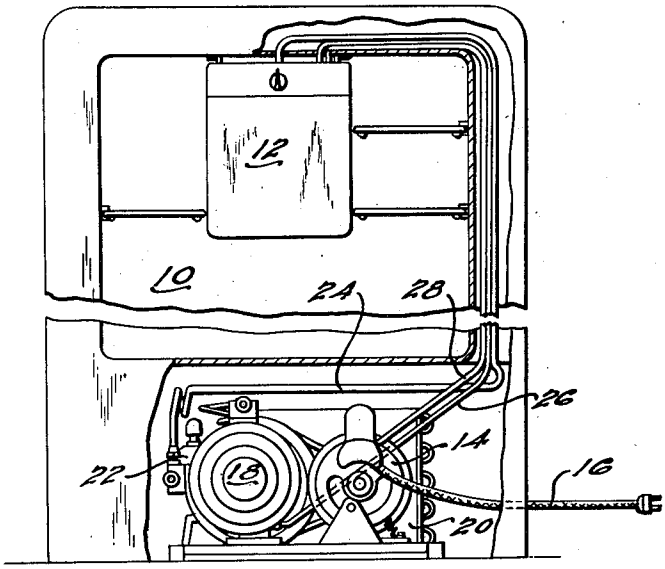
Sept. 9, 1941. E. F. HUBACKER 2,255,587

METHOD OF HEAT TRANSFER

Filed March 13, 1939 4 Sheets-Sheet 1

FIG. 1.



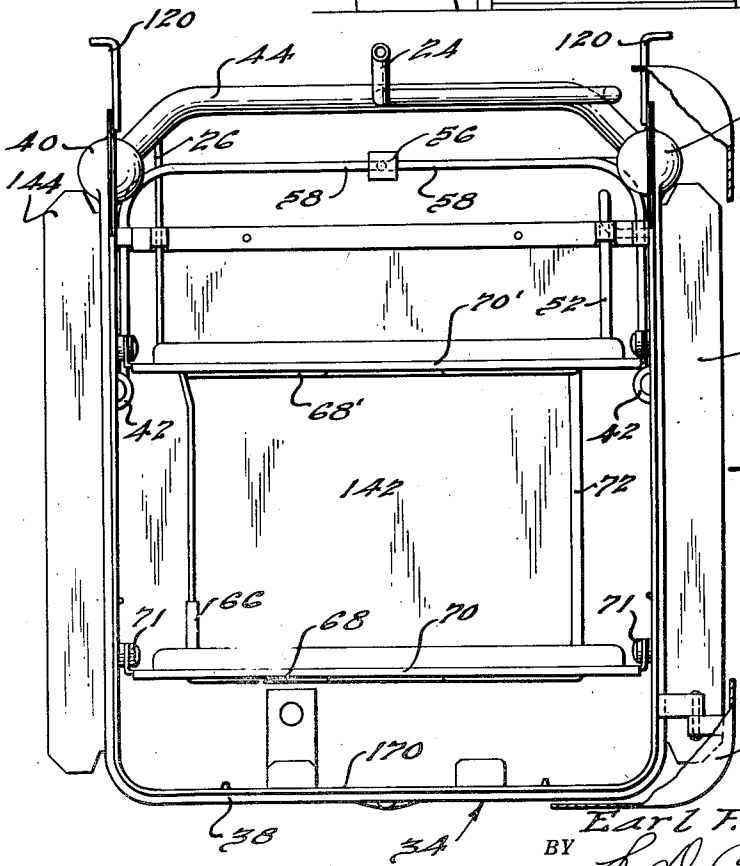


FIG. 2.

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METHOD OF HEAT TRANSFER

Filed March 13, 1939 4 Sheets-Sheet 2

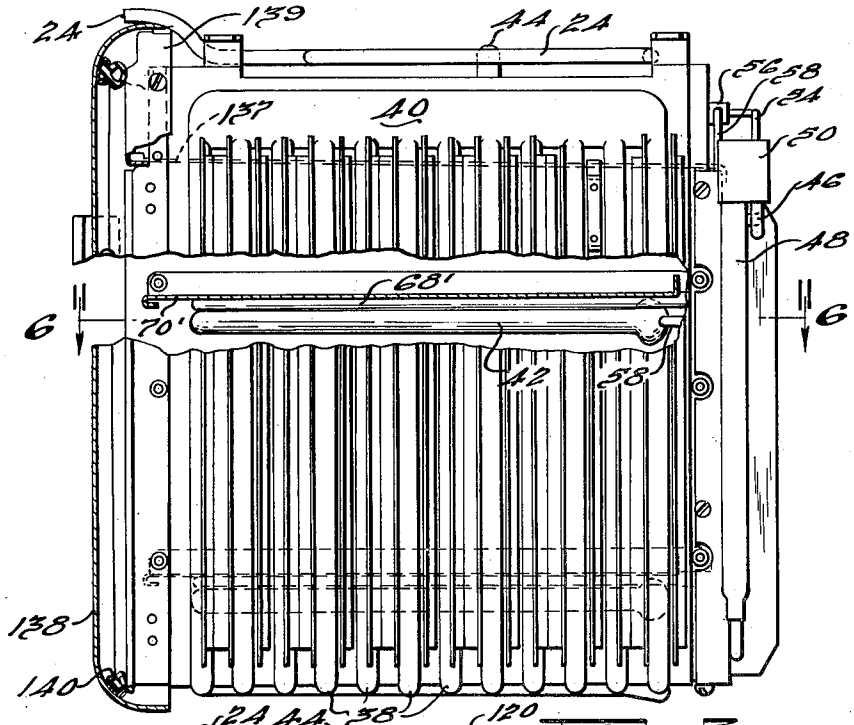


FIG. 3.

