Aug. 13, 1963 A. S. LIMPERT ET AL 3,100,451

PROPORTIONING PUMP

Filed Jan. 24, 1961 2 Sheets-Sheet 1

Fig. 1.

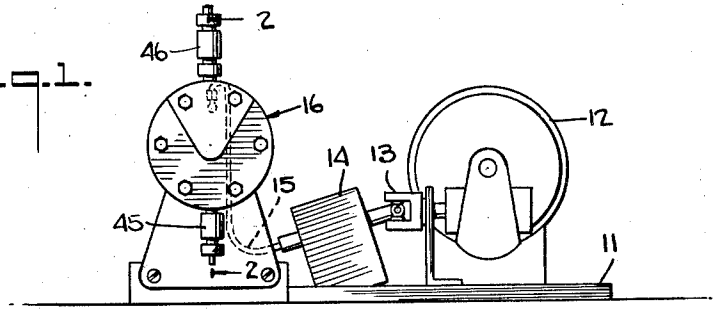


Fig. 2.

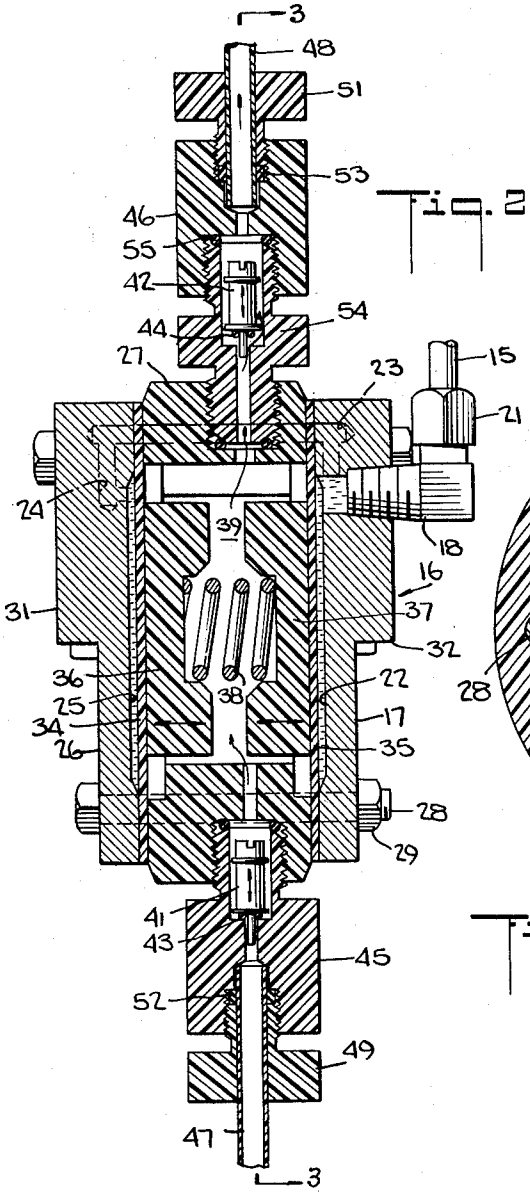
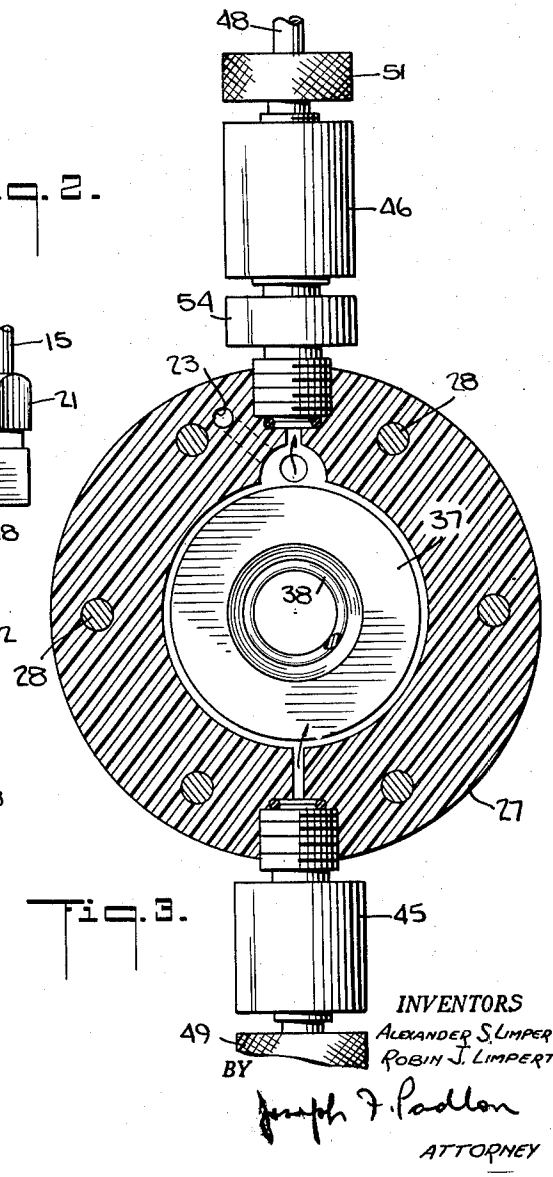


