

Sept. 1, 1925.

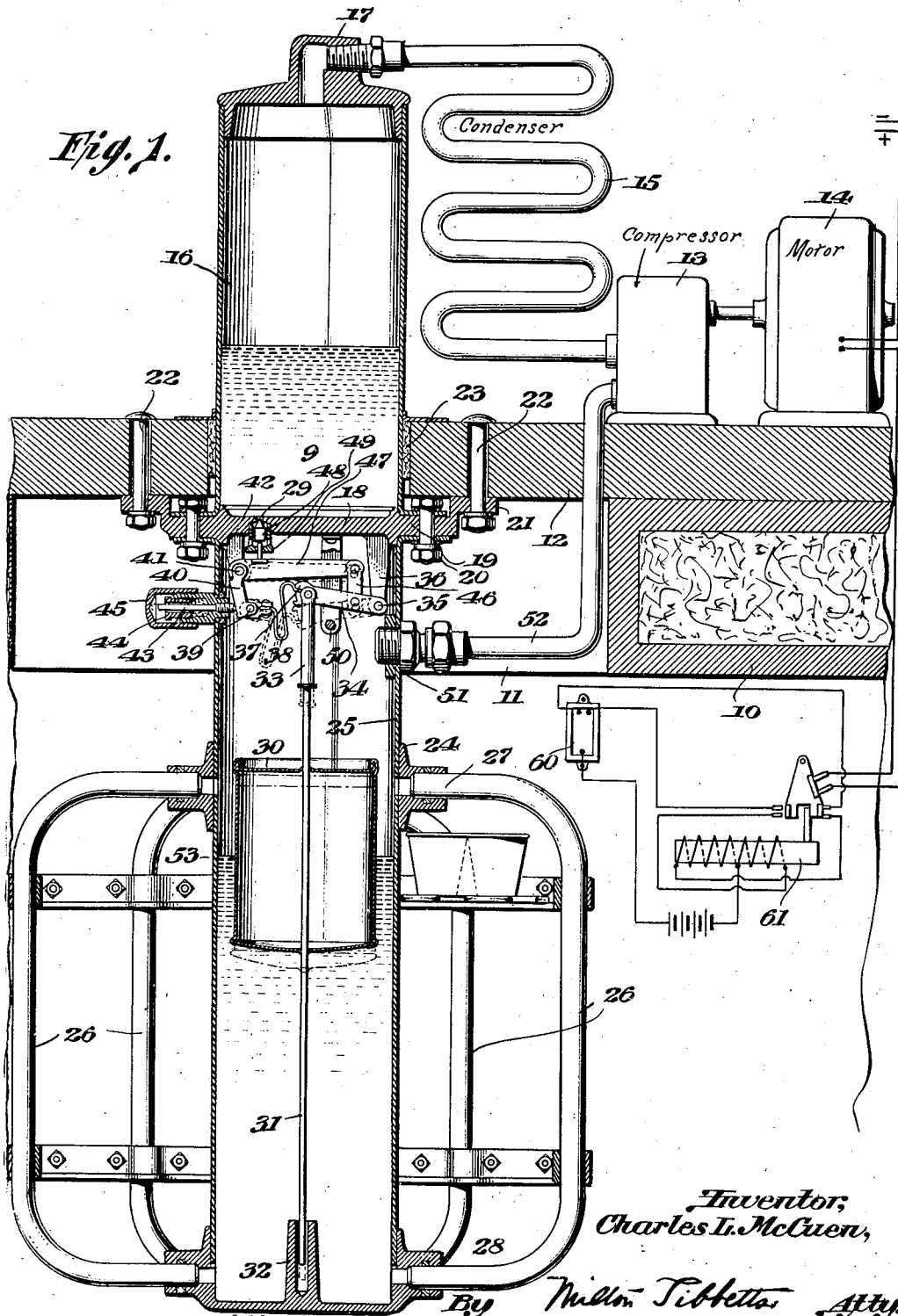
1,552,070

C. L. McCUEN

REFRIGERATING APPARATUS

Filed June 26, 1919

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Fig. 2.

