

Nov. 17, 1942.

L. A. PHILIPP

2,302,051

REFRIGERATING APPARATUS

Filed Aug. 2, 1940

7 Sheets-Sheet 1

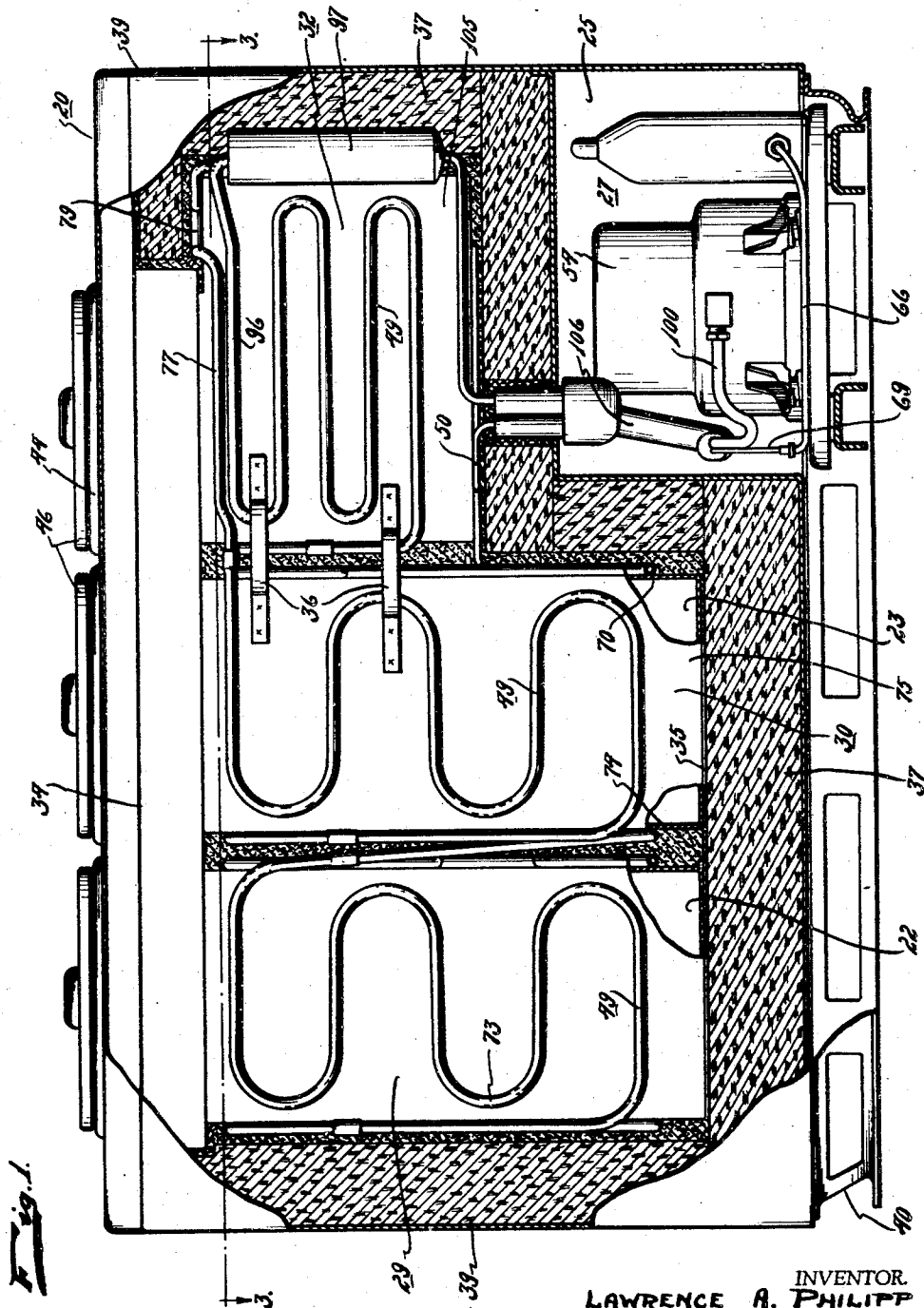


Fig. 1.

