Sept. 28, 1954 H. J. RAND 2,690,295

AIR PUMP

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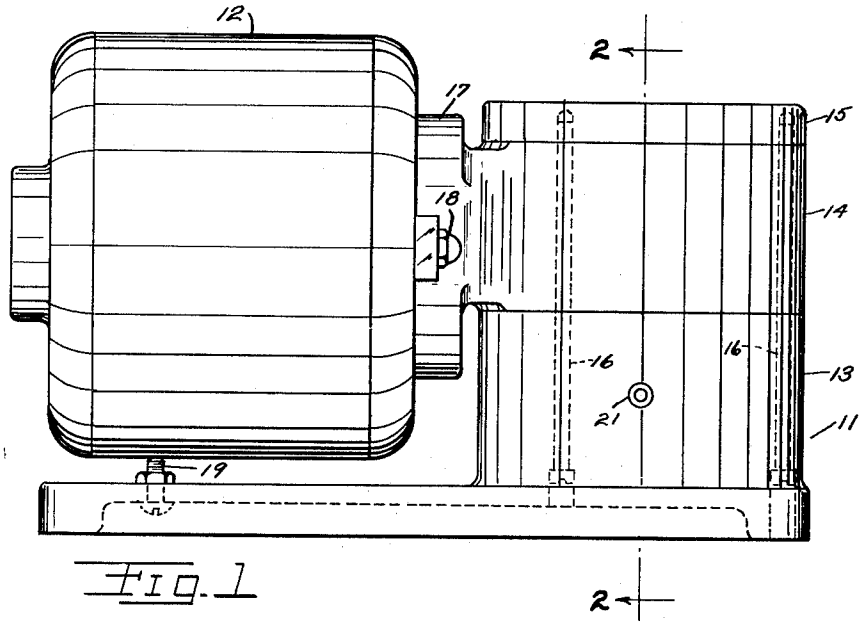


FIG. 1

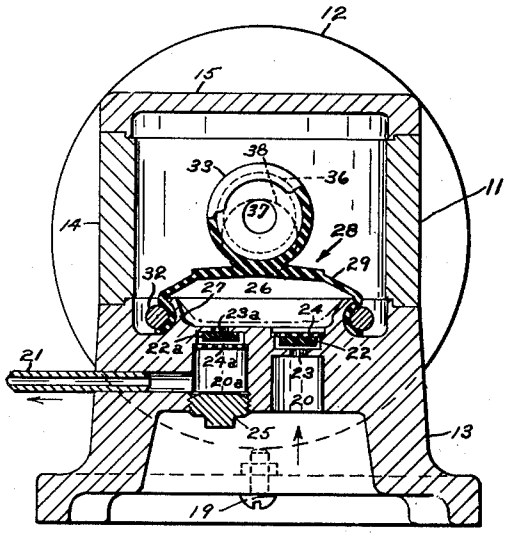


FIG. 2

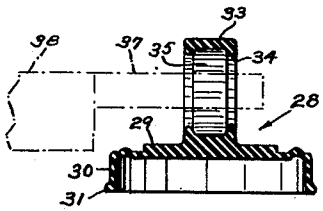


FIG. 3

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AIR PUMP

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3 Claims. (Cl. 230—170)

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This invention relates to an improvement in air pumps and more particularly to diaphragm operated pumps.

One of the objects of the present invention is to provide a novel attaching means for a diaphragm to a pump chamber wall.

Another object of the present invention is to provide a novel attachment between a reciprocating drive means and a diaphragm.

Another object of the present invention is to provide a novel attaching means for a diaphragm to a pump chamber wall and a novel attachment between a reciprocating drive means and the diaphragm.

Another object is to make a diaphragm for a pump of the type described and its associated elements all in one integral piece. This construction is cheaper, easier to make and easier to assemble and replace.

Other features of my invention reside in the arrangement and design of the parts for carrying out their appropriate functions.

Other objects and advantages of my invention will be apparent from the accompanying drawings and description and the essential features thereof will be set forth in the appended claims.

In the drawings, Fig. 1 is a side elevational view of the motor driven pump of this invention;

Fig. 2 is a vertical sectional view taken along the line 2—2 of Fig. 1. The diaphragm is shown in its expanded position by the solid lines and in its collapsed position by a dot-dash line; while

Fig. 3 is a sectional view of the diaphragm per se in its unstressed condition and with the reciprocating driving means shown in dot-dash lines.

The drawing discloses a motor driven pump, shown broadly by reference numeral 11, the motor being designated broadly by 12.

Pump 11 consists of a base 13, a housing 14 and a cap 15. These elements are rigidly connected together by screws 16. The pump 11 is attached to motor 12 by flange 17, which is attached to the motor flange by removable fastening elements 18. The motor 12 is also supported by screw 19 extending from base 13 to give a firm support to the motor. Flange 17, rigidly attached to the motor flange, assures a correct alignment for the diaphragm reciprocating means, to be later described.

