Oct. 11, 1932. B. H. WESTON 1,882,237

REFRIGERATING APPARATUS

Filed April 9, 1928

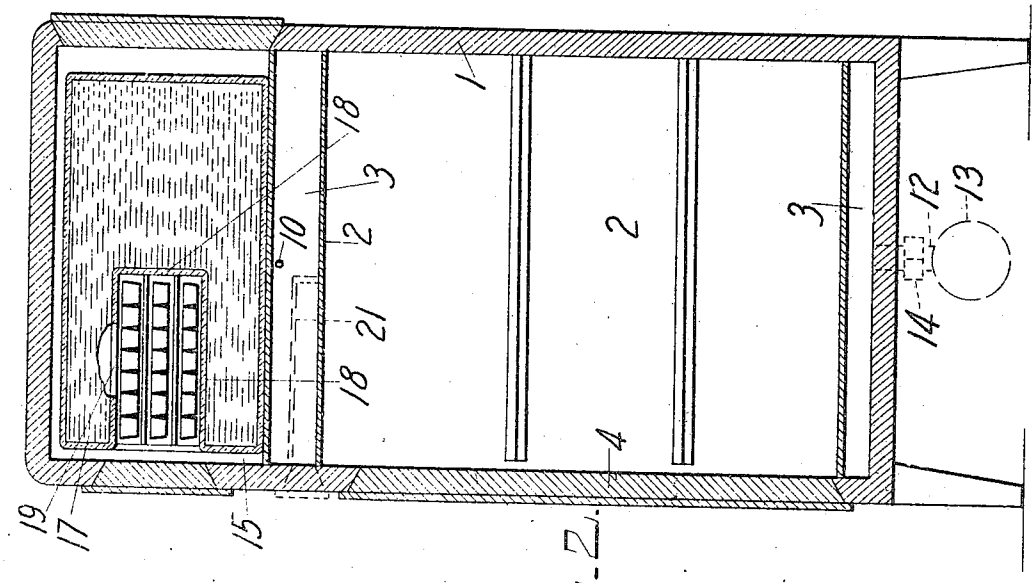


Fig. 2.

