Nov. 26, 1935.

L. A. PHILIPP

2,021,924

REFRIGERATING APPARATUS

Filed April 5, 1933

2 Sheets-Sheet 1

Fig. 4

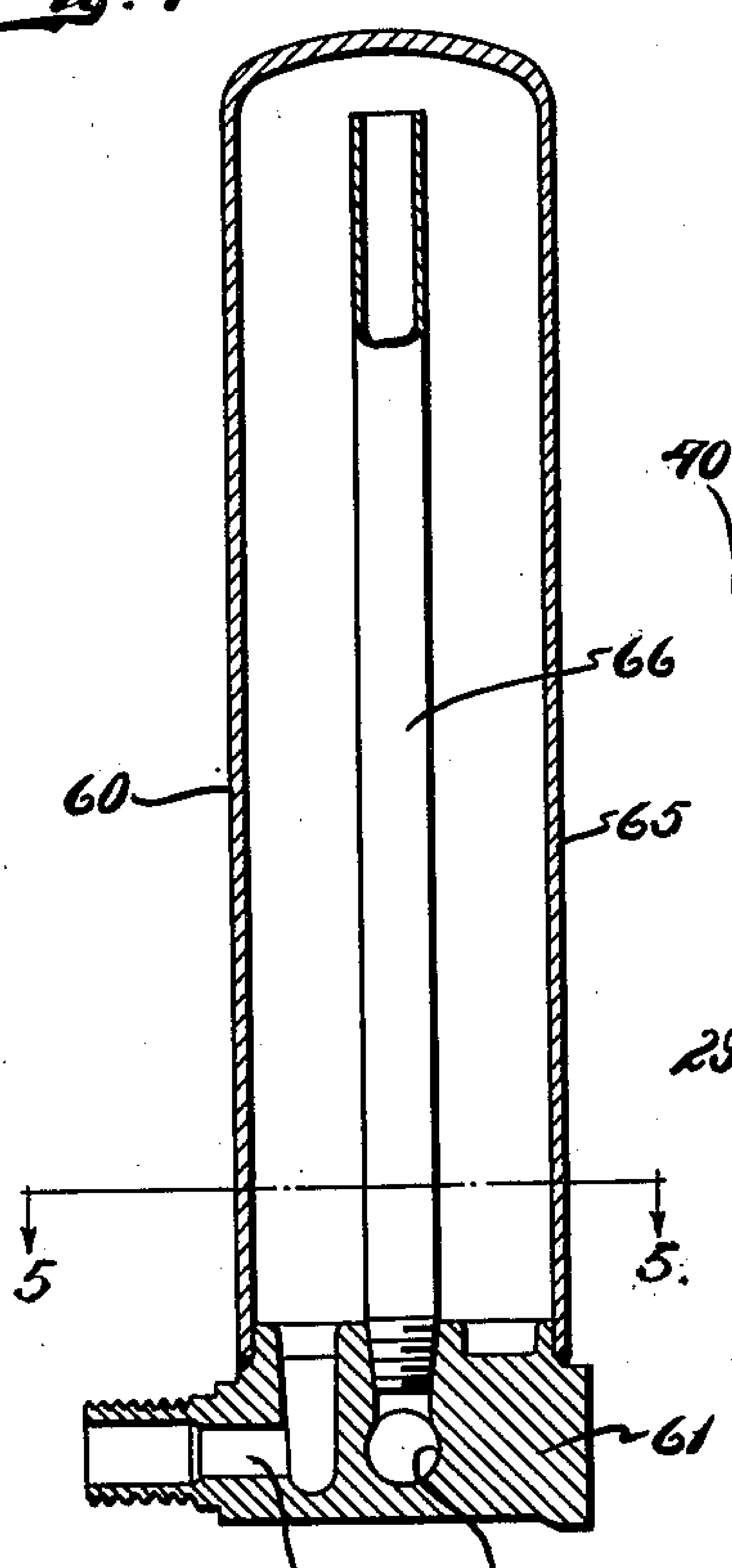

Fig. 2.

