

Aug. 27, 1940.

J. KARMAZIN

2,212,864

REFRIGERATING APPARATUS

Original Filed July 12, 1937 2 Sheets-Sheet 1

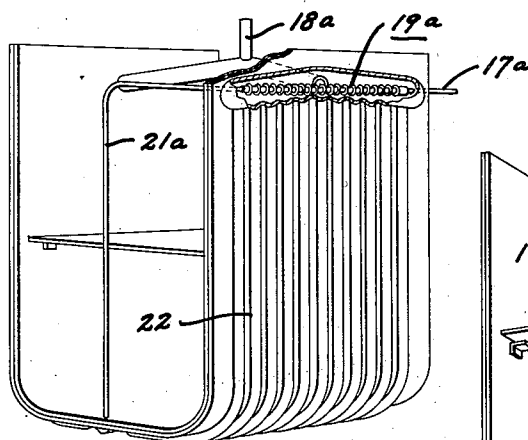
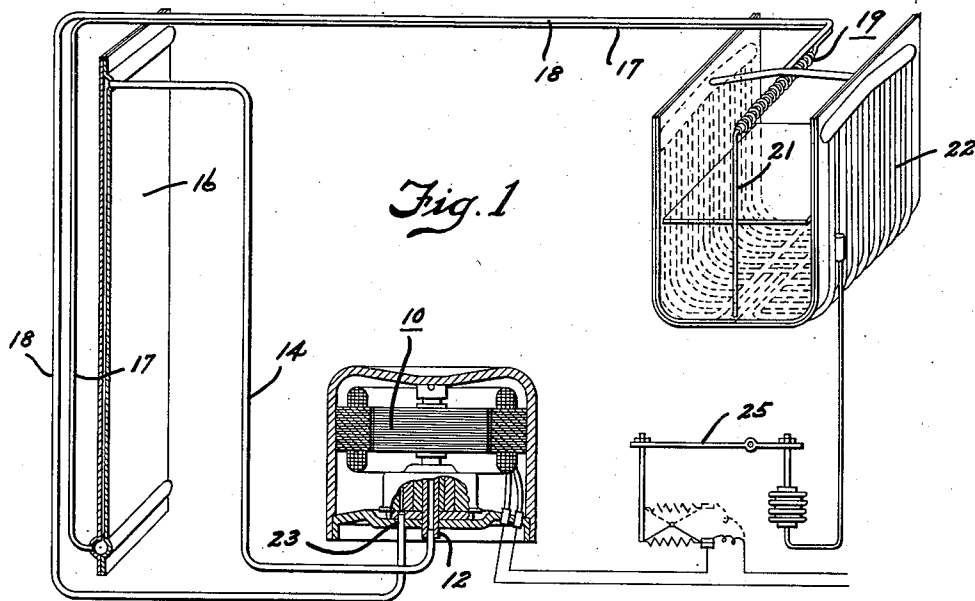


