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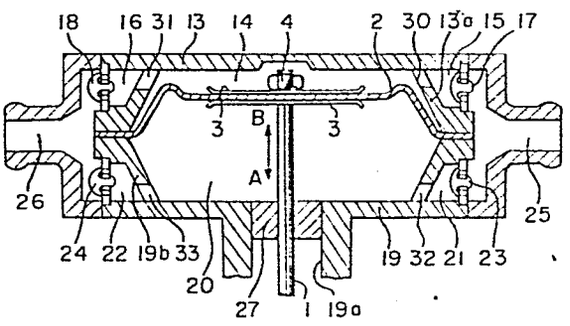
(54) Diaphragm type pump device.

(57) A diaphragm type pumpe device comprises a connecting rod (1), a diaphragm (2) connected to an end of the connecting rod, a cover (13) which firmly secures the outer circumferential part of the diaphragm and constitutes a first operation chamber (14), a frame (19) which opposes the cover to firmly secure the outer circumferential part of the diaphragm (2) in association with the cover (13) and constitutes a second operation chamber (20), and an intake port (15; 21) and a discharge port (16; 22) which are respectively communicated with the first operation chamber (14) and the second operation chamber (20) and provided with check valves (17, 23; 18, 24) each having different communicating direction, wherein the first and second operation chambers (14; 20) alternatively perform pumping operation by the amplitude movement of the diaphragm (2) due to a combination of the reciprocating movement of the connecting rod and the action of the check valves.

FIGURE 2



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DIAPHRAGM TYPE PUMP DEVICE

The present invention relates to an improvement in a diaphragm type pump device.

There has been proposed a device of this kind as shown in Figure 1.

In the Figure, a reference numeral 1 designates a connecting rod; a numeral 2 designates a diaphragm secured to an end of the connecting rod 1; a numeral 3 designates reinforcing plates for reinforcing the diaphragm; a numeral 4 designates a nut to fix the diaphragm 2 and the reinforcing plates 3 to the connecting rod 1; a numeral 5 designates a cover which secures the outer circumferential part of the diaphragm 2 in association with a frame 11 and constitutes an operation chamber 6; a numeral 7 designates an intake port formed in the cover 5; a numeral 8 designates a discharge port formed in the cover; a numeral 9 designates a check valve provided in the intake port 7; a numeral 10 designates a check valve provided in the discharge port 8; and a numeral 12 designates a fixing bolt.

The operation of the conventional pump device shown in Figure 1 will be described.

The diaphragm 2 is subjected to amplitude movement when the connecting rod 1 is reciprocatingly moved by a driving system (not shown).

The volume of the operation chamber 6 increases as the connecting rod 1 is lowered in the direction of A and fluid is sucked from the intake port 7 through the check valve 9 in an opening state, while the check valve 10 is in a closing state.

Conversely, the volume of the operation chamber 6 decreases as the connecting rod is raised in the direction of B whereby the check valve 9 will be closed while the check valve 10 is opened and the fluid in the operation chamber 6 is discharged through the discharge port 8. Thus, pumping operation is effected by repeating the movement as mentioned above.

In the conventional diaphragm type pump device constructed as described above, since the pumping operation has been effected only at one side of the operation chamber 6 constituted by the cover 5 and the diaphragm 2, the shape of the pump is disadvantageously large when a pump having a large capacity is required.

Further, when there is the problem of pulsation of fluid, it is necessary to increase the speed of the amplitude movement of the diaphragm 2. The increased speed adversely affects the durability of the diaphragm 2.

It is an object of the present invention to eliminate the disadvantage of the conventional device and to aim at miniaturization of the shape of a pump device and reduction in pulsation of fluid.

