

Aug. 9, 1960

W. L. MORRISON

2,948,123

METHOD OF FREEZING FOODSTUFFS AND THE LIKE

Filed Aug. 20, 1957

Fig. 1

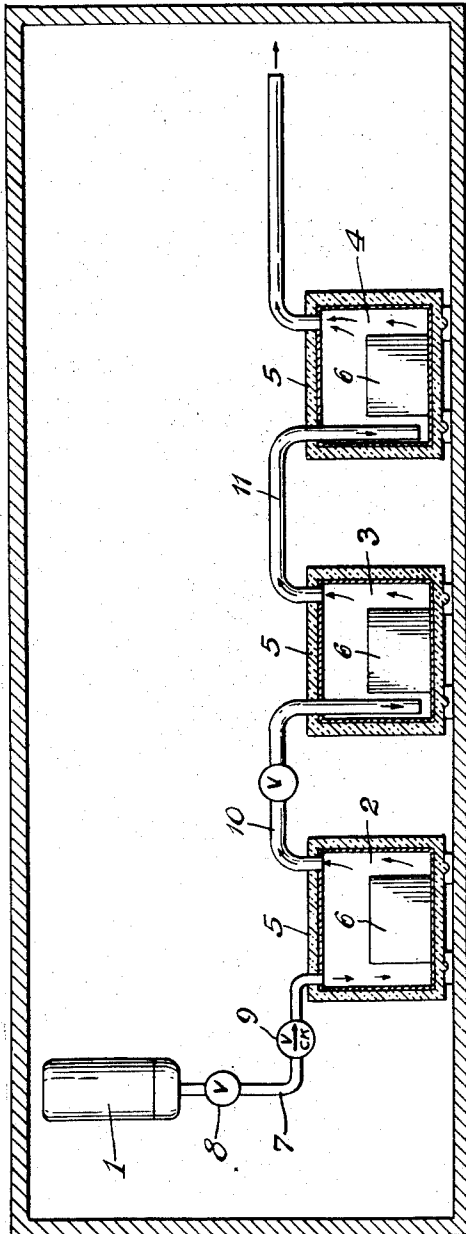
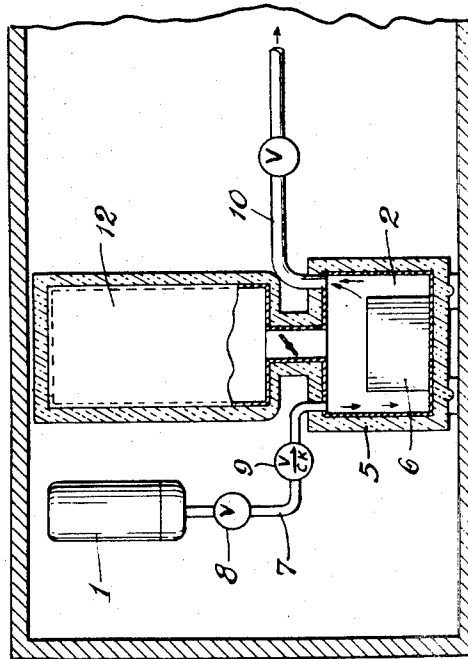


Fig. 2



Inventor
Willard L. Morrison
by Parker & Carter
Attorneys

1

2,948,123

METHOD OF FREEZING FOODSTUFFS AND THE LIKE

Willard Langdon Morrison, Lake Forest, Ill., assignor, by mesne assignments, to Liquefreeze Company, Inc., New York, N.Y., a corporation of New York

Filed Aug. 20, 1957, Ser. No. 679,311

3 Claims. (Cl. 62-64)

My invention relates to a method of freezing foodstuffs and the like for storage and shipment at temperatures far below freezing by the use of cold boiling liquids. Liquid nitrogen, liquid air, and other liquids inert in the sense that they neither form combustible nor explosive mixtures with air, may be used provided those liquids at or about atmospheric pressure are far below zero degrees F. When foodstuffs or similar materials are to be stored or held in frozen condition during shipment for long periods of time the temperature must be not zero but far below it.

While I prefer to maintain the liquid and resultant gases or vapors at approximately atmospheric pressure, the pressures may under some circumstances be above that point.

I propose to pack the material to be frozen loosely enough in a plurality of gas and liquid tight, preferably insulated storage and shipping containers to permit liquid and gas penetration into the interstices or spaces between the packages or bodies of the material.

