

July 20, 1943.

H. J. WIEDEN

2,324,749

REFRIGERATOR SYSTEM FOR CARS AND THE LIKE

Filed April 26, 1941

3 Sheets-Sheet 1

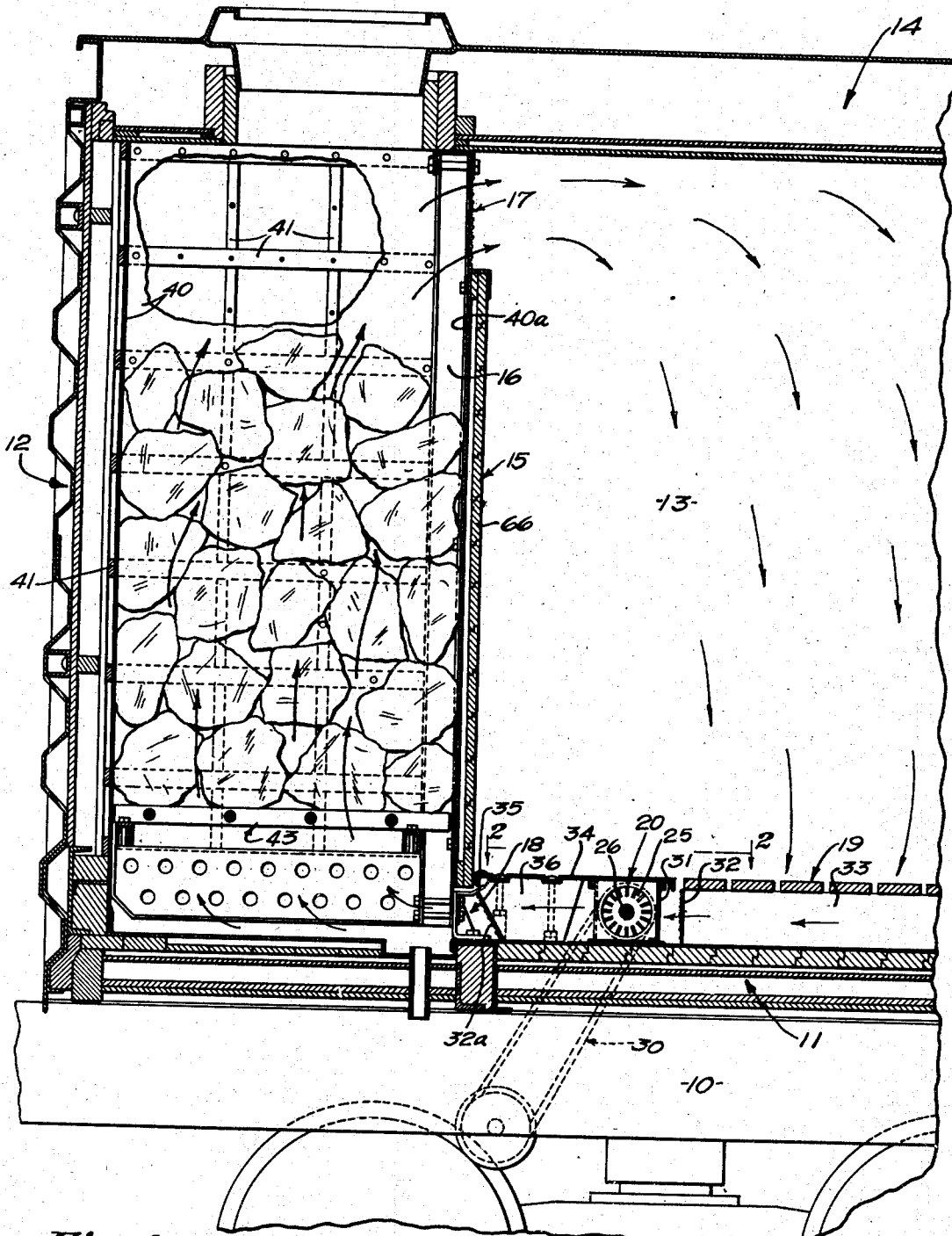


Fig. 1.

