

Jan. 31, 1939.

G. MUFFLY

2,145,776

REFRIGERATING MECHANISM

Filed Feb. 21, 1935

4 Sheets-Sheet 1

FIG 1

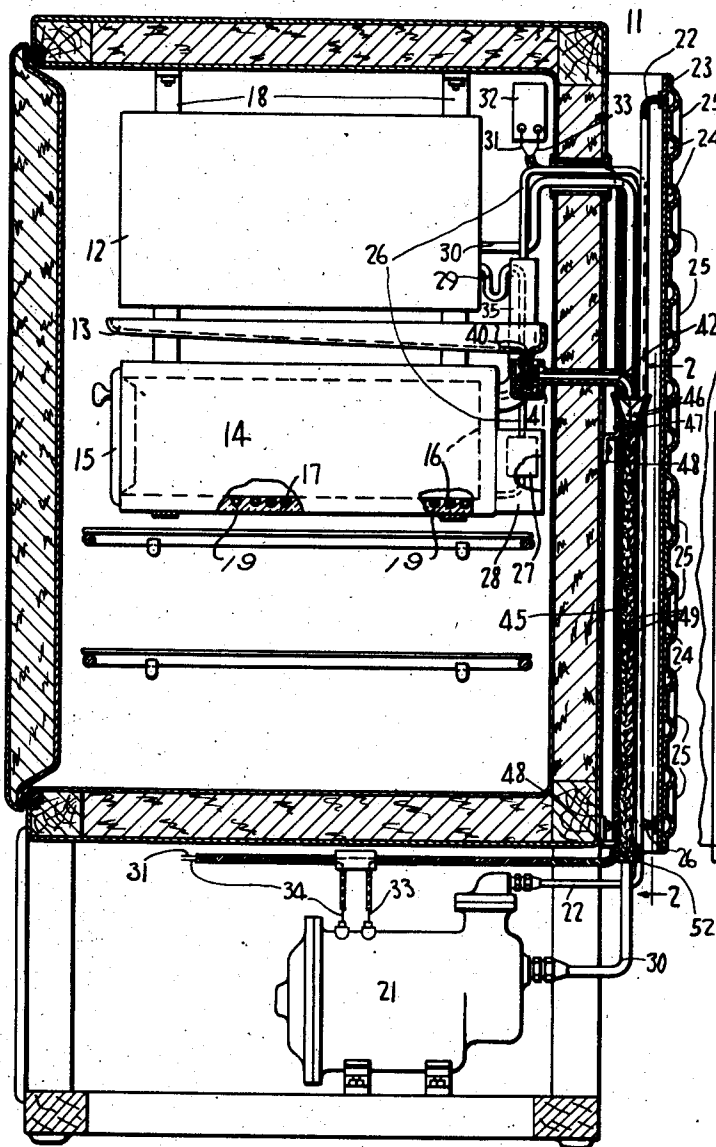


FIG 2

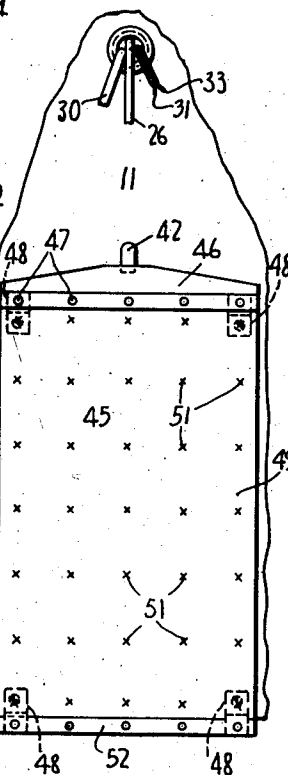
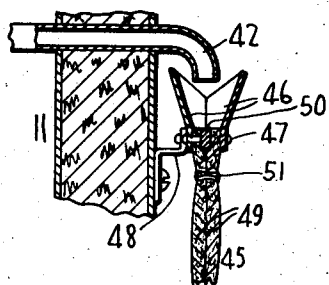


FIG 3



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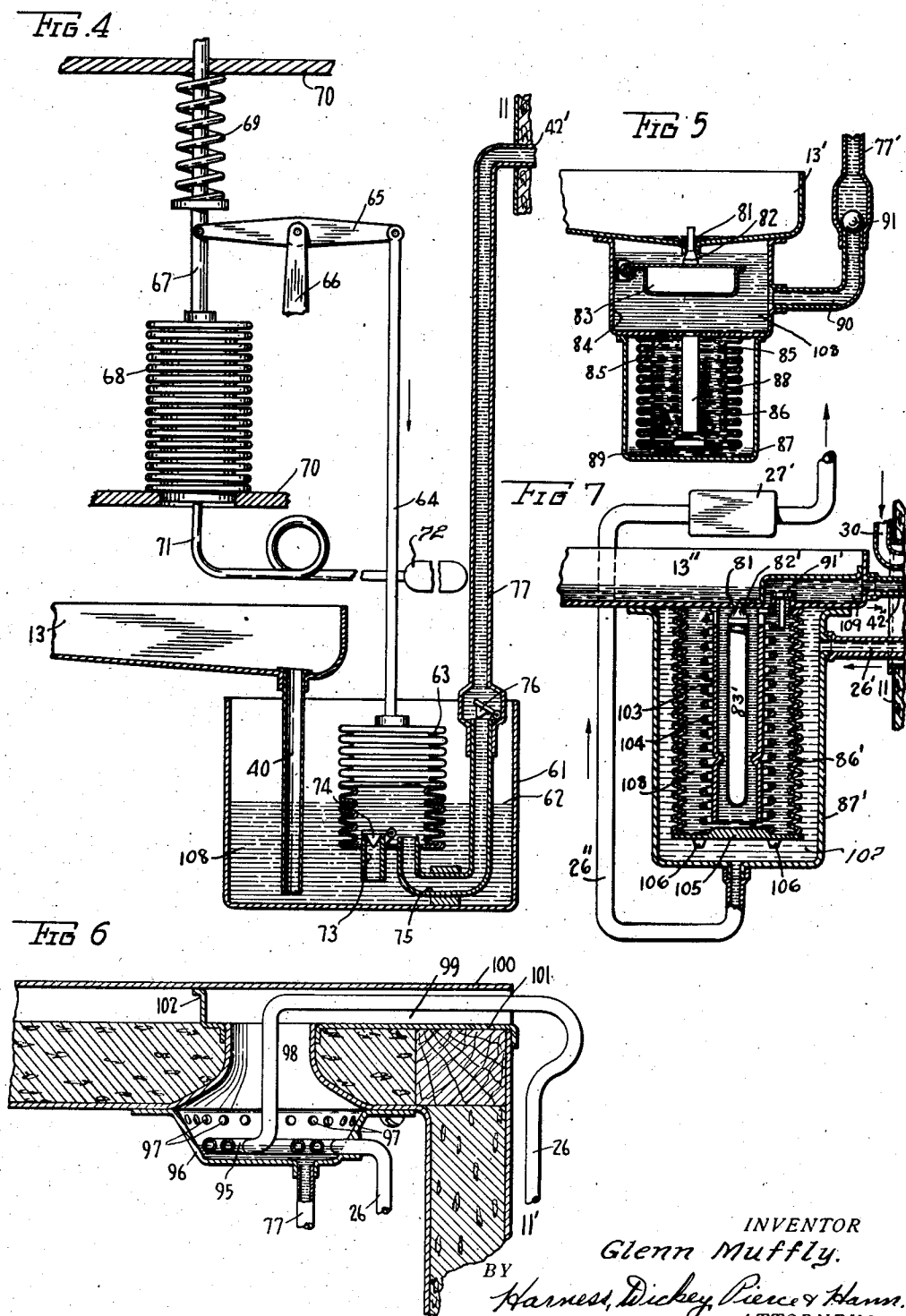
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4 Sheets-Sheet 2



