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REFRIGERATING APPARATUS

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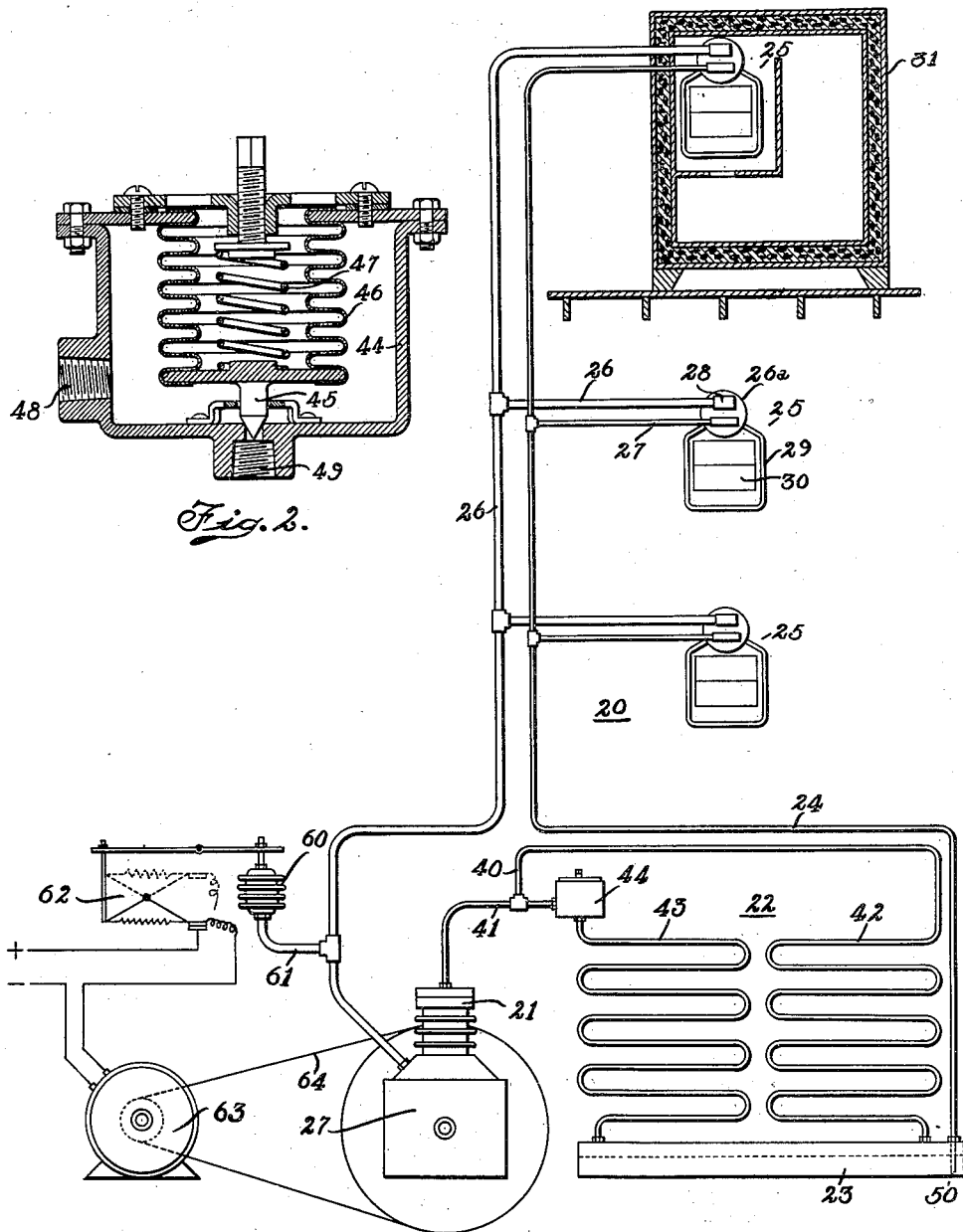


Fig. 1.