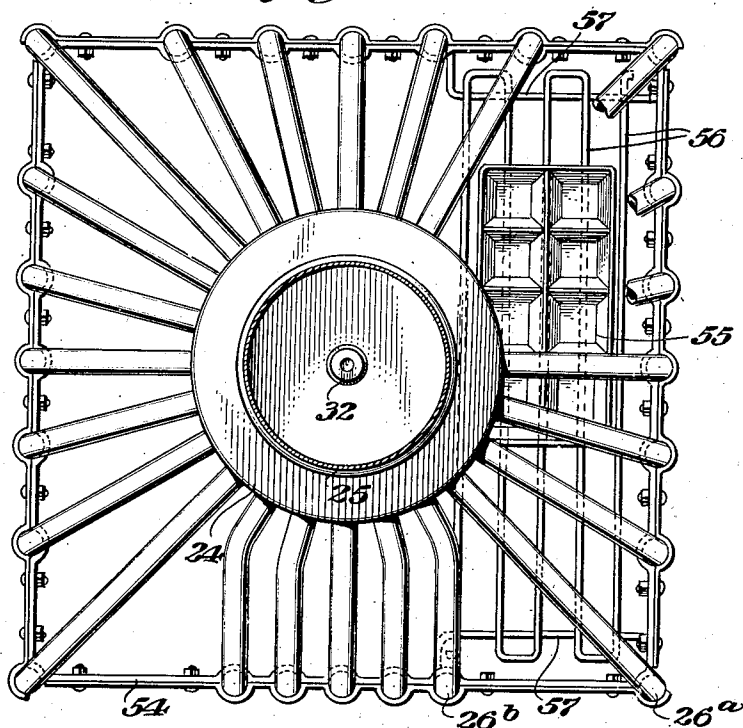
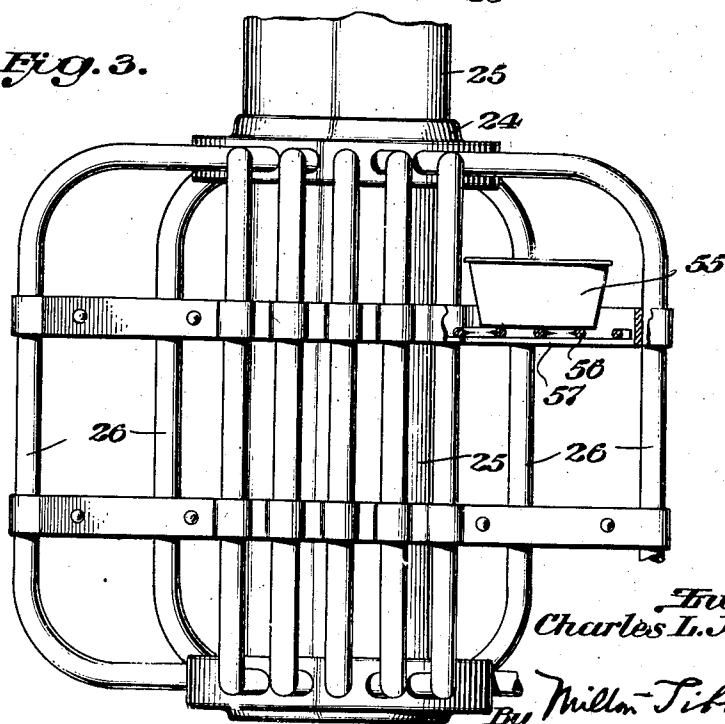


Fig. 3.



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UNITED STATES PATENT OFFICE.

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TO DELCO-LIGHT COMPANY, OF DAYTON, OHIO, A CORPORATION OF DELAWARE.

REFRIGERATING APPARATUS.

Application filed June 26, 1919. Serial No. 306,829.

To all whom it may concern:

Be it known that I, CHARLES L. McCUEN, a citizen of the United States, and resident of Detroit, Wayne County, State of Michigan, have invented certain new and useful Improvements in Refrigerating Apparatus, of which the following is a specification.

This invention relates to refrigeration and particularly to refrigerating apparatus of the compression type.

One of the objects of the invention is to simplify the mechanism of this type of apparatus and render it more reliable and longer lived.

Another object of the invention is to increase the capacity of the expansion chamber of the system in order to make it a sort of storage chamber whereby the compressor may be operated at less frequent periods while approximately maintaining a given temperature or a more uniform temperature may be maintained from constant operation of the compressor.

