Jan. 12, 1954

A. J. PEDIGO

REFRIGERATOR CONSTRUCTION HAVING AIR AND WATER VAPOR CIRCULATING MEANS

2,665,562

Filed May 28, 1951

7 Sheets-Sheet 1

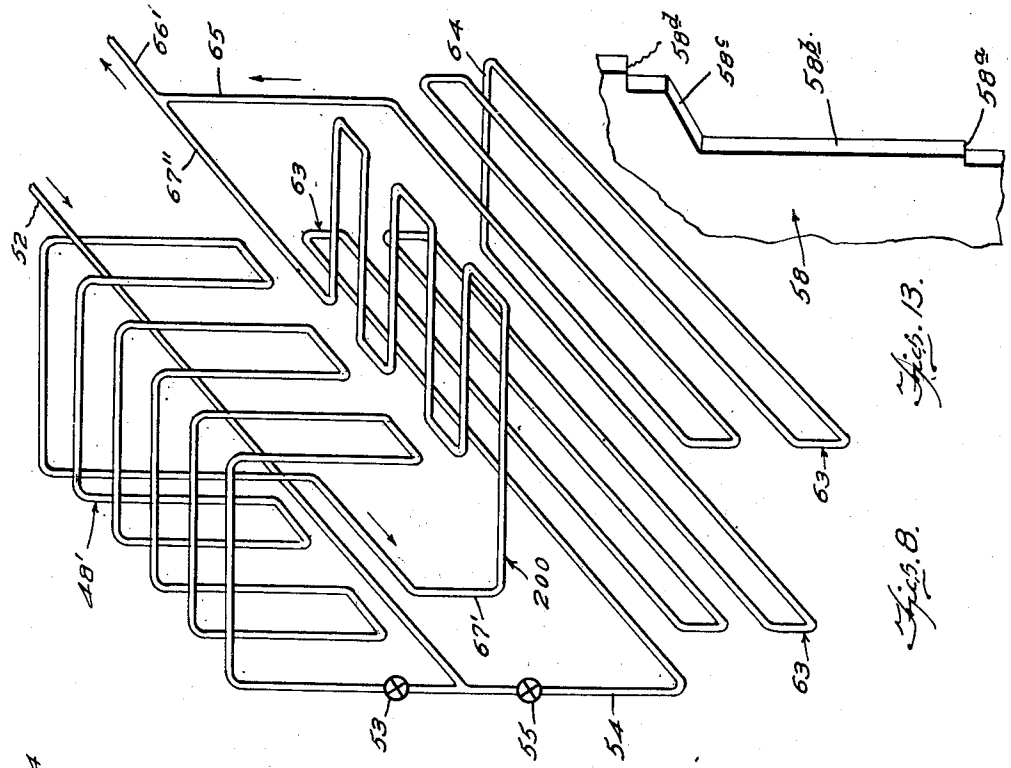


Fig. 13.

Fig. 8.

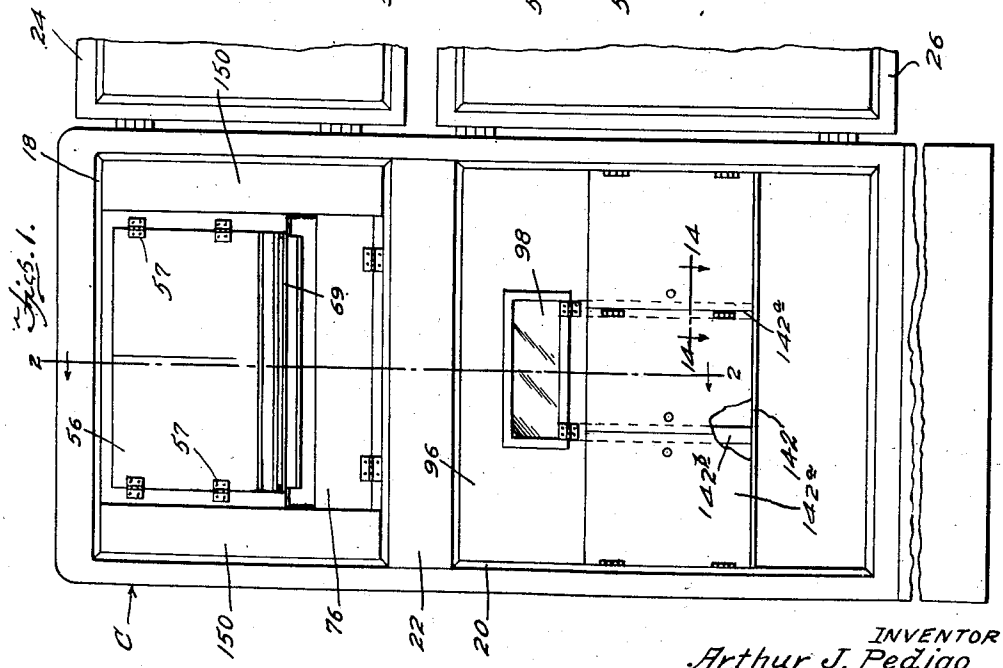


Fig. 1.

INVENTOR
Arthur J. Pedigo

By Wilfred E. Lawson
ATTORNEY

Jan. 12, 1954

A. J. PEDIGO

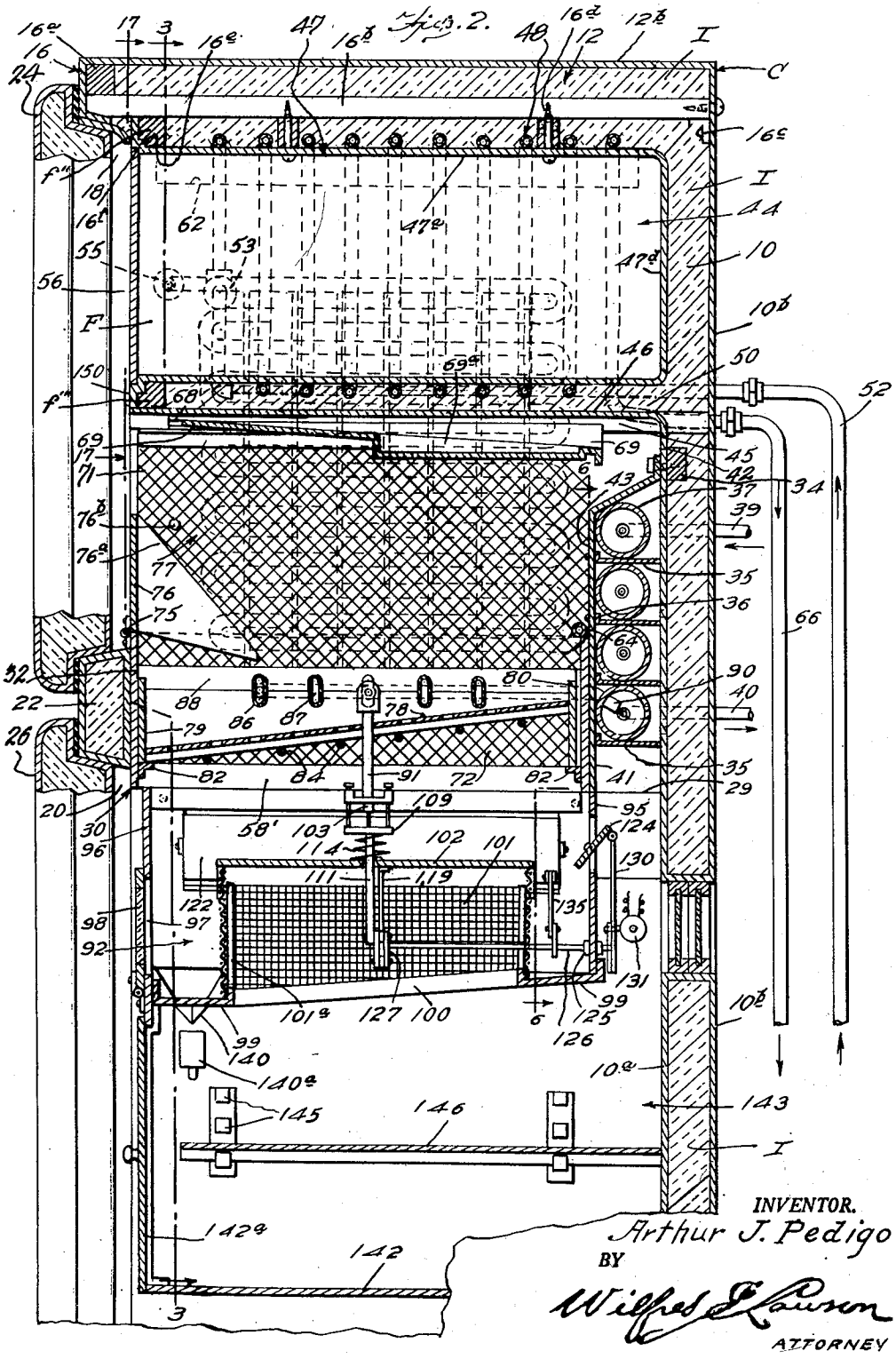
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Fig. 2.