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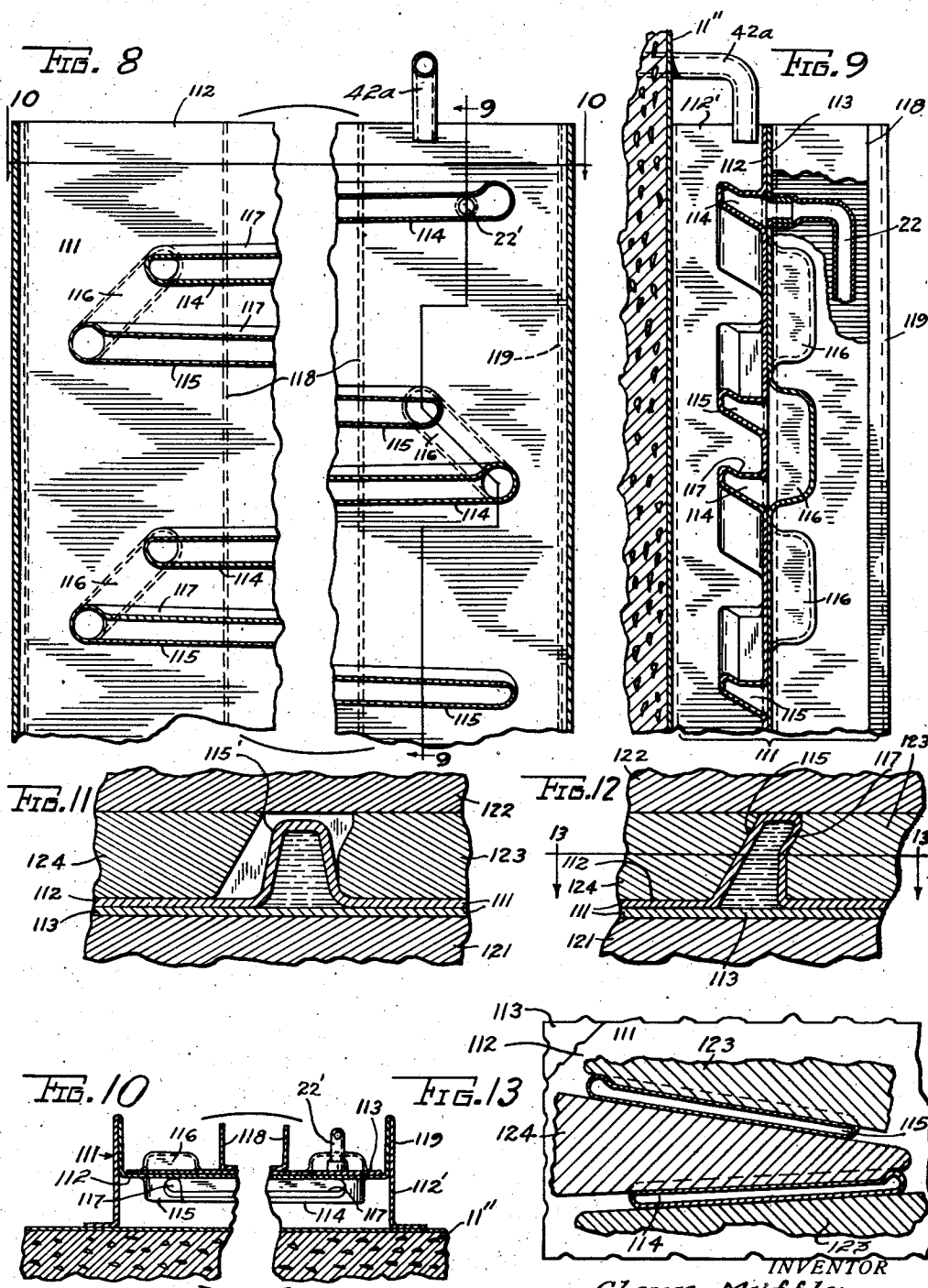
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REFRIGERATING MECHANISM

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4 Sheets-Sheet 3



Jan. 31, 1939.

