April 29, 1930. W. G. CUMMING 1,756,678

SUCTION PUMP

Filed March 10, 1928

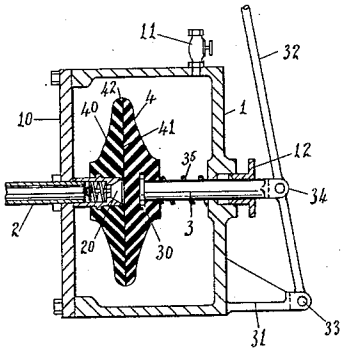


Fig 1

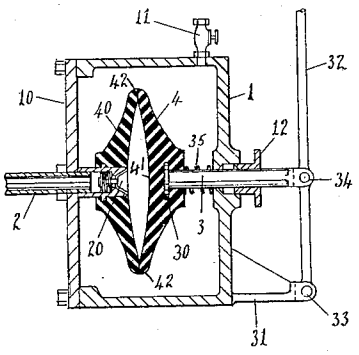


Fig 2

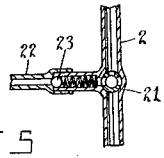


Fig 5

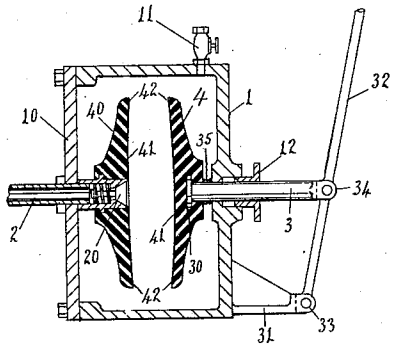


Fig 3

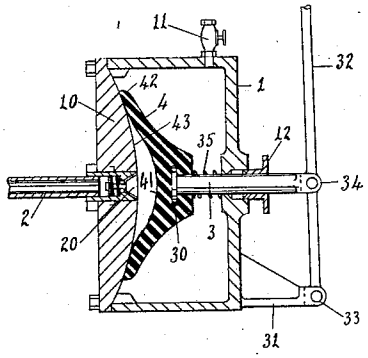


Fig 4

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Patented Apr. 29, 1930 1,756,678

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SUCTION PUMP

Application filed March 10, 1928. Serial No. 260,618.

This invention relates to pumps and particularly to those of the disc type adapted to produce and maintain a supply of gas or compressible fluid under pressure in a container.

The object of the invention is to provide a pump of novel design, simple construction, ready replacement of parts, inexpensive to manufacture, easy to operate and efficient in operation, which will produce the desired results.

A further object is to provide a pump in which the residual air at the end of the compression stroke is reduced to a minimum.

A further object is to provide a pump of the specified type which will function under a variable stroke without affecting its efficiency.

A further object is to provide a pump in which the heat generated in functioning is dissipated in the material operated on.

In disc and diaphragm pumps as designed up to the present time, the edges of the separable surfaces have been permanently attached and the charge, drawn in when the surfaces were caused to separate, was then discharged through a valved outlet on the return stroke.

Whereas in this invention the surfaces have edges which are free and separable, whereby the charge taken in by the operating stroke, may escape by the entire separation of the edges or may be driven out between the free edges, which form an outlet valve, on the return stroke of the pump, thus avoiding the necessity of an outlet valve.

Briefly stated, the device consists in a leak proof container, within which are mounted a fixed disc or surface having an inlet valve, preferably at its center, to a tube in the container wall, and a movable disc having flexible and resilient edges, adapted to reciprocate towards and away from the fixed disc or surface, such as a disc mounted on the end of a reciprocating rod, passing through a gland in the container wall and reciprocated by suitable mechanism.

In the following description, one form of means to carry out my invention is set forth, but I do not limit the scope of it to this specific device as it can be carried out in other modifications and construction.

In the accompanying drawings the invention is illustrated diagrammatically.

Fig. 1 shows the discs in complete contact at one end of the stroke.

Fig. 2 shows one of the discs drawn outwards and a cavity formed.

Fig. 3 shows the discs entirely separated.

Fig. 4 shows one of the discs replaced by a solid surface.

Fig. 5 shows a three way valve.

The container 1, has a cover 10, and a valved outlet 11.

An inlet tube 2, is mounted in the cover 10, or one of the walls of the container 1, and secured to the end projecting into the chamber of the container 1, is a disc 40, having a flexible and resilient edge 42, and a surface 41, which is slightly concave. An inlet valve 20, on the end of the tube 2, opens centrally on the surface 41, of the disc 40.

In the opposite wall of the container 1, a gland 12, provides a slide way for a reciprocating plunger 3, with a head 30, on which is mounted a disc 4, similar to the disc 40, and adapted to completely contact therewith when the plunger 3, is moved inwards, as shown in Figure 1.

Means to reciprocate the plunger 3, are shown comprising a hand lever 32, pivoted at 33, to a bracket 31, from the container 1, with a slotted pivotal coupling 34, to the outer end of the plunger 3.

A spring 35, may be mounted on the plunger 3, between the disc 4, and the gland 12, to maintain the discs normally in contact.

In place of employing two similar discs as shown in Figures 1, 2 and 3, one of them may be replaced by a rigid surface, either plane or curved. In Figure 4 is shown an assembly in which a rigid convex surface 43, forming the inner side of the cover 10, takes the place of the disc 40, in Figures 1, 2 and 3. It is obvious that the reciprocation of either the disc or the surface may take place and that the inlet valve may be in either of them.

