

May 23, 1972

H. E. PALMER

3,664,770

DIAPHRAGM PUMPS

Filed Feb. 18, 1970

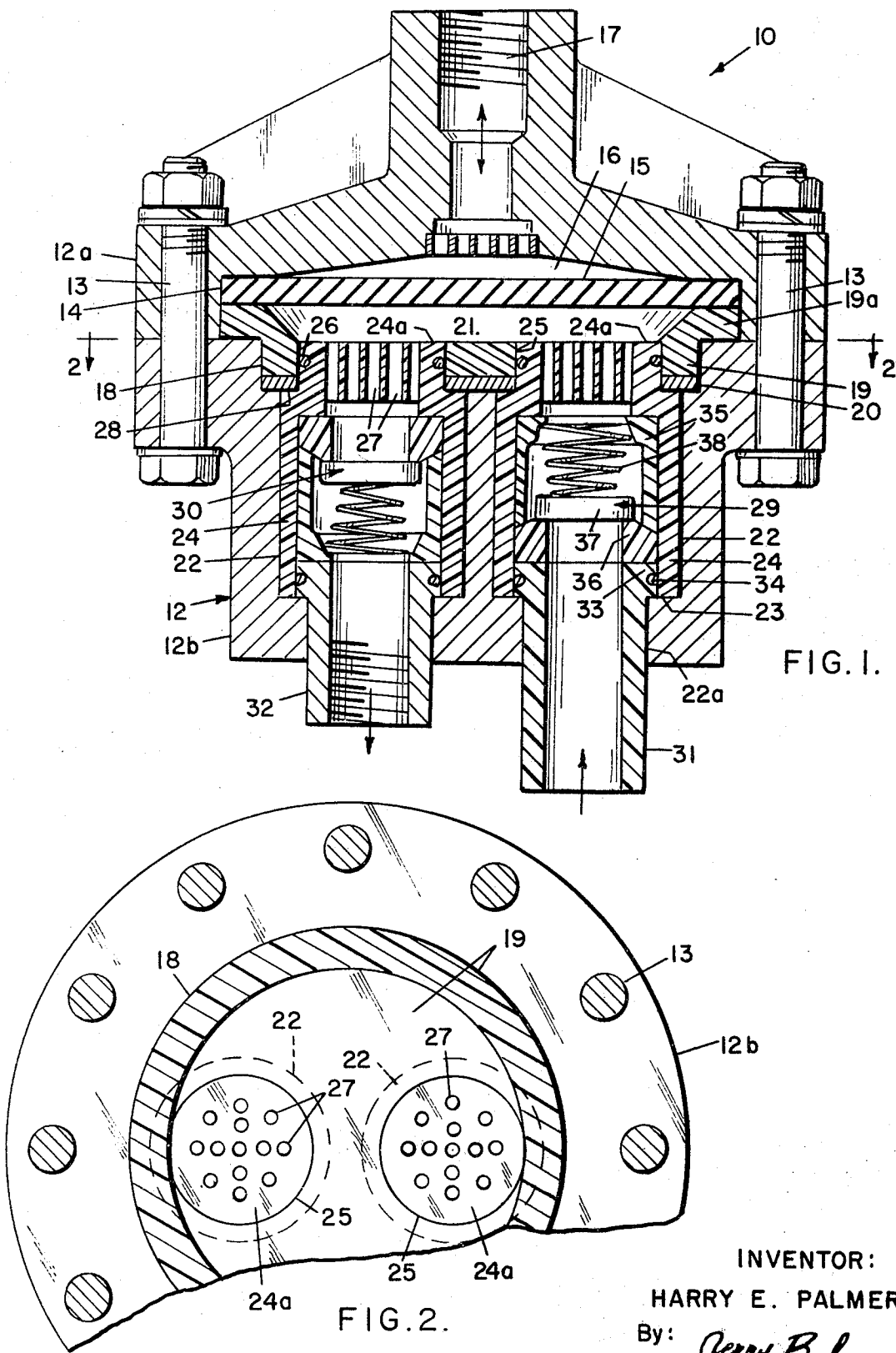


FIG. 1.

FIG. 2.

INVENTOR:
HARRY E. PALMER

By: *Jerry B. Berak*

1

3,664,770

DIAPHRAGM PUMPS

Harry E. Palmer, Calgary, Alberta, Canada, assignor to
Golden Arrow Manufacturing Limited, Calgary,
Alberta, Canada

Filed Feb. 18, 1970, Ser. No. 12,237

Int. Cl. F04b 17/00, 43/06

U.S. Cl. 417—383

2 Claims

ABSTRACT OF THE DISCLOSURE

A metallic housing contains a diaphragm and a backing plate of plastic material, the plate having an annular flange in abutment with the diaphragm so as to form a pumping chamber. Inlet and outlet valves are contained in plastic sleeves in the housing, the sleeves communicating with the pumping chamber and being sealingly fitted in openings in the backing plate. Thus, abrasive or corrosive liquid pumped through the valves and chamber is prevented by the plastic components from contacting the metallic housing.