Fig. 2

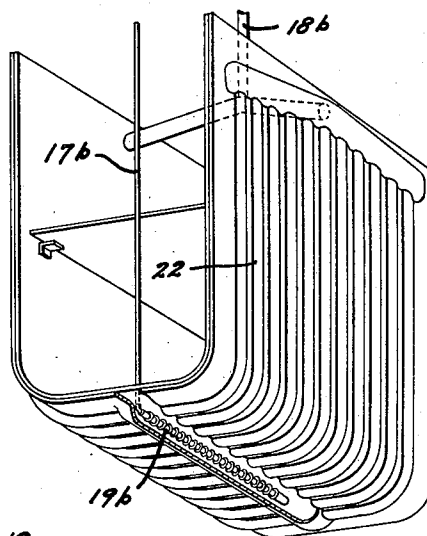


Fig. 3

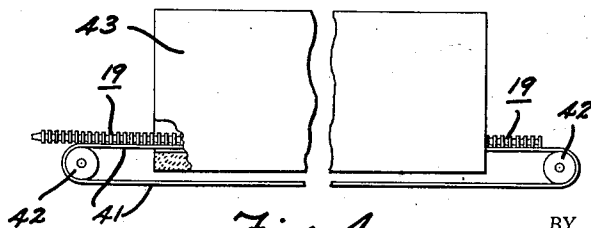


Fig. 4

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2 Sheets-Sheet 2

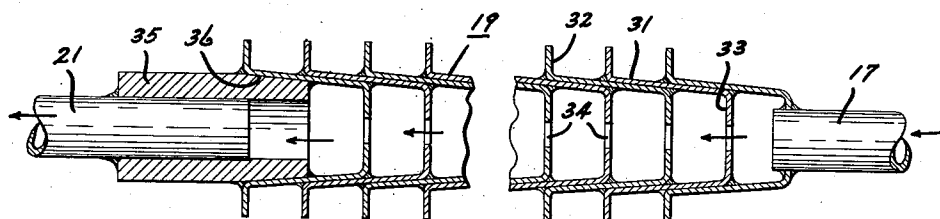


Fig. 6

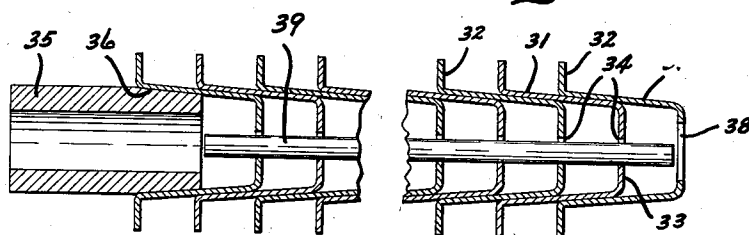


Fig. 5

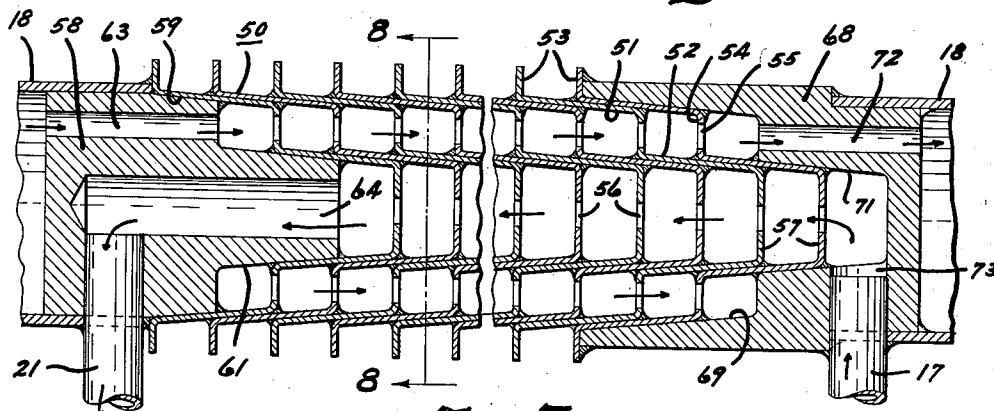


Fig. 7

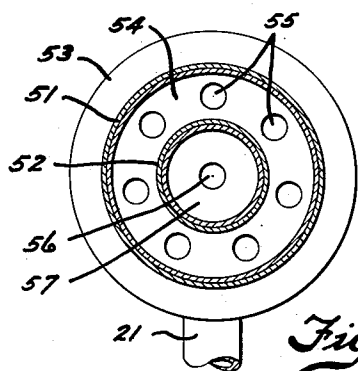


Fig. 8

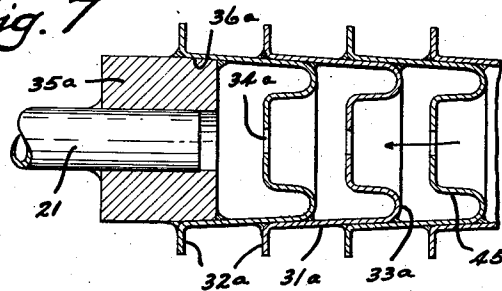


Fig. 9

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2,212,864

REFRIGERATING APPARATUS

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Renewed January 10, 1940

7 Claims. (Cl. 62-127)

This invention relates to refrigeration and particularly to a novel device for controlling the flow of liquid refrigerant in a refrigerating apparatus.

An object of my invention is to provide an improved liquid refrigerant flow control device such as a fixed restrictor and constructed of pressed sheet metal punchings.

Another object of my invention is to provide an improved combined heat exchanger and liquid refrigerant flow control device of pressed sheet metal construction.

A further object of my invention is to unidirectionally assemble a plurality of similar punched and pressed sheet metal members together and to bond the members to one another to form an elongated refrigerant restrictor or combined restrictor and heat exchanger having refrigerant passages therein and integral fin portions extending from the walls of the passages.

