

Aug. 14, 1962

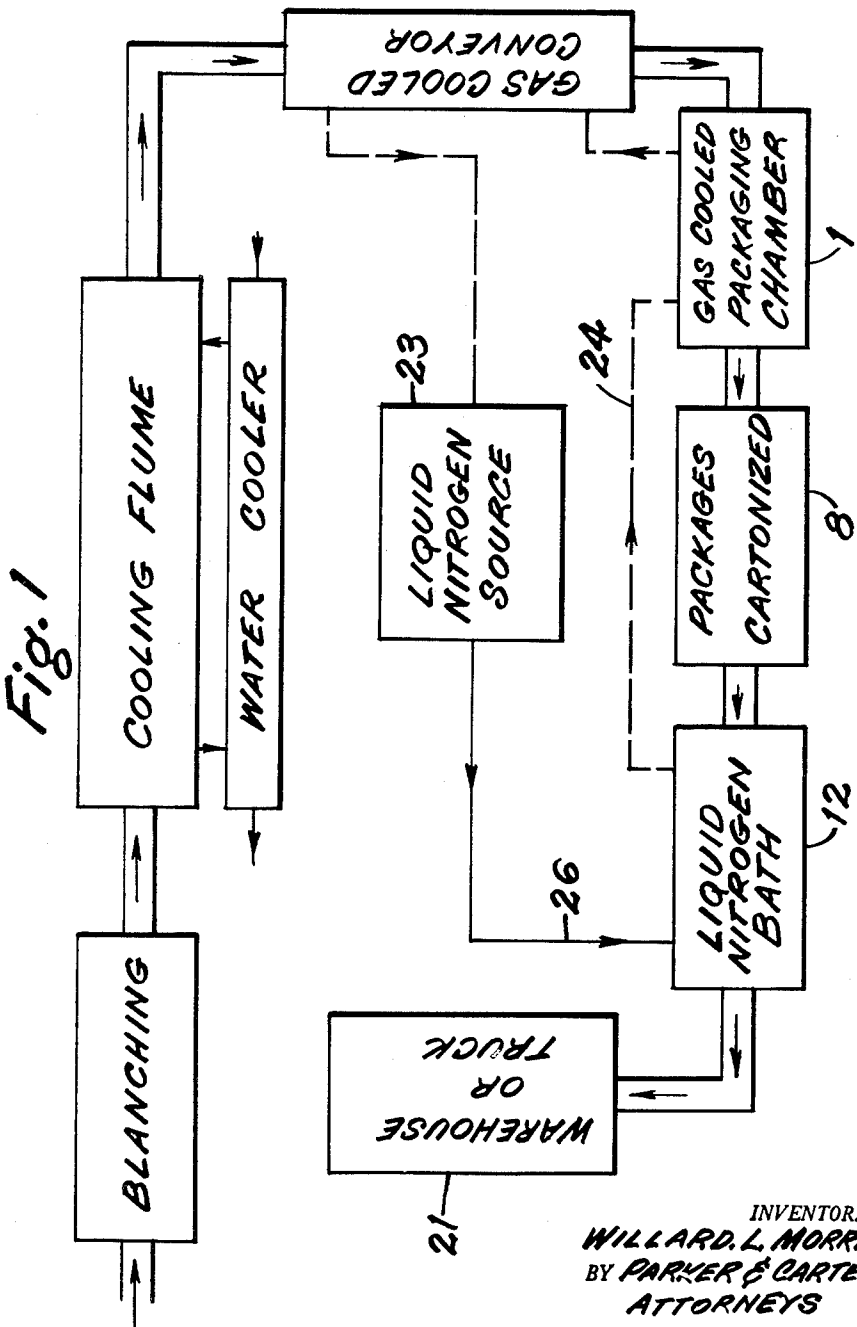
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APPARATUS FOR FREEZING FOOD

