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Kolfertz

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[54] ELECTRICALLY OPERATED DOUBLE-DIAPHRAGM PUMP

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[51] **Int. Cl.** **F04b 43/00,** F04b 45/00

[58] **Field of Search** ..... 417/412, 413, 416, 418, 480; 62/11 R, 11 F

[56] **References Cited**

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[57] **ABSTRACT**

An electrically operated double-diaphragm pump of the kind in which two diaphragms are actuated by a common oscillating arm situated between them, the arm being oscillated by an alternating current vibrating armature motor, has each diaphragm connected to the oscillating arm directly through a resilient coupling member made of rubber or rubberlike plastics material. The coupling member consists of a tube with a solid part in its middle to which the arm is fixed and the diaphragms are fixed, one to each end of the tube, by means of pins, one of which is fixed to each diaphragm and which fit one in each end of the tube. The pins may have heads which fit in internal sockets within the tube to hold the pins in the tube as the arm oscillates.

4 Claims, 2 Drawing Figures

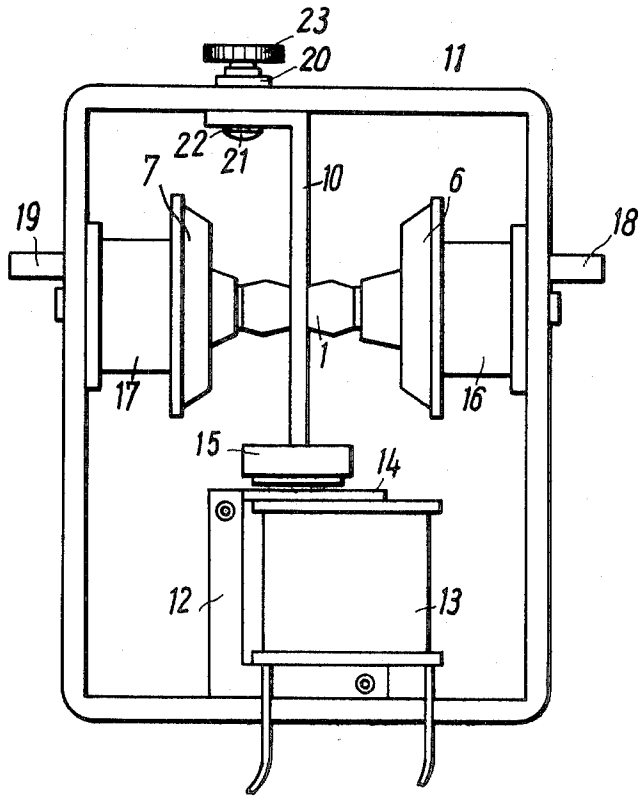

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Fig.1

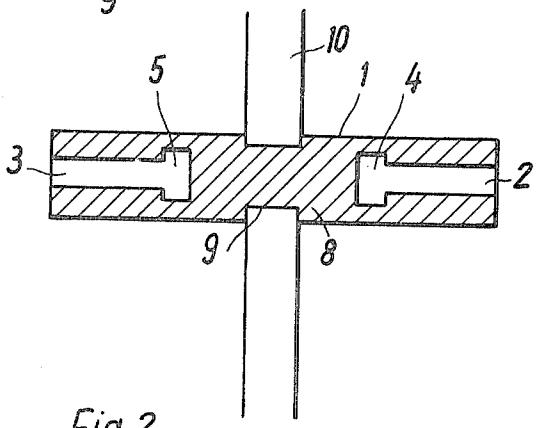
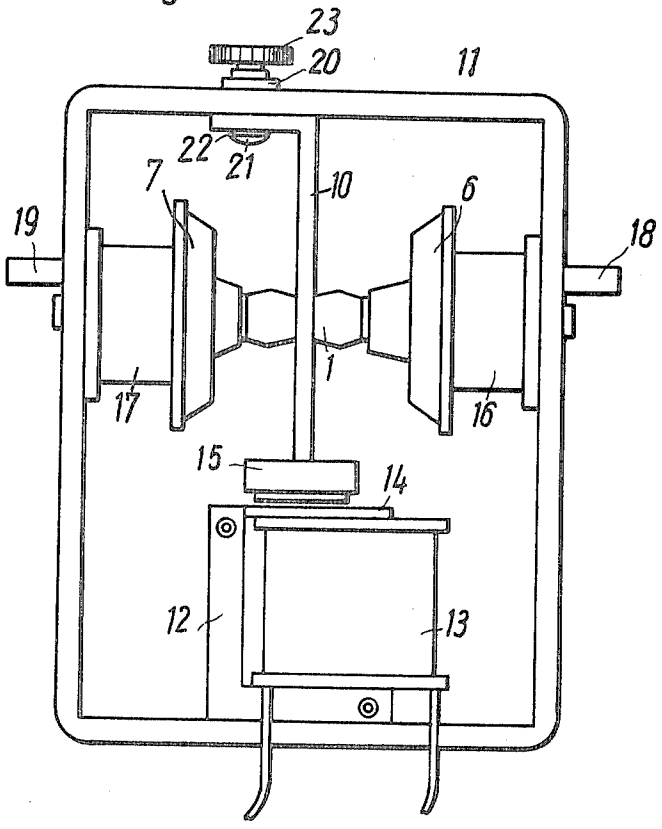


