Jan. 26, 1932. C. STEENSTRUP 1,843,005

REFRIGERATING MACHINE

Filed Sept. 12, 1928

Fig. 1.

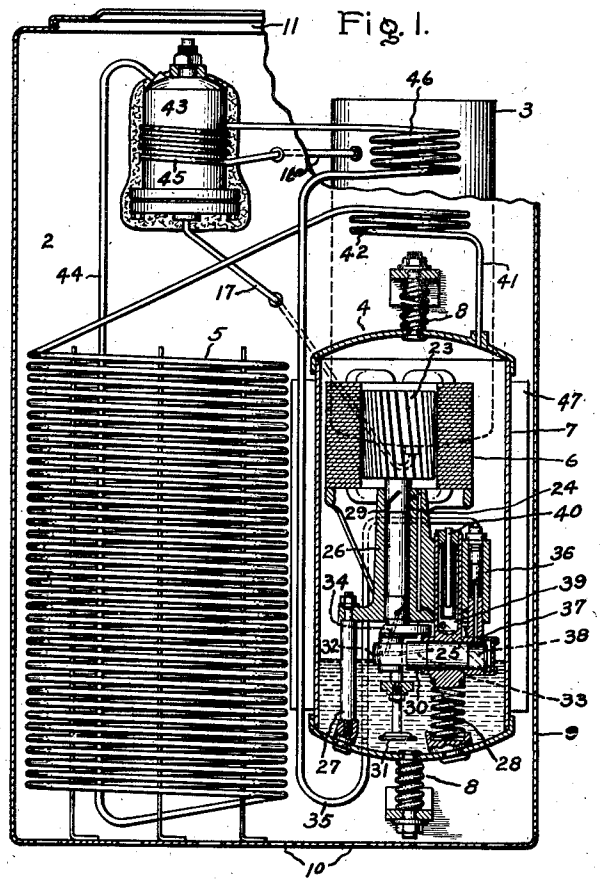


Fig. 3.

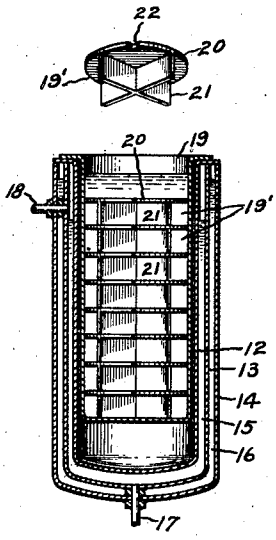


Fig. 2.

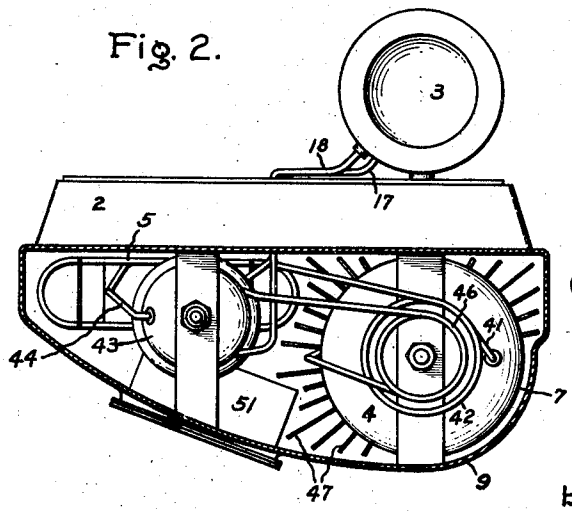
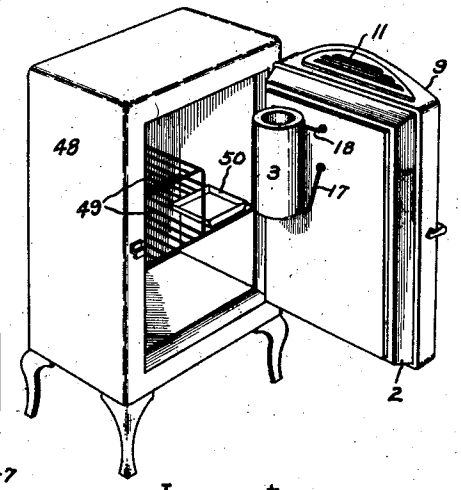


Fig. 4.