The containers will be arranged in series and at the start of an operation, each container will contain the material in the presence of air.

I propose to introduce the cold boiling liquid, perhaps nitrogen, at -320 degrees F. into the first container. The heat of the material and the container will cause such liquid to boil without rise of temperature but with resultant expansion of the gas at the boiling temperature. This will either expel the air from the container or some of the air will be mixed with the gas and brought down to the temperature thereof.

When the first container is filled with the cold gas further evaporation of the liquid will build up a sufficient pressure in the chamber or container to cause the gas to flow from the first chamber to the next chamber in series. The cold gas will preferably be discharged into the next chamber at the bottom thereof and as the gas gradually fills the chamber, it will be warmed, will expand and will mix with the air in the chamber. The gas discharged from the second chamber will be at a temperature above that of the gas discharged from the first chamber and will be discharged into the third chamber in the series in the same manner. This sequence of gas passage through a plurality of chambers in series will continue until the temperature of the gas discharged from the last chamber in the series has risen to a point at which its temperature is perhaps near the temperature of the material originally packed in the container.

By this time the first container and its contents will have been brought down to the desired low temperature so the first chamber is taken out of the series, additional cold boiling liquid is supplied to the second chamber in the series and another chamber is added to the high temperature end of the series and the process continues. By this arrangement, the temperature is brought down step by step by heat exchange with first the cold boiling liquid and then the cold gas evaporated therefrom.

This makes it possible to load the chambers with foodstuffs and the like in a relatively warm atmosphere. If

2

desired, the room in which the loading of the chambers takes place may be cooled by the cold gas discharged from the last chamber in the series or may be used for any other desired purposes.

5 The containers will preferably be insulated and the freezing of the foodstuffs can take place in the same insulated container in which the material is to be stored or shipped.

The pressure relief valves, under some circumstances, 10 may be used in the conduits joining the chambers or containers or at the end of the line so as to cause a sufficient pressure to be built up to insure of penetration of the cold gas into the interstices between the packages if the food is packaged or the objects themselves if they are not packaged.

The same principle may equally well be applied to the cooling of foodstuffs in a single step in a single cooling chamber. Under these circumstances there would be associated with a cooling chamber an expansion chamber 20 so that when the cold boiling liquid was condensed in the cooling or storage and shipment chamber and began to evaporate or boil off, the expansion chamber would receive the gas expelled from the food container chamber so that the cold gas will not be spilled out and wasted. 25 As the temperature of the gas in the chamber rises, gas from the expansion chamber will return to the cooling chamber.

A predetermined amount of cold boiling liquid may be added to the first container in the series and then after it evaporated, the container may be taken out of the series 30 and liquid added to the next chamber series and so on. On the other hand, a continuous supply of the liquid might be desirable.

This application is a continuation in part of my co- 35 pending application Serial No. 514,321 filed June 9, 1955, issued April 22, 1958 as Patent No. 2,831,329.

My invention is illustrated in the accompanying drawings, wherein:

Figure 1 is a diagram illustrating one exemplification of 40 my invention; and

Figure 2 is a diagram illustrating a somewhat simpler exemplification of my invention.

Like parts are indicated by like characters throughout the specification and drawings.

45 A source of a cold boiling liquid is indicated at 1 such as liquid nitrogen which for example is at -320 degrees F. at atmospheric pressure. The source as far as my invention is concerned may be a plant wherein liquid nitrogen is produced or it may be an insulated tank in which 50 liquid nitrogen is being stored.

A superchill shipper container is indicated at 2, and 3 and 4 are precooling shipper containers. Each of the shipper containers is insulated at 5 and contains foodstuffs or other material to be frozen, loosely packed 55 therein at 6. Liquid nitrogen is supplied to the shipper container 2 through duct 7. Flow of liquid nitrogen is controlled by flow control valve 8 and a check valve 9 in the duct 7 between the flow control valve 8 and the shipper container 2 prevents reverse flow in the duct 7.

60 When liquid nitrogen preferably though not necessarily in predetermined quantity is caused to enter the superchill shipper container, it will be in heat exchange relationship with the material to be frozen and with the walls of the container. The heat of this material and 65 the walls will cause the liquid nitrogen to boil and as a result the liquid evaporates and resumes its gaseous phase while the walls of the container and the stuff being frozen are both reduced in temperature. The gas boiled from the liquid will be at substantially the same pressure as the liquid nitrogen itself and will, where it comes in contact 70 with the foodstuffs and the container walls assist by heat

3

exchange in cooling them, thus raising its temperature to some extent.

