Aug. 31, 1965 D. O. STEWART 3,203,199

REFRIGERATING APPARATUS

Filed Dec. 10, 1963 5 Sheets-Sheet 1

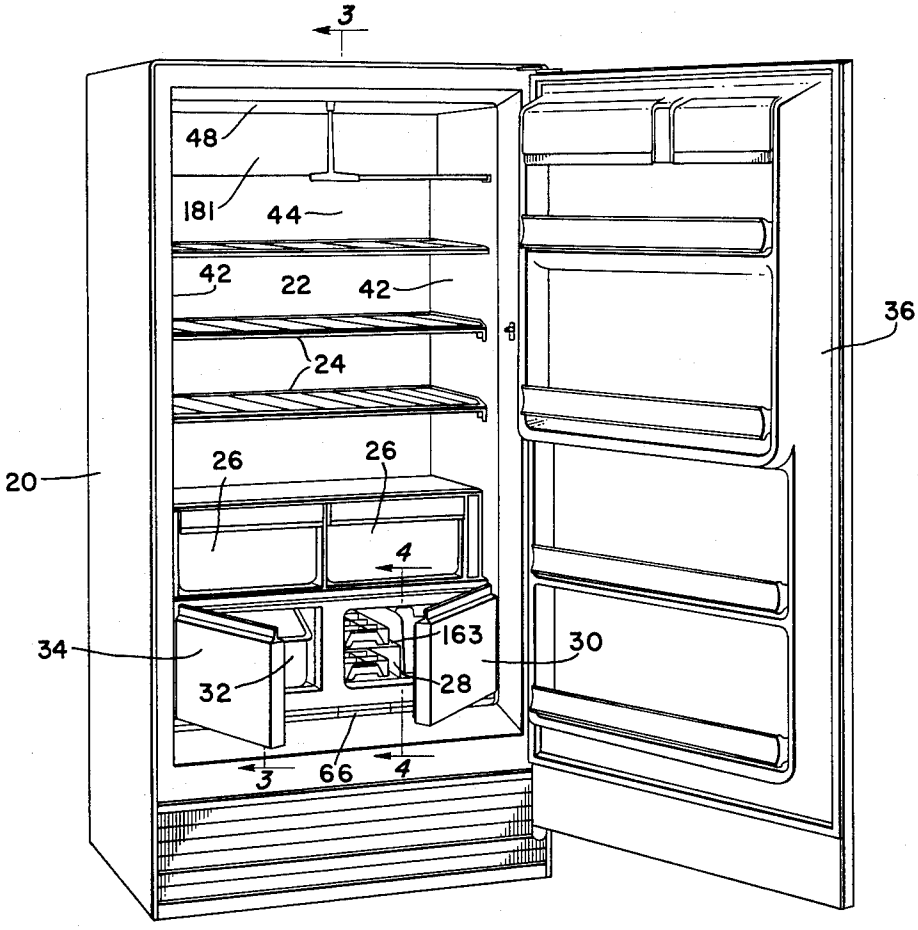

Fig. 1

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Filed Dec. 10, 1963 5 Sheets-Sheet 2

