

July 5, 1955

A. F. KIEFER
DIAPHRAGM PUMP

2,712,286

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2 Sheets-Sheet 1

Fig. 2.

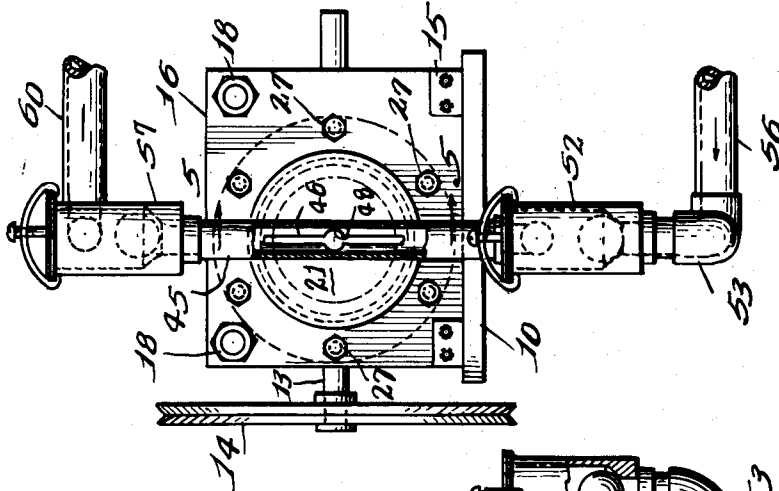
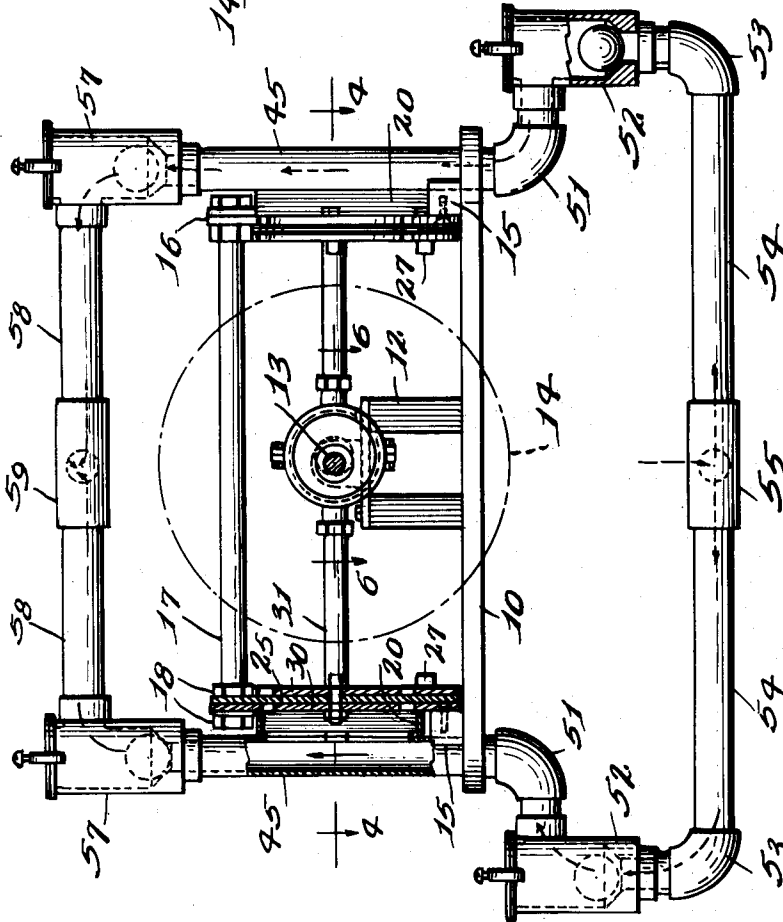


Fig. 1.