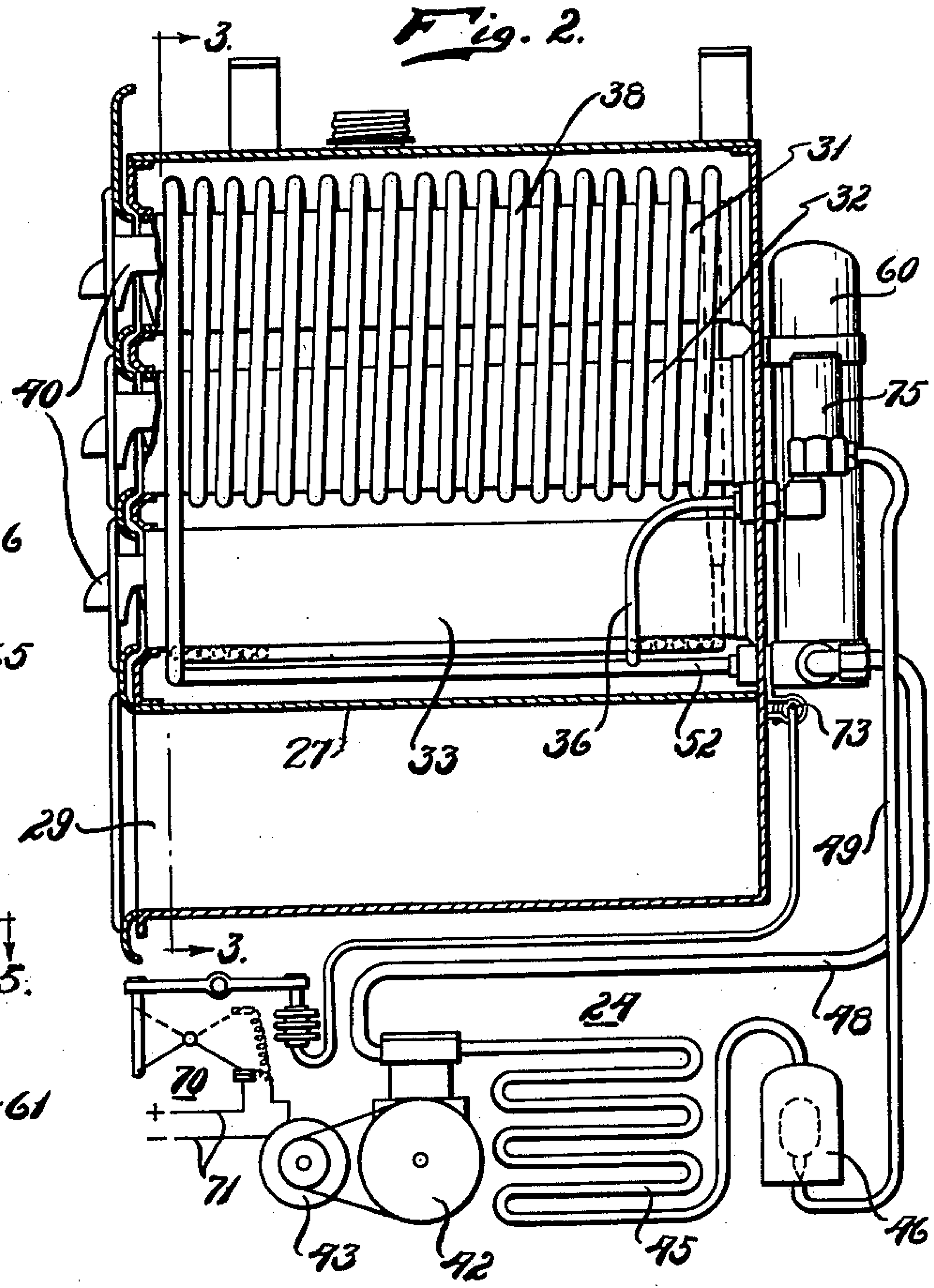

Fig. 3.