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3 Sheets-Sheet 2

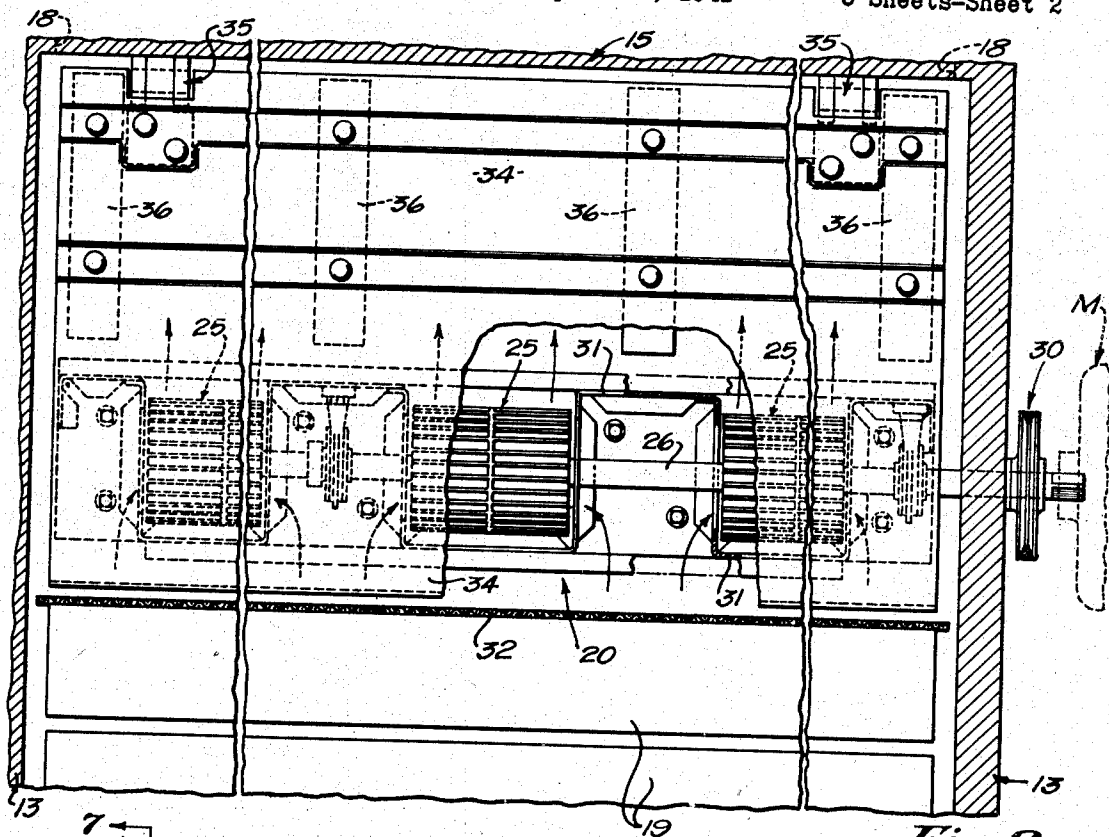


Fig. 2.

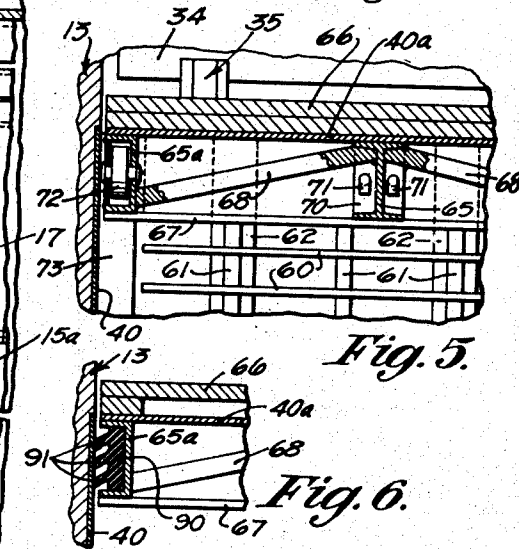
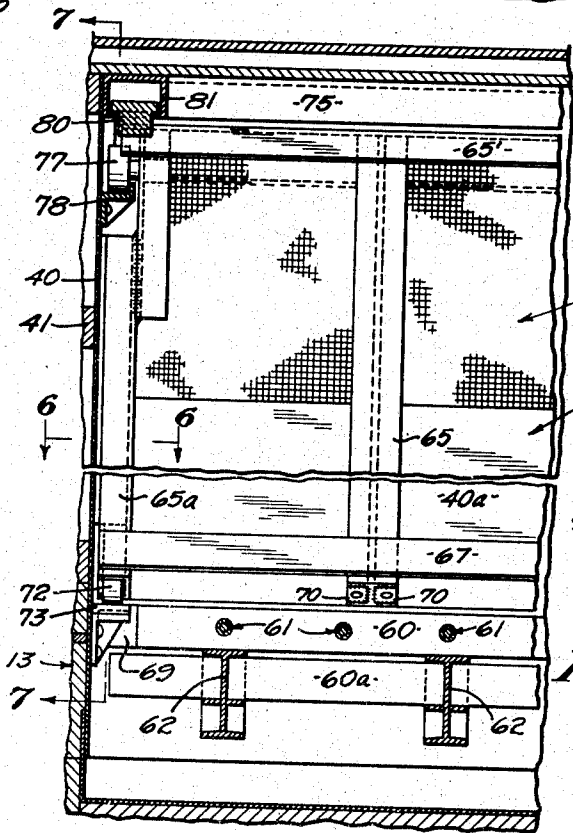


Fig. 5.

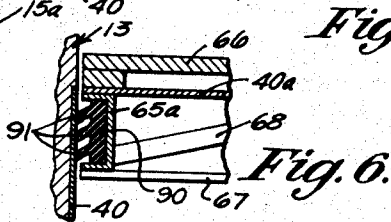


Fig. 6.

