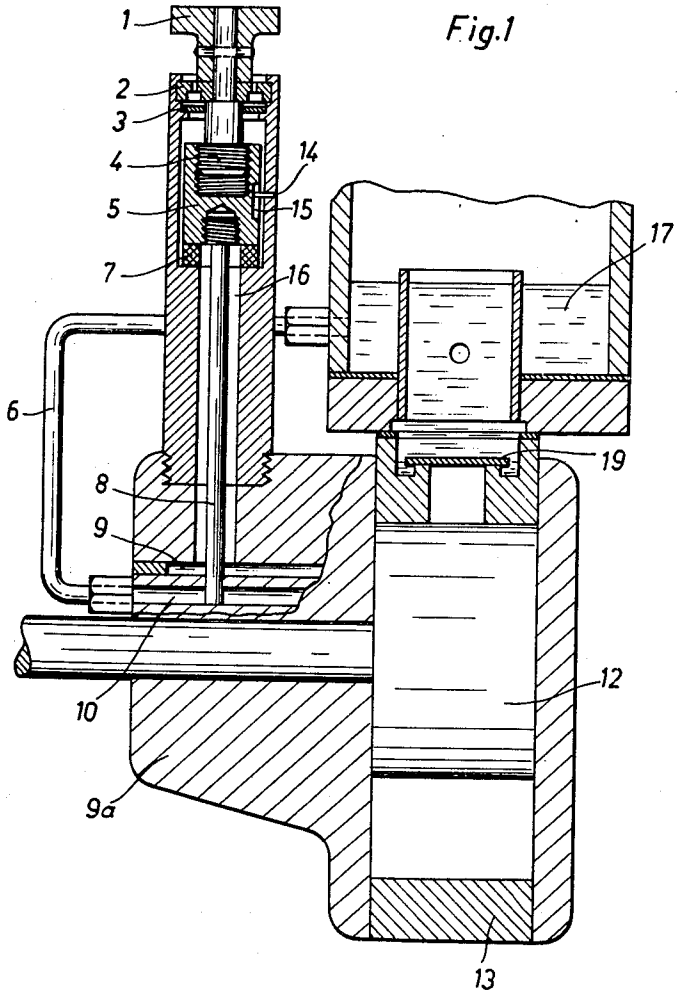
Jan. 29, 1957 K. ZIOCK 2,779,533

HIGH-VACUUM ROTARY OIL PUMPS

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Fig.1



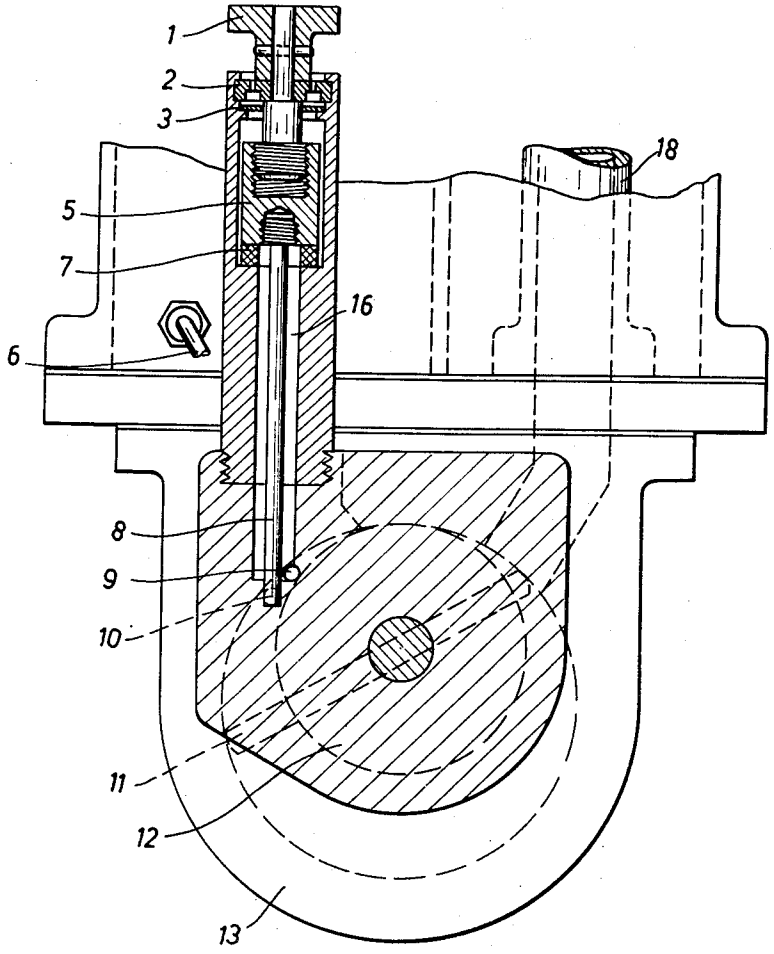
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Fig. 2