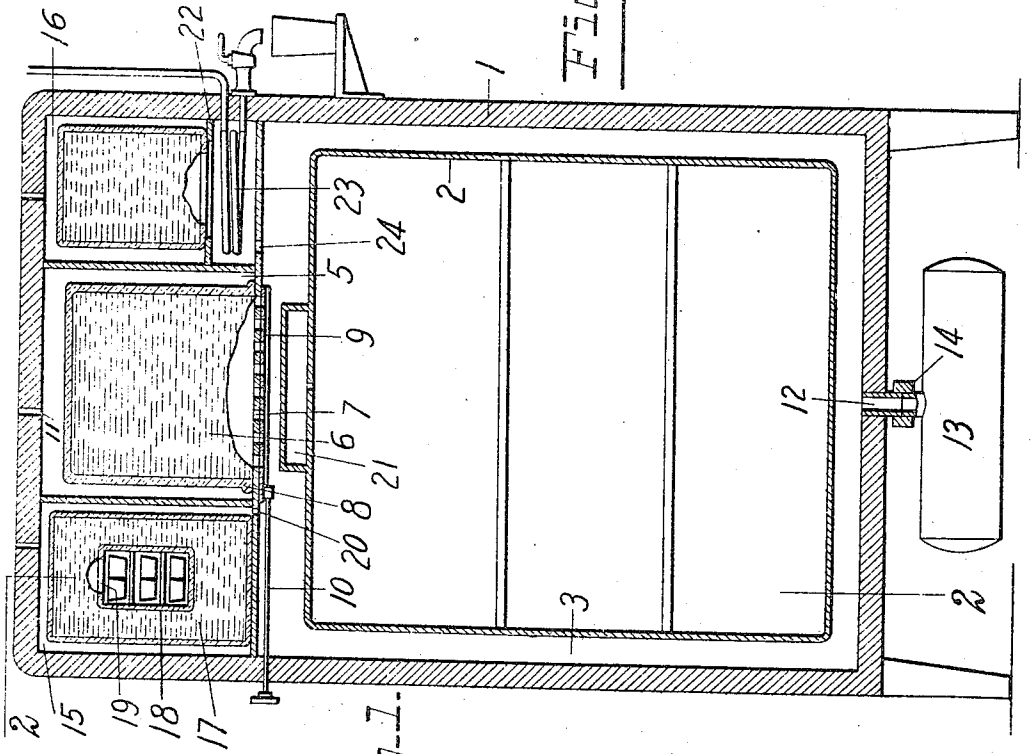


Fig. 1.

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REFRIGERATING APPARATUS

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This invention relates to refrigerating apparatus and more particularly to a refrigerating apparatus adapted to the use of solidified carbon dioxid.

It is well known that solidified carbon dioxid (CO_2) will produce a very low temperature but so far as I am informed no method or apparatus has been provided for the practical and economical utilization of the same as a refrigerant, the experimental uses which have been made having been wasteful and impractical from a commercial standpoint. Carbon dioxid when solidified is in the form of a snowlike substance which, by subjecting the same to a high pressure, may be formed into very hard cakes or blocks of any desired shape. When exposed the solidified carbon dioxid is slowly reconverted into gas and the gas thus given off has a very low temperature, and when pressed into solid blocks the gas is given off very slowly. Because of the slow evolution of the gases and the low temperature thereof a given quantity of solidified carbon dioxid will produce the same temperature and maintain such temperature for the same length of time as a very much larger quantity of ice, or a given quantity of solidified carbon dioxid will produce a much lower temperature and maintain the same for a much longer time than will the same quantity of ice.

One object of the invention is to provide a practical economical method and apparatus for utilizing solidified carbon dioxid for refrigerating purposes.

A further object of the invention is to provide a domestic refrigerator in which solidified carbon dioxid may be used as the refrigerant.

A further object of the invention is to provide such an apparatus which will be simple in its construction, inexpensive to produce and which may be operated conveniently and at a small expense.

A further object of the invention is to provide such a refrigerator with means for producing in a restricted area a very intense cold.

A further object of the invention is to provide a refrigerating apparatus of this kind with means for recovering the exhausted gas, so that it may be again solidified.

Other objects of the invention will appear as the invention is described in detail.

In the accompanying drawing Fig. 1 is a longitudinal vertical section taken through a domestic refrigerator embodying my invention; and Fig. 2 is a transverse sectional view of the same taken on the line 2—2 of Fig. 1 looking from right to left.

In this drawing I have illustrated one embodiment of my invention and have shown the same in the form of a domestic refrigerator but it will be understood that this particular embodiment has been chosen for the purpose of illustration only and that the apparatus may take various forms and may be used for various refrigerating purposes.

In carrying out my invention the solidified carbon dioxid is placed in a container or refrigerant chamber and such portion of the cake is exposed as may be necessary to produce the desired temperature. Preferably the cake of carbon dioxid is enclosed in a wrapping or cover of insulating material of some suitable kind, such as a heavy paper, the insulation being omitted from a part or all of the lower side of the cake. This, however, would depend upon the character of the apparatus being used. The refrigerant chamber has an outlet opening through which the gas given off by the carbon dioxid cake may escape and this gas is conducted through suitable passageways or conduits about a container for the substance which is to be chilled. Beyond the container for the substance which is to be chilled the passageway is provided with a suitable outlet through which the gas may escape, thus maintaining a circulation in the passageway and discharging the spent gas. The gas being absolutely dry and non-poisonous in character it may be discharged directly into the atmosphere but for the purpose of economy a gas receptacle may be connected with the outlet for the purpose of recovering the gas, which may then be again solidified by proper treatment.

