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VACUUM PUMP

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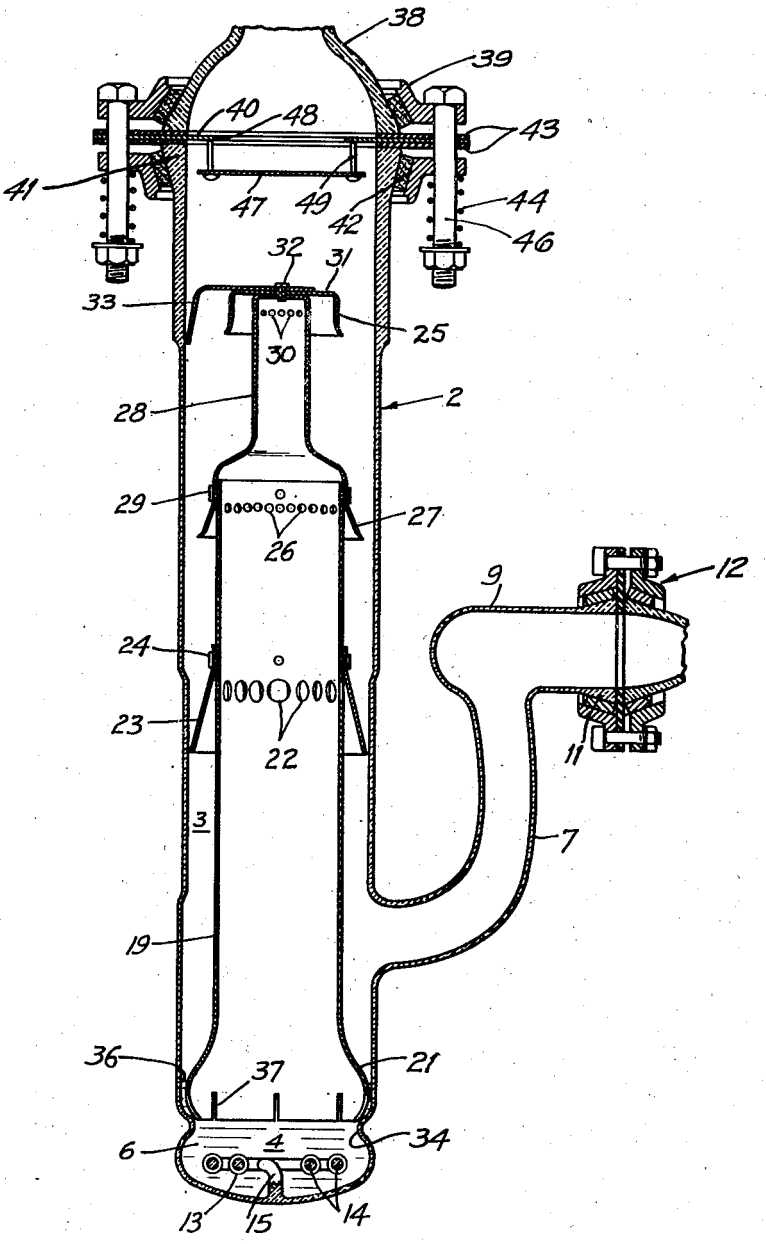

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VACUUM PUMP

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10 Claims. (Cl. 230—101)

My invention relates to a vacuum pump of the oil diffusion type.

It is among the objects of my invention to provide a simplified pump structure adapted to produce an exceptionally high vacuum with greater pumping speed and improved efficiency.

The invention possesses other objects and features of advantage, some of which, with the foregoing, will be set forth in the following description of my invention. It is to be understood that I do not limit myself to this disclosure of species of my invention as I may adopt variant embodiments thereof within the scope of the claims.

Referring to the drawing, the single figure is a vertical sectional view of the pump including the baffle.

In terms of broad inclusion my diffusion pump comprises a tubular casing providing an upper pump chamber and a lower boiler chamber for the working fluid or oil. A vapor chimney is disposed in the pump chamber and is provided with a plurality of umbrella-type jets; an improved arrangement and spacing of the jet hoods with respect to the casing being included. Improvements are also incorporated in the boiler structure, and in the sealing means at the base of the vapor chimney. Further improvements are provided in the vacuum connections to and baffle arrangement for the pump.