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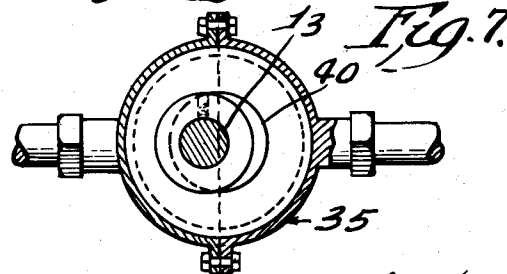
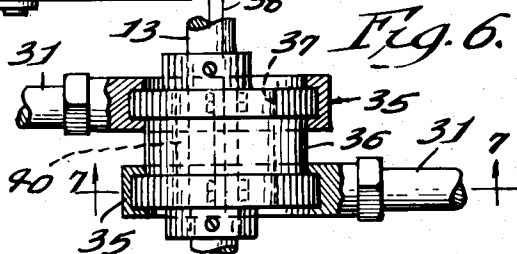
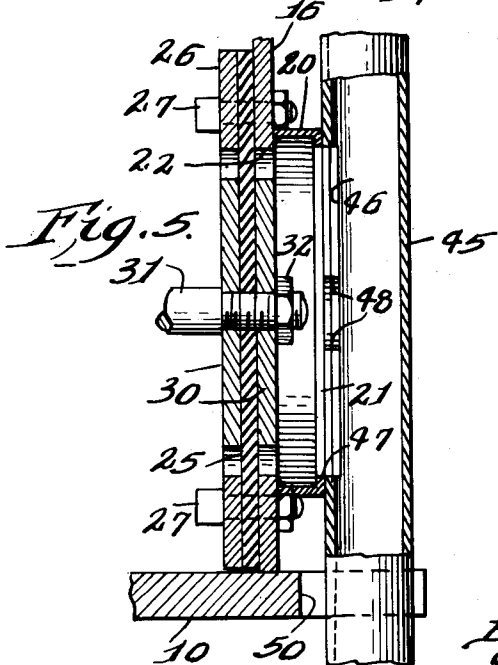
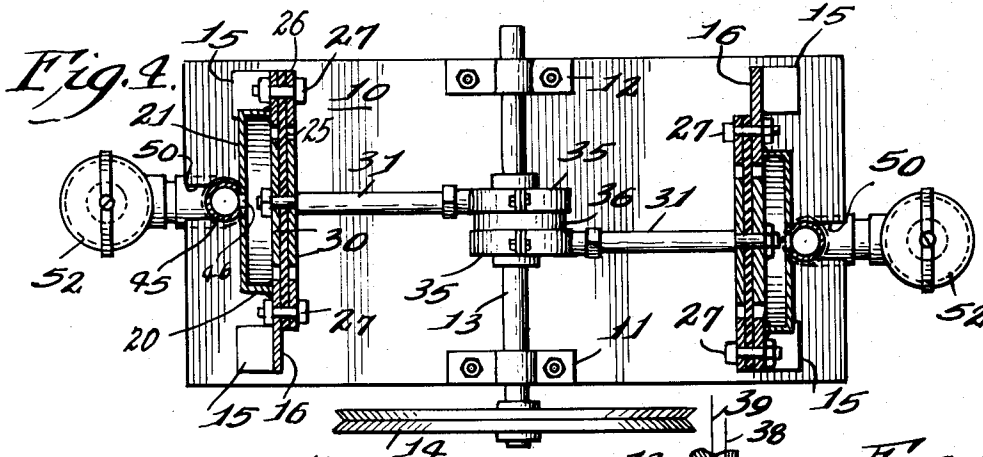
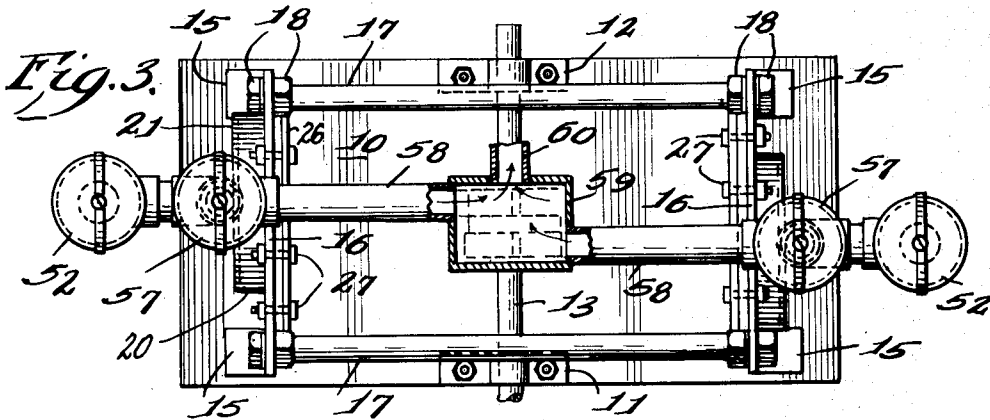
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2 Sheets-Sheet 2



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2,712,286

DIAPHRAGM PUMP

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2 Claims. (Cl. 103—150)

My invention relates to a diaphragm pump, and more particularly to a diaphragm pump designed to handle liquid media, especially media of substantial viscosity such as paint of one kind or another.

One object of my invention is to provide a diaphragm pump constructed in the main from standard parts. Only a few number of parts, if any, need to be especially made. This eliminates substantial tool and die expense.

Another object of my invention is to provide a diaphragm pump which is simple in design, easy to assemble and which may be constructed at relatively low cost.

Another object is to provide a diaphragm pump which possesses structural strength in large measure, and which can be depended on to give attention free, trouble free service for long periods of time.

