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SPECIAL VALVE ARRANGEMENT ON CENTRIFUGAL CONDENSERS AND COOLERS

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FIG. 1

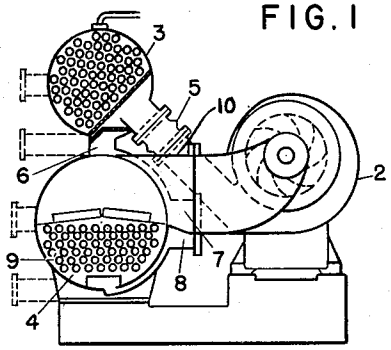
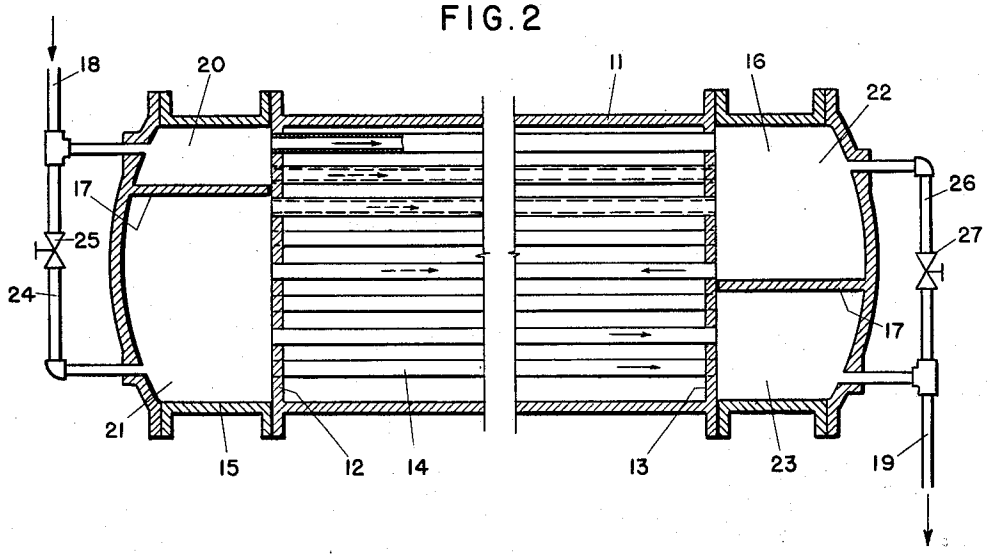


FIG. 2



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SPECIAL VALVE ARRANGEMENT ON CENTRIFUGAL CONDENSERS AND COOLERS

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4 Claims. (Cl. 62—115)

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This invention relates to a centrifugal refrigeration machine employed as a heat pump and more particularly to an improved arrangement of the machine whereby under some conditions the machine may be employed for water heating and water chilling duty while under other conditions the machine may be employed for water chilling only.

The chief object of the present invention is to provide a centrifugal refrigeration machine including an improved heat exchanger which permits the machine to be employed as a heat pump under some conditions of use while under other conditions the machine may be employed for normal water chilling duty only.

An object of the present invention is to provide an improved heat exchanger which is so arranged as to permit condensing water to make a plurality of passes therethrough under some conditions while under other conditions the condensing water makes only a single pass through the heat exchanger.

A further object is to provide a condenser arrangement in which longitudinally extending tubes are arranged to permit medium to pass a plurality of times through the condenser in heat exchange relation with fluid therein and means are provided to vary the direction of flow through the tube of a portion of the medium to decrease the period of time the medium is in heat exchange relation with fluid in the condenser. Other objects of my invention will be readily perceived from the following description.

This invention relates to a centrifugal refrigeration machine capable of use as a heat exchanger. The machine includes a cooler, a compressor and a condenser disposed in a closed circuit. Longitudinally extending tubes are disposed in the condenser shell. Compartments are provided at each end of the condenser shell for receiving medium from a source of supply and for passing the medium to a discharge line after its passage through the shell. These tubes are so disposed and arranged as to pass the medium a plurality of times through the condenser shell in heat exchange relation with fluid therein. Means are provided for varying the direction of flow through the tubes of a portion of the medium to decrease the period of time the medium is in heat exchange relation with fluid in the shell under some conditions of use.

