Oct. 31, 1950

B. E. WILLIAMS

2,527,782

REFRIGERATOR CAR

Filed Dec. 24, 1947

Fig. 1

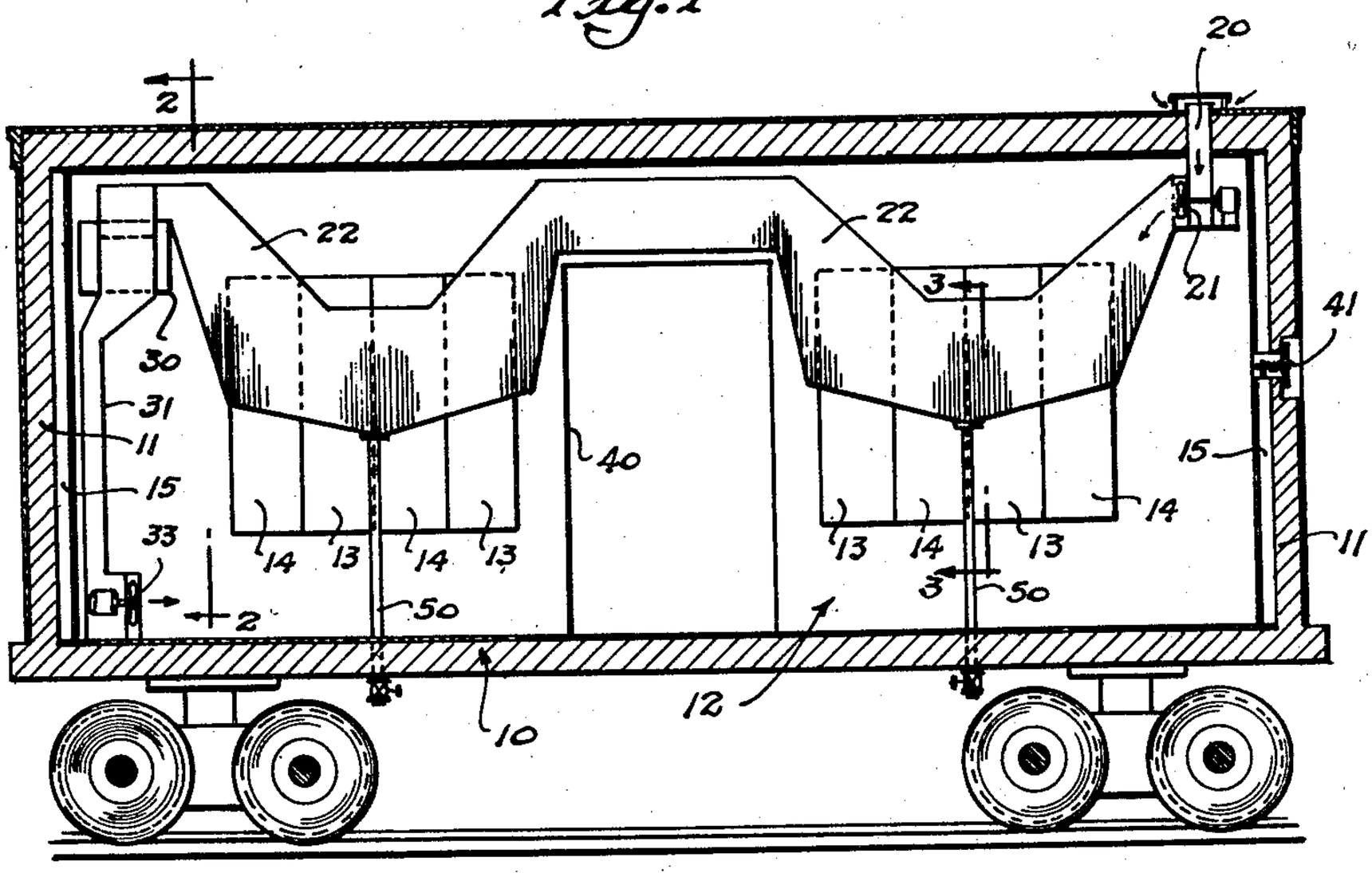


Fig. 2

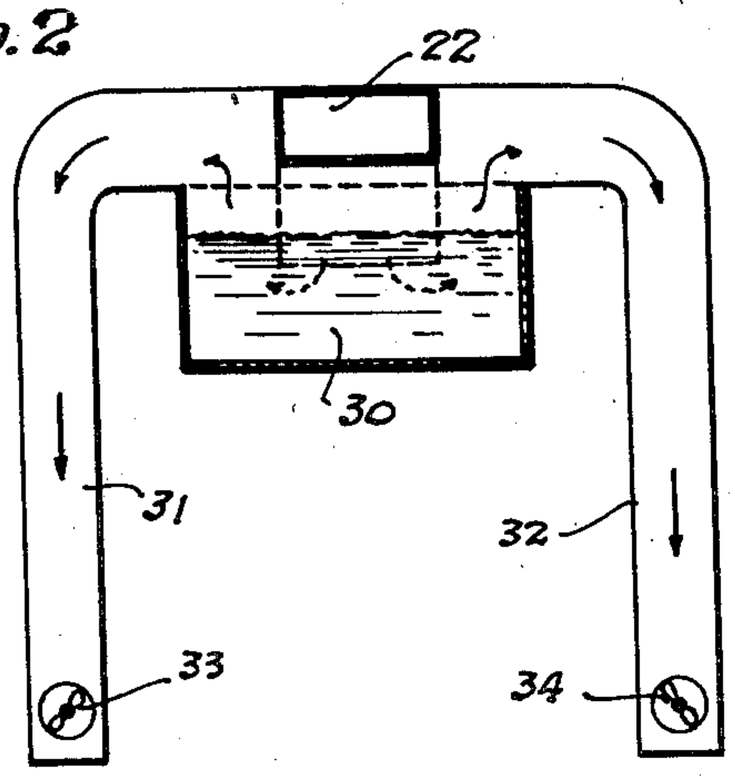
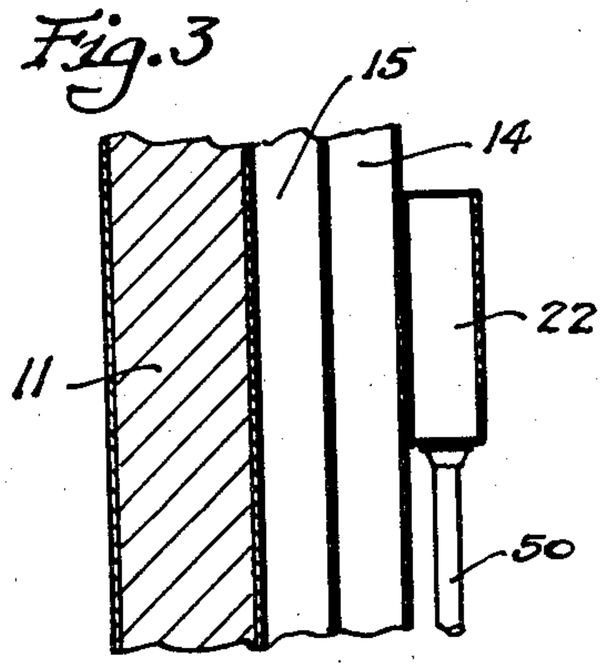


Fig. 3



INVENTOR.
Beverly E. Williams
BY
R. G. Story
ATTORNEY

Patented Oct. 31, 1950 2,527,782

UNITED STATES PATENT OFFICE

2,527,782

REFRIGERATOR CAR

Beverly E. Williams, Chicago, Ill., assignor, by mesne assignments, to Swift & Company, Chicago, Ill., a corporation of Illinois

Application December 24, 1947, Serial No. 793,670

16 Claims. (Cl. 62—6)

1

This invention relates to a refrigerated means for storing perishable products, and more particularly to an improved refrigerated storage structure for use in transporting perishable products.

It is an object of this invention to provide an improved wall structure and air-circulating system for a refrigerated transport means.

It is another object of this invention to provide an improved refrigerating wall structure, air-conditioning, and air-circulating system for refrigerated railroad cars.

Another object of this invention is to provide an improved insulating wall structure for a refrigerated storage means for perishable products.

A further object of this invention is to provide an improved air-cooling and humidifying means for a refrigerated storage means for perishable products.

It is another object of this invention to provide an improved ventilating and air-conditioning means for transporting perishable products.

Another object of this invention is to provide an improved structure wherein meat may be aged during shipment.

Another object of this invention is to provide an improved sealed structure for aging meat while transporting it, by purifying the air taken into the transporting means and preventing uncontrolled leakage of outside air into the sealed structure.

Another object of this invention is to provide an improved sealed structure having air-purifying and conditioning means in which a slight pressure is maintained for transporting perishable products.

Another object of this invention is to provide an improved sealed refrigerated structure having air-purifying and conditioning means associated therewith whereby meat may be aged during shipment.

Another object of this invention is to provide an improved method for shipping meat products.

Another object of this invention is to provide an improved ventilating method for, and means for use in, the shipping of meat products so that the meat may be stored during shipment under such conditions that it will retain most of its natural properties.