INVENTOR.
Arthur J. Pedigo
BY
Wilfred L. Lawson
ATTORNEY

Jan. 12, 1954

A. J. PEDIGO

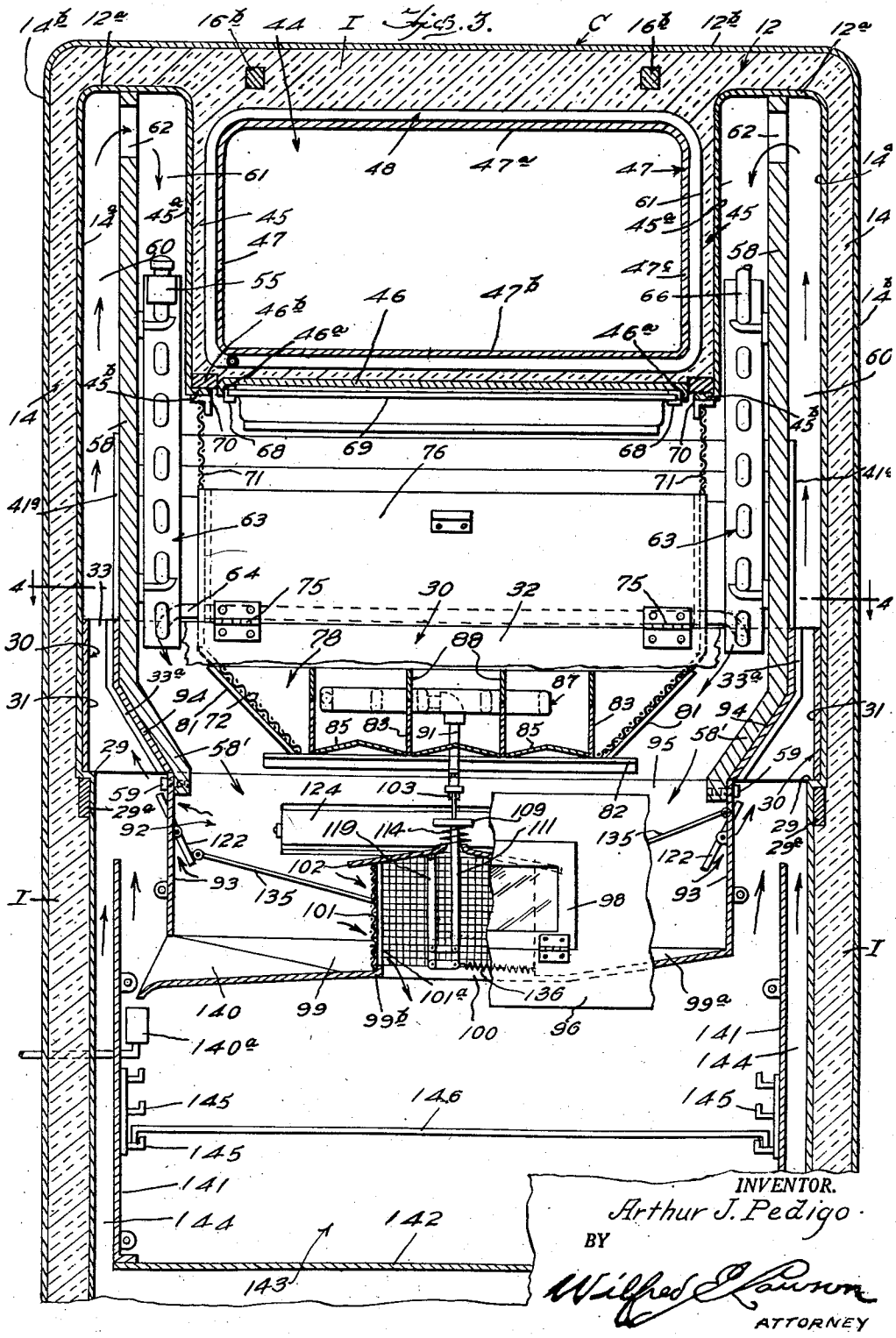
REFRIGERATOR CONSTRUCTION HAVING AIR AND WATER VAPOR CIRCULATING MEANS

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7 Sheets-Sheet 3

Fig. 3.



INVENTOR.
Arthur J. Pedigo
BY
Wilfred L. Lawson
ATTORNEY

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REFRIGERATOR CONSTRUCTION HAVING AIR AND WATER VAPOR CIRCULATING MEANS

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Fig. 4.

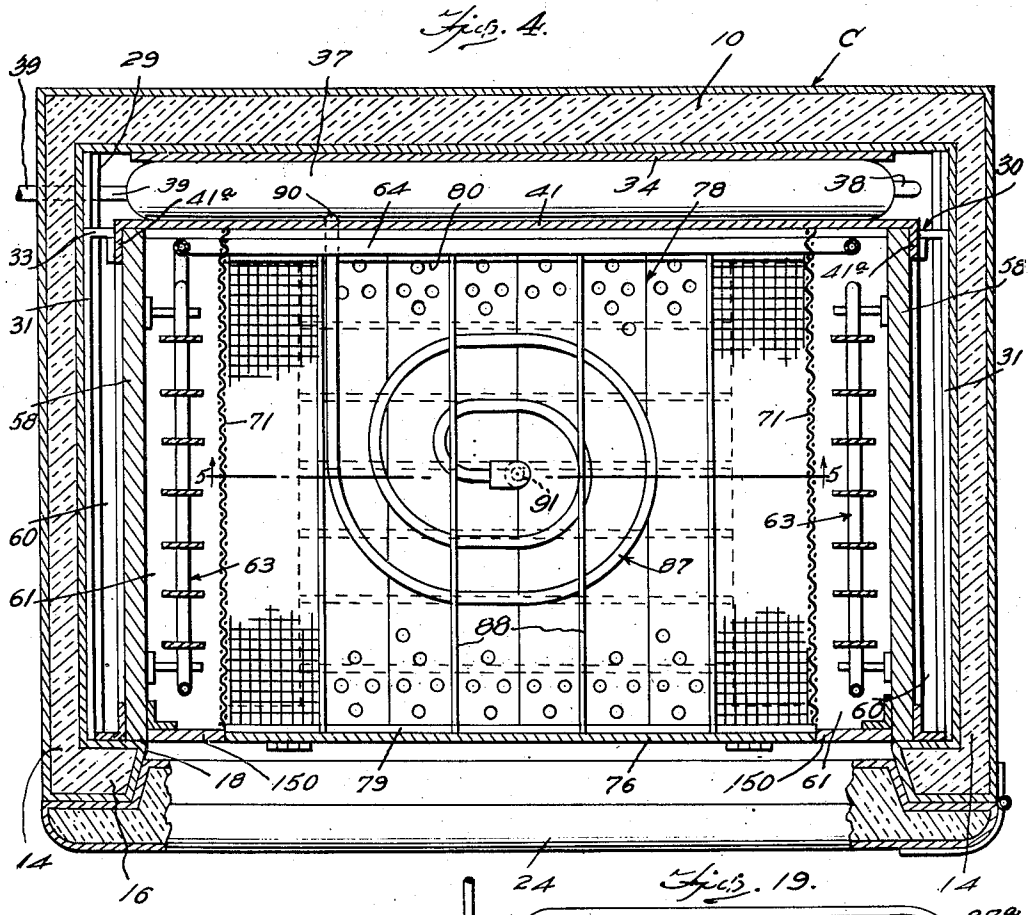


Fig. 19.

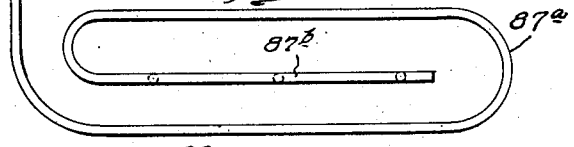


Fig. 5.

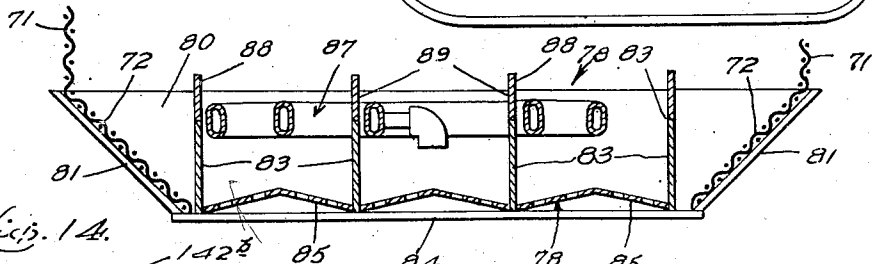


Fig. 14.

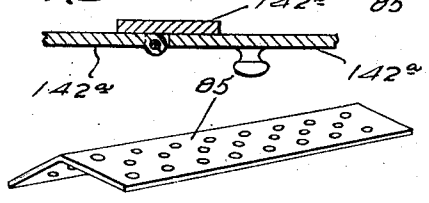


Fig. 12.

INVENTOR.
Arthur J. Pedigo
BY
Wilfred E. Lawson
ATTORNEY

Jan. 12, 1954 A. J. PEDIGO 2,665,562

REFRIGERATOR CONSTRUCTION HAVING AIR AND WATER VAPOR CIRCULATING MEANS

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Fig. 6.

