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APPARATUS FOR HIGH VACUUM PUMPS

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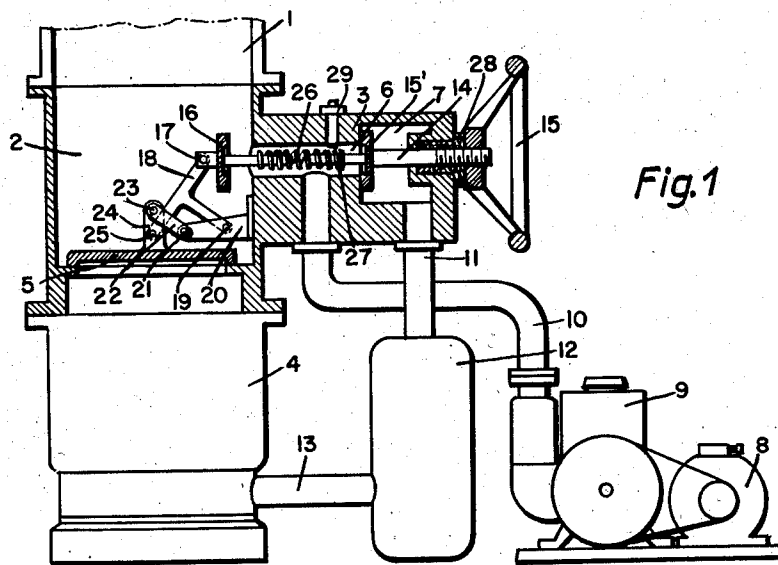


Fig. 1

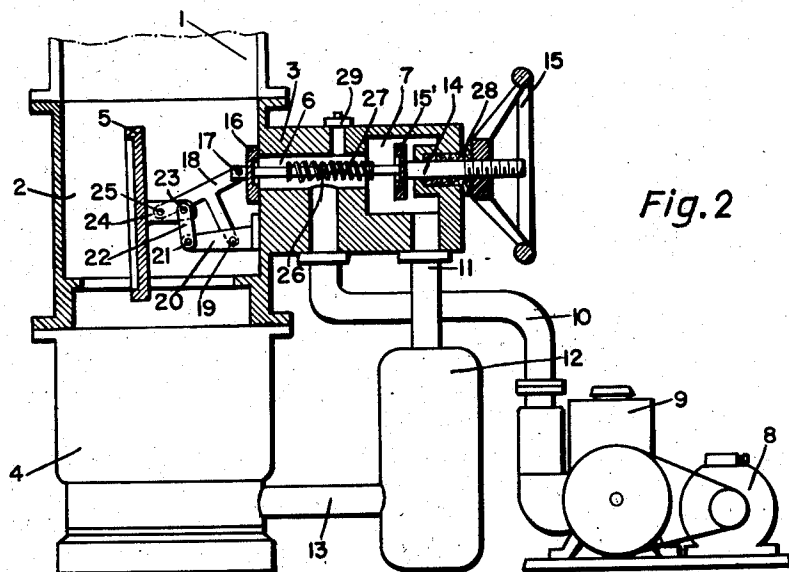


Fig. 2

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APPARATUS FOR HIGH VACUUM PUMPS

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High vacuum pump stands comprising preliminary and high vacuum pumps are already known. With these pump stands the chamber or space to be evacuated is first of all pre-evacuated by means of the preliminary or fore vacuum pump, from atmospheric pressure down to a vacuum of 1 to 10^{-1} mm. Hg. As soon as said preliminary vacuum is attained, the preliminary vacuum pump is disconnected from the space to be evacuated, the latter being now put into connection with the high vacuum pump, because said high vacuum pump can only begin to work efficiently when the pressures indicated as preliminary vacuum are reached. When producing the high vacuum itself, the preliminary vacuum pump is connected in series, at the outlet side, with the high vacuum pump, in order to lower the load on the latter.

At least three valves are generally employed to carry out such a method. Admittedly it is possible to work entirely without valves or with less than three, but in that case it will be impossible to begin heating the high vacuum pump before reaching the preliminary vacuum. This requires too much time with high vacuum pump stands which, by reason of the nature of the working processes to be performed, must be repeatedly flooded and again highly evacuated afterwards, because considerable loss of time results from the additional heating and cooling down periods. Such working methods occur with melting and casting plants, and with plants for the application of thin surface layers by means of high vacuum evaporation of the materials necessary for the same.

Of course the attendance of so many valves involves danger if the operators are unskilled. Every wrong manipulation of the valves leads not only to disturbances in the course of the pumping operations and therewith to loss of time, but also to damage and destruction of high-grade materials exposed to said treatments. There is a further danger of damaging valuable and expensive equipment, especially the high vacuum pumps, the same being designed as diffusion or steam jet pumps.