This invention relates to new and useful improvements in diaphragm pumps, and in particular the invention concerns itself with such pumps which are used for pumping abrasive and/or corrosive liquid chemicals, as for example in agricultural spraying operations, chemical manufacturing plants, and the like.

If such pumps are made of metal, they wear out very quickly under the abrasive or corrosive action of the liquid being pumped. Thus it is desirable to utilize chemical-resistant materials such as plastic materials as much as possible in construction of the pumps. However, it is not practical to make the entire pump of plastic, particularly where high pumping pressures on the order of 700 or 800 p.s.i. are encountered and substantial material strength is necessary to withstand such pressures.

It is therefore the principal object of the invention to provide a diaphragm pump of a novel construction which embodies plastic components contained in a metallic housing, such components defining the pumping chamber and the valve chambers so that the abrasive and/or corrosive material which is being pumped does not come in contact with the metallic housing, but at the same time the housing effectively contains and reinforces the plastic components to enable the pump to withstand high pumping pressures.

The pump of the invention is simple, compact, light in weight, easy to repair, and lends itself to economical manufacture.

With the foregoing more important object and features in view and such other objects and features which may become apparent as this specification proceeds, the invention will be understood from the following description taken in conjunction with the accompanying drawing, wherein like characters or reference are used to designate like parts, and wherein:

FIG. 1 is a vertical sectional view of the diaphragm pump of the invention; and

FIG. 2 is a fragmentary horizontal sectional view, taken substantially in the plane of the line 2—2 in FIG. 1.

Referring now to the accompanying drawings in detail, the diaphragm pump of the invention is designated generally by the reference numeral 10 and comprises a housing 12 of light-weight metal, as for example aluminum. The housing consists of two complemental sections, that is, a first or upper housing section 12a and a second or lower housing section 12b, the two sections being separably secured together in abutting relation by a plurality of bolts 13. It will be understood that the terms

2

"upper" and "lower" are used herein merely for convenient reference to the pump as shown in the drawing, and that as a practical matter the pump may be installed in an inverted position or on its side.

The upper housing section 12a is provided in the face thereof which abuts the section 12b with a circular recess 14 in which is positioned a circular diaphragm 15 of rubber-like material, preferably synthetic rubber. The top of the recess 14 is shaped to provide a chamber 16 above the diaphragm, the chamber 16 communicating with a passage 17 in the housing section 12a so that a connection may be made, as by a pipe or a hydraulic hose (not shown) to an actuating pump (also not shown) such as a conventional reciprocating piston or plunger type pump handling liquid such as water or oil. At the actuating pump the connection is made to the inside of the pump cylinder so that when the actuating pump operates, the water or oil in the chamber 16 of the pump 10 is subjected to pulsating pressure and the diaphragm 15 is actuated accordingly. However, it is to be noted that as far as the hereinafter to be described invention is concerned, the diaphragm 15 may be actuated by conventional mechanical means instead of by pulsating hydraulic pressure as explained above.

In any event, the lower housing section 12b is provided in the face thereof which abuts the upper section 12a with a circular recess 18 which is concentric with but somewhat smaller in diameter than the recess 14 in the section 12a. A backing plate 19 of a circular form and made of plastic material is positioned in the recess 18 on top of a circular insert plate 20 of metal, preferably steel. The plastic backing plate 19 is formed integrally with an annular flange 19a which is disposed in the recess 14 in the upper housing section 12a, being seated on the upper face of the lower section 12b and also being in abutment with the peripheral edge portion of the diaphragm 15. As will be noted, this arrangement provides a pumping chamber 21 between the diaphragm 15 and the backing plate 19, as defined by the annular flange 19a of the backing plate, the chamber 21 being completely isolated from the metallic housing sections 12a, 12b.

The lower housing section 12b is provided with a pair of juxtaposed cylindrical bores 22, the upper or inner ends of which open into the recess 18, while their open lower or outer ends are diametrically reduced as at 22a to provide upwardly facing shoulders 23. A pair of tubular valve sleeves 24 of plastic material are positioned in the respective bores 22, the lower ends of these sleeves abutting the shoulders 23 while their upper end portions 24a are diametrically reduced and project into registering openings 25 formed in the insert plate 20 and backing plate 19. The sleeve portions 24a are sealingly fitted into the openings 25 and sealing rings 26 may be provided to prevent leakage, as will be apparent. The upper end portions 24a of the sleeves are apertured as at 27 so as to communicate the interior of the sleeves with the pumping chamber 21. The diametric reduction of the sleeve portions 24a provided the sleeves with annular shoulders 28 which abut the insert plate 20, and the insert plate, thus interposed between the shoulders 28 and the backing plate 19, prevents upward displacement of the sleeves.