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UNITED STATES PATENT OFFICE

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REFRIGERATING APPARATUS

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This invention relates to refrigerating apparatus and more particularly to a mechanical refrigerating apparatus adapted to be installed in buildings of relatively great height, such as apartment houses.

An object of this invention is to provide a refrigerating apparatus of the mechanical type in which the condenser is provided with a by-pass in order to increase the liquid refrigerant pressure sufficiently to elevate the liquid refrigerant to evaporators placed a substantial elevation above the condenser.

Another object of this invention is to provide a refrigerating system with a condenser, such as of the air-cooled variety, having means for varying the capacity of the condenser in order to regulate the pressure of the liquid condensed therein.

Another object of this invention is to provide a condenser, such as of the air-cooled variety, with means for disconnecting a portion of the condenser in order to regulate or maintain the pressure of the condensed refrigerant.

Another object of this invention is to provide a refrigerating apparatus in which the evaporator is elevated substantially above the condenser and in which the condenser is provided with means for regulating the condenser capacity in accordance with the height of the evaporator from the condenser.

Another object of this invention is to provide a refrigerating apparatus capable of accomplishing the objects hereinbefore stated in an automatic manner.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawing, wherein a preferred form of the present invention is clearly shown.

In the drawings:

Fig. 1 is a diagrammatic view of a re-

frigerating apparatus embodying features of my invention, and

Fig. 2 is a detailed cross sectional view of an automatic valve which may be used in the apparatus shown in Fig. 1.

A refrigerating apparatus embodying features of my invention is generally designated as 20. The apparatus may comprise a compressor for receiving refrigerant at one pressure and delivering it at a higher pressure. This compressor may be mechanical, chemical or of any other type. In the embodiment shown, this may comprise a mechanical compressor 21 which delivers compressed refrigerant to a condenser generally designated as 22. The condenser 22 may be provided with a condensed refrigerant receiver 23 from whence the condensed refrigerant is delivered by the pipe 24 to one or more evaporators 25. The refrigerant evaporated in the evaporators 25 returns through one or more pipes 26 back to the compressor 21, for instance, to the crankcase 27 of the compressor.

The evaporators 25 may be of any type. For instance, they may be provided with a header 26a in which there is placed a float controlled valve, not shown, controlling the flow of refrigerant from the inlet pipe 27 into the header 26a. The header 26a may also be provided with an outlet fitting 28 which receives the evaporated refrigerant above the normal liquid level in the header 26a and delivers the evaporated refrigerant to the pipe 26 from whence it is returned to the compressor 21. The evaporator 25 may also be provided with depending loops 29 for increasing the refrigerating capacity of the evaporator and also for providing spaces in which to place the usual ice trays now used in domestic refrigerators of this type. When more than one of the evaporators 25 are used, they may be placed in similar or dissimilar spaces to be refrigerated. Any or all of them may be placed in refrigerating

cabinets similar to the cabinet 31. As shown diagrammatically, one or more of these evaporators 25 is located a substantial distance above or away from the condenser 22.

5 This occurs, for instance, when refrigerating cabinets are placed several stories above the condenser in an apartment house or the like.

10 With the usual air-cooled condenser using SO_2 it has been heretofore impractical to deliver refrigerant to evaporators a substantial distance, for instance 65 ft. or more in the case of SO_2 , above the condenser for the reason that a sufficient pressure could
15 not be maintained on the liquid refrigerant in order to elevate it to the height required. In order to adapt a condenser, particularly of the air-cooled type, to installations of this character, I have provided means for regulating the capacity of the condenser in order
20 to maintain the necessary pressure. As an embodiment, I have provided a by-pass around the condenser and have thus provided the condenser with means for increasing the normal pressure in said condenser. A specific example comprises a by-pass 40 from the pipe 41 leading from the compressor 21, which by-pass 40 may, if desired, include a section 42 of the condenser 22. Between the pipe 41 and the section 43 of the
30 condenser 22, throttling means 44 may be interposed. If the throttling means is to be automatic, it may be provided with a needle valve 45 operated by a diaphragm or sylphon 46 which prevents the opening of the needle valve 45 when the pressure in pipe 41 falls below a predetermined limit. This may be accomplished by providing an adjustable spring 47 for adjusting the minimum pressure at which the diaphragm or sylphon 46
40 opens the valve 45. A suitable inlet 48 may be provided for connecting the means 44 with the pipe 41 and a suitable outlet 49 may be provided for connecting the means with the section 43 of the condenser 22.