Fig. 3.



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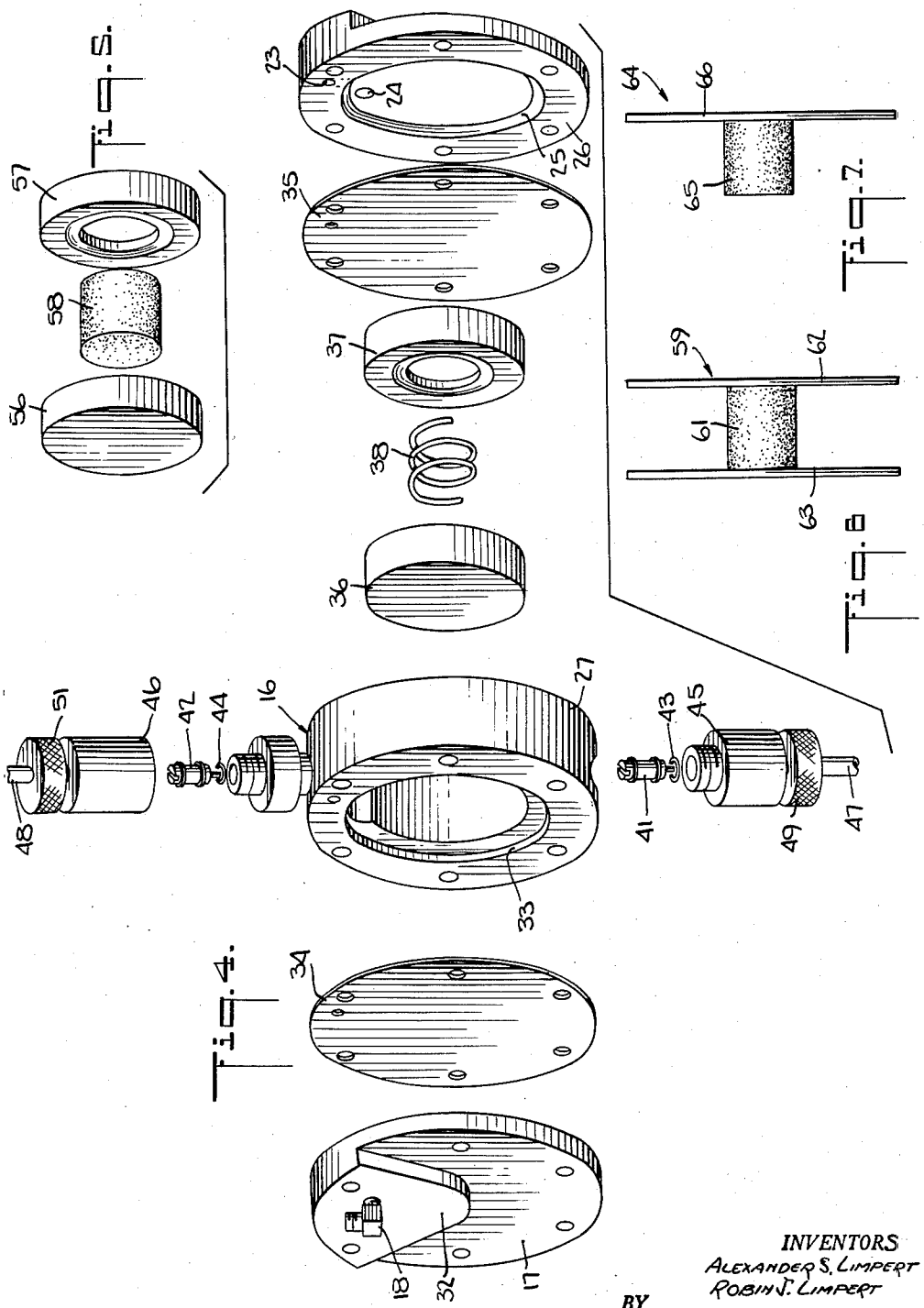


Fig. 5.