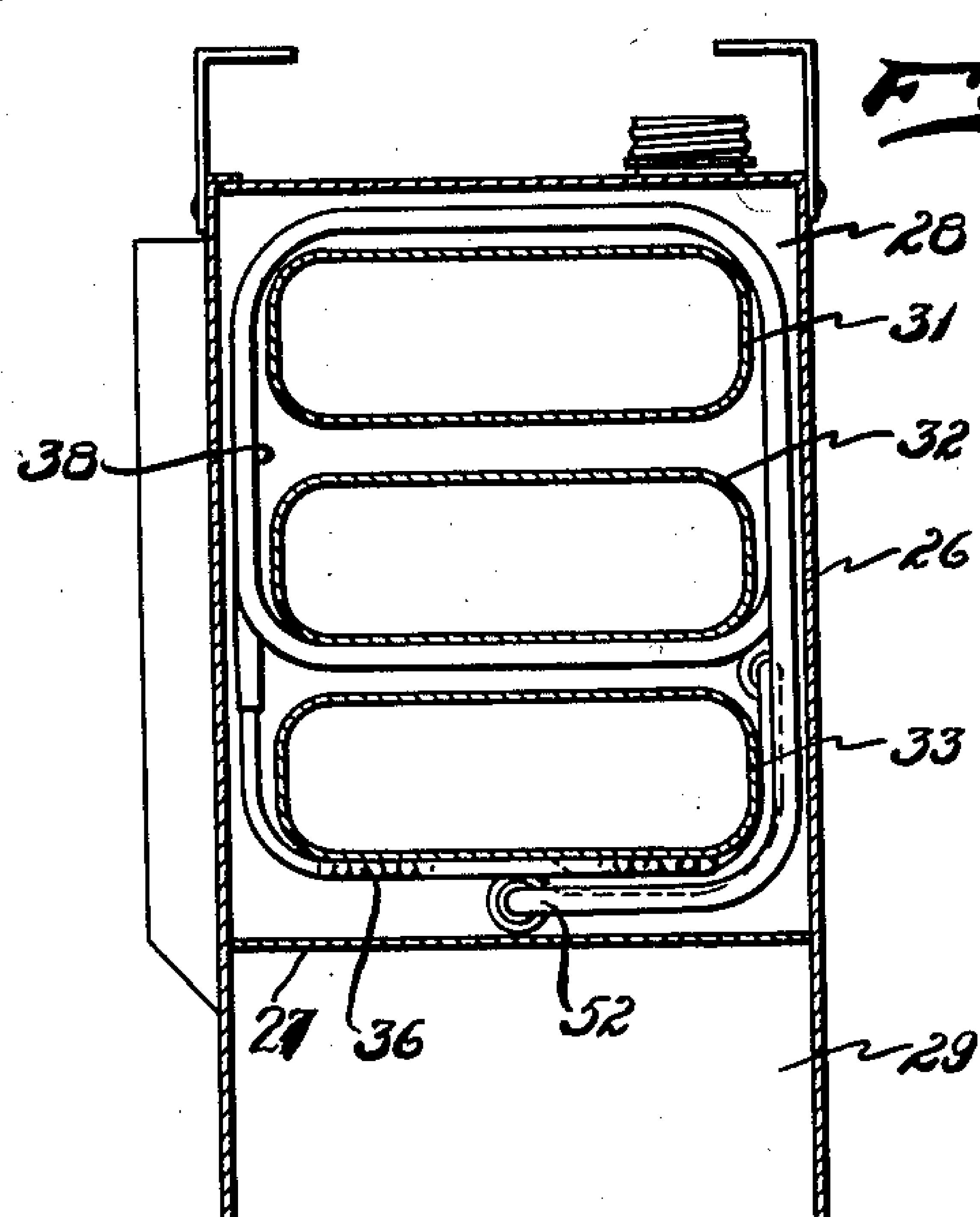

Fig. 1.

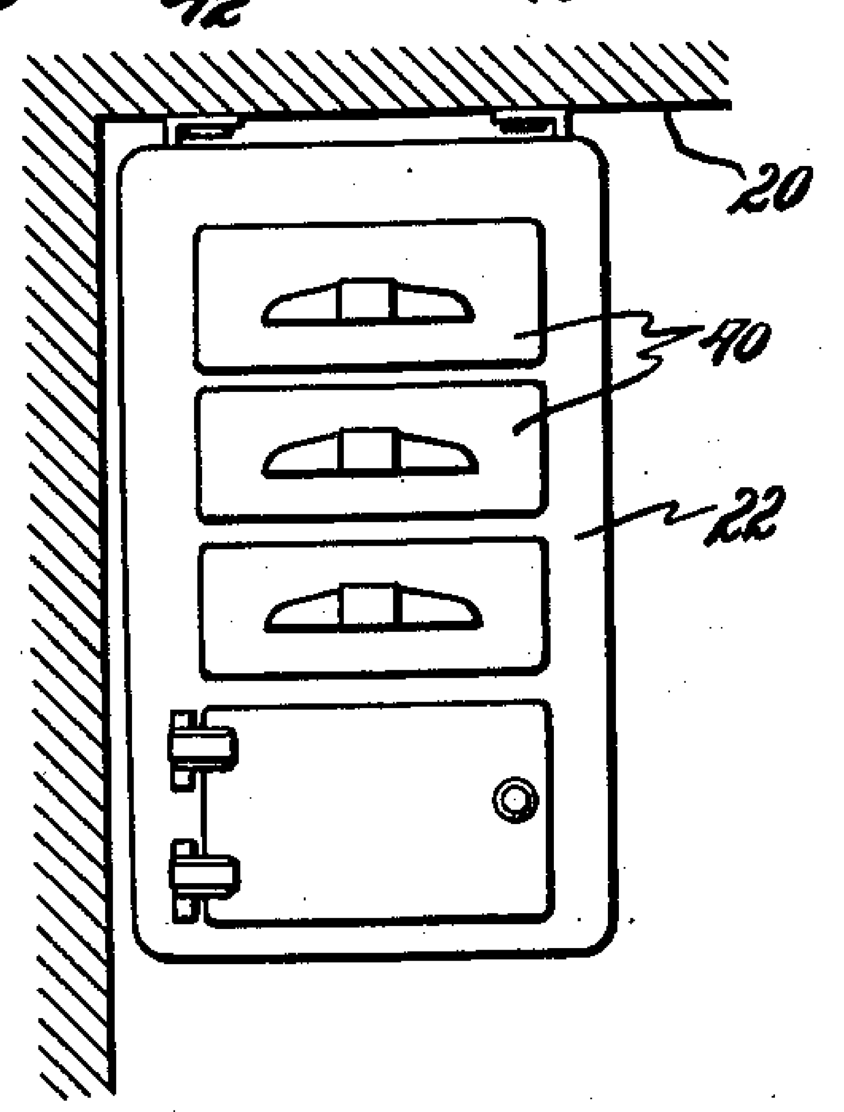

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Fig. 6.