A gas duct leads from the top of the superchill container 2 and discharges into the bottom of the precooler shipper container 3. Such gas when it enters the precooler container may be at approximately -250 degrees F. and will by heat exchange with the walls of the shipper container 3 and its contents be warmed as it cools the chamber and contents, rising from the bottom of the container to the top for discharge through the gas duct 11 to the bottom of the next precooler shipper container 4 where the same type of heat exchange takes place at of course a higher temperature, the temperature of the gas entering the second precooler shipper container may for example be at approximately -250 degrees F. and the temperature of the gas discharged from the final precooler shipper container may be at -50 degrees F.

This cold gas may be used for any suitable purpose. For example, it could be discharged into the room in which the shipper containers are filled with food or it may be in heat exchanged to assist in precooling or pre-freezing the foodstuffs before they are placed in the precooled shipper container.

When the nitrogen in the superchill shipper container is all evaporated and no further nitrogen in gaseous form is evolved, there will still be as temperature rises in the container some expansion of the gas supporting flow at a much lower rate from the superchill through the first precooler container. When the temperature in the superchill container has reached the desired low point, liquid nitrogen will be added to the first precooler container which now becomes the superchill container and a new precooler container will be put into circuit at the hot end of the series to receive the cold gas from the last precooler. Meanwhile, the container that was the superchill container is closed for storage or shipment.

Thus the individual containers will gradually step by step be lowered in temperature as they approach the head of the line where they are finally chilled with liquid nitrogen. I have shown only three of those containers but it will be understood that a multiplicity of containers in series may be used or that the containers might be arranged in parallel, a plurality of them receiving cold gas direct from the superchill container.

When the liquid nitrogen or other coolant is evaporated in the superchill container, it expands some six-hundred times in volume without substantial rise in temperature and that cold gas will much more than fill the container. Hence in the preferred form of the arrangement I conduct it to another container where the material is cooled by gas alone without contact with the liquid nitrogen. However, if desired a single container can be used. In such case, there will be associated with the superchill container above it, an expansion chamber 12 joined by a duct of large cross section so that as the cold gas boils off from the liquid after filling the superchill container, it will pass up into the expansion chamber and then as the gas at the lower part of the column is warmed by heat exchange with the foodstuffs on the walls of the shipper container it will rise to be replaced by cold gas descending by convention to the expansion chamber.

One application of my method is as follows: The various methods of freezing foodstuffs and the like down to the temperature at which such foodstuffs are stored and shipped under refrigeration, temperature in the order of something below zero degrees F. are well established and mechanisms and apparatuses and systems are presently in successful operation but in order to prevent the foodstuffs rising above a dangerous temperature, it has been customary in the past to provide after freezing while in storage and transit, refrigerating apparatus to maintain the low temperatures.

My method may follow the initial freezing of the foodstuffs and the like and is adapted to reduce the temperature substantially below the conventional tem-

4

peratures down perhaps to several hundred degrees below zero F. or somewhere, depending on circumstances, between that temperature and the usual temperatures in the order of slightly below zero depending on the length of time it is desired to be able to store the goods, what length of time required to ship the goods without additional refrigeration.

Therefore the frozen foodstuffs may be packed in insulated shipper containers and these shipper containers may then be placed in the series above disclosed and each shipper container will step by step be reduced in temperature and as successive shipper containers move forward in the series, the temperature attained, progressively decreases. If it is desired to get the minimum temperature, the shipper container will go through the entire cycle. If an intermediate temperature is adequate, the shipper container will be removed from the cycle as soon as the necessary minimum has been reached.

It is important to note in this connection that since the individual shipper containers and their contents are cooled and since the containers are insulated, the cold foodstuffs or if desired the foodstuffs before freezing, may be placed in the shipper container, the men working in a warm room and therefore avoiding the necessity of special clothing and the like. After each individual shipper container is closed, cooling of the container and its contents will proceed without substantial cooling of the area in which the men work and in which the individual shipper containers are cooled.