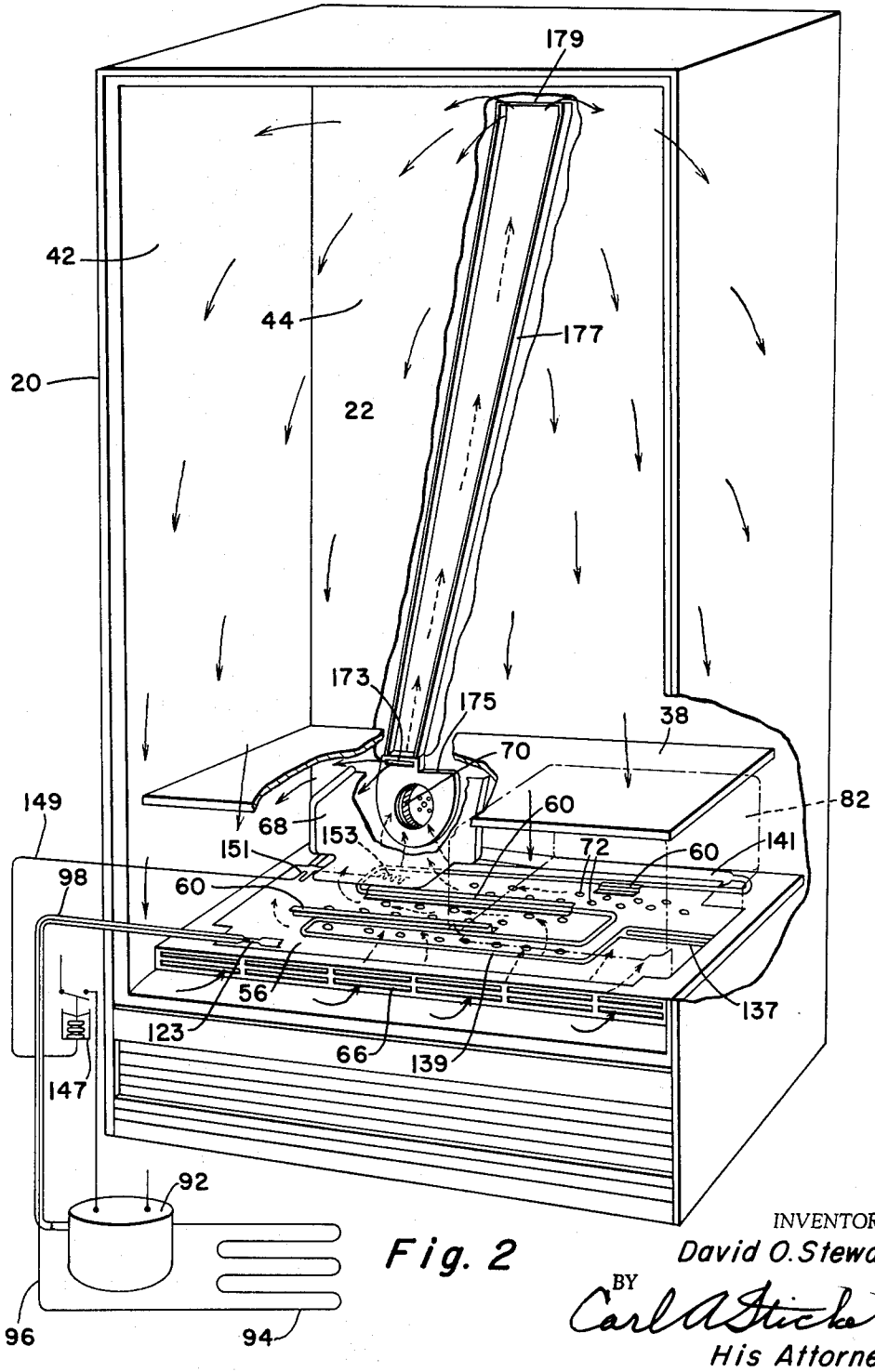

Fig. 2

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REFRIGERATING APPARATUS

Filed Dec. 10, 1963 5 Sheets-Sheet 3