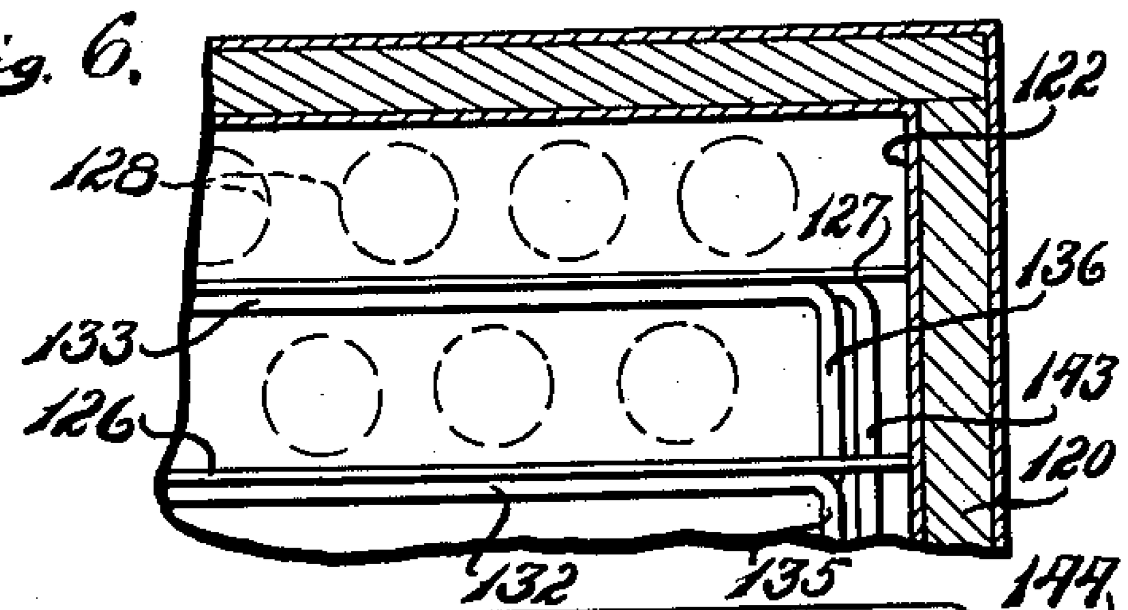


Fig. 7.

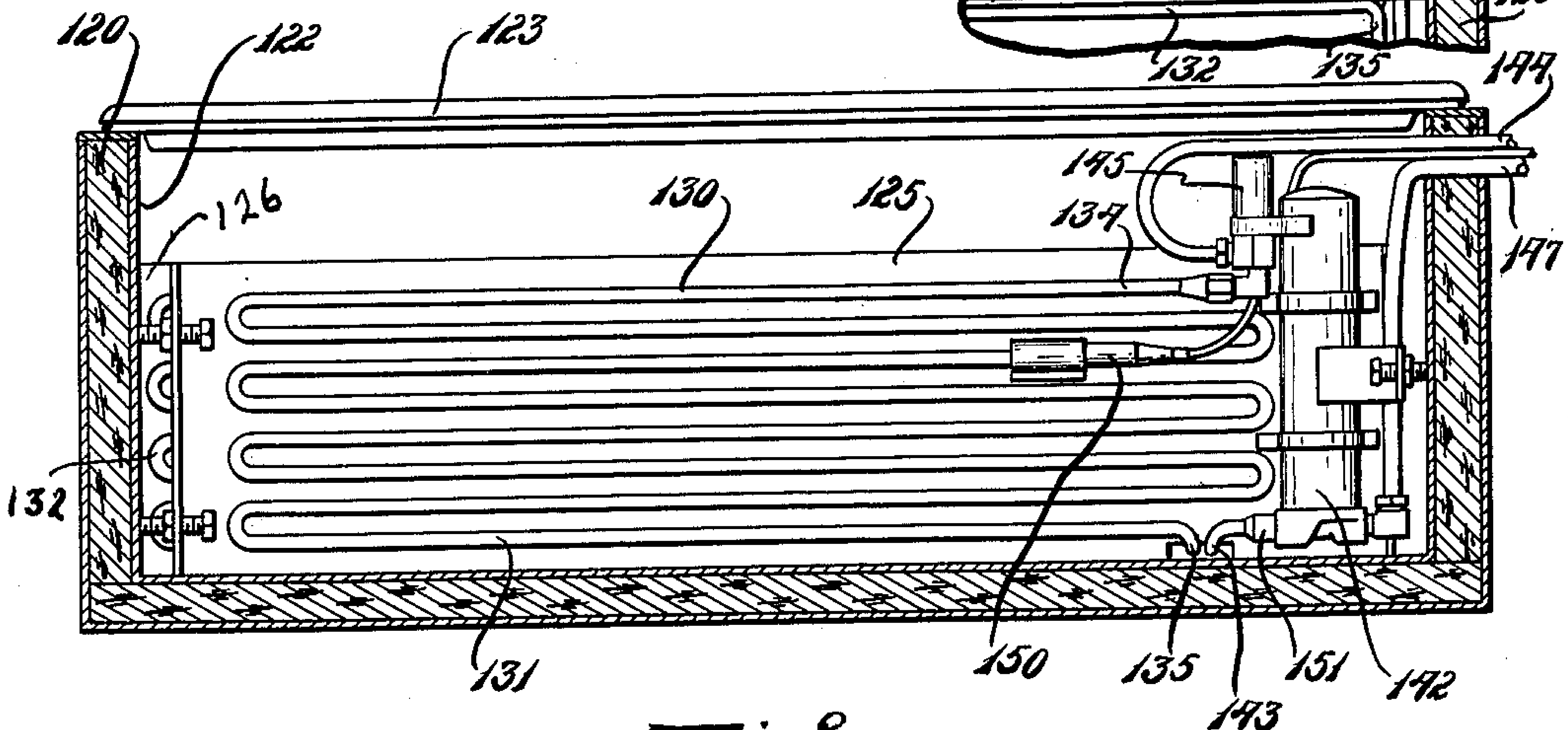


Fig. 8.