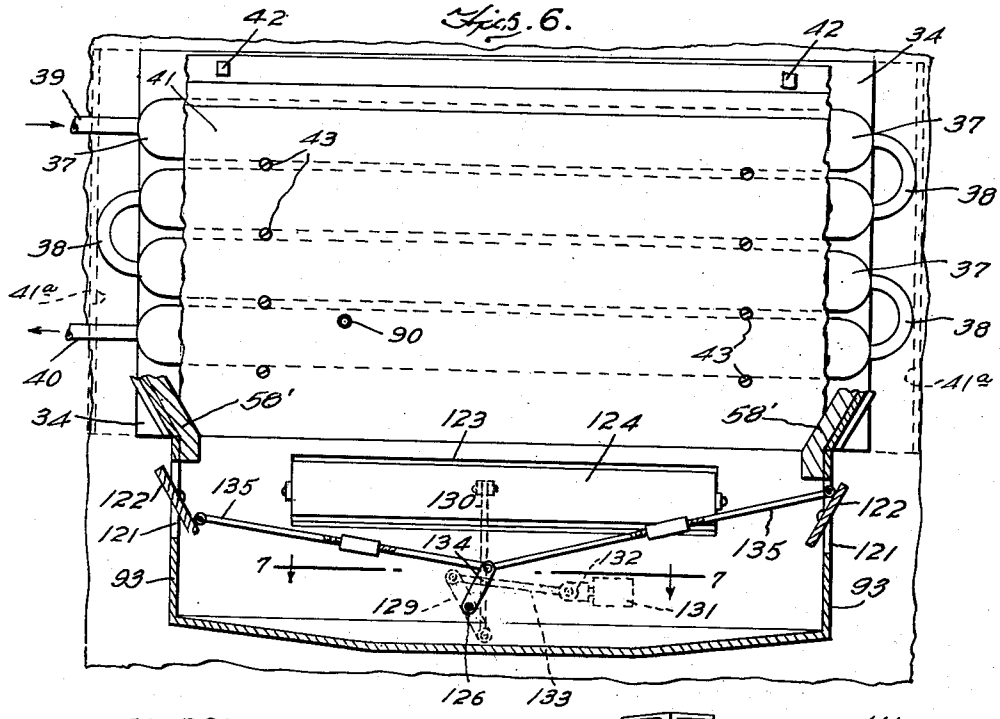


Fig. 9.

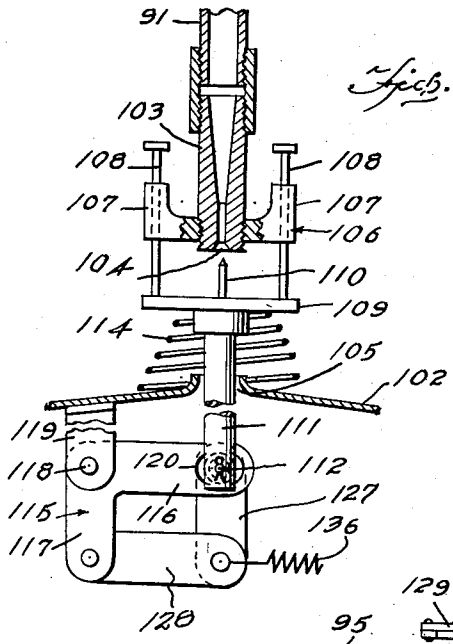


Fig. 10.

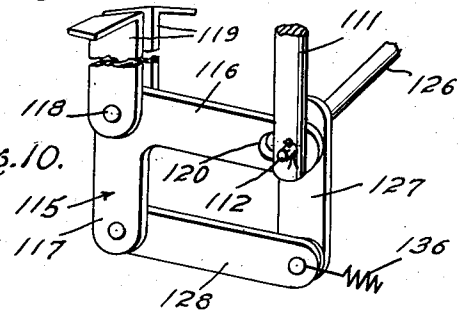
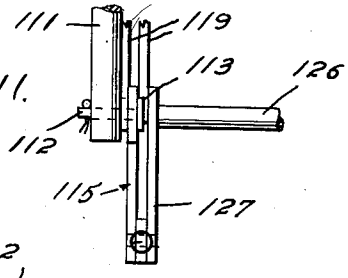


Fig. 11.



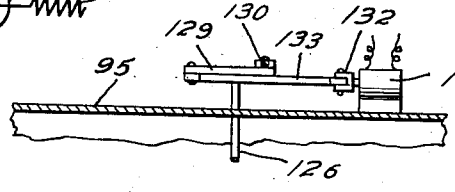


Fig. 7.

INVENTOR
Arthur J. Pedigo

By Wilfred E. Lawson
ATTORNEY

Jan. 12, 1954 A. J. PEDIGO 2,665,562

REFRIGERATOR CONSTRUCTION HAVING AIR AND WATER VAPOR CIRCULATING MEANS

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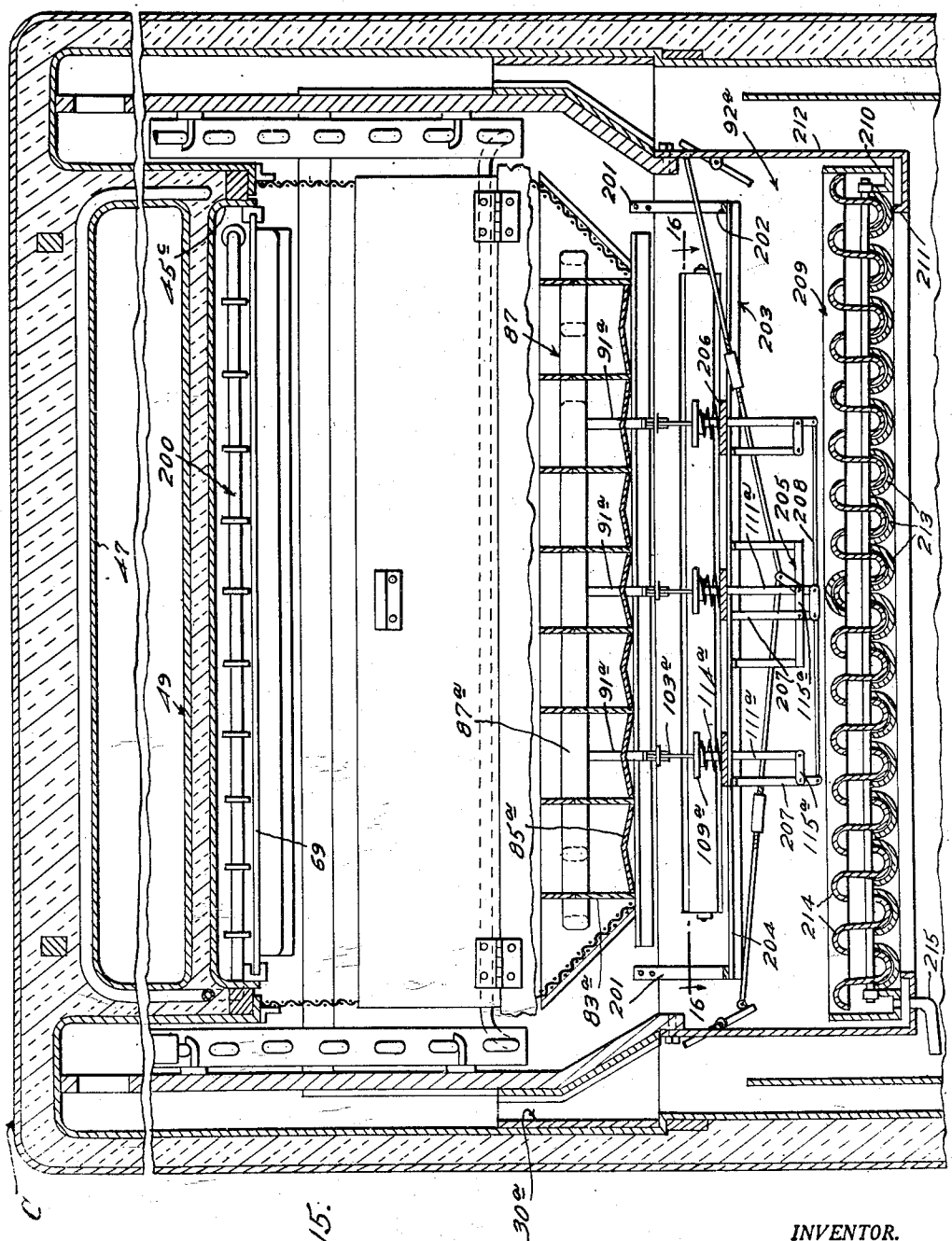


Fig. 15.

INVENTOR.
Arthur J. Pedigo
BY
Wilfred L. Lawson
ATTORNEY

Jan. 12, 1954

A. J. PEDIGO

2,665,562

REFRIGERATOR CONSTRUCTION HAVING AIR AND WATER VAPOR CIRCULATING MEANS

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7 Sheets-Sheet 7

Fig. 17.