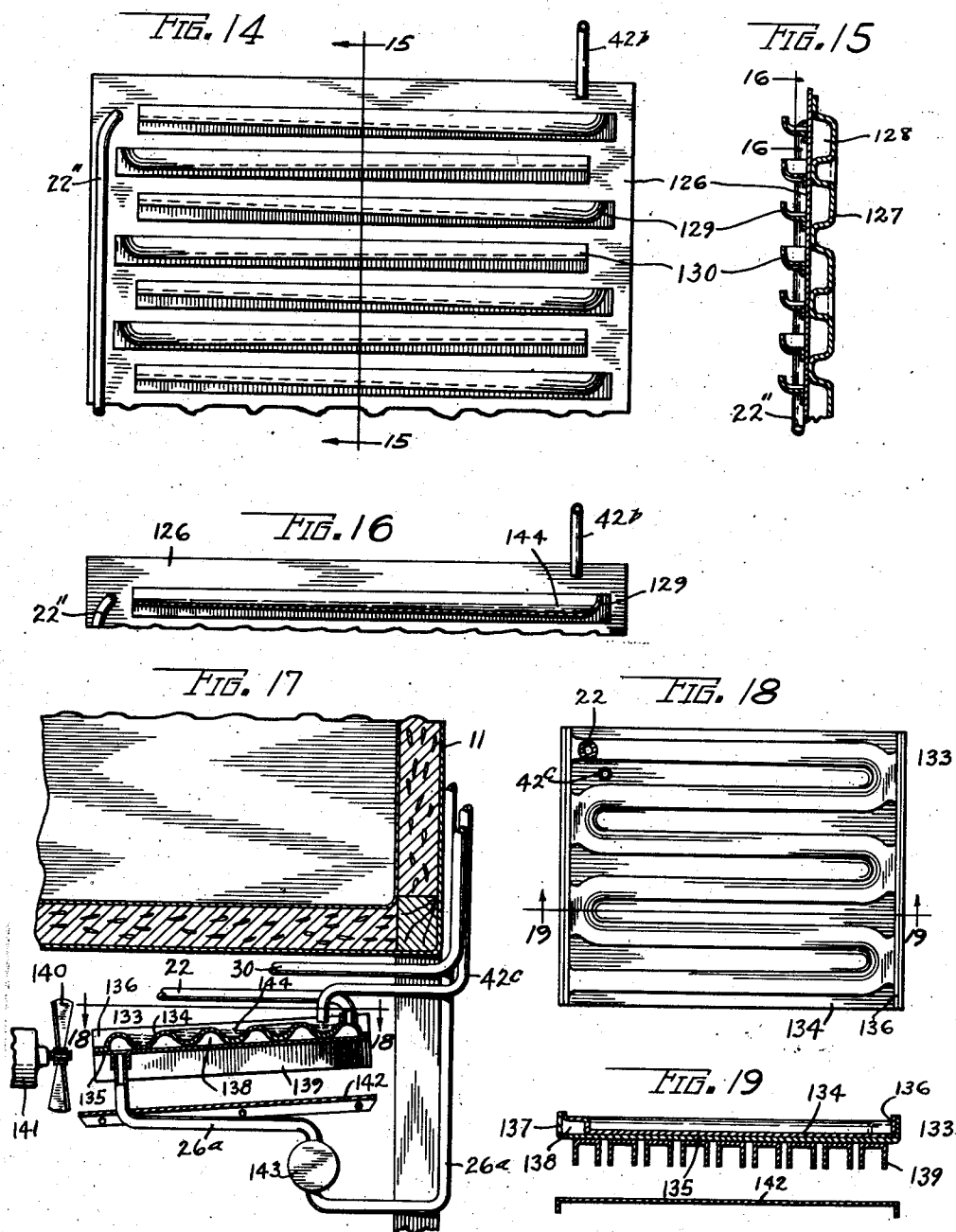
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REFRIGERATING MECHANISM

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4 Sheets-Sheet 4



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REFRIGERATING MECHANISM

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Application February 21, 1935, Serial No. 8,879

18 Claims. (Cl. 62-116)

This invention relates to refrigerating mechanism and is particularly applicable to those of the domestic type, the principal object being the provision of means for automatically disposing of moisture which condenses upon the evaporator or other refrigerated parts of said system.

Objects of the invention include the provision of means for automatically melting the moisture which condenses upon the evaporator or other refrigerated parts of a mechanical refrigerating system and automatically disposing of this moisture; the provision of a refrigerating system in which the evaporator or other refrigerated parts within the refrigerator cabinet exposed to contact of the air in the cabinet are raised in temperature above the melting point of ice during inoperative periods of the system whereby any moisture that has condensed and frozen thereon will be melted, together with means for collecting the frozen moisture thus melted and automatically discharging the same in evaporated form into the air exterior to the cabinet; the provision of means for cyclically melting frost formed upon the evaporator or other refrigerated parts of a refrigerating system, discharging the melting frost from the refrigerated space of the system, and causing the melted frost to be evaporated and discharged into the air; the provision of a novel form of means for collecting and discharging melted frost from the refrigerated space of a refrigerator cabinet; the provision of a novel form of means for collecting melted frost within the refrigerated space of a refrigerator cabinet and discharging it therefrom to a higher level; and the provision of a novel form of means for evaporating moisture in a mechanically refrigerated system.

Other objects of the invention include the provision of a novel form of pumping means for a refrigerating system auxiliary to the normal pumping or compressing means provided therein; the provision of a refrigerating system having an auxiliary pumping means associated therewith and caused to operate as a result of the cyclic operation of the refrigerating system; the provision of a refrigerating system having an auxiliary pumping means associated therewith and operative as a result of the variations in temperature occurring in a chamber to be refrigerated by the refrigerating mechanism; and the provision of a refrigerating system having an auxiliary pumping means mechanism associated therewith and actuated as a result of the variations in pressure occurring within said system.

Other objects of the invention include the pro-

vision of a refrigerating mechanism of the domestic type including a cabinet having a refrigerated space therein together with means for automatically defrosting the evaporator for cooling such space without affecting the freezing or frozen condition of liquids to be frozen or intentionally frozen liquids respectively within said space; the provision of a refrigerating mechanism including a cabinet having a refrigerated chamber, a pair of evaporators in the chamber one of which is adapted for the freezing of liquids and the other of which is adapted for chilling the air within the cabinet, the first mentioned evaporator being insulated against the transfer of heat therefrom to the air within the cabinet, and the second mentioned evaporator having a low thermal capacity; and the provision of a mechanical refrigerator in which the necessity of a relatively deep drip pan for defrosting purposes is eliminated.