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3 Sheets-Sheet 3

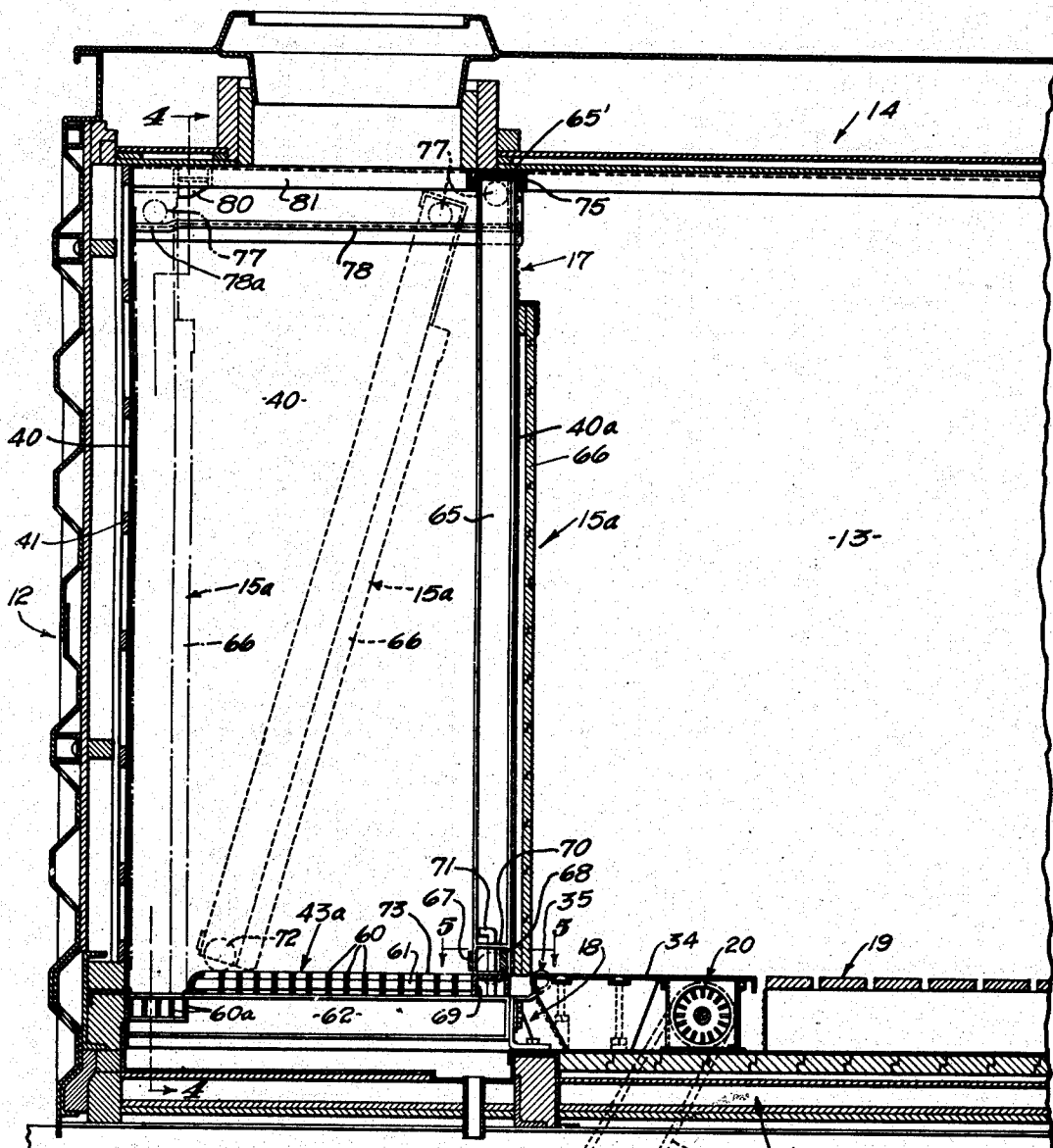


Fig. 3.

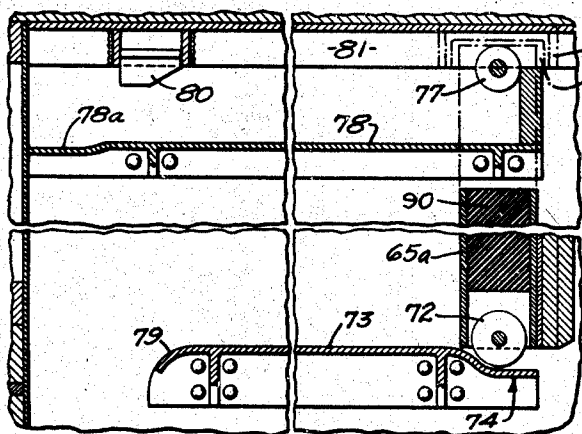


Fig. 7.

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UNITED STATES PATENT OFFICE

2,324,749

REFRIGERATOR SYSTEM FOR CARS AND
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Application April 26, 1941, Serial No. 390,548

8 Claims. (Cl. 62-24)

This invention has reference to the type of refrigerating systems used in refrigerator cars; and one of its general purposes is to increase the efficiency and refrigerating capacity of such systems.

Due to various causes, the refrigerating systems now in common use are of limited refrigerating capacity and of low efficiency. Among those causes the following general ones may be mentioned: ineffective direction of the mass of circulating air through the ice compartment, and ineffective contact between the circulating air and the ice. These causes of inefficiency and low cooling capacity are characteristic of present systems, whether or not a forced air circulation is maintained; and the result is not only poor cooling of the car load both in point of temperature and of uniformity throughout the load, but also that special equipment must be used to perform the operation of pre-cooling. The common systems have not sufficient capacity for removing heat at a rate high enough to perform a satisfactory precooling operation.

The present invention overcomes these shortcomings, increasing the cooling capacity and efficiency to such a marked degree over present systems that the improved system may be used for pre-cooling operations as well as for maintaining uniformly low temperatures in transit. The invention reaches its objectives by directing the impelled air current in such manner that all of the air flow passes through the ice bunker—the ice bunker, and the load compartment form a direct series arrangement through which a single stream of air passes; by forcing the whole air current into intimate contact with the ice and salt mixture; and by preferably maintaining through the ice and salt a direction of flow which is conducive to highest efficiency of use of the refrigerating agents.

It is characteristic of my improved system that the ice bunker is constructed, without any ice basket, to have an open and unobstructed interior capable of taking the ice charge directly against its walls and filling the whole cross-section of its interior. In the usual and common type of bunker the interior ice basket is spaced from the bunker walls so that the air stream passes mainly around the ice charge rather than through it; the stream flowing in contact with the ice at one side and a relatively warm car wall at the other. The resulting heat transfer is inefficient, as is likewise the use of the ice and salt. On the contrary, in my system where the air flow passes through the ice

and not around it, where the bunker walls are given surfaces capable of withstanding direct ice contact and moisture, and where the external walls are sufficiently heat insulated to prevent undue ice melting at those walls, the air cooling and ice use become much more efficient.

An additional advantage of considerable practical significance inherent in this type of bunker construction is that the bulkhead which divides the ice bunker from the load compartment may be made movable. In this way the bunker may be completely collapsed by moving it back to the car end wall which forms the end wall of the bunker, making substantially the entire space of the car available for disposition of load. Certain commodities, fresh vegetables in particular, are iced with crushed ice in a thick layer over the top of the load, with no ice in the bunkers. The bunker space is then unused, with consequent loss in load-carrying efficiency. This problem has long been recognized and numerous attempts have been made to develop collapsible bunkers, more or less successfully, but necessarily complicated by the presence of the ice basket as structure separate from the bunker compartment. In my bunker construction, however, nothing exists but four walls, an ice grate and the conventional ice hatches. One of these vertical walls is the bulkhead which I make movable with suitable attachments to anchor it in the normal or the collapsed position. The ice grate is permanently built at the level of the lading floor of the car and acts as a part of the lading floor when the bunker is collapsed. The necessary vertical beams which reinforce the bulkhead space the bulkhead facing away from the back wall of the bunker in the collapsed position and provide a vertical channel for a limited amount of air circulation from the fans if desired.

