Feb. 28, 1939. A. G. MORRIS ET AL 2,148,957

DIAPHRAGM PUMP

Filed June 28, 1937 4 Sheets-Sheet 1

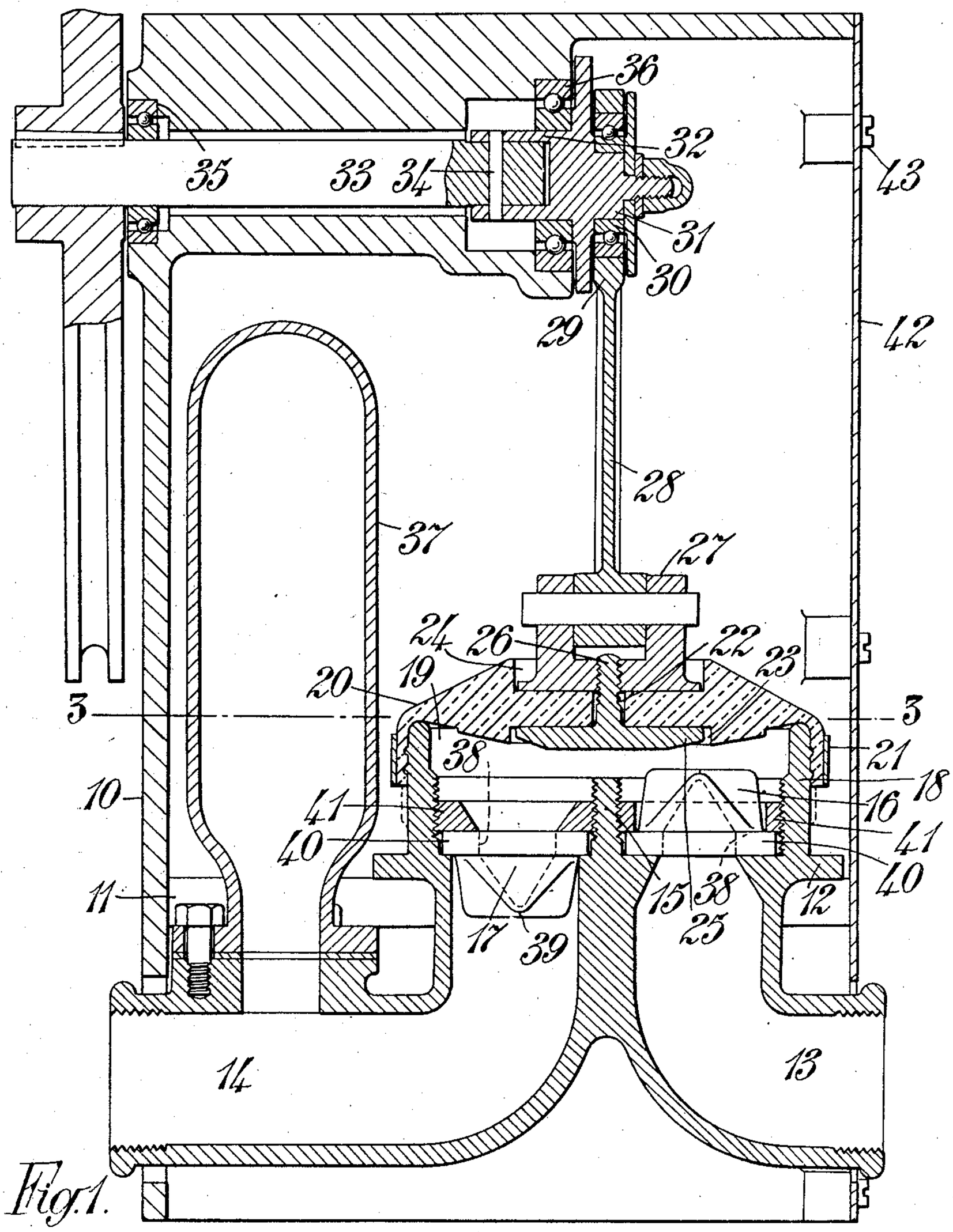

Fig. 1.

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Fig. 2.