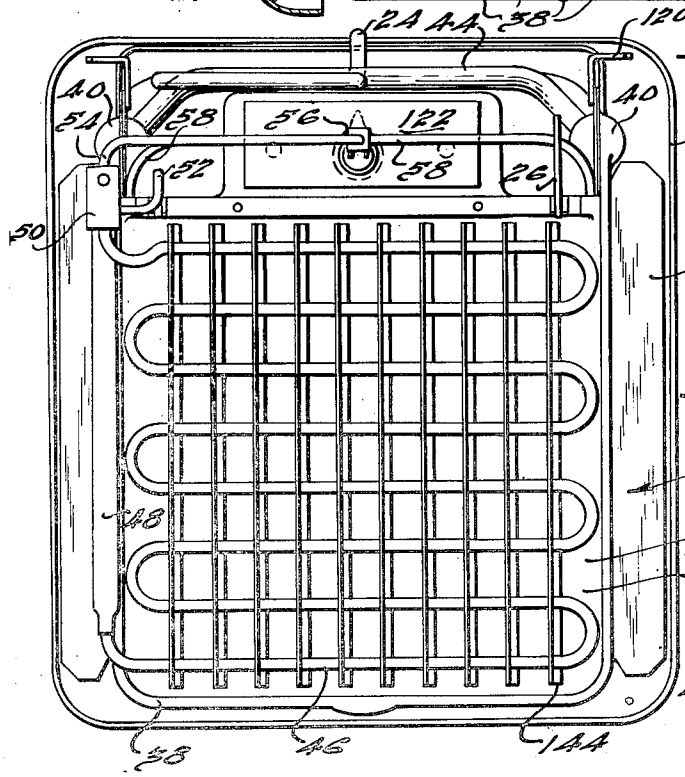


FIG. 4.

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METHOD OF HEAT TRANSFER

Filed March 13, 1939 4 Sheets-Sheet 3

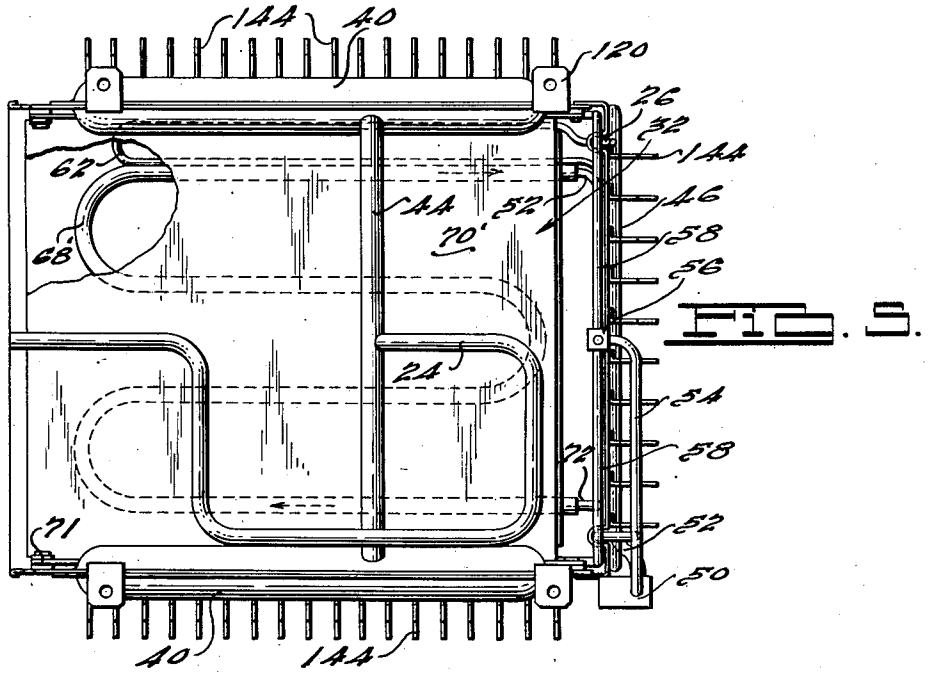


FIG. 5.

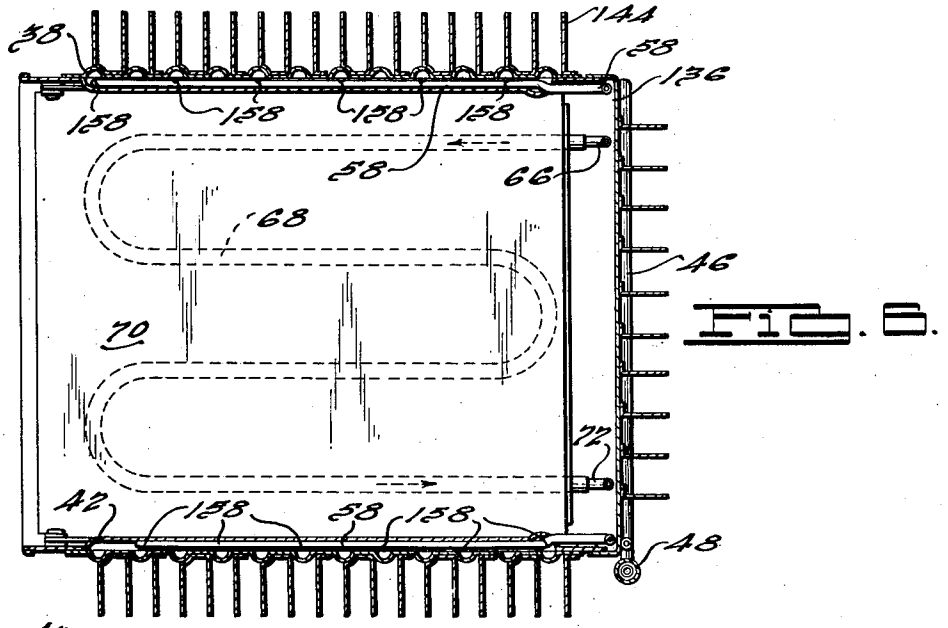


FIG. 6.

