June 3, 1952 J. L. ALLEN 2,599,149

COMPRESSOR APPARATUS

Filed Dec. 10, 1949 2 SHEETS—SHEET 1

Fig. 1.

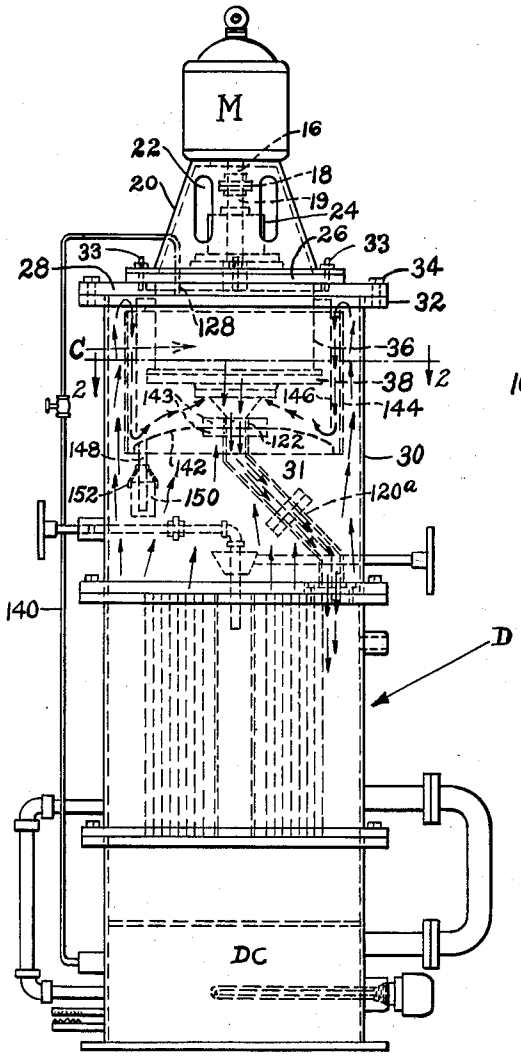

Fig. 2.

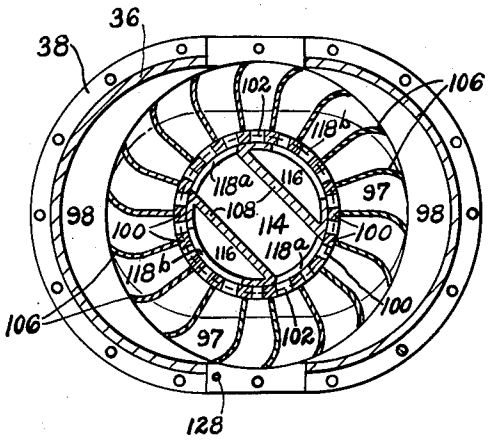

Fig. 3.

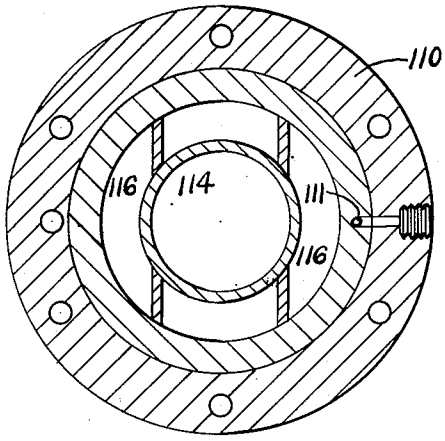

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Fig. 4.

