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DIFFUSION VACUUM PUMPS

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Fig.1.

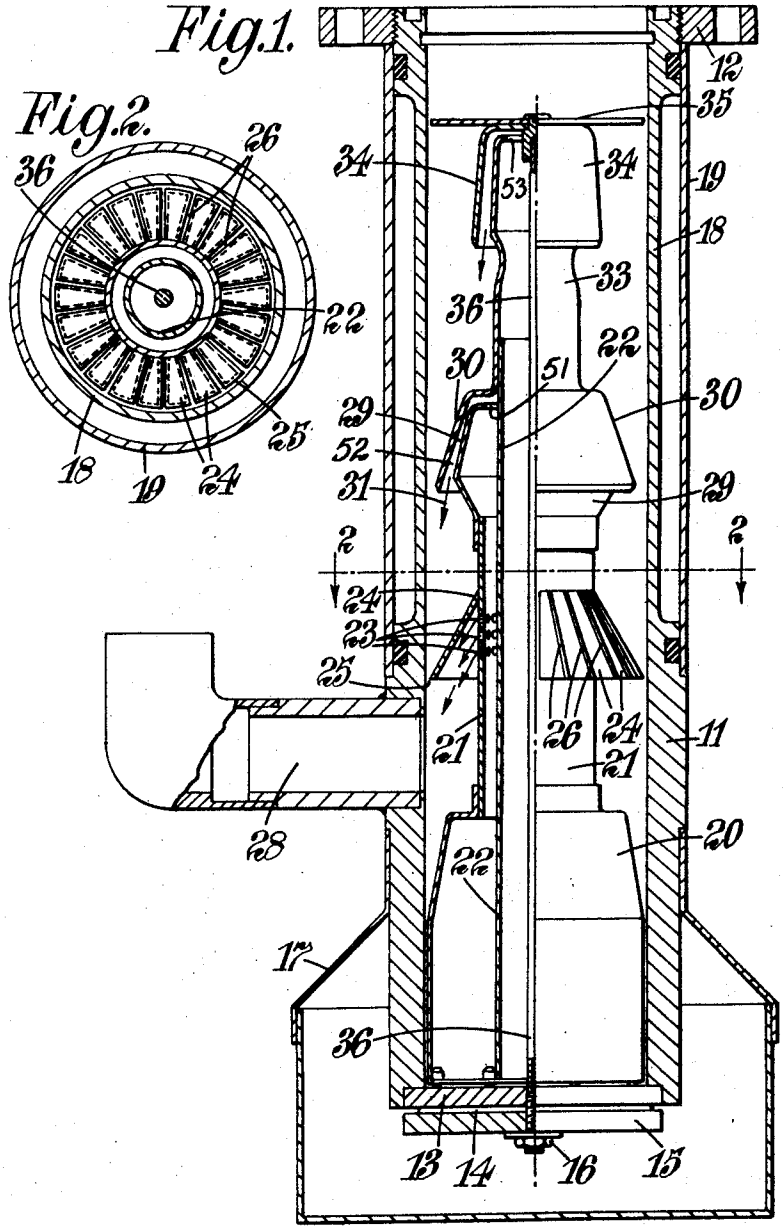


Fig.2.

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DIFFUSION VACUUM PUMPS

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7 Claims. (Cl. 230—101)

This invention comprises improvements in or relating to diffusion vacuum pumps, and relates to the type of diffusion vacuum pumps wherein vapor of a pumping liquid such as an apiezo oil, issues from within a hood across a gap where the gas to be pumped can diffuse into it. It is known that in diffusion pumps the best dimension of the gap is a function of the vacuum on which the pump is operating, as well as other factors such as velocity of the vapor of the pumping liquid, but if the gap is correct the capacity of the pump is a function of the size of the hood, that is to say up the length of its periphery. To increase the diameter of the pump beyond a certain point is not economical and therefore the capacity of a pump of this kind as hitherto constructed is limited to the capacity of the pump of maximum economical size.