The discs may be entirely of flexible and resilient material such as rubber, or may have centers of more rigid material with flexible

and resilient edges. In either case the flexibility and resiliency of the disc edges must be such that on the inward stroke, will permit the edges to be brought into contact while the centers are still slightly separated and subsequently yield while the centers are brought into contact, and that on the outward stroke will maintain the edges in contact while the initial cavity is formed by the separation of the centers, and will subsequently bend and permit the edges to be maintained in contact due to the pressure of the air in the container being greater than that in the cavity.

The operation of the device is as follows:—

Starting with the air in the container under pressure above that of the atmosphere, and the discs in complete contact as shown in Figure 1, at the commencement of the plunger's outward stroke, the centers of the discs separate and form an initial cavity under vacuum, the edges remain in contact due to their resilience and the normally concave form of the surfaces of the discs. As the stroke continues the flexible edges are maintained in contact by the pressure of the surrounding air and bend inwardly while still in complete contact. The vacuum created in the cavity between the discs opens the inlet valve and admits a charge of air at normal pressure. If the return stroke now starts and the centers of the discs approach each other, compressing the charge of air in the cavity until it reaches a pressure sufficient to drive it out of the cavity, it passes out between the edges of the discs into the container, thereby increasing the air pressure therein. The inward stroke of the plunger brings the discs again into complete contact and the cycle is repeated so that each reciprocation adds to the air pressure in the container.

If the outer stroke of the plunger continues until the edges of the discs are drawn apart, the charge of air is released and its compression is effected by the air already under pressure in the container. When this takes place, the heat of compression is absorbed and dissipated by the air in the container. The local heating that occurs when the charge of air is compressed between the discs is in this case eliminated.

The return or inward stroke will then bring the separated discs into complete contact again.

The pump is therefore able to function under a variable length of stroke with high efficiency.

In order to start the pump in a container with air at normal pressure, a three way valve 21, is mounted on the inlet tube 2, having a branch 22, containing a spring operated ball valve 23. When the valve 21, is set to the branch 22, and the discs are drawn apart at the beginning of the outward stroke, an initial cavity under vacuum is formed between the discs, which holds until the vacuum overcomes the tension of the spring of the ball valve, which then opens and admits a charge of air into the cavity, from which it is expelled on the return stroke. This operation may be continued until the pressure in the container is sufficient to hold the edges of the discs in contact during the formation of the initial cavity between the discs.

In this pump, as the faces of the discs can be brought into complete contact, the presence of residual air between the discs on the completion of the inward stroke can be entirely eliminated. The formation of the vacuum in the cavity of this pump is not affected by this defect, so common to pumps of this type.

I claim:

1. In a disc pump, a container, a pair of saparable discs mounted therein, one of which has a valved inlet, and means to move one disc to and from the other disc.

2. In a disc pump, a container, a pair of separable resilient discs mounted therein, one of which has a valved inlet, and means to move one disc to and from the other disc.

3. In a disc pump, a container, a pair of separable discs mounted therein, one of which has a concaved face and flexible edges and one of which has a valved inlet, and means to move one disc to and from the other disc.

4. In a disc pump, the combination of a container with a pair of separable resilient discs, a valved inlet stem supporting one disc and a reciprocating plunger supporting the other disc, and adapted to move it to and from the first disc.

5. In a disc pump, the combination of a container with a pair of separable resilient discs, a valved inlet stem supporting one of the discs, a plunger mounted in a gland supporting the other disc, and means to reciprocate the plunger adapted to draw the discs apart and to bring them together.

6. In a disc pump, the combination of a container with a pair of separable discs, one of which has resilient and flexible edges, a valved inlet stem supporting one disc, and a reciprocating plunger supporting the other disc, adapted to move it to and from the first disc.

7. In a disc pump, the combination of a container with a pair of separable resilient discs, a valved inlet stem supporting one of the discs, a plunger mounted in a gland supporting the other disc, and means to reciprocate the plunger and a spring mounted thereon adapted to bring the discs together.

8. In a disc pump, a container, a disc and a member having cooperating surfaces mounted therein, one of which has a valved inlet, and means to move the disc to and from the surface of the member.

9. In a disc pump, a container, a disc with flexible edges and a member having cooperating surfaces, mounted therein, one of which

has a valved inlet, and means to move the disc to and from the surface of the member.

10. In a disc pump, a container, a resilient disc and a member having cooperating surfaces, mounted therein, one of which has a valved inlet, and means to move the disc to and from the surface of the member.

11. In a disc pump, a container, a disc with a concaved face and flexible and resilient edges and a member having cooperating surfaces, mounted therein, one of which has a valved inlet and means to move the disc to and from the surface of the member.

12. In a disc pump, the combination with a container of a disc and a member having cooperating surfaces, means for reciprocating the disc relatively to the surface, said disc having a free flexible edge adapted to engage with the surface and an inlet valve communicating with the cavity formed between the disc and the surface.

13. In a compression pump, a container, a pair of flexible discs mounted therein having contactable surfaces, a valved inlet to one of the discs, and means to reciprocate one of the discs relatively to the other disc.

14. In a compression pump, a container, a concaved flexible disc and a surface contactable thereto mounted within the container, a valved inlet to the center of contact, and means to reciprocate the disc relatively to the surface.

15. In a compression pump, a container, means within and independent of the container to draw air therein, means to release the air from said means prior to compression, whereby the released air is compressed by the air in the container.

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