Oct. 15, 1957 L. H. LEONARD, JR., ET AL 2,809,497

UNITARY PURGE ARRANGEMENT FOR ABSORPTION REFRIGERATION SYSTEMS

Filed May 4, 1953 5 Sheets-Sheet 1

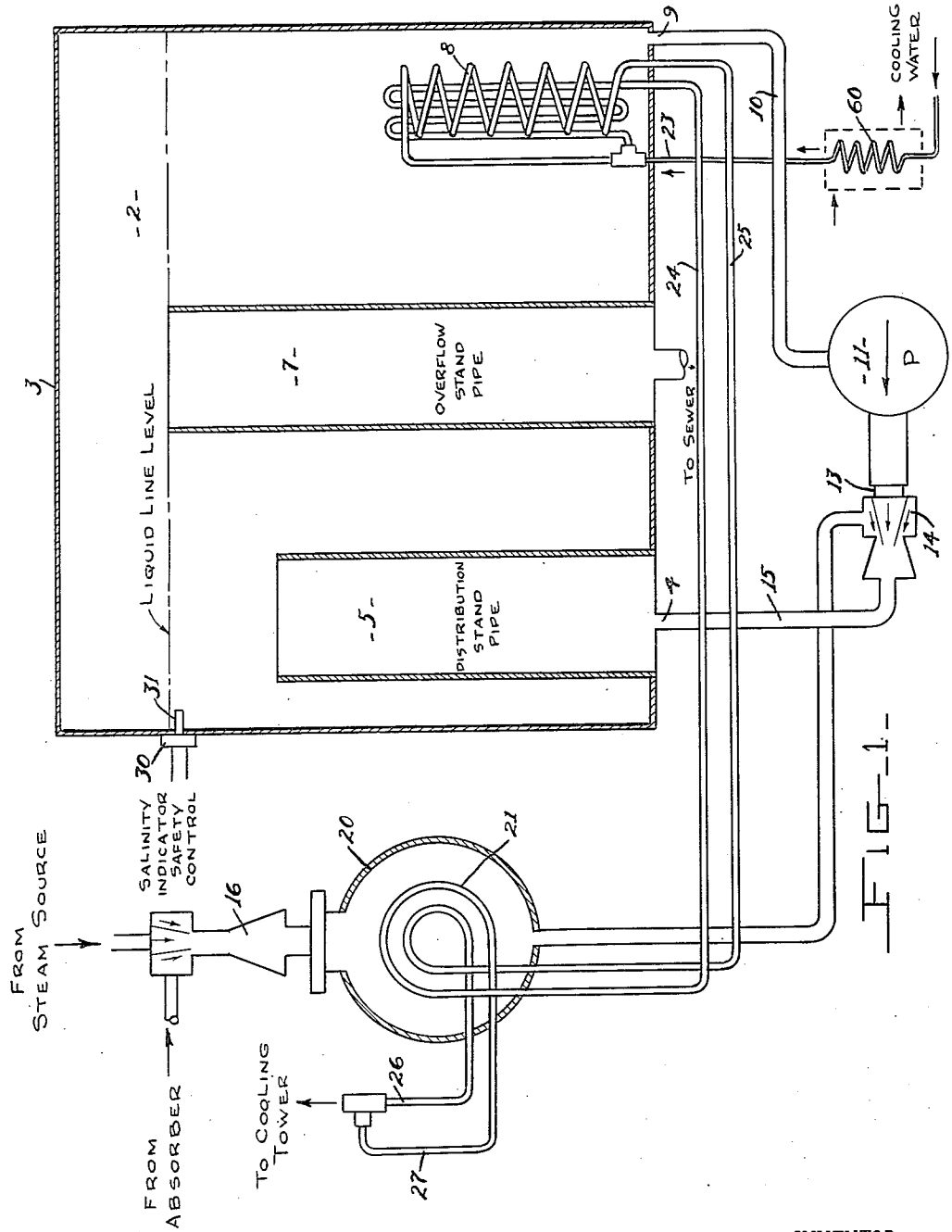


FIG. 1.