The base 13 contains an intake and exhaust valve. An intake valve aperture is shown at 20 and an exhaust valve aperture at 20*a* in base 13. The air is brought in under base 13 and pumped into pressure line 21. An air operated intake valve 22 and an air operated exhaust valve 22*a*

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are mounted in the apertures in the base. These valves may be small leaves of rubber. Restricted apertures 23 and 23*a* are blocked by valves 22 and 22*a* when in their closed position. Strainers 24 and 24*a*, to prevent the admission of foreign matter to the pump, are also located in the respective valve apertures. These strainers are force fit into their respective openings to hold the valves in place for slight vertical movement. A closure plug 25 blocks the passage between the intake chamber and the pressure line 21.

A readily expandable and contractible chamber for pumping the fluid is shown at 26. This expansion chamber is formed by an upstanding annular wall 27, integral with base 13, and the diaphragm 28. Wall 27 has a concave outer surface to detachably mount the flexible diaphragm.

The invention in this application relates to this novel diaphragm 28 and its operating connections. It may be made of rubber, plastic, or any other flexible material which will have a long life during many repeated oscillations. Flexible diaphragm 28, in its unstressed condition, as shown in Fig. 3, consists of a flat circular disc 29 with an integral, annular and peripheral flange 30 extending at approximately right angles from its under face and a ring shaped member 33 extending from its upper face. Flange 30, disc 29 and ring 33 may be molded as a one-piece, integral unit, or they could be fabricated separately and then permanently attached together. The disc 29 and flange 30 may also be made in one piece and later attached to ring 33. A bead 31 extends around the lower, outer edge of flange 30. This flange is mounted to embrace the outside face of wall 27, as shown in Fig. 2, and then a snap ring 32 is placed radially outside of the assembly to lock the diaphragm in position.

A means to reciprocate the diaphragm to pump the fluid is also provided. The integral projection or ring-shaped member 33 extends from the upper surface of disc 29 of flexible diaphragm 28. This projection 33 has a bore or aperture 34 with an axis extending perpendicular to the axis of disc 29. Recess 35, in projection or ring-shaped member 33, supports an eccentric driven member 36.

In the present embodiment, motor 12 eccentrically drives shaft 37 by means of motor shaft 38. The eccentrically driven member or bearing 36 is mounted on eccentrically driven shaft 37. The inside race of bearing 36 is a force fit on shaft 37. The outside race fits snugly in recess 35.

An alternative construction to reciprocate the

pump might be a cam driven by motor shaft **38** and mounted in recess **35**.

In the operation of the pump, motor shaft **38** rotates and reciprocates bearing **36** by eccentrically driven shaft **37**. This reciprocating means drives diaphragm **28** through ring **33** to expand and contract the expansion chamber **26** of the pump, as shown in full and dot-dash lines in Fig. 2. The fluid flows through intake valve **22** through the expansion chamber **26** and out exhaust valve **22***a* into pressure line **21**.

A practical application of this pump is shown in my copending application Serial Number 201,085, filed December 16, 1950, and entitled "Hollow Mattress and Inflation Control Therefor." In this application the pump is used for compressing air but it could very readily be used for compressing or pumping other fluids.

The diaphragm, the subject of this invention may very well be used for other applications and in other types of pumps.

What I claim is:

1. A pump diaphragm consisting of a substantially flat circular flexible disc, an integral depending peripheral annular flange projecting from one face thereof adapted to be mounted over an upstanding circular wall surrounding an expansion chamber of a pump, a bead on the outer lower edge of said flange, an integral ring-shaped projection extending from the middle of the other face of said disc, the axis of said ring extending perpendicular to the axis of said disc, and said ring having its inner periphery provided with an annular recess, whereby to retain an eccentrically driven member to reciprocate said diaphragm to alternately expand and contract said chamber, and whereby a retaining member surrounding said flange and wall may be held in place by said bead.

2. In a pump comprising a base having an upstanding annular wall, there being fluid inlet and outlet openings through said base within said annular wall and valves cooperating with said openings to open and close the same for pumping action; the combination therewith of a flexible rubberlike diaphragm having an integral depending annular flange, said flange telescopically receiving said upstanding wall, a bead on the lower edge of said annular flange, means securing said flange to said annular wall, an integral ring-shaped projection extending upwardly from the center of said diaphragm with the axis of said ring perpendicular to the axis of said annular flange, an eccentric snugly engaged in said ring-shaped projection, means for rotating said eccentric, an outermost surface on said annular wall concave outwardly, said flange securing means comprising a snapring outside said flange and releasably holding said flange in snug engagement with said outermost surface of said wall, said ring-shaped projection containing a groove in its inner periphery.

3. In a pump comprising a base having an upstanding annular wall, there being fluid inlet and outlet openings through said base within said annular wall and valves cooperating with said openings to open and close the same for pumping action; the combination therewith of a flexible rubberlike diaphragm having an integral downwardly extending annular flange, means securing said flange to said annular wall, an integral ring-shaped rubberlike projection extending upwardly from the center of said rubberlike diaphragm with the axis of said ring perpendicular to the axis of said annular flange, said projection having its inner periphery provided with an annular recess, an annular bearing in said recess and retained by the rubberlike characteristic of said projection, and a driving member engaged inside said bearing for oscillating said diaphragm.

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