These several improvement characteristics will be best understood from the following discussion of typical systems. Reference is made to the drawings where

Fig. 1 is a longitudinal vertical section showing one end of a typical refrigerator car equipped with an illustrative form of the improved system;

Fig. 2 is an enlarged fragmentary plan taken as indicated by line 2-2 on Fig. 1;

Fig. 3 is a section similar to Fig. 1, but showing a structure including the collapsible bulkhead;

Fig. 4 is a fragmentary vertical cross-section taken as indicated by line 4-4 on Fig. 3 with the bunker in the position shown in dotted lines in Fig. 3;

Fig. 5 is a fragmentary horizontal section taken on line 5-5 of Fig. 3;

Fig. 6 is a fragmentary horizontal section taken on line 6-6 of Fig. 4; and

Fig. 7 is a fragmentary vertical longitudinal section taken as indicated by line 7-7 on Fig. 4.

The car body may be of any suitable design and structure, and the apparatus of the improved system may be applied either to one end of the car or preferably in duplicate to both ends. Fig. 1 thus preferably shows the system as it is applied to either car end. The car body as shown has an under-frame 10, floor structure 11, end and side walls 12 and 13, and roof structure 14. In refrigerator cars all the walls, roof and floor are usually constructed to provide for some heat insulation and are so shown here. The ice bunker is formed in the car end by a bunker partition or bulkhead 15 mounted at its side edges on struts 16 at the side walls; with a screened air flow opening 17 above the upper edge of the bulkhead wall directly under the car roof, and another air flow opening 18 under the lower edge of the bulkhead next the floor. Both these openings extend across the whole interior width of the car and ice compartment. As in the Van Dorn Patent No. 2,214,210, September 10, 1940, and in his copending application Ser. No. 344,509, filed July 9, 1940 for Air circulating system, the lower opening 18 is preferably located entirely below the level of lading rack 19. The air circulating fan 20 may be located in any convenient position in the air stream, as will appear; but is here shown in its preferred location near opening 18 and under the lading rack level where it acts on the air flow confined below that level. No more of the details of the air impeller will be described here than are helpful in an understanding of structure and arrangement typical and illustrative of the present invention. For more full detail of the air impeller and its drive reference is made to the identified patent and application, the particular form shown here being that of the co-pending application.

As shown in the drawings the air impeller is made up of a plurality of radial bladed impellers 25 set in spaced relation along a single driving shaft 26 which extends transversely of the car substantially from side to side. The shaft may be driven by any suitable means, either from the running gear of the car or from any desired independent source. The copending application shows how shaft 26 is driven either from the running gear, during transit, or by any independently powered motor for precooling. The running gear drive is indicated diagrammatically at 30 in Figs. 1 and 2, and the independent drive applicable to impeller shaft 26, is indicated diagrammatically by motor M in Fig. 2, disconnectibly applied by belt and pulley to the outer end of impeller shaft 26.

Impellers 25 are mounted in a casing 31 of such form that air flows into the casing from the right in Fig. 1 and, as indicated by the arrows in Fig. 2, then flows radially into the individual impellers and is thrown out from the impellers horizontally toward the left in Fig. 1, and as indicated by the arrows in Fig. 2. As shown in Fig. 1, for the purpose of this installation the lading floor 19 is ended along a transverse line close to impeller casing 31, and a transversely extending vertical screen 32, mounted across the ends of lading floor stringers 33, screens out any solid matter which might otherwise enter the impeller casing and clog up or damage the individual

impellers. A cover plate 34, hinged at 35 at its edge adjacent bulkhead 15 extends outwardly from the partition at the level of the lading floor and forms the top or cover for impeller casing 31 and also forms a top enclosure, at the lading floor level, for the space between the impeller and partition 15. Between impeller casing 31 and partition 15 this cover plate 34 is supported by spaced blocks 36, so that the cover plate becomes a load-taking extension of the lading rack. Plate 34 is imperforate; and thus there is formed between impeller 20 and opening 18 an air flow channel which confines the impelled air stream from impeller 20 to the lower bunker opening 18. A screen at 32a, as well as the one at 32, prevents solid matter from being carried into the ice bunker and deposited on the ice. The stream of air impelled by the impeller must all enter the lower end of the ice bunker and cannot set up any circulation in the load compartment of the car independently of the air stream which passes through the ice bunker. The same would be true if the air impeller were positioned at any other suitable place in air stream, for instance at the upper opening 17; and also would be true if the air circulation were downward through the ice. My new system reaches definitely improved results utilizing the last mentioned direction of circulation, but its best results are attained by reversed (counter convection) flow through the ice. And the illustrated location of the impeller is preferred, as it greatly facilitates the maintenance of a closed circuit air stream. And this location also lends itself most efficiently to the movable bulk head features of my invention, described later.

In the commonly used type of ice bunker the compartment enclosed by partition 15 is usually equipped with an ice basket spaced all around from the walls of the ice compartment. In such a structure the air circulation is not confined to passing through the ice but passes in very large or major proportion around the ice; and the efficiency of air cooling is consequently very low. In contra-distinction to that practice, the present improvement provides a suitably lined ice bunker whose cross-section is to be totally filled with ice, so that the air stream cannot pass through the ice bunker without passing through the mass of broken ice and any intermingled salt. As shown in the drawings the end and side walls of the ice bunker are lined with a heavy sheet metal lining 40. This lining is preferably placed upon spaced slats 41, both lining and slats being secured to the end and side wall structures. When the lining 40 is thus applied with its supporting and spacing slats to the interior faces of any existing car structure, it provides the desired imperforate interior bunker wall, capable of taking the direct contact of the ice and impervious to and unaffected by moisture, and also it provides the desired heat insulation. The total heat insulation of the three external bunker walls is thus made to be sufficient to prevent any substantial ice meltage at the wall surfaces; and thus prevents the predominant formation of air channels next to a relatively warm wall, as would be the case were the external walls not extra-insulated. To provide a similar interior surface for bulkhead 15 a similar lining of sheet metal 40a is attached to the inner face of its panel 66. It is not necessary however that any heat insulating qualities be provided in the bulkhead, as heat transfer through it from the load to the ice is not undesirable.