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UNITARY PURGE ARRANGEMENT FOR ABSORPTION REFRIGERATION SYSTEMS

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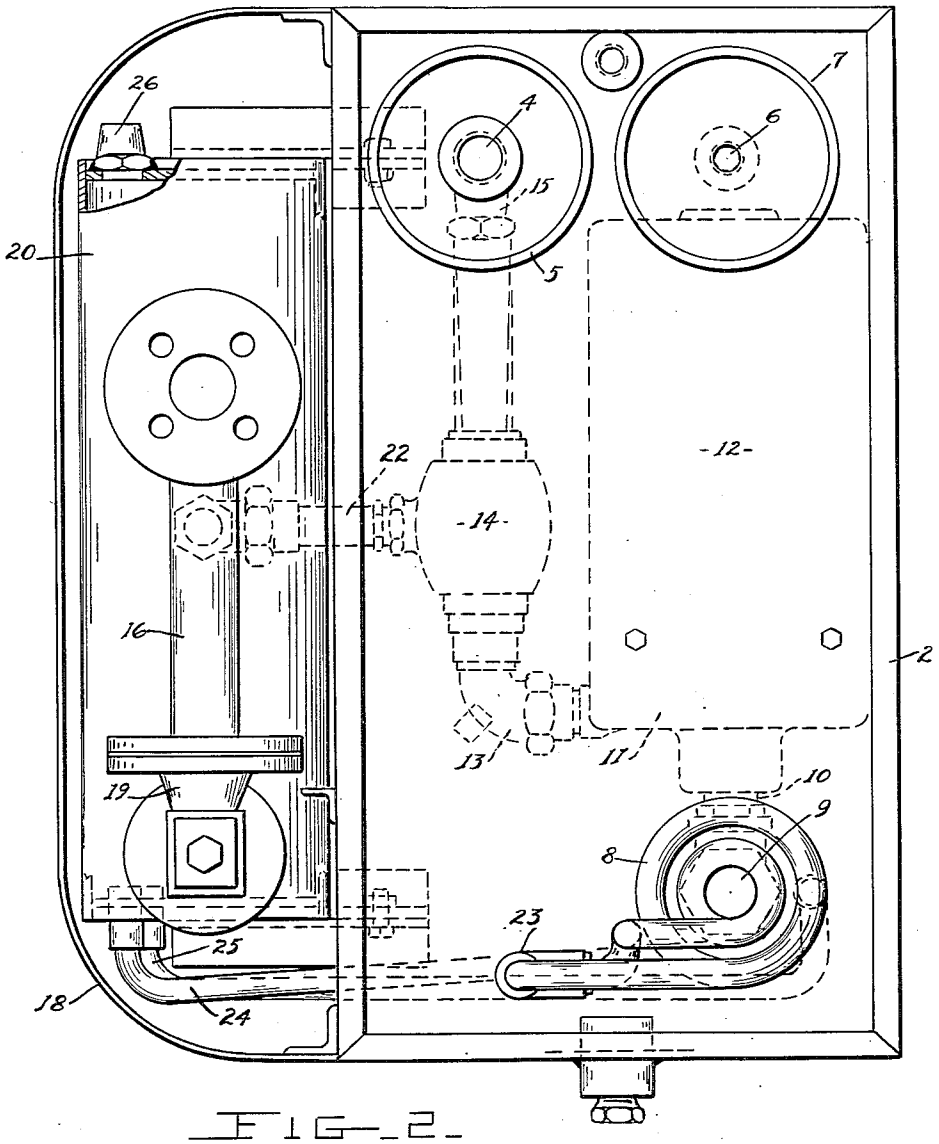


FIG. 2.