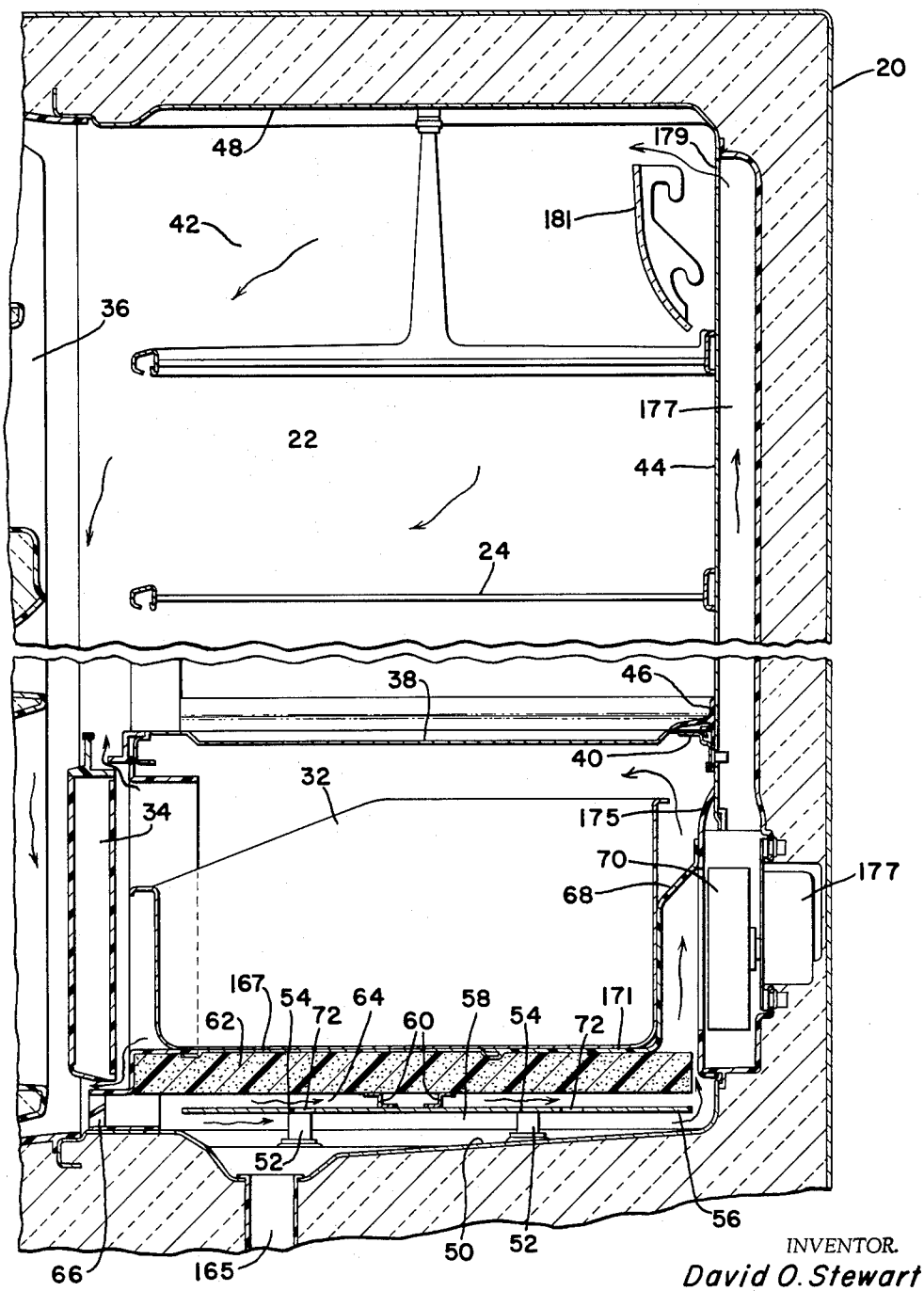

Fig. 3

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REFRIGERATING APPARATUS

Filed Dec. 10, 1963 5 Sheets-Sheet 4

