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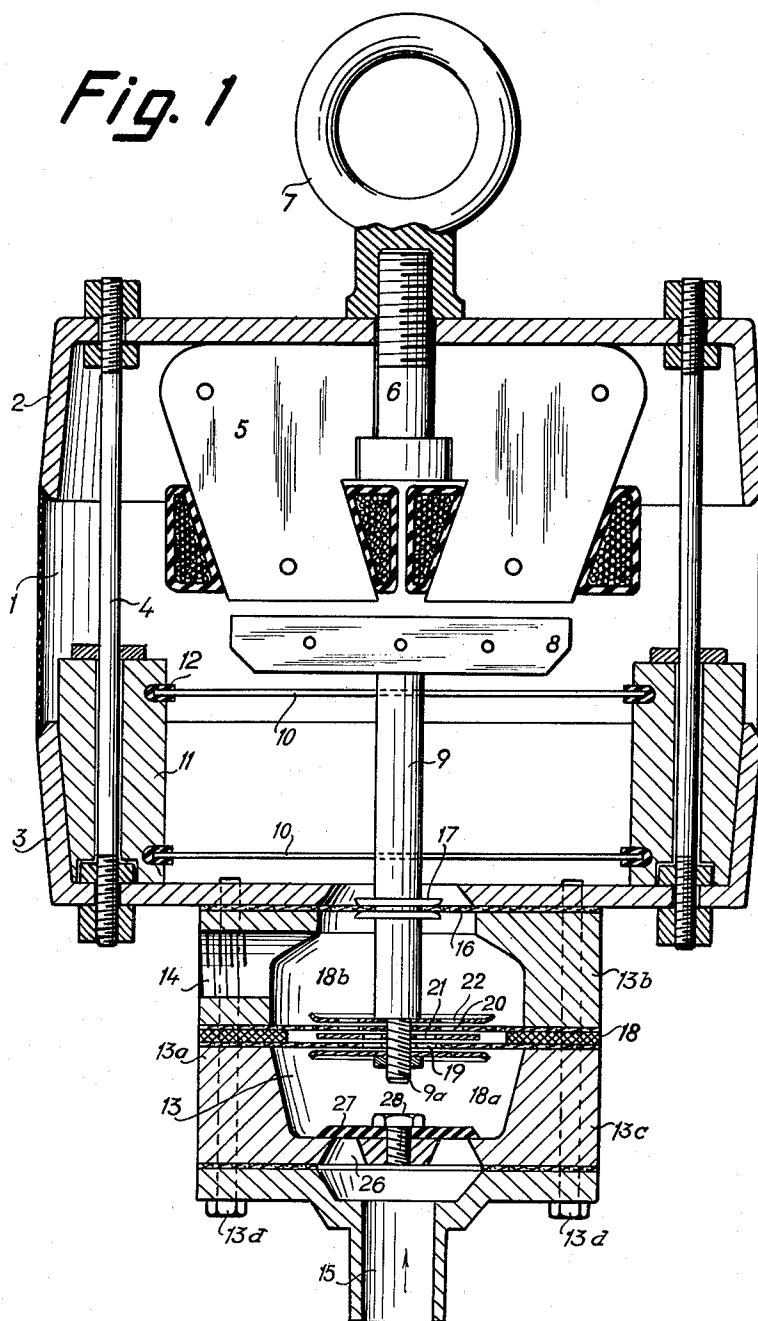
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ELECTROMAGNETICALLY OPERATED PUMP FOR RAISING LIQUIDS