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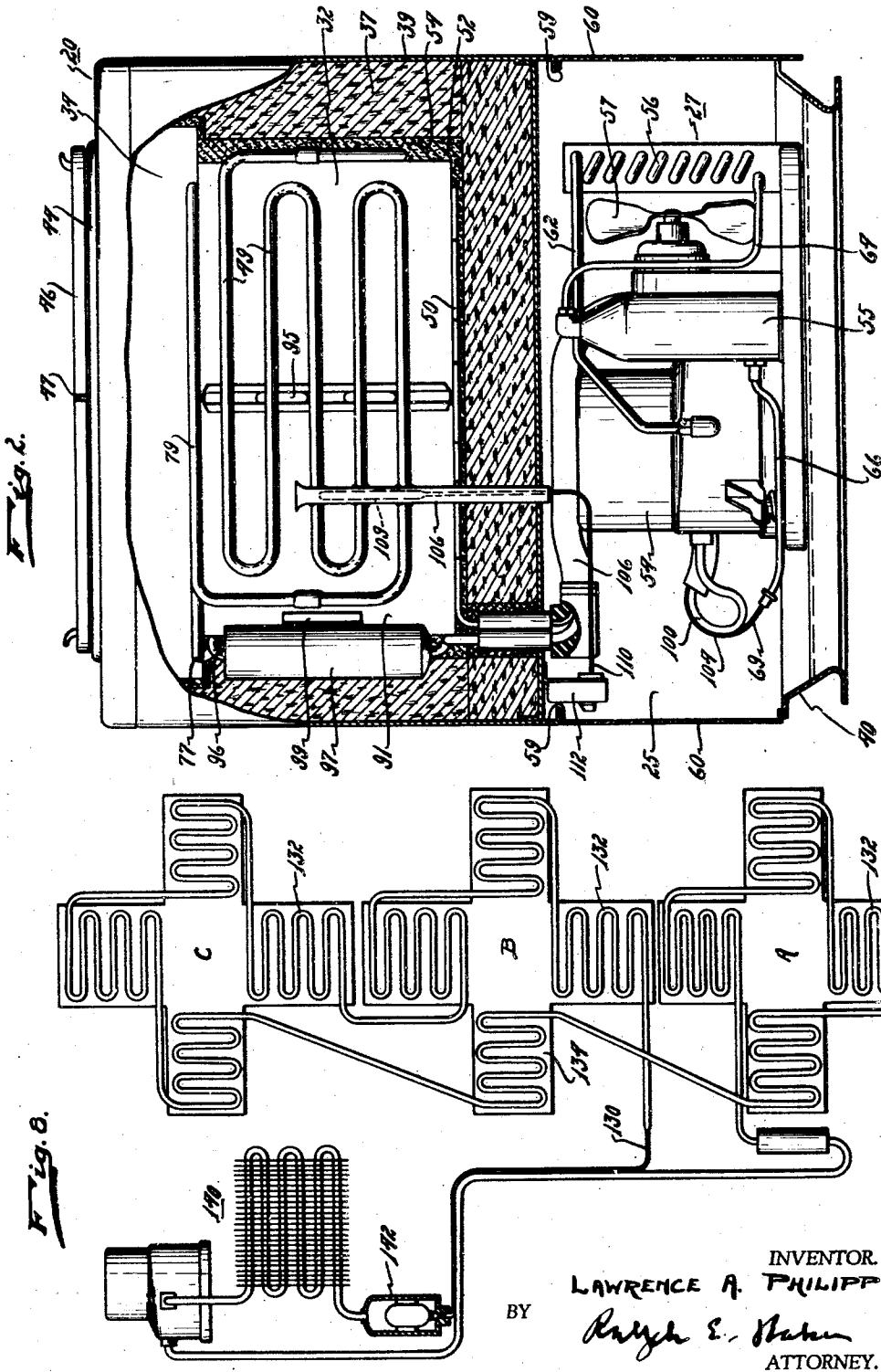
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Filed Aug. 2, 1940

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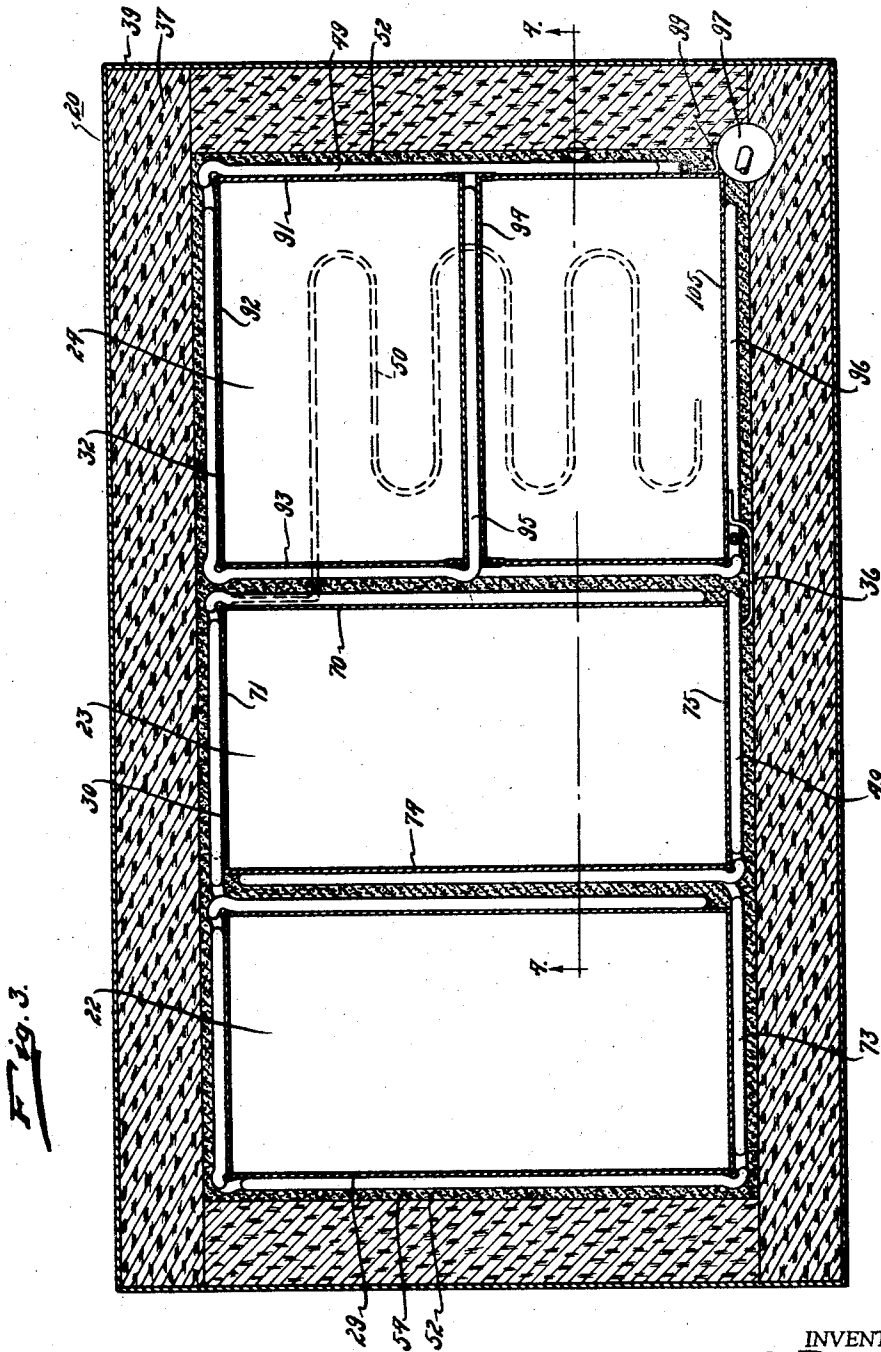
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REFRIGERATING APPARATUS