Fig. 7.

Fig. 6

Fig. 4.

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PROPORTIONING PUMP

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4 Claims. (Cl. 103—150)

This invention relates to chemical feeder pumps, and more particularly to an improved form of hydraulically actuated metefing pump.

Metering pumps are commonly employed for injecting measured quantities of liquid chemical or other potent liquid into a flow or substrate, as for example, when chlorinating water entering a swimming pool or adding reactants to a stream of chemical soltuion. The rate of flow of such substance moved by the pump is required to be definitely determinable, is usually adjustable to precisely predetermined values, and frequently is automatically so adjusted to correspond with the flow of substrate and thus provide a so-called "proportioning pump."

It has been found advantageous to construct such metering pumps for hydraulic actuation from a separate motorized pulsing unit, as set forth in our patent for "Liquid Proportioning Pump," Patent No. 2,869,467, dated January 20, 1959, where there is disclosed a diaphragm type of chemical pumping unit for actuation by hydraulic pulsing means.

The present invention contemplates the provision of an improved pumping unit for hydraulic actuation whereby certain economies of construction and improvement of operation are obtained through the use of a double diaphragm type of pump construction and other inventive features.

An object of the invention is therefore to provide a pump having increased pumping capacity for the same size pump.

Another object is to provide a metering pump having minimum "head space" or "clearance volume."

Another object is to provide a metering pump which is easy to clean.

Another object is to provide a pump which requires a minimum of expensive fittings in its construction.

Another object is to provide a pump wherein reduced diaphragm diameter obviates the need for bulky construction in a high pressure pump.

These and other objects of the invention are achieved by the use of a pumping chamber in the form of a cylinder closed at each end by an impermeable flexible diaphragm, which diaphragms are backed by pressure plates to form a hydraulically actuable pumping system having an internal hydraulic passage interconnecting the space between each diaphragm and its corresponding backing plate.

It will be observed that it is thus possible to double the volumetric efficiency of the pump without at the same time materially increasing its complexity because of the fact that an auxiliary hydraulic pulsing unit as described in the above mentioned patent can still be used to actuate the metering pump without change. It would of course, be exceedingly difficult, and probably impractical to attempt to actuate a pump having double diaphragm construction with opposed diaphragms by other than hydraulic means because of the mechanical complexity of the necessary linkages involved.

A clearer understanding of the invention may be obtained from the following detailed description of an illustrative example of a preferred form thereof taken in conjunction with the drawings, wherein:

FIG. 1 is an elevation of a metering pump constructed in accordance with the present invention;

FIG. 2 is a sectional view taken on the line 2—2 of FIG. 1;

FIG. 3 is a sectional view taken on the line 3—3 of FIG. 2;

FIG. 4 is an exploded view of FIG. 2 showing the component parts before assembly;

FIG. 5 is an exploded view of an alternative subassembly of FIG. 2;

FIG. 6 is a view of an alternative sub-assembly of FIG. 2; and

FIG. 7 is a view of an alternative sub-assembly of FIG. 2.

Referring now to the drawings in which like numbers refer to like parts throughout there is seen in FIG. 1 a base 11 carrying a motor rotated flywheel 12 connected by a yoke 13 to an adjustable hydraulic pulsing mechanism 14 of the kind described in our aforementioned Patent No. 2,869,467 whereby reciprocating pulsations of hydraulic fluid having a definite and controlled displacement and periodicity are produced in the hydraulic line 15 to the diaphragm pumping unit 16 which is seen more clearly in FIG. 2.

A backing plate 17 has a compression fitting 18 secured by a pipe thread into a tapped hole in said plate, and by means of compression nut 21 retains hydraulic line 15 in communication with a recess 22 in plate 17. Said recess 22 also communicates by means of drilled channels such as 23 and 24 with a similar recess 25 in an opposing backing plate 26. Backing plates 26 and 17 are secured in place by means of through bolts such as 28 seen also in FIG. 3, provided with nuts 29, and have bosses 31 and 32 adequate to provide a thickness of material sufficient to safely accommodate the application of fittings and the drilling of interconnections aforementioned.