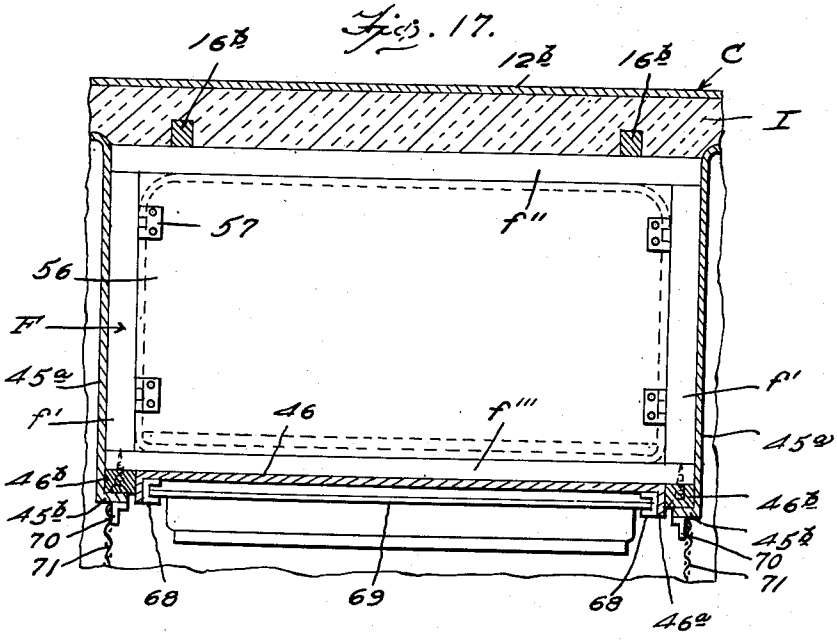


Fig. 18.

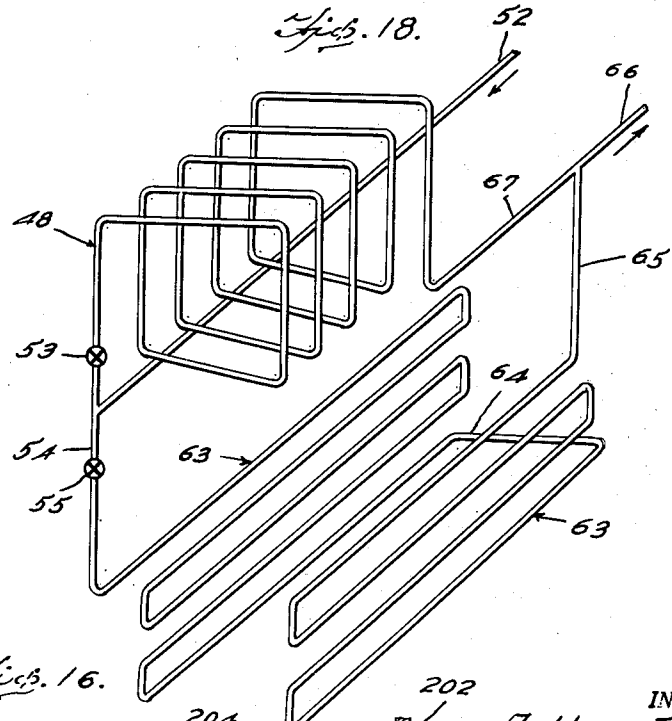
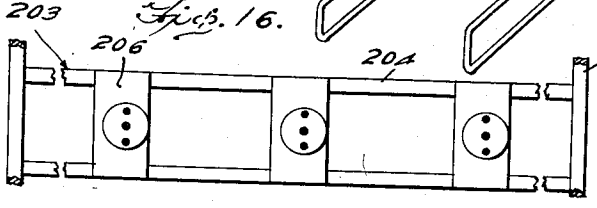


Fig. 16.



INVENTOR.
Arthur J. Pedigo
BY
Wilfred L. Lawson
ATTORNEY

Patented Jan. 12, 1954

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UNITED STATES PATENT OFFICE

2,665,562

REFRIGERATOR CONSTRUCTION HAVING AIR AND WATER VAPOR CIRCULATING MEANS

Arthur J. Pedigo, Richmond, Va.

Application May 28, 1951, Serial No. 228,680

17 Claims. (Cl. 62—43)

1

This invention relates generally to the class of refrigeration and is directed particularly to an improved refrigerator structure which is designed primarily for domestic use although it is not necessarily restricted to such use.

An object of the present invention is to provide an improved refrigerator structure designed to use both ice and mechanical refrigerating means and constructed in a novel manner whereby a continuous movement or circulation of air is maintained therein.

Another object of the invention is to provide an improved refrigerator structure of the character above set forth, having a freezing compartment constructed and arranged in a novel manner within the refrigerator cabinet.

Still another object of the invention is to provide a refrigerator structure employing both mechanical means and ice for maintaining the desired temperature level, wherein the ice containing portion of the structure, together with baffle walls for producing a desired circulation of air from the lower part of the structure through the ice chamber, are all mounted in a novel manner upon a single supporting frame.

Still another object of the invention is to provide in a refrigerator structure of the character stated, means for humidifying the air as it circulates in the structure, which means is automatically controlled simultaneously with the mechanical refrigerating mechanism, to discharge water vapor into the circulating air when the compressor mechanism begins to function.

Another object of the invention is to provide in a refrigerator structure of the character stated, a novel automatic window control mechanism whereby the vapor chamber is automatically put into communication with air circulating passages when the compressor mechanism and humidifying apparatus start to function.

The invention will be best understood from a consideration of the following detailed description taken in connection with the accompanying drawings forming a part of the specification, with the understanding, however, that the invention is not to be limited to the exact details of construction shown and described since obvious modifications will occur to a person skilled in the art.

In the drawings:

Figure 1 is a view in front elevation of a refrigerator constructed in accordance with an embodiment of the present invention.

Figure 2 is a vertical section taken through the upper part of the structure substantially in the plane of the line 2—2 of Figure 1.

Figure 3 is a sectional view taken substantially on the line 3—3 of Figure 2.

Figure 4 is a horizontal section taken substantially on the line 4—4 of Figure 3.

Figure 5 is a detail section taken substantially on the line 5—5 of Figure 4.

Figure 6 is a fragmentary sectional view taken

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substantially on the line 6—6 of Figure 2, looking in the direction of the arrows.

Figure 7 is a sectional view taken on the line 7—7 of Figure 6.

Figure 8 is a view in perspective of the refrigerating coils as used in a commercial form of the structure.

Figure 9 is a detail view partly in section and partly in elevation of the spray unit and a part of the operating means therefor.

Figure 10 is a view in perspective of the bell crank part of the spray unit.

Figure 11 is a view of said bell crank part as seen from the side nearest the operating shaft.

Figure 12 is a perspective view of one of the perforated plates forming a part of the ice grid.

Figure 13 is a detail, in perspective, of a part of the back edge of a baffle wall.

Figure 14 is a sectional detail taken substantially on the line 14—14 of Figure 1.

Figure 15 is a vertical section corresponding to Figure 3 taken through the upper half of the refrigerator structure with a portion of the freezing compartment area broken out, showing a modified design for commercial installations.

Figure 16 is a sectional view taken substantially on the line 16—16 of Figure 15 showing one form of supporting means for the several spray valves.

Figure 17 is a detail section taken substantially on the line 17—17 of Figure 2.

Figure 18 is a view in perspective of the system of coils as used in the refrigerator for domestic use.

Figure 19 is a plan view of the water coil in the commercial refrigerator construction, with which spray jets are connected.

Referring now more particularly to the drawings the refrigerator cabinet is generally designated C which includes the back wall 10, the top wall 12 and side walls 14.

The numeral 16 designates the front in which are formed the upper and lower door openings 18 and 20 respectively which are divided by the horizontal mullion rail 22.

The upper and lower doors for covering the openings 18 and 20 are designated respectively 24 and 26.

The walls are all double as shown, in that they have the inner and outer sheathing of sheet metal designated respectively 10a—10b; 12a—12b; and 14a—14b, filled with suitable heat insulation material I.

Each of the side walls 14 is reduced in thickness at about the elevation of the lower part of the mullion front piece 22 as shown in Figure 3, thereby forming upon each side of the interior of the cabinet structure the shoulder or ledge 29 as shown in Figure 2, which ledge extends from the front to the back of the cabinet.

In order to strengthen the inner wall structure below the ledge or shoulder 29 there is disposed at each side of the refrigerator a transverse sup-

porting bar 29a as shown in Figure 3 which engages the underside of the ledge 29 and has its ends secured to the front and back walls in a suitable manner, not shown.

The numeral 30 designates generally a rectangular frame piece which is made up of the two side portions 31 and the front and back portions 32 and 33 respectively, which side, front and back portions are of substantial width and are disposed vertically within the cabinet and the side portions 31 rest upon the adjacent ledges 29 as shown most clearly in Figure 3. This frame carries the major portion of the mechanism within the cabinet as hereinafter described.

The sheet 10a of the back wall has secured horizontally thereto on the back side thereof, the horizontal bar 34 and below this bar are secured, to the face of the wall sheet 10a, the vertically spaced horizontal and forwardly projecting thin plates 35. These plates at their forward edges have welded thereto the upstanding lugs 36 which are tapped to receive screw members for the purpose about to be described.