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Fig. 1



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Fig. 2

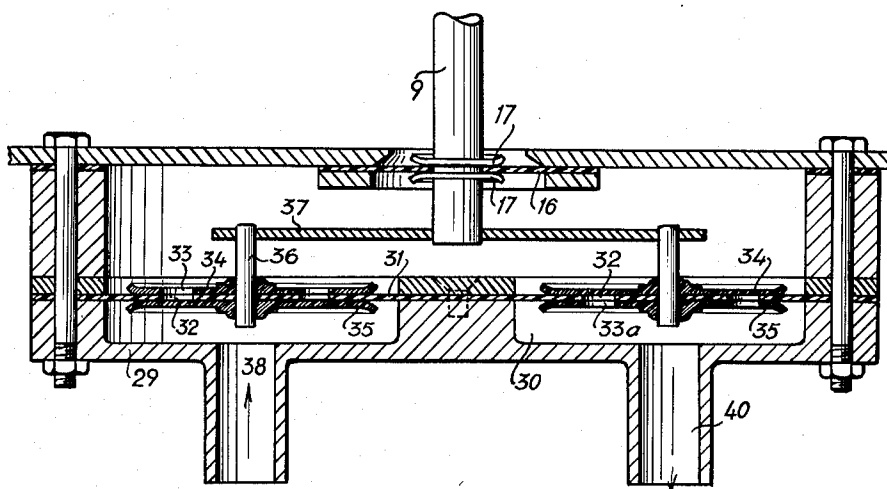
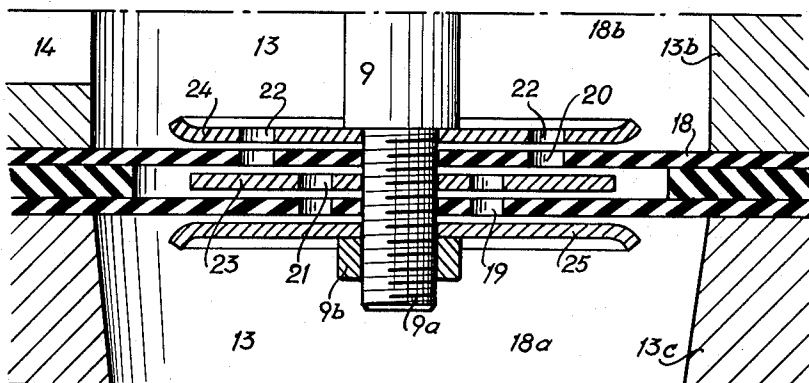


Fig. 3



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ELECTROMAGNETICALLY OPERATED PUMP FOR RAISING LIQUIDS

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3 Claims. (Cl. 103—53)

The present invention relates to an electro-magnetically operated pump for raising liquids, which is characterised by the fact that no rotary motor is required for driving it, since the suction is produced by the synchronous vibration of a diaphragm brought about by the intermittence of the magnetic field of an electromagnet.

It consists essentially of a casing in which is mounted an electromagnet, in front of the poles of which is arranged a moving armature coupled to a shaft supported by straps, the said shaft being integral with a diaphragm mounted in a lower chamber of the pump, the chamber being submerged in the liquid. Owing to the alternating movement of the said diaphragm caused by the axial displacement of the shaft, which in turn is caused to vibrate by the intermittent field of the electromagnet, the liquid is drawn up owing to the momentary formation of a vacuum which coincides with the phase in which the electromagnet attracts the armature mounted adjacent to its poles.

In accordance with the same system, other modified embodiments are provided for, all of which are based on the number of diaphragms or on the arrangement thereof inside the liquid suction and delivery chamber.

To enable the present specification to be more readily understood, a drawing is annexed thereto in which, solely by way of example, are shown a number of practical embodiments of a pump for raising liquids having the characteristics features described.

In the said drawing, Figure 1 is a sectional elevation of the pump as a whole, and Figure 2 shows a different method of assembling the suction and delivery diaphragms and also of the composite chambers in which a combined action of the said diaphragms is obtained. Figure 3 is an enlarged cross-sectional view of a detail of Figure 1.

The barrel of the pump is formed by a cylindrical casing 1 with two covers 2 and 3 adjustable inter se by means of screws 4. Mounted in the top cover 2 is an electromagnet 5 supported by the screw 6 screwed into an external ring 7. Opposite the poles of the electromagnet 5 is mounted an armature 8 which is integral with the shaft 9 supported by the straps 10 bearing on the members 11.

To facilitate the vibratory movement of these straps 10 a number of elastic cushions 12 are provided at the point of connection with the members 11.

Mounted in the lower cover 3 of this pump is the pump body 13a formed with an internal hollow space 13, having a lateral opening 14 and a lower central inlet duct 15.