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United States Patent Office 2,779,533 Patented Jan. 29, 1957

2,779,533

HIGH-VACUUM ROTARY OIL PUMPS

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Application December 17, 1954, Serial No. 476,016

Claims priority, application Germany December 22, 1953

3 Claims. (Cl. 230—202)

For producing a vacuum of less than 10 Torrs, rotary oil pumps usually serve at present as vacuum pumps, i. e. rotary piston pumps or rotary slide pumps. Both these pumps have in common an exhaust valve which is covered by oil and sometimes is biased by a spring, and which opens at the instant when the air, sucked in at the suction side of the pump, is compressed by a reduction of the working space of the pump to such a valve that the pressure below the exhaust valve exceeds the atmospheric pressure to which the valve is subjected from outside, or exceeds the sum of atmospheric pressure plus the quotient of spring force and valve area. Such pumps fail, however, in all those cases where vapours have to be evacuated and the points of condensation thereof at the temperature of the pump is reached already at a pressure which is smaller than the minimum pressure required for the opening of the exhaust valve, since in such a case the vapour condenses already during the compression before a pressure has been reached below the exhaust valve which is required for the lifting of this valve.

A possibility for overcoming these difficulties is offered by the gas ballast device according to the German patent specification 702.480. With pumps equipped with a gas ballast device, atmospheric air is admitted from outside into the space below the valve at the beginning of the compression. By the admission of a sufficiently high quantity of air—to be called hereinafter gas ballast—it is possible to ensure that a pressure required for the opening of the exhaust valve is produced below this valve, before the partial pressure of the vapour has reached its point of saturation. The sucked in vapours are then exhausted through the valve together with the admitted atmospheric air. The so called gas-ballast air required for this purpose is admitted directly from the atmosphere through a valve provided with a dosing bore. Owing to the additionally admitted gas-ballast air, such pumps do not produce the same high final vacuum than pumps without gas-ballast air. However, when all the vapours are withdrawn from the apparatus in question, then it is possible to close the gas-ballast valve. Then the pump produces the same final high vacuum as a pump without gas-ballast device. In order to reach with gas-ballast operation the best possible final vacuum, it is necessary to admit into the space below the exhaust valve at each revolution a greater amount of oil in order to provide a sufficiently thick sealing oil film between the sliding members of the pump. On the other hand, during operation without gas-ballast it is desirable to admit into the space below the exhaust valve only a small quantity of oil in view of the fact that, due to the lower air pressure below the valve, the requirements in respect to tightness are not as high as before, and also because the oil always contains dissolved gas which deteriorates the final vacuum of the pump if the oil reaches the high vacuum side of the pump.

The present invention offers a solution for the problem of increasing the supply of oil in the case of gas-ballast operation to a quantity, which is desirable for the gas-ballast operation, and which is greater than the quantity of oil which is required for operation without gas-ballast and which is not disturbing, and this is such a manner that the air admission and the oil supply into the pump are coupled with one another in such a manner that, if a greater quantity gas-ballast is admitted into the pump, also a greater quantity of oil is supplied, and vice versa, so that in each case the best operational conditions are obtained.