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7 Sheets-Sheet 3



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7 Sheets-Sheet 4

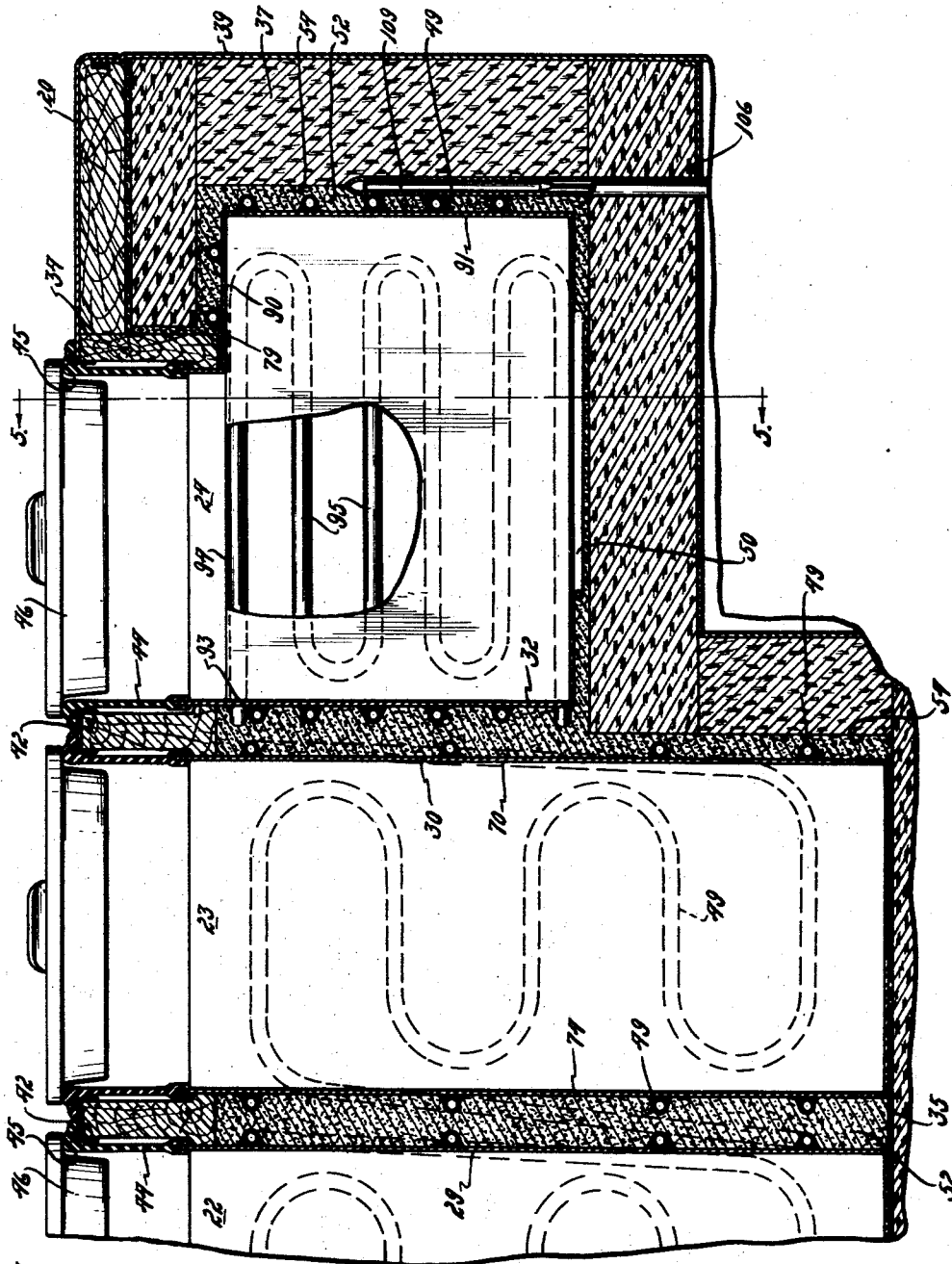


Fig. 4

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7 Sheets-Sheet 5

Fig. 5.