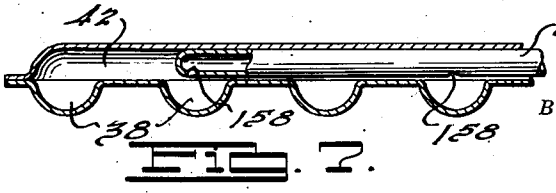


FIG. 7.

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METHOD OF HEAT TRANSFER

Filed March 13, 1939 4 Sheets-Sheet 4

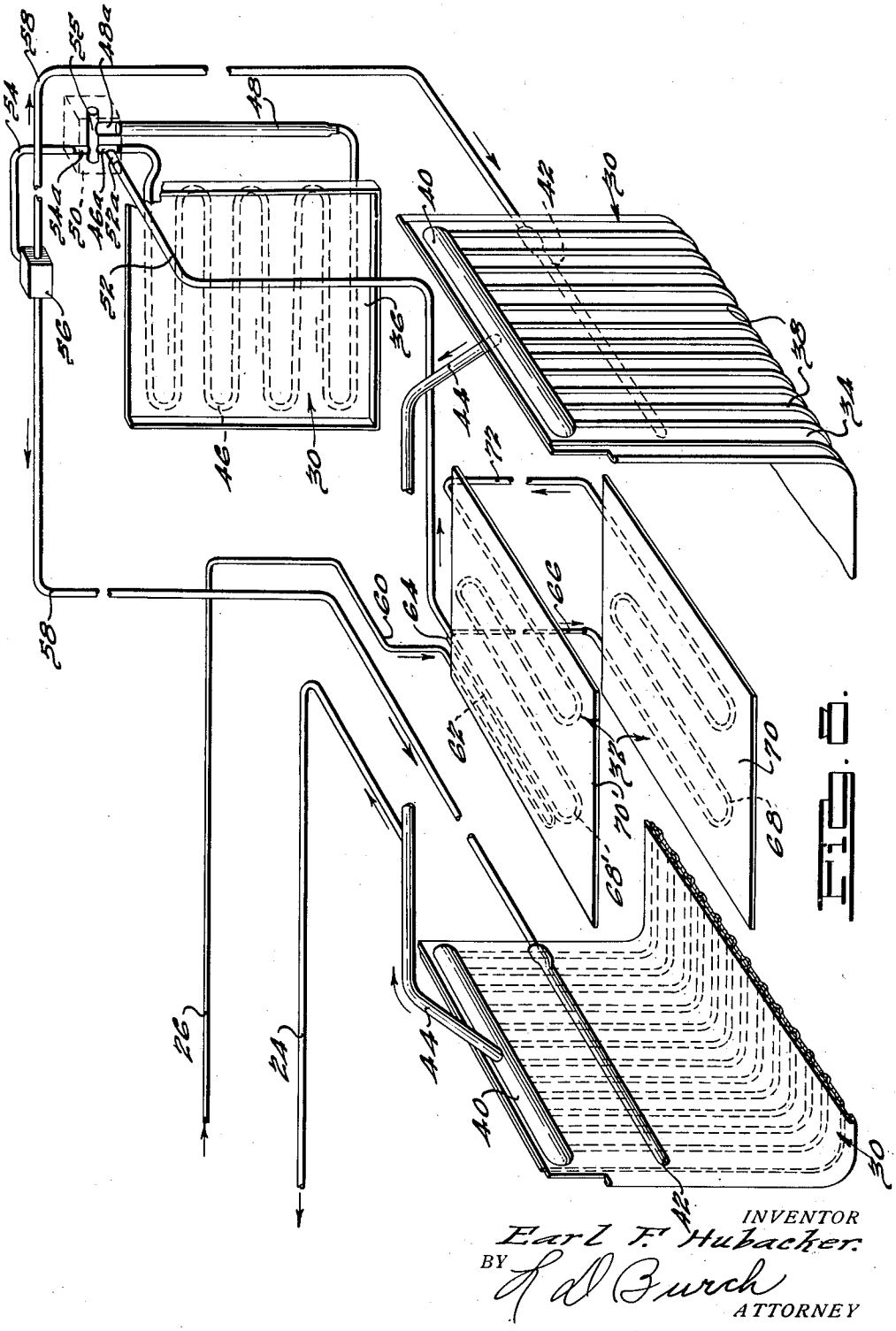


Fig. 8.

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Patented Sept. 9, 1941 2,255,587

UNITED STATES PATENT OFFICE

2,255,587

METHOD OF HEAT TRANSFER

Earl F. Hubacker, Highland Park, Mich., assignor to Borg-Warner Corporation, Chicago, Ill., a corporation of Illinois

Application March 13, 1939, Serial No. 261,526

5 Claims. (Cl. 62—178)

This invention relates to the art of refrigeration and has reference to improved methods of and apparatus for heat transfer which are particularly useful for providing different temperature and humidity conditions within different compartments and at the same time.