Hence it has already been suggested to connect the preliminary vacuum valve mechanically in such a way with the high vacuum valve that no wrong manipulations can occur. However, the known arrangements had led to various disadvantages and difficulties which are eliminated by the structure and mode of operation of the present invention. The improvement effected by our invention is characterized by the provision of a first space forming or connected with the space or chamber to be evacuated, a second space or chamber connected to the preliminary vacuum pump and connectible with the evacuation space, and a third space or chamber connected to the high vacuum pump and connectible with the second space so as to connect the latter to the high vacuum pump, and interconnected alternately in such a manner that either, on shutting off the first space against the high vacuum pump and closing the third space against the second space, the latter is caused to join the preliminary vacuum pump with the first space, occasioning thereby the preliminary vacuum formation; or on shutting off the second space against the first space and connecting the third and second spaces, the high vacuum pump is connected with the first space while the preliminary vacuum pump is switched in series with the high vacuum pump, so that the high vacuum is established with the aid of both pumps working simultaneously.

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Following the method as described above, the possibility arises for the first time with such high vacuum stands of allowing the arrangement of the first, second, and third spaces side by side, to dispose them in the same common casing, and to penetrate the first, second, and third spaces by means of a single actuating element, passing only thru one point of the casing, which operates the connecting and shutoff means between the high vacuum pump and first space, as well as on such means disposed between the first and second, and between the second and third spaces. Consequently this single actuating element can be switched into the desired position without any danger of wrong manipulation, and without any danger of disturbances or damage. The only possibility of wrong manipulation consists in the fact that switching over from preliminary vacuum to high vacuum can occur too early. But this danger can only appear if there is an error in reading the measuring devices, which generally must be regarded as excluded.

The drawing appended hereto shows an apparatus adapted for the execution of the novel method, and having the described characteristics, by way of illustration.

Fig. 1 of the schematically presented drawing indicates the position of the valves when producing the preliminary vacuum;

Fig. 2 shows the arrangement following Fig. 1 and the position of the valves when producing the high vacuum.

In Fig. 1, 1 indicates the evacuation space or chamber to be submitted to the high vacuum; in the sense of the invention under consideration it has been designated as the first space or chamber. This first space is connected by way of an intermediate space 2 bearing the valve box 3, and by way of the high vacuum valve in the form of plate 5 with the high vacuum pump 4. The high vacuum pump 4 is constructed thruout as a diffusion or steam jet pump, and especially as an oil diffusion or oil vapor jet pump. The valve box 3 contains first a valve chamber 6 designated in the sense of the present invention as the second space or chamber, and moreover a further valve chamber 7 forming the third space in the sense of the invention under consideration. A preliminary vacuum pump formed in the usual way and driven by an electric motor 8 bears the number 9. Accordingly the drawing shows that there are first of all spaces 1, 2 forming the evacuation space; that there is further a second space formed by the valve chamber 6 linking the preliminary vacuum pump 9 through conduit 10 together with the evacuation spaces 1, 2; and finally a third space formed by the valve chamber 7 uniting second space 6 through conduit 11, compensation vessel 12, and conduit 13 with the high vacuum pump 4. Thereby the first, second, and third spaces 2, 6 and 7 are penetrated by a single actuating element in the form of valve spindle 14, the position of which is variable following its dependence on hand-wheel 15. By this means the valve disk 15', provided upon valve spindle 14, locks in the position of Fig. 1 the second space 6 from the third space 7. On the other hand, the second valve disk 16, borne by spindle 14, is in Fig. 1 in a position where it connects spaces 1, 2 with second space 6. Linked with valve spindle 14 we find at 17 the toggle lever 18 which is hinged at 19 in the wall bracket 20. Said wall bracket 20 forms at 21 a further link point for the short link 22 which is hinged at 23 upon a projection 24 of valve plate 5. Projection 24 has hinged to it at 25 the toggle lever 18. By this special system of coupling a link triangle 17, 19, and 25 with a link triangle 21, 23, 25 the result is attained that the vacuum plate 5, when it is brought to the position shown in Fig. 2, extends parallel to the direction of flow in the spaces 1, 2 and high vacuum pump 4, so that it causes the least resistance to the flow.

The valve spindle 14 is discontinuous at 26. The point

of interruption is bridged by a helical spring 27, so that the valve disks 15' and 16 rest firmly upon their seats in the respective end positions of valve spindle 14. The point where spindle 14 passes through valve box 3 is packed in a high vacuum resistant manner, as indicated at 28. A flood valve is shown at 29.

The mode of operation of the so described parts is readily apparent from the drawing.

As can be seen from Fig. 1, with the valve spindle 14 moved as far as possible to the left, all the parts are in the position in which the preliminary vacuum has been created. This has been expected by shutting off the spaces 1, 2 from high vacuum pump 4 by means of the closed high vacuum valve 5, while the third space 7 is shut off from the second space 6 by bringing the valve disk 15' to its seat, and by the illustrated open position of valve disk 16, so that the second space 6 connects the preliminary vacuum pump 9 through conduit 10 with the spaces 1, 2.