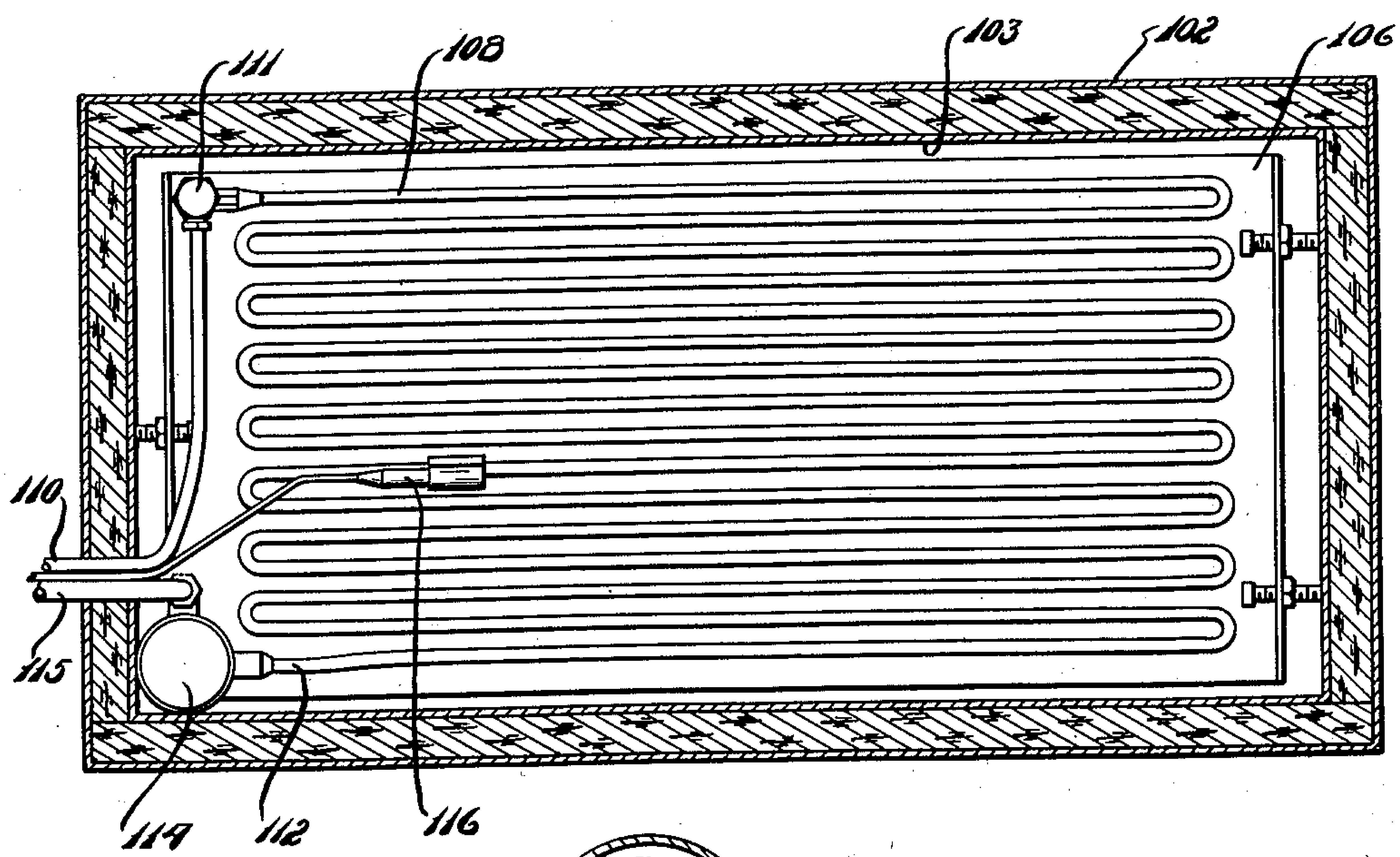
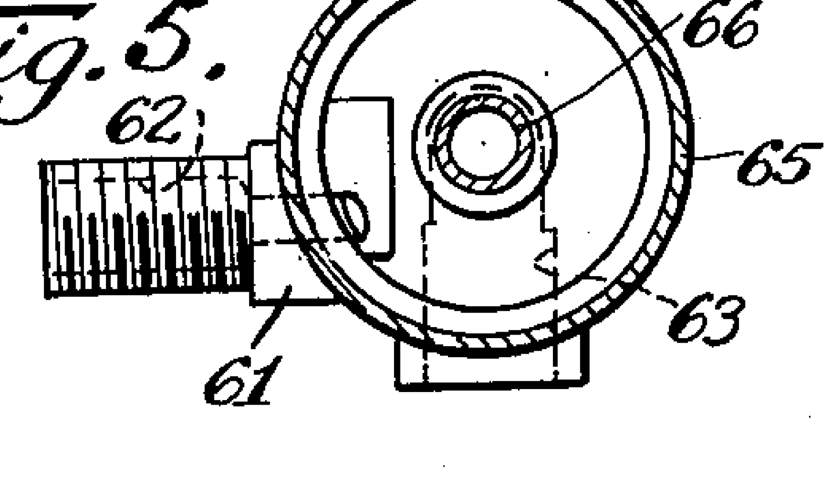


Fig. 5.



