AUSTRALIA
PATENTS ACT 1952

APPLICATION FOR A PATENT (CONVENTION OR NON-CONVENTION)
COMPLETE AFTER PROVISIONAL SPECIFICATION No.
51802/79

I, We
DYNAVAC PTY. LTD., of
44 Parkhurst Drive, Knoxfield, 3180, in the State of Victoria,
Commonwealth of Australia

hereby apply for the grant of a Patent for an invention entitled
"VACUUM PUMPS"

which is described in the accompanying provisional specification.

The application is a Convention application and is based on the application(s) for patent or similar protection made in

Our address for service is care of DAVIES & COLLISON, Patent Attorneys, of
1 Little Collins Street, Melbourne, in the State of Victoria, Commonwealth of Australia.

Dated this 25th day of October 1978

(A member of the firm of DAVIES & COLLISON) for and on behalf of
DYNAVAC PTY. LTD.

To: THE COMMISSIONER OF PATENTS
Davies & Collison, Melbourne and Canberra.
COMMONWEALTH OF AUSTRALIA
PATENTS ACT 1952
DECLARATION IN SUPPORT OF CONVENTION OR NON-CONVENTION APPLICATION FOR A PATENT

Insert title of invention.

Insert full name(s) and address(es) of declarant(s) being the applicant(s) or person(s) authorized to sign on behalf of an applicant company.

Cross out whichever paragraphs 1(a) or 1(b) does not apply

1(a) relates to application made by individual(s)
1(b) relates to application made by company; insert name of applicant company.

Cross out whichever paragraphs 2(a) or 2(b) does not apply

2(a) relates to application made by inventor(s)
2(b) relates to application made by company(s) or person(s) who are not inventor(s); insert full name(s) and address(es) of inventors.

State manner in which applicant(s) derive title from inventor(s)

Cross out paragraphs 3 and 4 for non-convention applications.

For convention applications, insert basic country(ies) followed by date(s) and basic applicant(s).

Insert place and date of signature.

Signature of declarant(s) (no attestation required)

Note: Initial all alterations.

In support of the Application made for a Patent for an invention entitled: "VACUUM PUMPS"

I We

John Howard Brett, Engineer
of
551 Esplanade, Mount Martha, in the State of Victoria, Commonwealth of Australia,

do solemnly and sincerely declare as follows:—

1. (a) I am the applicant........... for the patent

or (b) I am authorized by DYNAVAC PTY. LTD., the applicant........... for the patent to make this declaration on its behalf.

2. (a) I am the actual inventor........... of the invention

or (b)

3. The basic application........... as defined by Section 141 of the Act was made in................. on the.................

by.................

in................. on the.................

by.................

in................. on the.................

by.................

4. The basic application........... referred to in paragraph 3 of this Declaration were the first application........... made in a Convention country in respect of the invention the subject of the application.

Declared at Warrandyte this 11th day of November, 1979

[Signature]

DAVIES & COLLISON, MELBOURNE and CANBERRA.
1. A vacuum pump comprising, a pump body, an inlet and an exhaust, a pump mechanism which is operable to cause flow from said inlet to said exhaust, said pump mechanism including a working chamber in operative communication with said inlet and said exhaust, an anti-suck back valve which is adapted to adopt a closed condition when the pump stops said valve including a valve member which is actutable in response to a pressure difference between said inlet and said working chamber.
Complete specification for the invention entitled:

"VACUUM PUMPS"

The following statement is a full description of this invention, including the best method of performing it known to us.
This invention relates to improvements in or relating to vacuum pumps and particularly relates to such pumps incorporating anti-suck back valves.

A problem frequently associated with vacuum pumps is caused by flow back into the apparatus to which the pump is attached as the pump is stopped, or accidentally breaks down. The majority of two stage vacuum pumps use oil as a lubricant particularly in the low vacuum stage and the net result of stopping the pump is that there is an increase in pressure in the low vacuum stage which causes a corresponding increase in pressure in the high vacuum stage thereby causing a flow back through the pump into the associated apparatus. This flow back can even cause oil to be drawn from the pump contaminating the apparatus.

To overcome this problem it is sometimes the practice to provide vacuum pumps with anti-suck back valves which cut off the inlet pipe when the pump stops thereby ensuring that there is no flow back into the apparatus to which the pump is attached. These valves normally comprise electrically operated solenoid valves associated with the inlet passageway and arranged to close as the power is switched off. Alternative arrangements include centrifugally operated switch mechanisms which activate the valve or separate oil pumps which operate to prevent oil or air entering the high vacuum stage.

Such anti-suck back valves tend to increase the
overall cost of the vacuum pump and where electrical solenoid valves are fitted, they do not overcome all modes of failure.

It is with these problems in mind that the present invention has been devised.

