L. C. McNEAL.

DIAPHRAGM PUMP.

APPLICATION FILED JUNE 15, 1911.

1,007,719.

Patented Nov. 7, 1911.

2 SHEETS—SHEET 1.

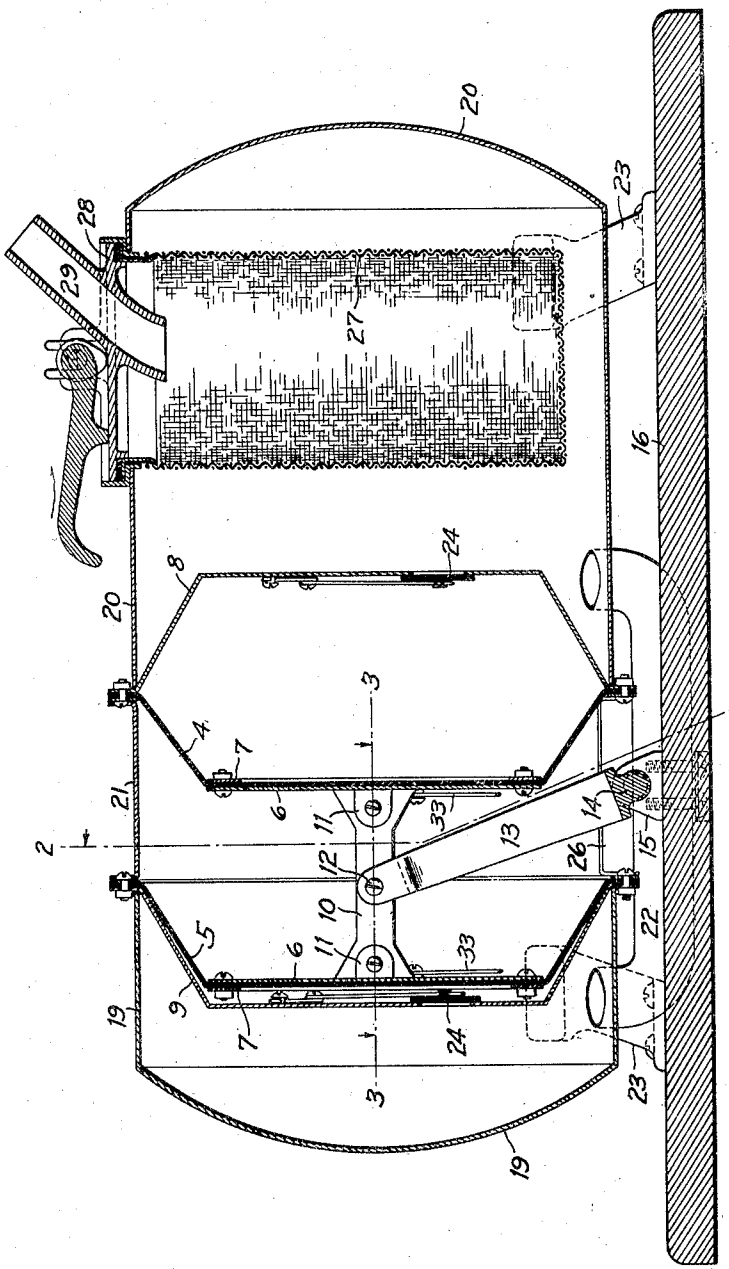

Fig. 1.

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2 SHEETS—SHEET 2.

Fig. 2.

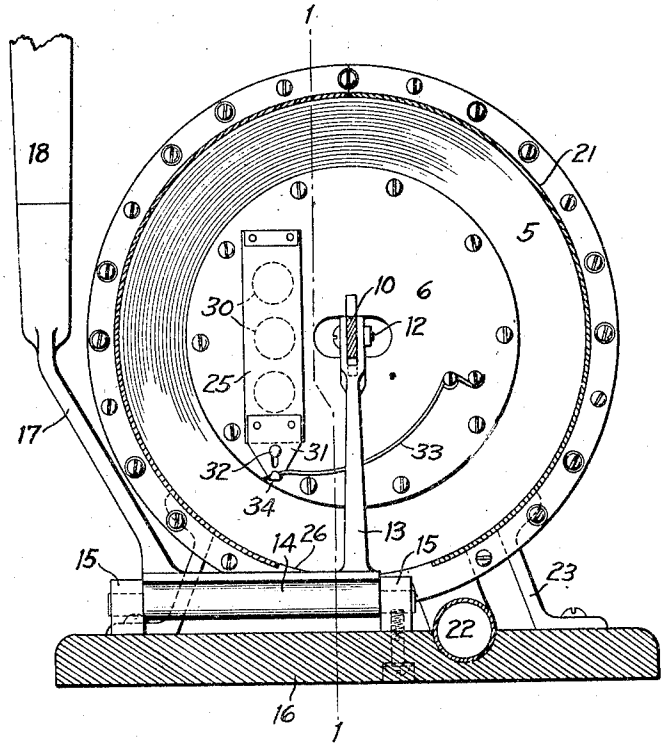
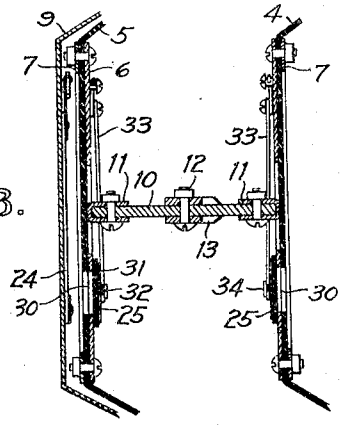


