Feb. 3, 1931. O. SEITZ 1,791,105

MULTISTAGE HIGH VACUUM DIFFUSION PUMP

Filed July 9, 1926

Fig. 1

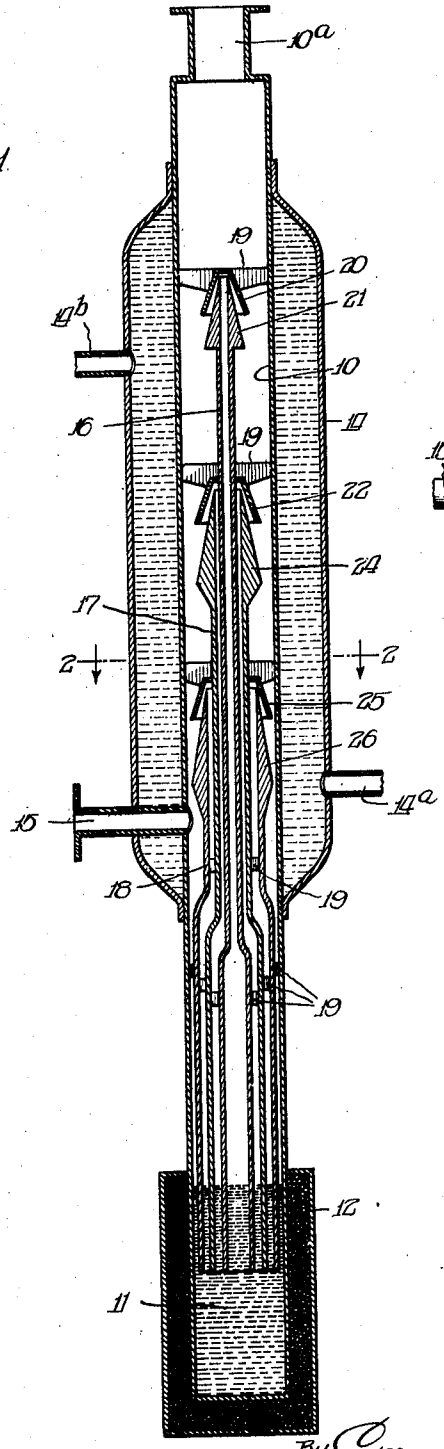
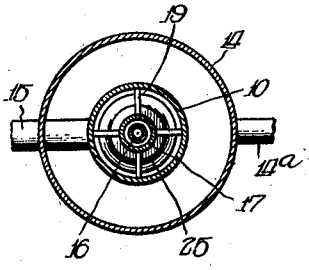


Fig. 2.



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UNITED STATES PATENT OFFICE

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MULTISTAGE HIGH-VACUUM DIFFUSION PUMP

Application filed July 9, 1926, Serial No. 121,339, and in Germany August 10, 1925.

This invention relates to improvements in the construction of multi-stage high vacuum pumps which operate on the diffusion principle. It has to do particularly with the construction of pumps suitable for industrial use, as distinguished from laboratory use.

The general object of the invention is the provision of a construction for such pumps which may be built entirely of metal, which is adapted to withstand the relatively trying usage incident to operation in industrial plants without particularly expert supervision, and which is particularly qualified against functional and structural disorders.

One of the more specific objects of the invention is the provision of a construction for metallic high vacuum pumps containing a plurality of stages, in which the necessity for internal seals or packing between internal parts, is obviated.

Another object is the provision of a construction for such pumps whereby desirable cooling of parts subjected to hot vapors is accomplished.

A further object is the provision of a construction which is self-contained and compact.

Another general object is the provision of a construction which will be certain and reliable in operation.

Other and further objects will be pointed out or indicated hereinafter, or apparent to one skilled in the art upon an understanding of the invention.

For the purpose of this application I disclose herein one form of structure embodying the invention, but it is to be understood that the same is presented for illustration only, and that the claims are not to be construed as limited to the particular form shown.

In the drawing forming a part of the specification,

Fig. 1 represents a sectional elevation of a three stage high vacuum diffusion pump, and

Fig. 2 represents a cross section on substantially line 2—2 of Fig. 1.

The nature of the invention will be ascertained by reference to this illustrative construction, wherein the reference numeral 10 designates a chamber tube adapted for connection at its end 10^a with the vessel or chamber to be evacuated and communicating at its other end with the boiler or generator 11 adapted to contain mercury. With the generator is associated a heating element 12 adapted to heat the generator and the contained mercury to a degree where the latter will be vaporized. Surrounding a portion of the tube 10 is a water jacket 14 through which cooling liquid may be circulated from an inlet 14^a to an outlet 14^b. An exhaust line or discharge tube 15 leads from the tube 10 for connection to a preliminary or lead pump or other arrangement.