Fig. 2, on the other hand, shows the position of valve spindle 14 in which it is moved as far as possible to the right, whereby all the parts have taken the position in which the formation of the high vacuum is reached. Thus the second and third spaces 6 and 7 are connected through the opened valve disk 15', the second space 6 being shut off from the spaces 1, 2 by means of the closed valve disk 16. The preliminary vacuum pump 9 is simultaneously in communication, through conduit 10, the second space 6, the already mentioned open valve disk 15', the third space 7, the conduit 11, the compensation vessel 12 and the conduit 13, with the spaces 1, 2 through the high vacuum pump 4, so that said high vacuum pump 4 is finally connected in series with the preliminary vacuum pump 9.

With the above-described apparatus, therefore, erroneous operation is entirely excluded when the valve spindle 14 is shifted into its extreme positions, assuming that the reversal from preliminary vacuum to high vacuum position is carried out at the right moment. Both operations can be expected from and performed also by unskilled attendants without any danger of error, so that the arrangement illustrated herein removes all the difficulties which prior to the present invention gave occasion for endangering of the pump plant and the materials being treated.

What we claim is:

1. High vacuum pump arrangement comprising, in combination, a fore vacuum pump having a relatively higher end pressure, a high vacuum pump having a lower end pressure, said high vacuum pump including a casing providing a first chamber adapted to be placed in continuous communication with a vessel which is to be highly evacuated, a casing providing a second chamber communicating with the fore pump and also a third chamber communicating with the high vacuum pump, a connection between the second and third chambers, valve means for controlling the connection between the second and third chambers, valve means controlling the communication between the high vacuum pump and the first chamber, connections between said valve means and disposed in said chambers for effecting coordinating movement of said valve means, and a single actuating element connected to the valve means for operating the same.

2. High vacuum arrangement as defined in claim 1, wherein said connections include a resilient member for providing for relative movement between the valve means upon operation of the actuating element.

3. A high vacuum pump arrangement comprising a high vacuum pump having a casing providing a vacuum chamber adapted to be connected to a vessel to be evacuated, a first valve controlling the communication between the high vacuum pump and such vacuum chamber, a valve housing providing a second chamber and a third chamber, means providing a connection between the second and third chambers, means providing a connection

between the vacuum chamber and the second chamber, a second valve controlling the connection between the vacuum and second chambers, a third valve controlling the connection between the second and third chambers, a fore pump, a conduit connecting the fore pump with the second chamber, a conduit connecting the high vacuum pump with the third chamber, a single operating means for said valves, and means interconnecting said valves and said single operating means so that upon opening of the second valve, the first and third valves are closed, while upon closing of the second valve, the first and third valves are opened, the first valve being in the form of a plate valve, and the interconnecting means, including a linkage between the first and second valves whereby upon closing of the second valve, the first valve is opened and turned into position with the plane thereof parallel to the direction of flow of gas through the first chamber so as to keep the resistance to such flow small.

4. A high vacuum pump arrangement comprising a high vacuum pump, a fore pump, a casing providing a vacuum chamber adapted to be connected to a vessel to be evacuated, a passageway connecting the vacuum chamber and the high vacuum pump, a valve housing providing a second chamber and a third chamber in communication with each other, means connecting the second chamber with the vacuum chamber and with the fore pump, means connecting the third chamber with the high vacuum pump, a single adjusting mechanism penetrating said second and third chambers and provided with a first valve controlling the passageway between the vacuum chamber and the high vacuum pump, with a second valve controlling the connecting means between the vacuum and second chambers, and with a third valve controlling the communication between the second and third chambers, so that in the one end position of the adjusting mechanism serving for the production of the preliminary vacuum, the vacuum chamber and the fore pump are connected by way of the second chamber, while the connections to the high vacuum pump are closed, and in the other end position of the adjusting mechanism serving for the production of a high vacuum, the first valve is in open position while the second valve is in closed and the second and third chambers are connected with each other and with the fore and high vacuum pumps, so that the pumps operate in series and are connected through the second and third chambers.

5. A high vacuum pump arrangement according to claim 4, wherein the adjusting mechanism passes through the valve housing at one end thereof, and a single packing for sealing said adjusting mechanism against the valve housing.

6. A high vacuum pump arrangement according to claim 4, wherein the valve housing consists of a single integral block which is hollowed out to provide the said second and third chambers.

7. A high vacuum pump arrangement according to claim 4, wherein the adjusting mechanism comprises a rod having a point of discontinuity, and a coupling spring bridging said point of discontinuity.

8. A high vacuum pump arrangement according to claim 4, wherein the first valve is in the form of a plate valve, said adjusting mechanism including a linkage connected to the said plate valve in such manner that in the open position of the plate valve, such plate valve extends parallel to the direction of flow of the medium to be evacuated.

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