

Oct. 29, 1963

R. LÜHMANN
LIQUID-RING GAS PUMPS
Filed Dec. 21, 1959

3,108,738

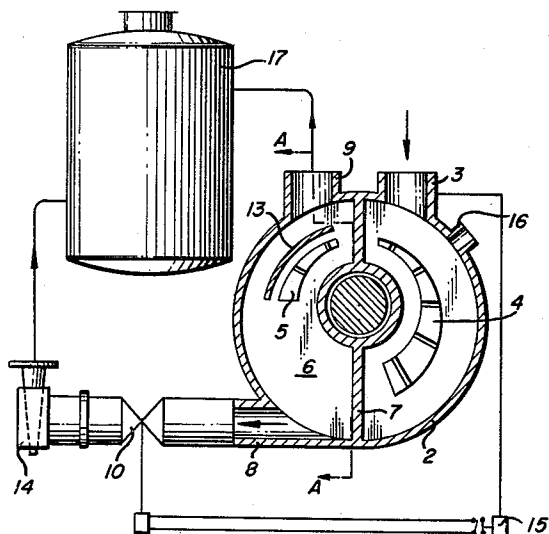


FIG. 1

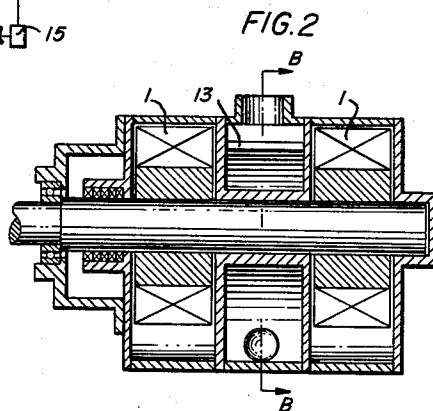


FIG. 2

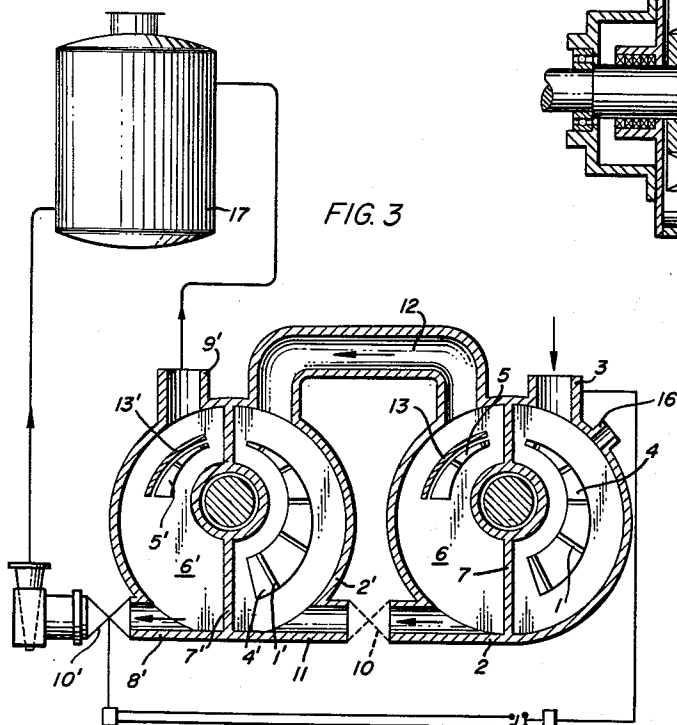


FIG. 3

INVENTOR
REINHOLD LÜHMANN

BY *Berman & Bierman*

ATTORNEYS

1

3,108,738

LIQUID-RING GAS PUMPS

Reinhold Lüthmann, Itzehoe, Holstein, Germany, assignor to Siemens & Henschel m.b.H., Itzehoe, Holstein, Germany, a corporation of Germany

Filed Dec. 21, 1959, Ser. No. 861,062

Claims priority, application Germany Dec. 30, 1958

6 Claims. (Cl. 230—79)

The present invention concerns liquid-ring gas pumps.

Known liquid ring gas pumps suffer from the disadvantages that they cause severe rattling noises when running with a high vacuum on the suction side and a kind of humming noise when running at low vacuum on the suction side. It is possible however, to achieve silent running in the high vacuum range by the introduction of by-passed air on the suction side, between the stages or in the impeller segments of the pumps. However, in some cases both the air delivery of these pumps in the high vacuum range, and the maximum vacuum achievable are considerably reduced when by-passed air is used.

It has been found that there is a further possibility of eliminating the noises in the high vacuum range by keeping the pressure chamber of the pump to a large extent free from liquid and by preventing the pressure slot from being covered with liquid. It was also found with low vacuum on the low suction side a cushion of liquid is desirable before the pressure slot, as this has a damping effect at the slot in this operating range on the outlet noises of the mixture of liquid and gas.

The object of the present invention is therefore to ensure silent running of the pump in the high vacuum range without any fall in output in this working range. On the other hand, it indicates a possibility of avoiding the humming noises which occur in the low vacuum range.

These advantages can be achieved, according to the invention, by liquid and gas being taken from the pressure chamber of the pump separately, with the connection for removal of the liquid arranged below the pressure slot. By means of an opening in the lower part of the pressure casing of the pump, the working liquid may be allowed to flow out, or it can be drawn off from the pressure chamber with the aid of a special liquid pump. The liquid and gas can then be conveyed into a joint circulation container, or, alternatively, the liquid only may be taken to this container and the gas forced out direct, provided adequate separation of liquid and gas in the pressure chamber is assured; if necessary, however, this can be achieved by a suitable arrangement of baffle vanes.