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Patented Jan. 26, 1932 1,843,005

UNITED STATES PATENT OFFICE

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REFRIGERATING MACHINE

Application filed September 12, 1928. Serial No. 305,518.

My invention relates to refrigerating machines and particularly to electrically driven refrigerating machines for domestic use.

It is frequently desirable to place a refrigerating system having a condenser in an enclosing housing, but it has heretofore been necessary to employ fans for circulating air through the housing to adequately cool the condenser of such systems. Accordingly, an object of my invention is to provide a construction of this kind in which the condenser of the system is cooled by a natural draft. I do this by forming and arranging the housing or enclosure in such relation to the condenser therein as to induce sufficient flow of air by natural draft through the housing to cool the condenser.

In certain buildings, as for instance apartment houses, the kitchen or pantry of an apartment is often very small, so that there is no space available for the ordinary domestic refrigerating machine. Another object of my invention is to provide a refrigerating machine which will take up a minimum of space, so that it may be placed under the drain board of the kitchen sink or under a table, or built into any available nook, or placed in any similar position.

In order to accomplish this I build the refrigerating machine into a door of the refrigerator with the evaporator of the machine on one side of a partition of the door and the balance of the mechanism on the other side of the partition.

The various features of novelty which characterize my invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of my invention, reference may be had to the following description taken in connection with the accompanying drawings, in which Fig. 1 is a side view, partly in section, of a refrigerating machine embodying my invention; Fig. 2 is a top view of the machine of Fig. 1; Fig. 3 is a sectional view of a detail; and Fig. 4 is a perspective view of a refrigerator in which my refrigerating machine is embodied.

Referring to the drawings, there is shown a door member comprising a partition 2, on one side of which is an evaporator 3 and on the other side is a compressor 4 and a condenser 5. The door member is hinged, or supported on the cabinet in any other suitable manner, for movement about a vertical axis so that the weight of the refrigerating machine will not have to be lifted in opening the door. The partition 2 is made of heat insulating material, such as cork. The compressor 4 is driven by an electrical motor 6, the motor and compressor being enclosed in a casing 7 which forms a compression chamber. The compressor casing 7 is mounted on the partition 2 by means of springs 8, the strength of the springs being such that the casing 7 may vibrate as a whole without transmitting the vibrations to the partition and thereby to the refrigerator. The casing 7 and the condenser 5 are surrounded by an enclosure or housing 9 which is mounted on the partition. This enclosure has openings 10 at the bottom and openings 11 at the top so that the condenser 5 and the casing 7 are cooled by an induced current of air through the enclosure. The enclosure is made neat in appearance and the openings in the top are in the form of louvers. By arranging the condenser in the housing 9 having openings in the top and bottom which facilitate the flow of air by natural draft, the chimney effect of the housing induces sufficient flow of air therethrough by natural draft to cool the condenser. This induced draft is caused by the air in the housing being heated by the condenser coil and rising through the openings in the top of the housing which draws cool air into the housing through the openings in the bottom thereof.