Said backing plates are so secured over an annular pump chamber 27 which may be seen more clearly in the exploded view of FIG. 4. As there are shown, the member 27 has recessed portions such as 33 on either side thereof and is covered on either side by the diaphragms 34 and 35 before the plates 17 and 26 are bolted in place thereover.

Also inserted therebetween before such closure are the cheeks 36 and 37 and the compression spring 38 therebetween. The function of the latter is to distend the diaphragms 34 and 35 in the quiescent condition when a hydraulic pulse is not being applied, and thus assist in filling the pump chamber 39 of FIG. 2 on the back stroke of the pump, thereby avoiding the need of negative pressure in the hydraulic system, and obviating the possibility of entraining undesired leakage bubbles of air therein. Such entrainment could occur in a hydraulic system which is nevertheless tight to hydraulic fluid because of the great disparity between the viscosity of air and that of hydraulic fluid, whereby air can enter apertures and seals which are still of ample tightness to prevent the escape of such media as hydraulic fluid.

It is convenient and desired to construct the operative parts of the described pump assembly, as well as those parts further to be described, of materials highly resistant to corrosion such as inert plastic polymers, and in the case of the spring 38, of stainless steel. Plates 17 and 26 are conveniently made of metal, while member 27 may be transparent plastic and diaphragms 34 and 35 of tough material such as a fluorinated hydrocarbon polymer.

Appropriate inlet and outlet valves 41 and 42, provided with annular seal rings 43 and 44 respectively are contained in valve chamber 45 and valve chamber cover 46 respectively, into which pump inlet and outlet tubes 47 and 48 are secured by compression screws 49 and 51 operative on the sealing washers 52 and 53 shown in FIG. 2. Said cover 46 has a valve chamber 54 screwed into it and sealed by washer 55.

Chamber 45 and cover 54, in turn, are threaded into appropriate tapped openings in the pump housing member

27 which communicate with the pump chamber 39 of FIG. 2.

In FIG. 5 there is shown an alternative construction of the cheek and spring elements for diaphragm distention above described, wherein cheeks 56 and 57 are resiliently separated by the block 58 of elastomeric material such as rubber or synthetic rubber.

In FIG. 6 there is shown another form of diaphragm distending device 59 wherein the elastomeric block 61 provides a unitary construction with the integral cheeks 62 and 63.

In FIG. 7 there is shown another form of diaphragm distending device 64 wherein an elastomeric block 65 is formed integral with a single cheek 66 for cooperation with a corresponding plain cheek not shown.

It will be observed that the structures shown in FIGS. 5, 6, and 7 are especially adapted for use in double diaphragm pumps of the instant construction. Also, they provide the advantages of overcoming metal fatigue in a spring, reduction of clearance volume, and in FIG. 6, the elimination of crevices for easy cleaning and in FIG. 7 a construction which, because of its freedom from undercut, is adapted for ready moldability.

When a resilient member such as shown at 58, 61 or 65, which is composed of an inherently resilient substance, is used, it is possible so to design the volume and elasticity thereof that it is almost fully equal in volume to the volume of the pump chamber when contracted. Under this condition the member is squeezed by the hydraulic driving pulses in a flattening manner, to nearly fill the pump chamber, in which case the volumetric efficiency of the pump can be made to approach one hundred percent. This is advantageous both in priming under high lift conditions, and in the accurate handling of fluids likely to separate in phase under conditions of reduced pressure, such as volatiles, gas solutions, or substances in which small quantities of foam may be entrained or entrapped.

The construction of the instant invention as above described is further advantageous over any attempt to use two pumps for the same purpose as a double diaphragm pump, for the reason that but a single resilient element is used for returning the diaphragms to the quiescent position. Aside from the obvious saving in material and complexity involved, it is further found that when two diaphragms are employed, it becomes impractical to provide them with independent resilient members because of the fact that it is then exceedingly difficult to cause them to equally divide the pumping load. Obviously, if two diaphragms are to be employed, it is imperative that they undergo approximately equal flexure during pumping in order that the operating life of the diaphragms will not be unduly shortened. If separate springs are used for the two diaphragms, the springs must have tensions which are both initially and permanently almost exactly equal. It is possible but costly to select springs so that they will initially provide the same tension, but no way is known to ensure that they will remain so indefinitely. This difficulty is entirely overcome by the present invention, wherein the tension of a single resilient member is shared by both diaphragms.