2

Another object of this invention is to provide an improved method of shipping meat so as to age it during transit.

Another object of this invention is to provide an improved method for shipping perishable products.

Another object of the invention is to provide a method for controlling the humidity and other conditions of the ventilating air whereby to avoid the drying out of a product contained in a railroad car during shipment.

Another object of the invention is to provide a method and means for controlling the humidity of the fresh air taken into a sealed transporting means to provide optimum conditions for shipping perishable products.

Another object of the invention is to provide an improved method for refrigerating and humidifying air for a refrigerated transporting means.

Other objects will appear from the specification below.

In the past it has been the practice to ship perishable products in refrigerated railroad cars, motor trailers, and the like, which have been equipped with means adapted merely to keep the shipping space at a relatively low average temperature. Such refrigerated means are usually provided with ice tanks or brine bunkers at one or both ends, and the air trapped within the sealed shipping space is circulated over a surface which is maintained cold by the brine, or the air is circulated through a brine spray produced by melting the ice contained in the bunker. It is quite evident that after the original charge of ice melts and the particular bunker has been reiced, the brine solution becomes more dilute and the temperature is thus caused to vary throughout a considerable range. Because of this wide temperature variation, it is necessary to produce a very low temperature at the start of the trip so that at the end of the trip the temperature will still be within the safe range. While an average temperature within the desired range is maintained, it is apparent that product shipped in such means is first unduly cool and then is subjected to higher temperatures than are proper for ideal storage before the product is unloaded. Not infrequently refrigerated railroad cars must be reiced, including the addition of

more salt, during shipment, and the above-mentioned variations, together with their harmful effect upon the product, are duplicated.

In making long hauls where several reicings are required, it is frequently necessary to drain the ice bunkers and replenish the whole ice and brine mixture. This, likewise, produces a harmful variation in the temperature conditions within the transporting means and also causes a loss of time, since the railroad car must be taken out of the train, or the heavy truck-trailer unit must be tied up at an icing station while the ice and brine are changed.

Further, because of the heavy weight of the ice bunker construction and the weight of the ice and brine, which weight is usually disposed at the very end of the structure, a heavy and relatively cumbersome body structure is required. This produces a freight car or transporting means that is somewhat unwieldy, and therefore it can be moved only in the slower-moving freight schedules. A conventional railroad refrigerator car, for example, carries from 6,000 to 10,000 pounds (3 to 5 tons) of ice, plus up to 30 per cent salt, in order to refrigerate a pay load of about 21,000 to 25,000 pounds of perishable food. For obvious reasons, attempts have been made to provide better insulation for such units for shipping perishables. However, no suitable insulation has been provided which will protect the lading sufficiently to permit cars to go through on the longer scheduled trips without reicing.

It has been proposed in the past to provide improved, light-weight structures for carrying perishables, which equipment may be worked into the faster-moving freight schedules. Such a means is shown in my Patent No. 2,381,796, dated August 7, 1945, entitled "Refrigerator Car and Method of Using." This construction provides for a plurality of channels which form a portion of the wall of the car body, together with suitable insulation. The purpose of the channels in the walls is to provide a means through which refrigerant may be circulated to quickly cool the car, and thereafter the refrigerant may be drained, the channels vacuumized, and the car readied for shipment with a fast-moving freight train.

An improvement on this new type of structure is disclosed in my co-pending application, Serial No. 739,155, filed May 3, 1947, entitled "Refrigeration of Cars," now Patent No. 2,496,189, wherein alternate channels of a structure similar to that of the above-described patented refrigerator car are filled with brine, and then the channels are sealed. In using this structure, the car may be quickly cooled by circulating a refrigerant in the remaining free channels, whereby heat is extracted from the body of the car, and the brine contained in the sealed channels is frozen solid. After the car has been cooled and the brine frozen, the said remaining free channels may be vacuumized to provide additional insulation, and the car is ready for shipment.

In each of my above-described transporting means which may be adapted to railroad cars, truck-trailer units, airplane shipping vans, or other portable van systems, a relatively light-weight structure can be used because of the even weight distribution and the dual function of the refrigerating means, which also serves, at least in part, as insulation for the wall of the structure during shipment. This new structure eliminates substantially all of the refrigerant's weight and

even reduces the weight of insulating structure required to surround the refrigerated structure.

This present invention is a further improvement on the basic idea of both of my above-mentioned inventions. It provides a new structure having an improved insulating wall wherein condensation of moisture on the outside layer of insulation is minimized as much as possible by shielding it from the usually colder inner storage chamber. It provides also for a ventilating system wherein fresh air is taken into the car and is cooled and humidified for distribution around the perishable product stored in the refrigerated transporting means.