Still further objects of the invention include the provision of a novel means for evaporating moisture; the provision of a novel means for evaporating moisture resulting from frost condensing upon the evaporator or other refrigerated surface of a mechanical refrigerating system; the provision of a refrigerant condenser of novel construction; the provision of a refrigerant condenser having novel means associated therewith for the evaporation of moisture; the provision of a novel form of means for insulating the walls of a mechanical refrigerator cabinet from the radiant heat of the refrigerant condenser; and the provision of means for enhancing the efficiency of a refrigerant condenser.

Further objects of the invention include the provision of a novel method of forming a refrigerant condenser or a like object; the provision of a novel method of automatically disposing of melted frost in a refrigerating mechanism; the provision of a novel method of insulating the walls of a mechanically refrigerated cabinet against the effects of radiant heat from the condenser of the cooperating refrigerating system; and the provision of a novel method of enhancing the efficiency of the condenser of a mechanical refrigerating mechanism.

The above being among the objects of the invention the same consists of certain novel features of construction, combinations of parts, and steps or steps of operation to be hereinafter described with reference to the accompanying drawings, and then claimed, having the above and other objects in view.

In the accompanying drawings which illustrate suitable embodiments of the present invention,

and in which like numerals refer to like parts throughout the several different views,

Fig. 1 is a vertical sectional view taken centrally through a refrigerator cabinet in a plane parallel to and between the side walls thereof and showing the cooperating refrigerating mechanism partly in side elevation, partly in section, and partly in broken view.

Fig. 2 is a fragmentary view taken on the line 2—2 of Fig. 1 and particularly showing the drip evaporator thereof.

Fig. 3 is an enlarged, fragmentary, sectional view taken in the same plane as the view in Fig. 1 and illustrating in greater detail the drip drain means and the manner in which it cooperates with the drip evaporator.

Fig. 4 is a more or less diagrammatic, fragmentary, partially broken, partially sectioned view disclosing a pumping mechanism which may be employed for discharging melted frost from the cabinet shown in Fig. 1.

Fig. 5 is a view similar to Fig. 4 showing a modified form of construction.

Fig. 6 is a fragmentary, vertical, sectional view taken through a refrigerator cabinet and disclosing a modified form of drip evaporator employing heat of the refrigerant liquid line instead of the heat of the condenser for effecting the evaporation.

Fig. 7 is a view similar to Figs. 4 and 5 but disclosing a modified form of pump structure in which the energy for the operation of the pump is obtained from variations of high side pressure of the refrigerating system.

Fig. 8 is a broken, fragmentary, vertical sectional view of a refrigerant condenser which is formed from sheet metal so as to provide a drip evaporator means in conjunction therewith.

Fig. 9 is a fragmentary, vertical sectional view taken on the line 9—9 of Fig. 8 and illustrating the relationship between the condenser and the cooperating refrigerator cabinet.

Fig. 10 is a reduced, broken, horizontal sectional view of the condenser shown in Figs. 8 and 9, taken on the line 10—10 of Fig. 8.

Fig. 11 is an enlarged, fragmentary sectional view illustrating a step in the operation of forming the condenser shown in Figs. 8, 9 and 10, together with a portion of the tools or dies employed in the step.

Fig. 12 is a view similar to Fig. 11 but illustrating a subsequent step of operation in the formation of the condenser.

Fig. 13 is a fragmentary sectional view taken on the line 13—13 of Fig. 12.

Fig. 14 is a fragmentary face elevational view of a modified form of condenser and drip evaporator of the general type illustrated in Figs. 8, 9 and 10.

Fig. 15 is a vertical sectional view taken on the line 15—15 of Fig. 14.

Fig. 16 is a fragmentary, vertical sectional view taken on the line 16—16 of Fig. 15.

Fig. 17 is a fragmentary vertical sectional view taken through a refrigerating cabinet and a portion of the condensing means therefor, showing a further modification of a refrigerant condenser and drip evaporator.

Fig. 18 is a plan view of the condenser shown in Fig. 17 taken as on the line 18—18 of Fig. 17.

Fig. 19 is a vertical sectional view taken on the line 19—19 of Fig. 18.

It is generally understood in the domestic mechanical refrigeration art that the moisture carried by the air in the refrigerator cabinet, in

coming in contact with the evaporator or other refrigerated parts of the refrigerating system, becomes condensed upon such evaporator or parts and forms frost thereon, and that over a period of time, depending upon conditions, the layer of frost may assume such proportions as not only to interfere with the proper refrigeration of the cabinet itself, but in many instances may interfere with the proper removal particularly of ice trays and the like from within the cabinet. For this reason it is necessary, or at least desirable, to shut down the refrigerating system at certain intervals, usually of one to two weeks' duration, and allow the interior of the cabinet to warm up to a sufficient extent to permit the frost to melt free from the parts upon which it has collected. Modern refrigerators are usually provided with a so-called drip pan located under the evaporator for the purpose of catching and collecting such frost as it melts from the evaporator during a defrosting period. In some constructions a drain pipe is provided for carrying off the melted frost to a suitable point of deposit, but such arrangement is not found to be wholly satisfactory for the reason that special connections must be made to connect the drain pipe with the point of deposit, and additionally the drain pipe may become clogged and result in a flooding of the cabinet. If no such drain pipe is employed then it is necessary for the housewife to remove the drip pan and empty the contents thereof and in order to eliminate any danger of the volume of melted frost exceeding the capacity of the drip pan during a defrosting period, the drip pan is necessarily made of such dimensions as to take up a material amount of valuable space in the cabinet.

I am aware that means for automatically defrosting a refrigerator cabinet at stated intervals have heretofore been suggested, such previously suggested means usually employing a time controlled or equivalent mechanism for defrosting the cabinet at desirable intervals of time, for instance, two or three days to a week. By the use of the present invention, however, no additional means whatever are required for automatically effecting defrosting of the cabinet other than those required in any conventional cabinet not equipped with an automatic defrosting means as previously suggested. This phase of my invention is accomplished by employing an evaporator of relatively low thermal capacity so that during inoperative periods of the refrigerating mechanism the entire evaporator structure may rise in temperature to above the melting point of ice and thus cause any frost which has collected thereon to melt and drain therefrom. By an evaporator of low thermal capacity is particularly meant any evaporator not having a material amount of hold-over heat absorbing capacity such as occurs in evaporators of the brine tank type. A number of the sheet metal or coiled tube types now found on the market may suffice in this respect.