The increased heat insulation of the external bunker walls, and the lining of both those walls and the bulkhead may be incorporated in the car when it is originally built. I show them here as being applied to an existing car.

The ice rests on a grate, indicated at 43. This grate may be of any suitable structure and supported in any suitable manner, it only being preferable that the grate be as open as practicable. The remainder of details of the structure illustrated in Fig. 1 need not be explained as they embody typical structure and do not enter into the invention.

The ice bunker is loaded in the usual manner with the ice broken to about the usual size, in pieces running from about 5 to 25 pounds. The usual percentage of salt (up to 30%) may be used, interspersed with the ice in several layers in the upper part of the ice mass.

In operation, air circulation takes place in a single closed circuit stream which flows in a confined stream from the impeller through opening 18, up through the mass of broken ice, out through the upper opening 17 and thence longitudinally of the car next the roof. From the upper longitudinal stream the air distributes into downward distributed flow through the car load and then through the slotted lading rack into the longitudinally extending space between the lading rack and the car flow. Thence the air flow is under the lading floor back to the impeller. If only a single air circulatory system is used in a car, the longitudinal and downward flow of air extends over the length of the whole car body from the single ice bunker. Where, as is more usual and preferred, the system shown in Fig. 1 is duplicated at the other end of the car, there are two independent streams of air circulation, each taking care of approximately one-half the load compartment of the car. In either case it will be seen that the circulation system is such that no circulation of air is set up in the load compartment except the circulation of air which must necessarily have passed through the ice.

As pointed out, the air stream preferably moves upwardly through the ice bunker, and in that movement it must move through and in direct contact with the mass of broken ice. In practice it has been found that the air flow creates devious and many small channels through the mass of ice, and does not tend to form clear passages around the mass of ice next the bunker walls. The additional heat insulation of the bunker walls aid in that desired result. Because of the imperforate walls of the ice compartment, salt tends to become more evenly distributed through the ice than it does in the perforate basket bunker which allows much to fall through without making contact with ice. The cooling capacity of the salted ice and brine is thus more effectively utilized in absorbing heat from the air. The drip water, likewise, is forced to percolate down through the ice mass, tending to distribute the saline brine. As a result the air which issues from opening 17 is cooled much more uniformly and to a much lower temperature than has been found possible with the usual systems now in use.

The cooled air, flowing longitudinally of the car close to the roof comes into contact first with the upper parts of the load. Passing down through the load the air picks up heat so that, during precooling operations or in transit, the upper part of the load is cooled to or held at a

lower temperature than the low part of the load. This distribution of load temperature is also desirable as it effectively counteracts the tendency of the upper part of the load to rise in temperature faster than the lower part during stoppages in transit.

Although it is preferred to use an air impeller of the type and placement indicated, as it has advantageous features in the system, yet the impeller may be of any type and placed at any suitable point in the air stream. It is of course placed most practicably at some point where the air stream is relatively constricted, as at or near either of the openings 17 or 18. Of those two practicable locations the one near the lower opening has definite advantages in the system, as well as advantages of protected placement on the car floor in a space otherwise unused.

The type of impeller which has impeller units distributed transversely across the width of the car also has advantages in the system in creating an air stream practically as wide as the car and bunker interior. The air passage under cover plate 34, and both openings 17 and 18, extend the full width of the ice bunker interior; and the even distribution of the air stream across these passages and openings aids materially in attaining distributed intimate contact of the air and the cooling agents in the bunker, as well as even distribution over the car load.

Accurately recorded trial operations of the improved system have indicated several definite superiorities over systems using an ice basket but otherwise identic, whether or not the air circulation is against natural convection, as shown in the drawings, or with natural convection downward through the ice bunker. The improvement over the usual system is however particularly marked when the circulation is against convection. Additional cooling capacity of between 20 and 40 percent has been measured under identic conditions of operation. The temperatures reached in precooling over a given length of time, and the temperatures maintained during transit, are substantially lower than those maintained in the systems using the ice basket. In precooling cars for frozen load shipment, under identic conditions, my basketless system has reached average temperatures close to 0° F. as against approximately 7.5° F. for the basket system. In precooling of fresh fruit my system has in 7½ hours cooled the load to the lowest point reached by the other system in approximately 20 hours.

The difference in average temperatures which have been maintained in transit, as between the two systems, has been 7° or more. And the temperature spread from top to bottom of the car using my system has been as little as one half that of the car using the basket system; 3° against 6° in a typical case.

The cooling capacity of the system, installed as illustrated with an air impeller small enough in size to be housed between the lading rack and car floor, has been found ample for all normal precooling operations, cooling the load down well within the time period allowed in practice for that purpose. As a consequence it is not necessary to utilize special apparatus for the precooling operation, as that operation may be carried on when the car is at rest by driving the circulation impeller from any suitable independent source of power.

And there has also been established a marked superiority in my basketless system, compared

with the basket system, when the impellers are not operating and air flow is by convection only. This superiority is particularly marked after air has been impelled through the ice for a short period in either direction to form the multitudinous air channels through it; but the superiority exists without such pre-impulsion of air through the ice. Whenever the impellers are not operating in my system the natural convection flow is much more effective in either cooling the load or maintaining it at low temperatures. And this is particularly important in keeping the load temperatures down during stoppages in transit.