Disposed horizontally upon each of the plates 35 is a cylinder 37 of about two inches in diameter and these are closed at their ends as shown in Figure 4 but the cylinders are connected to form a continuous passageway, by means of the small diameter return bend pipes 38 as clearly shown in Figure 6, the uppermost one of the cylinders 37 being connected to a water supply line 39 while the lowermost one is connected with the water return or outlet line 40.

Overlying the water cylinders 37 and serving as a shield therefor is the plate 41, the upper edge portion of which is extended rearwardly and upwardly to lie against the back wall sheet 10a where it is secured by bolts 42 which extend into the bar 34. In addition to the securing bolts 42 the shield plate 41 has passed therethrough screws 43 which enter the lugs 36. Each vertical edge of the plate 41 has integral therewith the forwardly projecting flange 41a, see Figure 4, the function of which is hereinafter set forth.

In the top central part of the cabinet C is located the freezer compartment or chamber which is generally designated 44. This freezing compartment comprises the two vertical side walls, each generally designated 45 which are spaced a substantial distance inwardly from the side walls 14 of the cabinet. Each of the freezing compartment side walls 45 has the outer wall sheet 45a which, as shown in Figure 3, forms a downward continuation of the top wall inner sheet 12a. Each wall sheet 45a terminates at its bottom edge in the inwardly directed horizontal flange 45b.

Extending forwardly from and forming a continuation of the inner wall sheet 10a of the back wall 10, as shown in Figure 2, is the horizontal bottom wall sheet 46 which, as shown in Figure 3, has the downturned side flanges 46a which oppose the inwardly directed edges of the flanges 45b.

To strengthen the wall sheets 45a and 46 there are provided the horizontal bars 46b which are formed of a suitable heat insulation material and which extend from the front part of the cabinet to the rear and butt against the rear wall sheet 10b. These bars 46b are positioned in the angle between the wall sheet 45a and the flange 45b and the downturned flanges 46a of the bottom sheet 46 are secured to the insulation bars 46b but are spaced from the metal flange 45b

as shown in Figure 3. The rear ends of the bars 46b are bolted or otherwise suitably secured to the back wall outside sheet 10b.

Disposed between the wall sheets 45a and above the bottom sheet 46 is the metal shell generally designated 47 which forms the inner wall lining of the freezing compartment and which comprises the top and bottom sheets 47a and 47b respectively, the side wall sheets 47c, and the back wall sheet 47d, shown in Figure 2. The front of this shell is open and is secured to a rectangular door frame which is generally designated F. This frame includes the vertical side portions f' and the top and bottom transverse portions f'' and f''', as shown in Figure 17. As is also shown in this figure the bottom portion or bar of the frame F extends across and is joined to the horizontal front to rear bars 46b.

Extending across the front of the cabinet below the top wall sheet 12b is a bar 16a and in this bar are mortised the front ends of top front to rear suspension bars 16b, the rear ends of which are supported on angle brackets 16c and secured to the outer or back wall sheet 10b as shown in Figure 2.

The top transverse bar or rail f'' is secured to the suspension bars 16b by screws 16d, or the like, as shown in Figure 2.

In addition to providing a connection such as the screws 16d, between the top 47a of the freezing compartment and the bar 16b, the top, bottom and side bars of the frame F are suitably recessed as indicated at 16e in Figure 2 to receive the lateral bordering angle flange 16f which is formed around the forward edges of the top, bottom and side walls of the freezing compartment. This bordering angle flange forms a suitable recess in which are received the edges of the front doors 56 for the freezing compartment. Such doors are hinged at the sides of the frame structure in any suitable manner as by means of the illustrated hinges 57. Thus it will be seen that the entire shell 47 is maintained in spaced relation with the side wall sheets 45a and the bottom sheet 46. It will be seen also that the shell 47 of the freezing compartment is completely free of any contact with the metal parts of the rest of the casing. As previously stated the supporting bars 46b and 16b, as well as the top and bottom portion and side portions of the frame F are made of a suitable heat insulation material or at least a material which is of low heat conductivity.

As shown the insulation material I is introduced between the shell 47 and the adjacent sheets 45a and 46.

Completely encircling the freezing compartment shell 47 are convolutions of a freezing coil 48. As illustrated the coil is wrapped around the shell and is in contact therewith. Thus it will be seen that the freezing coil may be installed with the shell in setting up the refrigerator structure and also it is supported by the shell which in turn is supported by the bars hereinbefore referred to.

As is shown in Figure 18, one end of the freezing compartment coil 48 has connected therewith the refrigerant supply pipe 52 which, of course, leads from the compressor mechanism, not shown, and the admission of the refrigerant into the coil 48 for expansion is controlled by the expansion valve 53. The refrigerant supply line 52 is also connected at the end which leads to the coil 48, to a pipe 54 through an expansion

valve 55 which leads to side coils as hereinafter described.

In view of the fact that expansion valves of the character herein employed are common and well known, such valves are only conventionally illustrated.

As shown in Figure 3 the side walls 45 of the freezing compartment are spaced inwardly a substantial distance from the side walls 14 of the cabinet and disposed vertically in each of the spaces between a cabinet side wall and a side wall of the freezing compartment, is a vertical baffle 58 which engages at its top edge against the underside of the top wall 12 and along its back edge against the rear wall 10, and the lower end of each baffle extends into the frame 31 and has a short inwardly angled bottom 58'. The baffles 58 are held in the supporting frame 31 between the front and back sections thereof in any suitable manner. Each of the baffles 58 has the lower part of its back edge notched as at 58a to engage the top edge of the frame, and above this notch the portion 58b engages against the face of the water tube shield plate 41. Above the edge portion 58b the baffle is cut, as shown at 58c and 58d to lie across the top part of the shiled plate 41, so that the baffle may contact the back wall 10 from the top of the shield to the top wall 12. There is thus formed between each baffle wall 58 and the adjacent side wall 14, a vertical flue 60 and between the inner side of each baffle wall 58 and the adjacent wall of the freezing compartment, a freezing coil area which is designated 61.

The top part of each baffle wall 58 has an opening 62 therein for the movement of air from the flue 60 into the coil area 61.

Disposed within each coil area 61 is a freezing coil unit which is generally designated 63, the convolutions of the coils being horizontally disposed as shown. As illustrated in Figure 18, the top or upper pipe of one coil unit 62 is connected to the pipe line 54 which is connected to the expansion valve 55 and the lower part of this unit is connected by the cross over pipe 64, with the lower part of the freezing coil unit 63 at the opposite side of the cabinet, the upper part of this last named unit being connected by the pipe 65 with the refrigeration return pipe 66 with which is also connected the outlet end 67 of the freezing cabinet coil unit 48.

Along the inner side of each flange 46a of the freezer compartment bottom sheet 46, there is secured a guide track 68 and slidably supported between these guide tracks to lie below the sheet 46a, is a downwardly and rearwardly inclined air baffle or deflector and drip plate 69. This deflector and drip plate forms the roof or cover over the hereinafter described ice chamber.

The deflector 69 has the rear half portion thereof pressed to form a water tray 69a. In this tray a quantity of water is kept for the purpose of absorbing odors which it will do when chilled. Also any moisture which may form on the underside of the sheet 46 will drip off onto the deflector and run into the tray, any excess flowing from the rear end of the tray onto and down the surface of the cover plate 41.

The chilling of the water will be brought about primarily by cool air leaking through the insulation from the frozen food compartment lying above the water pan and baffle. Also water lying in the pan will serve as an indicator of the need for raising the temperature in the frozen food compartment when the water begins to freeze, at which time the expansion of the refrigerant in

the coil around the food compartment can be cut down to thereby increase the economy of operation.

Secured along the underside of each flange 45b is an angle bar 70 to which is secured the top edge of a downwardly extending heavy wire mesh wall 71. This wall extends all of the way back to the plate 41 but at its front edge terminates short of the inner side of the mullion 22 as shown in Figure 2. Along the bottom of each heavy wire wall 71, a portion of the wall is turned to extend inwardly and downwardly as indicated at 72, Figure 3.

Secured to the top edge of the front part of the frame 30, by hinges 75, is a door panel 76 which closes the lower part of the space between the side walls 71. Thus there is formed an ice chamber or compartment which is generally designated 77 which has for its back wall the cover plate 41 which overlies the water tubes 37 as shown in Figure 2.

The inturned lower portions 72 of the screen walls 71 form a part of the bottom frame structure or rack upon which the ice is placed, the front and back of such rack, which is generally designated 78, being formed by the front and back plates 79 and 80 respectively. These plates 79 and 80 are joined to the adjacent edges of the screen walls 71 and they have the angularly turned flanges 81 at their ends which engage beneath the inclined portions 72.

To assist in supporting the ice compartment, each of the plates 79 and 80 rests upon an angle bar 82 which, as shown in Figures 2 and 3, is secured to the inner face of the adjacent part of the supporting frame 30.

Extending from the front to the rear of the rack structure and forming a part thereof, are division plates or webs 83 which are secured at their ends to the inner faces of the plates 79 and 80 as shown in Figure 2. As is also shown in this figure the top edges of the plates 83 are horizontal and slightly below the plane of the top edges of the plates 79 and 80 while the lower edges of the plates 83 are inclined to extend upwardly from the bottom edge of the forward plate 79.