The evaporator 3 is mounted on the inside of the door member so that it occupies a position within the refrigerator. The evaporator is shown in detail in Fig. 3 and the specific construction shown is disclosed and claimed in my copending application, Serial No. 148,266, filed Nov. 13, 1926, and assigned to the same assignee as the present application. The evaporator or cooling unit comprises three cup-shaped receptacles 12, 13 and 14, nested one within the other, with adjacent walls spaced apart to provide cham-

bers 15 and 16 therebetween. The inner chamber 15 contains refrigerant which enters through pipe 17 at the bottom, the evaporated refrigerant leaving by pipe 18. The outer chamber 16 contains a liquid whereby it functions as a heat reservoir. The liquid in chamber 16 nearly fills the same and is a freezing solution such as a mixture of glycerine and water or brine, so that the heat transferred from the inside of the receptacle 12, wherein articles to be frozen are placed, to the refrigerant in chamber 15 will be more rapid than from inside of the refrigerator box in which the evaporator is placed. In this way the temperature in the freezing chamber is kept low enough to readily freeze water in the ice cube tray 19, or other articles placed therein to be frozen without reducing the temperature in the refrigerator so low as to freeze food contained therein. The ice tray 19 is in the form of a cylinder open at the top and fitting in the receptacle 12. The ice tray has loosely setting in it a group of small ice trays 19′ one of which is shown above the evaporator in Fig. 3. These small ice trays consist of a bottom member 20 having upright members 21 united thereto. The small ice trays 19′ are placed in the ice tray 19 and then the tray 19 is filled with water. When ice is formed, the tray 19 is removed from the receptacle 12 and then each of the small ice trays are removed by the finger hole 22. Small blocks of ice are formed between the member 20 and 21.

The rotor 23 of the motor 6 is directly connected by a shaft 24 to an eccentric which drives the piston 25 of the compressor 4. This compressor is of the oscillating type. The shaft 24 is journaled in a bearing 26. The stator of the motor 6, the bearing 26 and the compressor are supported from the casing 7 by studs 27 and a spring 28, the spring 28 engaging the cylinder of the compressor, which is rotatably supported in an extension of the bearing. The bottom of the casing 7 contains oil which is used to lubricate the bearing 26. In order to provide a pump for forcing the oil into the grooves 29 of the bearing 26, the end 30 of the piston is enlarged in diameter and with the cooperating cylinder walls acts as an oil pump, drawing oil through the oil screen 31 into a port 32 in the crank arm from whence it is drawn through a passage 33 in the piston to the space which forms the cylinder of the oil pump. It is then forced back through the passage 33 into a port in the crank arm placed 180° from the port 32 thence upward through the passage 34 in the shaft 24 to the oil grooves 29.

Evaporated refrigerant gas, preferably sulphur dioxide, is drawn through the pipe 35 into the intake member 36 through which it passes, thence through the intake port 37 in the side of the cylinder, where the gas is compressed. The cylinder in its compression stroke oscillates and moves the port 37 so that it no longer registers with the opening in the intake member. The compressed gas is now forced through the cored passage 38 in the cylinder walls into the muffler box 39. The muffler box comprises several concentric cylinders, the middle one of which is closed at the bottom, but has openings in its side near the top, thus providing a tortuous passage for the compressed gas. The compressed gas leaves the inner of these cylinders 40 and enters the compressor casing 7 which is gas tight. The gas then passes out of the top of the casing through the pipe 41 into the coil of pipe 42 and there enters the coil of pipe 5 which forms the condenser. The compressed gas is cooled in the condenser by an induced current of air flowing over it and through the enclosing casing 9. From the condenser the condensed refrigerant is delivered in liquid form to the float chamber 43, which has a float therein. The float chamber and float are constructed in accordance with my copending application, Serial No. 203,354, filed July 5, 1927, and assigned to the same assignee as the present application. When sufficient liquid refrigerant accumulates in the float chamber the float rises to open a valve admitting the liquid refrigerant to the pipe 44 from whence it passes into the chamber 15 of the evaporator 3 through pipe 17. The refrigerant taking up heat from the refrigerator box and other articles that are to be cooled and also from the ice tray 19, again turns into gas and passes from the evaporator through pipe 18 through the coil of pipe 45 surrounding the float chamber 43, through the coil of pipe 46 to the pipe 35 and thence back to the compressor.

By passing the gas from the evaporator around the float chamber 43 by means of the coil of pipe 45, heat is taken out of the liquid refrigerant in the float chamber, since the gas leaving the evaporator is cooler than the compressed liquid refrigerant. In this way, the refrigerant delivered to the evaporator is cooled to a greater degree than if only the induced draft of air over the condenser were depended upon.

