The invention relates to refrigerating apparatus and has reference more particularly to a header feed for supplying liquid refrigerant to a plurality of evaporating coils.

When the supply of refrigerant to all the coils of a refrigerating system is substantially equal the refrigeration produced by each is the same, and therefore all the coils should return gas to the suction line of the system, whereas, in an unbalanced distribution some of the coils may return gas and some unevaporated liquid refrigerant. Therefore an object of the invention is to provide means for uniformly distributing a supply of liquid refrigerant to a plurality of evaporating coils of a refrigerating system so that the refrigerant delivered to each coil over a period of time will be substantially equal.

It is desirable to accomplish the above result with the use of a single liquid refrigerant valve on the evaporator coils of a refrigerating system. The invention has for an object to secure good distribution of the refrigerant by feeding the refrigerant to a header having outlets for each coil and by restricting the flow of refrigerant from these header outlets so as to maintain a sufficiently high pressure in the header to prevent evaporation of the refrigerant in the header. This is necessary to prevent the partial feeding of gas through the header orifices which would be the case if the header pressure were low enough to permit evaporation of the incoming refrigerant.

The uniformity of refrigerant distribution from the various orifice outlets of the liquid feed header can be still further improved by pre-cooling the liquid refrigerant admitted to the header. Therefore, another object of the invention is to pre-cool the liquid delivered to the header by providing a heat interchanger between the liquid refrigerant supply and the suction line leaving the evaporator coils. With pre-cooled liquid in the header a very wide range in header pressure is possible under varying operating conditions without interfering with the uniformity of refrigerant distribution.

Another object of the invention is to provide an adjustable orifice so that the size of the same can be varied at will. An adjustable orifice opening is desirable since the opening leading to each coil is dependent upon the amount of tube and fin surface supplied by the feed of each orifice. After definite determination of the proper orifice size for a given size unit the adjustable feature may be eliminated. Also the invention contemplates the provision of a fixed orifice which can, however, be readily cleaned.

With these and various other objects in view the invention may consist of certain novel features of construction and operation as will be more fully described and particularly pointed out in the specification, drawings and claims appended hereto.

In the drawings which illustrate an embodiment of the invention and wherein like reference characters are used to designate like parts—

Figure 1 is a plan view showing a plurality of evaporating coils equipped with the header feed of the invention and which are supplied with liquid refrigerant from a special type of expansion valve;

Figure 2 is a front elevational view of the structure shown in Figure 1;

Figure 3 is a sectional view taken longitudinally through the header showing the orifices leading to the evaporating coils;

Figure 4 is a sectional view through the header taken on line 4-4 of Figure 3;

Figure 5 is a perspective view showing a plurality of evaporating coils equipped with a modified construction of header feed having adjusting needles for varying the size of the orifices leading to the coils;

Figure 6 is a sectional view along line 7-7 of Figure 6 showing the construction of the adjusting needles;

Figure 7 is an elevational view with the side wall broken away showing the header of the invention applied to a refrigerating system for cooling water, and

Figure 8 is a plan view, parts being shown in section, of an expansion valve for supplying liquid refrigerant to the present header.

Referring to the drawings, particularly Figures 1, 2 and 3, a section of a refrigerating system is shown including a supply pipe 10 for delivering liquid refrigerant to the expansion valve 12 of any conventional type and which in turn delivers the liquid through pipe 13 to header 14, the said pipe connecting with a valve and header respectively. The header comprises a cylindrical member closed at one end and connecting with the liquid supply pipe 13 and with a plurality of evaporating coils forming an enclosure for the ends of said coils.

In Figure 1 the evaporating coils are shown equipped with fins 16 which are disposed within the frame 17 supporting the evaporating coils and through which is passed the medium to be cooled, for example, air, so that the same is brought into contact with the fins and the coils. The ends of certain tubes are connected by arcs-
ate sections of pipe 18 to provide a continuous length of tube forming a coil which finally joins with the suction line 13. Each evaporating coil is served by a nipple 23 Fig. 4 a having a reduced portion fitting within an opening in the header 14 by which the inlet end of the coil is joined to the header having a sealing fit therewith. The nipple has a bore extending throughout providing a small orifice 24 located within the header so that the orifice forms the inlet to the evaporating coil, the liquid refrigerant from the header being delivered from the orifice to the coil. In the embodiment shown the orifice is provided with a wire 25 which extends outside of the header and is preferably soldered thereto but may be otherwise secured in a manner that will seal the header. This arrangement is not justifiable to vary the size of the orifice but the wire can be removed to clean the orifice of foreign matter.

