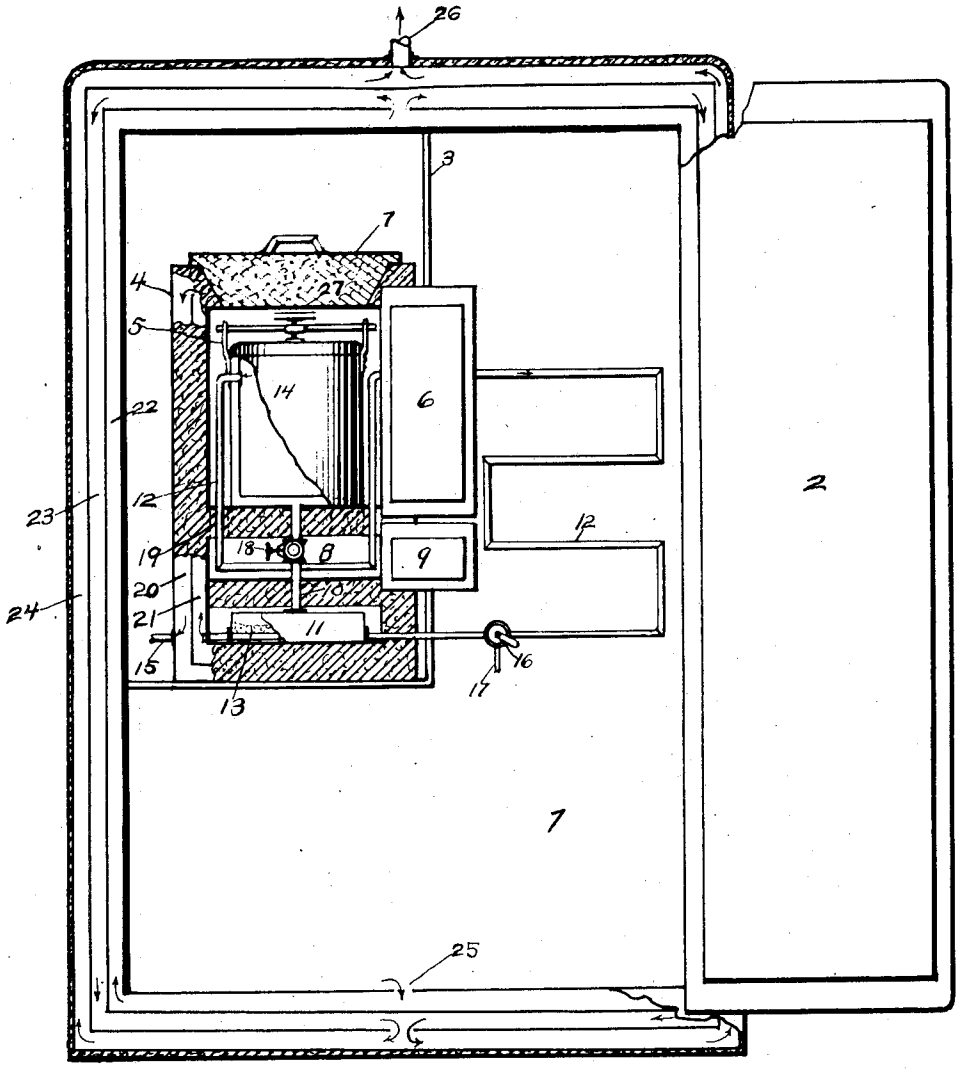
Jan. 31, 1933. H. H. CARPENTER 1,895,971

REFRIGERATING DEVICE

Filed March 17, 1930



INVENTOR

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Patented Jan. 31, 1933

1,895,971

UNITED STATES PATENT OFFICE

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REFRIGERATING DEVICE

Application filed March 17, 1930. Serial No. 436,539.

My present invention relates to a refrigerator comprising the conventional refrigerator compartment for either stationary or portable use in which ice or other refrigerating apparatus is customarily used to maintain the proper temperatures, in place of which I use a low temperature refrigerant; the object being to provide in connection with such refrigerating compartment a means adapted to the use of an extremely low temperature refrigerant, as for instance carbon dioxide snow, which has great refrigerating power in a small volume; second to provide means to retard the refrigerating effect of a low temperature refrigerant; and third to automatically control and vary as desired the refrigerating effect produced by a low temperature refrigerant; fourth to cool a low temperature compartment and using the residual cooling effect to refrigerate a relatively higher temperature compartment and thereby increase the efficiency of the refrigerant; fifth to completely utilize the refrigerating effect of the gases given off by the low temperature refrigerant.