Figs. 1 and 2 of the accompanying drawings show two cross sections taken at right angles of an arrangement for the simultaneous control of the air admission and of the oil supply into the pump.

If the button **1** is turned to the left, then, as a result of the screw joint between the pin **4** and the valve body **5** the latter is lifted together with its sealing ring **7**. Now air can enter into the working space of the pump through the bore **9** in the lid of the bearing **9a** of the pump, as well through the bore **16** in the gas-ballast valve and the ports in the lid **2** of this valve, and the admission of the air takes place at a point which is all the time separated from the suction opening **18** (Fig. 2) of the pump by the rotor **12** and the sliding vane **11** as well as by the wall of the casing **13**.

If in the working space of the pump, for instance in the case of high suction pressures, a pressure is set up which is higher than atmospheric pressure, then the valve disc **3** is lifted so that it bears against the lower side of the lid **2** and closes the ports in the lid **2** of the gas-ballast valve. The pin **14** slides within groove **15** of the valve body **5** and thus prevents the body **5** from following the rotation of the button **1**. In the case of small suction pressures, however, the valve disc **3** is in the position shown in Figs. 1 and 2, and air can flow through the ports in the lid **2** and throught cut-outs (not shown) in the ledge on which the valve disc rests as shown in Figs. 1 and 2, and past the disc **3** into the bore **16**.

In addition, by the rotation of the button **1** to the left also the rod **8**, which is firmly connected with the valve body **5** by a screw connection, is lifted and opens the bore **10** in the lid **9a** of the bearing of the pump. This bore **10** is in communication through the pipe **6** with the oil reservoir **17** over the exhaust valve **19**. When the rod **8** is so lifted, an additional quantity of oil can flow through the pipe **6** and the bore **10** from the oil reservoir **17** directly into the space between the slide vane **11**, the rotor **12** and the casing **13**, which space is closed at the top by the valve disc **19** of the exhaust valve.

If the button **1** is turned to the right, the valve body **5** is lowered as a result of the screw joint between the pin **4** and the body **5** in co-operation with the pin **14** and the groove **15**, so that the rubber seal **7** cuts off the supply of air through the bore **16**. At the same time the lower end of the rod **8** blocks the bore **10** and cuts-off the oil supply from the oil reservoir **17** into the working space of the pump.

In the latter case, oil is supplied from the oil reservoir **17** into the working space of the pump only through the conventional oil ducts, which are provided with all rotary oil pumps and are not shown in the drawings, e. g. through a bore in the casing **13** which connects the working space of the pump with the oil reservoir **17**, or through a pipe, similar to the pipe **6**, which, however, is continuously in communication with the working space of the pump.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A rotary vacuum pump comprising a housing with a cylindrical pump chamber having suction and exhaust ports, a rotor mounted free to rotate within said cylin-

drical chamber, said rotor being eccentrically disposed with respect to the axis of said cylindrical chamber and having radial slots with vanes slidably guided within said slots, an exhaust valve within the exhaust port surrounded by oil, an oil conduit connecting the oil surrounding said exhaust valve with said pump chamber to permit access of lubricating oil thereto, an air port opening into said pump chamber a short distance ahead of said exhaust port, an air conduit connecting said air port with surrounding air, a manually controlled valve connected to said conduit and controlling access of air to said air port, an additional oil conduit connecting said oil surrounding said exhaust valve with said cylindrical chamber for the admission of an additional quantity of oil into said cylindrical chamber and an additional oil valve controlling said additional oil conduit and connected and responsive to said manual air valve for substantially

simultaneous introduction of additional oil and air into said pump chamber.

2. A rotary vacuum pump according to claim 1, wherein the said vanes are biased into contact with the cylindrical wall of the pump chamber.

3. A rotary vacuum pump according to claim 1, wherein said rotor is mounted in a bearing and wherein said air conduit and said additional oil conduit form channels in said bearing which are substantially parallel to the axis of the pump chamber and are arranged to terminate at points along the periphery of said pump chamber.

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