In that embodiment of the invention here illustrated the refrigerator comprises a cabi-

net 1 similar to the cabinet of an ordinary refrigerator. Arranged within this cabinet is a container 2 for the substances which are to be chilled and which may be conveniently characterized as a food receptacle. This food receptacle is arranged within the cabinet as to permit the circulation of gas about the same and, in the present instance, a top, bottom and end walls of the receptacle are spaced from the corresponding walls of the cabinet to form passageways 3. The front wall of the receptacle is coincident with the front wall of the cabinet and the door 4 permits of access to the receptacle. The upper part of the cabinet is provided with a refrigerant chamber which is adapted to receive a cake of solidified carbon dioxid as shown at 6. The lower portion of the chamber, in the present instance the bottom wall thereof, is provided with an opening 7 which will expose that portion of the cake immediately above the same and through which the gas given off by the cake of carbon dioxid may enter the passageways 3. This gas being materially heavier than air will flow by gravity through the passageways. The cake is shown as protected by an insulating cover 8 on all but the bottom side thereof. If desired, means may be provided for regulating the size of the opening 7 and, as here shown, that opening comprises a series of slots in the bottom wall of the chamber and a gate or shutter 9 having similar slots is slidably mounted beneath the bottom wall of the chamber and may be actuated by a handle 10 to regulate the size of the slots and thus vary the total area of the opening leading from the chamber to the passageways. To permit the free flow of the gas from the chamber to the passageway the chamber may be vented, as shown at 11. The vent is very small and is arranged above the cake of carbon dioxid so that no gas will escape through the same and only a very small quantity of air will enter the chamber.

At a point beyond the food receptacle 2 and, in the present instance, in the bottom wall of the cabinet, is an outlet communicating with the passageways 3, which may, if desired, be in the form of a pipe 12. As has been stated, it is preferable to recover the gas in order that it may be again used and for this purpose I have connected with the outlet pipe 12 a gas receptacle 13 which, in the present instance, is cylindrical in form and is connected with the pipe 12 by a coupling 14 so that a filled receptacle may be readily removed and an empty one substituted therefor. I prefer to place within the gas receptacle 13 a gas absorbing substance, such as caustic potash (KOH) which has the capacity of absorbing many times its own bulk of gas. The capacity of the receptacle 13 may be in such proportion to the refrigerant chamber 5 that it will receive all the gas given off by a cake of carbon dioxid placed within the receptacle. Thus the gas receiver may be removed and a fresh one substituted therefor each time a fresh cake of carbon dioxid is placed in the refrigerant chamber.

The refrigerator may be readily adapted for cooling drinking water or for freezing liquids or other substances. The cake of carbon dioxid which is used for chilling the food receptacle may be utilized for these purposes but, in the present arrangement, I have provided for the use of separate cakes of carbon dioxid for freezing and for cooling water. To this end the upper portion of the cabinet is provided, on the respective sides of the refrigerant chamber 5, with supplemental refrigerant chambers, 15 and 16, these chambers being somewhat smaller than the chamber 5 and each adapted to receive a cake of solidified carbon dioxid. The chamber 15 contains a freezing chamber, which may be characterized as a "cold oven", and which is adapted to receive receptacles containing liquid or other substances which it is desired to freeze solid. It is necessary therefore, that the freezing chamber or oven should be subjected to an intense cold, in the present instance, it is of such a character that it will be surrounded on all but one side by solidified carbon dioxid. This may be conveniently accomplished by molding the cake of carbon dioxid 17 with a cavity, the walls of which are insulated, as shown at 18, in which may be supported one or more receptacles. In the present instance, shelves are arranged in each cavity so that three receptacles may be mounted therein one above the other. The insulating material for the upper wall of the cavity is provided with an opening 19 so that the carbon dioxid gas will enter the cavity and circulate about the receptacles therein and will then escape into the main chamber 15 from which it may be discharged through an opening 20 into one of the passageways 3. In the preparation of desserts and the like it may be desirable to chill the substances to a lower temperature than that maintained in the food receptacle but not to freeze the same and I have therefore provided a second cold oven 21 directly beneath the main refrigerant chamber 5, which is so arranged that a plurality of sides thereof will be exposed to the gases escaping from that chamber.