As I have mentioned, my system lends itself most effectively to the use of a collapsible bulkhead. The fact that the ice bunker, when not occupied by ice, is interiorly open and unobstructed makes it practicable to construct and support the bulkhead in such manner that it may be moved longitudinally against the end wall of the car to make substantially all of the car interior available for loading. And, in so providing for the movable bulkhead, I am enabled to locate the ice supporting grate at the level of the lading rack, so that the ice grate then becomes available for load support. The ice grate thus, in my system, performs three functions which are intimately tied into the system. It supports the ice preferably at a level at or above that of the lading rack and of the lower air opening 18; and when thus acting as an ice support it forms a continuation of the air stream restricting channel which extends from impeller 20 under cover 34 and through opening 18, to direct and distribute the air flow under the lower end of the ice charge. And it also acts to support carload when not used for ice support. When the ice grate is thus supporting carload it still maintains its function as a part of the directive air channel so that a certain amount of air circulation may be maintained through the car when the bunker ice is not used.

I now refer more particularly to Figs. 3 and following. In these figures the general car structure is the same as that before described and the same numerals are applied to corresponding parts. The lading rack 10, impeller unit 20, cover 34, and openings 18 and 17 are shown substantially as before. The lining and insulation of the three external walls of the ice bunker are also shown as before described and designated by the same numerals. The structure of bulkhead 15a is substantially the same as before shown, but its mounting and attachment to the car walls are such as to facilitate its movement between the positions shown in full and dotted lines in Fig. 3. And the location of the ice grate is such as to facilitate the operations here described. These modified structures and operations will now be described.

As shown in Figs. 3 and following, the major portion of ice grate 43a is made up of transverse bars 60 spacedly tied together by suitable members 61 and resting on several supporting beams 62, longitudinally extending and transversely spaced. These beams 62, having their ends abutting the end wall of the car, and having their inner ends connected with bulkhead 15a as will appear, act as thrust members to take any longitudinal thrust which may come upon the bulkhead.

Near end wall 12, the upper supporting surface of the ice grate is dropped to be substantially flush with the upper surfaces of beams 62, as shown in Fig. 3. This is done by placing a

few of the ice grate bars 60a at the lowered level, these lowered bars being mounted across and supported on beams 62 by any suitable means of support connection. The beams may be cut away and grate bars 60a may extend through the planes of the beams; or the bars may extend merely between beams and be welded or otherwise supported upon them.

The structure of the main body of bulkhead 15a as shown in Fig. 3 is substantially the same as that shown in Fig. 1. In essence this bulkhead structure comprises a series of vertical and laterally spaced struts 65 which extend upwardly from the level of the ice grate to points just under the car roof. As here shown, the two outermost struts 65a are preferably in the form of channel irons. These struts carry the bulkhead facing panel 66 whose lower edge is at about the level of lading rack 19 and the ice grate and whose upper edge defines the lower edge of upper air opening 17.

The spaced struts 65 are framed at their tops by a horizontal channel 65' and are interconnected at their lower ends by a strap 67 and braced by bracings 68. The lower ends of struts 65, in the full line position of Fig. 3, rest upon a transverse channel member 69. The lower end of each strut 65 is provided with flanger 70 through which locking pins 71 can be dropped through holes in channel member 69. Channel 69 being rigidly attached to the ends of longitudinal beams 62, the lower end of the bulkhead is thus securely but releasably connected to beams 62.

Each of the lateral struts 65a of the bulkhead has at its lower end a carriage roller 72 adapted to roll on a track 73 mounted on the car side wall. The forward end of track 73 is dropped, as shown at 74 in Fig. 7, so that the bulkhead, when in its full line position of Fig. 3, will be supported by its lower end resting upon channel 69. The upper surface of channel 69 is preferably flush with the upper surface of the ice grate, so that when pins 71 are removed and the lower end of the bulkhead forced rearwardly rollers 72 ride upwardly onto track 73 and raise the lower end of the bulkhead framing slightly above the level of the ice grate.

When in the normal full line position, the upper end of the bulkhead frame extends upwardly into a transverse channel 75 mounted across the car directly under the roof, this channel serving to position and support the upper end of the bulkhead. As the lower end of the bulkhead is moved rearwardly on track 73, the bulkhead first takes a tilted position somewhat like the tilted position shown in dotted lines in Fig. 3, and its upper end moves downwardly out of channel 75. The upper end of the bulkhead is also provided with rollers 77 at each side, adapted to run on tracks 78 mounted on the car side wall. When the bulkhead is in or about the tilted position shown in dotted lines in Fig. 3, these rollers 77 have dropped down on tracks 78 which then serve to carry the upper end of the bulkhead as the lower end is forced toward the end wall of the car. When the lower end of the bulkhead reaches the lowered portion 60a of the ice grate, the lower rollers 72 drop off the rounded ends 79 of tracks 73, and the lower end of the bulkhead moves down onto the depressed portion of the ice grate or onto beams 62, as the upper end is moved further rearwardly toward the vertical position shown in dotted lines in Fig. 3. Upon finally reaching that

position the upper rollers 77 reach depressed end portions 78a of tracks 78, so that the bulkhead is slightly lowered to rest its lower end on the ice grate or beams 62. And when the upper end of the bulkhead reaches this last mentioned position, it is secured by suitable latches. Those here shown are simply gravity latches 80 which are mounted in inverted channels 81. To release the bulkhead latches 80 are simply pushed up into the channels and they drop by gravity to latch the bulkhead when the bulkhead passes them to the dash-dot position of Fig. 3. Channels 81 are longitudinal channels extending from the car end wall to the transverse channel 75 to brace the latter against end thrust.

In its normal position, full lines in Fig. 3, the bulkhead is rigidly supported to form the bulkhead wall of the ice bunker and to take all thrusts to which it may be subjected. In its collapsed position dot-dash lines in Fig. 3, the bulkhead lies with its spaced struts 65 against lining 40 of the car end wall. In this position its weight is carried by its lower end resting on the ice grate, and it is locked in this position securely. With the bulkhead in this position the major portion of the ice grate, at the level of lading rack 18, becomes available for the support of additional car load which may occupy all of the normal ice bunker space. The cubic capacity of the car is increased by an amount substantially just equal to that of the ice bunker interior, and is increased to an amount equal to the entire interior of the car, less only the space occupied by the bulkhead.