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UNITARY PURGE ARRANGEMENT FOR ABSORPTION REFRIGERATION SYSTEMS

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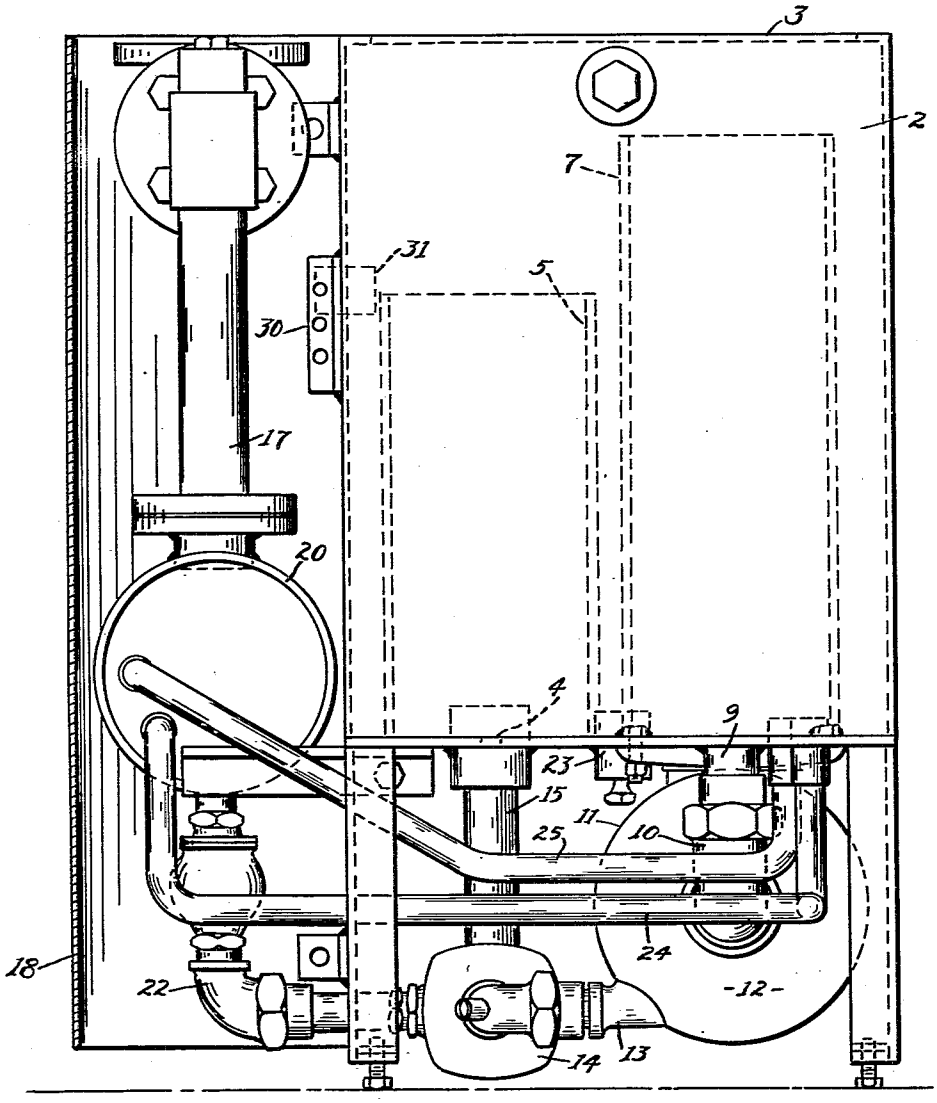


FIG. 3.