The chamber 16 is divided by a partition 22 into two compartments, the upper of which receives the cake of solidified carbon dioxid and the lower of which contains a cooling coil 23 formed in a water pipe. The partition 22 has an opening therethrough so that the carbon dioxid gas may pass from the upper compartment, about the coils and through an opening 24 into one of the passageways 3. It will be obvious that in the event it should be desired to utilize a circulating re-

frigerating liquid, such as brine, that a brine coil, similar to the coil 23, may be utilized, this coil then constituting the container for the substance to be chilled.

While I have shown and described one embodiment of my invention I wish it to be understood that I do not desire to be limited to the details thereof as various modifications may occur to a person skilled in the art.

Having now fully described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. A refrigerator comprising a chamber adapted to receive a cake of solidified carbon dioxid, a food receptacle arranged beneath said chamber, passageways leading from said chamber about said food receptacle, a second chamber, a block of solidified carbon dioxid arranged within said second chamber and having a cavity to receive a substance which is to be frozen.

2. A refrigerator comprising a cabinet having in the upper portion thereof a main refrigerant chamber and two supplemental refrigerant chambers, each of said chambers being adapted to receive a block of solidified carbon dioxid, a food receptacle arranged beneath said chambers, passageways leading from said main refrigerant chamber about said food receptacle, each of said supplemental chambers having communication with said passageways, the cake of carbon dioxid in one of said supplemental chambers being shaped to provide a cold oven, and a coil of water pipe arranged beneath the cake of carbon dioxid in the other of said supplemental chambers.

3. In a refrigerating apparatus, a container for solidified carbon dioxid, a second container arranged below the first mentioned container and adapted to receive a substance to be chilled, a passageway communicating with the first mentioned container, extending about the exterior of said second container and having near its lower end an outlet to which carbon dioxid gas will flow by gravity, and a gas recovering device connected with said outlet.

4. In a refrigerating apparatus, a structure having a chamber to be chilled, a container for solidified carbon dioxid having an opening in the bottom wall thereof arranged to expose only that surface of said carbon dioxid which rests on said wall and through which carbon dioxid may escape, a passageway communicating with said opening and arranged to conduct said gas about the exterior of said chamber which is to be chilled, and a gas receiver communicating with said passageway at a point beyond the chamber to be chilled.

5. A refrigerator comprising a chamber adapted to receive a cake of solidified carbon dioxid and having an opening in the lower part thereof to expose a portion only of said cake, a food receptacle arranged below said chamber, a passageway extending about the exterior of said food receptacle and communicating with said opening to conduct the gas given off by said carbon dioxid about said food receptacle, said passageway having an outlet at a point near the lower end of said food receptacle, and a gas receiver connected with said outlet.

6. A refrigerator comprising a cabinet having in the upper portion thereof a chamber to receive solidified carbon dioxid, said chamber having an opening in the bottom wall thereof to expose a portion only of said carbon dioxid, a food receptacle arranged beneath said chamber, a passageway for said carbon dioxid gas leading from said opening about the exterior of said receptacle, a container for gas absorbing material, and means for detachably connecting said container with said passageway.

7. In a refrigerating apparatus, a structure having a closed chamber to be chilled, a container for solidified carbon dioxid arranged above said chamber and having an opening in the bottom wall thereof arranged to expose only that surface of said carbon dioxid which rests on said wall and through which carbon dioxid gas may escape, and a passageway communicating with said opening and arranged to conduct said gas about the exterior of said chamber, said passageway having a restricted outlet near the bottom of said chamber.

In testimony whereof, I affix my signature hereto.

BURT H. WESTON.