In greater detail, and referring to the drawing, the diffusion pump embodying my invention comprises a tubular casing 2 preferably of glass, providing an upper pump chamber 3 and a lower boiler chamber 4 for the pump fluid or oil 6. A side arm or duct 7 is sealed to the casing adjacent the lower portions of pump chamber 3 for connection with a suitable backing pump. A mechanical pump capable of reducing the fore pressure to say about .5 mm. or less may be used. To facilitate making connection with the backing pump, the side arm 7 is preferably bent upwardly and is provided with an outwardly extending elbow 9 having a flared enlargement 11 for receiving a flanged coupling 12.

Oil 6 in the boiler chamber is heated by a resistance coil 13 held by a spiral glass core 14 having downturned ends 15 sealed to the bottom of the casing. This core holds the heater in fixed position spaced above the bottom. A pair of leads 16 are sealed to tubulations 17 on the sides of the boiler, to which leads the ends of the heater coil are connected. Glass beads 18 on the wire end leading to the center of the coil serve to insulate the parts.

The internal assembly of the pump is of metal, such as spun aluminum, and includes a vapor chimney carrying a plurality of say three umbrella-type jets. From the structural standpoint the unit comprises a main chimney section 19 of substantially uniform diameter having an enlarged base 21. Orifices 22 of the lower jet are formed in the upper half of main chimney section 19, and flaring hood 23 of this jet is supported by screws 24 threaded into the chimney.

Orifices 26 of the intermediate jet are formed adjacent the top of the main chimney section, and flaring hood 27 of this jet is formed integrally with the reduced upper chimney section 28, the parts being secured by screws 29 threaded into the main chimney section. Orifices 30 of the upper jet are formed adjacent the top of reduced chimney section 28. Flaring hood 25 of this jet is formed as a flange on cap 31 secured over the top by a screw 32. The internal pump assembly is centered by a three-armed spider 33 also held by screw 32.

Enlarged base 21 is preferably bell-shaped and seats on an annular shoulder 34 provided by a reduced neck formed in the casing between boiler chamber 4 and pump chamber 3. The lower portions of the bell are preferably curved inwardly of the shoulder so that these parts form a snug fitting seat. This arrangement also centers the unit and supports it above the bottom of the boiler. Oil condensing on the inner walls of the casing flows downwardly and collects in a ring 36 above shoulder 34, thereby forming a liquid seal at this joint. Suitable slots 37 in base 21 provide drain openings for returning excess oil from the pump chamber to the boiler, these openings being sized to maintain the desired amount of oil above the shoulder to preserve the liquid seal.

Connection with a manifold 38 communicating with the bulb to be evacuated is made by a coupling arrangement 39 which also preferably includes a baffle 40. The upper end of casing 2 has a flared enlargement 41, as has manifold 38, for receiving the halves of the coupling and associated gaskets 42. Main baffle 40 and gasket rings 43 are clamped between the coupling sections, excessive pressure on the gaskets being avoided and a resilient pressure maintained by springs 44 on coupling bolts 46. A secondary baffle plate 47 is mounted below aperture 48 by spacers 49. The underslung baffle plate 47 shields the orifice and directs the incoming molecules laterally into the vapor stream issuing from the upper jet, which arrangement retards back-

streaming into the manifold without unduly limiting admittance to the pump.

In accordance with the usual operation of pumps of this kind, oil is evaporated in the boiler, passes as a vapor up the chimney, discharges from the orifices, and then is directed downwardly by the hoods of the umbrella jets. Gas molecules from the vessel being evacuated are entrained in the downwardly directed vapor streams and carried toward duct 7 leading to the backing pump, the oil vapor condensing out along the walls of the casing.