Means are provided for collecting the frost which is thus melted and drips from the evaporator and other refrigerated parts of the mechanism during each inoperative period of each cycle of operation of the refrigerating mechanism, and then disposing of this moisture by means which are preferably formed as a unitary part of the refrigerator structure. By the employment of a refrigerating mechanism of the type employed in the present invention as above described it will be apparent that the heat trans-

fer efficiency of the evaporator will be continuously maintained and automatically re-conditioned during each cycle of operation, and additionally the housewife will be entirely relieved of the necessity of either defrosting the cabinet or disposing of the frost which melts during a defrosting period.

In order to dispose of the melted frost collected during each defrosting period in accordance with the present invention the melted frost is caused to be evaporated and discharged into the air surrounding the cabinet where, as a general rule, its effect will be found advantageous in increasing the humidity of the room in which the cabinet is positioned, and which humidity in modern homes is usually found to be less than that desired. Preferably, in accordance with a further phase of the present invention, the melted frost thus obtained is employed as an aid in insulating the walls of the cabinet from the heat which normally emanates from the condenser and raises the temperature of the walls of the cabinet either by direct radiation or by convection. At the same time the heat of the condenser may be employed to hasten the evaporation of the melted frost and the melted frost itself serves to lower the temperature of the condenser and thus increase its efficiency. One method of effecting this last result is to interpose a sheet or generally planular member of moisture absorbing material between the condenser and the adjacent wall of the refrigerator cabinet, and to discharge the melted frost onto such member. The member in being positioned between the condenser and the adjacent wall of the refrigerator cabinet serves to insulate the condenser from the cabinet, and by being positioned for the circulation of air around it, gives up its moisture content to the surrounding air and thus aids to cool the air to better absorb the heat from the condenser. On the other hand, the condenser may be positioned for the usual circulation of air about it and be so formed as to receive the melted frost and retain it for a sufficient length of time exposed to the air as to effect its evaporation. In this case the melted frost being in direct heat transferring relation with respect to the condenser is not only heated directly by the condenser to increase its rate of evaporation, but in being in such relation to the condenser and in evaporating from the surface thereof acts to increase the efficiency of the condenser.

Although in the broader aspects of the invention the melted frost may be drained by gravity from the interior of the refrigerator cabinet and delivered to the evaporating means, it may be desirable under certain conditions to deliver the melted frost to a point at an elevation greater than its point of collection, and in such event the present invention provides simple and effective means for elevating the melted frost. As hereinafter described such means may be caused to operate as a result of the cyclic operation of the refrigerating mechanism and thus provide an automatic and self-contained means amply sufficient for the purpose required.

Referring to the drawings and particularly to Fig. 1, the cabinet 11, which may be of any suitable or desirable construction, is shown as being cooled by an evaporator 12, which may also be of any conventional or desirable type.

The evaporator 12 and the control means 32 for the refrigerating system are preferably of the types that allow complete defrosting of the exposed surfaces of the evaporator 12 on a com-

paratively short cycle of time, so that no great amount of frost is collected between defrosting periods. Condensate or water from meltage of frost and ice on the evaporator 12 drips into the pan 13 positioned immediately below the evaporator 12 and is disposed of as hereinafter described.

A sharp freezer 14 is located beneath the pan 13 and is fitted with an insulated door 15 and its liner 16 is surrounded by the insulated wall 17. Being thermally insulated from the air in the cabinet 11, no condensation occurs on the outside of the freezer 14, hence it may be located below the pan 13, as shown, or in any other desired location.

The motor compressor unit 21, which may be positioned in any suitable location, is shown in the bottom of the cabinet below the lower insulated wall thereof and delivers compressed refrigerant vapor through the tube 22 to the top of condenser 23, preferably mounted on the back of cabinet 11 as shown. The condenser 23, as shown, is formed of two sheets of metal between which are formed passages 24, connected by a return loop passage 25 to provide a sinuous path for the refrigerant vapor, which condenses and collects in liquid form in the lower part of condenser 23.

The liquid refrigerant, still under condensing pressure, passes from the condenser 23 through tube 26 to the pressure reducing device 27, preferably positioned within the cabinet 11, which may be an expansion valve, a float valve or other suitable restricting apparatus.

The refrigerant liquid passes at reduced pressure from the device 27 into an evaporator 19 surrounding the liner 16 of the sharp freezer 14. Since the expansion device 27 will be refrigerated to some degree by the evaporation of refrigerant as soon as the pressure on the refrigerant flowing through it is reduced, an insulating cover 28 is shown around the expansion device 27 and joining the insulated wall of the sharp freezer 14.

The partly evaporated refrigerant leaves the sharp freezer 14 through the tube 29 and enters the upper evaporator 12, which has surfaces exposed to the cabinet air for the purpose of cooling same. From the evaporator 12 the refrigerant, which is now quite thoroughly evaporated, passes through the tube 30 back to the suction side of the compressor of the unit 21, where it is again compressed and re-delivered through the tube 22, thus completing its circuit.

The electric motor of unit 21 is supplied with current from conductors 31 and 34 of a power line. The conductor 34 is connected directly to the motor winding. The conductor 31 is connected to the thermostatic switch 32, from which conductor 33 leads back to the other terminal of the motor in unit 21.

The thermostatic switch 32 or other suitable control means, which may be of any suitable or conventional type, is shown positioned within the cabinet 11 adjacent the evaporator 12 and is arranged or adjusted to effect such operation of the system that the air cooling surfaces of the evaporator 12 and the tubes connected therewith will constantly or at frequent intervals shed the moisture condensed thereupon from the air within the cabinet.

The water thus shed drips into the pan 13, from which it drains out through the tube 40 into the trap 41 and thence out through the tube 42 which passes through the rear wall of the cabinet.

The tube 29, being cooled by low pressure refrigerant, is insulated by covering 35 except for its exposed portion which is looped downwardly and so located that drip therefrom also falls into the pan 13.

Condensate drips from the tube 42 into the condensate evaporator 45, where it is confined by the diverging metal walls 46 at the top thereof and which walls are secured by means of rivets 47 to brackets 48 and the sheets of fabric 49 from which the evaporator 45 is preferably formed. Spacers 50 (Fig. 3) are arranged to separate the fabric sheets 49 at their top edges so that water is allowed to run down between the two sheets 49 as well as to be absorbed by these sheets.