Thus the section 43 may be, under certain conditions, the main condenser, and the by-pass 40 need not have any condensing capacity at all. The means 44 prevents the
50 main condenser 43 from condensing refrigerant until the pressure in pipe 41 is above a predetermined pressure limit. The pressure in pipe 41 is transmitted through the by-pass 40 to the liquid in the receiver 23 and provides the pressure necessary to
55 lift the liquid refrigerant to the highest evaporator.

On the other hand, under other conditions, the section 42 may be the main condenser and may be of a capacity sufficient for winter
60 conditions. The section 43 may then be an auxiliary condenser capacity or area which is automatically added to the condenser 42 when the outside temperatures rise beyond a certain limit and tend to cut down the ca-

capacity of the condenser 42 below the requirements of the refrigerating system. Thus the capacity of the condenser, taken as a whole, may be varied in accordance with the pressure of the compressed refrigerant to compensate for variations in the temperature
70 of the air around the condenser.

The liquid receiver 23 is adapted to contain a quantity of liquid refrigerant having a level above the outlet 50 of the receiver into
75 pipe 24. It is thus seen that the pressure of the refrigerant above the liquid in the receiver 23 determines the height to which the liquid is lifted in the pipe 24. When insufficient pressure exists above this liquid, the evaporators placed at greater elevations do not receive the liquid necessary for refrigeration. When an air-cooled condenser, which is designed to provide sufficient condensing capacity for summer heat, is subjected to cold
80 temperatures during winter, heretofore it has been impractical to maintain sufficient pressures in the condenser to provide the proper elevation of the liquid. For this reason I have provided the section 43 of the condenser 22 with means for preventing the flow of refrigerant through it below the necessary minimum pressure and have provided the by-pass 40 for creating a pressure above the liquid refrigerant in the receiver 23. In the embodiment shown, the by-pass 40 includes an auxiliary condenser or section 42 of the condenser 22. Thus, it is seen that with the sections 42 and 43 both operating, sufficient condenser capacity may be provided during the
90 summer or during abnormally hot weather. When cool weather occurs, or during the winter season, the section 42 above may be sufficient to provide the necessary condensation and the section 43 will be disconnected by automatic means 44 in order to limit or vary the capacity of the condenser 22. Thus the condenser 22 is provided with a by-pass 40, which may include a portion of the condenser, and it is also provided with means for varying
100 or regulating the condenser capacity. The regulation of the condenser is such that a sufficient pressure is maintained on the liquid refrigerant to provide the necessary lifting power for the liquid in installations of the type heretofore described.

The apparatus may be made entirely automatic. This may be accomplished by providing an automatic control for the operation of the compressor 21. A means of accomplishing this may comprise a bellows 60 connected by the pipe 61 with the low pressure pipe 26. The bellows 60 is adapted to operate a snap switch 62 which controls the
110 starting and stopping of the motor 63 which drives the compressor 21, for instance, through the medium of the belt 64. Since the operations of the compressor 21, the condenser 22 and the evaporator 25 are all auto- 120 125 130

matic, the operation of the apparatus as a whole is rendered automatic.

While the form of embodiment of the invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. A refrigerating system comprising an evaporator for evaporating liquid refrigerant, a compressor for receiving the evaporated refrigerant from said evaporator and delivering it at a higher pressure, a condenser receiving refrigerant from said compressor and for delivering condensed refrigerant to said evaporator, means for preventing delivery of refrigerant directly from the compressor to the condenser at pressures below a predetermined pressure and a by-pass around said means and condenser from said compressor to said evaporator.