Another object is to provide a diaphragm pump wherein the tendency to contaminate the medium acted on by the pump is negligible, even after long periods of continuous use.

Another important object of the invention is to provide a pump wherein parts thereof that require periodic cleaning are so located that cleaning is easily accomplished. It is apparent that cleaning is necessary between uses of a pump with different media.

Still another object of the invention is to provide a diaphragm pump constructed with substantially fewer parts than previously known pumps of this class.

Other objects and advantages of the invention will be apparent as the description proceeds, reference being had to the accompanying drawings which illustrate one structural form of the invention. It is to be understood, of course, that in commercial embodiments of the invention various details might well vary somewhat from those here shown and described.

In the drawings:

Fig. 1 is a side elevational view, partly in section, of a diaphragm pump embodying my invention;

Fig. 2 is an end elevational view of said pump;

Fig. 3 is a top view, partly in section, of said pump;

Fig. 4 is a sectional view taken generally on line 4—4 of Fig. 1;

Fig. 5 is a sectional view on line 5—5 of Fig. 2;

Fig. 6 is an enlarged, fragmentary sectional view taken generally on line 6—6 of Fig. 1, and

Fig. 7 is a sectional view on line 7—7 of Fig. 6.

Referring to Figs. 1—4, a diaphragm pump embodying my invention is shown constructed on a rectangular base 10 which may be suitably mounted at the point of pump use. As best shown in Fig. 4, a pair of opposed bearing blocks 11 and 12 are mounted on base 10, each bearing block being located generally at the midpoint of a long side of the base. A shaft 13 is journaled in bearing blocks 11 and 12 and a pulley 14 or other suitable drive source such as a variable speed motor is mounted on or connected with the shaft.

Near each corner of base 10 is mounted an anchoring member 15, as best shown in Figs. 1 and 2. At each end of base 10 and suitably secured to the pair of anchoring

members 15 at that end is a vertically disposed, generally square plate 16 (Fig. 2). The upper corners of one plate 16 are respectively connected to the corresponding upper corners of the other plate 16 by means of a pair of tie rods 17. The rods are threaded at their ends, and, as illustrated, each rod end is provided with two nuts 18. Plates 16 are clamped between pairs of nuts 18 (Figs. 1 and 3). By this arrangement plates 16 are rigidly mounted on base 10, and they are braced with respect to each other and to base 10 in a structurally strong manner. Each plate 16 forms a part of a presently to be described pump unit.

The pump here illustrated and described comprises two substantially similar pump units, and, for convenience, only one of the pump units will be described in detail.

Referring to Figs. 1—5, and particularly Fig. 5, each pump unit includes a shallow pump casing 20 suitably secured, as by welding, to the outside face of a plate 16. In the illustrated pump unit, casing 20 is cylindrical in shape with one end of the cylinder open and the other end closed by a wall 21 (Figs. 2, 3 and 4). The open end of casing 20 is the one which is secured to plate 16 as aforesaid.

Plate 16 has a circular opening 22 (Fig. 5) therein which is concentric with casing 20 and is generally of the same or slightly less diameter. Circular opening 22 is covered by a flexible diaphragm 25, usually rubber, which is secured to plate 16 around the periphery of opening 22 by means of a clamping ring 26. The latter is secured to plate 16 with diaphragm 25 clamped therebetween by means of circumferentially spaced bolts 27. Diaphragm 25 thus seals circular opening 22 in a leakproof manner.

The central portion of diaphragm 25 is clamped between a pair of diaphragm plates 30 which are carried at one end of a connecting rod 31. As illustrated in Fig. 5, connecting rod 31 is reduced in cross section at its end to provide a shoulder which positions one of the diaphragm plates 30. The reduced end of connecting rod 31 is threaded and a nut 32 secures plates 30 in clamped relation one on each side of diaphragm 25.

Connecting rod 31 extends toward shaft 13, and its end adjacent that shaft terminates in a clamping band arrangement generally designated 35 in Figs. 6 and 7.

The connecting rods 31 of the two pump units, while generally parallel to each other, are staggered in the direction along shaft 13, as best shown in Figs. 4 and 6. The clamping bands 35 of the two connecting rods 31 are in alignment, and they are secured around a common bearing member 36. The latter has a central, circular bore 37 (Fig. 6) therein, the axis 38 of which is offset from the axis 39 of shaft 13.

An eccentric 40 (Figs. 6 and 7) is rigidly carried on shaft 13 and journaled in bore 37 of common bearing member 36. With this arrangement, rotation of shaft 13 imparts a back and forth and rocking motion to the connecting rods 31, and this motion effectively actuates the diaphragms 25 of the two pump units. When one diaphragm 25 is at the outward end of its stroke, the other diaphragm is at the inward end of its stroke and vice versa. Thus the two pump units operate in opposite phase.