By providing the coils or turns 42 and 46 in the pipes leading from the compressor casing, this casing can readily vibrate and the vibrations will be dampened out by these coils of pipe and not transmitted to the rest of the mechanism. The casing 7 is provided with fins 47 for conducting the heat away from the casing. The induced draft of air over the casing removes the heat from the casing and these fins.

In Fig. 4, I have shown my refrigerating machine as embodied in a door member of a refrigerator box 48, into which when the door is closed, the evaporator 3 extends. The box is provided with a shelf 49 for food and a

drip pan 50 for catching the water when it is desired to defrost the evaporator.

In operation, my refrigerating machine maintains a substantial uniform temperature in the refrigerator, being started and stopped in the well known manner by a thermostatically controlled switch contained in the box 51. In order that the motor in starting the compressor shall not have an excessive load, an unloader for the compressor is provided, the details of which are not shown.

I desire it to be understood that my invention is not limited to the particular arrangement shown and described, and I aim in the appended claims to cover all modifications which do not depart from the spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A refrigerator cabinet having a door opening and a door member, means for supporting said door member for movement about a vertical axis, a refrigerating machine carried by said door member, said refrigerating machine comprising an evaporator, a compressor and a condenser, said evaporator being located on one side of said door member, and said compressor and said condenser being located on the other side of said door member.

2. A refrigerator cabinet having a door opening and a door member comprising a partition, means for supporting said door member for movement about a vertical axis, said machine being carried by said door member, said machine comprising an evaporator, a condenser, a compressor and an electric motor for driving said compressor, said evaporator being located on one side of said partition, and said condenser, said compressor and said motor being located on the other side of said partition.

3. In combination with a refrigerator cabinet having a door opening and a door member therefor, means for supporting said door member for movement about a vertical axis, a refrigerating machine being carried by said door member, said machine comprising an evaporator, a compressor and a condenser, said evaporator being located on one side of said door member, and said compressor and condenser being located on the other side of said door member.

4. In combination with a refrigerator cabinet having a door opening and a door member therefor, means for supporting said door member for movement about a vertical axis, a refrigerating machine carried by said door member, said machine comprising an evaporator, a condenser, a compressor and a motor for driving said compressor, said evaporator being located on one side of said door member, and said condenser, compressor and motor being located on the other side of said door member.

5. A refrigerator cabinet having a door opening and a door member, means for supporting said door member for movement about a vertical axis, a refrigerating machine carried by said door member, said refrigerating machine comprising an evaporator, a compressor and a condenser, said evaporator being located on one side of said door member, said compressor and said condenser being located on the other side of said door member, and an enclosure mounted on said door member, said enclosure surrounding said compressor and condenser.

6. In combination with a refrigerator cabinet having a door opening, a door member therefor comprising a heat insulating partition for said opening, means for supporting said door member for movement about a vertical axis, a refrigerating machine, said machine being carried by said door member, said machine comprising an evaporator, a compressor and a condenser, said evaporator being located on one side of said partition, said compressor and condenser being located on the other side of said partition, and an enclosure mounted on said partition, said enclosure surrounding said compresssor and condenser.

7. A refrigerator cabinet having a door opening, a door member for said opening comprising a partition, means for supporting said door member for movement about a vertical axis, a refrigerating machine, said refrigerating machine being carried by said door member, said refrigerating machine comprising an evaporator, a compressor and a condenser, said evaporator being located on one side of said partition, said compressor and said condenser being located on the other side of said partition, and an enclosure mounted on said partition, said enclosure surrounding said compressor and condenser. said enclosure having openings at the bottom and top, said compressor and condenser being cooled by an induced current of air through said enclosure.