Other objects of the invention will appear from the following description taken in connection with the drawings which form a part of this specification, and in which:

Fig. 1 is a vertical sectional view and part elevation of a refrigerating apparatus embodying the invention, the condenser, compressor and motor being shown somewhat diagrammatically.

Fig. 2 is a plan view of the expansion chamber with the central tank portion of the chamber in section, and

Fig. 3 is a side elevation of the expansion chamber shown in Fig. 2.

Referring to the drawings, 10 represents a refrigerator having an opening 11 formed in the top thereof. 12 is a base upon which the entire refrigerating apparatus herein-after described is mounted. This base is adapted to set on top of the refrigerator and part of the refrigerating apparatus extends down through the opening 11 into the interior of the refrigerator as shown in the drawing. The base and all of the apparatus mounted on it may be removed as a unit.

Mounted on the base 12 is a compressor 13 operated by an electric or other motor 14 and a condenser 15 is shown somewhat diagrammatically as connected with the outlet from the compressor. This condenser may be of any desired type, either water or air

cooled. The condenser 15 has a storage chamber 16 connected to its outlet end, this storage chamber being shown in the form of a cylindrical tank with the condenser connected to its upper end as at 17.

The lower or bottom wall of the tank 16 is formed by a support 18 made of a casting or forging. It has a flange 19 to which the lower end of the tank 16 is connected as by bolts 20, and this flange 19 is extended as at 21 for connection to the support 18.

The expansion chamber of the refrigerating apparatus is suspended below the base 12 and in the present invention this chamber is of novel construction. In the illustrative form shown the expansion chamber 24 comprises two parts or compartments, one of which may be termed a storage compartment and the other an evaporation compartment. The storage compartment is represented by the elongated cylindrical tank 25 shown in the drawings and the evaporation compartment is represented by a series of vertically arranged pipes 26 which have their upper and lower ends bent inwardly towards the tank 25 and connected thereto as at 27 and 28 respectively. Thus the storage compartment may be said to have a relatively small surface area as compared with its cubic capacity and the evaporation compartment, composed as it is of a multiplicity of pipes or similar parts, has a relatively large surface area. Thus it will be seen that if the expansion chamber 24 is partly filled with a suitable refrigerant, particularly to a point below the upper ends 27 of the pipe 26, a sort of thermo-siphon action will take place because of the relatively large surface area of the pipes 26. Thus the refrigerant will be caused to boil in the pipes 26 and the evaporated refrigerant will rise through the upper ends of the pipes 26 and into the upper part of the tank 25. This will cause the liquid refrigerant in the lower part of the tank 25 to enter the lower ends of the pipes 26 and eventually all of the refrigerant will thus be boiled away or evaporated.

The tank part 25 of the expansion chamber has its upper wall formed by the support 18 above referred to, the upper end of the tank 25 being secured to the support by the bolts 20, directly beneath the tank 16 to which the condenser is connected. Thus the support 18 forms a partition be-

tween the tanks 16 and 25 or between the condenser and the expansion chamber, and it is intended that the refrigerant contained in the condenser and storage tank 16 under
 5 pressure shall be admitted to the expansion chamber through a suitably valved opening or passage which may be arranged in the partition 18 as shown in the drawings as at 29.

10 It has been customary heretofore in most refrigerating systems of this character to control the admission of the refrigerant to the expansion chamber by means of an expansion valve operating on the pressure or
 15 vacuum of the expansion chamber. This form of valve would necessarily operate at frequent intervals and admit very small quantities of the refrigerant in order to substantially maintain a constant pressure in
 20 the expansion chamber. In the present invention it is intended that the refrigerant shall be admitted in relatively large quantities and at more infrequent intervals, the expansion chamber acting somewhat as a stor-
 25 age chamber adapted to receive a considerable quantity of the condensed refrigerant and permit it to expand in accordance with the needs of its particular use. As shown the admission of the refrigerant to the ex-
 30 pansion chamber is controlled by a float operating in the storage compartment or tank 25 of the expansion chamber. The float is shown at 30 and it has a stem 31 which is
 35 guided in a boss 32 arranged in the lower end of the tank 25. The upper end 33 of the float stem is connected to a lever 34 pivoted at 35 to an arm 36 extending down-
 40 wardly from the support 18. The free end of the lever 34 has a segmental notch 37 in which the end of a spring 38 is adapted to slide. The spring 38 is of S shape and its
 45 opposite end is pivotally connected at 39 to a swinging arm 40 pivoted at 41 to an arm 42 extending downwardly from the support 18. The position of the arm 40, and consequently
 50 the tension of the spring 38, is adjustable by a threaded bolt 43 in the side of the tank 25. The stem of the bolt 43 is packed as by a nut 44 and a cap 45 may be screwed
 over the end of the bolt 43 after the latter has been finally adjusted.