To prevent the liquid entering the inside of the casing 1, there is provided between the latter and the chamber 13, an elastic joint 16 through which passes the shaft 9 without any passage between them as it is prevented by the washers 17 which fit tightly on the said elastic joint 16.

The pump body 13a is formed by two parts 13b, 13c, fitted together by means of screws 13d to the cover 3. Between parts 13b and 13c there are clamped two diaphragms 18 extending across the hollow space 13 intermediate the lateral opening 14 and the duct 15, thus

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dividing the said space 13 into a suction chamber 18a and a delivery chamber 18b for the liquid raised.

The diaphragms 18 as clearly shown in the drawings have bores coaxial with shaft 9, and the shaft extending through the bores. The lower end of shaft 9 has a threaded portion 9a, of smaller diameter than the remainder of the shaft. The threaded portion 9a carries plates 23, 24, 25 placed in an alternate arrangement with the diaphragms and secured to the shaft by means of a nut 9b.

Each diaphragm has a series of orifices 19 and 20 concentrically arranged around the shaft 9, so that they cannot enter into registration with one another. The upper plate 24 has orifices 22 registering with orifices 20 of the upper diaphragm 18, and the middle plate 23 has orifices 21 registering with the orifices 19 of the lower diaphragm. The lower plate 25 has no orifices.

Between the plates 23—25 and the diaphragm 18 there is left a slight play in order that under axial reciprocation of the shaft 9 and plates 23—25, the diaphragms 18 may be alternatively applied against the respective plates placed above and below the same. Thus, when the shaft 9 moves upwardly, the diaphragms 18 are pressed against plates 23 and 25 closing the orifices 19, 20, and thus no liquid circulation is allowed through the device. When the shaft 9 moves in the contrary direction plates 23, 25 move away from the diaphragms 18 allowing communication between the two sides of the diaphragms' ensemble to take place through the orifices 19—22.

In the base of the chamber 18a are the orifices 26 closed by an elastic washer 27 suitably fixed to the body of the chamber 18a by means of a screw 28. Opposite to the said orifices 26 is located the suction duct 15.

In the embodiment shown in Fig. 2 can be seen a double suction and delivery chamber. The said chamber is divided into two compartments 29 and 30 in which is mounted a common diaphragm 31 having orifices 32 which in the diaphragm of the chamber 29 coincide with the orifices 33 provided in the upper plate 34 and in the diaphragm of the compartment 30 the orifices 32 coincide with those 33a in the lower plate 35. The elastic joint 31 is subjected to pressure in both compartments by the plates 34 and 35 integral with the shafts 36 connected to the arm 37 which in turn forms part of the central shaft 9 carrying the washers 17 which press on the elastic joint 16.

The compartment 29 contains the suction intake 38 and compartment 30 the delivery connection 40.

In the embodiments described the lower chamber is submerged in the liquid, the level of the latter being maintained constant relatively to the suction tubes by means of an appropriate float arranged in such a manner that only that part of the chamber is submerged whilst the electrical part of the pump is located in the upper part of the said float.

In the embodiment illustrated in Fig. 1, the mode of operation of the pump described is as follows:

When the electromagnet 5 is connected up to the electric supply mains, the periodicity of the current causes an interruption in the setting up of the magnetic field which is translated into the rapid attraction of the armature 8 which during the ensuing phase becomes separated from the poles of the magnet by reason of the straps 10. This vibration, which is very rapid, is transmitted to the diaphragm 18 which during its upward movement sets up a vacuum in the suction chamber 18a which forces the elastic washer 27 to open and the liquid to pass in. When the diaphragm 18 descends this liquid cannot pass out through the inlet orifices 26 and can only pass through the orifices 19, 20, 21 and 22 by passing between the diaphragm 18 and the plates 25, 24 and 23. During the upward movement of the diaphragm 18 in the ensuing phase, the liquid is forced out of the delivery chamber 18b

through the opening 14 to which is coupled the working tube. To enable the suction to take place in view of the short stroke of the diaphragm 18, the duct 15 is submerged in the liquid.

By reason therefore of the synchronous vibration of the diaphragm 18 caused by the electromagnet 5 acting on the moving armature 8, the liquid will rise continuously, passing from the suction chamber to the delivery chamber through the orifices referred to and from the latter chamber to the outside through the outlet opening 14.