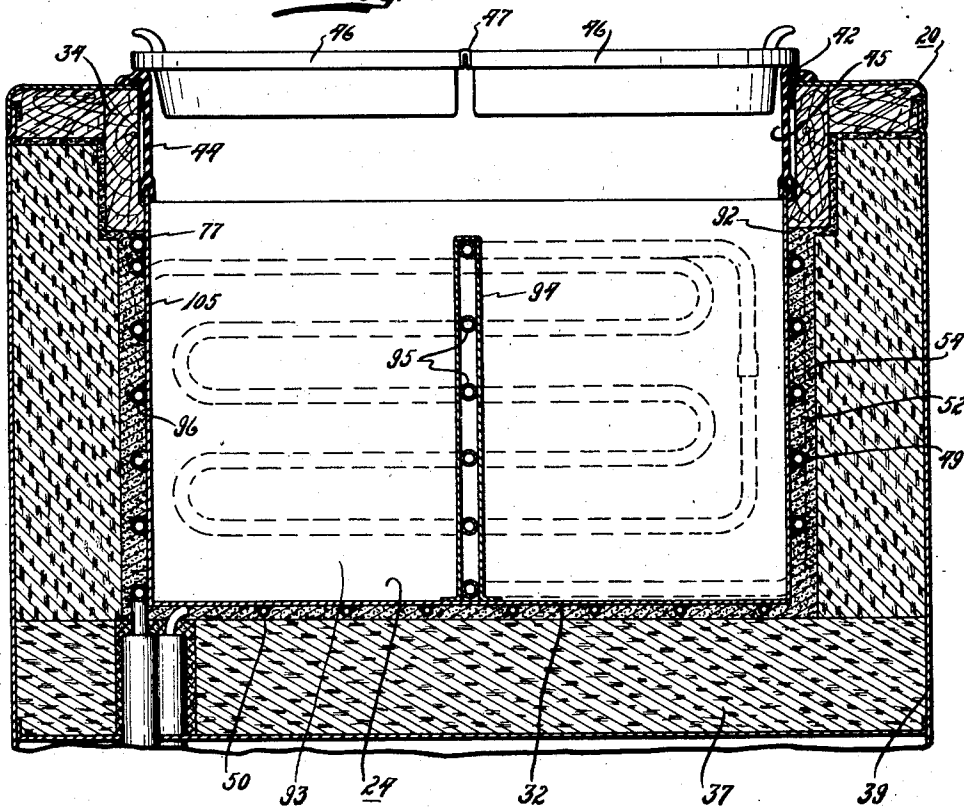
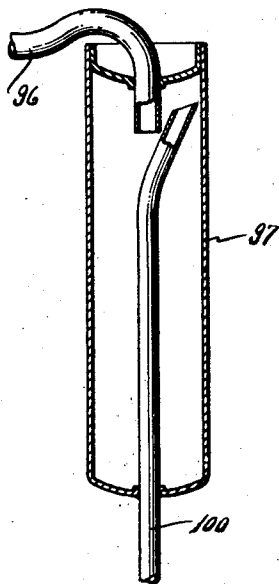


Fig. 6.



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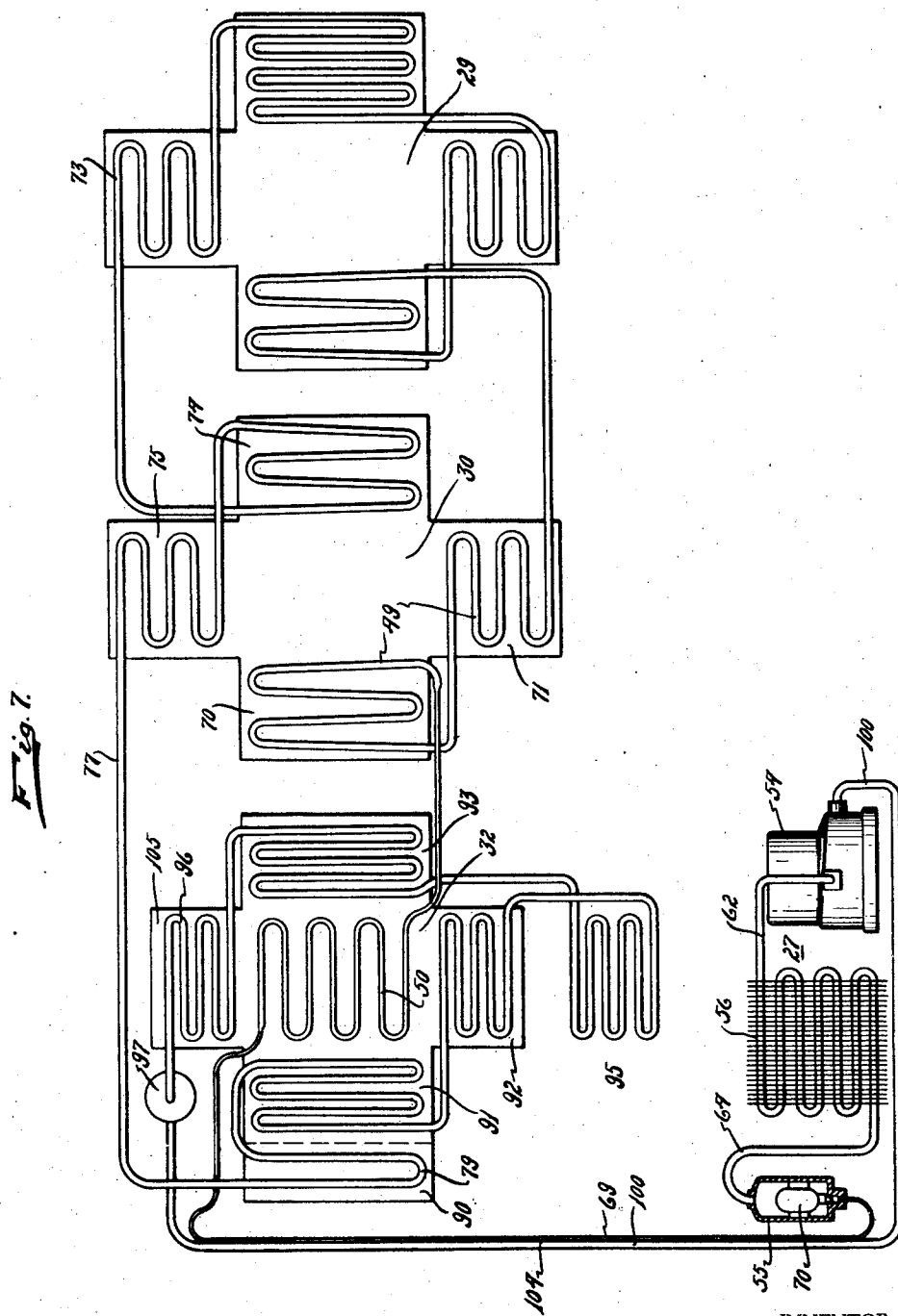
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REFRIGERATING APPARATUS