8. In combination with a refrigerator cabinet having a door opening, a door member therefor comprising a heat insulating partition, means for supporting said door member for movement about a vertical axis, a refrigerating machine, said machine being carried by said door member, said machine comprising an evaporator, a compressor and a condenser, said evaporator being located on one side of said partition, said compressor and condenser being located on the other side of said partition, and an enclosure mounted on said partition, said enclosure surrounding said compressor and condenser, said enclosure having openings at the bottom and top, said compressor and condenser being cooled by an induced current of air through said enclosure.

9. A refrigerator cabinet having a door

opening, a door member for said opening comprising a heat insulating partition and a refrigerating machine, means for supporting said door member for movement about a vertical axis, said refrigerating machine comprising an evaporator, a condenser, a compressor and an electric motor for driving said compressor, a casing forming a compression chamber, said motor and compressor being enclosed in said casing, said evaporator being located on one side of said partition, said casing being spring mounted on said partition on the other side from said evaporator, said condenser being located on the same side of said partition as said casing, and an enclosure mounted on said partition, said enclosure surrounding said condenser and said casing.

10. A refrigerator cabinet having a door opening, a door member for said opening comprising a heat insulating partition and a refrigerating machine, means for supporting said door member for movement about a vertical axis, said refrigerating machine comprising an evaporator, a condenser, a compressor and an electric motor for driving said compressor, a casing forming a compression chamber, said motor and compressor being enclosed in said casing, said evaporator being located on one side of said partition, said casing being spring mounted on said partition on the other side from said evaporator, said condenser being located on the same side of said partition as said casing. and piping connecting said casing with said condenser and said evaporator, said piping being coiled so as to take up vibrations in said casing.

11. A refrigerator cabinet having a door opening, a door member for said opening comprising a heat insulating partition and a refrigerating machine, means for supporting said door member for movement about a vertical axis, said refrigerating machine comprising an evaporator, a condenser, a compressor and an electric motor for driving said compressor, a casing forming a compression chamber, said motor and compressor being enclosed in said casing, said evaporator being located on one side of said partition, said casing being spring mounted on said partition on the other side from said evaporator, said condenser being located on the same side of said partition as said casing, a float chamber communicating with said evaporator and controlling the flow of refrigerant thereto, and piping connecting said casing with said condenser and said float chamber, said piping being coiled so as to take up vibrations in said casing.

12. A refrigerator cabinet having a door opening, a door member for said opening comprising a heat insulating partition and a refrigerating machine, means for supporting said door member for movement about a vertical axis, said refrigerating machine comprising an evaporator, a condenser, a compressor and an electric motor for driving said compressor, a casing forming a compression chamber, said motor and compressor being enclosed in said casing, said evaporator being located on one side of said partition, said casing being spring mounted on said partition on the other side from said evaporator, said condenser being located on the same side of said partition as said casing, a float chamber communicating with said evaporator and controlling the flow of refrigerant thereto, and piping connecting said casing with said condenser and said float chamber, said piping being coiled so as to take up vibrations in said casing.

13. A refrigerator cabinet having a door opening, a door member for said opening comprising a heat insulating partition and a refrigerating machine, means for supporting said door member for movement about a vertical axis, said refrigerating machine comprising an evaporator, a condenser, a compressor and an electric motor for driving said compressor, a casing forming a compression chamber, said motor and compressor being enclosed in said casing, said evaporator being located on one side of said partition, said casing being spring mounted on said partition on the other side from said evaporator, said condenser being located on the same side of said partition as said casing, a float chamber communicating with said evaporator and controlling the flow of refrigerant thereto, piping connecting said casing with said condenser and said float chamber, said piping being coiled so as to take up vibrations in said casing, said piping being also coiled about said float chamber, and an enclosure mounted on said partition, said enclosure surrounding said condenser, said casing and said float chamber, said enclosure having openings at the bottom and top, said condenser and said casing being cooled by an induced current of air through said enclosure.

In witness whereof I have hereunto set my hand this 10th day of September, 1928.

CHRISTIAN STEENSTRUP.