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Patented Nov. 26, 1935 2,021,924

UNITED STATES PATENT OFFICE

2,021,924

REFRIGERATING APPARATUS

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Application April 5, 1933, Serial No. 664,523

4 Claims. (Cl. 62—95)

This invention relates to refrigerating apparatus, and more particularly to refrigerating systems of the flooded type.

One of the objects of my invention is to provide a refrigerating system of the type including a condensing element and a flooded evaporating element with a refrigerant accumulator, which serves at all times to prevent the flow of liquid refrigerant from the evaporating element to the condensing element.

Another object of my invention is to provide a refrigerating system of the type including a condensing element and a flooded evaporating element with refrigerant accumulator of sufficient size as to permit variations in the charge of refrigerant admitted to the system without the possibilities of circulating liquid refrigerant from the evaporating element to the condensing element.

Another object of my invention is to provide a refrigerating system of the type including a condensing element, evaporating element, and a high side float mechanism, with a refrigerant accumulator at the outlet of said evaporating element, which accumulator is of sufficient size to accommodate any liquid refrigerant which may be circulated through the evaporating element either during normal operation of the system or all of the liquid refrigerant contained in the system which may be circulated through the evaporating element in the event said float mechanism becomes faulty in operation, or any other condition causing abnormal operation of said system, to thereby provide for refrigeration throughout the entire surface of the evaporating element by insuring delivery of liquid refrigerant through said evaporating element to the outlet end thereof without the possibility of passing liquid refrigerant into said condensing element.

Other objects and advantages will be apparent from the following description, reference being had to the accompanying drawings.

In the drawings:

Fig. 1 is a fragmentary view in cross section of a refrigerator cabinet in which a refrigerant evaporating element embodying features of my invention is located;

Fig. 2 is an enlarged view, partly in cross section and partly in elevation, of a refrigerant evaporating element shown in Fig. 1 and showing diagrammatically a condensing element connected to said evaporating element;

Fig. 3 is a view taken along the line 3—3 of Fig. 2;

Fig. 4 is a view in cross section of a refrigerant accumulator embodying features of my invention;

Fig. 5 is a view taken along the line 5—5 of Fig. 4;

Fig. 6 is a modified form of refrigerating apparatus embodying features of my invention;

Fig. 7 is a fragmentary top view in cross section of a portion of the apparatus shown in Fig. 6; and

Fig. 8 is a modified form of refrigerating apparatus embodying features of my invention.

Referring to the drawings, and particularly to Figs. 1 and 2, there is shown diagrammatically a fragmentary view of a refrigerator cabinet **20**. The cabinet **20** may be of any suitable construction of the household type. Within the cabinet **20** there is disposed a refrigerant evaporating element **22** to which is operatively connected a refrigerant condensing element **24**.

The evaporating element **22** comprises, in general, a tank **26** divided by a separator **27** into an upper compartment **28**, which is adapted to be filled with brine, and a lower compartment **29** for the storage of articles to be refrigerated at low temperatures. A plurality of sleeves **31**, **32** and **33** are disposed within the brine compartment extending from the front of the tank to the rear thereof. These sleeves are sealed against the brine in the compartment **28**. A relatively small refrigerant expansion coil **36** is disposed in the form of spiral coil in good thermal contact with the underside of sleeve **33**. The coil **36** is connected to a somewhat larger expansion coil **38**, which is helically wound around sleeves **31** and **32**. Liquid refrigerant is first delivered to the small coil **36** whence it passes into the larger coil **38**. The sleeves **31**, **32** and **33** are arranged for receiving ice making receptacles **40** for freezing ice cubes and the like.

The refrigerant condensing element **24** comprises, in general, a compressor **42**, motor **43** for operating the compressor, condenser **45**, and a combination liquid refrigerant receiver and high side float mechanism **46**. The compressor withdraws evaporated refrigerant from the element **22** through a vapor return conduit **48**, compresses the gaseous refrigerant and delivers it to the condenser wherein it is liquefied and from which it is delivered into the housing of the receiver-float valve mechanism. Liquid refrigerant is delivered to the element **22** through a liquid conduit **49** under the control of the float mechanism **46**.

In the refrigerating system hereinbefore described, I provide a charge of liquid refrigerant which is sufficient to permit the delivery of liquid refrigerant through the coils 36 and 38 and to the outlet end 52 of coil 38 during normal operation of the system. Thus, refrigeration is insured throughout the entire length of coils 36 and 38.

