PUBLISHED
JUNE 8, 1943.
BY A. P. C.

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COMPRESSION OR DEPRESSION PUMPS OF THE LIQUID RING TYPE

Filed Jan. 9, 1941

Serial No.
373,839

Fig. 1.

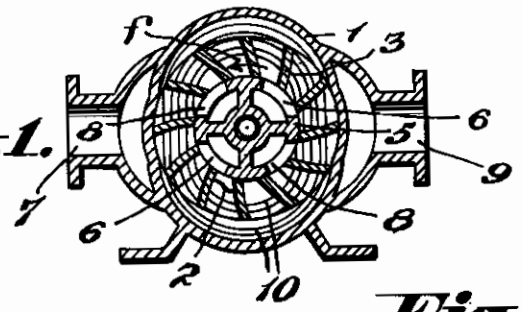

Fig. 2.

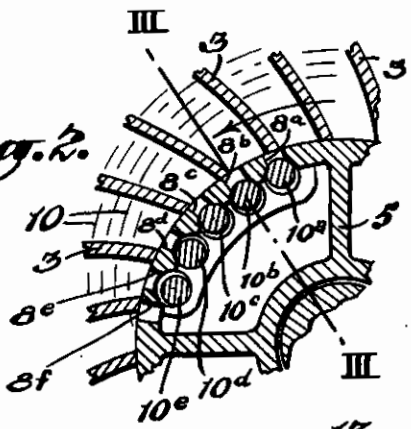

Fig. 3.

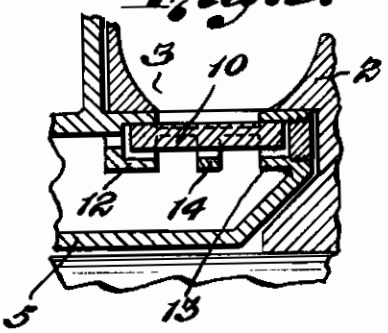

Fig. 4.

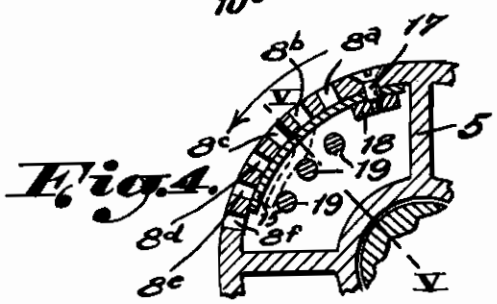

Fig. 5.

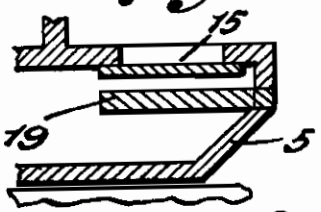

Fig. 7.

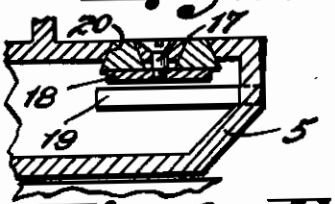

Fig. 6.

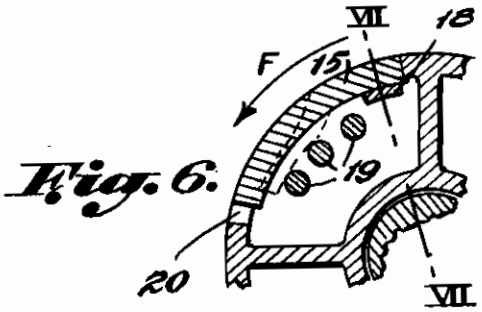

Fig. 8.

Fig. 9.

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Published June 8, 1943

Serial No. 373,839

ALIEN PROPERTY CUSTODIAN

COMPRESSION OR DEPRESSION PUMPS OF THE LIQUID RING TYPE

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Application filed January 9, 1941

My invention is directed to rotary depression and compression pumps for gases (vacuum pumps and compressors) of the liquid ring type, that is to say comprising, inside a body containing a quantity of liquid, at least one rotor having displacement recesses and rotating with the least possible clearance in contact with one or a plurality of stationary circular surfaces called distributors provided with suction and delivery openings, formed by one or a plurality of ports, for the passage of the gases which are respectively sucked from and delivered into the compartments or recesses formed between the blades by the rotating liquid ring formed under the action of centrifugal force and following the internal contour of said body formed with at least one lobe.

It has been found that in such pumps, a given angular position of the origin of the delivery opening or openings in the direction of rotation of the rotor is only suitable for a definite rate of operation, that is to say for a definite delivery pressure or for a definite vacuum. When a pump whose distributor is suitable for a certain rate of operation operates at a different rate, the communication between the delivery openings and the recesses of the rotor is effected too soon or too late. This produces overpressures that increase the power absorbed by the pump and disturb the operation.

An object of my invention is to enable a gas pump of the liquid ring type to be used for a whole scale of rates of operation while keeping the efficiency at its highest value and without any adjustments being required.

A further object of my invention is to provide a gas pump of the liquid ring type in which the angular position of the origin of the or of each delivery passage open to the gases carried along by the rotor, automatically varies according to the rate of operation to which it automatically adapts itself.

A still further object of my invention is to provide in a pump of the above character, a delivery passage at least the origin part of which is provided with a valve arrangement mounted to only allow the gases coming from the recesses of the rotor to pass when their pressure exceeds the delivery pressure of the gases.

According to an embodiment of my invention, the delivery opening or each delivery opening of the distributor is formed by a number of elongated elementary ports spaced in the direction of the rotation of the rotor, and with at least one part of which there co-operates a rod-shaped valve which is kept in register with said opening by a guiding device and is directly exposed to the delivery pressure of the pump.

