May 20, 1924. 1,494,758

O. SEITZ

ROTARY PUMP FOR PUMPING GASES

Filed June 20, 1923

Fig.1.

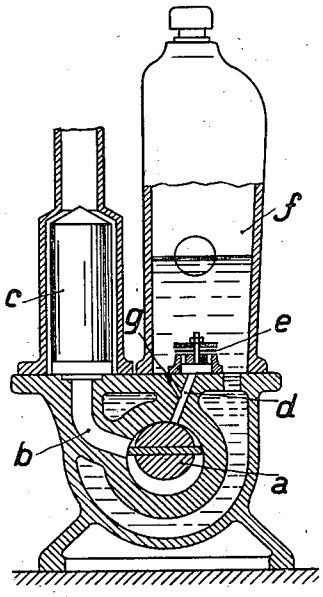
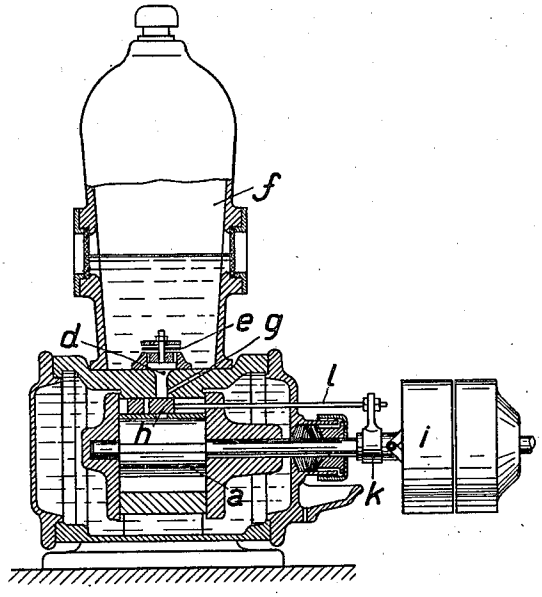



Fig.2.



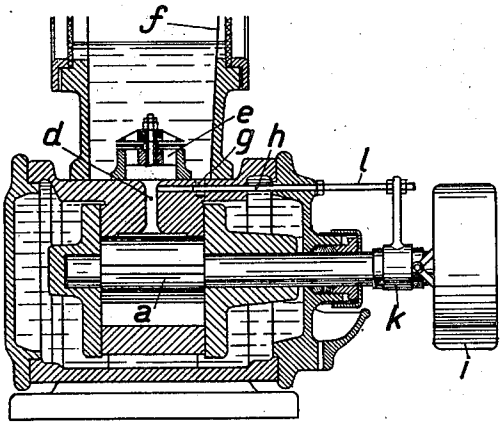




Fig.3.

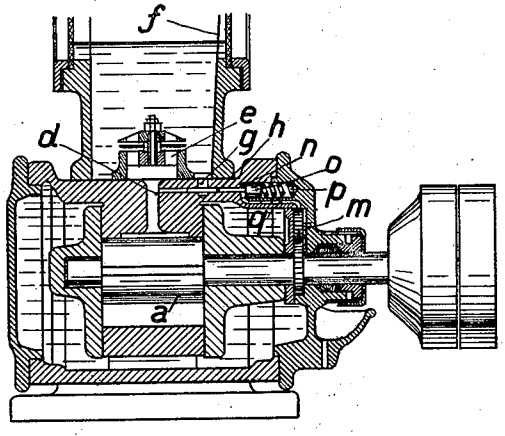



Fig.4.

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Patented May 20, 1924. 1,494,758

# UNITED STATES PATENT OFFICE.

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## ROTARY PUMP FOR PUMPING GASES.

Application filed June 20, 1923. Serial No. 646,696.

*To all whom it may concern:*

Be it known that I, OSKAR SEITZ, a citizen of the Swiss Republic, residing at Oberer Kapperlerhof, Baden, Switzerland, have invented certain new and useful Improvements in Rotary Pumps for Pumping Gases, of which the following is a specification.

