

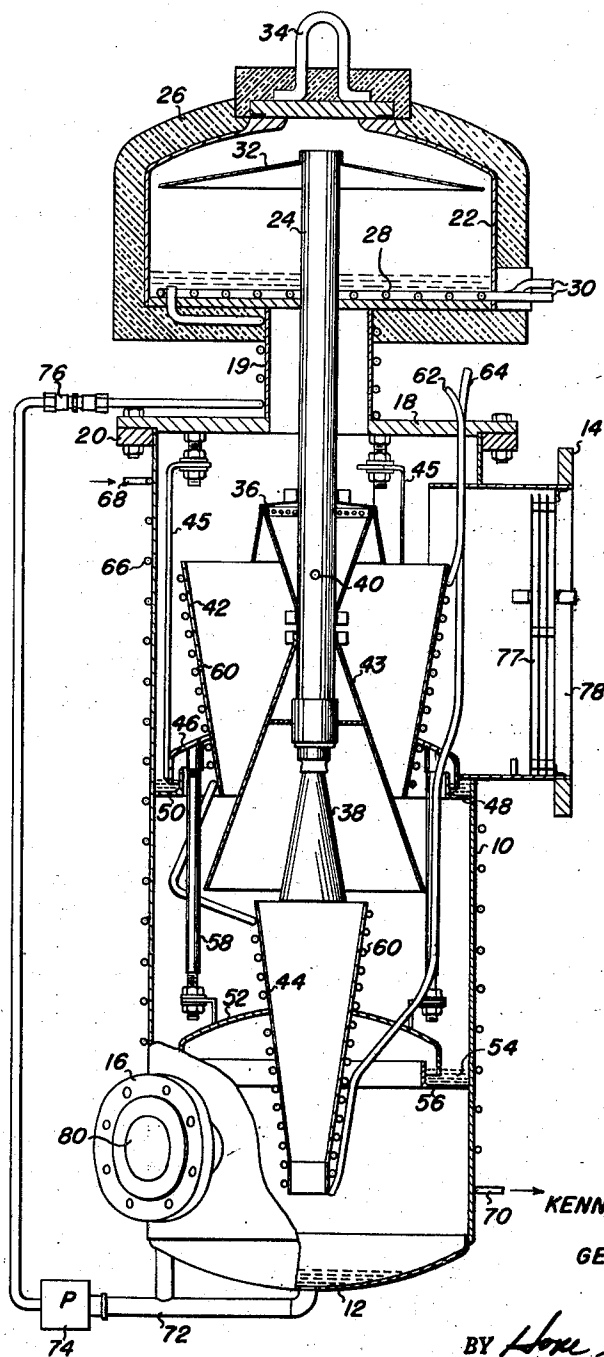
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OIL VAPOR PUMP

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OIL VAPOR PUMP

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This invention relates to a jet type oil vapor pump.

It is an object of this invention to provide simple, economical, and efficient constructions in oil vapor pumps. Another object is to provide for ready disassembly and reassembly of such pumps to facilitate cleaning. A further object is to provide an oil vapor pump in which the boiler is located at the top of the pump. Another object is to provide an oil vapor pump in which the jet and diffuser assembly is integral with the top plate and removable therewith. A still further object is to provide an oil vapor pump in which the jet and diffuser assembly are easily accessible for cleaning. A further object is to provide an oil vapor pump of a character suitable for construction in large size and capacity. Other objects will appear hereinafter.

These and other objects are accomplished by this invention which, in a preferred embodiment, comprises a casing, a boiler above the top of the casing and attached thereto by a vapor tube leading through the top plate into the interior of the casing, a jet or jets attached to the vapor tube and a diffuser arranged to operate in conjunction with each jet, the entire vapor tube-jet-diffuser assembly being rigidly attached to, and depending from, the top plate of the pump. The manner in which the various objects are attained will be more apparent from the following description taken in conjunction with the accompanying drawing and appended claims.

In the accompanying drawing, the single figure is a partial sectional view of an apparatus embodying the present invention in a preferred form.