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UNITARY PURGE ARRANGEMENT FOR ABSORPTION REFRIGERATION SYSTEMS

Filed May 4, 1953 5 Sheets-Sheet 4

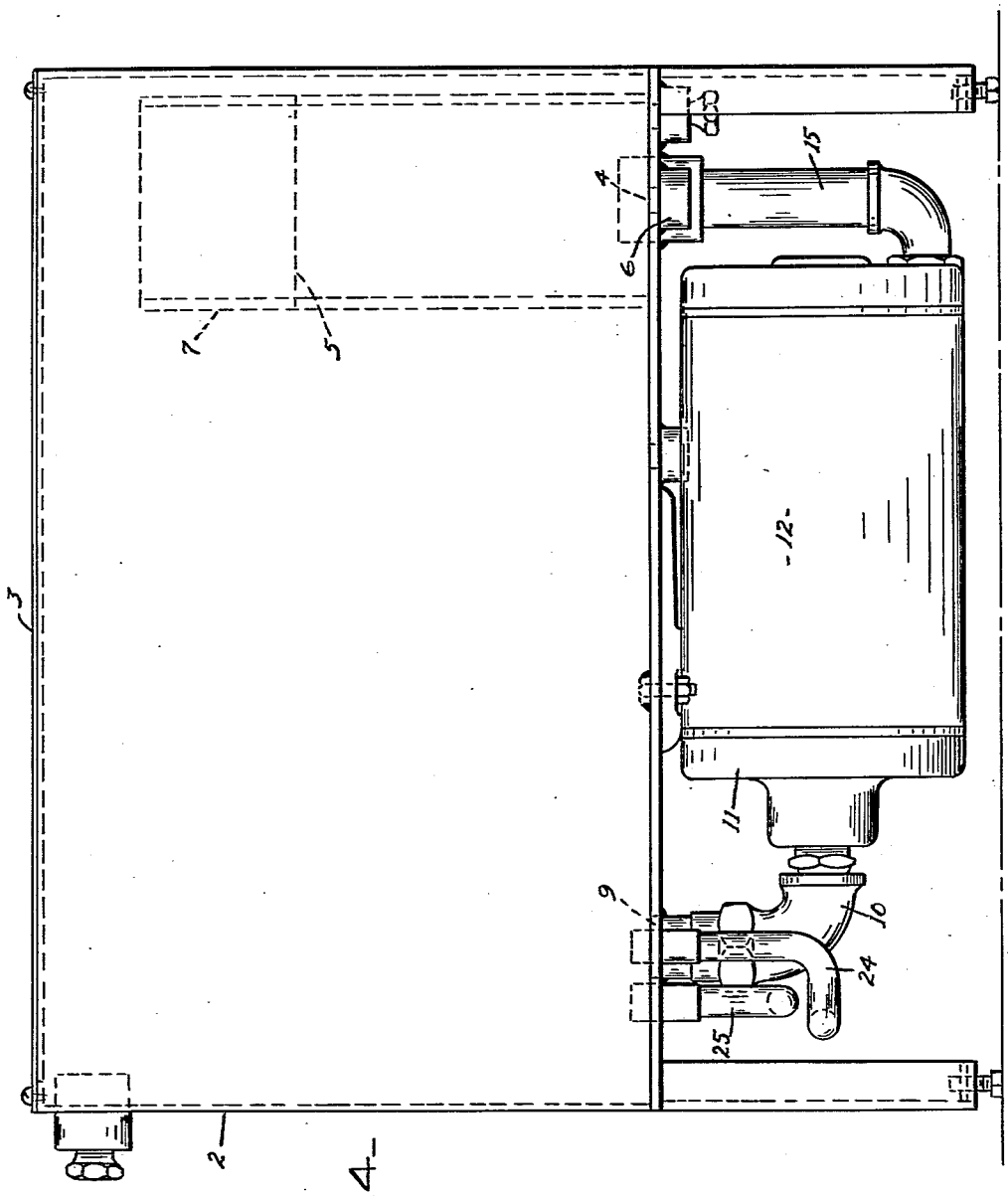


FIG. 4

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UNITARY PURGE ARRANGEMENT FOR ABSORPTION REFRIGERATION SYSTEMS

Filed May 4, 1953 5 Sheets-Sheet 5

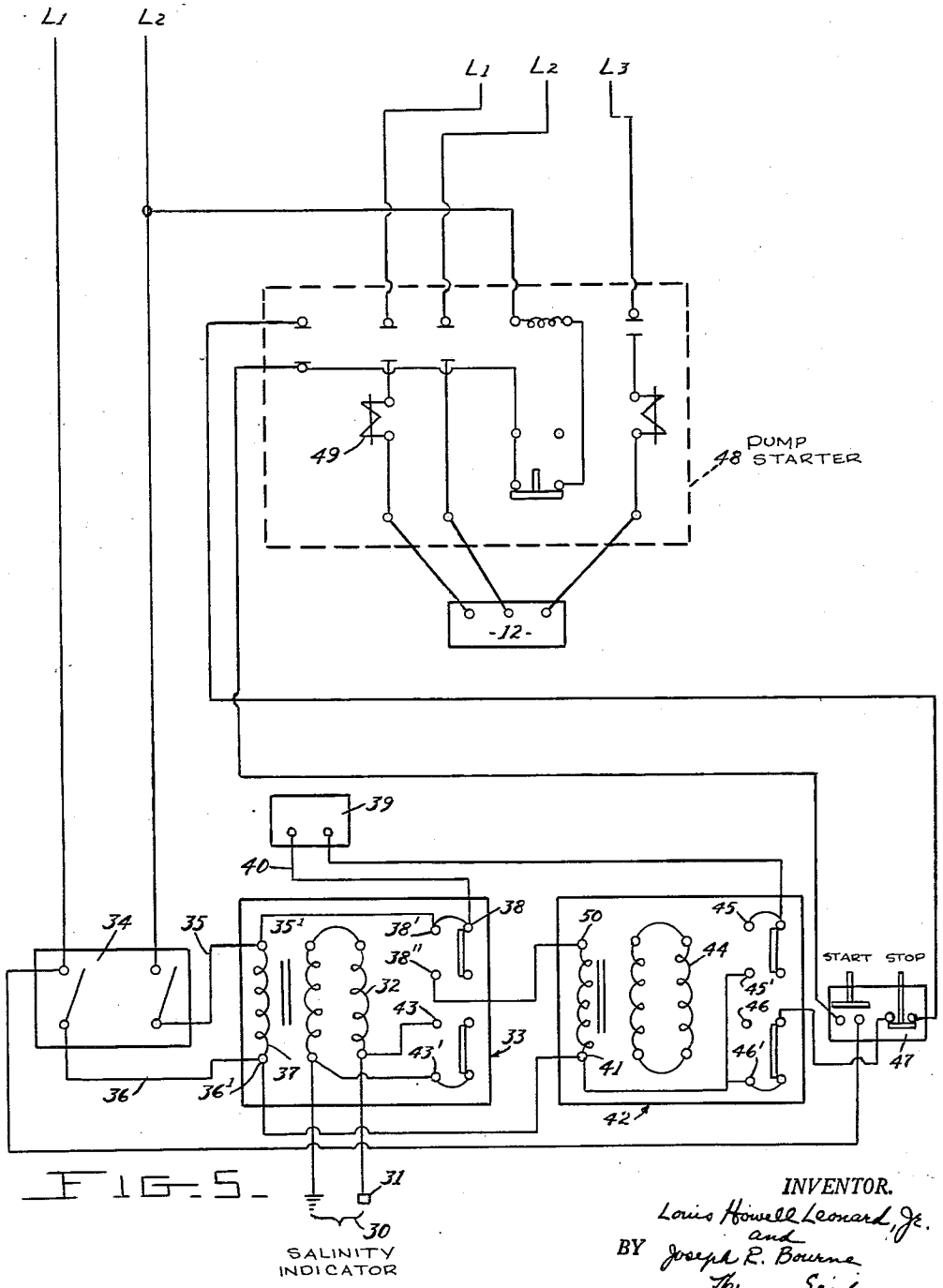


FIG. 5

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UNITARY PURGE ARRANGEMENT FOR ABSORPTION REFRIGERATION SYSTEMS

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Application May 4, 1953, Serial No. 352,665

14 Claims. (Cl. 62—5)

This invention relates to a purge arrangement for an absorption refrigeration system and, more particularly, to a unitary purge arrangement for an absorption refrigeration system including a salinity indicator.

The chief object of the present invention is to provide a unitary purge arrangement for absorption refrigeration systems.

An object of the present invention is to provide a unitary purge arrangement for an absorption refrigeration system which is assembled at the factory and easily and cheaply applied to the absorption refrigeration system in the field, thus eliminating the expenses and disadvantages of field assembly.

A further object is to provide a unitary purge arrangement for an absorption refrigeration system which includes a salinity indicator to indicate a predetermined degree of salinity of liquid employed in the purge arrangement.

A still further object is to provide a packaged purge arrangement including a salinity indicator which can be easily and quickly applied to an absorption refrigeration system during installation of said system without requiring field engineering and the increased costs of installation due to field engineering. Other objects of the invention will be readily perceived from the following description.