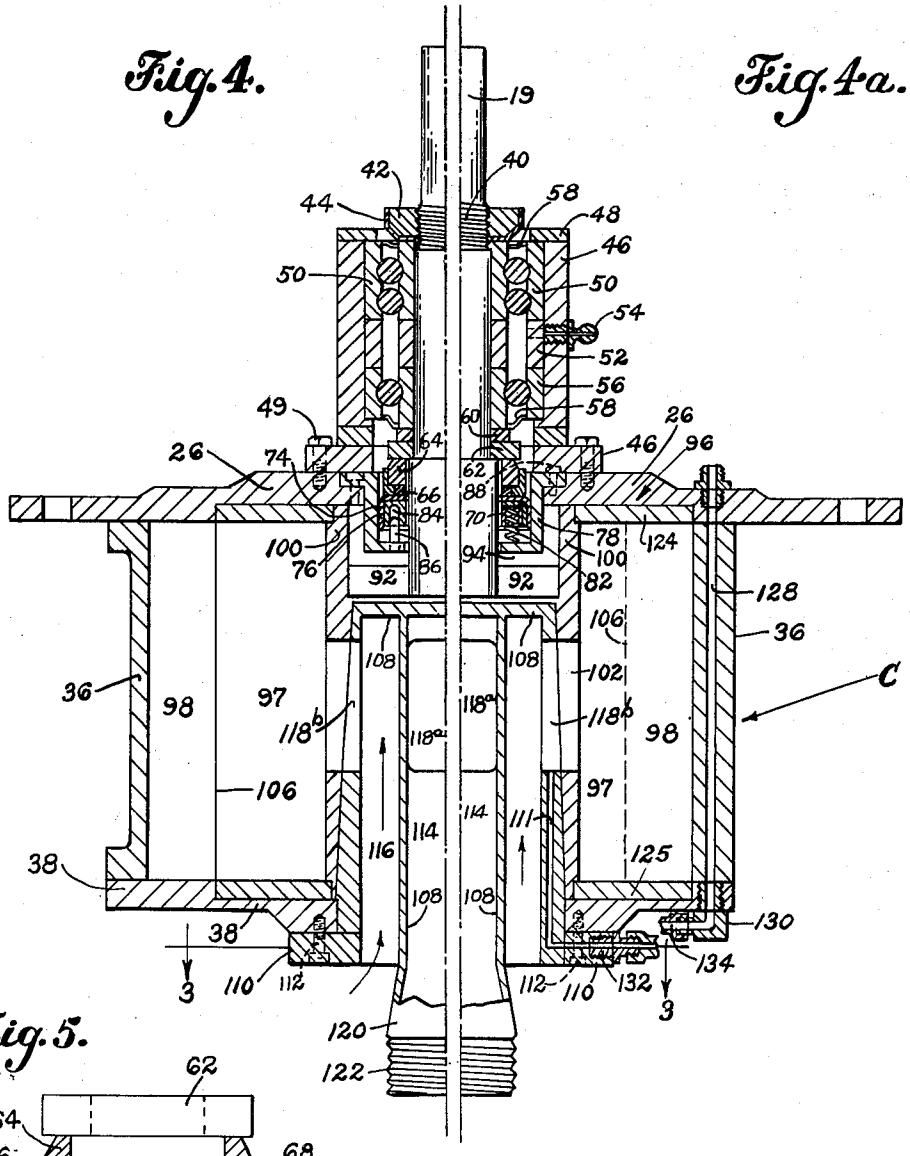
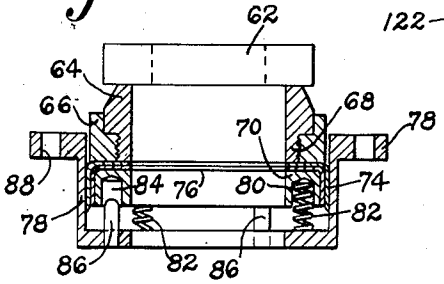


Fig. 4a.

Fig. 5.



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COMPRESSOR APPARATUS

John L. Allen, Boston, Mass.

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5 Claims. (Cl. 230—79)

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This invention relates to compressor apparatus.

One object of my invention is to so construct a steam compressor, such as can be used in distilling liquids, that it is water sealed and within a steam vapor space, thus saving space and eliminating the usual loss of heat from having the steam compressor outside said steam vapor space.

Another object is to so construct a rotary steam vapor compressor that it is provided with a distributor head in cooperation with a rotor whereby steam vapor is admitted, compressed and discharged while the rotor repeatedly circulates the same water within it, never discharging it.

A further object is to provide apparatus that eliminates the usual compression chamber and suction chamber required in water circulating distilling apparatus that discharges water.