As illustrated in the drawings, my invention is shown as being embodied in a refrigerating system and refrigerator of the so-called domestic type and which comprises in general a heat insulated compartment and a refrigerating system which includes two evaporators, one of the evaporators being arranged within the heat insulated compartment for cooling the air therein and the other of said evaporators being arranged within a second compartment within the heat insulated compartment and shielded from the circulating air therein, one of said evaporators being adapted to produce refrigeration at a different temperature level than that produced by the other of said evaporators and both of said evaporators being of such capacity, with respect to the compartment in which they are arranged, as to produce different temperature and humidity conditions in each of said compartments.

A principal object of the invention is to provide a new and improved form of refrigerating system which will operate to produce refrigeration at a plurality of different temperatures simultaneously.

Another object of the invention is to provide a new and improved form of evaporator construction which has one part particularly designed for fast ice freezing and for the low temperature storage of frozen foods and another part which is particularly designed for air cooling and is of such capacity and operated at such a temperature relative to the space to be cooled as to provide more favorable temperature and humidity conditions within such space, for the storage of food stuffs.

Another object of the invention is to provide a new and improved form of refrigerating system and refrigerant for use therein, so that said system will operate to produce refrigeration at a plurality of different temperature levels at the same time.

Another object of the invention is to provide a new and improved form of "two temperature" refrigerating system, which is simpler in construction, more efficient in operation, more dependable in operation, and less expensive to build than two temperature systems of the type heretofore known to the art.

Another object of the invention is to provide a new and improved form of evaporator construction which is particularly designed for air cooling and which is of such capacity that it may be operated at a higher temperature level than evaporators of the type heretofore known to the art and yet produce lower box temperatures and higher humidity conditions than have been produced by evaporators of the type heretofore used.

Other objects and advantages of the invention will be apparent from a consideration of the following specification, taken in conjunction with the accompanying drawings, of which there are four sheets and wherein:

Fig. 1 is a view illustrating a refrigerator of the household type, which includes a refrigerating system embodying the invention herein contemplated;

Fig. 2 is a front elevational view of the evaporator or heat absorbing portion of the refrigerating system;

Fig. 3 is a side elevational view, with parts broken away and other parts shown in section, of the evaporator illustrated in Fig. 2;

Fig. 4 is a rear elevational view of the evaporator;

Fig. 5 is a plan view of the evaporator, with parts broken away or omitted;

Fig. 6 is a horizontal section taken in a plane on the line 6—6 of Fig. 3, looking in the direction of the arrows;

Fig. 7 is an enlarged view of a detail shown in Fig. 6; and

Fig. 8 is an exploded view of the parts of the evaporator and illustrating the refrigerant circulation therethrough.

Referring now to Fig. 1, there is illustrated a refrigerator which includes a heat insulated compartment 10 and a refrigerating system which comprises heat absorbing means 12 arranged within the compartment 10, and a condensing unit assembly arranged externally of the compartment 10 and which comprises an electric motor 14, an electric conduit 16 adapted for connection to a suitable electric receptacle, a compressor 18 operatively connected to the motor 14, a condenser 20, and refrigerant expansion control means 22, the condensing unit being operatively connected to the heat absorbing means or evaporator 12 by a suction line 24 which returns vaporous refrigerant and lubricant from

the evaporator to the intake side of the compressor, a liquid line 26 which conducts liquid refrigerant from the condenser 20 to the intake side of the evaporator and under the control of the refrigerant expansion control means 22, and an electric conduit 28 affording an electrical circuit, which includes a thermostatically controlled switch which operates to open and close the motor circuit in accordance with predetermined temperature variations of the evaporator. This thermostatically controlled switch is commonly known as a "cold control" and has a bulb or other actuating device connected to the evaporator so as to open the motor circuit when the evaporator temperature falls below a predetermined point and to close the motor circuit when the evaporator temperature rises above a predetermined point, thereby tending to maintain the temperature within the compartment 10 within predetermined limits.

Referring now to Fig. 8, which is an exploded view of the heat absorbing means 12, the same comprises an air cooling part or section 30, the outside of which is exposed to the air within the compartment 10, and a low temperature or fast freezing part or section 32, which is arranged within a closed compartment provided by the air cooling part 30 of the evaporator. As will be hereinafter explained, the low temperature part of the evaporator is designed to operate at a temperature level of from 0° to 10° F., while refrigeration is produced in the air cooling or high temperature part 30 at a temperature level of from 19° to 29° F., the area of the section 30 exposed to the air within the compartment 10 being sufficient so as to produce a temperature within the compartment 10 of from 35° to 40° F., during the normal operation of the system.

The air cooling part or section 30 of the evaporator comprises a U-shaped metallic heat absorbing member 34 and a back wall member 36. The U-shaped member 34 consists generally of a continuous metallic surface provided with refrigerant passageways 38 therein and having upper headers 40 and lower headers 42, the upper headers 40 being in communication with the upper end of the passages or ducts 38 at the upper end thereof, and the lower headers 42 being in communication with the passages or ducts 38 at a lower level. Liquid is supplied to the ducts or passages 38 by means of the lower headers 42, and refrigerant vapor is conducted from the upper headers 40 by means of a cross tube 44 to which the suction line 24 is connected. The back wall part 36 of the air cooling evaporator consists, in general, of a flat plate having a coil of tubing 46 secured thereto. Refrigerant is supplied to the bottom of the coil 46 by a down-leg 48, and the upper part of the coil 46 is connected to a header 50. Liquid refrigerant is supplied to the header 50 by conduit 52, and the outlet from the header 50 is connected by a conduit 54 to a T 56 from which lines 58 conduct refrigerant to the liquid distributing headers 42 of the U-shaped member 34. The liquid line 26 supplies liquid refrigerant to one end 60 of a heat exchanger 62, the other end 64 of the heat exchanger being connected by a conduit 66 to one end of a coil 68 which is arranged upon the under side of a shelf or plate 70. The other end of the coil 68 is connected by a conduit 72 to another coil 68' which is arranged upon the under side of an upper plate 70', and the other end of the upper coil 68' is connected by conduit 52 to the header 50.