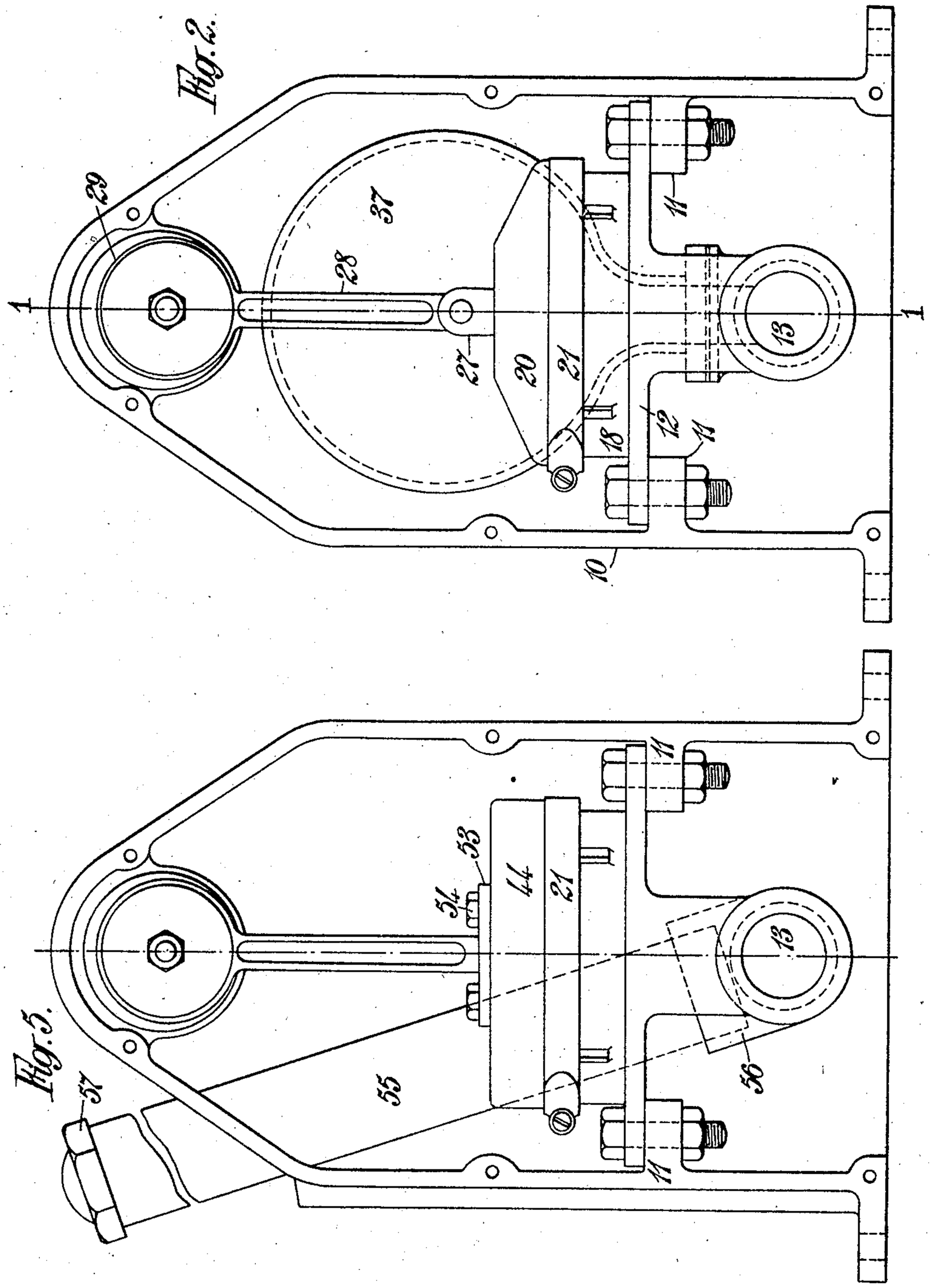

Fig. 5.