With the bulkhead at the car end, air circulation may be maintained if desired. Impeller 20 will set up a stream of air circulation from the space under lading floor 19 through the space under cover 34, and thence through the space under the loaded ice grate 43a. The air circulation will then pass upwardly next to the car end wall in the space between bunker facing 66 and end wall lining 40. The lower ends of bulkhead struts 65 being not framed together, open spaces are afforded between the spaced struts so that the air flow may pass upwardly between them to the upper opening 17, whence the air stream flows out over the load in the car.

To prevent leakage of the air current passing through the ice bunker, and to prevent leakage or seepage of water into the load compartment, a suitable sealing member is applied to struts 65a, such as shown in Fig. 6. The width of the bulkhead is such as to allow a slight clearance at its ends from the car side walls, or from the linings 40 on those side walls. That lining may be substantially flush with the general interior surfaces of the car side walls, as when the lining and the extra bunker insulation are originally built into the car; or it may be offset inward from the side wall surfaces if applied to a car already built. It is shown as if flush in Fig. 6. In any case the lining will extend far enough from the car end wall to overlap the bulkhead ends when the latter is in use to form an ice bunker. The sealing member shown in Fig. 6 seals the clearance between the bulkhead and the lining. As there shown it comprises a rubber strip 90 set in channel 65a and having vertical fins 91 which contact with the lining.

The described forms of system and structure are illustrative only. The features that comprise the invention are defined in the following claims.

I claim:

1. In refrigerating systems for a car or the like which has floor, roof and fixed side and end walls, 75

a transverse bulkhead dividing the car interior into a load compartment and an ice bunker at the end of that compartment, air circulation openings between the load compartment and the bunker at the upper and lower ends of the bulkhead and extending across substantially the full width of the car, and a lading floor spaced over the floor of the load compartment; the improvement which is characterized by the ice receiving bunker being directly delimited and walled by the bulkhead and by the fixed end and side walls of the car, all of said bunker delimiting walls being non-apertured and interiorly surfaced to withstand direct contact with a charge of ice and to be impervious to moisture, the side-defining surfaced walls of the bunker being substantially flush with the inner faces of the car side walls which delimit the load compartment, the interior space of the ice bunker which is delimited and bounded by its said surfaced walls being wholly open and unobstructed to receive an ice charge completely filling its horizontal cross-section, all so that there are no air flue spaces through which air may flow vertically around the ice charge, the external car walls which enclose the bunker being heat insulated to that degree which will prevent any substantial meltage of the ice charge adjacent and against those walls due to heat conduction therethrough, there being means for impelling an air current in a single closed flow circuit through the upper and lower circulation openings, the ice bunker and the load compartment, said means including an air impeller unit located in the space between the levels of the lading rack and the floor and acting to propel an air flow, of substantially the full car width, longitudinally of said space, and means at the level of the lading rack confining the air flow below that level between the impeller unit and the lower circulation opening at the bulkhead, there being an ice supporting grate in said delimited ice bunker permanently located at the substantial level of the lading rack and substantially filling the horizontal cross-section of said bunker, and the bulkhead being movable between its position in which it separates the ice bunker from the load compartment and a position in which it is approximately against the end wall of the car, and releasable means for securing the bulkhead in either of its stated positions.

2. In a refrigerator car or the like which has a floor, roof and side and end walls, an ice grate structure spaced above the car floor and extending from the car end wall to a transverse plane which defines a load compartment from an ice bunker space at the end of the car, load carrying structure spaced above the car floor in the load-compartment substantially at the level of the ice grate, a limited area of the ice grate next the end wall of the car being recessed downwardly to form a bulkhead receiving pocket, a downwardly facing and transversely extending channel secured under the car roof in a position substantially in said defining plane, a movable transverse bulkhead having two vertical positions, in one of which its lower edge rests on the ice grate structure and its upper edge is received in the channel, and in the other of which positions the bulkhead lies approximately against the end wall with its lower edge received in said pocket, and releasable means for securing the bulkhead in each of its stated positions.

3. In a refrigerator car or the like which has a floor, roof and side and end walls, an ice

grate structure spaced above the car floor and extending from the car end wall to a transverse plane which defines a load compartment from an ice bunker space at the end of the car, load carrying structure spaced above the car floor in the load-compartment substantially at the level of the ice grate, a limited area of the ice grate next the end wall of the car being recessed downwardly to form a bulkhead receiving pocket, a downwardly facing and transversely extending channel secured under the car roof in a position substantially in said defining plane, a movable transverse bulkhead having two vertical positions, in one of which its lower edge rests on the ice grate structure and its upper edge is received in the channel, and in the other of which positions the bulkhead lies approximately against the end wall with its lower edge received in said pocket, releasable means for securing the lower edge of the bulkhead to the ice grate structure in the first stated position, and releasable means for securing the upper edge of the bulkhead in the last stated position.

4. In a refrigerator car or the like which has a floor, roof and side and end walls, an ice grate structure spaced above the car floor and extending from the car end wall to a transverse plane which defines a load compartment from an ice bunker space at the end of the car, load carrying structure spaced above the car floor in the load-compartment substantially at the level of the ice grate, a limited area of the ice grate next the end wall of the car being recessed downwardly to form a bulkhead receiving pocket, a downwardly facing and transversely extending channel secured under the car roof in a position substantially in said defining plane, a movable transverse bulkhead having two vertical positions, in one of which its lower edge rests on the ice grate structure and its upper edge is received in the channel, and in the other of which positions the bulkhead lies approximately against the end wall with its lower edge received in said pocket, releasable means for securing the bulkhead in each of its stated positions, carrying rollers mounted on the laterad edges of the bulkhead, and cooperating tracks mounted on the side walls of the car and adapted to support the bulkhead during movement between its stated positions.