The header 50 consists of a block of metal having passageways 52^a, 46^a, 48^a and 54^a therein, cross-connected by a by-pass 55. Passage 52^a is connected to conduit 52; passage 46^a is connected to the upper end of the coil 46; the upper end of leg or conduit 48 is connected to passage 48^a; and the end of conduit 54 is connected to passage 54^a. Liquid refrigerant is supplied by the conduit 52 to passage 52^a and thence to passage 46^a where, due to the presence of vapor bubbles in the refrigerant, the liquid refrigerant will flow upwardly in passage 46^a, thence across by-pass 55, and downwardly through passage 48^a and leg 48 to the bottom of the coil 46. The bubbles of refrigerant vapor, which come into the header through passage 52^a, pass upwardly through passage 46^a and into passage 54^a and conduit 54 and do not circulate through leg 48 and coil 46. The leg 48 is of comparatively large diameter, so as to enable gas bubbles to pass by the downflowing liquid without impeding the flow thereof, while the coil 46 is of comparatively small diameter and, due to the extended heat absorbing surface provided by the plate 36 and the fins, refrigerant vapor is generated in the coil 46 and induces an upward circulation of liquid therein. Refrigerant vapor generated in the coil 46, together with liquid refrigerant supplied through passage 52^a, will flow upwardly through passage 46^a, passage 54^a and into conduit 54. The by-pass 55 insures that a continuous supply of liquid refrigerant will be supplied to the bottom of the coil 46 and permits the refrigerant vapor from the shelves 70 and 70' to pass into the conduit 54 without passing through the back wall section 36 of the air cooling part of the evaporator.

Thus we find that liquid refrigerant is supplied to the low temperature section 32 of the evaporator and thence in series through the section 36 and the U-shaped member 34 and is then returned by the suction line 24 to the intake side of the compressor.

If this evaporator were used in connection with a conventional refrigerating system using a single refrigerant such as sulphur dioxide (SO_2) or any one of the "F" refrigerants now being marketed under the name "Freon," as it could be, the evaporation of refrigerant would take place in all parts of the evaporator at substantially the same temperature level. While a single refrigerant could be used in this system, the present invention contemplates the use in this system of a refrigerant which consists of a solution or mixture of two or more refrigerant components such, for example, as a refrigerant consisting of ninety to ninety-five percent, by weight, of sulphur dioxide (SO_2) and five to ten percent, by weight, of dichlorodifluoromethane (CCl_2F_2), commonly known as "F-12." Other examples of refrigerants comprising a mixture or solution of two or more refrigerant components are:

Sulphur dioxide (SO_2) and carbon tetrachloride (CCl_4)

Sulphur dioxide (SO_2) and (F-11) trichloromonofluoromethane (CCl_3F)

Sulphur dioxide (SO_2) and (F-21) dichloromonofluoromethane ($CHCl_2F$)

Sulphur dioxide (SO_2) and (F-114) dichlorotetrafluoroethane ($C_2Cl_2F_4$)

Sulphur dioxide (SO_2) and ethyl chloride (C_2H_5Cl)

Sulphur dioxide (SO_2) and methyl chloride (CH_3Cl)

Sulphur dioxide (SO_2) and methylene chloride (CH_2Cl_2)
Sulphur dioxide (SO_2) and propane (C_3H_8)
Sulphur dioxide (SO_2) and normal butane (C_4H_{10})
Sulphur dioxide (SO_2) and isobutane (C_4H_{10})
Sulphur dioxide (SO_2) and dimethyl ether ($(CH_3)_2O$)
Sulphur dioxide (SO_2) and methyl formate ($C_2H_4O_2$)
Sulphur dioxide (SO_2) and dibutyl phthalate ($C_6H_4(COOC_4H_9)_2$)
Sulphur dioxide (SO_2) and dimethyl phthalate (C_6H_4) ($COOCH_3)_2$
Sulphur dioxide (SO_2) and methyl alcohol (CH_3OH)
Sulphur dioxide (SO_2) and monochlorobenzene (C_6H_5Cl)
Sulphur dioxide (SO_2) and methyl isobutyl ketone ($CH_3COC_4H_9$)
Sulphur dioxide (SO_2) and isopropyl acetate ($CH_3COOC_3H_7$)
Sulphur dioxide (SO_2) and amyl chloride ($C_5H_{11}Cl$)
Methyl chloride (CH_3Cl) and methylene chloride (CH_2Cl_2)
Methyl chloride (CH_3Cl) and isopropyl acetate ($CH_3COOC_3H_7$)
Methyl chloride (CH_3Cl) and methyl isobutyl ketone ($CH_3COC_4H_9$)
Methyl chloride (CH_3Cl) and dimethyl ether ($(CH_3)_2O$)
Methyl chloride (CH_3Cl) and methyl alcohol (CH_3OH)
Methyl chloride (CH_3Cl) and carbon tetrachloride (CCl_4)
Methyl chloride (CH_3Cl) and tetrachloroethane ($C_2H_2Cl_4$)
Methyl chloride (CH_3Cl) and toluene ($C_6H_5CH_3$)
Methyl chloride (CH_3Cl) and tetrachloroethylene (C_2Cl_4)
Methyl chloride (CH_3Cl) and amyl chloride ($C_5H_{11}Cl$)
Methyl chloride (CH_3Cl) and monochlorobenzene (C_6H_5Cl)
Methyl chloride (CH_3Cl) and normal butane (C_4H_{10})
Methyl chloride (CH_3Cl) and (F–12) dichlorodifluoromethane (CCl_2F_2)
Methyl chloride (CH_3Cl) and (F–11) trichloromonofluoromethane (CCl_3F)
Methyl chloride (CH_3Cl) and (F–114) dichlorotetrafluoroethane ($C_2Cl_2F_4$)
Methyl chloride (CH_3Cl) and (F–21) dichloromonofluoromethane ($CHCl_2F$)
Dichlorodifluoromethane (CCl_2F_2) (F–12) and (F–11) trichloromonofluoromethane (CCl_3F)
Dichlorodifluoromethane (CCl_2F_2) (F–12) and (F–21) dichloromonofluoromethane ($CHCl_2F$)
Dichlorodifluoromethane (CCl_2F_2 (F–12) and (F–114) dichlorotetrafluoroethane ($C_2Cl_2F_4$)