In order to prevent the slop-over of liquid refrigerant from the outlet 52 of coil 38 into the vapor return conduit 48, I have provided a refrigerant accumulator 60. The accumulator 60 comprises, in general, a fitting 61 having an inlet 62, which is connected to the outlet 52 of coil 38, and an outlet 63, which is connected to vapor conduit 48. The accumulator also includes a dome 65. Within the dome 65 is disposed a standpipe 66 having its upper extremity terminating adjacent the top of the dome and its lower end being disposed in open communication with the outlet 63. During normal operation, liquid refrigerant is delivered through the coils 36 and 38 up to the outlet end 52 of the coil 38. Thus, it will be noted that very little, if any, liquid refrigerant is delivered to the interior of the accumulator during normal operation of the system. It will also be noted that any variations in the charge of liquid refrigerant admitted to the system is immaterial, since it would be necessary to rise in the accumulator to a point above the upper end of standpipe 66 before the liquid would be delivered to the vapor conduit. Thus, it will be noted that the accumulator takes care of variations in the charge of refrigerant introduced into the system.

In order to prevent the slop-over of liquid refrigerant into the vapor conduit during any abnormal operation of the system, such, for example, as a leaky float valve mechanism, I have constructed the accumulator of sufficient size as to accommodate all of the liquid refrigerant in the system which is not contained in the coils 36 and 38. Thus, the possibility of frost back of the vapor conduit or destruction to parts of the compressor is eliminated since no liquid refrigerant passes into the vapor conduit 48. Another form of abnormal operation of the system may include the continuous insertion of warm substances in the trays 40 to be frozen. When this occurs, the system operates more than normal and evaporation takes place in coils 36 and 38 much faster than normally thus causing more liquid to pass through said coils. In a system of the type herein disclosed, it is usual to place the outlet of the combination liquid refrigerant receiver at the lowermost part thereof. Thus, any leakage of the float valve mechanism results in passage of all of the liquid in said receiver into the coils 36 and 38. Thus, an accumulator of sufficient size to accommodate all of the liquid in the system not contained in the coils 36 and 38 readily serves at all times to prevent the flow of liquid into the condensing element or conduit 48. Preferably, the accumulator is disposed at the rear of element 22 in a vertical position.

Preferably, the system is intermittently operated. In order to control the operation of the system, I provide an automatic switch 70 which controls the motor circuit to the power mains 71. Preferably, the switch is thermostatically controlled by means of a thermostatic fluid containing bulb 73, which is disposed in metallic contact with the fitting 61 of accumulator 60, where the expansion and contraction of the fluid in bulb 73 will be influenced by changes in temperatures at the outlet of coil 38 and changes in temperatures of the circulating air in the cabinet 20.

In order to prevent refrigeration taking place immediately upon entrance of the liquid refrigerant into the supply conduit 49 after leaving the float mechanism 46, I have provided a pressure responsive valve 75. This valve interconnects conduit 49 and coil 36. The valve 75 maintains the pressures in the supply conduit 49 sufficiently high enough to prevent refrigeration in conduit 49 to the extent of collection of frost thereon. This prevents loss of refrigeration and increases the capacity of the apparatus. Any suitable pressure responsive valve may be used for this purpose such, for example, as a weighted valve proper (not shown) responsive to changes in pressures in conduit 49.

Referring now to Fig. 8, there is shown an insulated cabinet 102 having a compartment 103 which is suitable for the cooling of bottled goods and the like. Within the compartment 103 there is disposed a metallic plate 106, which is preferably located on the bottom wall thereof. A refrigerant expansion conduit 108, which is arranged in the form of a serpentine coil, is secured to the plate 106 in any suitable manner, such as by solder. Preferably, the plate 106 and coil 108 extend over substantially the entire bottom wall of the compartment 103. Liquid refrigerant is delivered to the coil 108 through a liquid supply conduit 110 after passing through pressure responsive valve 111, which may correspond to the pressure responsive valve 75 shown in Fig. 2. An outlet end 112 of the coil 108 is connected to a refrigerant accumulator 114, which is the same as accumulator 60. Evaporated refrigerant is withdrawn from the accumulator 114 through vapor return conduit 115. A refrigerant condensing element similar to the element 24 may be connected to the liquid conduit 110 and vapor return conduit 115. A thermostatic fluid containing bulb 116 is connected to one of the parallel portions of the coil 108 and is operatively associated with a switch mechanism, for instance, similar to the switch mechanism 70, for controlling the operation of the switch in response to changes in temperature within the coil 108. In a bottle cooler of the type herein disclosed, a quantity of water or brine solution may be introduced into the compartment 103 and the bottles placed in the compartment in contact with the coil 108 and surrounded by the water or brine solution in the compartment 103 so that the bottles will be uniformly and efficiently cooled, and to serve as a holdover.