Referring to the figure, numeral 10 designates the pump casing. When the pump is in use, casing 10 is supported by a flange 14 on high-vacuum conduit 78, flange 14 being attached to a similar flange on the apparatus undergoing vacuation. The pump is further supported in use by flange 16 on conduit 80 as flange 16 is attached to a similar flange on the usual backing pump (not shown). The bottom of casing 10 consists of member 12 which is attached to casing 10 in a gas-tight manner. Member 12 may be welded to casing 10 or may be attached thereto by a flange arrangement. At the top of casing 10 top plate 18 forms a gas-tight connection with flange 20 of casing 10. Boiler 22 is located above casing 10 and is substantially concentric therewith. Boiler 22 is attached to top plate 18 by member 19. Vapor tube 24 passes from a point near the top of the interior of

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boiler 22 through the bottom of boiler 22 and through member 19 and top plate 18 to the interior of pump casing 10. Boiler 22 is lagged with insulating material 26 to prevent the loss of heat. The pump fluid in boiler 22 is heated by resistance element 28 which has leads 30 which may be connected to a source of current. Annular baffle 32 is attached to the top of vapor tube 24 and serves to minimize the entrainment of pump liquid with pump vapor during the operation of the pump. Member 34 is attached to the top of boiler 22 and serves as a convenient attachment for moving the pump or for lifting out the interior mechanism of the pump in the course of cleaning operations.

Vapor tube 24 is rigidly attached to the bottom of boiler 22. Jets 36 and 38 are attached to vapor tube 24, jet 36 being attached at a point near top plate 18 and jet 38 being attached at the terminus of vapor tube 24. The vapors which pass through jet 36 leave vapor tube 24 through aperture 40 and those which pass through jet 38 emerge from the bottom of vapor tube 24.

Diffusers 42 and 44 operate in conjunction with jets 36 and 38, respectively. Diffuser 42 is attached to annular skirt 46 which is connected to diffuser 44 in a gas-tight manner. Annular skirt 43 is attached to vapor tube 24 and operates in conjunction with diffuser 42 to guide the pump vapors during operation. Annular skirt 46 is held in position by strut means 45 extending downward from top plate 18. Circular angle member 48 is attached to casing 10 to form trough 50. Annular skirt 46 extends downward into trough 50 to form a fluid seal when the pump is placed in operation.

Diffuser 44 is held in position by annular skirt 52 in a manner similar to the arrangement of diffuser 42 and annular skirt 46. Annular skirt 52 extends downward into trough 54 formed by circular angle member 56 and this arrangement forms a fluid seal in a manner similar to the fluid seal formed by annular skirt 46 and trough 50. Annular skirt 52 is supported by struts 58 which extend downward from annular skirt 46. Troughs 50 and 54 are arranged in nesting order, the diameter of annular skirt 52 being less than the diameter across circular angle member 48 so that annular skirt 52 may be removed with top plate 18 without coming into contact with circular angle member 48. Diffusers 42 and 44 are cooled by liquid introduced into cooling coil 60 at opening 62 and which is withdrawn through opening 64. Casing 10 may also

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be cooled by liquid introduced into cooling coil 66 through opening 68 and withdrawn through opening 70. Condensed pump fluid collects at the bottom of the pump and is returned to the boiler through conduit 72 and pump 74. Conduit 72 includes union 76 which may be disconnected when the interior mechanism of the pump is removed from casing 10.

It may be seen that the jets, diffusers and annular skirts are all attached to top plate 18 which is in turn attached to lifting member 34 by means of member 19 and boiler 22. Thus, when it is necessary to clean out the interior of pump casing 10, it is only necessary to disconnect conduit 72 at union 76, release the flange bolts holding top plate 18 to flange 20, and hoist the entire boiler-vapor tube-top plate-jet-diffuser assembly in a single operation.