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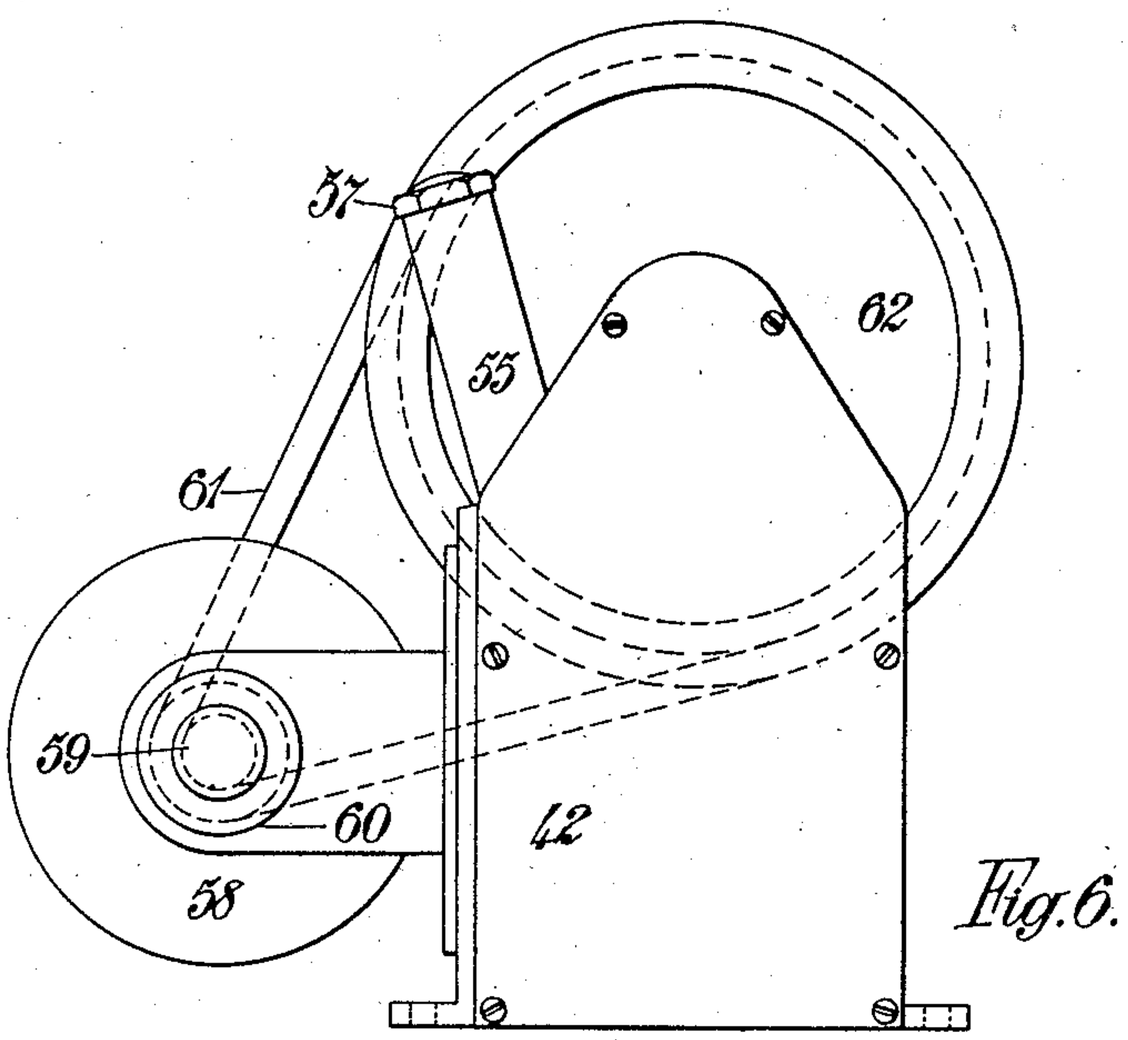

Fig. 6.