Extending across and joined to the bottom edges of the web plates 83 are bars 84 which project at their ends slightly beyond the bottom edges of the portions 72 of the screen side walls which bar ends assist in supporting the screen along its lower edge. These bars are thus disposed in a common plane which slopes upwardly and rearwardly as shown in Figure 2.

Resting upon the bars in the spaces between the web plates or division plates 83 are the apertured grids 85. These grids are of V-shape cross section as shown in Figures 5 and 12 and are placed with the channel sides down so that the longitudinal edges of the grids rest upon the bars 84 against the adjacent division plates 83. The grids 85 are loosely placed upon the bars 84 and may therefore be readily removed for cleaning if and when necessary.

In the construction above described a definite and very desirable function is accomplished. The design of the plates and the manner in which the apertured grids are supported as a result of such design effects the movement of the air from the front of the structure to the rear in coaction with other parts of the structure lying below the apertured grids such as the bottom or floor portions of the air conditioning chamber. With the described arrangement of the plates 83 and grids 85 it will be seen that the ice chamber will have a greater

depth at the front, from where the ice will be removed as needed and accordingly a larger quantity will be available in the front of the compartment and also the inclination of the grids will tend to cause the ice to gravitate into the deep front part of the compartment.

The top edges of the division plates 83 are slotted at suitable intervals as indicated at 86, Figure 2, to receive the convolutions of a flat water coil which is generally designated 87.

Disposed upon and extending longitudinally of the top edge of each division plate 83 is a flat plate strip 88 which is also slotted to receive the upper portion of each convolution of the water coil and the front and rear plates 79 and 80 of the rack have slots therein at 89, to receive the bottom edge of the strip 88.

One end of the water coil 87 is connected as indicated at 90, Figures 2, 4 and 6, into a water tube 37 while the other end of the coil which is at the center, as shown in Figures 2, 4 and 5, connects with a downwardly directed spray pipe 91, as shown in Figure 2.

Below the ice compartment 77 is an air conditioner chamber which is generally designated 92. This chamber comprises the side walls 93 which are spaced inwardly a substantial distance from the cabinet side walls 14 below the ledge 29, as shown in Figure 3. The walls 93 of the air conditioner chamber extend upwardly and along the outwardly sloping underside of the adjacent portion 58' of the baffle wall 58, as indicated at 94. These walls 93 and 94 may be secured to the baffle wall by bolts 59, as illustrated or in any other suitable manner. At the back of the air conditioner chamber is a back wall 95 which at its top edge abuts the lower edge of the water tube shield plate 41 as shown in Figure 1. As is also shown in this figure the lower edge of the back wall 95 is at a higher elevation than the side walls at the front edges of the latter and the side walls also slope upwardly slightly toward the rear.

To further assist in the maintenance of the baffles 58 in desired position, each of the front and back sections has an inwardly projecting flange 33a against which rests the adjacent wall portion 94 of the air conditioner structure 92.

The front of the air conditioner chamber is closed by a front wall or panel 96 in the lower central portion of which is the opening 97 which is covered by the outwardly and downwardly swinging door 98. This front panel 96 extends across the entire width of the front door opening below the level of the mullion 22 and is preferably made of metal so as to completely cover or hide the mechanism therebehind.

The numeral 99 designates the bottom or floor of the air conditioning chamber which, as shown, is secured to the bottom edges of the side and back walls and abuts the rear face of the front wall panel 96. This floor slopes downwardly and forwardly for the major portion of its length from the back to the front, as shown in Figure 2, the forward central portion of the floor being substantially horizontal and the floor also has upwardly sloping sides 99a as shown in Figure 3 which merge with a central portion 99b. In this central portion is formed a rectangular opening 100 which is enclosed by the upstanding rectangular screen wall 101 over the top of which is a cover 102. As shown in Figure 3 the cover 102 is substantially in the form of a hip roof which rests upon supporting posts 101a in the corners of the foraminous walls forming the enclosure 101. This cover or roof prevents drippings from the ice in the overlying ice chamber from passing downwardly through the opening 100 into the food chamber below while the foraminous wall 101 permits the ready up-flow of air currents from the food chamber, as will be readily apparent.

By having the bottom edge of the back wall 95 at a higher elevation than the forward ends of the side walls 93 as hereinbefore set forth it will be seen that the floor parts 99 and 99a will slope respectively upwardly and rearwardly and upwardly and laterally. As a result the cold air from the refrigeration elements, passing down through the opening 100 in the center of the drip pan will have a tendency to force the warm air to the rear and to the sides.

The pipe 91 has secured to the lower end, a spray nozzle 103 which has a constricted outlet 104 as shown in Figure 9. This nozzle outlet is directed downwardly toward and concentric with an opening 105 in the center of the cover or roof 102.

Secured to the nozzle 103 is a bracket 106 having two upwardly directed guides 107 through which are slidably extended the pins 108 which at their lower ends are attached to a deflector or splash plate 109. This plate is directly beneath the outlet 104 of the nozzle and it carries at its center the upwardly directed needle 110 which is adapted to enter the nozzle outlet when the plate 109 is moved upwardly.

From the underside of the plate 109 there extends downwardly the stem 111 which passes through the opening 105, as shown. This stem carries the transverse pivot pin 112 upon which is rotatably mounted a roller 113.

Surrounding the stem and interposed between the plate 109 and the roof 102 is an expansion spring 114 which normally urges the plate upwardly so as to introduce the needle 110 into the nozzle outlet to close the nozzle.

The numeral 115 designates a bell crank which is pivotally supported at the junction of its two arms 116 and 117, on a fixed pivot 118 which is supported in any suitable manner. The means here shown for supporting the pivot 118 and the bell crank, comprises a pair of hanger members 119 which are secured to the underside of the roof 102. However, any other suitable supporting means may be provided.

The arm 116 is substantially horizontally disposed and has formed therein elliptical opening 120 which extends lengthwise of the arm and in which is slidably engaged the roller 113.

Each of the side walls 93 of the air conditioning chamber has a window opening 121 therein in which is mounted for turning on a horizontal pivot, a window 122.

In the back wall is a corresponding opening 123 in which is mounted for swinging movement on a horizontal axis, a window 124.

Supported in a suitable bearing 125, Figure 2, extending through the back wall 95 of the air conditioning chamber is a rocker shaft 126 which extends forwardly toward and is substantially in alignment with the roller pivot 112, adjacent to which its forward end terminates. The forward end of this shaft 126 has secured thereto one end of a crank arm 127 and the lower end of this crank arm 127 is pivotally coupled with an end of a link 128 which has its other end pivotally coupled to the lower end of the arm 117 of the bell crank as illustrated in Figures 9 and 10.

The end of the link 128 which is coupled with the lower end of the crank 127 has attached thereto one end of a pull spring 136, the other

end of which is attached to any suitable fixed part of the structure such as, for example, the adjacent side of the opening 100, formed in the air conditioner chamber floor 99. This spring, assists the spring 114, in urging the valve needle to closed position in the nozzle outlet 104.

Upon the rear end of the shaft 126 outside of the air conditioning chamber there is secured, intermediate its ends, a crank arm 129. One end of this crank arm is connected by a pull rod 130, to the overlying window 124, adjacent to the top thereof or about its horizontal pivot.

At one side of the shaft 126 and at an elevation above the same, there is mounted in a suitable manner as, for example, upon the back wall 95 of the air conditioning chamber, a solenoid magnet 131 having an armature core 132, the magnet being supported so that the core will move horizontally in a path perpendicular to the shaft 126. This magnet core or armature is connected by a link 133, with the other end of the crank 129. Thus it will be seen that upon energization of the magnet so as to effect movement of the armature 132 thereinto, the crank 129 will be oscillated in a direction to pull down upon the window actuating rod 130 so as to open the window.

Inside of the air conditioning chamber the shaft 126 carries an upstanding crank arm 134 and this has attached to its upper end the adjustable coupling rods 135, each of which is connected to a side window 122, one rod being connected to the top part of its window and the other rod being connected to the bottom part of its window. Thus it will be seen that when the shaft 126 is rocked one rod will be pushed outwardly to open the window to which it is attached at the top and the other rod will be pulled inwardly to open the other window to which it is attached at the bottom of the window. The same movement will effect the above stated pull upon the rod 130 to open the back window 124.

It will also be apparent that when the magnet 131 is energized to effect the oscillation of the crank 129 and the turning of the shaft 126, the crank 127 will be moved to operate the bell crank 115 to pull down upon the stem 111 thereby withdrawing the needle 112 from the aperture of the spray nozzle 103. When the magnet is deenergized the springs 114 and 136 will effect the reverse movement of the needle to close the valve and this will also effect the reverse turning of the shaft 126.

