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FLUID CONTROL FOR STEAM COMPRESSOR TYPE DISTILLATION APPARATUS

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This invention relates to a fluid control apparatus and in particular to apparatus for providing a heat transfer fluid to process apparatus and distilling apparatus.

In certain installations concurrent needs may be found for providing distilled water and providing a fluid heating source for other processes such as space heating or air conditioning. Heretofore, these requirements have been met by separate apparatus functioning independently of each other. The present invention comprehends an improved fluid control apparatus providing high temperature fluid for use in process apparatus as well as high temperature fluid for use in the heat exchanger of a distilling apparatus.

Thus, a principal feature of the present invention is a provision of a new and improved fluid control apparatus.

Another feature of the invention is the provision of such apparatus arranged to provide high temperature fluid to each of a distilling apparatus and other process apparatus.

A further feature of the invention is the provision of such apparatus wherein a pair of compressors are connected in parallel for selectively alternative and concurrent use in providing compressed high temperature fluid to the distilling apparatus and process apparatus.

Still another feature of the invention is the provision of such apparatus wherein one of the compressors comprises a steam jet compressor.

A yet further feature of the invention is the provision of such apparatus wherein one of the compressors comprises a motor compressor.

Still another feature of the invention is the provision of such apparatus wherein the distilling apparatus comprises a tube spray film evaporator.

A yet further feature of the invention is the provision of such apparatus including means for bypassing the compressors to deliver steam directly from a high pressure source to the process apparatus in the event that the requirements of the process apparatus exceed the steam flow through the steam jet compressor.

Another feature of the invention is the provision of such apparatus wherein the distilling apparatus includes a first tube bundle for utilizing steam from the steam jet compressor and a second tube bundle for utilizing steam from the motor compressor.

Other features and advantages of the invention will be apparent from the following description taken in connection with the accompanying drawing wherein:

FIGURE 1 is a flow diagram illustrating a flow control apparatus embodying the invention; and

FIGURE 2 is a flow diagram illustrating a modified form of flow control apparatus embodying the invention.

Referring now to FIGURE 1 of the drawing, a fluid control apparatus generally designated 10 is shown to comprise a first fluid compressor 11 and a second fluid compressor 12 connected in parallel for compressing vapor delivered thereto from a distilling apparatus generally designated 13. The compressed fluid is delivered at a high temperature to a process apparatus 14 and to a heat exchanger 15 of the distilling apparatus 13. The invention comprehends the selective utilization of the compressors and more specifically comprehends an arrangement wherein compressor 12 comprises a steam jet compressor which is connected to a source 43 of high

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pressure steam, with the compressed steam being delivered through a back pressure regulating valve 16 to the process apparatus. At the same time the compressed steam is delivered to the heat exchanger 15, which in the illustrated embodiment comprises a tube bundle for vaporizing feed liquid, illustratively sea water, within the distilling apparatus 13. The distillate resulting from the heat transfer in the tube bundle is then delivered through a suitable pump 17 as distilled water.

The compressor 11 illustratively comprises an electrically operated motor compressor. Thus, when the requirements for process steam are relatively low so that insufficient steam is provided through the compressor 12 to provide the desired quantity of distillate water, the compressor 11 may be placed in service to supplement the steam jet compressor 12. Further, where no requirements for process steam obtain, the motor compressor may be operated alone to provide the vapor in the operation of the distilling apparatus 13.

Under certain conditions the requirements for low pressure steam in the process apparatus may exceed the capabilities of the steam jet compressor 12. To provide the additional steam requirements a bypass generally designated 18 is provided connected between the high pressure steam supply 43 and the process apparatus 14 and including a valve 19 automatically controlled by the steam requirements of the process apparatus by means of a conventional control generally designated 20. A shut-off valve 41 may be installed between steam supply 43 and compressor 12 to permit steam delivery to the process apparatus 14 solely through bypass valve 19 if desired.

More specifically, distilling apparatus 13 includes a shell 21 defining a chamber 22 into which the tube bundle 15 extends to be exposed to feed water sprayed thereinto from a spray device 23 in the upper portion of chamber 22. The feed water, which as indicated above, may comprise sea water, is introduced into chamber 22 from a supply 42 and delivered to the spray device 23 by means of a pump 24 through a feed conduit 25. A tap-off 26 from conduit 25 may be provided for disposing of the concentrated brine waste. The pump 24 is connected to a sump 27 in the lower portion of shell 21, the feed water being preheated by the distillate and brine waste in the chamber 22 in passing from the lower portion of the chamber 22 into the pump 24. The tube bundle may be connected to a suitable header 28 having an inlet portion 29 receiving compressed vapor from a delivery conduit 30 and an outlet portion 31 delivering the distillate water through an outlet conduit 32 to the pump 17. In the illustrated embodiment the tube bundle comprises a horizontal tube bundle onto which the feed water is sprayed from the device 23 whereupon heat is transferred from the compressed vapor within the tube bundle to the feed water forming a film thereon.