2. A refrigerating system comprising an evaporator for evaporating liquid refrigerant, a compressor for receiving the evaporated refrigerant from said evaporator and delivering it at a higher pressure, a condenser receiving refrigerant from said compressor and for delivering condensed refrigerant to said evaporator, means for preventing delivery of refrigerant directly from the compressor to the condenser at pressures below a predetermined pressure and a by-pass around said means and condenser from said compressor to said evaporator, said by-pass including an auxiliary condenser.

3. A refrigerating system comprising an evaporator for evaporating liquid refrigerant, a compressor for receiving the evaporated refrigerant from said evaporator and delivering it at a higher pressure, a condenser receiving refrigerant from said compressor, a receiver for receiving condensed refrigerant from said condenser and for delivering condensed refrigerant to said evaporator, means for preventing delivery of refrigerant directly from the compressor to the condenser at pressures below a predetermined pressure and a by-pass around said means and condenser from said compressor to said receiver.

4. A refrigerating system comprising an evaporator for evaporating liquid refrigerant, a compressor for receiving the evaporated refrigerant from said evaporator and delivering it at a higher pressure, a condenser receiving refrigerant from said compressor, a receiver for receiving condensed refrigerant from said condenser and for delivering condensed refrigerant to said evaporator, means for preventing delivery of refrigerant directly from the compressor to the condenser at pressures below a predetermined pressure and a by-pass around said means and condenser from said compressor to said receiver, said by-pass including an auxiliary condenser.

5. A refrigerating system comprising a compressor, an air-cooled condenser and an evaporator in a closed cycle, and means for automatically limiting the capacity of said condenser, in accordance with the pressure of refrigerant compressed by said compressor.

6. A refrigerating system comprising a compressor, an air-cooled condenser and an evaporator in a closed cycle, and means for automatically varying the capacity of said condenser, to maintain the compressor delivery pressure above a predetermined minimum.

7. A refrigerating system comprising a compressor, an air-cooled condenser and an evaporator in a closed cycle, and means for automatically disconnecting a portion of said condenser from said cycle, said means including an automatic pressure valve responsive to the pressure of the compressed refrigerant.

8. A refrigerating system comprising a compressor, a condenser and an evaporator in a closed cycle, and means for automatically disconnecting a portion of said condenser from said cycle, said means including an automatic pressure valve responsive to the pressure of the compressed refrigerant.

9. A refrigerating system comprising a compressor, an air-cooled condenser and an elevated evaporator in a closed cycle, and means for automatically varying the capacity of said condenser in accordance with the pressure of the compressed refrigerant to maintain the condensed refrigerant at a pressure sufficient to elevate the refrigerant to said evaporator.

10. A refrigerating system comprising a compressor, an air-cooled condenser and an elevated evaporator in a closed cycle, and means for automatically varying the capacity of said condenser to maintain the condensed refrigerant at a pressure sufficient to elevate the refrigerant to said evaporator, said last named means being provided with an adjustment for adapting it to different elevations of said evaporator.

11. A refrigerating system comprising a compressor, an air-cooled condenser and a plurality of evaporators at different elevations in a closed cycle, and means for automatically limiting the capacity of said condenser to maintain a pressure on the condensed refrigerant sufficient to elevate said liquid refrigerant to the highest of said evaporators.

12. A refrigerating system comprising a compressor, an air-cooled condenser and an elevated evaporator in a closed cycle, and means for varying the capacity of said condenser to maintain the condensed refrigerant at a pressure sufficient to elevate the refrigerant to said evaporator, said last named means being provided with an adjustment

for adapting it to different elevations of said evaporator.

13. A refrigerating system comprising a compressor, an air-cooled condenser and a plurality of evaporators at different elevations in a closed cycle, and means for limiting the capacity of said condenser to maintain a pressure on the condensed refrigerant sufficient to elevate said liquid refrigerant to the highest of said evaporators.

In testimony whereof I hereto affix my signature.

JESSE G. KING.

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