The problem of improving the shipment of perishable products has seemingly been given very little attention, and particularly is this true in connection with meat products. Many of the refrigerator cars in use today were built in the early 1900's. The average refrigerator car used for shipping meat products is about the same size as an ordinary 40-foot freight car and below the floor, is practically identical, being mounted on two heavily-sprung four-wheel trucks.

The understructure has a steel frame, but the floor, walls, and roof are of steel and wood construction. Some of these cars have steel ends to give greater strength against the tendency of the load to damage the car ends during sudden starting and stopping. The average insulation on the conventional car is two or three inches of hair felt or vegetable fibers which obviously provide a minimum of insulating effect, considering that much of the time the car is exposed to the direct rays of the sun. The inside dimensions of the usual car are about 33 feet long, 8 feet wide, and 8 feet high, and it has two hinged doors in the middle of each side wall so that the car can be loaded or unloaded from either side.

Ice is placed in bunkers, disposed usually at both ends of the car. These bunkers are mostly of wood construction and extend from floor to roof, and the deck of the bunker is adjustable so that it can be raised to about half-way, or in some cases a deck is provided that folds against the end wall to allow for "half-icing."

The bunker structures are sometimes removable, while others are collapsible so that they can be folded back against the walls to give more room when the car is not being iced and is being used as an ordinary freight car to haul lading which does not require refrigeration.

The ice is put into the bunkers of each car, from the top, through two doors in the roof associated with each bunker, one on each side of the sloping roof. The cakes of ice are delivered to these doors and are broken into large chunks before being put into the bunkers so as to give a greater surface to the ice to ensure a proper heat transfer.

Except for a few refrigerator cars that are equipped with fans, the air circulation throughout the usual railroad car is produced by the difference in weight between the warm and chilled air, i. e., a gravity principle. The air that is chilled by contact with the ice in the bunker becomes heavier and drops to the bottom and pushes out into the car under the floor racks, displacing and forcing the warmer air upwardly into the top of the car and then into the ice bunker.

In this system, the air circulation is not positive and varies in velocity, depending upon the way the ice is packed in the bunker, how closely the lading is stored in the car, and other variable

factors. Moreover, the use of a gravity principle results in unequal air circulation, and inevitably it is found that an uneven distribution of the cooling effect takes place. Thus, the product near the bunkers may be kept at the proper temperature, whereas that in the center of the car may be 10° F. or 20° F. warmer—too warm to preclude deterioration in the quality of the perishable product during shipment.

It has also been the practice in using the conventional car to load it with the meat product, seal the car, and ship it to the point of destination. As above described, such a car must be stopped in transit for the purpose of being reiced, and while this is being done, the meat is contained within a closed chamber with no positive means provided for ventilation so that eventually the air in the car becomes stale. Not infrequently the meat is received at the point of destination in a "smothered" condition, which necessitates aerating the product to "freshen" it up before it can be sold. In an extreme case the product may even be wholly spoiled. Thus, the failure to provide proper ventilation and air-circulating means detracts from the value of the product, and it is the purpose of this invention to provide an improved "breathing" and air-circulating means for such shipping arrangements.

It has been found that if the air within a closed shipping chamber is not only refrigerated, but is mixed with a small amount of fresh air from time to time and the air is positively circulated over the product, the product arrives at the point of destination in a more nearly fresh or perfect condition. This possibility is ensured when the air is properly conditioned as to humidity and temperature so that possibility of "smothering" the product is eliminated. This procedure is also of value in connection with many other perishable products which require the circulation of a small amount of fresh air to avoid deterioration.

This invention is designed primarily to provide an improved refrigerated railroad car, but as the description proceeds, it will be apparent that the fundamental concepts may be applied to other forms of shipping means, such as the truck-trailer, the portable lift van, or other refrigerated storage means. The refrigerated chamber is surrounded by a wall which includes a suitable insulating means, a sealed air space, and a chambered refrigerating wall structure which provides the inner surface surrounding the storage compartment. This air space, so called, which is disposed between the outer insulation and the colder inner wall, may be filled with any gas having good heat insulating properties, as dry air or carbon dioxide, etc.

The combination insulation provided by the sealed air space and the outside insulation effectively protects the usually cooler storage chamber against the inflow of heat, and at the same time this construction provides a means whereby the outer insulation, which may take the form of rock wool, spun glass, foam glass, foam rubber, or any other conventional insulating material, is protected against the condensation of moisture therein. The outer insulation is not in direct contact with the cold refrigerating wall structure surrounding the storage chamber because of the interposition of the sealed air chamber, and since the outer insulation is not cooled to the same temperature as the inner refrigerating wall, any moisture-ladened warm air coming in contact therewith does not tend to deposit or have its moisture condensed out onto the insulation. In other words, the outer insulation is maintained at a higher average temperature while protecting the storage chamber against heat transfer so that there is less tendency for moisture to condense on the insulation. This makes for a longer life and for a more effective insulation of the storage chamber because, when condensate forms in an insulation, it not only destroys its insulating properties, but causes it to quickly deteriorate in quality.