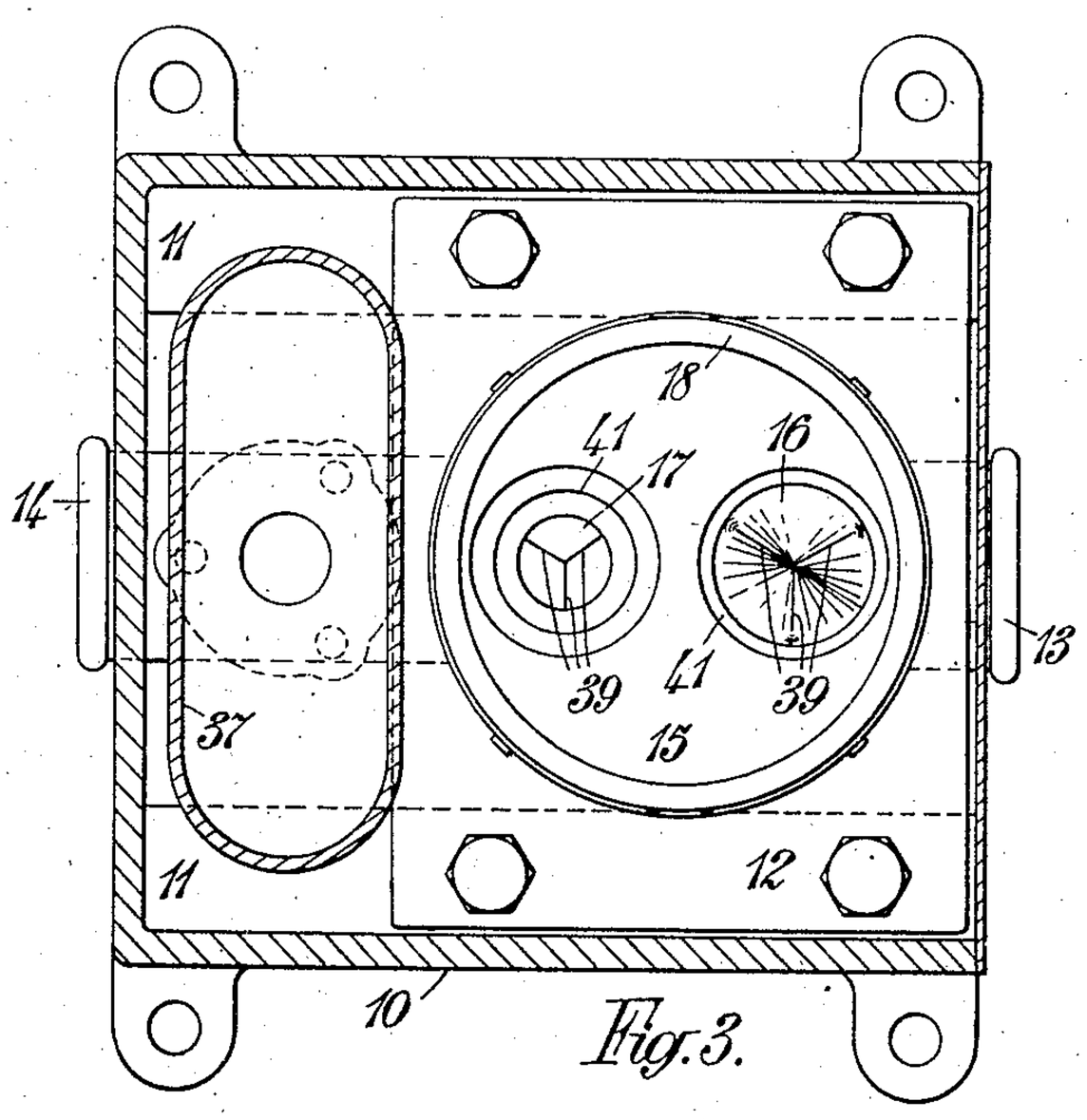

Fig. 3.