This invention relates to a unitary purging arrangement adapted to be attached to an absorption refrigeration system to purge non-condensible gases therefrom. The purging arrangement includes a tank for water, a water actuated ejector connected to the tank, a steam actuated ejector connected to the water actuated ejector and adapted to be connected to the portion of the system to be purged. Means for circulating water from the tank to the water actuated ejector and from the water actuated ejector to the tank are provided. A salinity indicator is also provided to indicate when a predetermined degree of salinity of water in the tank is attained.

The attached drawings illustrate a preferred embodiment of the invention in which,

Figure 1 is a diagrammatic view of a packaged purge arrangement;

Figure 2 is a plan view of the package purge arrangement;

Figure 3 is a view in side elevation of the package purge arrangement shown in Figure 2;

Figure 4 is a view in rear elevation of the purge arrangement shown in Figures 2 and 3; and

Figure 5 is a diagrammatic view illustrating the electrical circuit of the various elements of the arrangement.

Referring to the attached drawings, there is shown the unitary purge arrangement of the present invention adapted to be attached to the absorber of an absorption refrigeration system such as that disclosed in Berestneff Patent No. 2,565,943, granted August 28, 1951. The unitary arrangement comprises a tank 2 having a cover 3; the tank contains an inlet 4, surrounded by a distribution stand pipe 5. An outlet 6 is provided in tank 2, outlet 6 being surrounded by an overflow stand pipe 7. A cooling coil 8 is supported in tank 2, for a purpose hereinafter explained. Tank 2 also contains an outlet 9 connected by a pipe 10, to the pump 11 of a pump-motor unit 12.

Pump 11 withdraws water from tank 2 through outlet 9 and pipe 10 and forwards the water through pipe 13 to a water jet 14 of the ejector type. Water, passed through ejector 14, returns to tank 2 through pipe 15 and inlet 4. Stand pipe 5 assures that the entering water is distributed in the tank adjacent the water level maintained therein.