The liquid supply pipe 10 is provided with a coiled section located within a heat exchanger 20. The exchanger has connection at its respective ends with the suction line 21 leading from the header 19. The gas flowing through the return 21 is at a relatively low temperature compared with the liquid refrigerant flowing through the supply pipe 18. The condensate from the heat exchanger in considerable heat is removed from the liquid refrigerant and as a result the same is delivered to the expansion valve 12 and the header at a much lower temperature than would otherwise be the case. In fact, the liquid refrigerant is cooled to very nearly evaporator temperature.

The liquid refrigerant from supply pipe 10 passes through the expansion valve 12 into pipe 13 which delivers the same to the header 14. For this reason the small orifices 24 forming the inlet to the evaporating coil the liquid refrigerant in the header is maintained at a high pressure and therefore evaporation of the same within the header is prevented. Evaporation of warm refrigerant causes flash gas within the header which if allowed to generate would tend to monopolize one or more of the orifices, preventing the passage of liquid refrigerant to the respective evaporating coils. By maintaining a high pressure on the cool refrigerant within the header the generation of flash gas is prevented and with the liquid having delivered to the evaporating coils. The apparatus shown in the drawings the expansion valve 12 is provided with a diaphragm 23 which controls the movement of the valve and thus the liquid refrigerant delivered to the header. The chamber the underside of the diaphragm is connected by tube 26 with the suction line 21 and thus the pressure on the underside of the diaphragm is equalized with the pressure of the evaporated refrigerant being returned to the compressor.

The space above the diaphragm has connection with a thermostat bulb 27 through tube 28 so that the diaphragm has movement proportionately to variations in temperature of the thermostat bulb. It will therefore be understood that the operation of the valve is responsive to the temperature of the suction line as modified by the pressure existing in said suction line.

It is not necessary that the header of the invention be disposed horizontally. In Figure 5 a vertical header 114 is shown having a connection with pipe 113 which supplies the same with liquid refrigerant. The header connects with the inlet ends of the evaporating coils 115 by means of a nipple 123 in a manner identical with that shown in Figure 4.

In this modification, however, the orifice 124, nipple 23, Fig. 4 a having a reduced portion connecting the pointed end of the needle 129 passing through and extending outwardly of the bushing 130. The projecting end of the needle has threaded engagement with the threaded nut 131 which is threaded into a recess in the bushing to retain packing 132 around the needle, the bushing in turn has suitably threaded thereto the cap or housing 133 which encloses the projecting end of the needle. Before adjustment of the needle can be effected the housing must be removed. With the addition of adjusting means for the orifices such as described herein or less refrigerant can be supplied to a selected evaporating coil to vary the refrigerant produced by that coil, while the pressure within the header can be maintained sufficiently high to prevent generation of flash gas.

The header feed of the invention distributes the liquid refrigerant to all the coils uniformly and the refrigeration produced by each coil is substantially equal so that all the coils return gas to the suction line. Therefore, the warm air to be cooled which may be admitted to the bottom of frame 17 and expelled at the top thereof, Figure 2, is of uniform temperature and may in turn be used to cool various parts of the system. The pressure in the header may be described as intermediate between the condensing and evaporating pressure is possible. The pressure in the header can be described as inter-
mediate since it is below the pressure on the discharge side of the compressor but above that existing in the evaporating coils. The expansion valve suitably supplies the header with the required amount of liquid refrigerant to be care of the load on the evaporating coils and which therefore maintains the proper pressure in the header. The valve has operation responsive to the temperature of the suction line. However, the temperature control is modified by the pressure existing in the suction line as the underside of the diaphragm of the expansion valve is subjected to this pressure. By providing an adjusting needle for varying the size of the orifice openings a more flexible installation is secured since the orifice opening is dependent upon the amount of tube and fin surface of the coil fed by said orifice. When accurate determination of this factor has been made the adjustment of the orifice need not be altered and subsequent installation can be supplied with an orifice such as shown in Figure 4 which is not adjustable but which can be cleaned of foreign matter by removing the wire.

The invention is not to be limited to or by details of construction of the particular embodiment illustrated by the drawings, as various other forms of the device will of course be apparent to those skilled in the art without departing from the spirit of the invention or the scope of the claims.

What is claimed is:
1. In a refrigerating system, a plurality of evaporating coils, each coil having a small orifice forming the inlet through which liquid refrigerant is delivered to the coil, an expansion valve having a connection on the outlet side thereof joining with the header, whereby liquid refrigerant in the header is maintained at a pressure between the evaporating and condensing pressures, means supplying said expansion valve with liquid refrigerant, and means utilizing the cooled refrigerant gas flowing through the suction line of the evaporator for cooling the liquid refrigerant prior to supplying the same to the expansion valve, said last mentioned means precooling the liquid refrigerant to a temperature lower than the boiling point of the refrigerant in the header.