According to the present invention such a pump is characterised by the fact that the edge of the hood is formed into folds which afford increased length of lip within given overall dimensions. Preferably the folds are such that they afford gaps between themselves which are in communication with the peripheral gap provided between the hood and the surounding material of the pump.

In a preferred construction, the pump comprises a vertical tubular body, within which is an upstanding central vapor-tube carrying a hood formed by a plurality of little hoods side by side all round it, with gaps between them, and each communicating with the central vapor-tube by ports passing therethrough.

The following is a description by way of example of one construction of pump in accordance with the invention:

In the accompanying drawing:

Figure 1 is a vertical section through the pump, and

Figure 2 is a horizontal section in the line 2—2 of Figure 1.

The pump body comprises a stout vertical metal tube 11 which is provided with a flange 12 at the upper end for attachment to the chamber which is to be evacuated. The tube has a closure 13 at its lower end on the under side of which is secured an electric heating element 14 clamped in place by a plate 15 and nut 16. The lower end of the tube 11 and the heating element 14 are enclosed within a base portion 17 of the pump which is formed from sheet metal and constitutes a heating chamber which conserves and distributes the heat from the element 14, around the tube 11. The upper portion 18 of the tube is turned down thin and is covered with an outer tube 19 which is sealed to it at each end and forms a water cooling jacket which is provided with an inlet and outlet (not shown in the drawing).

Within the lower end of the tube 11 there is an evaporating vessel 20 for apiezo oil. The evaporating vessel 20 is securely united to a vapor-tube 21 which extends upwardly from it concentrically with the pump body into the upper portion which is surrounded with the water jacket 19. Within the vapor-tube 21 there

is an inner vapor-tube 22 of smaller diameter which extends out of the evaporating vessel 20 at the bottom upwardly through the outer vapor-tube 21 into the upper part of the water-jacketed space.

The outer vapor-tube 21, just below the level of the water jacket, is drilled with a number of sets of holes 23 arranged in groups of three, one above another, at intervals all around its periphery. Each group of holes is covered by a little hood 24. Each such little hood consists of two triangular side portions and a narrow tapered central portion which touches the centre tube at its upper end and extends outwardly and downwardly in an inclined direction until it nearly reaches the tubular wall 18 of the apparatus, but leaves a small gap 25 between its lower lip and the outer tube. The little hoods 24 are arranged side by side all round the vapor-tube with narrow gaps 26 between them approximately equal in size to the width of the gaps 25 between the lower edges of the hoods and the inner wall 18 of the pump body. Thus oil vapors, which are formed in the outer part of the vaporising vessel 20, rise through the vapor-tube 21, issue through the ports 23 in the wall thereof into the spaces within the little hoods 24 and then are deflected downwardly past the lips formed by the lower edges of the little hoods. They entrain gases which diffuse into them from above, not only the gases which pass through the gaps 25 of the inclined portions of the hoods 24 but also gases which pass down through the gaps 26 between hood and hood. This greatly increases the effective length of the diffusion lips and the efficiency of the pump.

Below the hood thus formed there is a lateral outlet 28 to a vacuum pump which may for example be of the type described in U.S. Specification No. 569,005, dated March 2, 1956.

The vapor-tube 21 extends up above the subdivided or folded hood consisting of the parts 24, as just described and at its upper end carries an enlarged top 29 somewhat like the top of the funnel of a locomotive. This top 29 is located within and spaced slightly from an intermediate hood 30 which is a plain conical hood and which is concentrically fitted to and carried by the top part of vapor tube 22. The top 29 is provided with a central circular opening 51 through which the vapor tube 22 passes. The diameter of this opening 51 is greater than the outer diameter of the vapor-tube 22 so that there is an annular port 52 connecting the interior of the top 29 with the under side of the hood 30. Further vapor issues from the vapor-tube 21 through the annular port 52 into the hood 30 and thence downwardly to afford an additional stage of pumping action as indicated by arrow 31. The inner vapor-tube 22 is extended upwardly as shown at 33 and terminates within a topmost hood 34. At its upper end the vapor-tube 22 has a central port 53 which places the interior of the vapor-tube 22 into communication with the underside of the hood 34. The upper hood 34 is smaller and more widely spaced from the pump casing and affords a preliminary impulse stage and diffusion lip for the gases which are to be evacuated. A transverse disc 35 is mounted above the uppermost hood and is spaced by a small gap from the surrounding pump body. Within the topmost hood is an internal screw-threaded lug and the whole assembly of hoods and vaporising chamber is held down on to the closure at the bottom of the pump body by a central screwed rod 36.