The electro-magnet 131 is connected in the circuit of the operating motor, not shown, for the refrigerant compressor, not shown. Normally when the compressor motor is idle and the magnet 131 is deenergized, the windows 122 and 124 will be closed and the spray nozzle 103 will also be closed. When the compressor motor starts the magnet 131 will be energized and this will effect the movement of the rods 130 and 135 to open the windows and it will also effect the withdrawal of the valve needle 110 so that water under pressure will be ejected from the nozzle 103 and will strike the deflection plate 109. It will be understood that the nozzle aperture is very minute so that the stream of water ejected therefrom will be very fine and the water will accordingly strike the point of the needle 110 and be deflected laterally from the plate 109 in a highly diffused mist. This will add to the circulating air in the refrigerator structure a certain amount of moisture during the operation of the compressor motor and when the motor stops the nozzle will be shut off.

In operation of the present refrigerator structure the ice compartment is filled with ice cubes or broken ice, the same being introduced into the open front of the compartment and onto the rack structure 78, the lower front part of which compartment is covered by the door 76.

In order to prevent the escape of the ice pieces to the sides when introducing it through the door opening, the door 76 is provided with the substantially triangular side wings or plates 76a, Figure 2, which swing upwardly and outwardly as the door is opened. The inner corners of these plates come into contact with stop pins 76b carried by the side walls of the ice chamber, thereby limiting the outward swinging movement of the door.

The water when discharged from the spray nozzle will be at the very lowest possible temperature because of its passage through the coil 87 on which ice has been resting. Because of this low temperature, when the water is first diffused it will absorb all of the gases in the immediate area or vicinity but as the temperature of the diffused water rises moisture will be added to the circulating air and there will be discharged into such air, oxygen and possibly some nitrogen which had been absorbed by the water. Since these gases are vital to the preservation of the food or might be described as being vital to the sustenance of life in the food it will be readily seen that the system of diffusing chilled water into the atmosphere of the refrigerator structure will result in the preservation of foods for a longer period of time than would be the case where such foods might be stored in other types of refrigerators where no water vapor in chilled form is added to the circulating air of the food compartment.

As will be readily apparent the drippings from the ice contained in the ice chamber will be deposited upon the floor 99 in the air conditioning compartment along with moisture condensed from the air and the mist created within this compartment and the accumulated water will flow downwardly and forwardly to the lower forward part of the floor 99 where it will run into a drain trough 140 which will carry it laterally and discharge it into an outlet receptacle 140a as shown in Figures 2 and 3.

The water thus collected will contain absorbed gases and odors and will thus carry the same out of the refrigerator structure when being discharged through the outlet as set forth.

Below the air conditioning chamber there are secured in spaced relation with the inner faces of the side walls 14, the baffle walls 141. These walls have their top edges at a substantial elevation above the bottom of the air conditioning chamber 92 and extend only part-way down into the food chamber and at their bottom edges they are joined by the floor plate 142. The side walls and the floor plate 141 and 142 extend to the back wall of the cabinet. This is a part of my co-pending application Serial No. 789,907. The front of the area defined by the walls 141 and floor 142, is closed by suitable doors 142a, here shown as three in number although two doors may be employed or even one if desired. In the construction shown there are provided the two vertical bars 142b which are shown as secured between the floor plate 142 and the bottom of the panel 96. As shown in Figure 1 the two outside doors 142a may be secured to the adjacent sides of the opening frame for the door 26 so that their inner edges will close against a vertical bar 142b and the middle door may be hinged to one of the bars 142b and close at its opposite

edge against the other bar. The compartment 143 thus formed may be employed for the keeping of foods which require a certain amount of moisture in the surrounding air. The floor plate 142 will permit the cold to penetrate into the lower part of the food chamber where there may be kept foods of the character which require a dryer atmosphere. By positioning the baffles 141 slightly away from the walls 14 the narrow flues 144 are provided for the movement of air from the lower part of the food compartment upwardly through the flues 60 and into the upper part of the refrigerator structure.

Within the chamber 143 the inner sides of the baffle walls 141 are provided with brackets 145 for the support of a shelf 146 or a plurality of the same.

For the purpose of hiding a portion of the mechanism when the top door 24 is opened, and also to cover the front part of each of the flues 61 and 62, there are provided the inserted side panels 150 which are best shown in Figures 1 and 4. These may be made of any suitable material such as metal, plastic, glass or the like.

By the provision of the water tubes 37, a storage space is provided in the refrigerator, for a quantity of water, for drinking or other purposes, which will be kept at a low temperature. The inlet or supply line 39 would be connected to a supply source, such as the city water supply main, while the return or outlet pipe line 40 would be connected to a suitable tap or faucet, not shown, which could be mounted directly upon the refrigerator cabinet or in any other desired location.

The construction illustrated in the foregoing figures is designed primarily for domestic use. Such structure, however, may with very slight alterations be made suitable for commercial uses and in Figures 8, 15, 16 and 19 is illustrated a modified construction for commercial installations.

Since the majority of the parts and the structure in general, are the same in the commercial construction as in the domestic, the same reference characters will be employed for the same parts. In the commercial construction a principal change resides in the addition of a freezing coil, here designated 200, which is disposed horizontally beneath the bottom of the freezing compartment and above the air deflection and drip plate 69.

In the use of the horizontal freezing coil 200, the refrigerant conducting tubes 48' of the commercial form of the refrigerator, instead of completely encircling the freezing compartment as in the domestic form, pass back and forth across the sides 47c and top 47a of the shell 47 of the freezing compartment and are connected at one end to an end 67' of the horizontal freezing coil 200, the other end of the coil 200 being connected by pipe 67'' with the refrigerant return line 66'.

The commercial form of the refrigerator constructed in accordance with the present invention will have some dimensions different from the domestic form of the refrigerator as, for example, the commercial form will be of materially greater width and possibly depth, as compared to its height than will be the domestic form. Figure 15 illustrates the increased width of the refrigerator structure, it being understood, of course, as shown by the drawings that a substantial portion of the structure through the freezing compartment is cut out and the lower half of the structure is left out of the view in order to better illustrate the increased dimensions and some additional features as well as modifications of features of the domestic structure. As is illustrated in Figure 15 the commercial construction will have a greater number of web or division plates which are here designated 83a and, consequently, a greater number of perforated or apertured grids 85a would be employed.

The water coil 87a instead of being approximately circular as in the domestic construction, will be substantially elliptical as shown in Figure 19 and the inner end of the coil will have the centrally disposed long terminal pipe portion 87b, Figure 19, which will extend in the direction of the width of the refrigerator.

In the air conditioning compartment or chamber 92a a multiplicity of spraying units is provided as shown. Three such units are here illustrated but it will be understood that any desired number may be employed.

For the operation of these spraying units or spraying nozzles the central pipe 87b of the water coil 87a has connected therewith the three downwardly directed pipes 91a in the lower end of each of which is the spray nozzle 103a.

For the support of the needle plate 109a and the spring 114a therebeneath, of each spray unit the following structure may be provided.

Connected between the front and back members of the frame structure 30a, which front and back members correspond to the front and back members 79 and 80 of the frame structure 30 are suitable hangers 201, with the lower ends of which are connected the end bars 202, Figure 16, of a horizontal frame which is generally designated 203 and which includes the spaced parallel side bars 204.

Suspended from the side bars 204 is a shorter horizontal frame shown in Figure 15 and designated 205 which provides a supporting means for the electro-magnet operated shaft 126.

The frame 203 supports suitable plates 206 upon each of which is supported a spring 114a for the overlying spray nozzles 103a. These plates 206 also serve as means for supporting the depending arms or hangers 207, the central one of which supports the bell crank 115a and links connected thereto as particularly illustrated in Figures 9 to 11 and by means of which the upwardly extending valve needle moving rod or stem 111a is actuated upon the turning of the shaft, not shown, with which it is connected, corresponding to shaft 126.

Each of the other hangers 207 carries a bell crank 115a which is connected by a link 208 with the centrally located bell crank so that the three valves may be operated in unison.

In this modified construction the drip pan located below the spray units, is of the construction illustrated in my co-pending application Serial No. 789,907, filed December 5, 1947 now Patent No. 2,591,862 of April 8, 1952. This pan structure is generally designated 209. This pan structure broadly comprises a rectangular trough 210 which is supported horizontally on the inner upturned flanges of a rectangular trough like frame 211 forming a part of the vertical walls 212 of the chamber. A number of gutters 213 extend transversely of the trough structure 210 and open at their ends into the trough and these gutters have disposed above them and longitudinally thereof the trough members 214 which are inverted over the narrow dividing spaces between the parallel gutters 213 as shown, whereby any water coming from the sprays above will be

caused to flow into the gutters and eventually into the side troughs to be carried off by means of the drain 215.

As previously stated, except for the above specifically described structural features, the construction illustrated in Figure 15, is the same as that described hereinbefore and particularly illustrated in the preceding figures.

I claim:

1. In a refrigerator construction of the character described, a cabinet, means therein providing an ice compartment, said compartment having foraminous side walls spaced from side walls of the cabinet, a chamber unit below said compartment, said unit having a bottom and side walls, the chamber unit side walls being directed upwardly in a plane passing between the foraminous walls and the cabinet side walls, a baffle wall extending from each of the unit side walls to the top of the cabinet providing inner and outer flues, said inner and outer flues being in communication at the top of the cabinet, a freezing coil in each of the inner flues, means for establishing air communication between the chamber unit and the outer flues, an electrically operated water spray means within the chamber unit, and means for operating said air communication establishing means simultaneously with the operation of the water spray means.