In addition to the improved wall structure, the present invention includes means for introducing fresh air into the sealed storage chamber. The fresh air is cooled, washed, and humidified to the proper degree so that it issues into the storage chamber to maintain ideal conditions therein. Circulating means are included in the air conduit to ensure proper movement of the air in the storage chamber so that the required ventilation takes place along with air circulation, and perishable products may be shipped therein to arrive in a condition more nearly fresh than has ever been possible heretofore.

The preferred form of the invention is shown in the drawings in somewhat diagrammatic form.

Figure 1 represents a sectional side elevation of a refrigerated railroad car embodying all the principles of my invention;

Figure 2 is an end elevation taken on line 2—2 of Figure 1; and

Figure 3 is a sectional end view, partly broken away, of a side wall structure taken on about line 3—3 of Figure 1.

In the embodiment of the invention, as represented in the drawings, a body 10 for a refrigerator car is shown, the walls of which have an outer layer of insulating material 11 that substantially surrounds all side of the car. The car body is constructed so that it may be rather completely sealed against infiltration of air, and a suitable fresh-air intake and controlled exhaust means are provided.

The walls of the car surround a central storage chamber 12, and as above described, the inner layer of the wall is divided into alternate channels 13 and 14 for purpose that will be described below. The channeled wall construction surrounding the storage space is separated from the insulated outer wall element 11 by a sealed air space 15. This air space protects the outer insulation against the extreme cold produced within the channeled inside wall.

The portion of the hollow inner wall that is formed into channels 13 and 14 provides a means for cooling the storage chamber 12 and for continuing the refrigerating effect. This chambered wall may be used as taught in my above-mentioned application for patent, and alternate channels as channels 13 may be filled with a brine solution adapted to be frozen solid to provide a cooling medium for the chamber, as explained above. The car may initially be chilled down and the brine frozen in channels 13 by circulation of a refrigerant in channels 14. After the proper cooling has been accomplished, channels 14 are drained and are then preferably vacuumized whereby to provide increased insulation for the wall structure.

In order to provide proper ventilation in the sealed storage chamber, a fresh air intake 20 is provided at the top of the car which delivers air into a suitable pumping means 21 for delivery through the air duct 22. Fresh air is taken in at

a rate sufficient to provide approximately one air change for the storage space per 24 hours, and usually this will require an intake of about three cubic feet of air per minute for a car of average size.

In certain instances a duct may be provided to deliver the air directly into a brine washing bath **30** which is maintained at a fixed temperature to bring the fresh air being washed to about the temperature of the brine bath. The brine washing serves to cleanse the air and also to adjust the humidity of the incoming air to bring it within the optimum range. This is done by regulating the salinity of the brine solution. After being scrubbed and cooled in the brine bath, the air may be carried by another duct so that it passes over the surface of the channels **13** and **14** before being delivered into the storage space **12**.

Alternatively the fresh air preferably may be and is delivered by duct **22** immediately over the surface of the wall channels **13** and **14**, whereby the air is thoroughly cooled in passing over the alternate channels **13** that enclose the frozen brine. After the air has been sufficiently cooled while passing through the air duct **22** and over the surface of the frozen brine channels, it is delivered into the brine washing bath **30**, which is preferably disposed at the top and near one end of the car. The brine bath then serves to wash and humidify the fresh air.

No matter which sequence of steps is followed in the cooling and humidifying of the air, the conditioned fresh air is fed into air ducts **31** and **32**, which are provided with air-pumping means **33** and **34**, respectively, to blow the air out into the lading storage space so that a circulation is established around all of the product situated therein. The draft of air flowing from each of the ducts **31** and **32** keeps all of the air in the entire lading storage space in circulation so that the air continuously moves over the product at a velocity approximating 50 feet per minute. While this is the preferred rate of movement for meat products, the air may be caused to pass over such a product at a speed within the range of from 40 to 60 feet per minute. When this is done, a proper amount of air, including fresh air, is continuously fed to the product to stimulate the enzymic action that causes aging.