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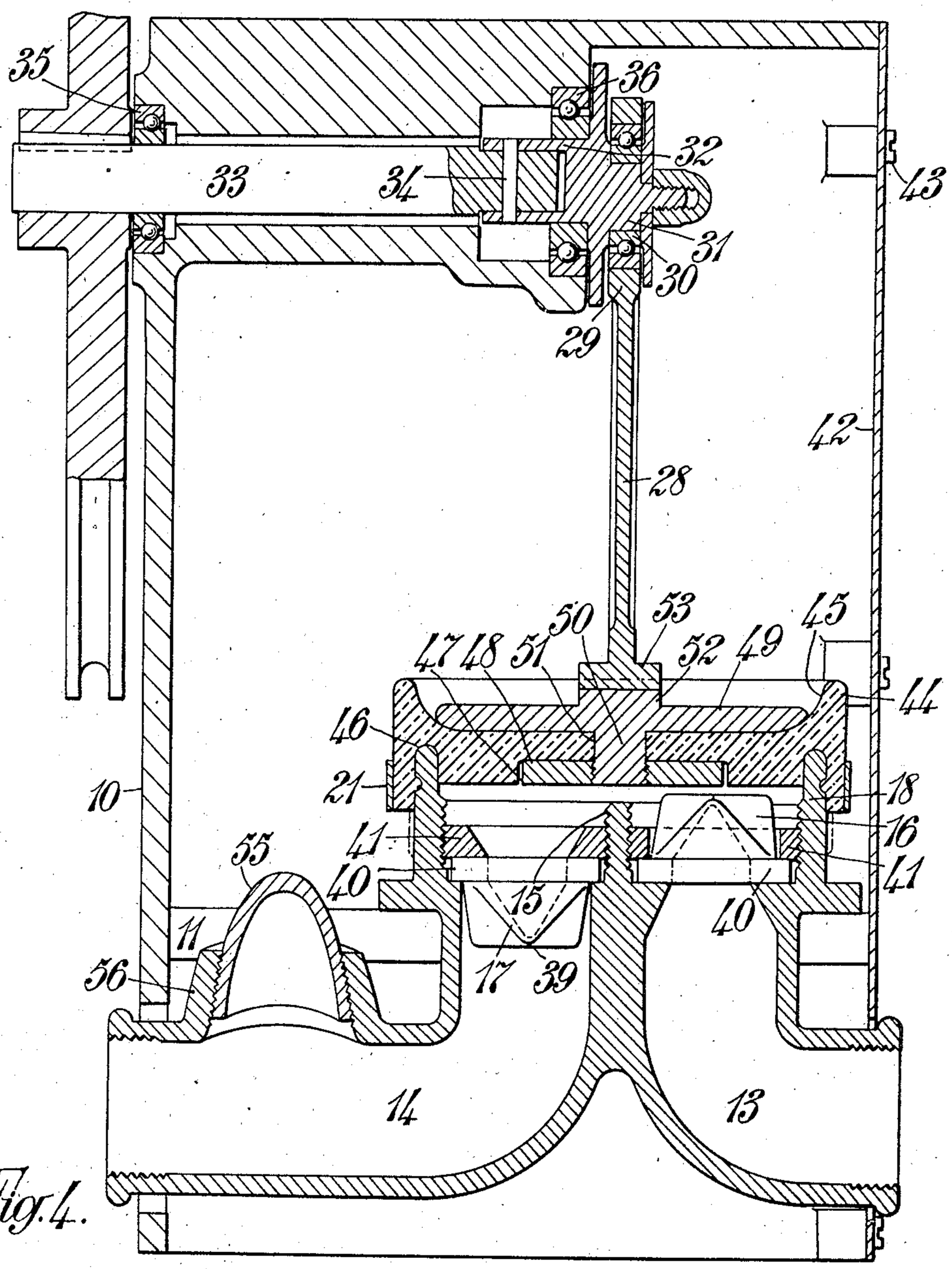

Fig. 4.

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UNITED STATES PATENT OFFICE

2,148,957

DIAPHRAGM PUMP

Alan Gordon Morris and Thomas Cooper Riggs,
London, England

Application June 28, 1937, Serial No. 150,810
In Great Britain July 1, 1936

3 Claims. (Cl. 103—150)

This invention relates to diaphragm pumps and has for its object the provision of a compact pump of the above type for dealing with all classes of fluids which has high efficiency, has no stuffing box, is positively self-priming and can be run at very low cost; will give long service without repair and when replacements are required these may be made inexpensively and with facility; and is silent in its operation.

A further aim of the invention is to provide a pump capable of dealing with liquids containing abrasive matter or grit in suspension, such as found in sump water and most springs and well waters.

The invention consists in a pump unit comprising a casting embodying, preferably integrally, inlet and discharge passages opening through rubber valves mounted in a partition of the casting into a pump chamber in or over which is seated a stout rubber diaphragm actuated by a crank or eccentric drive.