Preferably, the pump-motor unit 12 is mounted on and supported by the bottom of tank 2; likewise, the ejector 14 is mounted on and supported by the bottom of tank 2.

Steam actuated ejectors 16 and 17 are mounted on and supported by the front side of tank 2. Preferably, these ejectors are concealed when the unit is in use by a decorative cover 18. While we have shown two steam actuated ejectors 16 and 17 in Figures 2, 3, and 4, it will be appreciated that for some uses only a single steam actuated ejector is required, as shown in Figure 1.

Steam actuated ejector 16 is connected by a line (not shown) to the absorber of the absorption refrigeration system to purge non-condensible gases therefrom. Steam actuated ejectors 16, 17 are also connected to steam lines (not shown) in order that steam may be provided to operate the ejectors.

Ejector 16 is connected to ejector 17 as shown at 19. Steam actuated ejector 17 is connected to a casing 20 containing a cooling coil 21, as hereinafter explained. Casing 20 is connected to the water actuated ejector 14 by a pipe 22. Casing 20 is mounted on and supported by the front wall of tank 2.

Any suitable source of supply may be employed to supply cooling water through line 23 to coil 8, placed in tank 2. The cooling water passes from coil 8 and through pipes 24, 25 to the cooling coil 21 placed in casing 20. Cooling water leaves coil 21 through lines 26, 27 and may be wasted or circulated to a cooling tower, if desired.

It is desirable that operation of the purge arrangement be discontinued when the purge arrangement begins to draw solution from the absorber mixed with non-condensible gases being purged therefrom. For this purpose a salinity indicator 30 is provided. Salinity indicator 30 includes an electrode 31 extending within tank 2. Electrode 31 is connected to the holding coil 32 of the relay 33 as hereinafter explained. The opposite end of the holding coil 32 is grounded on tank 2. Thus, the presence of salt within water in the tank in as little as 1 percent by weight serves to complete an electrical connection thereby stopping operation of the pump and sounding a warning signal or doing both, as desired.

In Figure 5, we have shown a wiring diagram of the arrangement. Line connections L1 and L2 are connected to a reset switch 34. Reset switch 34 is connected to relay 33 by connectors 35 and 36. A transformer 37 is provided in relay 33, connected to holding coil 32. Terminal 35' of relay 33 is connected to terminals 38, 38' of the relay. Terminal 38 is connected to a warning device 39 by connector 40. Terminal 36' of relay 33 is connected to terminal 41 of a second relay 42 while terminal 38'' is connected to terminal 50 of the second relay. Activation of holding coil 32 caused by the salinity indicator 30 closes contacts 38', 38'' thus closing the circuit to the second relay 42, and energizing contacts 43, 43'. Closing of contacts 43, 43' assures that the holding coil 32 is energized until the reset switch 34 is thrown, de-energizing coil 32.

Energization of coil 32 closing contacts 38', 38'' supplies current to terminal 50 of the second relay 42 as described above. This second relay 42 is similar to relay 33, so that when the holding coil 44 is energized, contacts 45, 45' are closed thereby energizing the warning

device 39 and closing contacts 46, 46' to open the circuit through the starting-stopping button 47 to the pump starter 48 by de-energizing the holding coil thereof.

Considering normal operation of the purge arrangement, passage of steam through ejectors 16 and 17 draws non-condensible gases from the absorber (not shown) of the absorption refrigeration machine. The steam and the non-condensible gases pass in casing 20 in heat exchange relation with cooling water in the coil 21 thereof. From casing 20 the condensed steam and non-condensible gases are drawn by water actuated ejector 14 and passed to tank 2. Pump 11 withdraws water from tank 2 and passes the water to ejector 14 to draw non-condensible gases and condensed steam from casing 20. Cooling water is supplied to coil 8 in tank 2 through a line 23. The cooling water in coil 8 serves to cool water in tank 2. Cooling water, after passage through coil 8 passes through the lines 24 and 25 to the coil 21 of casing 20. Cooling water in coil 21 serves to condense the steam actuated passing into casing 20 from the steam ejectors. The cooling water after its passage through coil 21 may be forwarded to a cooling tower or wasted, if desired.