In rotary pumps with an air vessel, such as are employed for generating high vacua, by means of an oil return duct arranged as a by-pass around the delivery valve, a certain quantity of oil is allowed to flow back continuously during the working of the pump, said oil serving as a seal between the moving parts. When the pump is stationary the atmospheric pressure acting upon the oil in the air vessel forces this oil back through the oil return duct and the leaky places between the movable parts in the interior of the pump back into the oil reservoir. This return of the oil may be prevented by means of a closing device, such as for instance, a float valve located between the pump and the oil reservoir. This float valve, while the pump is stationary, is caused to float by the returning oil, and it finally shuts off the return of the oil by closing a passage aperture.

That manner of shutting off the return of the oil has however the following drawbacks: The oil in the air vessel usually contains numerous bubbles of air under atmospheric pressure. When the pump is stationary, these bubbles of air pass with the oil into the interior of the pump and into the suction passage as far as the float valve. Here they expand and penetrate into the reservoir before the float valve can close. Further, the oil in the air vessel contains moisture which is likewise carried over and, by reason of its high vapour tension, will spoil the vacuum when the pump is started again, until all the moisture has been transferred back to the delivery side. Moreover, impurities are carried over by the returning oil and are liable subsequently to interfere with the working of the pump. Finally the fact that the oil does actually penetrate into the interior of the pump is a great drawback because then the pump must be started with a much greater torque than the normal.

In order to obviate the first mentioned drawback, namely the penetration of air into the reservoir past the too-slowly operating closing device, instead of effecting the closure by means of a float valve which operates only when the pump has already come to a standstill, and the return flow of the oil has begun, the said closure is effected according to this invention by means of a closing device which closes the return passage for the oil immediately when the rotational speed of the pump drops below a determined value. The rotational speed at which the closing device is opened and closed, must be set so high that the pump on attaining said speed shall generate a sufficient pressure to prevent the oil from flowing back through the pump. For this purpose the closing device may be controlled for instance by a certrifugal governor which is mounted either directly upon the driving shaft of the pump or is coupled mechanically by means of a clutch to the said pump. In order to make the overall length of the pump as short as possible, the centrifugal governor may be structurally comprised within the clutch half on the pump side.

A further modification is the controlling of the closing device by oil pressure generated by an oil pump mounted on the shaft of the air pump. In order to reduce the overall length of the pump as much as possible the oil pump may be structurally comprised within the casing of the air pump.

Three embodiments of this invention are illustrated by way of example in the accompanying drawings in which:—

Figure 1 is a cross section of a rotary pump of the hitherto usual construction. In the figures, *a* is the rotor of the pump; *b* is the suction duct; *c* is the float valve closing the suction duct; *d* is the delivery duct; *e* is the delivery valve; *f* is the air vessel the oil in which is under atmospheric pressure; and *g* is the oil return duct. When the pump is stationary the oil penetrates from the air vessel *f* through the oil return duct *g*, the delivery duct *d*, the leaky place at the periphery of the pump rotor *a* and the suction duct *b* up to the

float valve *c*, and a certain period of time must lapse before the oil has risen to such a height as to lift the float valve and thus prevent further penetration of the oil.

Figures 2 to 4 illustrate three constructional examples of the invention. In these figures the letters *a*, *b*, *c*, *d*, *e*, *f*, *g* have the same significance as in Figure 1.

*h* is the closing device designed to prevent the return of the oil when the pump is stationary. In Figures 2 and 3 *i* is a certrifugal governor; *k* is the sleeve of said governor. The lift of said sleeve is transmitted through rodding *l* to the closing device *h*.

In Figure 4, *m* is an oil pump which, when the pump is rotating, generates oil pressure in the cylinder *n*; *o* is a piston which is moved in said cylinder by the oil pressure so as to operate the closing device *h*; *p* is a spring which has a constant tendency to move the piston *o* in opposition to the oil pressure; *q* is a pressure-equalizing duct connecting the cylinder *n* with the main oil chamber of the air pump.