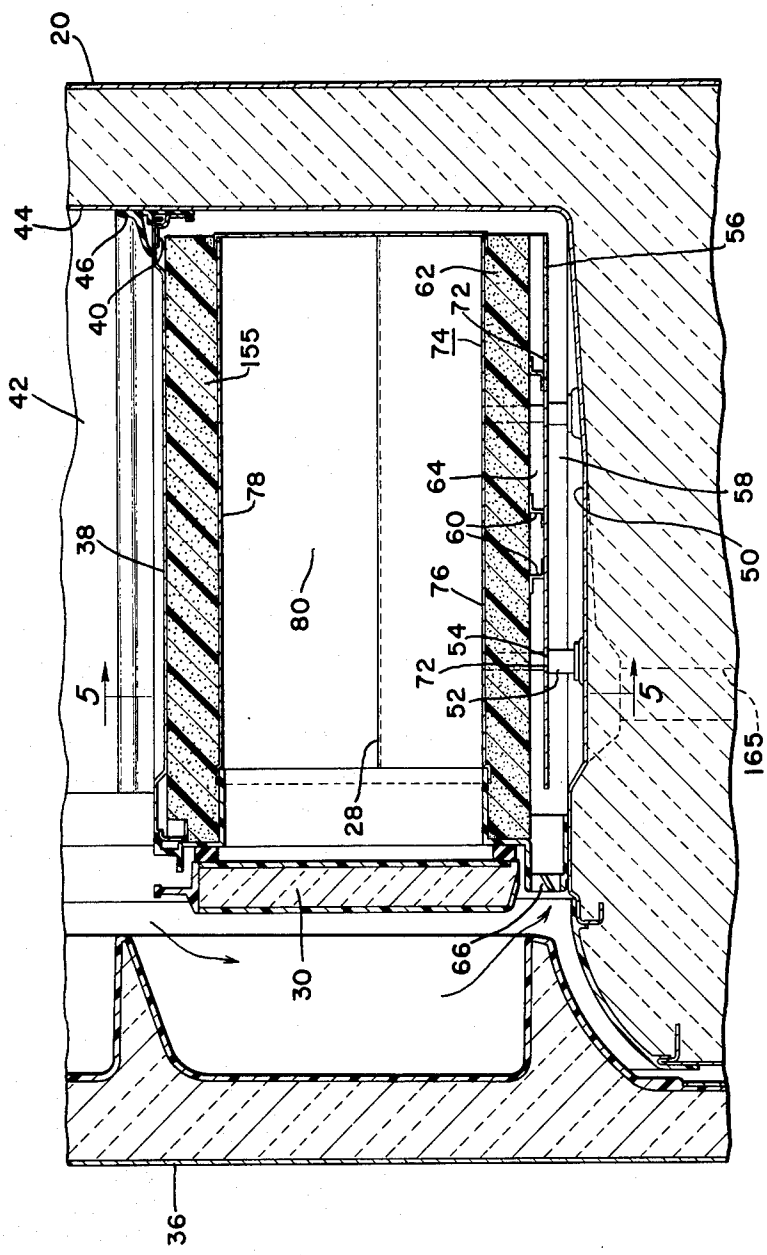

Fig. 4

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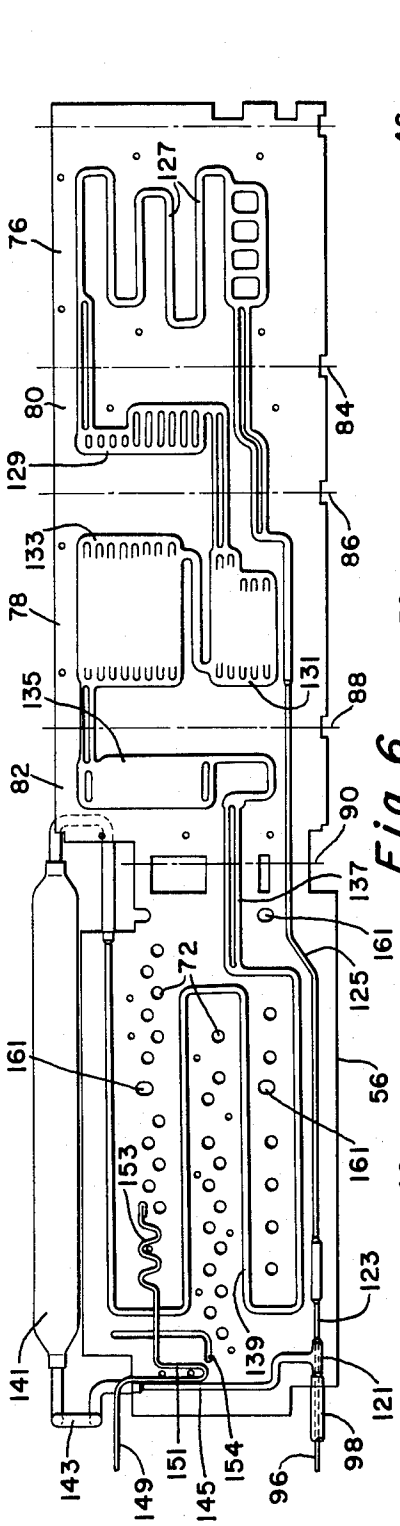

