30 and keeping a continuous pressure upon every part of the diaphragm and the fluid within the casing between the inlet and outlet overcoming one way valve 18 and pumping fluid to the outlet. Upon ascent of the piston further fluid is drawn into the casing through the inlet.

Although ring 32 in this embodiment descends at exactly one-half the rate of piston 30 this ratio may be varied, if necessary, by a double pinion of unequal diameters to accommodate any possible excess diaphragm, created by descent of piston 30, which projects into the annulus between the piston and casing 10. This ratio should be such that the same pressure is exerted upon all parts of the diaphragm when necessary to prevent undue stretching or bunching of the diaphragm during descent of the piston. The rate of descent of ring 32 can be made to vary, if necessary, with the material used for the diaphragm, length of stroke of the piston and the size of the annulus, the latter being determined primarily by the thickness of the diaphragm material.

While what hereinbefore has been described as the preferred embodiment of this invention, it is readily apparent that alterations and modifications may be resorted to without departing from the scope of this invention and such alterations and modifications are intended to be included within the scope of the appended claims.

I claim:

1. A pump comprising: a cylindrical casing, a flexible

3
diaphragm mounted within said casing, a piston concentric with and mounted within said casing engaging said diaphragm, a ring surrounding said piston filling the space between said piston and said casing and engaging said diaphragm, means contacting and moving said piston and means contacting and moving said ring at a reduced rate of speed with respect to said piston to accommodate folding of said diaphragm upon movement of said piston, said casing having an inlet and an outlet on the opposite side of said diaphragm from said piston.

2. A pump comprising: a cylindrical casing, a flexible diaphragm mounted within said casing, a piston concentric with and mounted within said casing engaging said diaphragm, a ring surrounding said piston filling the space between said piston and said casing and engaging said diaphragm, a rack on said piston, a second rack on said casing and a pinion mounted upon said ring and meshing with said racks whereby movement of said piston moves said ring, said casing having an inlet and an outlet on the opposite side of said diaphragm from said piston.

3. A pump comprising: a cylindrical casing, a flexible diaphragm mounted within said casing, a piston concentric with and mounted within said casing engaging said diaphragm, a ring surrounding said piston filling the space between said piston and said casing and engaging said diaphragm, means contacting and moving said piston and means contacting and moving said ring at a reduced rate of speed with respect to said piston to accommodate folding of said diaphragm upon movement of said piston, said ring having a thickness of approximately three times the thickness of the diaphragm, said casing having an inlet and an outlet on the opposite side of said diaphragm from said piston.

4. A pump comprising: a cylindrical casing, a flexible diaphragm mounted within said casing, a piston concentric with and mounted within said casing engaging said diaphragm, a ring surrounding said piston filling the space between said piston and said casing and engaging said diaphragm, means contacting and moving said piston, means contacting and moving said ring at a reduced rate of speed with respect to said piston to accommodate folding of said diaphragm upon movement of said piston, said ring having a thickness of approximately three times the thickness of the diaphragm and means securing said primary drive means to said diaphragm, said casing having an inlet and an outlet on the opposite side of said diaphragm from said piston.

5. A pump comprising: a cylindrical casing, a flexible diaphragm mounted within said casing, a piston concentric with and mounted within said casing engaging said diaphragm, a ring surrounding said piston filling the space between said piston and said casing and engaging said diaphragm, a rack on said piston, a second rack on said casing and a pinion mounted upon said ring and meshing with said racks whereby movement of said piston moves said ring, said racks being of the same length, said casing having an inlet and an outlet on the opposite side of said diaphragm from said piston.

6. A pump comprising: a cylindrical casing, a flexible diaphragm mounted within said casing, a piston concentric with and mounted within said casing engaging said diaphragm, a ring surrounding said piston filling the space between said piston and said casing and engaging said diaphragm, a rack on said piston, a second rack on said casing and a pinion mounted upon said ring and meshing with said racks whereby movement of said piston moves said ring, said ring maintaining the concentric relationship of said piston and casing, said casing having an inlet and an outlet on the opposite side of said diaphragm from said piston.

7. A pump comprising: a cylindrical casing, a flexible diaphragm mounted within said casing, a piston concentric with and mounted within said housing engaging said diaphragm, a ring surrounding said piston filling the space between said piston and said casing and engaging said diaphragm, a rack on said piston, a second rack on said casing, an arm mounted upon said ring and a pinion carried by said arm and meshing with said racks, said arm having a length equal to or greater than said racks preventing said ring from contacting said racks, said casing having an inlet and an outlet on the opposite side of said diaphragm from said piston.

8. A pump comprising: a cylindrical casing, a flexible diaphragm mounted within said casing, a piston concentric with and mounted within said casing engaging said diaphragm, a ring surrounding said piston filling the space between said piston and said casing and engaging said diaphragm, a rack on said piston, a second rack on said casing, an arm mounted upon said ring, a pinion carried by said arm and meshing with said racks, said arm having a length equal to or greater than said racks preventing said ring from contacting said racks and a sealing ring adjacent said ring, said casing having an inlet and an outlet on the opposite side of said diaphragm from said piston.

9. A pump comprising: a cylindrical casing, a flexible diaphragm mounted within said casing, a piston concentric with and mounted within said casing engaging said diaphragm, a ring surrounding said piston filling the space between said piston and said casing and engaging said diaphragm, means contacting and moving said piston and means contacting and moving said ring at a reduced rate of speed with respect to said piston to accommodate folding of said diaphragm upon movement of said piston, said ring having a groove on the diaphragm contacting face thereof, said casing having an inlet and an outlet on the opposite side of said diaphragm from said piston.

10. A pump comprising: a cylindrical casing, a flexible diaphragm mounted within said casing, a primary drive engaging said diaphragm, a secondary drive surrounding said primary drive engaging said diaphragm and moving at a reduced rate of speed with respect to said primary drive to accommodate folding of said diaphragm upon movement of said primary drive means and means securing said primary drive means to said diaphragm, said secondary drive having a groove on the diaphragm contacting face thereof, said casing having an inlet and an outlet on the opposite side of said diaphragm from said drive mechanisms.

11. A pump comprising: a cylindrical casing, a flexible diaphragm mounted within said casing, a piston concentric with and mounted within said casing engaging said diaphragm, a ring surrounding said piston filling the space between said piston and said casing and engaging said diaphragm, means contacting and moving said piston and means contacting and moving said ring at a reduced rate of speed with respect to said piston to accommodate folding of said diaphragm upon movement of said piston, said ring having a thickness of approximately three times the thickness of the diaphragm, said ring having a groove on the diaphragm contacting face thereof, said casing having an inlet and an outlet on the opposite side of said diaphragm from said piston.

References Cited in the file of this patent

UNITED STATES PATENTS

1,445,844 Mueser _____ Feb. 20, 1923

FOREIGN PATENTS

348,013 Great Britain _____ Apr. 27, 1931