These longitudinal ports are continuous or are formed by a row of holes or the like.

According to another embodiment of my invention, the delivery opening or each delivery opening of the distributor is at least partly closed by at least one valve, which is elongated in the direction of the rotation, which is made of flexible material, in such a manner as to uncover a more or less great length of the opening with which it co-operates, according to the pressure to which it is subjected.

Said valve may be free, but is preferably fixed at one of its ends on the distributor and co-operates with abutments that limit its movement.

The delivery opening or openings may in this case be continuous or be formed by elementary ports which are preferably spaced in the direction of the rotation of the rotor. Each of said openings may, moreover, comprise a plurality of parts, each of which is conjugated with its own valve.

Other features, objects and advantages of my invention will moreover become apparent from the ensuing description made with reference to the accompanying drawings which are given solely by way of example and in which:

Fig. 1 is a sectional elevation of a liquid ring air pump;

Fig. 2 is a partial similar view, on a large scale, showing the arrangement according to the invention;

Fig. 3 is a section along the line III—III of Fig. 2.

Fig. 4 is a similar view to Fig. 2 and relates to a modification.

Fig. 5 is a section along the line V—V of Fig. 4;

Fig. 6 is a similar view to Figs. 2 and 4, and relates to another modification.

Fig. 7 is a section along the line VII—VII of Fig. 6;

Figs. 8 and 9 are detail views of modification of Fig. 7.

In order to facilitate the explanation and in a nowise limitative manner, all these figures relate more particularly to a pump with a single rotor and with an internal distributor and with two lobes formed in the pump body. Said pump comprises, referring to Fig. 1, an elongated body 1 including a pump chamber having enlarged portions or lobes at opposite sides, the major axis of said chamber being vertical. The rotor 2 which is provided with blades 3 and in the

medial part of which are fitted one or a plurality of distributors 5 provided with suction openings 6 communicating with the suction pipe 7 and with delivery openings 8 communicating with the discharge pipe 9.

A quantity of liquid contained in the body 1 forms a liquid ring 10 following the internal contour of the pump chamber by the action of centrifugal force and when the rotor 2 rotates in the direction of the arrow *f*. Said ring represents a piston in each recess formed by the blades 3, and produces the suction and the delivery through the openings 6 and 8 of any desired gas.

According to the embodiment shown in Figs. 2 and 3, the delivery opening 8 is formed by a number of elementary longitudinal ports 8*a*, 8*b*, 8*c*, 8*d*, 8*e*, 8*f*. Said ports are elongated in the axial direction and are spaced apart from each other in the direction of the arrow *f*. They are shown as being continuous, but could, of course, be formed by a plurality of holes or openings.

Each of the ports, save the last one 8*f* in the direction of the arrow *f*, co-operates with a valve formed by a rod 10*a*, 10*b*, 10*c*, 10*d*, 10*e*, of cylindrical or other shape, the diameter of which is greater than the width of the co-operating port and which is arranged on the inner side of the distributor. Said rods may be of any suitable cross-section and are made of flexible material such as rubber, or again they are rigid, for example made of steel, cuprous metal, glass, stoneware or other material.

Guides 12, 13 and 14 respectively embrace said rods at their ends and at their central part with a clearance that enables them to move between their operative position in which they close the co-operating ports and a position that uncovers said ports.

It will be understood that the retaining valves thus formed remain closed as long as the pressure in the distributor is higher than the pressure in the recesses formed between the blades, with which recesses said valves are in contact. This latter pressure increases in the direction of the arrow *f* owing to the action of the liquid ring 10 so that the valve 8*d* which is opposite a recess of the rotor in which the pressure reaches this delivery pressure, opens as well as those following it in the direction of the arrow *f*. The position of the first valve opened varies according to the rate of operation of the air pump, and no substantial overpressure can occur.

According to the embodiment shown in Figs. 4 and 5, the valves 10 are replaced by a single deformable valve 15 which is elongated in the direction of rotation *f* of the rotor and is capable of covering the ports 8*a* to 8*e* inclusive. Said valve 15, which is formed by a strip of rubber or of flexible metal, is fixed by a screw 17 on a fixing member 18 before the ports 8 in the direction of the arrow *f*, and its opening travel is limited by abutments 19 fixed inside the distributor.

It will be understood that said valve 15 is deformed, as shown in dotted lines, and uncovers the ports 8 more or less according to the rate of operation of the pump, as explained in connection with the above example.

Referring to Figs. 6 and 7, the delivery port or ports, such as 20, are elongated in the direction of rotation *f* so as to permit the maximum opening of the gas passage. Said port 20, the cross-sectional width of which decreases as it is more remote from the axis, co-operates in this case with a deformable valve 15 of the same shape for which it acts as a housing and which is held at its upper end in the direction of the arrow *f* by a screw 17 on a transverse stop member 18 fixed to the distributor.

Abutments 18 limit the opening travel of this valve 15 which is effected over a more or less great length according to the rate of operation of the pump.

Absolute progressiveness is thus obtained.

The cross-section of the opening 20 may be provided with a shoulder as shown in Fig. 8, the valve 15 being in this case of corresponding shape.

The valve 15 may be made of flexible material and be reinforced with transverse metal bars 21, as shown in Fig. 9.

While I have specifically described forms that my invention may assume in practice, it will be understood that these forms have only been given by way of example and it is obvious that my invention is applicable to any construction of liquid ring compression or depression pump for gases, whatever be the shape of the distributors and the number of rotors.

ROBERT LÉON DARDELET.