Frozen foods are usually packed in cartons which are not impervious to gas and such cold boiling fluids as liquid nitrogen and so when the shipper container filled with packages packed loosely, in the sense that they are not wedged together, though they might receive the discharge of liquid nitrogen, the liquid as it first contacts the outside of the package which is warm is vaporized and the expanded gas resulting from the boiling of the liquid is discharged from immediate contact with the wrapper. But as the temperature of the wrapper falls to the point where it is substantially at the temperature of the liquid, the wrapper is wet by the liquid and the liquid is able to penetrate through the wrapper to contact the foodstuffs themselves. It is that contact of the foodstuffs which because the foodstuffs cause the liquid to boil, which participates in the entire final process of cooling so that disregarding the use of successive stages, even if cooling is at one stage, when enough liquid nitrogen is discharged into the container, it first penetrates between the wrappers, cools the wrappers, then penetrates through the wrappers to the foodstuffs, cools the foodstuffs and the resultant gas is being continuously discharged so that finally when liquid is no longer supplied to the shipper container, it may be sealed up for shipment containing the foodstuffs chilled to a point far below normal freezing temperatures.

Assuming that the packages are not wedged into the container, since such packages are always somewhat irregular in shape and dimensions, variations being perhaps very small decimals of an inch, nevertheless they are loose enough in the sense that there can be liquid penetration into the spaces between the packages antedating liquid penetration through the wrappers themselves. Under some circumstances, it is worth while to so relate the inflow of liquid and outflow of gas that a very slight pressure will assist gravity in causing penetration of the liquid into the spaces between the packages.

In the drawing, I have shown very diagrammatically the food package as at 6 merely to emphasize the fact that there is a possibility of liquid flow around the packages. As a matter of commercial practice, each shipping container would be packed with food filling it closely enough so that it could be shipped without danger of substantial displacement of the food packages which fill the container and the drawing is therefore to be understood as diagrammatic.

The drawings are purely diagrammatic. The details of

5

connections to permit the supply of liquid and the escape of resulting gas form no part of the present invention and are merely suggested.

The container, having been filled with the material usually wrapped in paper or other types of wrapper pervious to liquid and gas, will, of course, be closed up sufficiently to avoid waste of liquid and gas, and to make it possible to control the supply of the cold boiling liquid and the escape of the gas. The cold boiling liquid will be discharged into the container, will wet and penetrate the wrappers, will come into direct contact with the foodstuffs in the wrapping, will boil, expand, expel air, and finally leave the container filled with the foodstuffs and the gas. When the temperature has reached the desired point, the gas and air connections, whatever they are, will be disconnected and the container sealed for shipment.

I claim:

1. The method of shipping perishable material such as foodstuffs which comprises the steps of packing a multiplicity of packages of the material wrapped in liquid pervious wrappers in an insulated liquid tight shipper container, pouring liquid nitrogen at atmospheric pressure into the container in contact with the packages until the packages are wet with the liquid whereby the heat of the material vaporizes the liquid to expel the air from the container and a desired low temperature far below zero degrees F. is reached, and closing the packed container for storage and shipment while the surfaces of the packages are still wet with the liquid.

2. The method of shipping perishable material such as foodstuffs which comprises the steps of packing a multiplicity of packages of the material wrapped in liquid

6

pervious wrappers in an insulated liquid tight shipper container, there being clearances between the packages, pouring liquid nitrogen at atmospheric pressure into the container in contact with the packages until the packages are wet with the liquid and clearances between the packages are filled with the liquid nitrogen whereby the heat of the material vaporizes the liquid to expel the air from the container, and closing the packed container for storage and shipment before the liquid has completely evaporated.

3. The method of shipping perishable material such as foodstuffs which comprises the steps of pre-freezing a multiplicity of packages of the material wrapped in liquid pervious wrappers, packing said pre-frozen packages in an insulated liquid tight shipper container, pouring liquid nitrogen at atmospheric pressure into the container in contact with the packages until the packages are wet with the liquid whereby the heat of the material vaporizes the liquid to expel the air from the container and a desired low temperature far below zero degrees F. is reached, and closing the packed container for storage and shipment while the surfaces of the packages are still wet with the liquid.

References Cited in the file of this patent

UNITED STATES PATENTS

2,447,249	Hill	Aug. 17, 1948
2,483,100	Morrison	Sept. 27, 1949
2,502,527	McFarlan	Apr. 4, 1950
2,552,030	Bludeau	May 8, 1951
2,618,939	Morrison	Nov. 25, 1952
2,831,329	Morrison	Apr. 22, 1958
2,875,588	Berger	Mar. 3, 1959