Figure 2 is a longitudinal section of an improved rotary pump wherein the closing device *h* is operated by a centrifugal governor *i* and is structurally contained in the delivery duct *d* between the rotor and the delivery valve.

Figure 3 is a longitudinal section of an improved rotary pump wherein the closing device *h* is structurally contained in the oil return duct *g*. The said return duct in this modification has a form such that it can be controlled directly by a piston.

Figure 4 is a longitudinal section of a portion of an improved rotary pump wherein, the closing device is controlled by oil pressure by means of an oil pump *m*. In this construction the oil pump is shown as a rotary pump (gear pump). A pump of this kind has a determined delivery volume for a determined speed of rotation, but has not a determined pressure. In order however to obtain at a desired speed of rotation the pressure which is just able to move the piston *o*, the delivered oil in front of the piston *o* may be allowed to flow off through a duct the flow-resistance of which is such that the quantity of oil delivered at a desired speed of rotation requires for effecting its flow through the duct just that pressure which is also sufficient for moving the piston *o*. Instead of a separate duct, in some cases the leaky places in the oil pump which are unavoidably present or are artificially increased, are sufficient. Of course, a centrifugal pump may be employed which without such devices will generate an oil pressure increasing with the rotational speed. That part of the cylinder *n* in which the spring *p* is contained communicates by way of a pressure-equalizing duct *q* with the main oil chamber of the pump, in order that no counter-pressure shall be able to be produced in said part of the cylinder.

The operation of a pump constructed according to this invention is as follows:—

As will be perceived from all the constructional examples, when the pump is stationary, the closing device *h* is in its closed position so that it is not possible for the oil to flow from the air vessel in which atmospheric pressure exists back into the interior of the pump.

On starting the pump, either the centrifugal governor *i* moves outwards (Figs. 2 and 3), and its sleeve *k* moves towards the clutch half and by means of the transmission rodding *l*, causes the closing device *h* to open the delivery duct *d* or the oil return duct *g*, or (as shown in Fig. 4) the oil pump *m* places the cylinder *n* under oil pressure, and this oil pressure moves the piston *o* so that the closing device *h* likewise opens the oil return duct; the spring *p* being compressed. If the rotational speed of the pump drops to such an extent that there is a risk of the oil flowing back through the pump, the centrifugal governor *i* will move inwards and the oil pressure in the cylinder *n* will drop to such an extent that it can be overcome by the spring *p*, and the closing device *h* is thereby moved back into its closing position. The oil in the air vessel *f* is thus unable to get past the said closing device.

What I claim is:—

1. In a rotary pump comprising an air vessel for pumping gases, an oil return duct, and a closing device for preventing the oil from returning from said air vessel into the pump cylinder, through said oil return duct, the combination of means for causing said closing device to close said oil return duct immediately the rotational speed of the pump falls below a determined limit.

2. In a rotary pump comprising the combination claimed in claim 1, the additional combination that the closing device is operated by a centrifugal governor actuated by a moving part of the pump.

3. In a rotary pump comprising the combination claimed in claim 1 and the additional combination claimed in claim 2, the further combination that the centrifugal governor is located in the interior of the usual clutch half on the pump side.

4. In a rotary pump comprising the combination claimed in claim 1, the additional combination that the closing device is operated by oil pressure generated by a pump coupled to the air pump.

5. In a rotary pump comprising the combination claimed in claim 1 and the additional combination claimed in claim 4, the

further feature that the oil pump is located in the interior of the air pump casing.

6. In a rotary pump comprising the combination claimed in claim 1, the additional feature that the closing device is located in the delivery duct.

7. In a rotary pump comprising the combination claimed in claim 1, the additional feature that the closing device is located in the oil return duct.

In testimony whereof I have signed my name to this specification.

OSKAR SEITZ.