The attached drawing illustrates a preferred embodiment of my invention, in which

Figure 1 is a diagrammatic view of a centrifugal refrigeration machine including the present invention; and

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Figure 2 is a sectional view of the condenser of a centrifugal refrigeration machine.

Referring to the attached drawing, there is shown a centrifugal refrigeration machine for chilling water in a cooler, the chilled water being forwarded to a place of use. The machine comprises a centrifugal compressor 2, a condenser 3 and a cooler or evaporator 4 disposed in a closed circuit. Refrigerant vapor is compressed by compressor 2 and supplied to condenser 3 through pipe 5. In condenser 3, the hot gaseous refrigerant is disposed in heat exchange relation with cooling medium passing through the tubes of the condenser and is condensed.

The condensed refrigerant is supplied from condenser 3 through line 6 and float boxes 7 and 8 to cooler 4. Water to be chilled passes through the tubes 9 of cooler 4. Such water is in heat exchange relation with liquid refrigerant in cooler 4 and is cooled by such refrigerant, the refrigerant boiling off, refrigerant vapor being drawn through suction line 10 to compressor 2; the procedure is repeated so long as cooling is required.

In Figure 2, I have illustrated in somewhat greater detail the condenser 3 of the machine. Condenser 3 consists of a shell 11 having end supports 12 and 13 for longitudinally extending tubes 14 disposed within the shell 11. Water boxes 15 and 16 are disposed at opposite ends of shell 11. Baffles or division plates 17 are provided in water boxes 15 and 16 in accordance with a predetermined arrangement for flow of water through the tubes of the condenser. A line 18 connects a suitable source of supply of condenser water with water box 15. A line 19 passes water from box 16 to discharge which may be a drain, a cooling tower or the like.

Each water box 15 and 16 is divided in two compartments in accordance with the predetermined arrangement for flow of condenser water through the tubes 14. As shown, box 15 includes compartments 20 and 21; box 16 includes compartments 22 and 23. Baffles 17 form these compartments in such manner that under normal use condenser water flows from compartment 20 through some of the tubes 14 to compartment 22, then flows through other tubes 14 in the reverse direction to compartment 21 and again passes through some of the tubes 14 to compartment 23 to discharge as indicated by the solid arrows. It will be observed that in the arrangement shown the condenser water makes three passes through the shell of the condenser in heat exchange relation with refrigerant therein. Under these conditions the condensing water is heated to a con-

siderable extent thus permitting the machine to be utilized as a heat pump.

Under other conditions, however, the machine is used solely for chilling water in cooler 4. In such use, it is not desirable that the condenser water make a plurality of passes through tubes of condenser 3. Accordingly I have provided an arrangement whereby the condenser water makes only a single pass through the tubes of the condenser as shown by the dotted arrows. For this purpose a by-pass line 24 is provided connecting line 18 with compartment 21 of box 15. A valve 25 either manually or automatically operable is disposed in line 24.

A second by-pass line 26 is provided connecting compartment 22 with line 19. A valve 27 similar to valve 25 is placed in line 26. When it is desired to utilize the machine solely for chilling duty valves 25 and 27 are open permitting condenser water to make only a single pass through the tubes of the condenser. It will be noted (refer to Figure 2) that such piping and valve arrangements vary the direction of flow of condensing water through some of the tubes of condenser 3.

It will be appreciated under still other conditions the baffles 17 of boxes 15 and 16 and lines 24 and 26 may be so arranged as to afford other arrangements permitting the number of passes of condenser water through the tubes of the condenser to be varied.

The present invention provides a simple and inexpensive arrangement which permits a centrifugal refrigeration machine to be employed as either a heat pump or for normal chilling duties only. The arrangement does not involve any substantial expense and does not require redesign of the machine since it involves merely minor changes in the water box baffles and the provision of additional pipes and valves for the by-passes. This arrangement is of great advantage in applications such as the textile industry where large quantities of hot water are used. The machine may be used where heating water is required at some seasons of the year while chilled water is required at other seasons of the year for air conditioning duty.