Original Filed Jan. 14, 1960

2 Sheets-Sheet 1



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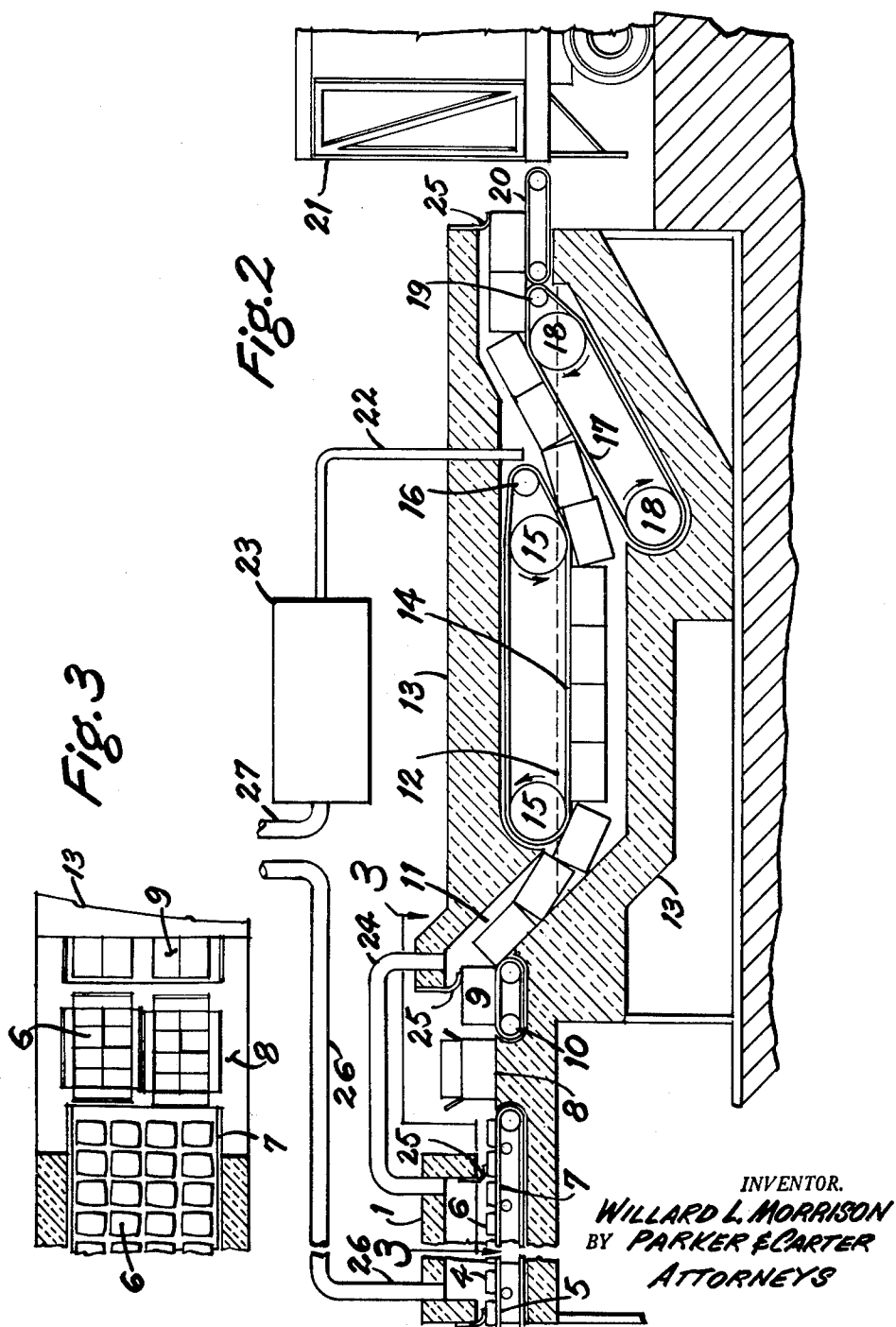
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APPARATUS FOR FREEZING FOOD

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Original application Jan. 14, 1960, Ser. No. 2,481. Divided and this application Jan. 24, 1961, Ser. No. 84,642

2 Claims. (Cl. 62—375)

My invention relates to apparatus for freezing food and has for one object to provide a method and apparatus which will eliminate much of the delay and cost now necessary in connection with the preparation of frozen food for the market.

I propose to pack the food in one pound or other suitable sized packages for use and then pack the soft, unfrozen packages in a carton, seal the carton and then freeze the carton and its contents by immersing it in a bath of liquid nitrogen at atmospheric pressure and -320 degrees F. The soft, unfrozen package can easily be placed in the carton and has sufficient strength to maintain its shape under the very light loads involved. The carton is rigid and stiff and retains its shape and strength even when wet with liquid nitrogen. Thus when the loaded carton is immersed and it and its contents wet with nitrogen and frozen by heat exchange down to the desired point, depending on how long it remains immersed. The contents of each package on freezing expands and expands the package so as to properly fill the carton with, for example, a dozen rectangular one pound food packages.

This obviates the necessity of providing time and space to freeze the individual packages by wind tunnel or cold plate and at the same time makes it unnecessary to handle and cartonize the frozen packages with resultant deterioration. The cartonizing is simple and easy and once cartonized, each individual package is protected during freezing and subsequent treatment.

It is proposed to use the gas evaporated from the bath by heat exchange to provide initial cooling of the packages before they are cartonized. They will not be cooled down to the freezing point but to a point just above it where they begin to freeze, perhaps where the contents are mushy so that they can be easily placed in the carton.