The foregoing and other objects of the present invention have been attained by providing a diagram type pump device which comprises a connecting rod, a diaphragm connected to an end of the connecting rod, a cover which firmly secures the outer circumferential part of the diaphragm and constitutes a first operation chamber, a frame which opposes the cover to firmly secure the outer circumferential part of the diaphragm in association with the cover and constitutes a second operation chamber, and an intake port and a discharge port which are respectively communicated with the first operation chamber and the second operation chamber and provided with check valves each having different communicating direction, wherein the first and second operation chambers alternately perform pumping operation by the amplitude movement of the diaphragm due to a combination of the reciprocating movement of the connecting rod and the action of the check valves.

A more complete appreciation of the invention and many of the attendant advantages thereof will be readily

obtained as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawing, wherein:

Figure 1 is a cross sectional view of a conventional pump device; and

Figure 2 is a cross-sectional view of the pump device of the present invention.

An embodiment of the present invention will be described with reference to drawing. The same reference numerals designate the same parts and therefore, description of these parts is omitted.

A diaphragm type pump device of the present invention is generally constituted by a frame 19, a cover 13, a pair of end plates 25, 26, a diaphragm 2 fixed to the connecting rod 1 and check valves 17, 18, 23 and 24.

The frame 19 has an insertion hole 19a through which the connecting rod extends upwardly so as to be movable by an external driving means. A sealing member 27 is provided at the insertion hole 19a to keep airtightness. The frame 19 also has an inner flange part 19b inwardly extends from the upper surface and two opposing openings 32, 33 are formed in the inner flange at positions near the upper surface of the frame 19.

The cover 13 is placed opposing the frame 19 and has an inner flange 13a downwardly extending from the lower surface. Two opposing openings 30, 31 are formed in the

inner flange 13a at positions near the lower surface of the cover 13. The outer circumferential part of the diaphragm 2, firmly secured at the top end of the connecting rod 1 by the nut 4, is clamped by opposing surfaces of the inner flanges of the cover 13 and the frame 19. Thus, a first operation chamber 14 is formed by the lower surface of the cover 13, the inner flange 13a and the diaphragm 2, while a second operation chamber 20 is formed by the upper surface of the frame 19, the inner flange 19b and the diaphragm 2.

The end plates 25 and 26 are attached to openings formed at both sides of the cover 13 and the frame 19. The end plate 25 has an opening for intaking air and the end plate 26 has an opening for discharging air.

The check valve 17 as a first check valve for intaking air is provided near the opening 30 to form a first intake port 15; the check valve 18 as a second check valve 18 is provided near the opening 31 to form a first discharge port 16; the check valve 23 as a third check valve is provided near the opening 32 to form a second intake port 21 and the check valve 24 as a fourth check valve is provided near the opening to form a second discharge port 22. The first and third check valves 17 and 23 act to only intake air and the second and fourth check valves 18 and 24 act to only discharge air.

The operation of the embodiment of the present invention as shown in Figure 2 will be described.

Reciprocating movement of the connecting rod 1 causes the amplitude movement of the diaphragm 2 as similar to the conventional device.

The volume of the first operation chamber 14 increases as the connecting rod 1 is lowered in the direction of A, on account of which the first check valve 17 is opened and the second check valve is closed to thereby suck fluid through the first intake port 15.

On the other hand, the volume of the second operation chamber 20 decreases whereby the fourth check valve 24 is opened and the third check valve 23 is closed with the consequence that the fluid in the second operation chamber 20 is discharged through the second discharge port 22.

When the connecting rod 1 is raised in the direction of B, the fluid sucked into the first operation chamber 14 is discharged through the first discharge port 16 and a fresh fluid is sucked into the second operation chamber 20 from the second intake port 21.

The first and second operation chambers 14, 20 alternately perform pumping operations by repeating the amplitude movement of the diaphragm.

As described above, in accordance with the present invention, chambers formed at the upper and lower sides of a diaphragm is used as operation chambers for alternate pumping operations thereby obtaining a pump capacity of two times as much as the conventional device.

It is, therefore, possible to miniaturize the shape of the pump while increasing its capacity in an economical manner. Further, pulsation of fluid can be remarkably reduced.