As above stated, the car body is tightly constructed, and preferably the side door **40** is provided with suitable sealing means so that a closed, sealed lading storage chamber is provided. As the fresh air is forcibly delivered into the chamber, a pressure is gradually built up until the spring-loaded exhaust valve **41** is raised and a portion of the air in the chamber is permitted to escape. As soon as the pressure within the chamber falls slightly, the valve closes, and thus a slight pressure above atmospheric is maintained in the sealed storage chamber so as to preclude leakage of untreated fresh air into the car.

In operation the car is initially cooled down by circulating a refrigerant in channels **14** or, in extremely cold weather, the channels **14** may be used for the circulation of a heating medium to warm up the lading storage space. In this manner, the refrigerant is distributed around a considerable wall surface surrounding the chamber in accordance with the teachings in my above-mentioned patent and application. As disclosed in my said application, when a refrigerant is circulated in the channels **14**, for example, the brine

contained in the sealed chambers **13** is frozen while simultaneously the car is being cooled, and after a sufficient quantity of refrigeration has been provided and the car loaded, the supply of refrigerant is cut off. The chambers **14** are then emptied and vacuumized to provide additional insulation in the wall structure. After loading and cooling the storage space in this manner, the car is ready for movement.

As the car moves in transit, fresh air is continuously drawn in through the fresh air inlet to be washed, humidified, and delivered through the duct **22** to flow over the surface of alternate frozen brine contained in the sealed chambers **13**. The air is thus cooled, and any excess moisture contained in the air may be condensed out and drained through suitable drain connections **50** to a waste outlet.

The conditioned air is then blown into the storage chamber and a proper air circulation is established. The properties of the fresh air are adjusted so that the temperature and moisture content of the mixture of fresh and recirculated air in the storage chamber **12** are held as nearly as possible to the ideal conditions for storage of product in the car. These conditions are continuously maintained while a portion of the used air is permitted to escape, and a slight pressure is maintained in the car so that there can be no infiltration of outside air to destroy the proper balance. When using this construction, the quality of the air in the storage space can be continuously controlled during shipment to insure the arrival of the product in a fresh condition.

When fresh meat cuts are being hauled on a relatively long journey, it is possible that such product may be aged somewhat to improve the quality thereof during the journey, and when this is the case the fresh air is treated to produce a temperature of approximately 40° F. in the chamber, together with a relative humidity of 92 per cent or higher. It is important to note that the desired temperature and humidity may be established along with a proper air flow over the product as described above, whereby the meat is shipped and aged under substantially ideal conditions. The fresh air taken in is thoroughly washed so that all air-borne mold spores are eliminated and the air is cleansed before it passes into association with the meat. If meat is to be so handled it is particularly important that there be no infiltration of untreated air, and for this reason, the slight pressure which may be built up in the structure here described is of a special value.

In addition to using the invention described herein for the transportation of meat, it is suggested also that vegetables, fruits, flowers and other perishable products may be shipped therein. When such types of perishable products are to be transported, it is possible to adjust the conditions within the lading storage space so that conditions can be maintained close to the ideal for the particular product. This may include the controlled introduction of a small percentage of carbon dioxide gas in the circulating air stream to slow down the respiration of the product. The temperature and humidity may be controlled as above described.

The above description covers one mode of adapting my invention to practice. It is quite evident that it may be constructed in other forms and that many modifications thereof will occur

to those skilled in the art which will fall within the scope of the following claims.

I claim:

1. A portable storage means for perishable products, comprising a storage chamber surrounded by insulated walls, hollow heat-exchanging means within the chamber and carried on the walls, which means are adapted to receive a heat-transfer medium, said exchanging means taking the form of a plurality of relatively wide, flat channels which serve also as insulating means when emptied of said heat-transfer medium, a fresh air intake for said storage chamber, an exhaust from said storage chamber for used air, humidifying means in said chamber, and means to force said fresh air through said humidifying means and to force said fresh air past said exchanging means and into said storage chamber whereby to produce a desired temperature and humidity therein.

2. A portable storage means for perishable products, comprising a storage chamber surrounded by insulated walls, hollow heat-exchanging means within the chamber and carried on the walls, which means are adapted to receive a heat-transfer medium, said exchanging means taking the form of a plurality of relatively wide, flat channels which serve also as insulating means when emptied of said heat-transfer medium, a fresh air intake for said storage chamber, an exhaust from said storage chamber for used air, humidifying means in said chamber, and means including an air pump and a duct system to force said fresh air through said humidifying means and to force said fresh air past said exchanging means and into said storage chamber whereby to produce a desired temperature and humidity therein.