In operating the pump illustrated in the figure, flange 14 is connected to the apparatus which it is desired to evacuate and flange 16 is connected to a backing pump of suitable capacity. After the backing pump has been placed in operation, heating element 28 is turned on and pump fluid in boiler 22 begins to boil. Vapors pass around baffle 32 and down vapor tube 24 into casing 10. A portion of the vapors pass through aperture 40 and jet 36 where they entrain gases passing through high vacuum conduit 78. Baffles 77 in conduit 78 prevent the passage of condensable fluids between the distillation apparatus and pump. Some of the pump fluid vapors are condensed on diffuser 42 and follow on to annular skirt 52, from which they flow into trough 54. From trough 54 they eventually overflow and collect at the bottom of casing 10.

The vapors which have not passed through aperture 40 emerge from the bottom of vapor tube 24 and pass through jet 38. Here they entrain some of the gases previously entrained by vapors passing through jet 36 and which are now at a slightly higher pressure than they were at the time of entrainment by vapors from jet 36. Most of the pump fluid vapors are condensed on the cool walls of diffuser 44 and the non-condensable gases are drawn off by the backing pump connected to flange 16. Pump vapors which have not already condensed are condensed on the cool walls of casing 10.

Condensed pump fluid which has collected at the bottom of casing 10 is now drawn through conduit 72 by pump 74 and returned to boiler 22 to complete the cycle.

Member 19 is in metal-to-metal contact with the base of boiler 22 and quickly becomes hot by conduction when the pump is in operation. In order to utilize the heat in member 19 pump fluid return conduit 72 is run around member 19 and the returning pump fluid is thereby warmed. By thus heating the pump fluid before it enters the boiler the efficiency of the unit is increased.

During operation of the pump troughs 50 and 54 quickly fill up with condensed pump vapor which prevents vapors from backing up. These troughs act to isolate compartments and the construction disclosed by this invention achieves this isolation without resorting to costly machining operations. Thus the pump is simple, efficient and may be fabricated without high production cost.

For purposes of illustration, a two stage pump has been shown and described but the principles of the invention are equally applicable to a single stage pump or to multi-stage pumps having more than two stages.

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While the invention has been described in considerable detail with reference to certain preferred structures, procedures, and materials, it will be understood that modifications and variations therein may be effected without departing from the spirit and scope of the invention as it is defined by the appended claims.

What we claim is:

1. An oil vapor pump comprising in combination a vertical casing, gas-tight closure means at the top and bottom of said casing, an inlet port in said casing for gases being pumped, an outlet port in said casing spaced from said inlet port, boiler means generally vertically above said casing, means for heating said boiler means, a vapor tube leading from a point near the top of the interior of said boiler means through the top closure means to the interior of said casing, a nozzle connected to said vapor tube, a diffuser arranged to operate in conjunction with said nozzle, said diffuser being supported from said top closure means, means for cooling said diffuser, and pump and conduit means for returning fluid from the bottom of said casing to said boiler means.

2. An oil vapor pump comprising in combination a vertical casing, gas-tight closure means at the top and bottom of said casing, an inlet port in an upper zone of said casing, an outlet port in a lower zone of said casing, boiler means generally vertically above said casing, means for heating said boiler means, a vapor tube leading from a point near the top of the interior of said boiler means through the top closure means to the interior of said casing, a plurality of nozzles connected to said vapor tube, a diffuser for each nozzle, all of said diffusers being supported from said top closure means, means for cooling said diffusers and pump and conduit means for returning pump fluid from the bottom of said casing to said boiler means.

3. An oil vapor pump comprising in combination a vertical casing, gas-tight closure means at the top and bottom of said casing, an inlet port in an upper zone of said casing, an outlet port in a lower zone of said casing, boiler means substantially directly above said casing, means for heating said boiler means, a vapor tube leading from a point near the top of the interior of said boiler means through the top closure means to the interior of said casing, a nozzle connected to said vapor tube, a diffuser placed to operate in conjunction with said nozzle, said diffuser being supported from said top closure means, means for cooling said diffuser, said nozzle and said diffuser being rigidly attached to said vapor tube and said top closure means respectively so that removal of said top closure means and said vapor tube effects also the removal of said nozzle and said diffuser, and pump and conduit means for returning fluid from the bottom of said casing to said boiler means.