The foregoing and other objects which will appear as the nature of the invention is better understood, may be accomplished by a construction, combination and operative arrangement of parts such as is disclosed by the drawings. The nature of the invention is such as to render it susceptible to various changes and modifications, and, therefore, I am not to be limited to the construction disclosed by the drawings nor to the particular parts described in the specification; but am entitled to all such changes therefrom as fall within the scope of my claims.

In the drawings:

Figure 1 is a front elevational view of my compressor apparatus shown connected to liquid distilling means.

Figure 2 is an enlarged, horizontal, sectional view taken on the line 2—2 of Figure 1.

Figure 3 is a sectional view taken on the line 3—3 of Figure 4.

Figure 4 is a vertical sectional view of the left side of the compressor portion of the apparatus.

Figure 4a is substantially a vertical sectional view of the right side of the compressor portion of the apparatus as viewed from the left.

Figure 5 is a longitudinal, sectional view through the shaft sealing assembly.

As illustrated, there is the usual motor M having a shaft 16 and a coupling 18 connected to a drive shaft 19. A skirt 20 is attached to said motor M and it has sight holes 22. A bearing housing 24 for said shaft 19 is attached to a cover plate 26 for a compressor casing 36, later described. Said cover plate 26 is attached to a collar 28 forming part of a tight, vapor housing 30, enclosing a vapor space 31, and having

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a flange 32. Bolts 33 hold said skirt 20 to said housing collar 28, and bolts 34 hold said flange 32 to said collar 28.

Within said vapor housing 30 is the compressor C having an outer casing 36 which is oval-shaped in top plan view and has a bottom cover plate 38.

Said shaft 19 has screw threads 40 on which a nut 42 screw-threadedly fits with a lock washer 44 on and between it and a ball bearing housing 46. Said housing 46 is held to said cover plate 26 by set screws 49 and has a top cover plate 48 and the usual bearing assembly 50 is retained within said housing 46. There is a brass spacer ring 52 next to said bearing assembly 50 equipped with an Alemite fitting 54, and there is another bearing assembly 56 next to said ring 52. At the ends of said bearing assemblies 50 and 56 are grease retaining rings 58 and at the end of said bearing assembly 56 is a brass spacer ring 60 that is sealed by a carboloy rotor ring 62. Next there is a carbon ring seal 64 bearing against a seal retainer ring 66 that is threaded as at 68. Next is an assembly ring 70 that has a sealing washer 74 of a material such as polytetrafluoroethylene mounted on a brass ring 76. This sealing assembly has an enclosure or outer casing 78 that bears against said compressor cover plate 26 and said ball bearing housing 46. Said assembly ring 70 has holes 80 therein into which coil springs 82 fit and bear against said outer casing 78 and it also has dowel holes 84 into which dowel pins 86 fit and extend into said outer casing 78 to prevent rotation of said assembly ring 70 in said casing 78. Screws 88 countersunk in said sealing assembly casing 78 hold it to said compressor cover plate 26.

A collar 92 forms a part of said shaft 19 beyond said casing 78 there being a space 94 between the collar 92 and casing 78 to permit rotation of said shaft.

A rotor 96 is welded to said shaft collar 92 and is rotated by said shaft 19. It operates in a space 97 enclosed by said compressor casing 36, which, due to its oblong or oval shape, in top plan view, varies in width. The outer portion of this space 97 serves as a water seal space 98. At the narrower portions (in top plan view) of said space 97 vapor is drawn into the compressor C at the completion of the compression stroke, which stroke discharges steam from the compressor through a chamber 114 later described. At the wider portions (in top plan view) of said space 97 vapor enters the compressor C during all of the suction stroke, which stroke draws steam

vapor thereinto through chambers 116 later described.

Said rotor has a core or body portion 100 the vertical portion of which flares outwardly and downwardly, in which a plurality of ports 102 are provided, there being one between each of the impeller blades 106 extending from said body 100.