3. A portable storage means for perishable products, comprising a storage chamber surrounded by insulated walls, hollow heat-exchanging means within the chamber and carried on the walls, said exchanging means taking the form of a plurality of relatively wide, flat channels, alternate channels being adapted to be filled with a brine solution having a given melting temperature, the remaining channels serving as conduits for the circulation of a refrigerant to cool the chamber and freeze the brine-filled channels, said remaining channels serving also as insulating means when emptied of the refrigerant, a fresh air intake for said chamber, an exhaust from said chamber for used air, humidifying means in said chamber, and means including an air pump and duct system, to force said fresh air through said humidifying means and to force said fresh air past said exchanging means and into said chamber whereby to product a desired temperature and humidity therein.

4. A portable storage means for perishable products, comprising a chamber surrounded by insulated walls, hollow heat-exchanging means within the chamber and carried on the walls, which means are adapted to receive a heat-transfer medium, said exchanging means taking the form of a plurality of relatively wide, flat channels which serve also as insulating means when emptied of said heat-transfer medium, a fresh air intake for said chamber, a brine bath associated with said fresh air intake to receive the fresh air to scrub it, cool it, and adjust the humidity thereof, an exhaust from said chamber for used air, means to force said fresh air through said brine bath and to force said fresh air past said exchanging means and into said chamber whereby

to produce a desired temperature and humidity therein.

5. A portable storage means for perishable products, comprising a chamber surrounded by insulated walls, hollow heat-exchanging means within the chamber and carried on the walls, which means are adapted to receive a heat-transfer medium, said exchanging means taking the form of a plurality of relatively wide, flat channels which serve also as insulating means when emptied of said heat-transfer medium, a fresh air intake for said chamber, a brine bath associated with said fresh air intake to receive the fresh air to scrub it, cool it, and adjust the humidity thereof, an exhaust from said chamber for used air, means including an air pump and a duct system to force said fresh air through said brine bath and to force said fresh air past said exchanging means and into said chamber whereby to produce a desired temperature and humidity therein.

6. A portable storage means for perishable products, comprising a chamber surrounded by insulated walls, hollow heat-exchanging means within the chamber and carried on the walls, which means are adapted to receive a heat-transfer medium, said exchanging means taking the form of a plurality of relatively wide, flat channels which serve also as insulating means when emptied of said heat-transfer medium, a fresh air intake for said chamber, an exhaust from said chamber for used air, humidifying means in said chamber, and means to force said fresh air into said chamber under a small degree of pressure after delivering the air through said humidifying means and past said heat-exchanging means whereby to produce a desired temperature and humidity in the chamber.

7. A portable storage means for perishable products, comprising a chamber surrounded by insulated walls, hollow heat-exchanging means within the chamber and carried on the walls, which means are adapted to receive a heat-transfer medium, said exchanging means taking the form of a plurality of relatively wide, flat channels which serve also as insulating means when emptied of said heat-transfer medium, a fresh air intake for said chamber, an exhaust from said chamber for used air, humidifying means in said chamber, and means including an air pump and a duct system to force said fresh air into said chamber under a small degree of pressure after delivering the air through said humidifying means and past said heat-exchanging means whereby to product a desired temperature and humidity in the chamber.

8. A portable storage means for perishable products, comprising a chamber surrounded by insulated walls, hollow heat-exchanging means within the chamber and carried on the walls, which means are adapted to receive a heat-transfer medium, said wall having an outer layer of insulation in solid form, said heat-exchanging means being separated from said outer layer of insulation by a small dead air space, said heat-exchanging means taking the form of a plurality of relatively wide, flat channels which serve also as insulating means when emptied of said heat-transfer medium, a fresh air intake for said chamber, an exhaust from said chamber for used air, humidifying means in said chamber, and means to force said fresh air through said humidifying means and to force said fresh air past said exchanging means and into said chamber where-

by to produce a desired temperature and humidity in the chamber.

9. A portable storage means for perishable products, comprising a chamber surrounded by insulated walls, hollow heat-exchanging means within the chamber and carried on the walls, which means are adapted to receive a heat-transfer medium, said wall having an outer layer of insulation in solid form, said heat-exchanging means being separated from said outer layer of insulation by a small dead air space, said heat-exchanging means taking the form of a plurality of relatively wide, flat channels which serve also as insulating means when emptied of said heat-transfer medium, a fresh air intake for said chamber, an exhaust from said chamber for used air, humidifying means in said chamber, and means including an air pump and a duct system to force said fresh air through said humidifying means and to force said fresh air past said exchanging means and into said chamber whereby to produce a desired temperature and humidity in the chamber.