Salinity indicator 30 is provided to indicate a predetermined degree of salinity of water in tank 2. One lead of the salinity indicator is grounded to tank 2 and the other is connected to electrode 31. A lithium bromide solution of about 1 percent by weight will close the circuit between the electrode and the grounded tank. When this circuit is closed, the holding coil 32 of relay 33 is energized and the contacts 38', 38'' and 43, 43' are closed. Contacts 43, 43' form a locking means to hold the circuit even if an initial surge of salt solution dissipates or weakens. The contacts 38', 38'' close the circuit to relay 42 and energize the holding coil 44 to reverse the position of contacts 44, 45 and contacts 46, 46' thereby breaking the circuit to the pump starter holding the coil 49 and stopping the pump as well as energizing the warning device 39.

It will be appreciated it is not essential in the invention to discontinue operation of the pump motor and to energize a warning device simultaneously to indicate to the operator that the water solution in the tank has reached a predetermined degree of salinity. One or the other or both means may be employed.

To resume normal operation after the pump has been stopped, the purge water system is cleaned thoroughly and the reset switch 34 is opened momentarily. Opening the reset switch shuts off the warning device and de-energizes the relays. If desired, to facilitate draining and flushing the purge water system, the pump can be operated by manually holding down the starting button 47. It will be appreciated the system will not resume normal operation with the safety system bypassed. If the reset switch is inadvertently left open, the purge pump will stop as soon as the starting button is released.

Under some circumstances, it may be advisable to provide further cooling of the water supplied through line 23 to coil 8 in tank 2. For this purpose a heat exchanger 60 may be provided to pass the cooling water supplied to coil 8 in heat exchange relation with a cooling medium therefor. Under most conditions of operation, this additional heat exchanger is not necessary.

The present invention provides a simple economical purge arrangement which can be readily attached to an absorption refrigeration in the field without requiring field engineering. The purge arrangement is provided as a unitary packaged arrangement thereby permitting ready attachment in the field. The salinity indicator of the present invention warns immediately if the solution is being withdrawn from the absorber, permitting operation of the purge to be discontinued automatically, if desired.

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

We claim:

1. A unitary purging arrangement adapted to be attached to an absorption refrigeration system to purge non-condensible gases therefrom which comprises a liquid tank, a liquid actuated ejector having its discharge connected to the tank, a steam actuated ejector having its discharge connected to the suction connection of the liquid actuated ejector and having its suction connection adapted to be connected to the absorber of the system, means for circulating liquid from the tank to the liquid actuated ejector and from the liquid actuated ejector to the tank to actuate said liquid actuated ejector, a salinity indicator and mechanism for actuating the liquid circulating means connected to the salinity indicator, said indicator actuating said mechanism to discontinue operation of the liquid circulating means when a predetermined degree of salinity of liquid in the tank is attained.

2. A unitary purging arrangement adapted to be attached to an absorption refrigeration system to purge non-condensible gases therefrom which comprises a tank for water, a water actuated ejector having its discharge connected to the tank, a steam actuated ejector having its discharge connected to the suction connection of the water actuated ejector and having its suction connection adapted to be connected to the absorber of the system, means for circulating water from the tank to the water actuated ejector and from the water actuated ejector to the tank to actuate said water actuated ejector, a salinity indicator, and a warning device for warning the operator of the system that a predetermined degree of salinity of water in the tank has been attained, said indicator actuating said warning device when predetermined degree of salinity of water in the tank has been attained.

3. A unitary purging arrangement according to claim 2 in which said circulating means comprises a pump having an actuating mechanism, said indicator serving to actuate said pump mechanism to discontinue operation of the pump when a predetermined degree of salinity of water in the tank has been attained.

4. A unitary purging arrangement adapted to be attached to an absorption refrigeration system to purge non-condensible gases therefrom which comprises a tank for water, a water actuated ejector having its discharge connected to the tank, a pump for circulating water from the tank to the power fluid supply connection of the water actuated ejector and from the water actuated ejector to the tank, a steam actuated ejector having its discharge connected to the suction connection of the water actuated ejector and having its suction connection adapted to be connected to the absorber of the system, a casing disposed between the steam actuated ejector and the water actuated ejector, a cooling coil in said casing, means for passing cooling medium through said coil in heat exchange relation with steam and non-condensible gases discharged in said casing by said steam actuated ejector, a cooling coil in said tank, means for passing a cooling medium through said tank coil in heat exchange relation with water in said tank, an overflow stand pipe in said tank to maintain a predetermined level of water in said tank, a second stand pipe in said tank connected to the outlet of said water actuated ejector to distribute water in the tank at approximately the level of water maintained in the tank.