5. In a refrigerator car or the like which has a floor, roof and side and end walls, an ice grate structure spaced above the car floor and extending from the car end wall to a transverse plane which defines a load compartment from an ice bunker space at the end of the car, load carrying structure spaced above the car floor in the load-compartment substantially at the level of the ice grate, a limited area of the ice grate next the end wall of the car being recessed downwardly to form a bulkhead receiving pocket, a downwardly facing and transversely extending channel secured under the car roof in a position substantially in said defining plane, a movable transverse bulkhead having two vertical positions, in one of which its lower edge rests on the ice grate structure and its upper edge is received in the channel, and in the other of which positions the bulkhead lies approximately against the end wall with its lower edge received in said pocket, releasable means for securing the bulkhead in each of its stated positions, carrying rollers mounted on the lateral edges of the bulkhead, and cooperating tracks mounted on the side walls of the car and adapted to support the bulkhead during movement between its stated posi-

tions, the tracks being recessed downwardly in areas adjacent the said defining plane and adjacent the end wall of the car to allow the lower edge of the bulkhead to rest on the ice grate structure in its two stated positions.

6. In refrigerating systems for a car or the like which has floor, roof and fixed side and end walls, a transverse bulkhead dividing the car interior into a load compartment and an ice bunker at the end of that compartment, air circulation openings between the load compartment and the bunker at the upper and lower ends of the bulkhead and extending across substantially the full width of the car, and a lading floor spaced over the floor of the load compartment; the improvement which is characterized by the ice receiving bunker being delimited and walled by the bulkhead and by the fixed end and side walls of the car, the said bunker delimiting side walls being substantially flush with the inner faces of the car side walls which delimit the load compartment and being non-apertured and interiorly surfaced to withstand direct contact with a charge of ice and to be impervious to moisture, the interior space of the ice bunker which is delimited by the bulkhead, the end wall and the surfaced side walls, being wholly open and unobstructed to receive an ice charge filling its cross-section from side to side, so that there are no air flue spaces through which air may flow vertically past the ice charge adjacent the side walls, the side walls which directly enclose the bunker being heat insulated to that degree which will prevent any substantial meltage of the ice charge adjacent and against those walls due to heat conduction therethrough, there being means for impelling an air current in a single closed flow circuit through the upper and lower circulation openings, the ice bunker and the load compartment, said means including an air impeller unit located in the space between the levels of the lading rack and the floor and acting to propel an air flow, of substantially the full car width, longitudinally of said space, and means at the level of the lading rack confining the air flow below that level between the impeller unit and the lower circulation opening at the bulkhead, there being an ice supporting grate in said delimited ice bunker permanently located at the substantial level of the lading rack and substantially filling the horizontal cross-section of said bunker, and the bulkhead being movable between its position in which it separates the ice bunker from the load compartment and a position in which it is approximately against the end wall of the car, and releasable means for securing the bulkhead in either of its stated positions.

7. In refrigerating systems for a car or the like which has floor, roof and fixed side and end walls, a transverse bulkhead dividing the car interior into a load compartment and an ice bunker at the end of that compartment, air circulation openings between the load compartment and the bunker at the upper and lower ends of the bulkhead and extending across substantially the full width of the car, and a lading floor spaced over the floor of the load compartment; the improvement which is characterized by the ice receiving bunker being delimited and walled by the bulkhead and by the fixed end and side walls of the car, the said bunker delimiting side walls being substantially flush with the inner faces of the car side walls which delimit the load compartment and being non-apertured and interiorly surfaced to withstand direct contact with a charge

of ice and to be impervious to moisture, the interior space of the ice bunker which is delimited by the bulkhead, the end wall and the surfaced side walls, being wholly open and unobstructed to receive an ice charge filling its cross-section from side to side, so that there are no air flue spaces through which air may flow vertically past the ice charge adjacent the side walls, the side walls which directly enclose the bunker being heat insulated to that degree which will prevent any substantial meltage of the ice charge adjacent and against those walls due to heat conduction therethrough, and there being means for impelling an air current in a single closed flow circuit through the upper and lower circulation openings, the ice bunker and the load compartment, said means including an air impeller unit located in the space between the levels of the lading rack and the floor and acting to propel an air flow, of substantially the full car width, longitudinally of said space, and means at the level of the lading rack confining the air flow below that level between the impeller unit and the lower circulation opening at the bulkhead.

8. In refrigerating systems for a car or the like which has floor, roof and fixed side and end walls, a transverse bulkhead dividing the car interior into a load compartment and an ice bunker at the end of that compartment, air circulation openings between the load compartment and the bunker at the upper and lower ends of the bulkhead and extending across substantially the full width of the car, and a lading floor spaced over the floor of the load compartment; the improvement which is characterized by the ice receiving

bunker being delimited and walled by the bulkhead and by the fixed end and side walls of the car, the said bunker delimiting side walls being substantially flush with the inner faces of the car side walls which delimit the load compartment and being non-apertured and interiorly surfaced to withstand direct contact with a charge of ice and to be impervious to moisture, the interior space of the ice bunker which is delimited by the bulkhead, the end wall and the surfaced side walls, being wholly open and unobstructed to receive an ice charge filling its cross-section from side to side, so that there are no air flue spaces through which air may flow vertically past the ice charge adjacent the side walls, there being an ice supporting grate in the said delimited ice bunker permanently at the substantial level of the lading rack, substantially filling the horizontal cross-section of said bunker, and extending under the lower edge of the bulkhead, a drip pan under the ice grate and also extending under the lower edge of the bulkhead, the bulkhead being movable between its position in which it separates the ice bunker from the load compartment and a position in which it is approximately against the end wall of the car, the vertical side edges of the bulkhead being close to but spaced from the inner faces of the car side walls, and vertically extending sealing strips mounted on the side edges of the bulkhead and contacting the flush side wall faces to direct ice melt water downwardly along said side edges into the drip pan below.

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