A still further object of my invention is to provide an elongated refrigerant restrictor or combined restrictor and heat exchanger of pressed sheet metal construction having a plurality of separated closed refrigerant passages therein and integral reinforcing means throughout the length thereof forming fixed restrictions to the flow of refrigerant through one of the passages.

In carrying out the foregoing objects it is a further and more specific object of my invention to form an elongated small diametered refrigerant restrictor of unidirectionally assembled and secured together pressed sheet metal members which can be located in gaseous refrigerant headers ordinarily provided between sheet metal shells forming a refrigerant evaporator.

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

In the drawings:

Fig. 1 is a diagrammatic illustration of a refrigerating system having a refrigerant restrictor constructed in accordance with my invention installed therein;

Fig. 2 is a perspective view of an evaporator of a refrigerating system having the refrigerant restrictor located in a gaseous refrigerant header thereof;

Fig. 3 is a perspective view of the evaporator disclosed in Fig. 2 and showing the refrigerant restrictor located in a different refrigerant header thereof;

Fig. 4 is a view illustrating diagrammatically

a furnace through which the restrictors of the present invention are passed for brazing same;

Fig. 5 is an enlarged fragmentary sectional view showing unidirectionally nested pressed sheet metal members assembled together and having brazing material disposed internally thereof prior to being placed in the furnace disclosed in Fig. 4;

Fig. 6 is a view of the members shown in Fig. 5 after having been bonded together to form a refrigerant restrictor of the present invention;

Fig. 7 is an enlarged fragmentary sectional view of a combined refrigerant restrictor and heat exchanger constructed in accordance with the present invention;

Fig. 8 is a sectional view through the combined refrigerant restrictor and heat exchanger shown in Fig. 7 and is taken on the line 8-8 thereof; and

Fig. 9 is a view similar to Fig. 6 and showing a portion of a restrictor constructed of pressed sheet metal members of modified form.

Referring to Fig. 1 of the drawings, there is shown a refrigerating apparatus comprising a motor-compressor unit 10 having an outlet 12 through which compressed refrigerant is delivered by means of a conduit 14 to a condenser 16. Refrigerant liquefied in the condenser 16 is delivered through conduit 17 to a heat exchanger, comprising conduit 17 thermally secured to a conduit 18, whence it passes to the refrigerant flow control device or restrictor, generally represented by the reference character 19, for delivery by conduit 21 to the evaporator 22. Refrigerant vaporized in the evaporator 22 is delivered by means of the suction conduit 18 to the inlet 23 of the compressor unit 10. A suitable thermostat or automatic control device 25 is provided for intermittently operating the motor-compressor unit 10 to provide substantially constant temperatures at the evaporator 22. The system operates in the conventional manner to withdraw heat at the evaporator from a food compartment or other object to be cooled and to dissipate heat at the condenser to the room air or other cooling medium.

In Fig. 1 the refrigerant flow control device or restrictor 19 is located outside the walls of the evaporator 22. The restrictor 19 may, however, be located between the sheet metal members or shells forming walls of the evaporator and to illustrate this I have shown in Fig. 2 of the drawings the restrictor 19a as being disposed within an enlarged gaseous refrigerant header located at the upper part of one leg of the evaporator 22.

In Fig. 3 I have shown the restrictor 19b as being within an enlarged refrigerant header located at the bottom of the evaporator 22 and adapted to discharge liquid refrigerant directly thereinto. The forming of the restrictor 19 into an elongated shape and of small diameter in accordance with the present invention permits its location within the evaporator 22 itself as illustrated in Figs. 2 and 3 to thereby serve as a heat exchanger as well as a refrigerant control device.