While I have described a preferred embodiment of my invention, it will be understood that my invention is not limited thereto since it may be otherwise embodied within the scope of the following claims.

I claim:

1. In a condenser arrangement for a centrifugal refrigeration machine, the combination of a shell, a plurality of longitudinally extending tubes in the shell through which condenser water passes, refrigerant from the refrigeration machine passing through the shell exterior of the tubes, compartments at opposite ends of said shell, a supply line for condenser water connected to a chamber in the compartment at one end of the shell, a bypass connecting the supply line to a second chamber in said compartment, a valve in the bypass, a discharge line connected to a chamber in the second compartment, a second bypass connecting the discharge line with a second chamber in the second compartment, and a second valve in said bypass, the opening of the two valves permitting the condenser water to make only a single pass through the shell resulting in the refrigerant being condensed, and the closing of the two valves permitting the condenser water to make a plurality of passes through the shell resulting in the condenser water being heated so that it may be used as a source of heat.

2. In a condenser arrangement for a centrifugal refrigeration machine, the combination of a shell, a plurality of longitudinally extending tubes in the shell through which condensing water passes, refrigerant from the refrigeration machine passing through the shell exterior of the tubes, compartments at opposite ends of said shell, a supply line for condensing water connected to a chamber in the compartment at one end of the shell, a bypass connecting the supply line to a second chamber in said compartment, a valve in the bypass, a discharge line connected to a chamber in a second compartment, a second bypass connecting the discharge line with a second chamber in the second compartment, and a second valve in said bypass whereby when said valves are closed condenser water makes a plurality of passes through the tubes of the shell resulting in the condenser water being heated so that it may be used as a source of heat while when said valves are open condenser water makes a single pass only through the tubes of the shell resulting in the refrigerant being condensed, the chambers in the compartments being so arranged that during the plurality of passes the water flows from the first chamber of the first compartment to the first chamber of the second compartment to the second chamber of the first compartment to the second chamber of the second compartment.

3. In a condenser arrangement for a centrifugal refrigeration machine, the combination of a shell, water boxes at each end of the shell, baffles separating each water box into two compartments, tubes connecting the first compartment of the first water box with the first compartment in the second water box, tubes connecting the first compartment of the second water box with the second compartment in the first water box, tubes connecting the second compartment of the first water box with the second compartment in the second water box, refrigerant from the refrigeration machine passing through the shell exterior of the tubes, condenser water for passage through the tubes in heat exchange relation with the refrigerant in the shell, a supply line connecting the condenser water with the first compartment of the first water box, a second line connecting the condenser water with the second compartment of the first water box, a valve in said second line, a discharge line for the condenser water, a fourth line connecting the second compartment of the second water box with the discharge line, a fifth line connecting the first compartment of the second water box with the discharge line, and a second valve in said fifth line, said elements being so arranged and assembled that condenser water flows from the first compartment of the first water box to the first compartment of the second water box, then to the second compartment of the first box, then to the second compartment of the second box and from the second box to the discharge line when said valves are closed resulting in the condenser water being heated so that it may be used as a source of heat while when said valves are open condenser water flows from the first water box to the second water box and then to the discharge line resulting in the refrigerant being condensed.

4. In combination with a centrifugal refrigeration system having a cooler, a compressor, and a condenser disposed in a closed circuit, the con-

denser including longitudinally extending tubes, refrigerant of the refrigeration system passing through the condenser exterior of the tubes, water boxes at opposite ends of the condenser connected to the tubes, and baffles separating each water box into two compartments, a supply line connected to a first compartment of the first water box, a bypass line connecting the supply line and the second compartment of the first water box, a valve in the bypass line, a discharge line connected to the first compartment of the second water box, a second bypass line connecting the discharge line and the second compartment of the second water box, and a second valve in the second bypass line, closing of the valves permitting condenser water to make a plurality of passes through the tubes resulting in the condenser water being heated so that it may be used as a source of heat while opening of the valves permits condenser water to make a single pass

only through the condenser resulting in refrigerant being condensed.

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