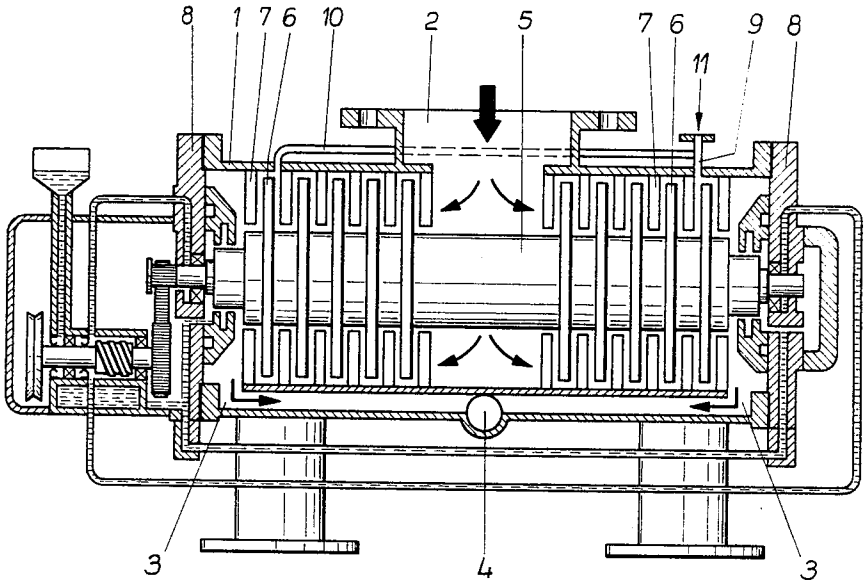
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ROTARY MOLECULAR VACUUM PUMP

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ROTARY MOLECULAR VACUUM PUMP

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ABSTRACT OF THE DISCLOSURE

A rotary molecular vacuum pump having either one multistage compression set, or a plurality of multi-stage compression sets connected in parallel, between the pre-vacuum side and the high vacuum side of the pump has at least one gas inlet which communicates with the multi-stage compression set, or with each such set, at an intermediate position between the pre-vacuum and high vacuum sides of the pump.

BACKGROUND OF THE INVENTION

(1) Field of the invention

The invention relates to rotary molecular vacuum pumps, that is to say mechanical high vacuum and ultra-high vacuum pumps.

(2) Description of the prior art

Pumps of the said kind possess either one multi-stage compression set consisting of several series connected pressure stages situated between the pre-vacuum side and high vacuum side, or two or more such multi-stage compression sets which are connected in parallel relative to the pre-vacuum and high vacuum sides. Each multi-stage compression set consists of wheels or impellers rotatable with the pump shaft and wheels which are fixed and secured to the pump housing. The rotating impellers and stationary wheels, in known manner, possess channels or passages extending obliquely to the plane thereof. High pumping speeds and very low pressures can be obtained with pumps of this kind in conjunction with pre-vacuum pumps. Apart from rotary molecular vacuum pumps comprising two multi-stage compression sets connected in parallel relative to the high vacuum side, whereof the pressure sides are connected to a pre-vacuum pump, similar rotary molecular vacuum pumps comprising only one multi-stage compression set are also known.

The pressure ratio, i.e. the ratio between the partial pressure of a gas at the pre-vacuum side and the partial pressure of the same gas at the high vacuum side, depends on the nature of the gas in the case of rotary molecular vacuum pumps. The pressure ratio rises in approximately exponential manner with the root of the molecular weight of the gas. Very high pressure ratios are the result for heavy gases, for example for oil vapours. In the case of rotary molecular vacuum pumps running at operating speed, oil vapours are practically prevented from passing out of the bearings situated at the pre-vacuum side or from the pre-vacuum pump, and from the pre-vacuum side to the high vacuum side of the pump, owing to the very high pressure ratios for such vapours. If the operation of a rotary molecular vacuum pump in a high vacuum or ultra-high vacuum plant is interrupted however, oil vapour can pass from the bearings of the pump and also from the pre-vacuum pump, to reach the high vacuum side of the pump from the pre-vacuum side, because the vapour pressure of the oil is commonly higher than the pressure at the high vacuum side of the pump. Care must accordingly be taken to ensure that, when the rotary molecular vacuum pump

is being slowed down or stopped, the high vacuum vessel and the high vacuum side of the pump do not come into contact with oil vapours from the bearings or from the pre-vacuum pump. This because even a slight contamination of the high vacuum side by bearing oil or pump oil would increase the pumping down time unacceptably during repeated evacuation to ultra-high vacuum, because these oils are converted but slowly to the gaseous state owing to their essentially very low vapour pressure, i.e. into a state in which they may then be drawn off by suction.

To prevent passage of oil vapour from the pre-vacuum side to the high vacuum side when the rotary molecular vacuum pump is being slowed down or stopped, the pump must be flooded with a purified gas to such extent that a molecular flow is no longer possible in the pump. Oil vapours can then pass from the pre-vacuum side to the high vacuum side only by diffusion. This process is negligible however at sufficiently high pressures.

An obvious way of admitting gas to a rotary molecular vacuum pump is to feed purified gas into the high vacuum side of the pump. To this end, a gas inlet valve need merely be connected to the high vacuum side. Since a rotary molecular vacuum pump is heated for use in ultra-high vacuum machinery, it is necessary to employ a gas inlet valve which is capable of being heated. Valves of this kind are known, but are very costly. It is a main object of the present invention to avoid the necessity of using such costly valves.