Fig. 3.



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UNITED STATES PATENT OFFICE.

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DIAPHRAGM-PUMP.

1,007,719. Specification of Letters Patent. Patented Nov. 7, 1911.

Application filed June 15, 1911. Serial No. 633,391.

To all whom it may concern:

Be it known that I, LUTHER C. McNEAL, a citizen of the United States, and resident of Rochester, in the county of Monroe and State of New York, have invented certain new and useful Improvements in Diaphragm-Pumps, of which the following is a specification.

This invention relates to diaphragm-pumps such as are employed for pumping fluids of various characters, and the invention is particularly applicable to air or vacuum-pumps for use in connection with vacuum-cleaning apparatus.

The object of the invention is to produce a pump of duplex type, that is, with two diaphragms, in which mechanism of novel and simple character is provided for actuating the two diaphragms simultaneously, and to this end I employ an actuating mechanism in which the mechanical connections are entirely pivotal in character, thereby dispensing with the slide-guides usually employed in pumps of similar type.

In the accompanying drawings:—Figure 1 is a longitudinal section of vacuum-cleaning apparatus embodying a pump constructed in accordance with the present invention, the figure being a sectional view on the line 1—1 in Fig. 2; Fig. 2 is a right-hand end-view of the apparatus of Fig. 1; and Fig. 3 is a detail sectional view, on the line 3—3 in Fig. 1, showing the connection between the diaphragms and the connecting bar.

The illustrated embodiment of the invention comprises two circular diaphragms 4 and 5, each of which has a flexible member of leather, or other suitable material, stiffened at its central portion by means of a circular metal plate 6 of less diameter than the leather portion. The metal plate is secured to the leather by means of a flat ring 7, and bolts passing through this ring, the leather, and the plate 6, as shown in Figs. 1 and 3. The metal plate stiffens the central portion of the diaphragm and affords a rigid member through which the necessary movements may be imparted to the diaphragm.

Coöperating with the two diaphragms are concave sheet-metal partitions 8 and 9, which, with the respective diaphragms 4 and 5, constitute two air-chambers into which the air is first drawn, and from which it is then expelled, through suitable inlet- and outlet-valves by the horizontal reciprocating movements of the diaphragms.

The two diaphragms are rigidly connected together by means of a horizontal connecting-bar 10. This bar is fixed at each end between two lugs 11, which may be conveniently formed by being cut and bent up from the metal sheets 6, as shown particularly in Fig. 3. The connecting-bar 10 is supported and actuated by a pivot 12 at the middle of the bar, this pivot being mounted in the forked upper end of a lever-arm 13. The lever-arm extends upwardly from, and is integral with, a rock-shaft 14 which is journaled in two bearing-blocks 15. The bearing-blocks are fixed to a base-board 16, which rests upon the floor or the ground when the pump is in use. As shown in Fig. 2, the rock-shaft extends laterally with respect to the diaphragms, and at its outer end it is provided with an upwardly-extending lever-arm 17. This arm may be provided with a manually-operable extension or handle 18 of any convenient length.

The pump is actuated by oscillating the handle 18, thus causing the rock-shaft to oscillate the lever-arm 13. The upper end of the lever-arm traverses a short arc in an approximately horizontal direction and carries with it the connecting-bar 10 and the rigid portions of the diaphragms. It will be apparent that this arcuate movement causes the connecting-bar to rise and fall slightly in addition to its horizontal movements, so that the movements of the diaphragms are not strictly axial. The parts are so proportioned and arranged, however, that each end of this arc of movement of the lever-arm substantially coincides with the horizontal axis of the diaphragms, so that, as shown in Fig. 1, when the parts are in their extreme position the rigid portions of the diaphragms are concentric with the peripheries of the diaphragms Accordingly, the flexible portions of the diaphragms are stretched equally, that is, to a symmetrical conical form, thus avoiding any unequal strain and injury to the diaphragms. As soon as the lever-arm begins its arcuate movement, thus raising the connecting-bar and the rigid portions of the diaphragms, it simultaneously loosens the flexible portions by the same movement, so that the arcuate movement may be freely performed without injury to the diaphragms.