In the embodiment shown in Fig. 2, the motive elements are the same as those described above. The suction and delivery chamber in this case is double. The liquid enters through the suction intake 38, passes through the orifices 32 and 33 in the diaphragm 31 and plate 34 of the compartment 29 during the downward movement of the diaphragm 31 and when the latter ascends the said liquid passes out in inverse direction through the orifices 32 and 33a in the diaphragm and plate of the adjoining compartment 30, passing to the outside through the delivery connection 40.

Both in the former and in the latter embodiment, the liquid cannot enter the casing containing the electrical parts, being prevented from doing so by the elastic joint 16.

In the embodiments illustrated the pump must be partially submerged in order to make use of the short suction stroke of the diaphragms. With that object in view the pump can be mounted on an appropriate float which enables only the lower chamber to be submerged whilst the upper chamber or casing for the electrical elements remains outside. In this way a constant level is obtained although in order to achieve it other appropriate means may be employed.

The materials, shapes and dimensions, both absolute and relative, of the lifting pump described are independent of the object of the invention, provided the variations made therein do not affect its essential features.

We claim:

1. In an electromagnetically operated pump for raising liquids, a pump body having a hollow space therein, a diaphragm extending across the hollow space and forming a suction chamber and a delivery chamber therein, plates on either side of said diaphragm covering a central portion of the surface thereof, a driving shaft secured to said plates and extending out of the pump body, electromagnetically operated means for actuating said shaft in an axial reciprocating vibratory motion to reciprocate the plates and the diaphragm, said diaphragm having a series of orifices disposed around said central portion, one of said plates having orifices in register with said orifices in said diaphragm, another of said plates being solid and adapted to block said orifices in said diaphragm, said plates and said diaphragm and the orifices therein coacting to form a valve effect open in one direction of said reciprocation and closed in the opposite direction to pass liquid in from the suction chamber to the delivery chamber upon said reciprocation, liquid inlet means including a check valve to said suction chamber and liquid outlet means from said delivery chamber.

2. In an electromagnetically operated pump for raising liquids, a pump body having a hollow space therein, a plurality of superimposed diaphragms extending across

the hollow space and forming a suction chamber and a delivery chamber therein, plates in alternate association with said diaphragms and covering a central portion of the surface thereof, a driving shaft secured to said plates and extending out of the pump body, electromagnetically operated means for actuating said shaft in an axial reciprocating vibratory motion to reciprocate the diaphragms, each said diaphragm having a series of orifices disposed around said central portion, the orifices in one of the diaphragms being out of register with the orifices in adjacent diaphragms, each said plate having orifices coincident with the orifices of one adjacent diaphragm and forming, in combination with the adjacent diaphragm central portions and the orifices thereof, a valve effect to pass liquid in from the suction chamber to the delivery chamber upon reciprocation of said diaphragms, said suction chamber having a suction duct for communication with a liquid to be raised, a suction valve in said duct, and said delivery chamber having an opening for connection thereof to an elevation tube.

3. In an electromagnetically operated pump for rising liquids, a pump body having a hollow space therein, two diaphragms extending across said hollow space in spaced relation to one another along the liquid flow direction and defining an intermediate chamber therebetween and a delivery chamber and a suction chamber adjacent said diaphragms, plates on either side of said diaphragms covering a central portion of the surface thereof, a driving member secured to said plates, a driving shaft secured to said driving member and extending out of the pump body, electromagnetically operated means for actuating said shaft in axial reciprocating vibratory motion to reciprocate the plates and the diaphragms, said diaphragms having a series of orifices disposed around said central portion, one of said plates in either said diaphragm having orifices in register with the orifices in said diaphragm, another of said plates in either diaphragm being solid and adapted to block said orifices in said diaphragm, either diaphragm and the respective plates and the orifices therein coacting to form a valve effect open in one direction of said reciprocation and closed in the opposite direction to pass liquid in from the suction chamber to the intermediate chamber and from the intermediate chamber to the delivery chamber upon said reciprocation, liquid inlet means including a check valve to said suction chamber and liquid outlet means from said delivery chamber.

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