SUMMARY

According to the invention there is provided a rotary molecular vacuum pump comprising a housing having pre-vacuum and high vacuum sides and at least one multi-stage compression set located in the housing between the pre-vacuum and high vacuum sides, the improvement which consists of a gas inlet communicating with the multi-stage compression set at an intermediate pressure stage thereof between the pre-vacuum and high vacuum sides.

With a rotary molecular vacuum pump as just set forth the reflux of oil vapours from the pre-vacuum side to the high vacuum side is prevented with practically the same reliability during the running down of the pump, as during the admission of gas to the pump on the high vacuum side, but standard or conventional valves may be employed as gas inlets. These valves need not be capable of being heated because they are not situated at the high vacuum side. Valves, for example valves made of plastics materials, possess seals consisting of elastomers, which can give off gases. This is immaterial however, since such gases can be given off by the valves only during operation of the pump, and can then only pass into the intermediate pressure stage. The gases are then drawn off from the intermediate stage to the pre-vacuum side, without affecting the pressure at the high vacuum side of the pump. Moreover, and as when admitting gas to the pump from the pre-vacuum side, this occurs in a pump according to the invention during the running-down period of the pump which is considerably shortened because the rotor is decelerated by the friction of the gas fed in addition to bearing friction.

BRIEF DESCRIPTION OF THE DRAWING

The drawing shows a longitudinal section through a rotary molecular vacuum pump comprising two multi-stage compression sets connected in parallel relative to the high pressure vacuum side of the pump.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawing, a rotatable shaft **5** carries rotor discs **6** which rotate between wheels or discs **7** fastened to a cylindrical housing **1** comprising a central suction connector **2** and two pre-vacuum connectors **3** one at each end of the housing **1**. The rotor discs **6** and stator discs **7** form sets of compression stages. The pre-vacuum connectors communicate with a stub pipe **4** common thereto. The discs in known manner, possess passages, not shown, which extend obliquely to the plane thereof. The pressure rise intervenes symmetrically, from the centre of the pump towards the end bearing plates **8** of the housing **1**. The driving system for the pump shaft **5**, and the lubricating system for the bearings, are fastened on the end bearing plates **8**. The direction of delivery of the pump is indicated by arrows. The gas inlets **9** for the gas inflow are situated at an intermediate compression stage of each set of the pressure stages, which latter are situated between the pre-vacuum and high vacuum sides of the pump. If desired, a plurality of gas inlets **9** may be associated with a plurality of intermediate compression stages of each set of compression stages. The gas inlets **9** are connected by an inlet pipe **10** common thereto and which is closed, as at **11**, by means of a valve, of known form, not shown and constructed of a material which does not have to withstand high heat conditions. The intermediate compression stages communicating with the gas inlets **9** are so far distant from the high vacuum side of the pump, that gases passing from the elastomer seals of the valve into the intermediate stages cannot flow therefrom to the high vacuum side. On the other hand, the intermediate stages are so far distant from the pre-vacuum side of the pump that the partial pressure of oil still prevailing at the inlet positions is so low that practically no oil vapour can be entrained to the high vacuum side upon flooding the pump. Admission of gas, up to atmospheric pressure, is possible at the full speed of rotation of the pump, so that its running-down time is reduced appreciably.

A rotary molecular vacuum pump according to the invention may advantageously be employed to determine the gaseous atmosphere at the high vacuum side. For example, if a particular gas mixture is fed into the intermediate pressure stages in appropriate quantity during normal operation of the pump, the lighter ingredients of the gas mixture are preferentially concentrated at the high vacuum side, because the pressure ratios in rotary molecular vacuum pumps depend on the molecular weight of the gases, as stated. In this manner, a required gaseous atmosphere can be produced at the high vacuum side.

I claim:

1. In a rotary molecular vacuum pump comprising a housing having a pre-vacuum and high vacuum sides and at least one multi-stage compression set located in the housing between the pre-vacuum and high vacuum sides, the improvement which consists of a gas inlet communicating with the multi-stage compression set at an intermediate compression stage thereof between the pre-vacuum and high vacuum sides.

2. A pump according to claim **1** in which at least two multi-stage compression sets are connected in parallel in the housing between the pre-vacuum and high vacuum sides and a gas inlet communicates with each of said sets at an intermediate compression stage thereof between the pre-vacuum and high vacuum sides of the pump.

3. A pump according to claim **2**, wherein the gas inlets are connected one with the other by an inlet pipe common thereto.

4. A pump according to claim **1**, wherein a plurality of gas inlets communicate with a plurality of intermediate compression stages of the multi-stage compression set between the pre-vacuum and high vacuum sides of the pump.

5. A pump according to claim **2**, wherein a plurality of gas inlets communicate with a plurality of intermediate compression stages of each multi-stage compression set between the pre-vacuum and high vacuum sides of the pump.

6. A pump according to claim **1** in which the gas inlet is capable of admitting gas to the pump at pressures up to atmospheric pressure.

7. A pump according to claim **2** in which the gas inlets are capable of admitting gas to the pump at pressures up to atmospheric pressure.

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