An additional advantage of the instant invention resides in the fact that the reduced clearance volume made possible principally by the double diaphragm construction causes the pump to be especially effective during the initial priming operation, and in fact causes it to provide a lift or suction pressure of marked superiority over that obtainable from other constructions.

Although this invention has been described in terms of a specific illustrative example thereof, it will be readily understood that various modifications or elaborations will occur to those skilled in the art, and it is therefore intended that the invention shall be limited only by the appended claims.

What is claimed is:

1. In a feeder pump for hydraulic pulsing, an apertured cylindrical body of relatively rigid material having a hydraulic passageway therethrough, flexible diaphragms covering the ends of said body and having openings aligned with said passageway, rigid cover plates covering the ends of said body and the said diaphragms and having recessed portions on the interior faces thereof communicating with said passageway and having at least one exterior opening for energization, through bolts passing between said cover plates and through said body and said diaphragms for securing them rigidly together, an inlet and an outlet valve chamber, located one in each of said apertures, a valve freely movable in each said valve chamber, and a toroidal washer of resilient material on each said valve, and resilient compressible means located between said diaphragms for applying dilating pressure thereto and comprising a pair of recessed cylindrical and diaphragm contacting cheek pieces and a compression spring located therebetween and in the recesses.

2. In a feeder pump for hydraulic pulsing, an apertured body of relatively rigid material having a hydraulic passageway therethrough, flexible diaphragms covering the ends of said body and having openings aligned with said passageway, rigid cover plates covering the ends of said body and the said diaphragms and having recessed portions on the interior faces thereof communicating with said passageway and having at least one exterior opening for energization, means passing between said cover plates and through said body and said diaphragms for securing them rigidly together, and an inlet and an outlet valve chamber, located one in each of said apertures, a valve freely movable in each of said valve chamber, and a flexible washer of resilient material on each said valve, and resilient compressible means located between said diaphragms for applying dilating pressure thereto and comprising a pair of recessed cylindrical and diaphragm contacting cheek pieces and a compression spring located therebetween and in the recesses.

3. In a feeder pump for hydraulic pulsing, an apertured body of relatively rigid material having a hydraulic passageway therethrough, flexible diaphragms covering the ends of said body and having openings aligned with said passageway, rigid cover plates covering the ends of said body and the said diaphragms and having recessed portions on the interior faces thereof communicating with said passageway and having at least one exterior opening for energization, means passing between said cover plates and through said body and said diaphragms for securing them rigidly together, and an inlet and an outlet valve chamber, located one in each of said apertures, a valve freely movable in each said valve chamber, and a washer of resilient material on each said valve, and resilient compressible means located between said diaphragms for applying dilating pressure thereto and comprising a pair of recessed cylindrical and diaphragm contacting cheek pieces and a homogeneous resilient compressible member located therebetween and in the recesses.

4. In a feeder pump for hydraulic pulsing, an apertured body of relatively rigid material having an hydraulic passageway therethrough, flexible diaphragms covering the ends of said body and having openings aligned with said passageway, rigid cover plates covering the ends of said body and the said diaphragms and having recessed portions on the interior faces thereof communicating with said passageway and having at least one exterior opening for energization, means passing between said cover plates and through said body and said diaphragms for securing them rigidly together, and an inlet and an outlet valve chamber, located one in each of said apertures, a valve freely movable in each said valve chamber, and a toroidal washer of resilient material on each said valve, and resilient compressible means located between said diaphragms for applying dilating pressure thereto.

(References on following page)

References Cited in the file of this patent

UNITED STATES PATENTS

1,835,919	Waseige	Dec. 8, 1931
2,399,803	Herbert	May 7, 1946
2,768,818	Egerer	Oct. 30, 1956
2,869,467	Limpert et al.	Jan. 20, 1959
2,919,650	Wiggermann	Jan. 5, 1960

FOREIGN PATENTS

221,685	Australia	Nov. 21, 1957
856,459	France	June 14, 1940
339,136	Great Britain	Dec. 4, 1930