The feed water vapor passes upwardly from the shell 21 through a conventional demister 33 to a suction conduit 34 connected to the throat 35 of the steam jet compressor 12 and to the inlet 36 of the motor compressor 11. The vapor within chamber 22 may be under an operating pressure of below 2 p.s.i. The steam from high pressure source 43 may be at a pressure of approximately 100 p.s.i. The compressed vapor is delivered from compressor 11 through a delivery conduit 37 having a unidirectional flow valve 38, to conduit 30 and the compressed vapor is delivered from compressor 12 through a delivery conduit 39 having a unidirectional flow valve 40 also to the conduit 30. Thus, the compressors 11 and 12 are effectively connected in parallel between conduits 34 and 30. The back pressure regulating valve 16 is connected between the delivery conduit 30 and the process apparatus 14 and comprises a conventional regulating

valve which may be adjusted to maintain the back pressure at approximately 4 p.s.i.

While the novel arrangement of parallel connected compressors providing conjoint heat transfer fluid delivery jointly to each of process and distilling apparatus is particularly advantageous where the distillation apparatus comprises a spray film evaporator as illustrated in the embodiment utilizing a low differential between the temperature of the feed liquid and the saturation condensing temperature at the condensing pressure it is obvious that the arrangement may be utilized to advantage with other forms of evaporating apparatus.

Referring now to FIGURE 2 a fluid control apparatus 110 generally similar to fluid control apparatus 10 is illustrated. For simplification of disclosure, elements of apparatus 110 corresponding to similar elements of apparatus 10 have been given the same reference numeral but 100 higher. Apparatus 110 differs from apparatus 10 in the provision of a heat exchanger means generally designated 115 comprising a pair of discrete tube bundles 142 and 143 extending into space 122 from the opposite ends of the shell 121. The delivery conduit 139 leading from steam jet compressor 112 is provided with a branch conduit 144 leading to the inlet portion 129a of a header 128a at one end of the tube bundle 142. The delivery conduit 137 leading from the motor compressor 111 is connected to the inlet portion 129b of a header 128b at one end of the tube bundle 143. The distillate is delivered through headers 131a and 131b from the tube bundles to the distillate pump 117 as in apparatus 10. In all other respects apparatus 110 is similar to and functions similarly to the apparatus 10.

While I have shown and described certain embodiments of my invention, it is to be understood that it is capable of many modifications. Changes, therefore, in the construction and arrangement may be made without departing from the spirit and scope of the invention as defined in the appended claims.

I claim:

1. Fluid control apparatus comprising: distilling apparatus having a heat exchanger adapted to use steam as a heat source, spray means for utilizing said heat exchanger to produce steam from an aqueous feed, work means adapted to use steam, means defining a suction passage for conducting steam from said distilling apparatus,

means defining a delivery passage for conducting compressed steam to said work means and to said heat exchanger, steam jet compressor means connected between said suction passage and said delivery passage and having a high pressure steam inlet, motor compressor means connected between said suction passage and said delivery passage, and control means selectively operating said steam jet compressor means and said motor compressor means to provide said compressed steam selectively to said work means and to said heat exchanger.

2. Fluid control apparatus comprising: distilling apparatus having a heat exchanger adapted to use steam as a heat source, spray means for utilizing said heat exchanger to produce steam from an aqueous feed, work means adapted to use steam, means defining a suction passage for conducting steam from said distilling apparatus, means defining a delivery passage for conducting compressed steam to said work means and to said heat exchanger, steam jet compressor means connected between said suction passage and said delivery passage and having a high pressure steam inlet, motor compressor means connected between said suction passage and said delivery passage, a regulator valve between said delivery passage and said work means, and control means selectively operating said steam jet compressor means and said motor compressor means to provide said compressed steam to said heat exchanger and to said work means when the pressure of said compressed steam exceeds the regulated pressure of said regulator valve.

References Cited by the Examiner

UNITED STATES PATENTS

1,200,996	10/1916	Saderlund et al.	202—75
1,213,596	1/1917	De Baufre	202—75
1,361,834	12/1920	De Baufre	202—75
1,390,677	9/1921	De Baufre	202—75
2,441,361	5/1948	Kirgan	202—160 X
2,500,934	3/1950	Kean	202—75
2,895,546	7/1959	Sadtler	202—75

FOREIGN PATENTS

616,329 1/1949 Great Britain.

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