The sheets 49 are loosely stitched or riveted together at spaced intervals over their entire area, as indicated at 51, and are capable of absorbing a considerable volume of water.

Each of the sheets 49 is exposed on one side to air circulating between the sheets 49 and the condenser 23 or between the sheets 49 and the adjacent rear wall of the cabinet 11. Heat from condenser 23 warms the sheets 49 and causes water to evaporate therefrom more rapidly than it would at room temperature. The absorbing capacity and exposed surfaces of sheets 49 are such that condensate will be totally evaporated before any water drips from the bottom edges of sheets 49, which are secured together by the metal binding 52 (Fig. 2) and attached to the lower brackets 48, which are seen in Figs. 1 and 2.

The sheets 49 also serve as insulation, blanketing the rear wall of cabinet 11 from direct radiation of heat from the condenser 23. Part of the heat radiated by the condenser is absorbed in evaporating condensate from the sheets 49, thus further reducing the heat leakage into the rear wall of cabinet 11 and conserving the refrigerating effect of the evaporator 12.

In Fig. 1 the condenser 23 is shown as extending nearly to the top of the cabinet, while the condensate evaporator 45 is limited in height to a level at which water may be drained from the trap 41. In some cases it may be desirable to provide a greater area of fabric sheets 49 than provided for in Fig. 1, and in such case the arrangements shown in Figs. 4, 5 and 7 may be employed.

Fig. 4 illustrates one method of elevating the water so that the tube 42', corresponding to the tube 42 previously described, may be located near the top of the cabinet with a corresponding increase in the vertical dimension of sheets 49. As shown in Fig. 4 the drain tube 40 of pan 13 delivers condensate to a sump 61, where the water level is shown at 62.

A bellows 63 is positioned in the sump 61 and is operated by a rod 64 projecting upwardly therefrom and a rocker arm 65 pivoted to a support 66 which is here shown broken but may be assumed to be a part of the housing 70 of a thermostatic switch such as is indicated at 32 in Fig. 1.

The rocker arm 65 is actuated by a rod 67, here shown as being urged upwardly by a bellows 68 and downwardly by a compression spring 69, both contained within the housing 70. The bellows 68 is connected with a capillary tube 71 through which fluid pressure from a suitably located bulb such as 72 or similar means acts to vary the internal pressure affecting the expansion or contraction of the bellows 68.

The parts 67 to 71, inclusive, are typical of elements commonly used in thermostatic control and may be assumed to be included in assembly 32

of Fig. 1. The bellows 68 expands during idle periods of the refrigerating system in response to a rise of temperature and the corresponding rise of pressure in the bellows 68, from the position to which it has been compressed by the spring 69 during operation of the system. The resulting movements of the rod 67, rocker 65 and rod 64 cause alternate expansion and compressing movements of the bellows 63, thus drawing water into the bellows 63 past the valve 74 and forcing it out of the bellows 63 past the valve 76 into the tube 77 leading to outlet tube 42'.

The sump 61 is designed to have ample capacity to hold all of the water dripping from the evaporator 12 during any idle period of the refrigerating system. The volume of water pumped at one stroke of rod 64 is in excess of the amount normally drained into the sump 61 during a cycle of operation of bellows 68, hence the sump 61 will not overflow.

It will be understood that the bellows 68 may be employed to operate some other control means than the usual switch, or may be employed solely to actuate the water pump.

An example of a water pump which is thermally operated independently of any control device is shown in Fig. 5, where the pan 13', corresponding to the pan 13 previously described, is fitted with a drain port 81 in place of a drain tube such as 40. Water runs through this port, past a valve 82 on a float 83 into chamber 84 in which the float 83 is located and through ports 85 into a bellows 86 sealed to the bottom of the chamber 84 until the water level lifts the float 83, which thereafter acts to cause the valve 82 to function as a check valve even though float 83 is submerged.

The bellows 86 is located within the cabinet 11 so as to be affected by temperature changes therein and is surrounded by gas-tight housing 87. It is stopped from excessive compression by a stem 88 attached to the bottom of chamber 84 and adapted to contact the head of the bellows. In the space between the bellows 86 and the housing 87, a small volume of volatile liquid 89 is placed and sealed after the space is evacuated.

The vapor pressure of this volatile liquid is preferably such that it rises above and falls below atmospheric pressure during cyclic operation of the refrigerating system in response to changes of air temperature around housing 87. These variations of pressure cause the bellows 86 to be compressed and expanded, pumping water into the chamber 84 through the port 81 and out past the check valve 91 to the tube 77', thus producing the same effect as before described in connection with Fig. 4.

The float 83 is very little lighter than water, hence the valve 82 opens under the suction produced by the expansion of the bellows 86 after the chamber 84 has filled with water. The stem of the valve 82 projects upwardly into the pan 13' for convenience in priming the pump and in making sure that the valve is working freely.

The upwardly extending tube 77 and 77' of Figs. 4 and 5 respectively might lead to a condensate evaporator such as is seen in Fig. 6, instead of to the tube 42 or 42' as seen in Figs. 1, 2, 3 and 4. The condensate evaporator shown in Fig. 6 is heated by the coil 95 formed in the liquid tube 26 and located within the evaporating pan 96 which is attached to the inside of the upper wall of the cabinet 11'. The holes 97 in the pan 96 allow some of the warmer air within the cabinet to flow into the pan 96, upward

through passage 98 and out at the rear of the cabinet through the passage 99.

Heat passes from the hot liquid refrigerant in the coil 95 to the water in the pan 96, causing the water to evaporate and the water vapor to pass out through the passages 98 and 99. The passage 99 is enclosed by the top sheet 100, the lower sheet 101 and the wall 102 of the cabinet 11' so that the water vapor is not allowed to enter the insulation of the cabinet.

A further modification of the condensate pump is seen in Fig. 7 where the pan 13' is fitted with a bellows chamber 87' in which there is a bellows 86' soldered or otherwise sealed to the pan 13. The port 81 in the pan 13' is closed by the valve 82' which is opened by suction and reclosed by the very slight buoyancy of the float 83'. The float is guided by the in-turned bead of the guide tube 103 which is open at the bottom and is also provided with ports at the top where it is attached to the bottom of pan 13. The guide 103 also serves as a guide for the spring 104 held under compression between the bottom wall of pan 13' and the head 105 of the bellows 86' and as a stop against which the movable head 105 of bellows 86' may strike to limit its compressing movement.