4. An oil vapor pump comprising in combination a vertical casing, gas-tight closure means at the top and bottom of said casing, an inlet port in an upper portion of said casing, an outlet port in a lower portion of said casing, boiler means substantially directly above said casing, means for heating said boiler means, a vapor tube leading from a point near the top of the interior of said boiler means through the top closure means to the interior of said casing, a generally cylindrical metal member encircling said vapor tube and extending between and being secured to said boiler means and said top closure means, nozzle

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means connected to said vapor tube, diffuser means placed to operate in conjunction with said nozzle means, said diffuser means being supported from said top closure means, means for cooling said diffuser means, and conduit and pumping means for returning fluid from the bottom of said casing to said boiler means, said conduit means making contact with said metal member attached to said boiler means in order to utilize waste heat from said boiler means to raise the temperature of pump fluid which is about to enter the boiler.

5. A multi-stage oil vapor pump comprising in combination a cylindrical pump casing provided with top and base plates, a boiler placed substantially directly above the top of said pump casing and connected thereto by means of a vapor tube leading from a point near the top of the interior of said boiler through said boiler and the top plate of said casing to the interior of said casing, means for heating said boiler, a plurality of jets attached to said vapor tube, a diffuser arranged in conjunction with each jet, each said diffuser being attached to, and supported by, the top plate, means for cooling the diffusers, an annular trough on the interior of said casing opposite each diffuser, the distance between walls of said annular troughs decreasing progressively as distance from the bottom of said casing increases, an annular skirt integral with each diffuser and extending into the annular trough opposite the diffuser, low pressure connection means near the top of said casing, a fore-pump connection means near the bottom of said casing, a fluid-return conduit leading from the bottom of said casing to said boiler, and pumping means in the line of said fluid-return conduit.

6. An oil vapor pump comprising casing means defining a generally vertical pump chamber, an upper portion of said casing means being removable and forming a closure member for said chamber, spaced-apart inlet and outlet means for said chamber, vapor diffusion pumping means disposed in said chamber, boiler means mounted on said closure member and being disposed generally vertically above said chamber, vapor channeling means extending from said boiler means downwardly through an upper portion of said chamber and communicating with said diffusion pumping means, said vapor channeling means being arranged to channel vapors from said boiler means to said diffusion pumping means, and fluid return means connecting the bottom of said chamber with said boiler means and being constructed and arranged for returning pump fluid from the bottom of said chamber to said boiler means.

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7. An oil vapor pump comprising in combination a pump casing defining a generally vertical pump chamber, an upper portion of said pump casing being removable and constituting a removable closure member, inlet means communicating with an upper portion of said chamber, outlet means communicating with a lower portion of said chamber, pumping means disposed in said chamber and including nozzle and diffuser means arranged in mutually cooperating relation, boiler means disposed generally vertically above said chamber and including boiler heating means, vapor channeling means extending from said boiler means downwardly through said closure member to said nozzle means and being in communication with said boiler means and said nozzle means, and fluid return means, including fluid pumping means, connecting the bottom of said chamber with said boiler means and being constructed and arranged for returning pump fluid from the bottom of said chamber to said boiler means.

8. An oil vapor pump comprising in combination a pump casing defining a generally vertical pump chamber, said casing including a removable closure member at the top of said chamber, an inlet port in an upper portion of said casing, an outlet port in a lower portion of said casing, pumping means disposed in said chamber and including nozzle and diffuser means arranged in mutually cooperating relation, boiler means disposed substantially directly above said chamber and including boiler heating means, vapor conduit means in communication with said boiler means and extending downwardly from said boiler means through said closure member into communication with said nozzle means, means for mounting said boiler means and vapor conduit means and pumping means as a unit with said closure member for removal therewith, and fluid return means connecting the bottom of said chamber with said boiler means and being constructed and arranged for returning pump fluid from said chamber to said boiler means.

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