A distributor plug 108 is fixedly set in the interior of said rotor body 100 around which the rotor vertically revolves. It flares outwardly and downwardly to conform to the flare of said rotor body 100, thus insuring a tight fit therein, and it has a bottom flange 110 outside said compressor casing plate 38 that is screwed as at 112 to said plate 38. A passage 111 extends upwardly through the lower portion of said plug 108, and through said flange 110, being in communication with the ports 102 on the suction side of the compressor C which passage 111 serves as a conduit for a water seal make-up, later described.

Within said rotor body 100 an interior or central chamber 114 is provided partly bounded by said plug 108, through which compressed steam is discharged from said compressor C. Outside said chamber 114 said plug 108 has walls defining two chambers 116 which, as shown, are sector-shaped, into which the steam vapor enters said plug 108 from said vapor space 31 during the suction strokes of said blades 106.

In said plug 108, at the outer part thereof, are four ports, two of which serve as discharge ports 118*a* and two of which serve as suction or intake ports 118*b*. The ports 118*a* communicate with said rotor space 97 and said central chamber 114 on the discharge stroke. The ports 118*b* communicate with said rotor space 97 and said chambers 116 on the suction or intake stroke.

From said compressor casing cover 38 a discharge pipe 120, exteriorly screw-threaded as at 122, communicates with said central chamber 114, through which the super-heated steam from the compressor C flows through a pipe 120*a*, which serves as an extension of pipe 120, to the steam chest of the usual distilling means or plant D.

Inside said casing 36 and extending laterally from and attached to said rotor body 100 is an upper plate 124 that rotates with said rotor next to said top cover plate 26, and there is a lower plate 125 attached to said rotor body 100 and next to said lower plate 38 that also rotates with said rotor. Said plates 124 and 125 are attached to said blades 106.

There will be a slight conversion of the water in said water space 98 into vapor by steam flash, hence I provide a water supply, intake passage including a vertically extending passage 128. This passage 128 extends through said compressor casing cover plate 26, down the side of said compressor casing 36, through its bottom cover plate 38 and outside thereof to a brass fitting 130 and to another brass fitting 132 in the distributor plug bottom flange 110, which fittings are connected by a copper tube 134. Communication of said fitting 132 with said passage 111 makes possible the replenishment of any loss of water in said compressor C resulting from steam flash. The water may be drawn from outside the distilling system through a feed pipe 140, or the latter may extend to and communicate with the usual distillate chamber DC at the bottom of said distilling means as shown in said Figure 1 thus obtaining the supply from the distilling system itself.

I show my apparatus provided with an indirect passage of the water vapor from the distilling means to the compressor, which is preferable under most conditions and is highly desirable when the distilling means is used on a ship or other moving conveyance, to prevent any water from entering the compressor C. This indirect passage is made by a bottom baffle plate 142 in the steam space 31 supported by collars 143 on said pipe threads 122, which deflects the vapor from the distilling means towards a circular baffle wall 144 connected to said plate 142 and extending upwardly therefrom spaced inwardly from the wall of said housing 30. The vapor passage is continued by means of another and shorter circular vertical, baffle wall 146 spaced laterally from said baffle wall 144 and which terminates above the bottom baffle plate 142. This indirect passage of the vapor prevents its direct entry from the distilling means to the compressor C, thus eliminating the possibility of water or other liquid passing into the suction chambers 116.

Any condensation taking place in said indirect passage will flow into a tube 148 that leads off said bottom baffle plate 142 into an open-seal container 150 below said plate 142 and which is supported by clips 152 to said tube 148.

What I claim is:

1. Compressor apparatus comprising a non-circular, outside casing embodying a top and a bottom, a shaft extending into said casing, a rotor in said casing attached to and rotatable with said shaft and embodying a body enclosing a space interiorly thereof, said casing having an impeller blade space outside said rotor body, impeller blades attached to said body and extending outwardly into said impeller blade space, but being spaced from said outside casing at its wider portions whereby there is a space for liquid outside said blades, a plate at the bottom and a plate at the top attached to said blades and adjacent said casing bottom and top respectively, said rotor body having a plurality of ports in communication with said body interior space and with said casing impeller blade space, and a hollow, distributor plug within said rotor body interior space and fixed to said casing around which said rotor is adapted to rotate, said plug having two intermediate wall portions spaced apart which together with peripheral portions of said plug define two inlet, side chambers and an outlet, intermediate chamber within said space enclosed by said rotor body, said plug having ports therein whereby said side and intermediate chambers communicate with said body ports.