This application is a division of my co-pending application Serial No. 2,481 filed January 14, 1960.

Other objects will appear from time to time in the specification and claims.

The invention is illustrated diagrammatically in the accompanying drawings, wherein—

FIGURE 1 is a flow sheet;

FIGURE 2 is a vertical section through part of the apparatus.

FIGURE 3 is a plan view in part section of one end of the apparatus of FIGURE 2.

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

Referring to the flow sheet, the food—it might be peas for example—is blanched in the usual way in the blanching station. It then flows through a cooling flume immersed in water, the water being cooled by any suitable water cooler. The blanched, cooled peas are then carried from the flume through a gas cooled conveyor to a gas cooled packaging machine where in the usual way, perhaps beans or peas are packaged in preferably one pound or other suitable size packages. These packages are then cartonized at the cartonizing station and then fed through a liquid bath of liquid nitrogen, being kept in the bath for a suitable length of time depending upon the temperature to be desired. Thereafter the cartons without opening or without handling the individual packages flow to a warehouse or truck.

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Meanwhile the gas evaporated in the liquid bath is conducted as gas no longer in liquid phase to and passes through the package machine area, thence through the gas cooled conveyor area and back to the liquid source which, if desired, may be a reliquefaction plant where nitrogen is reliquefied. It then flows as liquid from the liquid source back to the bath. If the liquid source is not a reliquefier, then the gas after leaving the gas cooled conveyor can be wasted. If it is a reliquefier, the gas will be supplied thereto for reliquefaction.

Referring to FIGURES 2 and 3, the packaging chamber is illustrated diagrammatically at 1. One pound wrappers 4 are brought to it on a conveyor 5. They are filled with food, for instance, peas, the packaging mechanism forming no part of the present invention being not illustrated. The sealed packages 6 leave the packaging chamber 1 on the conveyor 7 and go to the cartonizing table 8 where the one pound packages are packed in the carton as shown. The sealed carton 9 is then fed by a conveyor 10 to a chute 11 and falls by gravity into the liquid nitrogen bath 12 in the insulated housing 13. The force of gravity on the column of cartons forces each in succession downwardly beneath the conveyor 14, which travels around rollers 15 driven by the drive roller 16 from any suitable variable speed source of power not shown. The belt 14 is on its lower run below the level of the liquid in the bath so that the filled cartons which tend to float are held below the liquid level and are conveyed forwardly through the bath by the belt 14. As the cartons leave the bath, they are forced upwardly onto the discharge belt 17, passing around pulleys 18, driven by any suitable source of power by the pulley 19. Each package as it rides up to the top of the belt 17 is received on the delivery belt 20 and fed into the shipper container 21. The liquid nitrogen is supplied to the bath 12 through a pipe 22 from a reliquefaction unit or liquid nitrogen source 23. The gas evaporated by the heat of the food in the bath passes out through a duct 24. Any suitable means 25 are provided at entrance and exit to minimize escape of the gas from the bath chamber. The duct 24 leads to the packing chamber and the gas then leads through a duct 26 to the nitrogen cooled conveyor whence the duct 27 leads to the liquefier.

The cooling effect of the liquid nitrogen is of course much greater than that of the gaseous nitrogen even at the same temperature because liquid nitrogen when it boils expands some six hundred times. The liquid nitrogen must remain in the bath so that all the foodstuff as it passes through will be wet with it for a sufficient length of time to produce the desired low temperature. The bath is at rest. The food passes through it but with respect to the gas boiled off, the gas is flowing. The foodstuff is traveling also but its travel has nothing to do with the temperature desired. The desired temperature of the food before it is cartonized is controlled by controlling the rate at which the gaseous nitrogen flows past. Or to put it another way, by controlling the proportion of the gaseous nitrogen which passes around the food in consonance with the proportion which can be returned directly for reliquefaction. Perhaps under some circumstances all the gaseous nitrogen will be passed around the unfrozen food. Perhaps under other circumstances only a part will be treated and the remainder with minimum rise in temperature will be returned for reliquefaction or wasted if reliquefaction is not used.

It is standard practice to freeze one pound or use size food packages in wind tunnels or between plates. When they are frozen in wind tunnels, they are hard to pack in cartons because they do not fit, because they expand and change their shape slightly.

The present invention makes separate package freezing unnecessary. The food may be packed in the usual

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way under convenient, well known, temperature conditions in separate packages. These packages may then be packed in the carton unfrozen, even at room temperature. I prefer to cool them slightly down toward but still above freezing because I have by my method, liquid nitrogen available which can be used easily and effectively to cool down toward freezing. The optimum would be to freeze the food down to the point at which it just begins to be a little mushy, then each separate one pound package is placed in a carton and the carton is sealed. Flimsy one pound packages expand and tend to go round or change their shape when they are cooled in the wind tunnel or between cold plates so that is why so much care must be taken but the carton if strong enough to stand shipment is strong enough to act as a form so that when the flimsy packages expand as they freeze, all twelve of them come in contact with one another and snugly fill the carton and each of them is rectangular and of proper shape.