"F–11," "F–12," "F–21" and "F–114" are simply the commercial names of some of the refrigerants indicated, and are used principally for the purposes of convenience.

In addition to the foregoing mixtures or solutions, other mixtures or solutions of two or more components may be used.

Of the refrigerants in the foregoing list, propane (C_3H_8), normal butane (C_4H_{10}) and isobutane (C_4H_{10}) are classified as aliphatic hydrocarbon compounds;

Ethyl chloride (C_2H_5Cl), methyl chloride (CH_3Cl), methylene chloride (CH_2Cl_2), amyl chloride ($C_5H_{11}Cl$), carbon tetrachloride (CCl_4), tetrachloroethane ($C_2H_2Cl_4$) and tetrachloroethylene (C_2Cl_4) are classified as halogen derivatives of aliphatic hydrocarbon compounds; and

Dichlorodifluoromethane (CCl_2F_2), trichloromonofluoromethane (CCl_3F), dichlorotetrafluoroethane ($C_2Cl_2F_4$) and dichloromonofluoromethane ($CHCl_2F$) may be classified as halogen derivatives of aliphatic hydrocarbons or as fluorine derivatives of an aliphatic halogen compound.

Theoretically, if a mixture of 5% of F–12 in SO_2 at 20 lbs. absolute pressure is supplied to the low temperature side **32** of the evaporator, a shelf temperature of 10° F. will be produced. In the low temperature section **32** of the evaporator, F–12 will evaporate from the mixture, in a much higher concentration than 5%, and will thereby reduce the concentration of F–12 eventually to 0°. The almost pure SO_2 will then feed over through the conduits **54** and **52** to the higher temperature evaporator, and at 20 lbs. absolute, will vaporize at approximately 25° F.

In actual performance, however, an evaporator, as illustrated, with a 5% concentration of F–12 entering the low temperature section **32**, will not produce a temperature of 10° F. at 20 lbs. absolute, in the section **32**. This is due to the fact that first, the liquid refrigerant mixture supplied through the conduit **25** must be reduced in temperature to the boiling temperature, and this reduction in temperature is obtained by vaporizing a high concentration of F–12, so that the final concentration is something less than 5%. Second, in cooling the shelves or low temperature section **32**, more heat is added to the refrigerant mixture, and the final temperature obtained is an average between the boiling point of the initial concentration and the concentration leaving the shelves. From actual experience, it appears possible to obtain approximately one-half of the theoretical spread.

This temperature spread, however, will vary materially with the load on the cabinet. This is due to the fact that the available refrigeration per pound of mixture circulated is constant, and since more pounds of refrigerant or mixture are circulated at higher loads, more refrigeration is available at the lower temperature level.

A greater temperature spread between the temperature at which the refrigerant vaporizes in the section **32** and that at which it vaporizes in the box cooling section **30** may be obtained by using a larger concentration of F–12, for example.

It appears desirable to operate the shelves **70**, **70'** at a temperature of approximately 10° F. and the air cooling section at a temperature of approximately 19° F. In the particular evaporator illustrated, this may be obtained by using a mixture consisting of approximately 2½ oz. of F–12 and 2 lbs. 6 oz. of SO_2, which is approximately 6½ to 7% of F–12 concentration.

In a system of this type, the addition of F–12 tends to increase the condenser head pressure and thereby increase the power input to the compressor. However, it has been found that in a well built compressor with low friction losses, the increase in head pressure increases the power input very slightly, and there is a tendency for an overall gain in power consumption per day because the suction pressure increases slightly, and the outside evaporator is more efficient due to the improved ebullition because of the in-

creased quantity of gas flowing through it and also due to the extended surface provided by the fins.

The mixture just described may be classified by what is commonly termed a minimum boiling point mixture. In addition to this, there are other types of mixtures, known as a normal boiling point and a maximum boiling point. The normal boiling point mixture would be represented by a mixture such as F–12 and F–21. In this mixture the boiling point is always between the boiling point of the pure constituents. The general design of a system employing such a mixture would be similar to the SO_2 F–12 system, in that a small concentration of F–12 would be added to F–21, and this mixture fed to the shelves where F–12 would vaporize much more rapidly than F–21 and reduce the mixture to pure F–21, which would be fed to the outside evaporator.