Referring now to Fig. 5 of the drawings I have shown a plurality of unidirectionally superimposed sheet metal members each having a tapered tubular portion 31 struck or pressed therefrom and telescoped together. Each sheet metal member also has an integral fin portion 32 extending outwardly from the tube part 31 thereof and an end wall portion 33. In striking the tube portion 31 from a sheet metal blank of predetermined size and shape an orifice or small opening 34 is punched from the blank at the center of the end wall 33. A predetermined number of the pressed sheet metal cup members are stacked one upon another to form an elongated structure of any desired length. A hollow metal end element 35 having a tapered surface 36 fitting within the end sheet metal member of the stacked structure is adapted to receive the end of the refrigerant conduit 21. At the opposite end of the assembled structure I place an end sheet metal cup member provided with a relatively large opening 38 for the reception of the end of the liquid refrigerant conduit 17. After assembling a restrictor device of predetermined length as described and as shown in Fig. 5 a copper brazing strip or rod 39 is passed through the openings 34 of the cup members so as to be disposed within the assembled structure. The assembled structure is then placed on a conveyor belt 41 (see Fig. 4) mounted upon driving pulleys 42 and caused to travel into and through the furnace 43. Heat generated in any suitable or desirable manner within the furnace 43 melts the copper brazing strip or rod 39 and causes the copper to flow into crevices at the joint between the pressed sheet metal cup members of the structure 19 to bond the members together in fluid-tight relationship. The restrictor structure 19 may, if desired, be turned or rotated during its travel through the brazing furnace 43 to cause uniform flow of the molten copper or rod 39 therein so as to insure the making of uniform bonds or fluid-tight joints between the plurality of pressed sheet metal cup members. After the brazed structure 19 has had conduits 17 and 21 secured thereto as shown in Fig. 6 of the drawings the orifices or small openings 34 formed in the plurality of pressed sheet metal cup members thereof, provide a passage of small cross-section and relatively great length therethrough.

In operation of the refrigerating system liquid refrigerant is fed from the pipe 17 into the restrictor 19 at one end thereof. Since the walls 31 of the plurality of pressed sheet metal cup members of the restrictor device provides a plurality of relatively large chambers throughout the length of the restrictor any sediment entering same will collect and be trapped in these chambers. Thus the chambers within the restrictor 19 prevent clogging of the orifices to insure proper flow of refrigerant therethrough and to control the passage of refrigerant from the high to the low pressure side of the refrigerating system. The chambers within the restrictor 19 also renders the purpose of a filter screen therein unnecessary.

Liquid refrigerant under pressure in conduit 17 has its pressure reduced to the low pressure prevailing in conduit 21 and evaporator 22 by the great frictional or viscous resistance to the flow of fluid through the plurality of orifices in the restrictor, as is well-known in the art.

In Fig. 9 of the drawings I have shown a modified form of refrigerant flow device or restrictor and the pressed sheet metal cup members thereof have their bottoms 33a bent or formed inwardly as at 45. The forming of the sheet metal cup members as shown at 45 in Fig. 9 provides a restrictor of increased structural strength over the restrictor 19 shown in Fig. 6 to prevent deformation thereof. It is to be understood that the pressed sheet metal cup members of my improved restrictor may take various forms without departing from the principle of the invention.

Referring now to Fig. 7 of the drawings I have disclosed a unitary combined restrictor and heat exchanger structure generally represented by the reference character 50 and adapted to be interposed in the gaseous refrigerant suction conduit 18 of the refrigerating system and preferably closely adjacent the evaporator 22. By employing the combined structure 50 in a refrigerating system the positioning of the restrictors 19a and 19b within the walls of the evaporator or the welding or soldering of the refrigerant conduits 17 and 18 in intimate thermal contact with one another to provide a heat exchanger for the refrigerating system is unnecessary. The combined restrictor and heat exchanger 50 comprises a plurality of unidirectionally superimposed sheet metal members each having two tapered tubular portions 51 and 52 struck or pressed therefrom. The tubular portion 51 of each sheet metal member is of larger diameter than the tubular portion 52 thereof and these portions of one sheet metal member are telescoped upon or into similar portions of another of the members. Each of the sheet metal members of the restrictor 50 has an integral fin portion 53 extending outwardly from the tubular portion 51 thereof. The web part 54 of each sheet metal member of restrictor 50 extending from and connecting the tubular portions 51 and 52 thereof has a plurality of openings 55 punched therein (see Fig. 8). In striking the sheet metal members of the restrictor 50 from a blank of predetermined size and shape an orifice or small opening 56 is punched from the blank at the center of the end wall 57 thereof. A predetermined number of the sheet metal members are unidirectionally stacked one upon another to form an elongated structure of any desired length. A metal plug element 58, having a tapered surface 59 fitting within a part of the tapered wall of tubular portion 51 and having another tapered surface 61 fitting within a part of the tapered wall of tubular portion 52 of the end sheet metal member of restrictor 50, is adapted to receive an end of the gaseous refrigerant suction conduit 18 of the refrigerating system. This element 58 is provided with an opening or a plurality of openings 63 extending entirely therethrough to permit the passage of gaseous refrigerant from one portion to another portion of conduit 18 through the device 50 interposed therein. Another opening 64 provided in element 58 communicates with the interior of the combined element or device 50 and has an end of the refrigerant conduit 21 secured therein. Another metal plug element 68 located at the opposite end of the device 50 and fitted within conduit 18 has a hollowed-out part 69 which fits