It is preferred to mount in the valve orifices rubber valves of known kind having a slit or slits adapted normally to seal under the resilience of the rubber and fluid pressure. The unitary casting to which may be coupled a bell or air chamber is mounted upon or housed in a casing or frame member which may be adapted to carry an electric motor for driving the pump.

Convenient embodiments of the invention are illustrated in the accompanying drawings in which:

Figure 1 illustrates in sectional view one form of pump unit according to the invention, the section being taken on line 1—1 of Figure 2;

Figure 2 is a front elevation of the unit shown in Figure 1 with the front plate removed;

Figure 3 is a sectional plan view taken on line 3—3 of Figure 1 with the diaphragm removed;

Figures 4 and 5 are views similar to Figures 1 and 2 of a modified form of pump unit, and

Figure 6 is a view drawn to a smaller scale of a pump unit including a motor and drive therefrom.

In carrying the invention into effect according to one convenient mode illustrated in Figures 1, 2 and 3 of the drawings, an outer casing or frame 10, preferably in the form of a box casting the upper portion of which may be wedge-shaped, as indicated in Figure 2, where the drive shaft is introduced, is adapted to support on a pair of projecting flanges 11 a plate 12 cast in one with a unit embodying inlet and delivery L-shaped passages or branches 13 and 14 respectively arranged in the same plane back to back, the orifices of which open into a partition 15 in the casting in which rubber valves 16, 17 are seated. Around and embracing the partition and valve orifices is a circular wall 18 which forms a pump chamber 19 closed by a rubber diaphragm 20 of cup form fitted on the outer periphery of the wall 18 and clamped in position by a metal band 21. The diaphragm is of stout form having thick walls tapering outwardly.

In the centre of the diaphragm a hole 22 is provided and recesses 23, 24 are made respectively for the large head 25 of a clamping screw 26 and a junction 27 to which the lower end of a connecting rod 28 is pivotally connected. The screw 26 is secured to the junction 27 with the centre portion of the diaphragm clamped between the head 25 of screw 26 and the junction. The upper or big end 29 of the connecting rod is mounted on a ball or roller bearing 30 carried by a crank pin 31 of a crank shaft portion 32 sleeved over and secured to a driving shaft 33 by pin 34. The shaft 33 and the crank shaft portion 32 are mounted in bearings 35 and 36 in the tapered part of the casing 10.

As shown the delivery branch 14 has mounted on it and in communication therewith a bell or air chamber 37. This chamber is located within the outer casing 10 and is of substantially circular form in front view (Figure 2).

The rubber valves 16, 17 are of known kind and each comprises a stout rubber block recessed at 38 on one side and of somewhat pyramidal form on the other, having a single or, as shown, a tripartite slit 39 through the rubber which constitutes a resiliently self-closing and sealing valve element under fluid pressure. Each valve has a rubber flange 40 mounted on the seating around the valve orifices and secured in position by a clamping bezel or ring 41 screwed into the orifices.

The front of the casing 10 is closed by a metal plate 42 secured to the casing by set screws 43 or the like.

A modified form of diaphragm and bell or air chamber is shown in Figures 4 and 5 in which parts similar to those of the first described form have been given the same reference numerals. According to this modification the diaphragm 44 is of stout disc form the upper surface of which is dished or has a concave recess 45 while the lower surface is provided with an annular groove 46, for reception of the upper portion or rim of the annular wall 18, and a circular recess 47 for a clamping nut 48. An annular metallic disc 49 is located in the recess 45 of the diaphragm

and has a central threaded portion 50 extending through a central opening 51 of the diaphragm and upon which the clamping nut 48 is secured to thus clamp the diaphragm between the disc 49 and the nut. The disc 49 has an upstanding rib portion 52 to which the plate-like lower end 53 of the connecting rod 38 is secured by means of bolts 54.

The bell or air chamber according to the modified form of the invention consists of a tube 55 having its lower end screwed into a boss 56 formed on the delivery branch 14, the tube extending angularly through the side of the upper part of the casing 10 and having a cap 57 closing its upper end.