I have found it desirable to make the umbrella jets successively smaller in size as the jets approach the top of the chimney. This decrease applies to both the size of the orifices and to the deflecting hoods. As shown in the lower rim diameter of hood 27 is smaller than that of hood 23; likewise the rim diameter of hood 25 is smaller than that of hood 27. Consequently the clearance between the rims and the casing increases from jet to jet upwardly along the pump. I also prefer to restrict the diameter of the casing somewhat in the region surrounding the lower jet, this restriction extending from about the upper end of hood 23 to the point where side arm 7 is connected. The cross-sectional area of the pumping chamber is thus greater in the vicinity of the upper jets than at the lower jet.

With my pump, using a good grade of pump oil, it is possible to produce at high pumping speeds a low value of pressure, say of the order of 10^{-7} mm. Hg.

I claim:

1. A diffusion pump comprising a tubular casing providing a lower boiler chamber and an upper pump chamber, said casing having a shoulder therein between said chambers, and a vapor chimney in the pump chamber having its lower end seated on said shoulder, said end of the chimney being provided with an opening communicating between the boiler chamber and the pump chamber portions external the chimney.

2. A diffusion pump comprising a tubular casing providing a lower boiler chamber and an upper pump chamber, said casing having a shoulder therein between said chambers, and a vapor chimney in the pump chamber having a bell-shaped lower end seated on said shoulder, said end of the chimney being slotted to provide an opening communicating between the boiler chamber and the pump chamber portions external the chimney.

3. An oil diffusion pump comprising a tubular casing providing a lower boiler chamber for said oil and an upper pump chamber, said casing having an annular shoulder therein between said chambers, and a vapor chimney in the pump chamber having a lower end shaped complementary to and seated on said shoulder, whereby oil condensing on the casing collects to form a liquid seal at said shoulder, and a drain passage arranged to return excess oil to the boiler chamber.

4. A diffusion pump comprising a glass casing, a vapor chimney in the casing, a duct sealed to a side of the casing adjacent the lower portions of said chimney, said duct having an enlarged outer end, and a sectional coupling having one half engaging said enlarged end.

5. A diffusion pump comprising a casing having an enlarged upper end, a vapor chimney in the casing, a sectional coupling having one half engaging said end, means clamping the coupling sections together, and a baffle plate above the chimney and interposed between said sections.

6. A diffusion pump comprising a casing having an enlarged upper end, a vapor chimney in the casing, a sectional coupling having one half engaging said end, a gasket interposed between said sections, bolts clamping the coupling sections together, and springs on said bolts for maintaining a resilient pressure on the gasket.

7. A vapor chimney for a diffusion pump comprising a main section having a bell-shaped lower end, an annular row of orifices in said section arranged intermediate the ends thereof, a hood on the section overlying said orifices, a second annular row of orifices in said section arranged adjacent the upper end thereof, a reduced upper chimney section having an enlarged lower end providing a hood for said second row of orifices, said last mentioned section having substantially straight vertical side walls extending upwardly from its enlarged end, another annular row of orifices in said reduced section adjacent the upper end thereof, and a hood on the reduced section overlying the last mentioned orifices.

8. A diffusion pump comprising a casing, a vapor chimney in the casing, a duct registering with the upper end of the casing, a baffle above the chimney and interposed between said duct and casing, and means clamping the duct and baffle and casing together.

9. A diffusion pump comprising a casing providing an upper pump chamber and a lower boiler chamber for holding a pumping fluid, a vapor chimney unit loosely disposed in the pump chamber with its lower end communicating with the boiler chamber, said chimney unit having a spacer adjacent the upper end to hold it centered in the casing, said casing having an opening at the top of greater width than said chimney unit whereby the latter is insertable through said opening, a duct communicating with the opening at the top of said casing, means clamping the duct and casing together, and a heating element supported on the casing for boiling the fluid in said boiler chamber.

10. A diffusion pump comprising a casing providing an upper pump chamber and a lower boiler chamber for holding a pumping fluid, a vapor chimney unit loosely disposed in the pump chamber with its lower end communicating with the boiler chamber, said chimney unit having a spacer adjacent the upper end to hold it centered in the casing, said casing having an opening at the top of greater width than said chimney unit whereby the latter is insertable through said opening, a duct communicating with the opening at the top of said casing, a baffle interposed between the duct and casing, means clamping the duct and baffle and casing together, and a heating element supported on the casing for boiling the fluid in said boiler chamber.

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