Filed Aug. 2, 1940

7 Sheets-Sheet 6



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2,302,051

REFRIGERATING APPARATUS

Filed Aug. 2, 1940

7 Sheets-Sheet 7

Fig. 9.

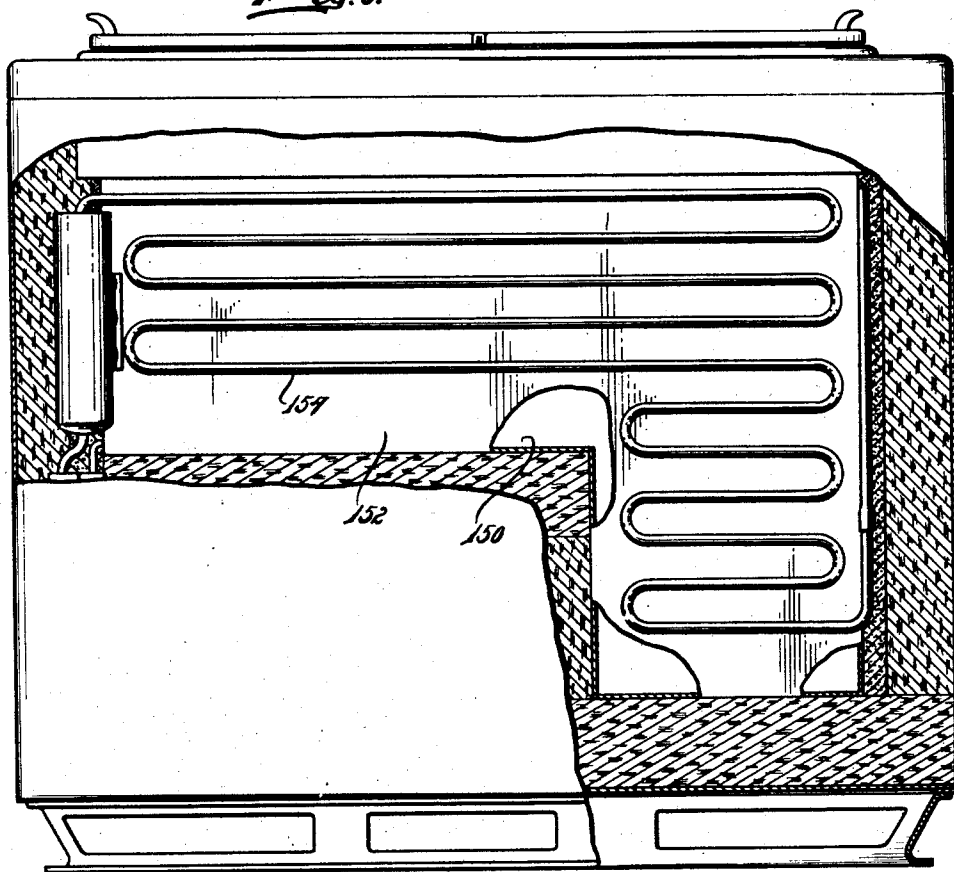
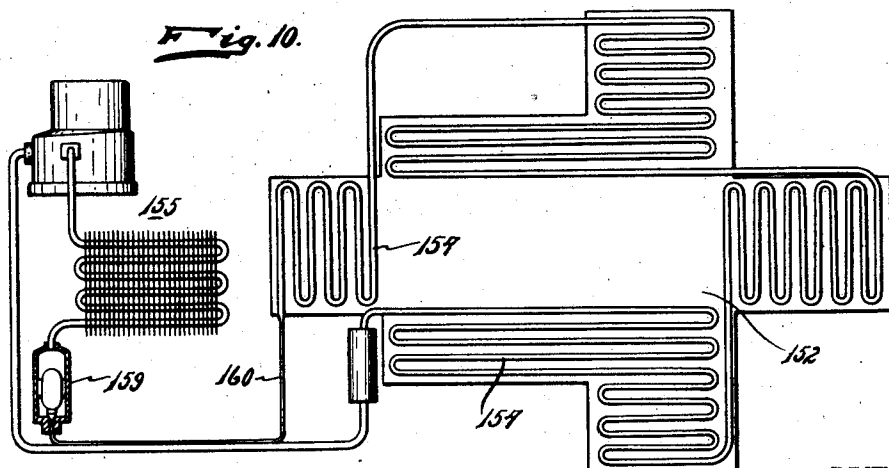