The function of the spring 38 is to yield-
 55 ably maintain the lever 34 in either of its two positions, that is, either the upper or valve closing position as it is shown in full lines in Fig. 1 of the drawings, or in its
 60 lower or open position as it is shown in dotted lines in Fig. 1. The lever 34 is moved from one position to the other by the float 30 and the spring 38 maintains the lever 34
 in its upper position until the level of the liquid in the tank 25 has dropped consider-
 65 ably so that the weight of the float 30 acts to pull the lever 34 downwardly. Said lever then snaps over the dead center and is main-

tained in its lower position by the spring 38 until such time as the level of the liquid in the tank 25 rises considerably above the point of buoyancy of the float and the float thereby pushes the lever 34 over dead center
 70 to its upper position.

The lever 34 is connected by a link 46 with a lever 47 which is also pivoted to the arm 42 at 41. The lever 47 near its fulcrum is connected to the stem of a valve 48 contained in
 75 a cage 49 and adapted to control the passage 29. Thus the lever 34 in its upper position holds the valve 48 firmly against its seat so that the passage 29 is thereby closed and the lever 34 in its lower position rests against a
 80 stop 50 and the valve 48 permits the admission of the refrigerant from the tank 16 into the expansion chamber 24.

An outlet 51 from the expansion chamber 24 is connected by a suitable pipe 52 with
 85 the intake side of the compressor 13 above referred to.

The normal level of the liquid refrigerant in the expansion chamber 24 is shown at 53 and the valve 48 is in closed position. With
 90 the operation of the compressor the evaporated refrigerant or gas in the upper part of the expansion chamber is withdrawn through the pipe 52 and passed into the condenser 15 where it is condensed and then
 95 stored in the chamber 16. This action of the compressor of course reduces the pressure in the expansion chamber and causes the refrigerant in the pipes 26 to boil or evaporate. As the gas is withdrawn from the upper part
 100 of the expansion chamber the liquid refrigerant enters the lower ends of the pipe 26 thus lowering the level of the liquid in the tank 25. As soon as this level reaches the point where the weight of the float 30 over-
 105 comes the resistance of the spring 38 the lever 34 snaps over the dead center and opens the valve 48 thus admitting the refrigerant from the tank 16. The valve remains open until such time as the level of the liquid re-
 110 frigerant in the tank 25 reaches the point where the buoyancy of the float 30 overcomes the spring 38 and snaps the lever 34 back into the position shown in full lines in Fig. 1. This closes the valve 48 and prevents fur-
 115 ther admission of the refrigerant until the level in the tank 25 is again reduced.

It will be understood of course that open-
 120 ing of the doors of the refrigerator and thus letting in warm air will cause a sudden rise of temperature on the surface of the pipes 26 and hence accelerate the evapora-
 125 tion of the refrigerant therein. It will be understood further that the temperature within the refrigerator will be approxi-
 mately controlled by the use of a thermostat indicated diagrammatically at 60 and con-
 130 nections, similarly indicated at 61, for starting and stopping the motor 14, or by similar means. On the other hand, starting and

stopping of the motor may be done manually or as occasion arises. In some instances it may be desirable to operate the motor continuously. On the other hand, it may be shut off for relatively long periods due to the fact that considerable refrigerant may be stored in the storage compartment 25 of the expansion chamber.