Fig. 6

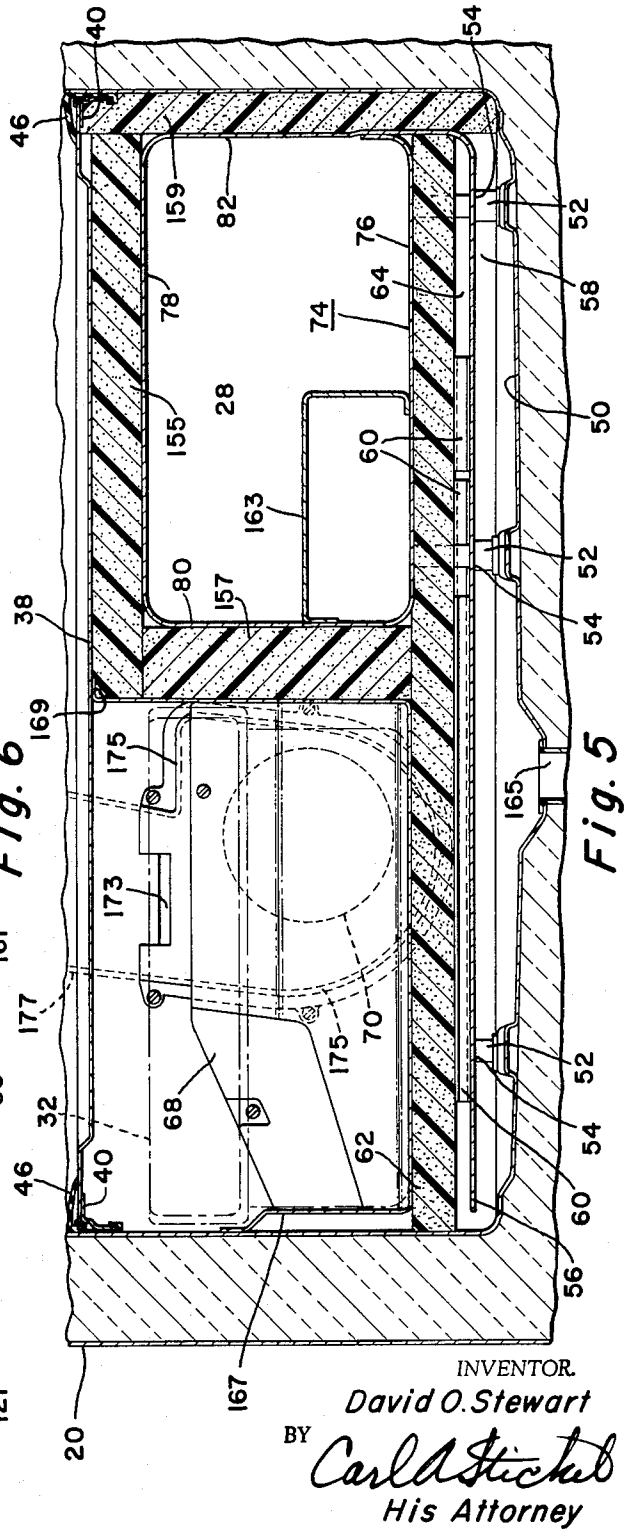

Fig. 5

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3,203,199

REFRIGERATING APPARATUS

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8 Claims. (Cl. 62—414)

This invention pertains to refrigerating apparatus and more particularly to a refrigerator having a meat keeper, a small freezer and an exceptionally large storage space mounted at above freezing refrigerating temperatures.

Many families now have a large freezer for the storage of frozen foods. Consequently, it is unnecessary for such families to buy refrigerators with conventional large capacity freezers which are intended for families without a separate freezer.

It is an object of this invention to provide a refrigerator with a small freezer sufficient to provide a normal supply of ice cubes along with a normal sized meat keeper kept at about 30° F. with the remainder of the refrigerator adequate in size for the storage of large quantities of food at about 35° F. sufficient for a large family.

It is another object of this invention to provide a compact, efficient and economical arrangement for establishing satisfactory ice freezing temperatures and meat keeping temperatures in separate small compartments and above freezing refrigerator temperatures in a very large compartment.

It is another object of this invention to provide an improved, inexpensive and efficient support arrangement for cooling units and insulation in a refrigerator.

These and other objects are attained in the form of refrigerators shown in the drawings in which at the bottom there is provided a sheet metal evaporator having one portion extending in a complete rectangular loop enclosing the freezing compartment and having an extending plate type portion beneath and spaced from and parallel to the bottom of the rectangular loop portion. This plate portion is spaced by spacers away from a slab of insulation which separates the plate evaporator portion from the enclosed freezing compartment and the meat tender compartment above. Pegs of plastic material extend upwardly from the bottom wall of the refrigerator through apertures in the plate and the insulation into supporting relation with the bottom of the rectangular loop portion of the evaporator to provide a suitable support. These support pegs are provided with shoulders for supporting the plate portion of the evaporator.

A centrifugal fan is provided at the rear of the meat tender compartment which draws in air from the large storage compartment above through louvers adjacent the front edge of the refrigerator plate evaporator portion and through passages above and below the plate evaporator portion to a plastic shroud connected to the fan inlet. The major portion of the air discharged by this fan passes through a duct in the rear wall of the cabinet and discharges the air forwardly from the top of the rear wall into the large storage chamber. In addition the fan has a slot which discharges the air forwardly into contact with the rear wall and subsequently into contact with other parts of the meat tender for keeping the meat tender at about 30° F. A thermostatic switch controlled by a thermosensitive element contacting two places on the evaporator plate section cycles the refrigerator system to operate the plate portion on a defrost cycle while the rectangular loop portion is maintained at freezing temperatures for the satisfactory freezing of ice therein. The fan maintains temperatures within the large storage compartment at about 35° F.

Further objects and advantages of the present invention will be apparent from the following description,

reference being had to the accompanying drawings wherein a preferred embodiment of the present invention is clearly shown.

In the drawings:

FIGURE 1 is a perspective view of a refrigerator with the door open disclosing one embodiment of my invention;

FIGURE 2 is a diagrammatic view of the refrigerating and air circulating system together with an outline of the cabinet;

FIGURE 3 is a vertical sectional view taken substantially along the line 3—3 of FIGURE 1;

FIGURE 4 is a fragmentary vertical sectional view taken substantially along the line 4—4 of FIGURE 1;

FIGURE 5 is a fragmentary sectional view taken substantially along the line 5—5 of FIGURE 4; and

FIGURE 6 is a development of the sheet metal evaporator including the loop portion and the extending portion together with a tubular accumulator and the refrigerant connections.

Referring now more particularly to FIGURE 1 there is shown a refrigerator cabinet 20 having an upper above freezing refrigerator compartment 22 provided with shelves 24 and at the bottom two moist storage drawers 26. Below the moist storage drawers 26 is a freezing compartment 28 closed by a swinging door 30 and meat tender compartment containing the meat tender 32 which is insulated from the freezing compartment 28 and closed by the swinging door 34. All these compartments are closed by the common outer door 36.