As shown in Figure 6 of the drawings the pump unit may incorporate an electric motor 58 mounted on the side of the casing 10 with its shaft 59 parallel with the drive shaft 33 of the pump. The motor may be coupled to the drive shaft 33 by suitable reduction gear which, as shown, is of the pulley type comprising a pulley 60 secured to the motor shaft 59 and driving through a belt 61 a large pulley 62 secured to the pump drive shaft 33. The large pulley 62 may be provided with a handle for manual operation if desired.

It will readily be appreciated that in both forms of the invention the drive between shaft 33 and the connecting rod 28 may be an eccentric one instead of the crank and crank pin arrangement shown.

The operation of both forms of the invention will be readily apparent, the diaphragm being actuated by the crank or eccentric drive whenever the drive shaft is rotated to intermittently draw fluid through the inlet passage 13 and the inlet valve 16 into the pump chamber 19 and discharge same through outlet valve 17 and delivery passage 14, the delivery being rendered even in well known manner by the bell or air chamber which is in communication with the delivery passage.

The rubber valves which seal under the resilience of the rubber and the fluid pressure have distinct advantages over mushroom type valves in that they are opened and closed rapidly and with little effort. Thus higher operating speeds of the pump are obtainable. Furthermore, it has been found that by utilizing the rubber valves a volume of liquid even greater than that corresponding to the displacement of the diaphragm is delivered per stroke due to the easy opening of the valves and the fact that as the diaphragm approaches the top of its stroke the inertia of the incoming liquid through the inlet valve 16 causes opening of the outlet valve 17 and thus delivery commences before the suction stroke of the diaphragm is completed.

In both forms of the invention the parts are of robust nature, thus giving long service, and are readily disassembled so that replacement of parts may be made with facility.

Although the invention has been described with reference to a single pumping unit it will be appreciated that the same principles may be employed in connection with a pump comprising a plurality of units arranged to operate in series or parallel or in a group.

We claim:

1. A pump unit comprising in combination, a casting, a pump chamber embodied in said casting, a partition in the casting forming the lower wall of the pump chamber, inlet and discharge passages formed in the casting below said partition and opening through said partition into the pump chamber, a rubber inlet valve and a rubber outlet valve mounted in said partition said valves respectively controlling communication between the inlet and discharge passages and the pump chamber, a rubber diaphragm of cup form mounted over the pump chamber, a clamping screw having a head, a junction member, said diaphragm having a thick wall tapering outwardly and having its centre portion clamped between the head of said clamping screw and said junction member, and a crank drive for actuating said diaphragm including a connecting rod pivotally connected to said junction member.

2. A pump unit comprising in combination, a casting, a pump chamber formed by a circular wall of said casting, a partition in the casting forming the lower wall of the pump chamber, an inlet passage and a discharge passage both formed in the casting below the partition and opening through the partition into the pump chamber, a rubber inlet valve and a rubber outlet valve both mounted in the partition and respectively controlling communication between the inlet and discharge passages and the pump chamber, a diaphragm in the form of a thick rubber disc having an annular groove on one side in which the rim of said annular wall of the casting is received, means for clamping the marginal portion of the diaphragm to said annular wall, a concave recess in the other side of said thick rubber disc, an annular metallic disc located in said concave recess, said annular metallic disc having a central threaded portion extending through the centre of the thick rubber disc, a nut screwed on said threaded portion whereby the centre of the diaphragm is clamped between said annular metallic disc and said nut, and driving means for actuating said diaphragm including a connecting rod secured to said annular metallic disc.

3. A pump unit comprising in combination, a casting, a pump chamber formed by a circular wall of the casting, a partition in the casting forming the lower wall of the pump chamber, inlet and discharge passages formed in the casting below the said partition and opening through the partition into the pump chamber, a rubber inlet valve and a rubber outlet valve mounted in said partition, said valves respectively controlling communication between the inlet and discharge passages and the pump chamber; a rubber diaphragm of cup form fitted over the outer periphery of the said circular wall of the casting; a clamping ring clamping the marginal portion of the diaphragm to said circular wall, two interconnected clamping elements between which the centre portion of the diaphragm is secured, and a crank drive for actuating said diaphragm including a connecting rod secured to one of said interconnected clamping elements.

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