

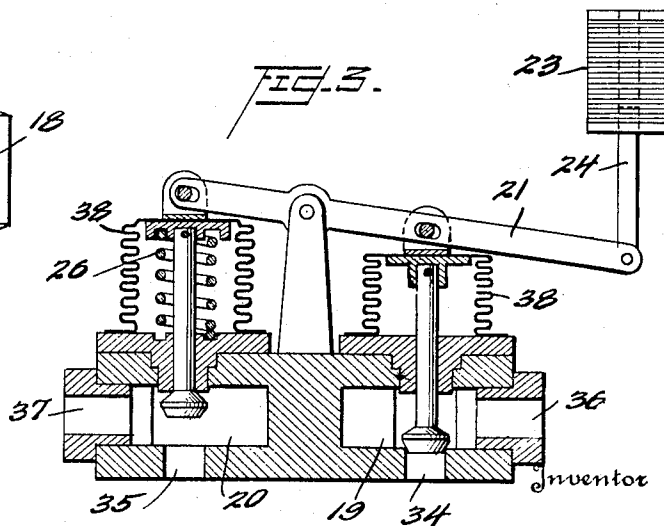
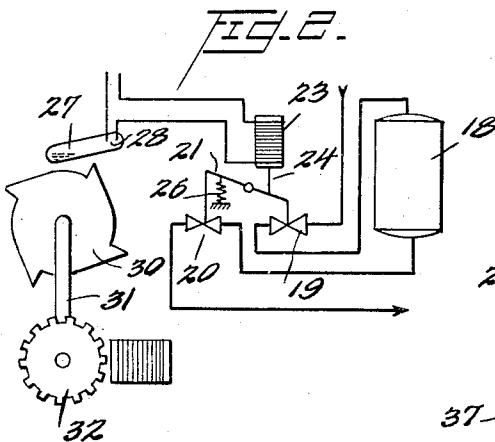
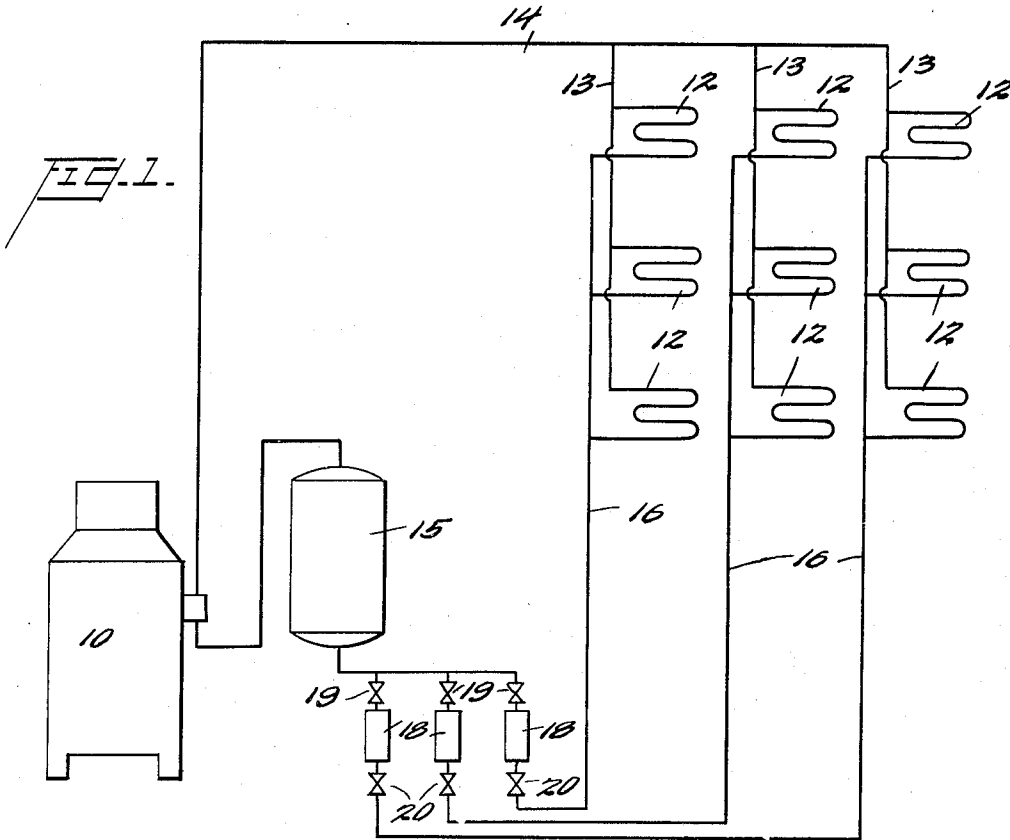
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SAFETY DEVICE FOR REFRIGERATION SYSTEMS

Original Filed April 8, 1930



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UNITED STATES PATENT OFFICE

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SAFETY DEVICE FOR REFRIGERATION SYSTEMS

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Application April 8, 1930, Serial No. 442,598
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7 Claims. (Cl. 62—2)

This invention relates to refrigeration apparatus and more particularly to that type of refrigeration apparatus in which a plurality of evaporators or cooling units are operated by a single machine or unit for changing the refrigerant vapor back to liquid.