Fig. 10.



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UNITED STATES PATENT OFFICE

2,302,051

REFRIGERATING APPARATUS

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Application August 2, 1940, Serial No. 349,449

6 Claims. (Cl. 62—99)

This invention relates to refrigerating apparatus, and more particularly to such type of apparatus as is used for refrigeration and storage of ice creams and the like.

One of the objects of the present invention is to provide a refrigerator cabinet wherein the system is employed for refrigerating a plurality of compartments, with a plurality of the compartments being refrigerated at substantially uniform temperatures and an additional compartment is refrigerated at a somewhat lower temperature and to arrange to accomplish this in a new and improved manner.

Another object of my invention is to take advantage of the vapor pressure drop in a long continuous refrigerant conduit so as to utilize the conduit for establishing uniform temperatures in various refrigerated compartments, by refrigerating a portion of the walls of one compartment before delivering the refrigerant in the conduit to a second compartment and then later refrigerating the remaining walls of the first compartment to thereby establish and maintain uniform temperatures between the two compartments.

It is a further object of my invention to maintain a relatively low temperature in a storage compartment by refrigerating the bottom wall and a partition wall of the compartment as well as side wall so as to prevent any rise in temperature due to environment air or heat of compression and condensation.

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

In accordance with the present invention, I have provided an ice cream cabinet which consists of several compartments all of which are cooled by a small refrigerating conduit which is placed in thermal heat exchange relation with walls of the liners which form the various compartments. This continuous single path conduit is arranged so as to pass refrigerant into contact with some of the walls of a particular liner and then it is conducted to all of the walls of the second compartment whence it flows back to the first compartment to refrigerate the remaining wall or walls. By this arrangement it will be noted that due to the vapor pressure drop in the single path conduit that the second compartment would receive lower temperature refrigerant than the walls of the first compartment which receive refrigerant in its passage to the second compartment. However, the first compartment receives

still lower temperature refrigerant when it passes from the second compartment back to the first compartment to refrigerate the remaining wall or walls of the first compartment at that time thus maintaining uniformity in the temperatures of the two compartments. It will also be noted that the ice cream cabinet is of the so-called portable type which includes a motor-compressor-condenser unit mounted within the cabinet and movable therewith. This unit is positioned below one of the smaller food storage compartments, and due to the heat of condensation I have refrigerated not only the side walls of the smaller compartment but the bottom wall as well, and in addition have provided a vertically disposed partition element which is refrigerated to aid in maintaining low temperature in this compartment against the heat of condensation. Also, I have arranged that this small compartment receive its refrigerant after the refrigerant has passed from the two larger compartments so that due to the vapor pressure drop in the refrigerant conduit this relatively small compartment receives low temperature refrigerant in its side walls so as to maintain a somewhat lower temperature in the smaller compartment than in the two larger ones. This smaller compartment may be used to store ice creams of the type which are covered with chocolate and the like and require a relatively low temperature for such storage.

In the drawings:

Fig. 1 is a side elevational view of a cabinet with parts broken away and parts shown in section;

Fig. 2 is an end elevational view with parts broken away and parts shown in section;

Fig. 3 is a cross sectional view taken along line 3—3 of Fig. 1;

Fig. 4 is a fragmentary cross sectional view taken along line 4—4 of Fig. 3;

Fig. 5 is a fragmentary cross sectional view taken along line 5—5 of Fig. 4;

Fig. 6 is a vertical cross sectional view of the accumulator used in the invention;

Fig. 7 is a diagrammatic view of the refrigerating system;

Fig. 8 is a diagrammatic view of a modified arrangement of refrigerating system;

Fig. 9 is an end elevational view of a modified form of the invention with parts broken away and parts shown in section; and

Fig. 10 is a diagrammatic arrangement of the refrigerating system shown in Fig. 9.

Shown in the drawings is a cabinet 20 having food storage compartments 22, 23 and 24 adapted

for use in storage of ice cream, frozen foods and the like, and a compartment 25 wherein is mounted a compressor-condenser unit 27.

The storage compartments 22, 23 and 24 are formed by liners 29, 30 and 32 respectively each having access opening through the top. Each of the liners is securely affixed adjacent its top portion to a frame structure 34. The liners 29 and 30 are further secured together by a plate 35 that extends across the bottom walls of the liner and affixed thereto by solder, weld or the like. Straps 36 further secure the liners 30 and 32 in assembled relation. Suitable heat insulation material 37 is placed about the sides and bottom of the liners and enclosed by an outer shell or casing 39 of the cabinet. The cabinet is supported on a channel shaped frame member 40.