Claims:

1. A diaphragm type pump device which comprises a connecting rod (1), a diaphragm (2) connected to an end of said connecting rod, and a cover (13) which firmly secures the outer circumferential part of said diaphragm and constitutes a first operation chamber (14), c h a r a c t e r i z e d in that a frame (19) opposes said cover (13) to firmly secure the outer circumferential part of said diaphragm in association with said cover and to constitute a second operation chamber (20), that an intake port (15;21) and a discharge port (16;22), respectively are communicated with said first operation chamber (14) and said second operation chamber (20) and are provided with check valves (17;23 and 18;24) each having different communicating direction, and that said first and second operation chambers (14;20) alternately perform pumping operation by the amplitude movement of said diaphragm (2) due to a combination of the reciprocating movement of said connecting rod (1) and the action of said check valves.

2. The diaphragm type pumpe device according to Claim 1, c h a r a c t e r i z e d in that said frame (19) and cover (13) respectively have an inner flange (13a and 19b) to clamp the outer circumferential part of said diaphragm (2).

3. The diaphragm type pump device according to Claim 1 or 2, c h a r a c t e r i z e d in that end plates (25;26) are attached to openings (30;31 and 32;33) formed at both sides of said cover (13) and frame (19) and in that (25) one

of said end plates has an opening for intaking air and the other (26) has an opening for discharging air.

4. The diaphragm type pumpe device according to one of Claims 1 to 3, c h a r a c t e r i z e d in that an intake port (15) and a discharge port (16) for said first operation chamber (14) are respectively formed by openings (30,31) formed in an inner flange (13a) extending downwardly from the lower surface of said cover (13) and first and second check valves (17,18) and an intake port (21) and a discharge port (22) for said second operation chamber (20) are formed by openings (32;33) formed in an inner flange (19b) extending upwardly from the upper surface of said frame (19) and third and fourth check valves (23;24).

FIGURE 1

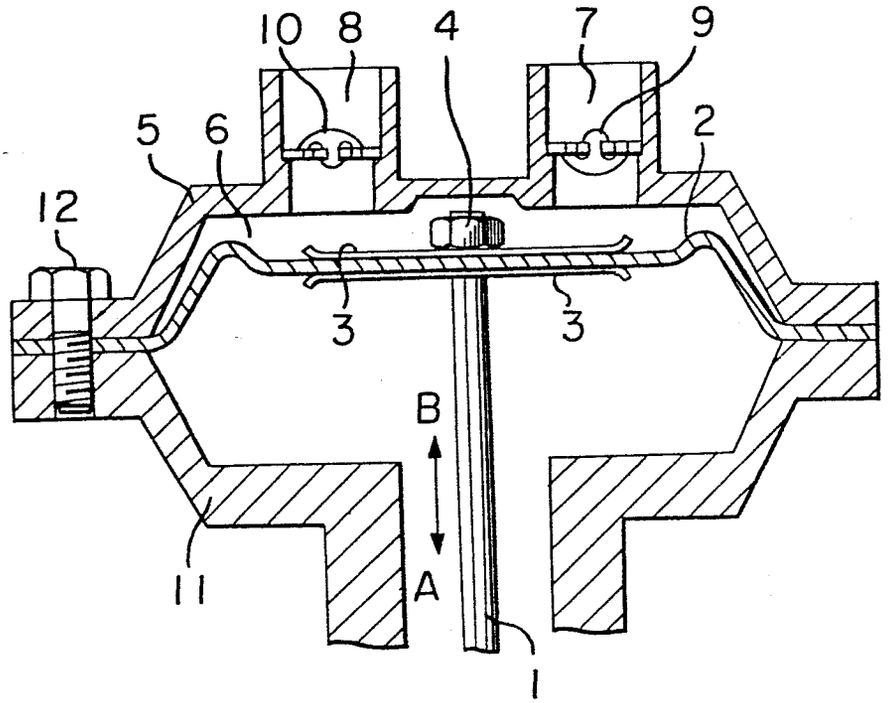

FIGURE 2