Another example of the normal boiling point mixture would be one in which one component is relatively non-volatile. An example of this system would be SO_2—dibutyl phthalate. In this system the dibutyl phthalate would stay in the outside evaporator and practically pure SO_2 would be fed to the shelves. The dibutyl phthalate mixing with the pure SO_2 would cause a rise in boiling point so that the temperature in the shelves would be correspondingly lower than the outside evaporator temperature.

In a mixture system having a maximum boiling point such as dimethyl ether—SO_2, if a concentration of 10% dimethyl ether was fed to the shelves, the gas leaving would contain less than 10% dimethyl ether. This would mean that the concentration of dimethyl ether in the liquid would increase, and this increase would continue until the liquid composition was approximately 30%, at which concentration the gas leaving would also be 30%. The boiling point would go up as the concentration increased and the composition of the liquid in the outer evaporator would be 30%.

In operation, a system such as the one illustrated is charged with a quantity of refrigerant which is a mixture or solution of a plurality of components, such as a 5 to 10% solution of F–12 in SO_2. The terms solution or mixture, as used herein, are not to be construed only in their technical sense, but are intended to refer to a body of a plurality of components or ingredients associated in whatever manner such components or ingredients will associate when placed together in a system such as a refrigerating system.

Where the evaporator comprises a plurality of sections or parts, as illustrated in the drawings, the refrigerant medium will operate to produce different temperature conditions in each section of the evaporator, because the refrigerant solution or mixture in one section of the evaporator will contain a different percentage of the components of the refrigerant than the solution or mixture in the other section of the evaporator, and there will be a temperature differential between the temperatures of the different sections of the evaporator, because the solution in one section will boil at a different temperature than the solution in the other section. The temperature differential can be varied by using different percentages of the components of the refrigerating medium.

The refrigerant medium, in circulating through the system, is discharged from the compressor into the condenser where condensation of the vaporous refrigerant takes place, and thence to the receiver from which it passes under the control of the refrigerant expansion control **22** to the low temperature section **32**, wherein a percentage of each of the components of the refrigerant will boil off in going through the freezing coils, and the remainder of the mixture or solution will be discharged through conduit **52** into the header **50**.

The refrigerant in the low temperature section **32** of the evaporator, it will be observed, is exposed to substantially the same suction pressure as the refrigerant within the air cooling portion **30** of the evaporator. In passing through the low temperature section **32**, the gas coming off of the refrigerant mixture will contain a greater percentage of the refrigerant component having the higher volatility or lower boiling point, with the result that the residual refrigerant which is discharged into the header **50** has a lower percentage of the higher volatile component in it than is present in the mixture or solution in the section **32**. The mixture of refrigerant which is discharged into the header **50** passes into the coil **46** and also into the U-shaped member **34**, and such refrigerant has a higher boiling point than the boiling point of the solution in the freezing section **32**. Since the refrigerant in the section **32** boils at a lower temperature than the refrigerant which is delivered to the coils of the air cooling section **30** of the evaporator, it will be apparent that a lower temperature will be produced in the freezing section **32** than in the air cooling section **30**.

The vaporous refrigerant from both sections of the evaporator passes into the upper part of the headers **40**, from whence the suction line conducts such refrigerant vapor, together with whatever lubricant may be entrained therein, to the intake side of the compressor **18**. The average composition of the gas passing through the suction line should always be the same as the average composition of the liquid entering the evaporator.

In Figs. 2 to 7, inclusive, the actual details of construction of the evaporator illustrated in Fig. 8 are shown. The U-shaped member **34** may consist of two sheets of metal, the faces of which are secured in intimate engagement, such as by welding or brazing, and which sheets of metal, prior to assembly, have been formed with suitable grooves, so that after assembly and bending, the U-shaped member will contain a series of ducts or passages **38** which extend from one end thereof to the other and between the longitudinal upper headers **40**. The refrigerant expansion control **22** may consist of a high side float, and the conduit **26** between such control and the end **66** of the coil **68** on the lower shelf **70** of the evaporator may comprise a capillary tube so as to prevent the expansion of refrigerant before it is delivered to the evaporator. The system is charged with sufficient fluid so as to maintain a level of liquid refrigerant in the evaporator intermediate the upper and lower limits of the headers **40**. The passageways **38**, the liquid distributing headers **42**, the coil **46**, and the coils **68**, **68'** and the connections between such parts, are maintained substantially filled with liquid during the normal operation of the system. The heat exchanger **62**, it will be observed, is provided by arranging a part of the liquid line supplying liquid refrigerant to the low temperature section **32** in heat exchange relationship with the

tail end of the coil which forms the last part of the low temperature evaporator section 32. Both the coils 68 and 68', as well as the coils which form the heat exchanger 62, are soldered to the under side of the shelves 70, 70'. The shelves 70 and 70' may consist of two generally flat plates which are suitably supported by insulating pins 71 from the inside wall of the U-shaped sheet metal member 34. The space between the sides of the U-shaped sheet metal member 34 is closed at the back by the sheet metal wall 136 which comprises a part of the back wall section 36. A wall 137 closes the top of the space between the side walls of the member 34, and at the front a door 138 pivotally carried by the member 34 is provided with an annular gasket 140 on the inner face thereof, which cooperates with the front edge of the member 34 and a front edge portion of the horizontal wall 137 to seal the space inside of the member 34 against circulation of air thereinto from the compartment 10. This closed space within the member 34 may be designated as a low temperature zone or compartment 142, access to which may be had by opening the door 138.