The two plastic sleeves 22 contain an inlet valve assembly 29 and an outlet valve assembly 30, respectively, for the liquid to be pumped, the liquid being delivered to and from the pump through suitable connection fittings 31, 32, respectively, which extend into the reduced bore portions 22a and are equipped with flanges 33 seated against the shoulders 23. Sealing rings 34 may be provided on the flanges 33 to engage the sleeves 22 and prevent leakage at this point.

The inlet valve assembly 29 consists of a plastic, tubular

3

valve cage 35 and a plastic valve seat 36 positioned inside the associated valve sleeve 24, a ceramic valve disc 37 and stainless steel spring 38 which biases the disc 37 against the seat 36. The outlet valve 30 has the same components as the valve 29, but their position in the sleeve 24 is inverted for liquid flow in the outward direction through the connection 32.

The most significant feature of the invention is that the pumping chamber 21 is defined by the synthetic rubber diaphragm 15 and the plastic backing plate 19 with its annular flange 19a, and that the valves 29, 30 are contained in the plastic sleeves 24 having their portions 24a sealingly fitted in the backing plate 19, while the inlet and outlet connections 31, 32 are also sealingly fitted into the sleeves 24. Thus, when abrasive and/or corrosive liquid flows through the valves and through the pumping chamber, it is completely isolated from the metallic housing sections 12a, 12b and these sections therefore do not sustain damage by contact with the liquid being pumped. At the same time the metallic housing effectively reinforces the plastic components contained therein, so that the pump is capable of operating at high pressures. The plastic valve cages 35 and seats 36 and the ceramic valve discs 37 also are not affected by the pumped liquid, and the only metal parts which are contacted by the liquid are the springs 38 which are made of stainless steel and have a high resistance to abrasion and corrosion.

The plastic components of the pump are preferably made of polypropylene which has good resistance to both acids and alkalis, but any other suitable plastic material may be used.

It may be also noted that the structural arrangement of the parts is such that the various internal components are held in place when the two housing sections are assembled and secured by the bolts 13. Similarly, when these bolts are removed and the housing sections separated, the internal components may be quickly and easily removed and replaced without the use of any tools.

What is claimed as new is:

1. In a diaphragm pump, the combination of a metallic housing including first and second complementary housing sections separably secured together and having abutting faces provided with concentric circular recesses, a circular diaphragm of flexible rubber-like material positioned in the recess of the first housing section, a circular backing plate of plastic material positioned in the recess of the second housing section, said backing plate

4

including an annular marginal flange disposed in the recess of the first housing section in abutment with the peripheral portion of said diaphragm so as to provide between the diaphragm and the backing plate a pumping chamber which is isolated from the metallic material of the housing, said flange of said backing plate projecting radially outwardly from the backing plate and being seated on the abutment face of the second housing section, said second housing section being provided with a pair of juxtaposed cylindrical bores having inlet and outlet connections respectively for liquid to be pumped, a pair of tubular valve sleeves of plastic material positioned in the respective bores, said valve sleeves having apertured inner end portions sealingly fitted in openings provided in said backing plate with the interior of the sleeves communicating with said pumping chamber, a metallic insert plate positioned in the recess of the second housing section in abutment with said backing plate and at the inner ends of said bores, the inner end portions of said valve sleeves being radially stepped to provide annular shoulders in abutment with said insert plate, said inlet and outlet connections being sealingly fitted in outer end portions of said valve sleeves, and inlet and outlet valves provided in the respective sleeves.

2. The pump as defined in claim 1 wherein the recess in the first housing section also provides a chamber for actuating fluid which is separated from said pumping chamber by said diaphragm, said actuating fluid chamber having a connection for actuating fluid under pulsating pressure whereby to actuate the diaphragm.

References Cited

UNITED STATES PATENTS

3,294,030	12/1966	Fox	417—395
2,804,086	8/1957	Johnston	137—454.6
3,036,527	5/1962	Hise	417—389
2,732,126	1/1956	Booth	417—395
1,846,753	2/1932	Rayfield	137—454.4

FOREIGN PATENTS

510,883	8/1939	Great Britain.
---------	--------	----------------

WILLIAM L. FREEH, Primary Examiner

U.S. Cl. X.R.

417—454