It will be further understood that the form of the evaporation compartment of the expansion chamber may be considerably varied from that shown, the principal feature being that the evaporation compartment shall have a relatively large surface area. The pipes 26 which comprise the evaporation compartment shown are preferably vertically arranged in a series bordering an area of rectangular form and the upper and lower ends of the pipes are bent inwardly towards the central tank 25 to which they are connected. The connection of the upper ends of these pipes to the tank 25 is above the highest point reached by the liquid level in the tank 25 so that the thermo-siphon action will take place. As shown in the various figures the pipes 26 are somewhat separated from the central tank 25 and are positioned by a separating or bracing means in the form of several bands 54 extending entirely around the rectangular series of pipes. It will be observed that the vertically disposed pipes with their inwardly bent top and bottom portions form a cage of sufficient volume to receive therein articles to be cooled. As shown in Figs. 2 and 3, two of the pipes, 26^a and 26^b, are abnormally separated to provide a somewhat larger space between them so that a water pan 55 can be inserted between the pipes and the central tank. This pan may be supported upon a shelf 56 which in turn rests upon brackets 57 connected to one of the bands 54. The pan 55 preferably has a series of substantially cubical compartments so that water in the pan may be frozen into cubes for domestic use.

Obviously, several of the shelves 56 may be used and food that it is desired to keep extremely cold may be placed on these shelves rather than elsewhere in the refrigerator, it being apparent that the pipes 26 are the coldest part of the apparatus.

Other forms than those described may be used without departing from the spirit of the invention.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. In a refrigerating apparatus, an expansion chamber comprising an upright storage compartment, a series of vertical pipes separated from the compartment and having their upper and lower ends connected to the compartment, and a shelf arranged in the space between the compart-

ment and said pipes, said shelf being supported directly by said vertical pipes and in direct metallic contact therewith.

2. In a refrigerating apparatus, an expansion chamber comprising an upright storage compartment, a series of vertical pipes separated from the compartment and having their upper and lower ends connected to the compartment, separating means connected to said pipes, and a shelf supported by said separating means, said vertical pipes, separating means and shelf being in direct metallic contact with one another.

3. In a refrigerating apparatus, in combination, an expansion chamber including a storage compartment and an evaporating compartment connected thereto, the evaporating compartment comprising a series of pipes having upright side portions bordering an area and laterally turned top and bottom portions, said side portions and laterally turned portions constituting with said storage compartment a series of upright loops arranged to form a cage, and a shelf within the cage adapted to receive a pan thereon, said shelf being in intimate metallic contact with said pipes.

4. In a refrigerating apparatus, in combination, an expansion chamber including a storage compartment and an evaporating compartment connected thereto, the evaporating compartment comprising a plurality of pipes each connected with the storage compartment and forming therewith a series of vertical loops, said loops being arranged to form a cage, and bracing means connecting adjacent pipes and supported thereby and having provisions for supporting a pan thereon, said bracing means being in intimate metallic contact with said pipes.

5. In a refrigerating apparatus, in combination, an expansion chamber including a storage compartment and an evaporating compartment connected thereto, the evaporating compartment comprising a plurality of upright pipes each connected with the storage compartment and forming therewith a series of vertical loops, said loops being arranged to form a cage open at one side to receive a pan therein, and means in intimate metallic contact with said pipes, adapted for supporting said pan within the cage.

6. In a refrigerating apparatus, in combination, an expansion chamber including a storage compartment and an evaporating compartment connected thereto, the evaporating compartment comprising a series of spaced vertically disposed pipes connected with the storage compartment to form therewith a series of vertical loops, said loops being arranged to form a cage open at one side to receive a pan therein and exposed to the direct action of the air adapted to circulate thereover, and a shelf arranged

within the cage in intimate metallic contact with said pipes adapted to support said pan.

7. In a refrigerating apparatus, an expansion chamber comprising an upright
5 storage compartment normally containing liquid refrigerant therein, a series of vertical pipes spaced from the compartment and having their upper and lower ends connected to the compartment respectively
10 above and below the level of the liquid refrigerant therein, and a shelf arranged in the space between the compartment and said pipes.

8. In a refrigerating apparatus, an expansion chamber comprising an upright

storage compartment normally containing liquid refrigerant therein, a series of upright pipes spaced from the compartment and having their upper and lower ends connected to the compartment respectively
20 above and below the level of the liquid refrigerant, said pipes containing liquid refrigerant to substantially the same level as in the storage compartment, and a shelf
25 arranged in the space between the compartment and said pipes approximately at the level of the liquid refrigerant therein.

In testimony whereof I affix my signature.

CHARLES L. McCUEN.