The shelves 70 and 70' are adapted to support liquid holding receptacles such as ice trays. Also, the floor of the low temperature compartment 142, which is provided by the inside wall of the horizontally extending portion of the member 34, provides a shelf for the reception of liquid holding trays, this shelf being designated by the reference character 170. While this shelf 170 is refrigerated in the sense that the surface of the shelf is in direct and intimate engagement with refrigerant which is in the passages 38, the temperature of this shelf 170 will be considerably higher than that of the shelves 70, 70', due to the fact that the refrigerant in the passages 38 will boil at a much higher temperature than the refrigerant in the coils 68, 68'. The outside walls of the air cooling section 30, as well as the back wall section 136, may be provided with fins 144 so as to increase the effective heat transfer surface and facilitate the cooling of air within the compartment 10.

The branch lines 58 which supply refrigerant to the liquid distributing headers 42, extend through a wall of the headers 42 and along the length of the headers so as to distribute refrigerant to the various ducts 58. One of the tubes 58, for example the left hand one illustrated at the top of Fig. 6, extends completely along the length of the header and is provided with openings 158 which are arranged to discharge refrigerant upwardly into each of the first, third, fifth, seventh, ninth and eleventh of the passages 38, counting from the left in Fig. 6, while the other tube 58 is provided with openings 158 which are arranged so as to discharge refrigerant upwardly into the second, fourth, sixth, eighth, tenth and twelfth of the passages 38, counting from the left in Fig. 6. In this way, circulation of refrigerant through the passages 38 and between the headers 40 is induced, the bubbles of refrigerant vapor generated in the shelves 70 and 70', and in the coil 46, contributing to effect such circulation.

In this manner, more efficient heat exchange is effected between the refrigerant in the passages 38 and the air in the compartment 10. It will be understood, of course, that free communication is afforded between each of the passages 38 by means of the headers 40 and 42. The U-shaped member 34 which may for convenience be called a shell, may be provided with brackets 120, by means of which the entire evaporator assembly may be suspended from the top wall of the provision compartment 10. The liquid line 26 preferably is arranged in heat exchange relationship with the suction line 24. The thermostatic control switch 122 previously referred to may be supported above the upper inside wall 37 and immediately behind a partition 139 which closes the space at the front of the shell between the sides thereof and above the wall 137. The thermostatic element of the switch 122 preferably is associated with the box cooling portion 30 of the evaporator.

The invention herein disclosed constitutes an improvement of that shown in my prior co-pending applications relating to the same subject matter, including Serial No. 114,940, filed December 9, 1936; Serial No. 179,149, filed December 11, 1937; and Serial No. 181,748, filed December 27, 1937. For further details in connection with this, the method of and apparatus for heat transfer herein disclosed, reference may be had to such prior applications.

While the invention has been described with some detail, it is to be understood that the description is for the purpose of illustration only and is not definitive of the limits of the inventive idea. The right is reserved to make such changes in the details of construction and arrangement of parts as will fall within the purview of the attached claims.

I claim:

1. The method of producing refrigeration which comprises forming a liquid solution of (SO_2) and (CCl_2F_2), evaporating liquid from said solution to produce refrigeration at one temperature, transferring liquid from said solution to form a body of refrigerant at another point having a boiling point different than that of said solution, evaporating refrigerant from said body of refrigerant to produce refrigeration at a temperature different than that produced by evaporating refrigerant from said solution, condensing the refrigerant vapor and returning the same in liquid form to said solution.

2. The method of producing refrigeration which comprises forming a liquid solution of (SO_2) and ($CHCl_2F$), evaporating liquid from said solution to produce refrigeration at one temperature, transferring liquid from said solution to form a body of refrigerant at another point having a boiling point different than that of said solution, evaporating refrigerant from said body of refrigerant to produce refrigeration at a temperature different than that produced by evaporating refrigerant from said solution, condensing the refrigerant vapor and returning the same in liquid form to said solution.

3. The method of producing refrigeration which comprises forming a solution of a plurality of liquid refrigerant components of different volatility, one of which components comprises (SO_2), and another of which components comprises a fluorine derivative of an aliphatic halogen compound, evaporating higher volatile portions of the refrigerant from said solution to produce refrigeration at one temperature, transferring liquid from said solution to form a body of refrigerant at another point having a boiling point different than that of said solution, evaporating lower volatile portions of the refrigerant from said body to produce refrigeration at a temperature different than that produced by evaporating refrigerant from said solution, condensing the

refrigerant vapor and returning the same in liquid form to said solution.

4. The method of producing refrigeration which comprises forming a solution of a plurality of liquid refrigerant components of different volatility, one of which components comprises (SO_2), and another of which components comprises (CCl_3F), evaporating refrigerant from said solution to produce refrigeration at one temperature, transferring liquid from said solution to form a body of refrigerant at another point having a boiling point different than that of said solution, evaporating refrigerant from said body to produce refrigeration at a temperature different than that produced by evaporating refrigerant from said solution, condensing the refrigerant vapor and returning the same in liquid form to said solution.

5. The method of producing refrigeration which comprises forming a solution of a plurality of liquid refrigerant components of different volatility, one of which components comprises (SO_2), and another of which components comprises a fluorine derivative of an aliphatic halogen compound, evaporating refrigerant from said solution to produce refrigeration at one temperature, transferring liquid from said solution to form a body of refrigerant at another point having a boiling point different than that of said solution, evaporating refrigerant from said body to produce refrigeration at a temperature different than that produced by evaporating refrigerant from said solution, condensing the refrigerant vapor and returning the same in liquid form to said solution.

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