Suitable openings 42 are provided in the top wall of the shell or casing 39 in alignment with a respective opening of the liners 29, 30 and 32. Sleeves 44 formed of non-heat conducting material extend downwardly through openings 42 to join the upper peripheral edge of the liner serving as a breaker strip between compartment liner and cabinet casing, and form a throat for access to the food storage compartments. The access openings 45 are closed by suitable lids 46. The lids 46 are formed in two sections hingedly mounted to each other as at 47.

Coiled and secured by solder or the like to each of the external side walls of liners 29, 30 and 32 in heat exchange relation are conduits 49 for the passage of refrigerant therethrough. The conduits are connected together in series. Coiled and soldered to the bottom wall of liner 32 in thermal relation is conduit 50 which is of smaller diameter than conduit 49 coiled and bonded to the side walls. The coils 49 and 50 are further bonded in heat exchange relation to their respective walls by a coating of "Hydrolene" 52. The "Hydrolene" 52 being poured so as to fill the space formed between the liners and the space 54 formed between the side walls of the liners and the insulation material 37.

The compartment 24 is of shallower depth than compartments 22 and 23 as it extends over the machine compartment 25. Mounted in the machine compartment 25 is a compressor-condenser unit 27 comprising a hermetically sealed motor-compressor unit 54, high side float assembly 55, condenser 56, and a motor driven fan 57 for force circulation of air through the compartment and over the condenser. The compartment is in communication with the atmosphere through openings 59 formed in opposite sides of the casing 39, and over which extends screen guards 60.

In operation, refrigerant is compressed within the unit 54 and discharged through conduit 62 into the condenser 56 where it is cooled and liquified. The liquified refrigerant flows from the condenser, through conduit 64 into the tank of the high side float assembly 55 whose outlet end is connected through an intermediate conduit 66 to the capillary tube 69 which leads to the cooling coil 50. The flow of refrigerant is controlled within the assembly 55 by a float operated needle valve 70 (see Fig. 7), and additional regulation of the flow is provided by the restriction of the capillary tube 69 to maintain a sufficient pressure differential between the condensing unit and cooling coils 50 and 49.

The evaporating or cooling coils 49 and 50 are arranged so that the refrigerant flows from the

capillary tube 69 into the small diameter coil 50 cooling the bottom wall of compartment 24, and then flowing into the larger diameter coils 49. The coils 49 are arranged and interconnected so that the refrigerant flows to cool the side wall 70, then side wall 71 forming the adjacent sides of compartment 23. From the coil bonded on side wall 71 the refrigerant flows through the coils in consecutive order around the four sides of compartment 22. The last coil 73 bonded to side wall of compartment 22 connects to a coil bonded on side wall 74 whose opposite end is connected to a coil on the wall 75 which together form the opposite adjacent sides of compartment 23. After cooling wall 75 the refrigerant flows through conduit 77 which is looped and bonded, as at 79, to a top ledge portion 90 of compartment 24. From the loop 79 the refrigerant flows through a coil bonded to side wall 91, then a coil on side wall 92. Walls 91 and 92 forming adjacent sides of compartment 24.

A double wall partition 94 extends longitudinally centrally of the compartment 24. Coiled within the partition 94 is conduit 95 one end of which is connected to outlet of the conduit bonded to side wall 92 and the opposite end connected to inlet end of a conduit bonded on side wall 93 which in turn is connected to the conduit 96 bonded on adjacent side wall 95. The walls 91, 92, 93 and 95 forming the four sides of storage compartment 24. The outlet end of coiled conduit 96 terminates within the accumulator or tank 97 affixed by bracket 99 to wall 91.

The vaporized refrigerant is withdrawn from the accumulator 97 into the motor-compressor unit 54 through conduit 100. The return suction conduit 100 and the capillary tube 69 are bonded together as at 104 in heat exchange relation for further cooling of the refrigerant passing in tube 69 by the returning vaporized refrigerant in conduit 100. The capillary tube 69 and conduit 100 are also sheathed in the tubular member 106 to prevent frost accumulation on their exterior surface.

In the present arrangement a similar uniform temperature is maintained in compartments 22 and 23 as the intermediate compartment 23 is first cooled on two sides with the refrigerant flowing around the other two adjacent sides after cooling compartment 22. Because of the vapor pressure drop in the coil 49 the system as thus used provides for this uniformity in temperatures in the compartments 22 and 23 and also provides for a lower temperature in compartment 24. It will be obvious that this arrangement can be adapted for cooling a multiple number of compartments where two adjacent sides of each compartment are cooled in consecutive order, and then in reverse order the opposite two adjacent sides are cooled. The compartment 24 is maintained at a lower temperature to compartments 22 or 23 by the bonding of the small diameter conduit 50 to its bottom wall and through which the refrigerant first must flow before entering the larger diameter coil 49 and by the vapor pressure drop in coil 49.

To facilitate the process of manufacture, conduits are coiled and bonded to each of the respective side walls after which the ends are telescopically joined to a respective end of an adjacent coil, and soldered. It will be noted that the coiled conduits are interconnected so that the top of one is joined to the bottom of the adjacent coil so that the refrigerant flows upwardly through each of the coiled conduits.