Fig.2



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ELECTRICALLY OPERATED DOUBLE-DIAPHRAGM PUMP

This invention relates to electrically operated double-diaphragm pumps for use, for example, for aerating the water in aquaria, of the kind in which the two diaphragms are actuated by a common oscillating arm situated between them, the arm being oscillated by an alternating current vibrating armature motor.

In existing pumps of this kind, the oscillating arm is attached to the wall of a surrounding housing and is connected to each of the two diaphragms by means of a separate linkage. That is to say there is an individual linkage for each of the two diaphragms, one on each side of the arm. Such pumps operate quietly owing to the opposite movements of the two diaphragms, with one diaphragm making a suction stroke while the other makes a discharge stroke and vice versa, but they have the disadvantage that the two linkages which include a number of pivots require considerably maintenance and can give trouble brought about by wear. This is a serious disadvantage when the pump has to operate continuously as is necessary for aerating aquarium water.

In some cases the double linkage has been replaced by a rigid connection between the oscillating arm and each diaphragm, but this makes it necessary to modify the pump so that the diaphragms are no longer operated by a common arm, but instead two separate arms are provided, one for each diaphragm. When there are two separate arms, it is necessary for the electromagnet of the motor to have an E-shaped core. This kind of core occupies a great deal of space.

The object of the present invention is to provide an electrically operated double-diaphragm pump of the kind described above which is free from the disadvantages of the present forms of such pumps and which is of simpler and more compact construction and has a longer working life than the existing pumps.

To this end, according to this invention, in a pump of the kind described, each diaphragm is connected to the oscillating arm through a resilient coupling member.

Preferably there is a single coupling member through which both of the diaphragms are connected to the oscillating arm, the coupling member being made of rubber or of rubberlike plastics material.

The provision of a resilient coupling member or members leads to several important advantages. First of all, it is no longer necessary to use a linkage consisting of a number of parts pivotally connected to each other. The construction of the pump is therefore made simpler and less expensive. Secondly the pump is more reliable in operation and finally the E-shaped core which was necessary in some forms of prior pump may be replaced by a U-shaped core which is more compact.

In a preferred form of the invention, the two diaphragms are coaxial with each other and the coupling member is in the form of a tube which has the diaphragms attached one to each end and has a solid middle part to which the arm is fixed.

When the coupling member is in the form of a tube, the diaphragms may be attached to it by means of pins which fit one in each end of the bore of the tube.

This method of attaching the diaphragms to the arm again helps in giving the pump a longer working like.

An example of a pump constructed in accordance with the invention is illustrated in the accompanying drawings in which:

FIG. 1 is a section through a resilient coupling member forming a part of the pump; and

FIG. 2 is a plan view of the pump with part of a surrounding housing removed to show interior details.