As the diaphragms are similar in size and construction, and as the connecting-bar is pivoted at its middle point, the weight of

the structure as a whole is balanced about this point, so that there is no tendency in the bar to move from its horizontal position at any part of its path of movement.

The construction just described produces a very simple and efficient mechanism in which the usual slide-guides are unnecessary, and in which all sliding movements are eliminated, while at the same time the movements imparted to the diaphragms do not depart from strictly axial movement to an extent which can be injurious to the diaphragms.

The diaphragms and the partitions 8 and 9 are mounted between and supported by three cylindrical casing-members 19, 20 and 21, these members having annular flanges at their ends between which the diaphragms and the partitions are clamped by means of bolts. The casing-members 19 and 20 are closed at their ends, and together they constitute a vacuum-chamber or receiver into which air is drawn by the pump, these casing-members being connected for this purpose by a conduit 22. The casing-members are mounted upon legs 23 fixed to the base-board 16. The intermediate casing-member 21 constitutes an outlet-chamber into which the air is discharged from the pump, and the air issues from this chamber through an opening 26 at the bottom.

The pump is illustrated as employed in connection with vacuum-cleaning apparatus, being provided for this purpose with a dust-bag or strainer 27 in the casing-member 20. Access to the dust-bag is afforded by a removable cover 28, which is provided with an air-inlet 29. This air-inlet may be connected with a flexible hose or with any apparatus from which air is to be exhausted.

In connection with the pump just described I employ inlet- and outlet-valves of well known form. The inlet-valves 24 are mounted upon the partitions 8 and 9 to control inlet-openings therein, while the outlet-valves 25 control outlet-openings in the sheet-metal members 6 of the diaphragm. The inlet-valves and the outlet-valves are similar in construction. Each outlet-valve comprises, as shown in Figs. 2 and 3, a flap of leather, or other flexible material, fixed at its upper end to the plate 6 in position to close three openings 30 shown in dotted lines in Fig. 2. To the lower end of the valve-flap is riveted a piece of sheet-metal 31, which is slotted to engage loosely a headed stud 32 projecting from the plate 6. A wire spring 33 fixed to the plate engages a hook 34 on the member 31 and subjects the valve-flap constantly to tension, thus tending to draw it closely into engagement with the surface of the plate 6. A slight air-pressure within the pump, acting through the outlet-openings 30, forces the valve-flap away from the surface of the plate, this movement being permitted by the sliding of the member 31 upon the stud 32 and the yielding of the spring 33. When the pressure is relieved the spring draws the flap back to the surface of the plate 6, and any air-pressure outside of the valve tends to close it more firmly.

My invention is not limited to the embodiment thereof hereinbefore described and illustrated in the accompanying drawings, but may be embodied in various other forms within the nature of the invention, as it is defined in the following claims.

I claim:—

1. A diaphragm-pump having, in combination with a casing provided with inlet- and outlet-openings, two parallel diaphragms having flexible outer portions and rigid central portions, a bar connecting said central portions, and an oscillatory lever-arm for actuating the diaphragms, the lever-arm being pivoted directly to, and supporting said bar, whereby reciprocating movement is imparted to the bar and the diaphragms, the bar, except for its connection with the lever-arm and the diaphragms, being freely movable.

2. A diaphragm-pump having, in combination with a casing provided with inlet- and outlet-openings, two parallel diaphragms having flexible outer portions and rigid central portions, a bar rigidly connecting said central portions, and a lever-arm for actuating the diaphragms, the lever-arm being pivoted directly to, and supporting said bar at the middle thereof, whereby reciprocating movement is imparted to the bar, the bar and the central portions of the diaphragm being substantially balanced at said pivotal connections.

3. A diaphragm-pump having, in combination with a casing provided with inlet- and outlet-openings, two parallel diaphragms having flexible outer portions and rigid central portions, a bar rigidly connecting said central portions, and a lever-arm pivoted directly to said bar for supporting the bar and imparting reciprocating movements thereto in the general direction of its length, the path of movement of the bar terminating, at each end, substantially at the axis of the diaphragms, whereby the diaphragms are symmetrically stretched at each end of the path of movement.

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