A tubular sleeve 106 is bonded in heat exchange relations to the coil conduit on end wall 92 of compartment 24. Inserted in the sleeve 106 is end 109 of a fluid filled capillary tube 110 operatively connected to a switch mechanism 112 interposed in the electrical circuit (not shown) for operatively controlling the motor within casing 54 providing intermittent cycling operation of the motor-compressor unit.

In the modified form shown in Fig. 8 the refrigerant flows from the capillary tube 130 into the coiled conduits 132 bonded in heat exchange relation to the side walls of a respective compartment. The coils are connected in series so that the refrigerant flows to cool three of the sides of compartment B to thence flow and cool progressively the four sides of compartment C. The outlet of the last coil of compartment C is connected to the soil on side 134 of compartment B. The refrigerant after cooling compartment C returns to cool the side wall 134 of compartment B; thence flowing progressively through the coiled conduits bonded to each of the four sides of compartment A. From compartment A the vaporized refrigerant is withdrawn into the compressor-condenser unit 140 where it is cooled and liquified to be returned to the cooling coil 132 as desired. A high side float assembly 142 and capillary tube 130 controlling and regulating the flow of liquid refrigerant to the coils 132.

In the modified form shown in Figs. 9 and 10 the food storage compartment 150 is formed by a liner 152 around the exterior sides of which is bonded refrigerant coils 154. Refrigerant conduit coiled on each of the side walls of the liner 152 is connected in series to the coil on the adjacent wall so that the refrigerant progressively flows through each of the cooling coils around the four side walls to be returned to the compressor-condenser unit 155 to be cooled, and liquified further refrigerating the compartment 150. The flow of liquid refrigerant is controlled and regulated to the cooling coils 154 by means of a high side float assembly 159 and capillary tube 160. By serpentine refrigerant conduit to each of the side walls of the compartment, and joining the ends to the conduit coiled and bonded to the adjacent wall, it facilitates for an economical manufacturing process while at the same time there is a complete cooling of the entire surface area of the side walls as the conduit can be easily coiled and bonded over the entire surface even though the compartment may be irregular in depth.

While I have described the preferred form of my invention, I do not wish to limit myself to the precise details as shown and described, but wish to avail myself of such variations and modifications as may come within the scope of the appended claims.

I claim:

1. Refrigerating apparatus comprising three box-like liners for food compartments, a single path refrigerant evaporating conduit arranged in heat exchange relation with the four vertical side walls of each of said liners and with the bottom wall of one of said liners, said conduit being arranged to conduct the refrigerant in heat exchange relation first with said bottom wall and then with two sides of a second liner and then with four sides of a third liner and then with the other two sides of the second mentioned liner and finally with the four sides of the first mentioned liner.

2. Refrigerating apparatus comprising three box-like liners for food compartments, a single path refrigerant evaporating conduit arranged in heat exchange relation with the four vertical side walls of each of said liners, said conduit being arranged to conduct refrigerant about some of the sides only of one of said liners and then to four sides of a second liner and then to the remaining sides of the first mentioned liner and finally to the four sides of a third liner.

3. Refrigerating apparatus comprising three box-like liners for food compartments, a single path refrigerant evaporating conduit arranged in heat exchange relation with the four vertical side walls of each of said liners, said conduit being arranged to conduct the refrigerant in heat exchange relation first with two sides of one of said liners and then with four sides of a second liner and then with the other two sides of the first mentioned liner and finally with the four sides of a third liner.

4. Refrigerating apparatus comprising three box-like liners for food compartments, a single path refrigerant evaporating conduit arranged in heat exchange relation with the four vertical side walls of each of said liners and with the bottom wall of one of said liners, said conduit being arranged to conduct the refrigerant in heat exchange relation first with said bottom wall and then with two sides of a second liner and then with four sides of a third liner and then with the other two sides of the second mentioned liner and finally with the four sides of the first mentioned liner, that portion of said conduit which extends over said bottom wall being of smaller diameter than other portions of said conduit.

5. Refrigerating apparatus comprising three box-like liners for food compartments, a vertical partition wall extending across one of said liners to divide it into two food compartments, a single path refrigerant evaporating conduit arranged in heat exchange relation with the four vertical side walls of each of said liners and with the bottom wall of one of said liners, said conduit being arranged to conduct the refrigerant in heat exchange relation first with said bottom wall and then with two sides of the second liner and then with four sides of the third liner and then with the other two sides of the second mentioned liner and finally with the four sides of the first mentioned liner, said conduit also extending in thermal heat exchange relation with said partition wall.

6. Refrigerating apparatus comprising three box-like liners for food compartments, a vertical partition wall extending across one of said liners to divide it into two food compartments, a single path refrigerant evaporating conduit arranged in heat exchange relation with the four vertical side walls of each of said liners and with the bottom wall of one of said liners, said conduit being arranged to conduct the refrigerant in heat exchange relation first with said bottom wall and then with two sides of a second liner and then with four sides of a third liner and then with the other two sides of the second mentioned liner and finally with the four sides of the first mentioned liner, that portion of said conduit extending across said bottom wall being of smaller diameter than other portions of said conduit, said conduit also extending in thermal heat exchange relation with said partition wall.