over and receives the tapered wall of tubular portion 51 and has a second hollowed-out part 71 which fits over and receives the tapered wall of the tubular portion 52 of the sheet metal members of the structure. This element 68 also has an opening or a plurality of openings 72 extending entirely therethrough to permit the passage of gaseous refrigerant from one portion to another portion of conduit 18 through the device 50. Another opening 73 provided in element 68 communicates with the interior restricted portion of device 50 and has an end of the liquid refrigerant conduit 17 secured therein.

By reference to Fig. 7 it will be noted that compressed relatively warm liquid refrigerant flowing from conduit 17 enters the elongated passage extending through the device 50 and formed by the smaller diametered tubular portion 52 of the sheet metal members thereof. The orifices or small openings 56 provide an elongated passage of small cross-section and of relatively great length through the device 50. The liquid refrigerant upon passing through the elongated passage of device 50 has its pressure reduced to a lower pressure and flows from the device 50 through opening 64 and conduit 21 to the evaporator. Gaseous refrigerant flowing from the evaporator to the compressor of the refrigerating system by way of conduit 18 is directed through the openings 63 in element 58 at the one end of device 50, through the passage formed between the two tubular portions 51 and 52 of the plurality of sheet metal members of device 50 and through the openings 72 in element 68. The liquid refrigerant flowing towards the evaporator in the use of the device 50 is surrounded by refrigerant flowing from the evaporator and in this way the cool gaseous refrigerant gives up its heat to the relatively warm liquid refrigerant to precool same. Therefore the device 50 provides an efficient improved form of heat exchanger for the refrigerating system. It is to be understood that the various sheet metal members of the combined heat exchanger and restrictor 50 may be bonded together in much the same manner as various parts of the restrictor 19. Prior to heating device 50 copper brazing rods may be inserted in both refrigerant passages thereof to thereby seal the passages from one another in fluid-tight relationship. The metal members 35, 35a, 58 and 68 and the refrigerant pipes communicating therewith may be bonded to the structure in any suitable or desirable manner.

From the foregoing it will be seen that I have provided an improved flow control device or an improved combined refrigerant flow control device and heat exchanger for a refrigerating system which can be constructed from a plurality of unidirectionally nested and secured together sheet metal integral fin and tube members. It will be seen that the devices disclosed while being elongated are of great structural strength due to the superimposing, telescoping and bonding together of the pressed sheet metal members. My invention provides structures that can be readily assembled into various lengths as desired and can be manufactured at low cost.

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. In a refrigerating system, an element form-

ing a combined heat exchanger and control device for controlling the flow of refrigerant from the high pressure side to the low pressure side of the system comprising, a plurality of unidirectionally superimposed sheet metal members each having a tube portion telescoped into the tube portion of an adjacent member and secured thereto to provide a wall of a closed refrigerant passage extending through the element, each of said plurality of sheet metal members also having a second integral tube portion telescoped into the second integral tube portion of an adjacent member and secured thereto to provide a wall of a second closed refrigerant passage extending through the element and surrounding said first named passage, and certain of said sheet metal members having an integral part thereof extending a predetermined distance into one of said passages to form a plurality of obstructions to the flow of refrigerant therethrough.

2. In a refrigerating system, an element forming a combined heat exchanger and control device for controlling the flow of refrigerant from the high pressure side to the low pressure side of the system comprising, a plurality of unidirectionally superimposed sheet metal members each having a tube portion telescoped into the tube portion of an adjacent member and secured thereto to provide a wall of a closed refrigerant passage extending through the element, each of said plurality of sheet metal members also having a second integral tube portion telescoped into the second integral tube portion of an adjacent member and secured thereto to provide a wall of a second closed refrigerant passage extending through the element and surrounding said first named passage, and certain of said sheet metal members having an integral part thereof extending a predetermined distance into the said first named passage to form a plurality of obstructions to the flow of refrigerant therethrough.