The large above freezing storage compartment 22 is separated from the below freezing compartment 28 and the meat tender compartment by a removable sheet metal horizontal partition wall 38 supported by the meat ledges 40 extending around the side and rear walls. This partition 38 is sealed to the side and rear walls 42 and 44 by the rubber strip 46 having a protruding edge lying on top of the partition wall 38 and having its opposite edge portions sealed to the side and rear walls 42 and 44. The side and rear walls 42 and 44 together with the top and bottom walls 48 and 50 have an inner liner which forms their inner surfaces. The bottom wall 50 is provided with six projections or pegs 52 of low heat conducting material such as plastic extending upwardly with each having a shoulder 54 and supporting the plate type sheet metal evaporator portion 56. This plate type evaporator portion 56 extends horizontally above the bottom wall 50 and is held in spaced relation with the bottom wall 50 to provide an air passage 58 between the bottom wall 50 and the plate evaporator portion 56. Fastened on top of the plate type evaporator portion 56 are the Z-shaped spacers 60 which support a slab 62 of molded polystrene bead type of insulation. Through the use of these spacers 60 an air passage 64 is formed between the slab of insulation 62 and the plate evaporator portion 56. In front of the air passages 58 and 64 there is provided an air inlet grill 66 through which air may flow from the large storage compartment 22. The air inlet grill 66 extends substantially all the way across the bottom wall of 50. The spacers 60 also act as baffles to direct the flow of air from the grill 66 through the passage 64 to the inlet shroud 68 of the centrifugal fan 70. In addition, the plate type evaporator portion 56 is provided with numerous perforations 72 between the refrigerant passages thereof to allow the air to flow and equalize with the most efficient heat transfer and with the least restriction on opposite sides thereof.

On the one side, the tips of the pegs 52 support the rectangular loop portion 74 which includes the bottom wall 76, the top wall 78 and the left wall 80 and the right wall 82 of the freezer portion of the plate type evaporator which

is shown complete in development in FIGURE 6. The rectangular loop portion 74 is formed by folding the sheet metal evaporator shown in FIGURE 6 upon the lines 84, 86, 88 and 90. There is an integral extension adjacent the fold 90 providing the connection between the large plate type portion 56 and the rectangular loop portion 74.

As illustrated in FIGURE 2, a sealed motor compressor unit 92 compresses the refrigerant and forwards the compressed refrigerant to a condenser 94 from which the liquefied refrigerant is forwarded through a capillary restriction tube 96 extending through the suction conduit 98 and the dual entrance 121 to the restriction passage 123 in the plate portion 56. The liquefied refrigerant then passes through the passage 125 to the opposite end of the evaporator and the passage 127 in the bottom wall portion 76. From the passage 127 the refrigerant flow extends through the parallel passages 129 in the left side wall 80 from which dual passages extend to two parallel passage portions 135 in the side wall portion 82 from which the dual passages 137 extend through the connecting portion to a serpentine passage portion 139 provided in the horizontal plate portion 56 of the evaporator. This serpentine passage portion 139 connects at its end through tubing with an inclined accumulator 141 connecting at its upper end through tubing 143 with a passage 145 at the end of the plate portion 56 connecting with the dual entrance portion 121.

Refrigerant vapor is formed from the liquefied refrigerant in all of these passages until the liquefied refrigerant is completely evaporated upon reaching the passage portion 145 so that the evaporated portion leaves the dual entrance 121 by passing around the capillary tube 96 into the suction conduit 98 which connects with the inlet of the sealed motor compressor unit 92. The operation of the sealed motor compressor unit 92 is controlled by a snap-action thermostatic switch 147 connected in series with one of the leads of the sealed unit 92. The operating bellows of this switch 147 is connected to thermosensitive capillary tube 149 having serpentine portions 151 and 153 clamped to an edge portion and a central portion of the plate evaporator portion 56. A heating barrier slot 154 is provided in the plate evaporator portion 56 between the two clamp portions 151 and 153. The snap-action switch 144 is set to operate on a defrost cycle. It is provided with a sufficient differential that the switch 147 will not close until the plate evaporator portion 56 completely defrosts and attains a predetermined high above freezing temperature of about 37½° F. and will not open until it reaches the temperature of about —1° F. A thin plastic spacer is provided between the clamp portion 153 and the plate type evaporator portion 56 so that this portion of the evaporator will normally cause the closing of switch 147 while the portion 151 will control the opening of the switch 147. This control will maintain desired temperatures in all parts of a refrigerator.