2. In a refrigerator construction of the character described, a cabinet, means therein providing an ice receiving chamber, said chamber having foraminous walls, refrigerant coils positioned adjacent to the outer sides of said foraminous walls, an air conditioning chamber below the first chamber and having an open top, means for directing the circulation of air from below the air conditioning chamber to the top of the cabinet and back down across said coils into the air conditioning chamber, the downflowing air passing over said foraminous walls, a water vapor diffusing means within the air conditioning chamber, means for opening the sides of the air conditioning chamber, and an operative coupling between the last mentioned means and the water vapor diffusing means whereby the sides of the air conditioning chamber are opened simultaneously with the starting of the diffusing means.

3. The invention as stated in claim 2, with a water coil in the lower part of said ice chamber having an end directed downward into the air conditioning chamber, and said water vapor diffusing means comprising a valve closing said coil end, electro-magnetic means for opening the valve and actuating said coupling, and a deflector plate against which water from the coil end is discharged when the valve is opened.

4. The invention as stated in claim 2, wherein said air conditioning chamber has a bottom having a central opening, an upstanding foraminous wall upon said bottom and enclosing said opening, a cover over said foraminous wall and said opening, and said diffusing means being disposed directly above said cover.

5. In a refrigerator construction, a cabinet having side, top and back walls each including spaced inner and outer wall sheets, a freezing chamber in the central upper part of the cabinet and comprising outer side wall sheets depending from the top wall inner sheets in spaced relation with the cabinet side walls and joining the back wall inner sheet, the chamber further including a bottom wall sheet extending forwardly from the back wall inner sheet and a shell between and spaced from the depending side wall sheets and said bottom wall sheet, the shell and the last named sheets in spaced relation therewith terminating short of the front of the cabinet, closure means for the front of the chamber, an ice compartment below said chamber and having side walls depending from said depending side wall sheets and a bottom ice supporting grid structure, a vertical baffle wall between each cabinet side wall on one side and a side of the chamber and ice compartment side wall on the other side forming inner and outer vertical flues, said flues being in communication at their top ends, means forming an air conditioner chamber below the ice compartment having front, back and side walls, the air conditioner chamber side walls joining the lower ends of the baffle walls, a refrigerant coil lying against the top and sides of the freezing chamber shell, a refrigerant coil in each of said inner flues, means for putting the air conditioner compartment into communication with the lower end of each outer flue, and means for diffusing water vapor into the air of the last named compartment.

6. The invention as set forth in claim 5, with a frame unit mounted horizontally in the cabinet, and means for supporting the ice compartment grid, the baffles and the air conditioner chamber from said frame.

7. The invention as set forth in claim 5, wherein said freezer chamber bottom wall sheet is at an elevation above the bottom edges of said depending side wall sheets, a drip plate supported in spaced relation with and below the bottom wall sheet, and a refrigerant coil disposed horizontally in the space between said bottom wall sheet and drip plate.

8. The invention as set forth in claim 5, with an open top food compartment in the lower part of the cabinet below the air conditioner chamber, said food compartment having front, side, back and bottom walls, said food compartment side walls being spaced from the cabinet side walls and from the air conditioner side walls forming side flues leading into the said outer flues.

9. The invention as set forth in claim 5, with an open top food compartment in the lower part of the cabinet below the air conditioner chamber, said food compartment having front, side, back and bottom walls, said food compartment side walls being spaced from the cabinet side walls and from the air conditioner side walls forming side flues leading into the said outer flues, and a screened opening in the bottom of the air conditioner chamber for discharging cold air downwardly directly into said food compartment.

10. The invention as set forth in claim 5, wherein said ice compartment side walls are of foraminous character and said grid comprises front and back plates, spaced division plates connecting said front and back plates and having upwardly and rearwardly sloping bottom edges, cross members secured to said bottom edges, and perforated plates lying upon said cross members between the division plates.

11. In a refrigeration construction, a cabinet, means therein providing an upper freezer chamber, an intermediate ice compartment and a bottom air conditioner compartment, a plurality of water tubes disposed rearwardly of said ice compartment, a shield plate disposed vertically over said tubes and constituting a back wall for said ice compartment, an apertured grid bottom for said ice compartment, said chamber and said compartments having side walls spaced from the side walls of the cabinet, said air conditioner

compartment having its side walls spaced farther apart than the side walls of the chamber and ice compartment and having the upper portions thereof inclined outwardly and upwardly, vertical baffles in the spaces between the cabinet side walls and the side walls of the freezer and the ice compartment, said air conditioner compartment side walls each being joined to the lower ends of the baffles, said air conditioner back wall joining at its top edge with the bottom edge of said shield plate, a pivoted window in each of the side walls and the back wall of the air conditioner compartment, a water spray nozzle directed downwardly in the air conditioner compartment, a valve for said nozzle, means for opening said valve, and means operated by and simultaneously with said valve opening means for opening said windows.

12. A refrigerator structure of the character set forth comprising a cabinet having insulated top, side, front and back walls, the front wall having door covered openings, means forming a freezing chamber in the upper part of said cabinet, said chamber having insulated top and side walls, said chamber side walls being spaced from the cabinet side walls, a shiftable door covering the front of said chamber, refrigerant coils in the side and top walls of said chamber, an ice compartment suspended from and beneath said chamber, said compartment having open side and bottom walls for the circulation of air therethrough, a water vapor chamber below the ice compartment and having upwardly extending walls lying between the cabinet side walls and said chamber side walls forming inner and outer vertical flues, means for producing water vapor in the vapor chamber, refrigerant coils in said inner flues at the sides of the ice compartment, and means for carrying warm air currents over from the tops of the outer flues into the inner flues, said outer flues being in communication with food storage space beneath the vapor chamber.

13. In a refrigerator construction, a cabinet having side, top and back walls each including spaced inner and outer wall sheets, a freezing chamber in the central upper part of the cabinet and comprising outer side wall sheets depending from the top wall inner sheets in spaced relation with the cabinet side walls and joining the back wall inner sheet, the chamber further including a bottom wall sheet extending forwardly from the back wall inner sheet and a shell between and spaced from the depending side wall sheets and said bottom wall sheet, the shell and the last named sheets in spaced relation therewith terminating short of the front of the cabinet, closure means for the front of the chamber, an ice compartment below said chamber and having side walls depending from said depending side wall sheets and a bottom ice supporting grid structure, a vertical baffle wall between each cabinet side wall on one side and a side of the chamber and ice compartment side wall on the other side forming inner and outer vertical flues, said flues being in communication at their top ends, means forming an air conditioner chamber below the ice compartment having front, back and side walls, the air conditioner chamber side walls joining the lower ends of the baffle walls, a refrigerant coil completely encircling the freezing chamber shell, a refrigerant coil in each of said inner flues, means for putting the air conditioner compartment into communication with the lower end of each outer flue, and means for diffusing water vapor into the air of the last named compartment.

14. In a refrigerator construction, a cabinet having side, top and back walls each including spaced inner and outer wall sheets, a freezing chamber in the central upper part of the cabinet and comprising outer side wall sheets depending from the top wall inner sheets in spaced relation with the cabinet side walls and joining the back wall inner sheet, the chamber further including a bottom wall sheet extending forwardly from the back wall inner sheet and a shell between and spaced from the depending side wall sheets and said bottom wall sheet, the shell and the last named sheets in spaced relation therewith terminating short of the front of the cabinet, closure means for the front of the chamber, an ice compartment below said chamber and having side walls depending from said depending side wall sheets and a bottom ice supporting grid structure, a vertical baffle wall between each cabinet side wall on one side and a side of the chamber and ice compartment side wall on the other side forming inner and outer vertical flues, said flues being in communication at their top ends, means forming an air conditioner chamber below the ice compartment having front, back and side walls, the air conditioner chamber side walls joining the lower ends of the baffle walls, a refrigerant coil lying against the top and sides of the freezing chamber shell, a refrigerant coil in each of said inner flues, means for putting the air conditioner compartment into communication with the lower end of each outer flue, means for diffusing water vapor into the air of the last named compartment, and means for effecting movement of air beneath said conditioner chamber rearwardly and laterally for passage into said flues.

15. A refrigerator construction according to claim 14 wherein the last named means comprises a bottom wall for the air conditioner chamber, said bottom wall having a central upwardly and rearwardly sloping portion and upwardly and laterally sloping portions extending from opposite sides of said central portion.

16. A refrigerator construction according to claim 14 wherein said ice supporting grid comprises front and back plates, spaced division plates connecting said front and back plates and having upwardly and rearwardly sloping bottom edges, connecting members secured to and transversely of said division plates bottom edges, perforated plates disposed between the division plates and supported on said connecting members, said division plates each comprising upper and lower parts in edge to edge relation, the opposing edges of said division plate parts having matching recesses, a water coil lying horizontally in openings formed by the said matching recesses, means for supplying water to one end of said coil, and a coupling between the other end of the coil and said water vapor diffusing means.

17. The invention according to claim 16, wherein each of said perforated plates is of inverted flattened V form in cross-section.

ARTHUR J. PEDIGO.

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