A rotary vacuum pump in which the pump shaft extends into a reservoir and is provided with a paddle element connected to a seal which can be located into and out of sealing contact with an oil feed passageway in the pump shaft to allow or prevent the passage of oil from the reservoir to the pump.
This invention relates to rotary vacuum pumps of the kind in which oil is used as a sealing medium and the pump casing is immersed in the oil which is contained in a reservoir. Such a pump will hereinafter be referred to as a rotary vacuum pump "as herein defined."

It is characteristic of such pumps that when they are stopped under vacuum oil is sucked from the reservoir through the oil feed ducts and then enters the system which is being evacuated where it may cause serious contamination. When the reservoir has been sufficiently emptied the oil is succeeded by atmospheric air which may scatter the oil about the system being evacuated and finally raise the pressure in the system to that of the surrounding atmosphere.

A possible arrangement for preventing oil from being sucked back into the system which is being evacuated is to draw oil from the reservoir and drive it along a single main oil way to the pump by means of a positive displacement oil pump driven by the motor which drives the rotary vacuum pump. The main oil way is closed by a spring or gravity controlled shut-off valve when the pumps are inoperative and this valve must be capable of resisting the difference in pressure between the inside of the pump casing and the surrounding atmosphere without leaking.

When the pumps are started however the oil pump must be capable of creating a sufficiently high oil pressure in the main feed duct to force open the valve and supply oil to the vacuum pump. The oil flow required by the vacuum pump will vary greatly with operating temperature and with the manufacturing tolerances of the individual parts of the pump and it is therefore essential to provide an oil pump with excessive displacement, and also a pressure relief valve to prevent overloading the vacuum pump with oil and the driving motor with additional power. The system described can provide a complete safeguard against oil suck-back, but it is complex and costly to install and greatly increases the overall cost of the pump.

The object of the present invention is to provide a system for preventing oil suck-back having the merits of the system referred to but without its defects.

Thus according to the present invention there is provided a rotary vacuum pump as herein defined characterized in that the pump shaft extends into the reservoir and carries at least one hollow paddle-like element adapted, when the pump is operative to cause rotary movement of a seal element relative to at least one oil feed passageway in said shaft to cause unsealing thereof whereby oil may pass from the reservoir to the pump.

Conveniently the seal element is resiliently urged into contact with the pump shaft by means of a spring element or elements associated with the paddle element.

The invention will now be described further, by way of example only with reference to the accompanying drawings, in which:

FIG. 1 is a cross section of a pump made in accordance with the invention, and

FIG. 2 is an elevation of one of the elements of the pump of FIG. 1.

As shown in the drawings there is provided a vacuum pump 10 contained within a tank or reservoir 11 for oil. The pump has a rotor 12 carried upon a shaft 13 which is rotatable in bearings 14 located in a housing 17 to which the casing 11 is attached. The shaft 13 extends from the housing 17 to enable it to be connected to a drive means (not shown). An oil seal 15 is provided between the housing 17 and the shaft 13. Drillings 16 lead from the pump interior via the housing 17 for the bearings 14 to a bearing block 18 at the opposite end of the pump in which is located the other end 13a of the shaft 13. An oil seal 19 is provided between the bearing block 18 and the shaft 13a.

Between the oil seal 19 and the rotor 12 the shaft 13a is provided with an annular recess 20 with which the drillings 16 co-operate. The shaft 13a is provided with a central drilled and tapped hole to receive a securing bolt 21 for a paddle element 22 to be described below.

Also provided in the shaft 13a are drillings 23 which extend from the free end of the shaft, parallel to the drilled and tapped hole, to open into the recess 20.

Surrounding the bolt 21 is an annular seal element 24 in which are through holes 25 (see FIG. 2) which correspond to the drillings 23 of the shaft 13a. Part of the element 24 is cut back to provide an accurate peripheral cut out 26 and this cut out co-operates with a stop peg 27 secured to and projecting from the end of the shaft 13a. The element 24 is free to turn on the bolt 21.

The paddle element 22 comprises a boss 22a in which are provided blind holes 22b adapted to receive compression springs 22c which bear against the seal element 24 to hold it against the end of shaft 13a. Also mounted on the boss 22a are two driving pins (not shown) which co-operate with a pair of holes 28 in the seal element 24 in order to rotate the latter (as explained below).

Between the opposite face of the boss 22a and the head 21a of the bolt 21, and surrounding a sleeve part 22d of the boss 22a through which the bolt 21 passes, is a torsion spring 29.

Attached to the periphery of the boss 22a are paddles 22e each of which is cup shaped in form.

An air inlet is provided and arranged to have attached thereto an air inlet tube (not shown) from the apparatus being exhausted. The housing 17 is provided with a gas balance regulator 30.

When the vacuum pump is started air being exhausted enters the pump via the inlet and the paddle element 22 is accelerated. This results in the paddles 22e being rotated and due to the presence of oil in the pump resistance to rotation of the paddle element 22 occurs due to the form of the paddles 22e. The seal element 24 is rotated by the connection thereof to the pins of the boss and thus the holes 25 are brought into alignment with the drillings 23 of the shaft 13a to allow oil to flow into the pump.

If during operation the vacuum pump stops the torsion spring 29 causes the paddle element 22 to rotate to misalign the holes 25 in the seal element 24 with the drillings 23 of the shaft 13a.

When the seal element 24 is in a position in which the drillings 23 have their open ends closed the flow of air and oil into the system being exhausted is prevented. The arrangement described above operates whenever the pump stops and serves to exclude oil from the pump whilst ensuring that the system being evacuated is kept under vacuum.

By providing a paddle element of the kind described, and a torsion spring control therefor it is possible to ensure that oil is fed to the pump at the most suitable...
pressure dependent upon whether the seal element is positioned so as to fully open the drillings 23 or only partially open them.

An arrangement as described above may be produced as a very compact unit.

I claim:

1. A rotary vacuum pump having a rotatable pump shaft and an oil feed passageway in said shaft, said pump also having an oil reservoir, a seal element rotatably mounted adjacent said shaft oil feed passageway and said reservoir, said seal element and said shaft having alignable oil feed passageways, said shaft having a paddle-like element fixed to said seal element and pivoted on said shaft for limited rotation relative thereto and for being driven thereby, said paddle-like element being immersible in said reservoir, spring means acting on said seal element to bias said seal element to an oil feed passageway misaligned position when said vacuum pump is non-operative, and when said pump is operative said shaft rotates said paddle-like element and causes rotary movement of said seal element relative to said oil feed passageway to cause unsealing of said passageway to permit oil to pass from said reservoir to said pump.

2. A rotary vacuum pump as claimed in claim 1 including stop means on said shaft, and in which the seal element is provided with rotary movement limiting formations arranged to co-operate with said stop means on the shaft.

* * * *