5. In combination with an absorption refrigeration system including an absorber, an evaporator, a generator and a condenser, a purging arrangement, said purging arrangement comprising a steam actuated ejector having its suction connection connected to the absorber to remove non-condensible gases therefrom, a liquid tank, a liquid actuated ejector having its discharge connected to the liquid tank and having its suction connection connected to the discharge of the steam actuated ejector, means for circulating liquid from the tank to the liquid actuated ejector and from the liquid actuated ejector to the tank to actuate said liquid actuated ejector, a casing

disposed between the steam actuated ejector and the water actuated ejector, a coil in said casing, means for passing a cooling medium through said coil in heat exchange relation with steam and non-condensible gases discharged into the casing by the steam actuated ejector, a cooling coil in said tank, and means to pass a cooling medium through said coil in heat exchange relation with liquid in said tank.

6. A purging arrangement according to claim 5 in which a salinity indicator is provided.

7. A unitary purging arrangement adapted to be attached to an absorption refrigeration system to purge non-condensible gases therefrom, which comprises a liquid tank, a liquid actuated ejector having its discharge connected to the tank, a steam actuated ejector having its discharge connected to the suction connection of the water actuated ejector and having its suction connection adapted to be connected to the absorber of the system, means for circulating the liquid from the tank to the liquid actuated ejector and from the liquid actuated ejector to the tank to actuate said liquid actuated ejector and indicating mechanism for indicating a predetermined degree of salinity of liquid in said tank, said indicating mechanism including a salinity indicator having an electrode extending into liquid in the tank, a terminal connected to the tank, an electrical circuit including said indicator, a first relay in said circuit, a second relay in said circuit, and means in said circuit for actuating said circulating means, attainment of a predetermined degree of salinity of water in said tank closing the circuit to discontinue operation of the circulating means.

8. A purging arrangement according to claim 7 in which said circuit includes a warning device, said warning device being actuated when said circuit is closed to warn the operator that a predetermined degree of water in the tank has been attained.

9. A purging arrangement according to claim 8 in which the circuit includes a reset switch and each relay includes a holding coil whereby the warning device is operated when the circuit is closed until the switch is thrown to open the circuit.

10. A unitary purging arrangement adapted to be attached to an absorption refrigeration system to purge non-condensible gases therefrom which comprises exhausting mechanism adapted to be connected to the absorber of the system for withdrawing non-condensible gases from the system, a liquid tank containing a cooling coil therein, means for circulating liquid from the tank to the exhausting mechanism and from the exhausting mechanism to the tank, and means for sensing the purging of absorber liquid from the system.

11. A unitary purging arrangement adapted to be attached to an absorption refrigeration system to purge non-condensible gases therefrom which comprises a tank for water containing a cooling coil therein, a water actuated ejector having its discharge connected to the tank, a steam actuated ejector having its discharge connected to the suction connection of the water actuated ejector, said steam actuated ejector having its suction connection adapted to be connected to the absorber of the system, and means for passing water from the tank to the power fluid supply connection of the water actuated ejector to actuate said ejector and a salinity indicator to indicate a predetermined degree of salinity of water in the tank.

12. A unitary purging arrangement according to claim 11 including a casing between the steam actuated ejector and the water actuated ejector, a coil in the casing and means for passing a cooling medium through the coil in heat exchange relation with steam and non-condensible gases discharged into the casing by the steam actuated ejector.

13. A unitary purging arrangement adapted to be attached to an absorption refrigeration system to purge non-condensible gases therefrom which comprises a tank for water containing a coil through which cooling medium is passed in heat exchange relation with the water in the tank, a water actuated ejector having its discharge connected to the tank, a steam actuated ejector having its discharge connected to the suction connection of the water actuated ejector, said steam actuated ejector having its suction connection adapted to be connected to the absorber of the system, and means for passing water from the tank to the power fluid supply connection of the water actuated ejector.

14. A unitary purging arrangement adapted to be attached to an absorption refrigeration system to purge non-condensible gases therefrom which comprises a tank, a liquid actuated ejector having its discharge connected to the tank, a steam actuated ejector having its discharge connected to the suction connection of the liquid actuated ejector, said steam actuated ejector having its suction adapted to be connected to the absorber of the system, a coil in said tank, means for passing a cooling medium through said coil in heat exchange relation with liquid in said tank, a heat exchanger without the tank adapted to cool cooling medium passing to the coil in said tank, and means for passing liquid from the tank to the power fluid supply connection of the liquid actuated ejector to actuate said ejector.

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