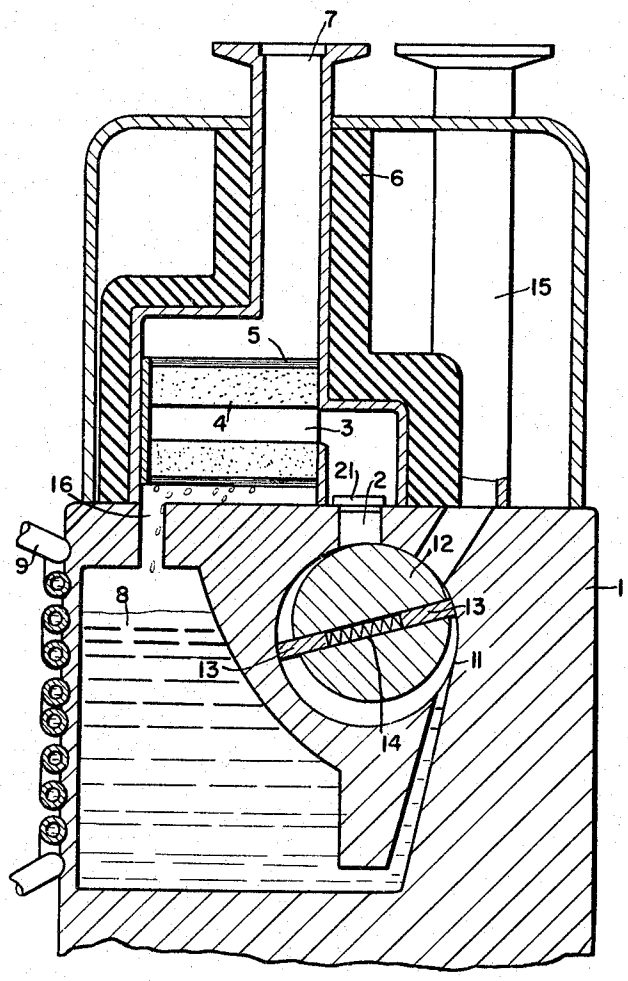
June 27, 1967 W. RÖLLINGER 3,327,936

PUMP

Filed Jan. 17, 1966



INVENTOR
Willy Röllinger

BY Spencer & Kaye
ATTORNEYS

United States Patent Office

3,327,936

Patented June 27, 1967

3,327,936

PUMP

Willy Röllinger, Porz-Westhoven, Germany, assignor to Leybold Holding AG, Zug, Switzerland

Filed Jan. 17, 1966, Ser. No. 521,178
Claims priority, application Germany, Aug. 27, 1965, L 51,490
5 Claims. (Cl. 230—207)

The present invention relates to a method and apparatus for improving the ability of rotating pumps, and more particularly rotary vacuum pumps, to withstand water vapor.

Vacuum pumps are generally provided with a gas-ballast device if considerable amounts of water vapor are drawn in during the operation of the pump. The gas-ballast device serves to eliminate the condensation of the water vapor within the pump, since water contaminates the oil in the pump and results in considerable corrosion damage to the pump.

Although the original prior art arrangements recognized the effect of the gas-ballast during the compression process, it was later recognized that other factors must be considered. For example, the exhaust gas must not be fed through passageways wherein the walls have a lower temperature than that which corresponds to the point of condensation of the exhaust gas, since this would add water droplets into the system. Thus, the prior art then provided means for maintaining all parts of the pump at sufficiently high temperatures, for example 80° C., which is generally the conventional operating temperature for pumps. By maintaining the pumps at the proper temperature, it was also possible to obtain with conventional gas-ballast amounts of approximately 10% of the suction capacity of a pump, a pump capability of withstanding water vapor of 30 torr, i.e., a capability of withstanding the saturation vapor pressure of the water at 30° C. water temperature. Although lower pump temperatures result in a higher gas-ballast percentage, the resultant vacuum of a pump is decreased at increasingly higher gas-ballast amounts.

In contradistinction, in conventional vacuum pump structures higher pump temperatures result in higher oil temperatures. This also provides a disadvantage in that hot oil is contaminated more quickly under the influence of oxygen or other active gases than cold oil and thereby light volatile derivative products occur in increased amounts in hot oil. Thus, there results an increased contamination of the oil and the resultant vacuum of the pump is again decreased.

Another consideration regarding the operating temperature of the pumps is that vacuum pumps often must be started at a temperature which corresponds to the ambient temperature. At this temperature the pump oil has, however, a considerably higher viscosity than at the operating temperature of for example 80° C. This makes a higher starting moment necessary because the pump oil is selected so that it is sufficiently heavy at the operating temperature in order to fulfill its sealing function in a satisfactory manner. Thus, the temperature of the pump and that of the oil affect the ability of the pump to withstand water vapor.

It is therefore an object of the present invention to improve the ability of rotary pumps to withstand water vapor.

It is another object of the present invention to decrease the critical temperature of the pump.

According to the present invention, there is provided a rotary pump having means for separating the oil-gas-vapor mixture which emanates from the pump exhaust valve, means for feeding the separated oil to a storage

chamber and means for feeding the vapor portion to the outside via a conduit. The separating means and the conduit are heat insulated from the pump interior and a cooling device is provided for the oil storage chamber so as to have different temperatures in different portions of the pump system.