3. In a refrigerating system, an element forming a combined heat exchanger and control device for controlling the flow of refrigerant from the high pressure side to the low pressure side of the system comprising, a plurality of unidirectionally superimposed sheet metal members each having a tube portion telescoped into the tube portion of an adjacent member and secured thereto to provide a wall of a closed refrigerant passage extending through the element, each of said plurality of sheet metal members also having a second integral tube portion telescoped into the second integral tube portion of an adjacent member and secured thereto to provide a wall of a second closed refrigerant passage extending through the element and surrounding said first named passage, certain of said sheet metal members having an integral part thereof extending a predetermined distance into one of said passages to form a plurality of obstructions to the flow of refrigerant therethrough, and certain of said sheet metal members having an integral fin portion extending outwardly from the wall of said second named closed refrigerant passage.

4. In a refrigerating system, an element forming a combined heat exchanger and control device for controlling the flow of refrigerant from the high pressure side to the low pressure side of the system comprising, a plurality of unidirectionally superimposed sheet metal members each having a tube portion telescoped into the tube portion of an adjacent member and secured thereto to provide a wall of a closed refrigerant passage extending through the element, each of

said plurality of sheet metal members also having a second integral tube portion telescoped into the second integral tube portion of an adjacent member and secured thereto to provide a wall of a second closed refrigerant passage extending through the element and surrounding said first named passage, each of said sheet metal members having an integral part thereof extending a predetermined distance into said first named passage, said integral part of said sheet metal members being disposed in spaced apart relation to one another to form a plurality of obstructions to the flow of refrigerant through said first named passage, and each of said sheet metal members also having an integral fin portion extending outwardly from the wall of said second named refrigerant passage.

5. In a refrigerating system, an element forming a combined heat exchanger and control device for controlling the flow of refrigerant from the high pressure side to the low pressure side of the system comprising, a plurality of unidirectionally superimposed sheet metal members each having a tube portion telescoped into the tube portion of an adjacent member and secured thereto to provide a wall of a closed refrigerant passage extending through the element, each of said plurality of sheet metal members also having a second integral tube portion telescoped into the second integral tube portion of an adjacent member and secured thereto to provide a wall of a second closed refrigerant passage extending through the element and surrounding said first named passage, each of said sheet metal members having an integral part thereof extending a predetermined distance into said first named passage, said integral part of said sheet metal members being disposed in spaced apart relation to one another to form a plurality of obstructions to the flow of refrigerant through said first named passage, each of said sheet metal members also having an integral fin portion extending outwardly from the wall of said second named refrigerant passage, and the portion of each of said sheet metal members connecting the tube portions thereof being perforated to permit a substantially non-restricted flow of refrigerant through said second named refrigerant passage.

6. A refrigerating apparatus comprising, an

evaporator, a condenser, and a motor-compressor unit operatively connected together by conduits to form a closed refrigerant fluid circulating system, means interposed in the conduit leading from said condenser to said evaporator for dividing said system into a high pressure side and a low pressure side and adapted to control the flow of refrigerant fluid therebetween, said means including a plurality of unidirectionally superimposed sheet metal members each having a tube portion telescoped and secured together to provide a wall of a closed passage adapted to extend therethrough, certain of said sheet metal members having an integral part thereof projecting into the passage and provided with an opening and said integral part of said certain of the sheet metal members being disposed in spaced apart relation to the integral part of other of the certain members with the openings therein of such size and character as to form restrictions at a plurality of points along the passage to the flow of refrigerant fluid therethrough.

7. A refrigerating apparatus comprising, an evaporator, a condenser, and a motor-compressor unit operatively connected together by conduits to form a closed refrigerant fluid circulating system, means interposed in the conduit leading from said condenser to said evaporator for dividing said system into a high pressure side and a low pressure side and adapted to control the flow of refrigerant fluid therebetween, said means including a plurality of unidirectionally superimposed sheet metal members each having a tube portion telescoped and secured together to provide a wall of a closed passage adapted to extend therethrough, certain of said sheet metal members having an integral part thereof projecting into the passage and provided with an opening, said integral part of said certain of the sheet metal members being disposed in spaced apart relation to the integral part of other of the certain members with the openings therein of such size and character as to form restrictions at a plurality of points along the passage to the flow of refrigerant fluid therethrough, and certain of said sheet metal members having an integral fin portion extending outwardly from the wall of said passage.

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