In the accompanying drawing is shown in front elevation a refrigerating compartment with the improvements adapted to carry out the above stated objects installed therein.

Referring to the drawing, I provide a refrigerating compartment 1, having a door 2, and a support 3, which carries the container 4 formed of non-heat-conducting material. The container 4 has a main compartment 5, a door 6, and a cover 7, also a sub-compartment 8 for low temperatures, and a door 9. The reservoir 11 partially filled with a volatile liquid 13 is positioned within the insulated container 4. The receptacle 11 is connected with the space between the double walls of the receptacle 14 by the conduit 10 and closed by the valve 18.

The low temperature refrigerant receptacle 14 is connected to the gas conduit 12 adapted to refrigerate both refrigeration compartments 1 and 8 by the gas evolved by the low temperature refrigerant. The coil 12 finally passes through the receptacle 11 and through the insulating gas spaces 21 and 20 around the container 4, and ends at 15. The container 14 has a removable cover held down by a clamp screw member 27 to form a gas tight joint. Compartments 5 and 8 are connected by a plurality of openings 19. The coil 12 contains near its end a three-way valve 16 having an opening 17. The container 4 and the compartment 1 both have a series of concentric spaces in their outer walls adapted to contain the outflowing CO_2 gas which acts as an insulating medium. The container 4 has such insulating gas spaces 20 and 21, and compartment 1 similar spaces 22, 23 and 24.

In the operation of the device the container 14 is filled when needed with a low temperature refrigerant such as carbon dioxide snow which has a temperature of around 100 degrees below zero F. When the temperature of the low temperature refrigerating compartment 1 rises above the point desired, heat will be extracted from the gas of the low temperature refrigerant flowing through the coil 12 and out at 15. If the discharged carbon-dioxide gas flowing through the coil 12 and finally through the chamber 11 has a temperature above the boiling point of the liquid 13 in the chamber 11 it will cause it to boil. The resultant gas passes through the conduit 10 and condenses in the space between the double walled container 14, the condensed liquid returning to the receptacle 11. The heat thus conveyed to the low temperature refrigerant in receptacle 14 causes it to gasify and produce refrigeration in compartment 1. Further generation of gas from the liquid in chamber 11 stops as soon as the gas flowing from the coils 12 is below its boiling point. On a rise of temperature in compartment 1 the cycle is again repeated.

The low temperature refrigerating compartment 8 is refrigerated partly by the coil 12 passing therethrough and partly by the atmosphere from the compartment 5 circulating through the openings 19.

The three way valve 16 in the line 12 may be turned to discharge the contained gas out the opening 17.

By thus diverting a part of the gas normally flowing through the conduit in chamber 11 a means to control the temperature

in compartment 1 is attained by partially or wholly cutting out the thermostatic action of the liquid in the chamber 11 which causes in turn a variation in the amount of the low temperature refrigerating gas generated. The discharged gas from the conduit 12 passes upward from member 11 in the hollow space 21 and on reaching the top of the container 4 flows down through an outer surrounding space 20 and finally out conduit 15 into compartment 1. A similar path is followed by the CO_2 gas on leaving compartment 1. Passing out through the opening 25 the gas then flows upwardly through the surrounding hollow space 22, thence down through the surrounding space 23, thence upwardly through the space 24, and finally discharges out through the conduit 26. Any number of consecutive hollow spaces might be used. I find that CO_2 gas is a good insulating medium. The object sought here is to utilize its insulating property to retard the heat inflow by having concentric layers of slowly moving outgoing gas surround the refrigerating compartments. Similar methods of using the insulating properties of CO_2 gas to insulate any compartment requiring refrigeration might be used, as for instance shipping containers, refrigerating cars, and ice cream cabinets.

The chamber 11 containing the liquid 13 is virtually a thermostat in its action, except that in place of using the pressure of the contained liquid to control the flow of the refrigerant in the coils the heat in the gas generated is used to vaporize the low temperature refrigerant and thereby increase the refrigerating effect. The stoppage of the generation of the gas in the thermostatic member stops the refrigerating effect.