As shown in FIG. 2, the pump comprises a rectangular housing 11 in which a core 12 of a field electromagnet is mounted. The core 12 is of the usual U-shaped kind used in AC vibrating armature motors and carries an exciter coil 13 which, in use, is connected to an AC supply. The core 12 has a pole shoe 14 and an armature 15, in the form of a permanent magnet, is attached to the end of a resilient arm 10 which is mounted on the top wall of the housing 11. The two poles of the permanent magnet armature 15 are directed towards the pole shoe 14 and a gap between the armature and the pole shoe is adjustable.

The arm 10 is fixed to a resilient coupling member 1 in the manner shown most clearly in FIG. 1 of the drawings. The coupling member 1 is made of rubber although it may alternatively be made of plastics material of a rubberlike resilience. The member 1 is in the form of a tube with a solid middle part 8 which extends through a hole in the arm 10 and has an annular groove 9 around it in which the part of the arm surrounding its hole fits. The tubular end parts of the coupling member 1 have blind bores 2 and 3 with enlarged sockets 4 and 5 at their inner ends.

Two pump chambers 16 and 17 are mounted on the sidewalls of the housing 11 and are arranged symmetrically one on each side of the oscillating arm 10. The pump chambers 16 and 17 are provided with diaphragms 6 and 7 respectively and these diaphragms are mounted coaxially with each other and coaxially with the coupling member 1. The two diaphragms 6 and 7 each have a coupling pin fixed centrally to them and the two pins fit in the blind bores 2 and 3 in the coupling member 1. The pins have heads which fit in the sockets 4 and 5 to resist withdrawal of the pins. In this way the two diaphragms 6 and 7 are connected to the oscillating arm 10 so that as the arm oscillates, the diaphragms 6 and 7 move to and fro.

The two pump chambers 16 and 17 have air inlets and also air outlet connections 18 and 19 respectively which, in use, are connected to an air supply tube. As the diaphragms 6 and 7 move to and fro, air is sucked into the chambers 16 and 17 through their inlets and is discharged through the air outlet connections 18 and 19. The chamber 16 discharges air while the chamber 17 is drawing air in and vice versa.

The oscillating arm 10 is mounted on the top wall of the housing 11 by means of a rubber bush 20 which extends through a hole in the top wall and through a hole in a bent over part of the arm 10. The bent over part of the arm 10 is held in position on the bush 20 by a bolt 21 the head of which acts on the bent over part of the arm 10 through a washer 22. A knurled adjustment nut 23 is screwed onto the bolt 21 and adjustment of the nut 23 moves the arm 10 upwards or downwards to a limited extent and so adjusts the gap between the armature 15 and the pole shoe 14.

Although the invention is illustrated and described with reference to a single preferred embodiment thereof, it is to be expressly understood that it is in no way limited to the disclosure of such a preferred embodiment, but is capable of numerous modifications within the scope of the appended claims.

I claim:

1. In an electrically operated double-diaphragm pump arrangement comprising in combination,

an actuating arm having an opening oscillatably mounted between a pair of opposed and coaxial pump diaphragms;

an alternating current vibrator armature motor operatively connected to said actuating arm for oscillating it substantially along the axis of said coaxial pump diaphragms,

a tubular unitary coupling member of rubber or rubberlike plastics material having a solid central portion and being operatively connected at opposite ends to said pair of opposed pump diaphragms, so that oscillation of the arm reciprocates said pair of diaphragms via said coupling member to operate said pump, said coupling member extending through said opening of said arm and forms a positive connection therewith.

2. A pump as claimed in claim 1, further comprising means defining an opening in said arm, and means defining an annular groove extending around said solid part in the middle of said tube, said coupling member extending through said opening fitting in said groove.

3. A pump as claimed in claim 1, further comprising pins fixed one to each of said diaphragms, said pins fitting one in each end of said tube.

4. A pump as claimed in claim 3, further comprising means defining sockets within said tube, one adjacent each end thereof, and heads on said pins, said heads fitting in said sockets to resist withdrawal of said pins from said tube.

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