The freezer portion 74 is provided with a slab of insulation 155 between its top portion 78 and the partition wall 38 and additional slabs 157 and 159 on the left and right sides thereof. The slabs 155, 157 and 159 may be molded of polystyrene beads. It should be noted that the plate type evaporator portion 56 is provided with large apertures 161 through which extend the pegs or supports 52. The plate type evaporator portion also includes cut-out portions bordering the line of fold 90 to reduce conduction between the freezer portion 74 and the horizontal plate portion 56 so that the portion 56 can defrost on every "off" cycle without causing the freezer portion 74 to reach ice melting temperature. The freezer portion 74 is adapted to receive ice trays and has a shelf 163 therein so that one ice tray may be supported on top of another. The space at the side of the shelf 163 may be used for the storage of small amounts of frozen products or for additional ice trays. The insulation provided by the slabs 62, 155, 157 and 159 as well as the openings in the sheet metal evaporator adjacent the folding line 90 is sufficient to insulate the freezing section 74 from the remainder of the refrigerator so that it can maintain below freezing temperatures while above freezing temperatures are maintained in other parts of the refrigerator. The small apertures 72 in the plate type evaporator in addition to providing equalization of pressures and flow also provide openings through which the defrost water can, during the "off" cycle, melt from the plate portion 56 and drip onto the bottom wall 50 which is sloped toward the drain conduit 165 for suitable disposal of the defrost water.

At the side of the freezing evaporator portion 74 is a U-shaped sheet metal meat tender shelf 167 having one side fastened to the adjacent side wall. The opposite side wall of the meat tender shelf 167 is provided with a flange 169 which is fastened to the partition wall 38. This meat tender shelf 167 supports the meat tender 32 in front of the fan 70. The fan shroud 68 has a bottom plastic portion 171 extending into a cut-out portion of the meat tender shelf 167 for reducing the heat transfer with the meat tender 32 so as to prevent the rear portion of the meat tender 32 from becoming cooled below 30° F. The meat tender 32 is cooled through the bottom wall of its shelf 167 and the slab of insulation 62. It is also cooled by air discharged forwardly from the slot 173 in the outlet housing 175 of the fan 70. The air discharged from this slot 173 provides sufficient air flow into and around the meet tender 32 to maintain its contents at the desirable temperature of about 30° F.

Only a small portion of the air circulated by the fan 70 is discharged from the slot 173. The remainder is discharged upwardly through the duct 177 to an outlet 179 at the top of the rear wall 44. This aperture 179 is located behind the glass shield 181 so that the air discharged through the outlet 179 is diffused and distributed throughout the compartment 22 so as to maintain satisfactory refrigeration temperatures on all the shelves and in the high humidity drawers 26. The air from the compartment 22 is then drawn downwardly between the insulated and sealed plastic door 30 of the freezer 74 and the outer door 36 to the inlet grill 66. Other air flows between the unsealed and uninsulated door 34 of the meat tender compartment and the outer door 36 also to the inlet grill 66. This air flow provides substantially uniform temperatures throughout the compartment 22. Air from the meat tender compartment also passes around the unsealed edges of the door 34 and mixes with the air flowing to the inlet grill 66.

The fan 70 is continuously driven by the fan motor 177 except when the doors are open. This refrigerator has a food compartment capacity of more than 13 cu. ft. in the compartment 22 while the freezer compartment capacity is only about ½ cu. ft. This refrigerator therefore provides a large amount of storage space for normal food storage and only a small amount of freezer space for day to day storage of frozen foods and freezing of ice. The refrigeration arrangement provides the temperature desired in all compartments so that satisfactory refrigeration is maintained throughout.

While the embodiment of the present invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted.

What is claimed is as follows:

1. A refrigerator including walls having an inner liner enclosing a compartment, said liner being provided with a plurality of pegs of low heat conducting material projecting into said compartment, a slab of insulation having apertures receiving said pegs and supported upon said pegs, and a refrigerant evaporator portion within said compartment supported upon the end portions of said pegs.

2. A refrigerator including walls having an inner liner enclosing a compartment, said liner being provided with a plurality of pegs of low heat conducting material projecting into said compartment, a plate type refrigerant evaporator portion having perforations receiving said pegs, said pegs each having a shoulder thereon for sup-

porting said plate type evaporator portion, a slab of insulation supported upon said plate type evaporator portion having apertures receiving said pegs, and a second evaporator portion supported on the end portions of said pegs.

3. A refrigerator including a cabinet having insulated walls enclosing a storage space, a horizontal partition wall within said space, means enclosing a freezing compartment located on one side of the middle portion of the space beneath said partition wall, an evaporator portion associated with said freezing compartment, a receptacle and means for supporting said receptacle on the opposite side of said middle portion beneath said partition wall, insulating means beneath said receptacle, a second evaporator portion beneath said insulating means, fan and duct means having an inlet located beneath said partition wall communicating with the space beneath said insulating means for drawing air beneath said insulating means in heat transfer with said second evaporator portion and having a large outlet above said partition wall for discharging a major portion of the air above said partition wall and a small outlet beneath said partition wall adjacent said receptacle for discharging a minor portion of the air beneath said partition wall in heat transfer with said receptacle.