It is to be understood that the thermostatic member 11 plays no part in refrigerating the compartment 1, but acts only as a control means of the temperature therein. The liquid 13 may be sulphur dioxide for instance or any other compound adapted to vaporize at a predetermined temperature so as to hold the compartment 1 at the temperature desired by the operator.

Coil 12 extends through a portion of compartment 1, exterior to the container 4, and then enters that container and communicates with the refrigerant receptacle 14. Compartment 1 is refrigerated mainly by the heat absorbed through the coils 12 by the gas from the low temperature refrigerant vaporized in the refrigerant receptacle 14. The pipes which extend into the refrigerant receptacle are conductors of heat and some heat from chamber 1 is continually penetrating the insulating material to cause the slow and continuous evolution of gas. Applicant's device serves to accelerate or retard the rate of sublimation of the solid carbon-dioxide according to the temperature in compartment 1. A further absorption also takes place after it is discharged from the end of the coils at 15 into the compartment 1. By the direct heat absorption through the coils 12 and the final discharge of the low temperature refrigerant gas into the compartment 1, the highest efficiency is attained. The use of brines or other intermediate transfer agents of heat with their expense of maintenance, added weight and inefficiency are entirely avoided.

The secondary compartment 8 is held at a very low temperature and may be used to store such foods as are required to be frozen, or for the freezing of ice or other purposes requiring low temperature.

It is to be understood that the refrigerating compartment 1 may be, a refrigerating car, a motor truck body, a stationary refrigerator box, or other device in which refrigeration is required. It is also understood that the exact means shown for setting up and controlling the refrigerating effects may be changed and that any other changes might be made in the invention as shown without departing from the spirit thereof as claimed.

Having thus described my invention I claim:

1. In a refrigerator, in combination with a refrigerating compartment, a container adapted to contain a low temperature refrigerant, a conduit connected to the said container and adapted to use the refrigerating effect of the gases from the low temperature refrigerant by their passage through the said conduit, means arranged to cause the gases from the low temperature refrigerant if above a predetermined temperature on passing through the said conduit to volatilize a liquid, the volatile product of said liquid in turn volatilizing a low temperature refrigerant in the said container.

2. In a refrigerator, in combination with a refrigerating compartment, a container adapted to contain a low temperature refrigerant, a conduit connected to the said container and adapted to use the refrigerating effect of the low temperature refrigerant gas by its passage through the said conduit, a volatile liquid positioned to receive heat from said outgoing gas from the said conduit, means arranged to cause the said volatile liquid to govern the flow of the gas through the said conduit from the low temperature refrigerant.

3. In a refrigerator, in combination with a refrigerating compartment, a container adapted to contain a low temperature refrigerant, a conduit connected to the said container and adapted to use the refrigerating effect of the low temperature refrigerant gas by its passage through the said conduit, a volatile liquid positioned to receive heat from said outgoing gas from the said conduit, means so arranged that when the said volatile liquid is in its liquid state it ceases to

cause the low temperature refrigerant to produce refrigeration in the refrigerating compartment.

4. In a refrigerator, in combination with a refrigerating compartment, a container adapted to contain a low temperature refrigerant, a conduit connected to the said container and adapted to use the refrigerating effect of the low temperature refrigerant gas by its passage through the said conduit, a volatile liquid positioned to receive heat from the outgoing gas from the said conduit, a valve controlled conduit to vary the amount of heat received by the said volatile liquid, means arranged to cause the said volatile liquid when volatilized to govern the flow of the gas from the low temperature refrigerant through the conduit to produce refrigeration.

5. In a refrigerator, in combination with a refrigerating compartment, a container adapted to contain a low temperature refrigerant, a conduit connected to the said container and adapted to use the refrigerating effect of the low temperature refrigerant gas by its passage through the said conduit, a volatile liquid positioned to receive heat from the outgoing gas from the said conduit, means to regulate the flow of the gases from the said volatile liquid, means arranged to cause the volatile product of said liquid to govern the flow of the gas through the said conduit from the low temperature refrigerant.

In testimony whereof, I have signed my name to this specification.

HOWARD H. CARPENTER.