It is a general object of the present invention to provide safety means for a multiple refrigeration system.

More particularly it is an object of this invention to provide means to limit the quantity of refrigerant which can escape in a given period from a broken or damaged liquid line in a multiple refrigeration system.

An important feature of the invention resides in the provision, in a multiple refrigeration system, of a plurality of secondary receivers, each of such capacity as to provide the maximum quantity of refrigerant required by the cooling units associated therewith, together with means for periodically and alternately connecting each secondary receiver to the main receiver and to the pipe delivering liquid refrigerant to the cooling units.

Other and important objects and features of the invention will be more apparent to those skilled in the art upon a consideration of the accompanying drawing and following specification wherein is disclosed a single exemplary embodiment of the invention with the understanding, however, that such changes may be made therein as fall within the scope of the appended claims without departing from the spirit of the invention.

In said drawing:

Figure 1 is a schematic showing of a refrigeration system having the present invention applied thereto;

Figure 2 is a detail showing schematically the valve control mechanism for one of the secondary receivers; and

Figure 3 is a view in section of the actual valve mechanism.

In providing refrigeration in individual apartments of an apartment building, two general systems are in vogue. The first consists in providing a complete refrigeration unit for each apartment, which requires, of course, not only a refrigerator or chest but also an evaporator or cooling unit and some form of mechanism for taking the vapor from the liquid in the cooling unit and condensing it to a liquid and returning it to the cooling unit. The second form makes use of a refrigerator chest in each apartment, containing an evaporator or cooling unit, and at some

convenient location a central refrigerating device is arranged and connected by suitable piping to a plurality of the cooling units. This second system, which the present invention is intended to improve, is cheaper, of course, than the system where an individual unit is placed in each apartment, but it is subject to danger where the refrigerant is toxic, for, in case of a break in the pipe lines supplying the liquid refrigerant to the evaporators, there is a possibility that all of the refrigerant in the system can be delivered through this break or leak. This is the primary danger of multiple systems installed according to the present practice.

The present invention contemplates controlling the quantity of refrigerant that can leave the system within a given time so that this danger is reduced to such proportions as to conform to safety. In fact, it substantially reduces the danger to that comparable with unit systems where leakage, of course, can take place.

Referring now to the drawing, there is disclosed at 10 any suitable refrigeration apparatus which may comprise a compressor and condenser as well as suitable control apparatus; or adsorption apparatus together with a condenser and control devices. The type of apparatus is independent of the invention which is suitable for any of the present well known refrigeration systems. Each apartment in the building is intended to be provided with a refrigerator containing an evaporator conventionally represented by the reference character 12. These evaporators may be of the flooded type in which coils or tanks are filled with the refrigerant liquid. The vapor from the liquid is drawn off through the pipes 13 to the manifold 14 where it is conducted to the refrigeration apparatus 10 and changed from its vapor phase to a liquid in any of the well known manners. This liquid, hereinafter referred to as the condensate, is then delivered to a receiver 15, as is customary. This receiver acts as a reservoir to always maintain a quantity of liquid on hand for delivery to the evaporators as required and usually under control of float valves in the evaporators which serve to maintain the liquid level therein constant.

To further reduce the amount of refrigerant in the system, the well known dye type of evaporator may be substituted for the flooded type above described.

As shown, it is customary to connect several evaporators by means of a single liquid riser 16. If one of these risers should leak or be broken in the present systems, all of the liquid in the

receiver 15 could escape through the leak, for it is to be remembered that the refrigerant liquid is such that it will vaporize at atmospheric temperature and pressure.

The present invention provides, in addition to the conventional apparatus already enumerated, a secondary receiver 18 for each liquid riser 16. each secondary receiver is provided with an inlet valve 19 controlling the flow of liquid from the main receiver to the secondary receiver, and an outlet valve 20 controlling the flow of liquid from the secondary receiver to the riser 16.

In Figure 2 the valves 19 and 20 are shown as having their operating stems connected by means of a centrally pivoted lever 21, so arranged that but one of the valves can be opened at one time. If the valve 20 is opened, the valve 19 will be closed, and any leak in a riser 16 will only permit the escape of the liquid in its secondary receiver.

In order that each secondary receiver may be filled with liquid periodically, means is provided to open the valve 19 for a sufficient length of time to fill the secondary receiver and at the same time to close the valve 20 so that any leak occurring during this change-over could not exhaust the liquid from the main receiver. Conveniently, the valves are operated by means of a solenoid 23 connected by means of a link 24 to the inlet valve end of the lever 21. The valve lever is normally held in the position shown in Figure 2 with the outlet valve 20 opened by means of the spring 26, but, when the solenoid is energized by closing its circuit by tilting the mercury switch 27 so that the mercury runs down and engages the contacts 28 therein, the valves are reversed, and fluid is permitted to flow into the secondary receiver 18 from the main receiver either by gravity or by the pressure of the liquid which vaporizes at temperatures below atmospheric. The switch bulb 27 is periodically tilted to reverse the position of the valves by means of a cam 30 mounted on the shaft 31 of a suitable clock 32 here shown to be an electric clock although it may be of any desired type.