In accordance with the present invention there is provided a vacuum pump comprising an inlet, an exhaust and a pump mechanism including a working chamber, an anti-suck back valve associated with said inlet operable to close when the pump stops to prevent flow from the pump to said inlet, said valve including a valve member which is actuated by a pressure difference between pressure at said inlet and pressure within said working chamber.

In one arrangement the vacuum pump comprises a pump body, an inlet and an exhaust, a pump mechanism which is operable to cause flow from the inlet to the exhaust. The pump mechanism includes a working chamber in operative communication with the inlet and the exhaust. An anti-suck back valve is provided which is adapted to adopt a closed condition when the pump stops, the valve including a valve member which is actuated in response to a pressure difference between the inlet and the working chamber.

The vacuum pump may include a bleed-off passage in operative communication with the working chamber and one side of the valve member. The other side of the valve member communicates with the inlet the arrangement being such that, in use, the valve member will close the inlet when pressure in the bleed-off passage is greater than pressure at the outlet.

Preferably the inlet includes an inlet passage with a valve seat in or at one end thereof. The valve member may include a piston element and a sealing head and is movable between and open position and a closed position in
which the sealing head seats against the valve seat that movement being in response to pressure difference between the inlet and the working chamber. Preferably the piston element communicates with the bleed-off passage.

In one form the pump mechanism includes two working chambers which are in communication via a transfer passage one of the working chambers communicating with the inlet and the other working chamber communicating with the exhaust. Preferably the bleed-off passage communicates with said transfer passage.

The valve member may also be a flexible diaphragm which in a closed position is arranged to seal the inlet passageway. It is understood that the present invention is equally applicable to a single stage vacuum pump, the valve being closed by a pressure difference between the inlet passage and the pressure within the working chamber of the single stage pump downstream of the jet.

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

Figure 1 is a cross-sectional side-on view of a vacuum pump in accordance with the present invention; and

Figure 2 is a sectional view taken along the line II-II of Figure 1.

The vacuum pump illustrated in Figures 1 and 2 comprises a housing 1 defining a first low vacuum chamber 2 and second high vacuum chamber 3 joined by a transfer port 9. The housing also defines an oil reservoir 4 which communicates with the low vacuum stage via an oil feed duct 5. A passageway 10 is also provided between the two chambers 2 and 3 to locate coaxial shafts 12 and 11 of two rotors 14 and 13 located respectively in the high vacuum and low vacuum working chambers 3 and 2. Alternatively a single shaft may be provided the two rotors being secured thereto. The shafts are keyed together and support
annular oil passageways 15 and 16, the oil passageway 15 on the high vacuum side being serviced by a free standing oil head 26. The rotors are driven by an externally mounted pulley 27 and the rotors are secured within the housing 1 via a pair of end plates 19 and 20.

An inlet pipe 8 extends through the oil chamber 4 and communicates with the working chamber 3 of the high vacuum stage via a port 17 and subsequently connects with port 9 illustrated in Figure 2. The exit from the high vacuum stage to the low vacuum stage is angularly displaced to the inlet port 17. The transfer port 9 connects the two chambers 2 and 3 and an exhaust duct 6 connects the low vacuum chamber 2 to the oil reservoir 4 via a one way valve 7.

Figure 2 illustrates the eccentric mounting of the rotors 13 and 14 and illustrates the sealing blades 28 which in effect produces the pumping action within the pump. The two stage vacuum pump as described at this stage is a conventional design of vacuum pump and although contributing to the present invention does not constitute the novel features of this invention.

The novel features of the present invention are particularly illustrated with reference to Figure 2. A bleed-off passageway 24 is provided to communicate with the transfer duct 9 between the two chambers 2 and 3. The bleed-off passageway 24 terminates in a working space 21 in which is located the free end 21a of a valve member 22. The valve member comprises a valve sealing head 23 supported by a valve stem 22 which acts as a piston and is a close sliding fit in a passageway 25 provided within the housing to connect the inlet port 17 with the bleed-off passageway 24. The valve sealing head 23 is fitted with a flexible sealing member (not shown) and is arranged to be located within a chamber 18 provided at the base of the inlet pipe 8.
In the normal operation of the pump, the valve member 22 assumes the position shown in Figure 2 and the gas is sucked through the pump via the inlet 8, the chamber 18 into the high vacuum stage 3 and then into the low vacuum stage via the transfer port 9 and to outlet via the outlet passageway 6. Also in normal operation oil for sealing the clearances in chamber 2 is drawn in through passage 5 and along the shaft journal in end plate 19. When the pump stops or breaks down oil will continue to flow into chamber 2 from passageway 5 or from passageway 6 if valve 7 does not seal completely. This has the effect of causing an increase in pressure within the low vacuum stage 2. Normally this increase in pressure causes a subsequent increase in pressure throughout the pump and therefore into the high vacuum chamber via the transfer passageway 9 and eventually into the inlet pipe 8. In certain circumstances this increase in pressure can be such that oil is drawn through the low vacuum chamber into the high vacuum chamber and to enter the inlet pipe 8 and thereby contaminate apparatus to which the pump is attached.