If desired, not only the lowermost hood 24 can be sub-divided by folds as above described but also the intermediate or uppermost hoods 30 and 34 can be so sub-divided if desired.

I claim:

1. A diffusion pump comprising in combination an upstanding tubular body, a vapor tube centrally located within the body, means at the bottom of the vapor tube for producing an upward stream of vapor therein, a hood carried upon the vapor tube constituted by an assembly of little hoods side by side around the vapor-tube, with narrow parallel gaps between them, each hood communicating with the central vapor tube by ports passing through said tube, the outer edges of the little hoods being parallel with the inner wall of the tubular body and spaced therefrom by gaps equal in width to the gaps between the hoods, an inlet to the body at the top thereof, an outlet therefrom below the hood, and means adjacent the upper end of said vapor-tube for substantially obstructing the upward flow of vapor therefrom.

2. A diffusion pump as claimed in claim 1, wherein the said means for producing an upward stream of vapor comprises an evaporating vessel in the lower end of the body, and an electrical heating element in heat transfer relationship with said evaporating vessel.

3. A diffusion pump as claimed in claim 1 further comprising a second hood carried by the vapor-tube at a higher level than the other hood.

4. A diffusion pump as claimed in claim 2, further comprising an inner vapor-tube within the vapor-tube and a further hood, the lower end of said inner vapor-tube being received within said evaporating vessel and the upper end of the inner vapor-tube extending upwardly into said further hood.

5. A diffusion pump as claimed in claim 1, further comprising a hollow base and a heating element within said hollow base, said hollow base encasing the lower end of the tubular body and being shaped to conserve and distribute the heat from the heating element.

6. A diffusion pump comprising in combination an upstanding tubular body, a first vapor-tube centrally located within the body, an inner vapor-tube centrally located within said first vapor-tube, means at the bottom of said vapor-tubes for producing an upward stream of vapor therein, ports passing through the first vapor-tube intermediate its length, a first hood carried by the first vapor-tube and being constituted by an assembly of little hoods side by side around the vapor-tube with narrow parallel gaps therebetween, each hood communicating with the interior of the first vapor-tube through the ports, the outer edges of the little hoods being parallel wih the inner wall of the tubular body and spaced therefrom by a gap equal in width to the gaps between the hoods, an intermediate hood carried by said inner vapor-tube intermediate its length, said first vapor-tube terminating within said intermediate hood and in communication therewith through an opening in said first vapor-tube, an upper hood, the upper end of said inner vapor-tube terminating within said upper hood, said upper hood being in communication with the interior of said inner vapor-tube through a port in the inner vapor-tube, an inlet to said tubular body at the top thereof and the outlet from said tubular body below said first hood.

7. A diffusion pump comprising in combination a tubular body, a vapor tube centrally located within the body, means at the bottom of the vapor tube for producing an upward stream of vapor therein, ports in the vapor-tube, hood means surrounding the vapor tube and in communication with the interior thereof through said ports, said hood means comprising a downwardly sloping exterior wall divided by a series of inwardly folded walls, the lower edges of the divided exterior wall being spaced by a gap from the interior of the tubular body and the inwardly folded walls being separated from one another by gaps of closely comparable width to the gap between the exterior wall and the body, and means adjacent the upper end of said vapor tube for substantially obstructing the upward flow of vapor therefrom.

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