In Fig. 6, there is disclosed a bottle cooler wherein the contents of the bottles are cooled by the air in the cabinet instead of by a liquid medium. In this type of cabinet the possibilities of labels coming off the bottles is eliminated. In Fig. 6, there is shown a cabinet 120 having a compartment 122, the upper end of which is closed by a movable lid or cover 123. Within the compartment 122 there is disposed a series of vertical plates 125, 126 and 127, which are spaced apart to permit the placing of bottles 128 between the plates. Refrigerant expansion coil 130 is associated with the plates 125, 126 and 127. The coil or conduit 130 is arranged in three sections, each of which is in the form of a serpentine coil, first, one section 131 is associated with the plate 125 whence the conduit is directed to the plate 126 where a second section 132, in the shape of a serpentine coil, is secured thereto, and after leaving the section 132, which is secured to plate 126, the conduit is directed to the plate 127 where a third section 133, in the form of a serpentine-like coil is placed in contact with the plate 127. Liquid refrigerant enters the expansion coil 130 at an inlet end 134 whence it passes through section 131, portion 135 of the conduit or coil 130, then through section 132 and portion 136 of coil 130 into section 133. The section 133 is connected to a refrigerant accumulator 142 by a portion 143 of conduit 130. The accumulator 142 is the same as accumulator 60. Liquid refrigerant is supplied to the expansion coil 130 through a liquid supply conduit 144 after passing through a pressure responsive valve 145, which corresponds to the valve 75. Evaporated refrigerant is withdrawn from the accumulator 142 through a vapor return conduit 147. A fluid containing thermostatic bulb 150 is associated with one of the parallel portions of the expansion coil, section 131, which is associated with the plate 125 and is operatively connected with the switch mechanism similar to the switch 70 for controlling the operation of the condensing element, which may be, for example, the element 24. If desired, the thermostatic bulb 150 may be placed in thermal contact with an inlet connection 151 of the accumulator 142 so that it will be responsive to changes in temperatures in the portion 143 of the expansion coil 130 to thus control the operation of the switch and electric motor in response to changes in temperatures at the outlet of the expansion coil 130. In devices of this type, the bottled goods may be placed between the plates and between the side walls of the cabinet and the plates where the refrigerating effect of the expansion coil 130 will be sufficient to cool the contents of the bottled goods to the proper temperatures, without the necessity of providing a liquid circulating medium within compartment 122 to aid in uniformly cooling the bottled goods. This is advantageous in the event it is desired to retain the labels on the bottles until the goods may be sold.

In the bottle cooler shown in Figs. 6 and 7 only one refrigerated plate may be used if desired. When only one refrigerated plate is used, it is preferable to place it in a vertical position adjacent one of the vertical walls of the compartment 122 for cooling the bottled goods similarly as the bottles are cooled in the apparatus shown in Fig. 8.

Although only a preferred form of the invention has been illustrated, and that form described in detail, it will be apparent to those skilled in the art that various modifications may be made therein without departing from the spirit of the invention or from the scope of the appended claims.

What I claim as my invention is:

1. A refrigerating system comprising a low pressure portion and a relatively high pressure portion, said high pressure portion including a combination liquid refrigerant receiver and float valve mechanism, said valve mechanism being so positioned in said system as to permit all of the liquid refrigerant in the high pressure portion to pass to the relatively low pressure portion in the event of abnormal operation of said valve mechanism and said low pressure portion including a refrigerant accumulator, the quantity of liquid refrigerant contained in said system being so proportioned and controlled by said valve mechanism that only a relatively small, if any, portion of the accumulator is filled with liquid refrigerant during normal operation of said valve mechanism, said accumulator being of sufficient size to accommodate all of the liquid refrigerant in said system which is not contained in the other part of the low pressure portion in the event of said abnormal operation of said valve mechanism, and said accumulator having an outlet for gaseous refrigerant in the lower part thereof and including standpipe means of sufficient length associated with said outlet to prevent the passage of liquid refrigerant through said outlet.

2. A refrigerating system comprising a refrigerant evaporating element, a refrigerant accumulator connected to the outlet of said element, means for circulating refrigerant through said element, a vapor return conduit interconnecting said means and said accumulator, a liquid supply conduit associated with said means and said element, and means for controlling the flow of liquid refrigerant to said element, the quantity of liquid refrigerant contained in said system being so calibrated and controlled by said latter means that the quantity of liquid refrigerant delivered to the evaporating element is sufficient to pass to the outlet thereof so that a relatively small portion of the accumulator is filled with liquid refrigerant during normal operation of the system, said accumulator being of sufficient size to accommodate all of the liquid refrigerant in the system which is not contained in the evaporating element and which is delivered to the accumulator during abnormal operation of said system and said accumulator having an outlet for gaseous refrigerant in the lower part thereof and including standpipe means of sufficient length associated with said outlet to prevent the passage of liquid refrigerant through said outlet.

3. In a cooler, the combination with a cabinet having a compartment, of a refrigerating plate forming substantially the bottom wall of said compartment, said compartment being arranged to receive bottled goods to be refrigerated, and adapted to contain a quantity of liquid in which the bottles are immersed for uniformly cooling the contents of the bottles, a high side float for controlling the flow of liquid refrigerant to said refrigerating plate, a refrigerant accumulator associated with the outlet of said refrigerating plate and being vertically disposed in said compartment and a refrigerant condensing element associated with said high side float and accumulator.

4. In a cooler, the combination with a cabinet having a compartment, of a refrigerating coil forming substantially the bottom wall of said compartment, said compartment being arranged to receive bottled goods to be refrigerated, and adapted to contain a quantity of liquid in which the bottles are immersed for uniformly cooling the contents of the bottles, a high side float for controlling the flow of liquid refrigerant to said refrigerating coil, a refrigerant accumulator associated with the outlet of said refrigerating coil and being disposed in said compartment, and a refrigerant condensing element associated with said high side float and accumulator.

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