By means of a regulating valve in the pipe for removing the liquid, provision can be made to ensure that the separate removal of the liquid from the pressure chamber of the pump is effected only under conditions of high vacuum on the suction side of the pump, so as to make possible the formation of the desired cushion of liquid in the pressure chamber of the pump under conditions of low vacuum on the suction side. It is particularly advantageous if the regulating valve is controlled by the pressure of the pump on the suction side.

According to the design of the pump, it may suffice in the case of multi-stage pumps if only the last stage is so constructed that an accumulation of liquid in the pressure chamber in front of the pressure slot is prevented, as it is often only the last stage which causes noisy working.

A further advantage of the pump covered by the invention is that obstruction in the liquid ring no longer occurs in the crown of the pump, and overloading of the shaft or increased power consumption in the high vacuum range are prevented.

The invention will be described further, by way of ex-

2

ample, with reference to the accompanying drawings in which:

FIG. 1 is a section through a single stage pump (on line B—B of FIG. 2).

FIG. 2 is a cross-sectional view along line A—A of FIG. 1; and

FIG. 3 is a view similar to that of FIG. 1 of a two-stage pump.

There is provided a casing 2 within which is eccentrically mounted an impeller 1. Gas enters the pump through a suction pipe 3 and a suction slot 4 and is directed into the segments formed by adjacent impeller blades and the liquid ring of the pump. The liquid required for the working of the pump may be introduced at any point on the suction side 16 of the pump or at the hub of the impeller. Due to the continuously changing volume of the segments during rotation of the impeller 1, a mixture of liquid and gas is caused to leave the working chamber through the pressure slot 5 and to enter the pressure chamber 6 of the pump, which is separated from the suction chamber by a baffle vane 7. The gas-liquid mixture strikes the wall of the pressure chamber and possibly also separation vanes located therein, and the liquid and gas are thus separated. The liquid collects in the lower part of the pressure chamber 6, and can be drained off through a connected pipe 8. The gas leaves the pressure chamber of the pump through a connecting pipe 9. The liquid required for working of the pump, may, if there is an adequate natural fall, flow from the pressure chamber of the pump through the connecting pipe 8 under gravity. If there is no natural fall, liquid can be drained off by means of a special liquid pump 14 to which the connection pipe 8 is attached. In this way, the pressure slot 5 always remains free from liquid.

Pump 14 drains liquid from the pressure chamber 6. Switching arrangement 15, controlled by the pressure of pump 14, actuates magnetic valve 10. Vane 13 serves for the separation of liquid and gas in chamber 6. Liquid from pump 14 enters tank 17.

By means of a valve 10, it is possible to arrange that the liquid required for the operation of the pump flows out through the special opening 8 only under conditions of high vacuum on the suction side of the pump. When conditions of low vacuum on the suction side of the pump prevail the valve 10 is closed and liquid and gas leave the pump together through the connecting pipe 9.

FIG. 3 illustrates a two-stage pump designed in accordance with a second embodiment of the invention. The reference numbers used are the same for both stages but to prevent confusion an apostrophe is placed after the reference number in the case of the parts belonging to the second stage. The connections for directing the flow of gas and liquid from the first to the second stage are indicated by the reference numbers 11 and 12, the pipe 11 being for conveying the liquid and the pipe 12 for conveying the gas. The valves 10 and 10' can of course, be used in the manner set out above when desired.

I claim:

1. A liquid ring gas pump having at least one stage in which at each stage there is provided a casing, an eccentrically rotatable mounted vaned impeller within said casing, a suction chamber and a pressure chamber within said casing, gas and liquid inlets in said suction chamber, gas and liquid outlets in said pressure chamber, means for introducing gas and liquid into said suction chamber and for discharging said gas and liquid through said gas and liquid outlets in said pressure chamber, said casing having a suction slot between said suction chamber and said impeller and a pressure slot between said impeller and said pressure chamber, a valve in said liquid outlet, means responsive to the pressure in said suction chamber

3

connected to said valve for opening said valve when the pump is working at high vacuum in said suction chamber to allow for the separate removal of gas and liquid from said pressure chamber, said means closing said valve when the pump is working at low vacuum in said suction chamber to ensure the formation of a cushion of liquid in said pressure chamber.

2. A liquid ring gas pump as set forth in claim 1 in which said liquid outlet is located below said pressure slot.

3. A liquid ring gas pump as set forth in claim 1 in which there is a baffle in said casing dividing said casing into said suction and pressure chambers.

4. A liquid ring gas pump as set forth in claim 1 in which said liquid and gas outlets are spaced apart a sufficient distance to allow separation of said liquid from said gas.

4

5. A liquid ring gas pump as set forth in claim 1 in which a plurality of stages are provided in parallel.

6. A liquid ring gas pump as set forth in claim 1 in which a separate liquid pump is provided at said liquid outlet and said liquid is drawn off by said separate liquid pump from said pressure chamber.

References Cited in the file of this patent

UNITED STATES PATENTS

10	1,310,584	Smith	July 22, 1919
	1,760,475	Carrier	May 27, 1930
	2,230,405	Jennings	Feb. 4, 1941

FOREIGN PATENTS

15	269,506	Germany	Jan. 23, 1914
	662,514	Germany	July 15, 1938