The medium to be pumped is conducted toward and away from each pump unit by means of a continuous pipe 45 which, as illustrated, extends across the closed wall 21 of pump casing 20. Pipe 45, in the form of the invention shown, is suitably secured as by welding to wall 21 so that in effect there exists a common wall between pump casing 20 and pipe 45. Communication between pipe 45 and pump casing 20 is established by means of a single elongated opening in this common wall. Thus, pipe 45 has an elongated lateral opening 46 (Fig. 2) in its side adjacent pump casing 20, and pump casing

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20 has a registering opening 47 in its wall 21. The registering openings 46 and 47 may be enlarged somewhat at their centers, as shown at 48 in Figs. 2 and 5, to afford clearance for the adjacent end of connecting rod 31.

I have found that the registering openings 46 and 47 should exceed a certain minimum size in order to assure proper operation of a pump unit under all reasonable conditions. This is one of the detailed features of my invention. I have found that the length of the elongated openings should be at least two-thirds the major dimension of diaphragm 25. In the form of the invention here illustrated, the major dimension of the diaphragm is, of course, its diameter. Further, I have found that the areas of the elongated openings should be at least one and one-half times the cross sectional area of pipe 45. The upper limit of area size is not particularly important to pump operation, this limit being determined by practical considerations of connecting pipe 45 to casing 20.

As shown in Figs. 4 and 5, the lower ends of pipes 45 pass downwardly through openings such as slots 50 provided in the ends of base 10.

The lower end of each pipe 45 is provided with an elbow 51 (Fig. 1) that leads laterally into one side of an inlet check valve 52. The other side of check valve 52 leads to an elbow 53 which in turn is connected to a pipe 54 extending beneath and generally parallel to base 10. The pipes 54 from the two pump units converge in a coupling 55 (Fig. 1) having a lateral extension 56 (Fig. 2) which forms a single inlet for the pump.

The upper end of each pipe 45 leads into one side of an outlet check valve 57. The outlet check valves 57, as will be seen in Fig. 1, are fully exposed for easy cleaning, and they are staggered both vertically and horizontally from the inlet check valves 52 which also are fully exposed for easy cleaning. Leading from the other side of outlet check valves 57 and extending above and generally parallel to base 10 are pipes 58 which lead to a coupling 59 (Figs. 1 and 3). A pipe 60 (Figs. 2 and 3) leads away from coupling 59 and forms an outlet for the pump.

Operation of my pump is believed to be self-explanatory from the drawings and the foregoing description. One operating feature of my pump, however, requires special mention. Because of my arrangement of a single slotted pipe for conducting the medium toward and away from each pump unit, there is relatively little agitation of the medium in the pump casing compared with prior diaphragm pumps where all or most of the pumped medium enters the pump casing. This reduced agitation prolongs the life of the diaphragm, particularly when the pump is used with vitreous enamel or other abrasive medium. Also, since diaphragm wear is re-

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duced, contamination which in part results from diaphragm wear likewise is reduced.

Since the main drive shaft, its bearings, the eccentric and the bearing for the connecting rods are physically located remote from the diaphragm and the pump medium, the necessary lubrication for such elements creates no problem with respect to contaminating the medium.

As previously mentioned, my pump is constructed in the main from standard, readily available parts, thereby affording manufacturing economies. No expensive tools and dies are required for producing the pump. Further, the pipes and valves through which the medium flows all are external of the pump and thus are readily available for easy cleaning.

From the above description it is thought that the construction and advantages of my invention will be readily apparent to those skilled in the art. Various changes in detail may be made without departing from the spirit or losing the advantages of the invention.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is:

1. A diaphragm pump comprising a casing, a flexible diaphragm in one wall of said casing, driving means directly connected to the central portion of said diaphragm for actuating said diaphragm, a continuous pipe for conveying the medium to be pumped toward and away from said casing, said pipe having a single, elongated, lateral opening therein and said casing having a single, elongated opening communicating with the lateral opening in said pipe, the length of said elongated openings being at least two-thirds the major dimension of said diaphragm, and a pair of check valves in said pipe, one beyond each end of said lateral opening.

2. A diaphragm pump comprising a casing, a flexible diaphragm in one wall of said casing, driving means directly connected to the central portion of said diaphragm for actuating said diaphragm, a continuous pipe for conveying the medium to be pumped toward and away from said casing, said pipe having a single, elongated, lateral opening therein and said casing having a single, elongated opening communicating with the lateral opening in said pipe, each of said elongated openings having an area of at least one and one-half times the cross-sectional area of said pipe, and a pair of check valves in said pipe, one beyond each end of said lateral opening.

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