The bellows head 105 is urged downwardly by the spring 104 and upwardly by the pressure of liquid refrigerant 107 within the housing 87'. This liquid refrigerant, entering the cabinet through the tube 26', corresponding to the tube 26 previously described, passes through housing 87' and the tube 26'' to the expansion device 27', corresponding to the device 27 previously described, hence the pressure on the outside of bellows 86' will be the high side pressure of the refrigerating system, which varies considerably between operating and idle periods. It is this variation of pressure acting upon the bellows 86' and the spring 104 which draws the water 108 into the bellows 86' from the pan 13' through the port 81 and forces it out past the check valve 91' into the passage 109 which connects with the tube 42'', corresponding to the tube 42 previously described.

The stops 106 on the bottom of bellows head 105 keep the bellows head from closing the refrigerant outlet into tube 26''.

The condensate evaporator may be combined with the condenser as shown in the Figs. 8, 9 and 10 if desired, instead of one of the type shown in Fig. 1. Referring to Fig. 8 it will be seen that the high pressure refrigerant vapor line 22' leads into the conduit 114 formed in the condenser 111 between the metal sheets 112 and 113. Similarly formed conduits 115 lead from left to right of the condenser and are joined at their ends with conduits 114 by means of headers 116 formed by depressions in the sheet 113. Water dripping from the tube 42a, corresponding to the tubes 42, 42' and 42'' previously described, falls into the trough 117 formed in the top of the upper conduit 114 and flows from this trough into another trough 117 formed in the top of the conduit 115 next below it, and so on until the water is evaporated by the heat given off by the condensing refrigerant.

The arrangement of these parts is further shown in Figs. 9 and 10, where it is seen that the outer sheet 112 of the condenser is marginally formed into supporting flanges 112' which attach to the rear of cabinet 11' and is also formed into the projecting double rib 118 disposed vertically on either side of the condenser. Additional ribs 118 are attached to the rear side of the condenser

to assist in the dissipation of heat to the atmosphere.

A method of forming the condenser conduits 114 and 115 with the trough 117 is shown in Figs. 11, 12 and 13. Referring to Fig. 11 it will be seen that the sheet 112 is first made with the easily formed ribs 115', then attached to sheet 113 as by brazing or welding, the conduit space filled with a liquid and the conduit 115' then reformed into the shape 115 with the trough 117.

The die for this reforming operation comprises the base plate 121, a number of wedge-shaped members 123 and 124, and the upper plate 122. With the plates 121 and 122 held in position in a press, a further movement of the press mechanism forces the wedges 123 and 124 against the liquid-filled conduits 115', forming them into conduits 114 and 115 as seen in Fig. 13.

Another method of forming a similar condenser with troughs for the evaporation of condensate is illustrated in Figs. 14, 15 and 16. The condenser is in this case formed by the sheets 126 and 127 with sinuous channels 128 pressed into sheet 127 and the two sheets welded or otherwise secured together in a gas-tight manner. The tube 22'', corresponding to the tubes 22 and 22' previously described, leads into the upper horizontal leg of passage 128 and the condensate drip tube 42b, corresponding to the tube 42 previously described, feeds water to the condenser troughs as in Figs. 8 and 9, but in this case the troughs 129 and 130 differ from the troughs 117 in being formed by separate pieces of metal which are soldered, brazed, or welded to the sheet 126.

Referring to Fig. 16 it will be seen that water dripping from the tube 42b into the upper trough 129 will accumulate up to the level 144 before any water overflows into the next lower trough 130, which will in turn overflow into the next lower trough 129 after accumulating a given quantity of water. This arrangement of the troughs provides for the storage of a considerable volume of water and the design is so arranged as to provide in this way against the possibility of condensate flowing over the condenser and dripping off before it has been completely evaporated.

Figs. 17, 18 and 19 show a horizontally disposed condenser and condensate evaporator located below the refrigerator and in the path of air circulated by a fan. The condenser 133 is formed by the sheets 134 and 135 which are attached together to enclose the circuitous passage 138. As seen in Figs. 18 and 19, the sheets 134 and 135 are turned upward at two of their edges to form the vertical walls 136 and 137, thus forming a series of troughs for water 144 as seen in Fig. 17. The water 144 is, of course, frost which has been melted off of the refrigerant evaporator, such as the evaporator 12 in Fig. 1, and has been collected in a pan such as the pan 13 in Fig. 1 and delivered to the condenser 133 by the tube 42c, corresponding to the tube 42 and corresponding tubes in previous views. This water overflows from one trough to the next lower one and the proportions are such that the water will be entirely evaporated without overflowing the lowermost trough.

The liquid tube 26a, corresponding to the tube 26 previously described, is shown in Fig. 17 with a liquid refrigerant receiver 143 included therein, although this is not an essential feature. A blast of air is forced over the top of the condenser 133 and over the fins 139 on the bottom of the condenser by the fan 140 which is driven by the motor

141. This motor may be the same one which operates the usual compressor or entirely separate therefrom. Air drawn below the baffle wall 142 is returned by the fan to cool the condenser and to carry away water vapor evaporated from the upper side of the condenser.

It will be noted that the several troughs formed on the upper side of the sheet 134 are not connected together by any channels or specific over-flow passages. The water merely overflows the corrugation at the top of one of the parallel legs of passage 138 into the next trough; being restrained from overflowing at the sides of the condenser by the upturned wall 136.

Formal changes may be made in the specific embodiments of the invention described without departing from the spirit and substance of the broad invention, the scope of which is commensurate with the appended claims.

What I claim is:

1. In a refrigerating mechanism, in combination, a refrigerator cabinet having heat insulated walls, a refrigerating system for cooling the interior of said cabinet including a condenser positioned exteriorly of the walls thereof, and means providing an exposed body of water between said condenser and the adjacent insulated wall of said cabinet.

2. In a refrigerating mechanism, in combination, a refrigerator cabinet having heat insulated walls, a refrigerating system for cooling the interior of the cabinet and including a condenser arranged exteriorly of said insulating walls and in spaced relation with respect thereto, and means for exposing water to the atmosphere between said condenser and the adjacent wall of said cabinet whereby to absorb heat by evaporation and thus reduce the heat transfer from said condenser to said wall of said cabinet.