With this arrangement it can be seen that only a limited amount of liquid refrigerant will be subjected to each riser at any time. The capacity of each secondary receiver is determined both by the load on the riser and the interval of valve operations. For example, let it be assumed that anhydrous ammonia is the refrigerant and that the load on each riser is 300 pounds ice melting effect per day, or 100 pounds per box, as shown in Figure 1. Then;

Refrigeration effect of 1 lb. NH_3 = 475 B. t. u.
Refrigerant required per riser per day =

$$\frac{300 \times 144}{475} \text{ lbs.} = 91$$

where 144 represents the number of B. t. u.'s liberated per pound of ice melted.

Assuming a valve operation interval of 60 minutes, the secondary receiver has a capacity of

$$\frac{91}{24} \text{ lbs.} = 3.79$$

Thus, the maximum amount of ammonia that can possibly leak out of any break in a riser is 3.79 pounds in one hour. This quantity can be varied by varying the number of risers or changing the valve shift intervals.

It will be clear that with the valves 19 closed, liquid will be delivered through the risers by the pressure of the refrigerant in the secondary receivers and that by the time the liquid in these

receivers is used up, a valve shift will take place, and they will be replenished from the main receiver. All of the solenoids controlling the various secondary receiver valves can be actuated from a single switch in unison, or separate cams and switches can be provided so that they can be filled at different times.

In Figure 3 are shown the structural details of the dual valve mechanism in which the valves 19 and 20 are arranged in a single casing to control the ports 34 and 35, respectively, where the liquid is fed in through the ports 36 and 37, respectively. The valve stems are surrounded by the collapsible bellows 38 so that no packing is required, and one of the bellows houses the spring 26 previously referred to.

A complete refrigeration system using an adsorber, a plurality of evaporators, and an elevated condenser as well as automatic control mechanism for such system, is shown and described in my copending application Serial Number 398,774, filed October 10, 1929, for Refrigeration system.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. In a refrigeration system, in combination, a plurality of evaporators containing a liquid refrigerant, a refrigeration device remote from the evaporators and including a condenser and a condensate receiver, vapor pipe lines associating the low side of the evaporators and the refrigeration device, liquid pipe lines associating the high side of the evaporators and the receiver and means in said last mentioned pipe lines adjacent the receiver to limit the quantity of condensed refrigerant which can flow in each under the expanding action of the liquid in a predetermined period of time.

2. In a multiple refrigeration system, in combination, a plurality of evaporators, a refrigeration unit comprising means to condense vapor from said evaporators, and a condensate receiver, a plurality of pipe lines each conveying said condensate from said receiver to one or more of said evaporators and means time-controlled to limit the quantity of condensate which can pass into any one pipe line from the receiver during a given interval of time.

3. In a multiple refrigeration system, in combination, a plurality of evaporators, a refrigeration unit comprising means to condense vapor from said evaporators, and a condensate receiver, a plurality of pipe lines each conveying said condensate to one or more of said evaporators, a secondary receiver for each pipe line and between it and the main receiver, means to normally isolate said main and secondary receivers and means to periodically connect said main and secondary receivers to recharge the secondary receivers.

4. In a multiple refrigeration system, in combination, a plurality of evaporators, a refrigeration unit comprising means to condense vapor from said evaporators, and a condensate receiver, a plurality of pipe lines each conveying said condensate to one or more of said evaporators, a secondary receiver for each pipe line, a valve between each secondary receiver and the main receiver, a valve between each secondary receiver and its pipe line, means associating said valves for alternate opening and closing and means to operate said valves periodically.

5. In a refrigeration system comprising a plurality of evaporators for liquid refrigerant and a single device for converting vapor from the

refrigerant to liquid, the combination of a receiver for refrigerant from said device, a pipe to deliver said refrigerant from said receiver to one or more of said evaporators and means to limit the flow of refrigerant in said pipe in a given interval to the maximum required during that interval by the evaporators connected thereto.

6. In a refrigeration system comprising a plurality of evaporators for liquid refrigerant and a single device for converting vapor from the refrigerant to liquid, the combination of a receiver for refrigerant from said device, a pipe to deliver said refrigerant from said receiver to one or more of said evaporators, a secondary receiver in said pipe near said main receiver, an inlet valve and an outlet valve for said secondary receiver and means to periodically and alternately open one of said valves and close the other.

7. In a refrigeration system comprising a plurality of evaporators for liquid refrigerant and a single device for converting vapor from the refrigerant to liquid, the combination of a receiver for refrigerant from said device, a plurality of pipes each to deliver said refrigerant from said receiver to one or more of said evaporators, a secondary receiver in each such pipe near the main receiver, each secondary receiver being of such capacity as to hold only sufficient liquid for the maximum demand on its pipe in a fixed period of time, an inlet valve normally closed and an outlet valve normally open for each receiver, and automatic means to briefly reverse the positions of said valves once in each fixed period.

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40	115
45	120
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55	130
60	135
65	140
70	145
75	150