Additional objects and advantages of the present invention will become apparent upon consideration of the following description when taken in conjunction with the accompanying drawing in which the figure is a schematic cross sectional view of a pump according to the present invention.

Referring now to the drawing, there is shown in the figure a pump housing in the lower portion **1** of which there is provided a tubular body **11** forming a pumping chamber. A rotor **12** is mounted for rotation within the pumping chamber and is arranged eccentrically with respect to the tubular body **11**. The rotor **12** is provided with slots within which vanes **13** are passed outwardly against the interior surface of the tubular body **11** by suitable spring means **14**.

Above the lower portion of the pump, there is provided an upper portion containing a high vacuum intake or suction conduit **15**. The pumping chamber is provided at the outlet side with a channel **2** which is closed by an outlet valve **21**, schematically shown. Above the outlet valve **21** there is provided a separating device **3** having filter and separating elements **4** and **5** contained therein. The separating device **3** communicates with an exhaust channel **7** which is insulated by insulating material **6** arranged thereabout. The separating device also communicates with an oil reservoir or chamber **8** via a passageway **16**, the oil contained in the reservoir being fed into the pumping chamber. A cooling device **9** schematically shown as cooling coils is provided on the exterior of the pump housing and adjacent to the largest oil covered surface of the reservoir **8** for cooling the reservoir **8** and also the passageway **16** so as to cool the oil on its way to the reservoir.

The operation of the present invention is such that the gas mixture is sucked in through the intake channel **15** by the vacuum pump and is mixed with the oil in the pumping chamber wherein at the outlet thereof, i.e., outlet valve **21** there is provided an oil-gas-vapor mixture. This mixture is fed to the separating device **3** wherein the oil is filtered out and the vapor is passed out through outlet channel **7**. The heat insulation **6**, surrounding the separating device and the outlet channel provides that those parts of the pump through which the exhaust gas flows are brought to and maintained at as high a temperature as possible so as to prevent condensation of the gas-vapor into water droplets. On the other hand, those parts of the pump which come into contact with the oil after it has been separated from the exhaust gas flow, are exposed to an intense cooling through the use of a cooling device such as device **9**. For such cooling, the creation of large surfaces which are in contact with the oil and with the surrounding air is provided. In addition to the provision for a water coolant device **9**, there may also be provided coolant means in the form of a fan means for blowing cold air to cool the air surrounding the oil.

Therefore, according to the present invention the critical operating temperature of the pump may be considerably decreased. Through a suitable arrangement of piping and insulation as well as by additional shielding of the separating device at the pump exhaust valve **21**, such as insulation **6**, in providing insulation about the separating device for the separation of the oil vapor mixture so as to shield these portions from the pump temperature, the pump temperature may be decreased substantially. Thus

the present invention increases the ability of a pump to withstand water vapor by providing means for separating the oil-gas-vapor mixture so that the oil is not contaminated by the water, these means including the separating device and the insulation for keeping the outlet portion of the pump at a temperature sufficient so as to not cause condensation of the vapor, and means for cooling the oil so that the pump may be operated at a lower temperature than in conventionally operated pumps.

In addition to the improvement in the capability of the pump to withstand water vapor, the present invention also provides the further advantage of longer life for the structural elements. That is the degree of contamination of the oil and the life of the structural elements which, for example are made from the Buna variety of rubber and are used for sealing, depend upon the operating temperature of the pump. Therefore, by decreasing the operating temperature, the durability of the pump is substantially increased.

It will be understood that the above description of the present invention is susceptible to various modifications, changes and adaptations, and the same are intended to be comprehended within the meaning and range of equivalents of the appended claims.

What is claimed is:

1. An arrangement for improving the capability of rotating pumps to withstand water vapor wherein a gas mixture is drawn into the pump and an oil-gas-vapor mixture emanates therefrom, comprising in combination:

a pump housing forming a pumping chamber;

an inlet and an outlet communicating with said pumping chamber;

separating means communicating with said outlet for separating the oil-gas-vapor mixture emanating from the outlet;

channel means in communication with said separating device for conducting the separated vapor portion outside of said pump;

insulating means surrounding said channel means and said separating device for insulating said channel means and said separating device from the interior of said pump;

oil storage means communicating with said separating means for storing the separated oil; and

cooling means in communication with said storage means for cooling the same.

2. An arrangement as defined in claim 1 wherein said oil storage means is provided with a plurality of oil covered surfaces of varying dimensions and said cooling means directly cools the largest surface thereof.

3. An arrangement as defined in claim 1 and further comprising means forming a passageway connecting said separating means and said storage means, and said cooling means also cools said passageway.

4. An arrangement as defined in claim 1 wherein said oil storage means is provided adjacent to the pumping chamber.

5. An arrangement as defined in claim 1 and further comprising means forming a passageway connecting said separating means and said oil storage means, said storage means being arranged adjacent to the pumping chamber and being provided with a plurality of surfaces of varying dimensions, and said cooling means directly cooling the largest surface thereof and also cooling said passageway.

References Cited

UNITED STATES PATENTS

2,929,550	3/1960	Sadler	230—207 X
2,951,633	9/1960	Fites	230—207

ROBERT M. WALKER, *Primary Examiner.*