2. In a refrigerating system, the combination with an evaporator, of a header enclosing the inlet end of a plurality of evaporating coils, each coil having a small orifice within the header forming the inlet end thereof through which liquid refrigerant is supplied to the coil, an expansion valve having a connection on the outlet side thereof joining with the header, thereby liquid refrigerant in the header is maintained at a pressure between the evaporating and condensing pressures, means supplying said expansion valve with liquid refrigerant, and means utilizing the cooled refrigerant gas flow through the suction line of the evaporator for cooling the liquid refrigerant prior to supplying the same to the expansion valve, said last mentioned means precooling the liquid refrigerant to a temperature lower than the boiling point of the refrigerant in the header.

3. In a refrigerating system, the combination with an evaporator, of a header enclosing the inlet end of a plurality of evaporating coils, each coil having a small orifice within the header forming the inlet end thereof through which liquid refrigerant is supplied to the coil, an expansion valve having a connection on the outlet side thereof joining with the header, thereby liquid refrigerant in the header is maintained at a pressure between the evaporating and condensing pressures, means supplying said expansion valve with liquid refrigerant, and means utilizing the cooled refrigerant gas flow through the suction line of the evaporator for cooling the liquid refrigerant prior to supplying the same to the expansion valve.

4. In a refrigerating system, the combination with an evaporator, of a header enclosing the inlet end of a plurality of evaporating coils, each coil having a small orifice within the header forming the inlet end through which liquid refrigerant is delivered to the coil, an expansion valve having a connection on the outlet side thereof joining with the header, whereby liquid refrigerant in the header is maintained at a pressure between the evaporating and condensing pressures, means supplying said expansion valve with liquid refrigerant, and means utilizing the cooled refrigerant gas flowing through the suction line of the evaporator for cooling the liquid refrigerant prior to supplying the same to the expansion valve.

5. In a refrigerating system, the combination with an evaporator, of a header enclosing the inlet end of a plurality of evaporating coils, each coil having a small orifice within the header forming the inlet end thereof through which liquid refrigerant is supplied to the coil, an expansion valve having a connection on the outlet side thereof joining with the header, thereby liquid refrigerant in the header is maintained at a pressure between the evaporating and condensing pressures, means supplying said expansion valve with liquid refrigerant, and means utilizing the cooled refrigerant gas flow through the suction line of the evaporator for cooling the liquid refrigerant prior to supplying the same to the expansion valve.

6. In a refrigerating system, the combination with an evaporator, of a header enclosing the inlet end of a plurality of evaporating coils, each coil having a small orifice within the header forming the inlet end thereof through which liquid refrigerant is supplied to the coil, an expansion valve having a connection on the outlet side thereof joining with the header, thereby liquid refrigerant in the header is maintained at a pressure between the evaporating and condensing pressures, means supplying said expansion valve with liquid refrigerant, and means utilizing the cooled refrigerant gas flowing through the suction line of the evaporator for cooling the liquid refrigerant prior to supplying the same to the expansion valve.

7. In a refrigerating system, the combination with an evaporator, of a header enclosing the inlet end of a plurality of evaporating coils, each coil having a small orifice within the header forming the inlet end thereof through which liquid refrigerant is supplied to the coil, an expansion valve having a connection on the outlet side thereof joining with the header, thereby liquid refrigerant in the header is maintained at a pressure between the evaporating and condensing pressures, a diaphragm for controlling the operation of said valve, said diaphragm having movement proportionate to variation in temperature of the refrigerant gas leaving the evaporator as modified by the pressure of said refrigerant gas, and means utilizing the cool refrigerant gas flowing through the suction line for cooling the liquid refrigerant prior to supplying the same to the expansion valve.
liquid refrigerant prior to supplying the same to the expansion valve.

8. In a refrigerating system, in combination, a plurality of evaporators each including at least one cooling coil, a distributor header for distributing liquid refrigerant to said evaporators, an expansion valve connecting with said header and delivering liquid refrigerant thereto, a flow resistance passage for each evaporator and which connects the cooling coil thereof with the header, means supplying said expansion valve with liquid refrigerant, and other means forming part of the suction line of the refrigerating system and utilizing the cool refrigerant gas flowing through the same for cooling the liquid refrigerant in said first mentioned means prior to supplying the same to the valve, whereby said flow resistant passages maintain the liquid refrigerant within the header at a relatively high pressure which in conjunction with the precooling of the refrigerant prevents evaporation within the header.

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