Within the tube 10 are mounted in concentric or telescoped relationship the nozzle tubes 16, 17 and 18, the lower ends of which are in separate communication with the generator chamber, dipping into the mercury in the generator, so that mercury vapor may be supplied to them severally from the latter. These nozzle tubes may be supported in the desired relationship and connected to the tube 10 by supporting members 19 so arranged as to permit unobstructed flow of vapor through the tubes. It is desirable that the evaporation area between the tubes 10 and 18 be less than that exposed between the nozzle tubes 18 and 17 and 17 and 16. At their upper ends the respective nozzle tubes are provided with the nozzle portions 20 and 21, 22 and 24, 25 and 26, arranged to emit vapor from the respective tubes in a downward direction in tube 10. The arrangement thus provides three stages in the pump chamber, the first stage of which, produced by the action of the vapor emitted from the nozzle tube 16, operates purely on the diffusion principle. The arrangement of the nozzle portions 22, 24 of the second stage, and of the nozzle portions 25, 26 of the third stage, is such that the vapor from the tubes 17 and 18 enters the expanding nozzle portions at its maximum pressure, in order that the velocity at the outlet may be as high as possible. The nozzle portions 24 and 26 form, in association with the sides of the tube 10, compression throats

into which the vapor from the tubes 17 and 18 is ejected at high velocity.

In operation, the action of the nozzles draws the air or gas from the evacuated chamber in through the end 10^a of the tube 10, and the mercury vapor from the tube 16 is diffused in this gas. By the action of the jets emitted from the nozzles of tubes 17 and 18 the air is drawn into the compression throats by entrainment, and the mixture of mercury vapor and air cooled by contact with the walls of tube 10 which are subjected externally to the cooling influence of the liquid in the water jacket. The gas is discharged through the line 15 to the preliminary vacuum pump, and the mercury which is condensed in the tube 10 returns to the generator 11.

What I claim is:

1. A multi-stage vacuum pump comprising, in combination, a tube having an inlet end portion for connection to a vessel to be evacuated, a plurality of nozzle tubes each open at both ends and arranged in telescoped relationship within said tube, elements supported in spaced relation with respect to certain of the ends of said nozzle tubes and cooperating therewith to provide nozzles directed away from said inlet end portion of said first-named tube, and a generator common with respect to and operable to provide for the supply of operating vapor to the nozzle tubes severally at their other ends.

2. In a multi-stage vacuum pump, in combination, a chamber tube having an air inlet and an air outlet, a diffusion nozzle in the chamber tube, an ejecting nozzle between the diffusion open-ended nozzle and the air outlet, nozzle tubes disposed in telescopic relationship with respect to each other, the open ends of said nozzle tubes forming part of said nozzles, and a vapor generator having independent communication with each of said nozzle tubes and being operable by virtue of such communication to provide for the supply of operating vapor to the same separately.

3. In a vacuum pump, a vapor generator, a casing communicating at one end thereof with said generator, and a plurality of spaced telescopically-arranged tubular members disposed within said casing, the respective ends of said members adjacent said casing end communicating with said generator, the other ends of said members being provided with nozzles, the outermost of said members being spaced from said casing and forming therewith a common condensate return passage from each of said nozzles to said generator.

4. In a vacuum pump, a plurality of spaced open-ended telescopically-arranged tubular members, a vapor generator communicating with adjacent ends of said members, and dish-shaped nozzle portions disposed in spaced relation with respect to each other and arranged about certain of said members, the other ends of certain of said members providing complementary nozzle portions and cooperating with said first-named portions to form nozzles.

5. In a vacuum pump, a vertically disposed elongated casing, a vapor generator communicating with the lower end of said casing, spaced open-ended telescopically-arranged tubular members supported in said casing and each communicating at their respective lower ends with said generator, the upper end of each of said members being provided with a nozzle and extending beyond the upper end of the outer adjacent member, the outermost of said members being spaced from said casing and forming therewith a common condensate return passage from said nozles to said generator.

6. In a vacuum pump, means providing a chamber having a fluid-inlet opening and a fluid-outlet opening, an open-ended tubular member disposed in said chamber with its open end directed toward said fluid-inlet opening, a second open-ended tubular member disposed within and spaced from the first with its open end extending beyond such end of the first member, an element associated and cooperating with the open end of said second member to provide a nozzle directed away from said fluid-inlet opening, a second element disposed about the extended end portion of said second member and cooperating with the open end of said first-named member to provide a second nozzle operable to supplement the pumping action of said first-named nozzle, and means operable to provide for the supply of operating vapor to said members.

In testimony whereof I have hereunto subscribed my name at Zurich, Switzerland, on the 11 day of June, A. D. 1926.

OSKAR SEITZ.