10. A portable storage means for perishable products, comprising a chamber surrounded by insulated walls, hollow heat-exchanging means within the chamber and carried on the walls, which means are adapted to receive a heat-transfer medium, said exchanging means taking the form of a plurality of relatively wide, flat channels which serve also as insulating means when emptied of said heat-transfer medium, a fresh air intake for said chamber, an exhaust from said chamber for used air, humidifying means in said chamber, and means to force said fresh air through said humidifying means and to force said fresh air past said heat-exchanging means and into said chamber, said last-mentioned means to deliver the fresh air into said chamber including a duct having an outlet through which the air issues to effect a mixture of the fresh humidified and cooled air with the recirculating air present in the chamber and cause circulation of the mixture around product stored in the chamber, whereby humidified and cooled air is caused to surround all the products in the chamber.

11. A portable storage means for perishable products, comprising a chamber surrounded by insulated walls, hollow heat-exchanging means within the chamber and carried on the walls, which means are adapted to receive a heat-transfer medium, said exchanging means taking the form of a plurality of relatively wide, flat channels which serve also as insulating means when emptied of said heat-transfer medium, a fresh air intake for said chamber, an exhaust from said chamber for used air, humidifying means in said chamber, and means to force said fresh air through said humidifying means and to force said fresh air past said heat-exchanging means and into said chamber, said last-mentioned means to deliver the fresh air into said chamber including an air pump, a duct system, and an outlet through which air issues to effect a mixture of the fresh humidified and cooled air with the recirculating air present in the chamber and cause circulation of the mixture around products stored in the chamber, whereby humidified and cooled air is caused to surround all the products in the chamber.

12. A portable storage means for perishable products, comprising a chamber surrounded by insulated walls, hollow heat-exchanging means within the chamber and carried on the walls, which means are adapted to receive a heat-transfer medium, said exchanging means taking the form of a plurality of relatively wide, flat channels which serve also as insulating means when emptied of said heat-transfer medium, a fresh air intake for said chamber, an exhaust from said chamber for used air, means operatively associated with said heat-exchanging means to condition the fresh air as to temperature and humidity, means to mix the conditioned fresh air with air filling the chamber, said mixing means including means to circulate the mixture of air over the products, and said fresh air conditioning means being operative to produce the conditions in the fresh air whereby the mixture of fresh and recirculated air has desired properties for storage of products in the chamber.

13. A portable meat storage and aging means comprising a chamber surrounded by insulated walls, a fresh air intake for said chamber, means to wash and condition as to temperature and humidity the fresh air received through said intake, said washing serving to remove the mold spores from said air, and means to feed a stream of the washed and conditioned air into the chamber at such a temperature and humidity as to maintain a mixture of fresh and recirculated air in the chamber having a temperature of approximately 40° F. and a relative humidity of upwards of 92 per cent, with a rate of air circulation of said mixture of between 40 to 60 feet per minute.

14. A portable meat storage and aging means comprising a chamber surrounded by insulated walls, a fresh air intake, means to wash and condition said fresh air as to temperature and humidity, said last means being operative to remove mold spores from the fresh air and to condition it to have a temperature below about 40° F. and humidity of above about 92 per cent, means to feed the conditioned fresh air into the chamber to mix with the air therein to produce a mixture of fresh and recirculated air having a temperature of about 40° F. and a humidity of upwards of 92 per cent and to maintain a pressure therein, and means to control the exhaust of used air from the chamber.

15. A portable meat storage and aging means comprising a chamber surrounded by insulated walls, hollow heat-exchanging means within the chamber and carried on the walls, said heat-exchanging means taking the form of a plurality of relatively wide, flat channels, alternate channels being adapted when in use to be filled with a brine solution which may be frozen, a fresh air intake, means to wash and condition said fresh air as to temperature and humidity, said last mentioned means serving to remove the mold spores from said air, and means to deliver the fresh air to the chamber through said washing means and past the brine channels to condition said fresh air to have a temperature below about 40° F. and a humidity above about 92 per cent so that after said fresh air is mixed with the recirculated air in the chamber, said mixture will have a temperature of approximately 40° F. and a humidity of upwards of 92 per cent.

16. A portable storage container for perishable products, including a storage chamber surrounded by insulated walls, hollow heat-exchanging means within the chamber and adjacent the walls, said means being adapted to receive a heat-exchanging medium, said means having a relatively large face parallel to the adjacent wall and being relatively small in depth as measured normal to the adjacent wall, a fresh air intake for said storage chamber, an air passage one end of which con-

nects to said intake and the other end of which opens into said chamber, air cleaning and humidifying means in said passage to clean and condition the air passing therethrough, and air pump means to draw air through said passage from said intake and to discharge it into said chamber, said passage being positioned to bring said air into heat-exchanging relationship with said heat-exchanging means.

BEVERLY E. WILLIAMS.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,478,471	Dowding	Dec. 25, 1923