It is of the utmost importance that each carton remain in the bath the desired length of time to insure the desired temperature drop. This merely means that the rate of speed of all the conveyors will be coordinated as is common in such industry to insure that each carton stays in the bath the desired length of time.

An important advantage is that when the carton with its frozen contents leaves the bath chamber on its way to storage or shipper container, the carton containing as it does, if not any unevaporated liquid nitrogen, at least cold gaseous nitrogen filling the pores of the carton, provides a protective envelope about the assembled packages to prevent contact of ambient air with them for a length of time sufficient to get them into cold storage or into the shipper container or into some area where ambient air will not deteriorate the package. This is in sharp contrast with the situation prevailing where the individual packages at zero or less degrees F. must be separately handled and packaged in cartons after freezing the special means must be taken to protect those individual packages before being cartoned against contact with the ambient air.

The carton serves as the shape or form so no special shaping and no special control of the shape or dimensions of the filled package is necessary.

The packages, wrappers or containers may be of paper waxed or unwaxed, thin cardboard or plastic but in each case they are soft, flexible and disposable. The carton is preferably of paper board, corrugated boxboard, plastic or even wood as the case may be and while it is disposable, it is stiff and rigid compared to the material of which the package wrappers themselves are made and this relationship is essential in that the flimsy wrappers must be free to expand and change shape slightly to adjust themselves to the freezing of the food in the usual way but they must be adequately resisted by the strength of the carton so that when they have made their expansion and change in shape, they will all be locked in place in contact with one another to fill the carton solidly to avoid loose handling and deterioration.

The foods which are packed may take the form of raw or uncooked vegetables—blanching is not cooking—which will fill the small disposable containers or may take the form of cooked food, stews and the like. Either type of food lends itself well to treatment according to my invention.

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The use and operation of my invention are as follows:

Packages to be frozen enter the bath chamber through the intake port and the downwardly inclined ramp 11 which conducts the packages one after the other into and discharges them below the level of the liquid. Since they float they are propelled horizontally by the horizontal feed conveyor 14 entirely immersed below the surface of the liquid. The upper strand of the feed conveyor is out of contact with the liquid but contained within the gas dome above the level of the liquid. The discharge belt 17 in the discharge ramp is at its feed end below the level of the liquid and below the discharge end of the horizontal conveyor belt so that the discharge belt as it emerges from the liquid engages the under sides of the packages, conveys them upwardly along the discharge ramp to exit through the discharge gate at the right hand end of the bath chamber.

The important thing here is that both conveyor belts remain entirely within the chamber, being in contact with the liquid and the gas evaporated from it. The individual packages are forced by gravity into contact with the feed end of the horizontal conveyor belt and because they float are conveyed by contact with the belt toward the discharge where they successively come in contact with the discharge belt and are lifted upwardly out of the liquid to discharge.

I claim:

1. Food freezing means comprising an insulated housing, a bath chamber therein containing liquid nitrogen at atmospheric pressure, means for supplying liquid nitrogen thereto, means for withdrawing the gas therefrom and re-liquefying it, a chamber having an intake port with a gravity ramp leading therefrom downwardly below the level of the bath, a discharge port with a conveyor leading upwardly thereto, a belt conveyor in the bath having its lower run only below the level of the liquid between the gravity ramp and the discharge belt, means for propelling the belt to simultaneously hold food packages below the level of the liquid and urge them through the bath toward discharge.

2. Food freezing means comprising an insulating housing, a bath chamber therein containing liquid nitrogen at atmospheric pressure, means for supplying liquid nitrogen thereto, means for withdrawing the gas therefrom and re-liquefying it, the chamber having an intake port, a conveyor extending through the port, an entry passage downwardly inclined from the discharge end of the conveyor into the bath chamber above the level of the liquid therein, a horizontal conveyor entirely within the bath chamber, the feed end of which is immediately adjacent the discharge end of the entry passage, the lower run of the conveyor being below and the upper run above the level of the liquid, an upwardly inclined discharge conveyor extending from below the discharge end of the horizontal conveyor above the level of the bath liquid, a discharge port adjacent the discharge end of the discharge conveyor and a delivery conveyor extending through the discharge port from the discharge conveyor.

References Cited in the file of this patent

UNITED STATES PATENTS

2,582,789	Morrison	Jan. 15, 1952
2,951,353	Morrison	Sept. 1, 1960