4. A refrigerator including a cabinet having insulated walls encosing a storage space, a horizontal partition wall within said space, means enclosing a freezing compartment located on one side of the middle portion of the space beneath said partition wall, an evaporator portion associated with said freezing compartment, a receptacle and means for supporting said receptacle on the opposite side of said middle portion of said space beneath the partition wall, insulating means beneath said receptacle, a second evaporator portion beneath said insulating means, a fan housing located behind said receptacle and having an inlet extending beneath and communicating with the space beneath said insulating means and having outlet means extending above said partition wall and discharging into the space above said partition wall, said outlet means also having a discharge slot behind said receptacle discharging adjacent said receptacle, said fan housing containing a fan cooperating with said inlet and said outlet means for drawing air beneath said insulating means in heat transfer with said second evaporator portion and discharging the air through said outlet means above said partition wall and from said discharge slot into heat transfer with said receptacle.

5. A refrigerator including a cabinet having insulated walls enclosing a storage space, a horizontal partition wall within said space, means enclosing a freezing compartment located on one side of the middle portion of the space beneath said partition wall, an evaporator portion associated with said freezing compartment, a receptacle and means for supporting said receptacle on the opposite side of said middle portion of said space beneath said partition wall, insulating means beneath said receptacle, a second evaporator portion beneath said insulating means, fan and duct means having an inlet located beneath said insulating means for drawing air beneath said insulating means in heat transfer with said second evaporator portion and having a large outlet above said partition wall for discharging a major portion of the air above said partition wall and a small outlet beneath said partition wall adjacent said receptacle for discharging a minor portion of the air beneath said partition wall in heat transfer with said receptacle, said second evaporator portion being in the form of a refrigerated plate extending beneath said insulating means substantially throughout the greater portion of the space beneath said first mentioned evaporator portion of said receptacle.

6. A refrigerator including a cabinet having insulated walls enclosing a storage space, a horizontal partition wall within said space, a sheet metal evaporator portion located on one side of the middle portion of the space beneath said partition wall providing a freezing compartment, a receptacle and means for supporting said receptacle on the opposite side of the middle portion of said space beneath said partition wall, insulating means beneath and between said evaporator portion and said receptacle, a second evaporator portion beneath said insulating means, said second evaporator portion being of sheet metal in the form of an integral extension of the first mentioned sheet metal evaporator portion, fan and duct means having an inlet located beneath said partition wall communicating with the space beneath said insulating means for drawing air beneath said insulating means in heat transfer with said second evaporator portion and having a large outlet above said partition wall for discharging a major portion of the air above said partition wall and a small outlet beneath said partition wall adjacent said receptacle for discharging a minor portion of the air beneath said partition wall in heat transfer with said receptacle.

7. A refrigerator including a cabinet having insulated walls enclosing a storage space, a horizontal partition wall within said peace, means enclosing a freezing compartment located on one side of the middle portion of the space beneath said partition wall, an evaporator portion associated with said freezing compartment, a receptacle and means for supporting said receptacle on the opposite side of the middle portion of the space beneath said partition wall, insulating means beneath and between said evaporator portion and said receptacle, a second evaporator portion beneath said insulating means, said second evaporator portion being provided with upwardly extending spacers extending into contact with said insulating means for providing air passages between said second evaporator portion and said insulating means, fan and duct means having an inlet communicating with said air passages for drawing air through said air passages in heat transfer with said second evaporator portion and having outlet means for discharging a major portion of the air above said partition wall.

8. A refrigerator including a cabinet having insulated walls enclosing a storage space, a horizontal partition wall within said space, means enclosing a freezing compartment located on one side of the middle portion of the space beneath said partition wall, an evaporator portion associated with said freezing compartment, a receptacle and means for supporting said receptacle on the opposite side of said middle portion of said space beneath said partition wall, insulating means beneath and between said evaporator portion and said receptacle, a second evaporator portion beneath said insulating means, fan and duct means having an inlet located beneath said partition wall communicating with the space beneath said insulating means for drawing air beneath said insulating means in heat transfer with said second evaporator portion and having a large outlet above said partition wall for discharging a major portion of the air above said partition wall and a small outlet beneath said partition wall adjacent said receptacle for discharging a minor portion of the air beneath said partition wall in heat transfer with said receptacle, said fan means being located behind said receptacle, said receptacle supporting means comprising a sheet metal wall having a plastic wall portion at the rear adjacent said fan means for preventing overcooling of the rear of said receptacle.

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