However, in the present invention the increase in pressure also causes an increase in pressure within the bleed-off passageway 24. Because of the close clearances of rotor 14 and blades 28 in chamber 3 the pressure rises considerably in passageway 24 before a significant pressure increase is communicated to chamber 18. Accordingly, the pressure differential between the face of the valve sealing head 23 which is subject to the vacuum within the inlet pipe 8 and the increased pressure within the working space 21 communicated via passageway 24 causes the valve piston 22 to lift so that the valve sealing head 23 engages an annular seat 29 defined by the periphery of the base of the inlet pipe 8. With the valve in this position the inlet pipe 8 is closed from the high vacuum chamber of
the pump and therefore there is no possibility of oil or air entering the apparatus to which the pump is coupled. If the pressure within the pump increases further, for instance, by being open to atmosphere, the pressure differential will increase still more, the effect of which merely increases the seal of the valve sealing head on the associated valve seat.

In normal usage, the pressure differential between the base of the inlet pipe 8 and the bleed-off passageway 24 is so small that it will not lift the valve member 22 so the valve member assumes the open position shown in Figure 2. Furthermore, as the pump is started up, the pressure within the transfer passage 9 drops until the pressure within the bleed-off passageway 24 is so low that it will no longer lift the valve 22 against gravity and therefore the sealing head 23 and valve stem 22 drop to the position shown in Figure 2 and allow flow through the inlet pipe 8.

The anti-flow back valve described above has the advantage that it is simple in construction and does not require complicated means such as a solenoid or centripetrically operated switches and yet effectively seals the inlet 8 from the pump when the pump ceases to operate. Furthermore, it is quite simple to provide within the casting which forms the housing 1 of the pump, the necessary bleed-off passageway 24 and port 17 into which the simple valve member 22 can be located. The location of the underside of the valve sealing head 23 against the adjacent surface of the port 17 as well as the close running fit of the piston 22 in the passageway 25 prevents excessive gas flow between the bleed-off passageway 20 and inlet passageway 8.

Although a piston type valve member is illustrated in Figure 2, it is understood that within the spirit of this invention a diaphragm or other suitable valve may be
used to seal off the inlet passageway. It is also understood that the present invention is not restricted to a two-stage vacuum pump and it is possible to incorporate a similar system in a single stage vacuum pump, the pressure differential being set up between the inlet passageway and a pressure within the working chamber downstream of this passage.
THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A vacuum pump comprising, a pump body, an inlet and an exhaust, a pump mechanism which is operable to cause flow from said inlet to said exhaust, said pump mechanism including a working chamber in operative communication with said inlet and said exhaust, an anti-suck back valve which is adapted to adopt a closed condition when the pump stops said valve including a valve member which is actuatatable in response to a pressure difference between said inlet and said working chamber.

2. A vacuum pump according to claim 1 including a bleed-off passage in operative communication with said working chamber and one side of said valve member the other side of said valve member communicating with said inlet the arrangement being such that, in use, said valve member will close said inlet when pressure in said bleed-off passage is greater than pressure at said inlet.

3. A vacuum pump according to claim 1 or claim 2 wherein said inlet includes an inlet passage with a valve seat in or at one end thereof, said valve member including a piston element and a sealing head and movable between an open position and a closed position in which said sealing head seats against said valve seat said movement being in response to a pressure difference between said inlet and said working chamber.

4. A vacuum pump according to claim 3 when appended to claim 2 wherein said piston element communicates with said bleed-off passage.

5. A vacuum pump according to any preceding claim wherein said pump mechanism includes two working chambers which are in communication via a transfer passage one of said working chambers communicating with said inlet and the other said working chamber communicating with said exhaust.

6. A vacuum pump according to claim 5 when appended to any one of claims 2 to 4 wherein said bleed-off
passage communicates with said transfer passage.

7. A vacuum pump comprising an inlet, an exhaust and a pump mechanism including a working chamber, an anti-suck back valve associated with said inlet operable to close when the pump stops to prevent flow from the pump to said inlet, said valve including a valve member which is actuable by a pressure difference between pressure at said inlet and pressure within said working chamber.

8. A vacuum pump substantially as herein described with reference to the accompanying drawings.

9. The steps or features disclosed herein or any combination thereof.

Dated this 9th day of October, 1979
DYNAVAC PTY. LTD.,
its Patent Attorneys
DAVIES & COLLISON