2. Compressor apparatus comprising a non-circular, outside casing embodying a top and a bottom, a shaft extending into said casing, a rotor in said casing attached to and rotatable with said shaft and embodying a body enclosing a space interiorly thereof, said casing having an impeller blade space outside said rotor body, impeller blades attached to said body and extending outwardly into said impeller blade space, but being spaced from said outside casing at its wider portions whereby there is a space for liquid outside said blades, a plate at the bottom and a plate at the top attached to said blades and adjacent said casing bottom and top respectively,

said rotor body having a plurality of ports in communication with said body interior space and with said casing impeller blade space, and a hollow, distributor plug within said rotor body interior space and fixed to said casing around which said rotor is adapted to rotate, said plug having two intermediate wall portions spaced apart which together with peripheral portions of said plug define two inlet, side chambers and an outlet, intermediate chamber within said space enclosed by said rotor body, said plug having ports therein whereby said side and intermediate chambers communicate with said rotor body ports, said top and bottom plates being movably inset in the said casing top and bottom.

3. Compressor apparatus comprising a noncircular outside casing embodying a top and a bottom, a shaft extending into said casing, a rotor in said casing attached to and rotatable with said shaft and embodying a body enclosing a space interiorly thereof, said casing having an impeller blade space outside said rotor body, impeller blades attached to said body and extending outwardly into said impeller blade space, but being spaced from said outside casing at its wider portions whereby there is a space for liquid outside said blades, said rotor body having a plurality of ports in communication with said body interior space and with said casing impeller blade space, and a hollow distributor plug within said rotor body interior space and fixed to said casing around which said rotor is adapted to rotate, said plug having two intermediate wall portions spaced apart which together with peripheral portions of said plug define two inlet, side chambers and an outlet, intermediate chamber within said space enclosed by said rotor body, said plug having ports therein whereby said side and intermediate chambers communicate with said rotor body ports.

4. Compressor apparatus comprising a noncircular outside casing embodying a top and a bottom, a shaft extending into said casing, a rotor in said casing attached to and rotatable with said shaft and embodying a body enclosing a space interiorly thereof, said casing having an impeller blade space outside said rotor body, impeller blades attached to said body and extending outwardly into said impeller blade space, but being spaced from said outside casing at its wider portions whereby there is a space for liquid outside said blades, said rotor body having a plurality of ports in communication with said body interior space and with said casing impeller blade space, and a hollow, distributor plug within said body interior space and fixed to said casing around which said rotor is adapted to rotate, said plug having two intermediate wall portions spaced apart which together with peripheral portions of said plug define two inlet, side chambers and an outlet, intermediate chamber within said space enclosed by said rotor body, said plug having ports therein whereby said side and intermediate chambers communicate with said rotor body ports, said casing having a passage at the outside thereof through which liquid may be supplied to space within said casing exteriorly of said plug intermediate wall portions, said passage being in communication with a said rotor body port.

5. Compressor apparatus comprising a noncircular outside casing embodying a top and a bottom, a shaft extending into said casing, a rotor in said casing attached to and rotatable with said shaft and embodying a circular body enclosing a space interiorly thereof, said casing having an impeller blade space outside said rotor body, impeller blades attached to said body and extending outwardly into said impeller blade space but being spaced from said outside casing at its wider portions whereby there is a space for liquid outside said blades, said rotor body having a plurality of circumferential ports in communication with said body interior space and with said casing impeller blade space, and a hollow distributor plug that is circular in cross-section within said rotor body interior space and fixed to said casing around which said rotor is adapted to rotate, said plug having two interior straight wall portions spaced apart, and together with circumferential portions of said plug defining two sector-shaped inlet chambers opposite each other, the space between said interior wall portions providing a centrally located outlet chamber in said plug, said plug having ports therein whereby some of said rotor body ports are in communication with said outlet and some are in communication with said inlets.

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