3. In combination, a refrigerator cabinet having a chamber to be cooled, a refrigerating system associated with said cabinet for the purpose of cooling the same and including an evaporator positioned within said chamber and a condenser and compressor positioned exteriorly thereof, a plurality of open troughs thermally associated with said condenser and arranged to deliver water from one to the other thereof, means for collecting water dripping from said evaporator, and means for conducting said water to an upper one of said troughs.

4. In a refrigerating mechanism, in combination, a refrigerating system, a cabinet to be cooled by said system and having insulated walls, a condenser for said system supported adjacent to an outer face of one of said insulated walls, an extended surface of sinuous trough-like formation exposed to air outside of said cabinet and to heat from said condenser, means for collecting water of condensation within said cabinet, and means for delivering said water to said extended surface.

5. In a refrigerating mechanism, in combination, a refrigerator cabinet including a chamber having heat insulated walls, a door for said chamber normally sealing it against the circulation of the surrounding room air, a refrigerating system including an evaporator positioned within said chamber, a condenser, a compressor and means for driving said compressor arranged exteriorly of said chamber, a moisture absorbing element positioned exteriorly of said cabinet and exposed to the room air surrounding the same, and means for collecting and conveying to said element moisture condensing on said evaporator.

6. In combination, a refrigerator cabinet having a chamber to be cooled provided with heat insulated walls, a moisture absorbent element of planular formation supported from the walls of said cabinet on the exterior thereof and in spaced relation with respect to said walls, a refrigerant evaporator within said chamber, means for collecting moisture condensed upon said evaporator, and means for delivering said moisture to said element.

7. In a refrigerating system, in combination, an evaporator, a condenser, a compressor and means for driving said compressor, a mass of absorbent material positioned in heat transfer relation with respect to the high side of said system, means for collecting water condensed upon said evaporator, and means for conducting said water to said absorbent material for the purpose of causing said water to be evaporated therefrom.

8. In a refrigerating mechanism, in combination, a refrigerator cabinet having a heat insulated chamber, an evaporator within said chamber, means for evaporating water positioned exteriorly of said chamber, means for collecting moisture from the walls of said evaporator at a point below the upper edge of said evaporating means, and means for elevating said water and delivering it to said water evaporating means.

9. In a refrigerating mechanism, in combination, a refrigerator cabinet having a chamber provided with heat insulated walls, a refrigerating system including an evaporator positioned within said chamber, water evaporating means positioned exteriorly of said chamber, means for collecting water from said evaporator within said cabinet, and means operable as a result of variations in the operating conditions of said system for elevating said collected water and delivering it to said water evaporating means.

10. In a refrigerating mechanism, in combination, a refrigerator cabinet having a chamber provided with heat insulated walls, a refrigerating system including an evaporator positioned within said chamber, water evaporating means positioned exteriorly of said chamber, means for collecting water from said evaporator within said cabinet, and means operable by variations in temperature within said chamber for elevating said collected water and delivering it to said water evaporating means.

11. In a refrigerating mechanism, in combination, a refrigerator cabinet having a chamber provided with heat insulated walls, a refrigerating system including an evaporator positioned within said chamber, water evaporating means positioned exteriorly of said chamber, means for collecting water from said evaporator within said cabinet, and means operable in response to variations in pressure within said refrigerating system for elevating said collected water and delivering it to said water evaporating means.

12. In a refrigerating mechanism, in combination, a cabinet having a chamber to be cooled provided with heat insulated walls, a refrigerating system including an evaporator positioned within said chamber, a condenser and compressor, means for causing cyclic operation of said refrigerating system, means for collecting condensed moisture in said chamber, water evaporating means exteriorly of said chamber, and means actuated by cyclic operation of said system for delivering said condensed moisture to said water evaporating means.

13. In a refrigerating mechanism, in combination, a refrigerator cabinet having a chamber to

be cooled, a refrigerating system including an evaporator in said chamber and a generally planar condenser exteriorly of said chamber, said condenser being arranged with the plane thereof in generally horizontal position and formed to provide means on its upper surface for supporting an open body of water, and means for delivering water from said chamber to said means on said condenser.

14. The method of operating a refrigerating mechanism including a cabinet having heat insulated walls and a refrigerating system for cooling said cabinet including a vertically extending condenser arranged in exteriorly spaced relation to one of said walls, comprising periodically defrosting the evaporator of said system, collecting water dripping from said evaporator, and exposing said water in extended area condition between said condenser and said one of said walls to the flow of air.

15. In combination, a refrigerating system including a condenser so constructed and arranged as to hold a body of water supplied thereto, an evaporator, and means for collecting water condensed upon said evaporator and delivering it to said condenser for the purpose of re-evaporating said water and dissipating it to the atmosphere.

16. In combination, a refrigerating system including a condenser, an evaporator and a control for said system so constructed and arranged as to cause the temperature of said evaporator to rise above and to fall below the temperature required to freeze ice during each cycle of operation of said system, means for collecting water condensing on said evaporator, and means for delivering said collected water into material heat con-

ducting relationship with respect to said condenser whereby to effect re-evaporation of said water and dissipation thereof in the surrounding air.

17. In a refrigerating system, in combination, an evaporator, a condenser, a plurality of open troughs thermally associated with said condenser and arranged to deliver water from one to the other thereof, means for collecting water dripping from said evaporator, and means for conducting said water to an upper one of said troughs.

18. In a refrigerating mechanism, in combination, a refrigerator cabinet having a chamber provided with heat insulated walls, a refrigerating system including a condenser means positioned exteriorly of said chamber and a pair of evaporators positioned within said chamber, one of said evaporators being insulated against the transfer of heat to it from the air within said chamber and the other of said evaporators having a relatively low thermal storage capacity and exposed to the air within said chamber for the purpose of cooling the same, thermally responsive control means for said system so constructed and arranged as to cause said uninsulated evaporator to rise above the temperature required to melt ice during one portion and to drop below the temperature required to freeze water during another portion of each cycle of operation of said system, means for collecting moisture dripping from the second mentioned evaporator, means for conducting said collected moisture to a point exteriorly of said chamber, and means for dissipating said water over a substantial area exteriorly of and adjacent to said chamber whereby said water is evaporated in the air surrounding said cabinet.

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