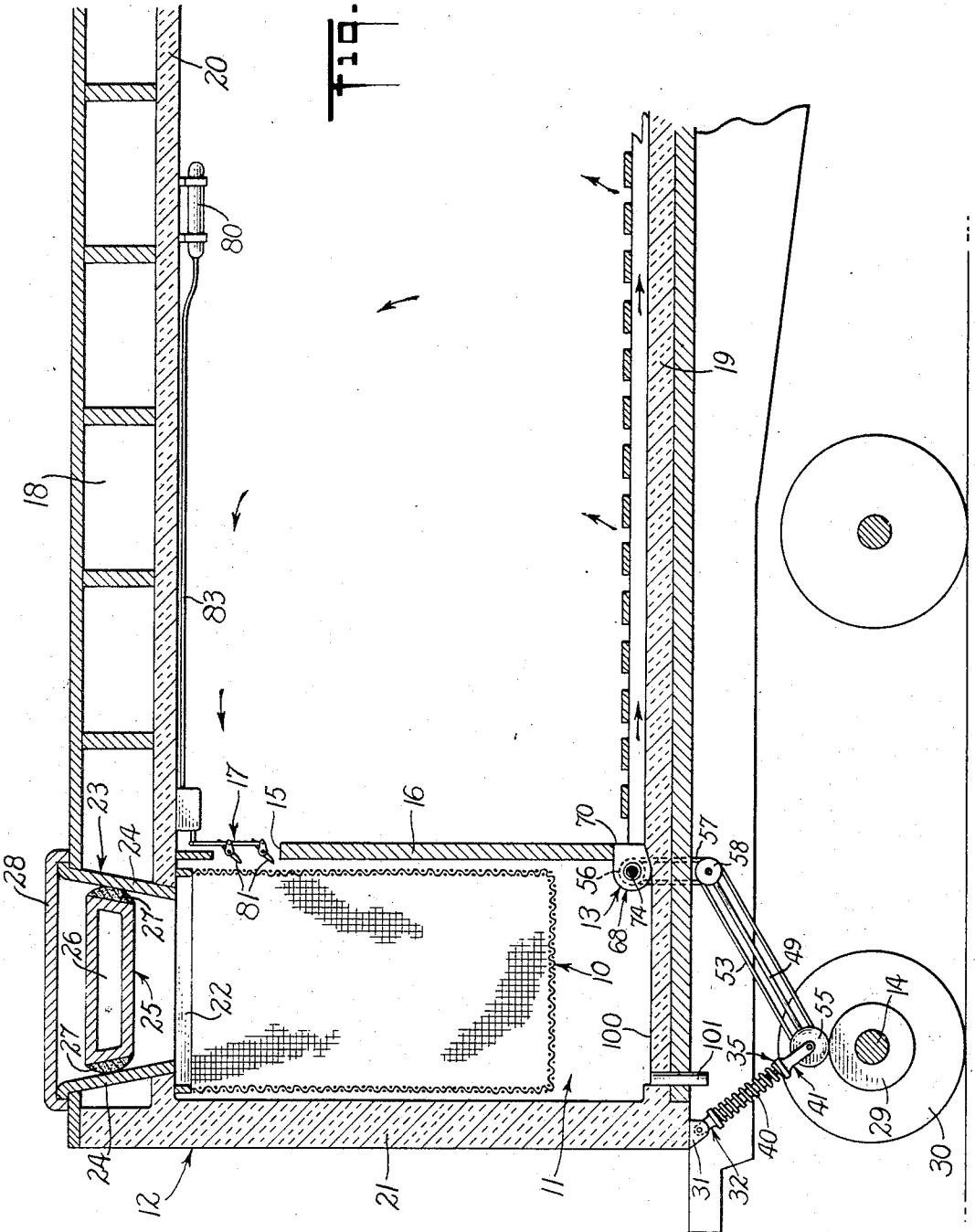
Jan. 16, 1945. G. E. HULSE 2,367,502

REFRIGERATION APPARATUS

Filed July 22, 1942 2 Sheets-Sheet 1

Fig. 1.



INVENTOR
George E. Hulse
BY
Blair, Curtis & Hayward
ATTORNEYS

Jan. 16, 1945. G. E. HULSE 2,367,502

REFRIGERATION APPARATUS

Filed July 22, 1942 2 Sheets-Sheet 2

Fig. 2.

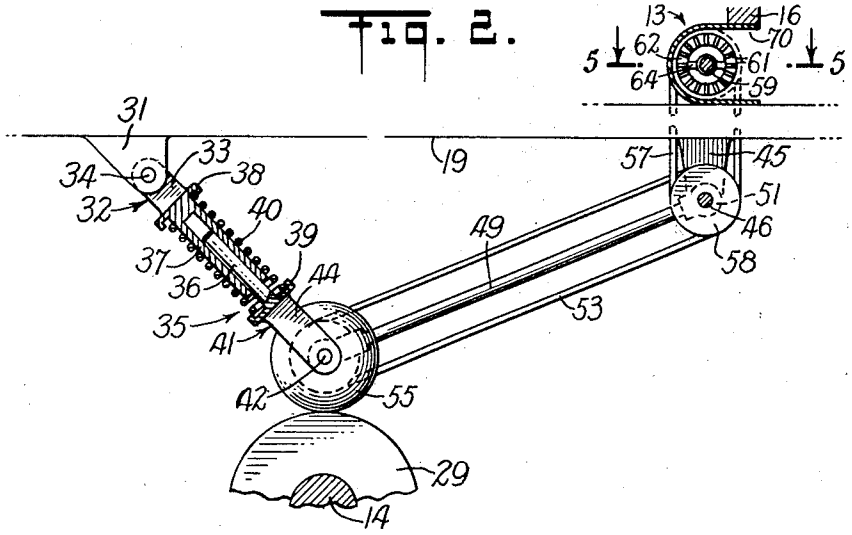


Fig. 3.

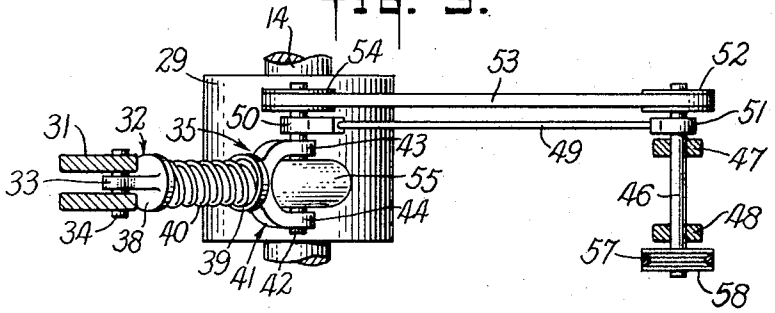


Fig. 4.

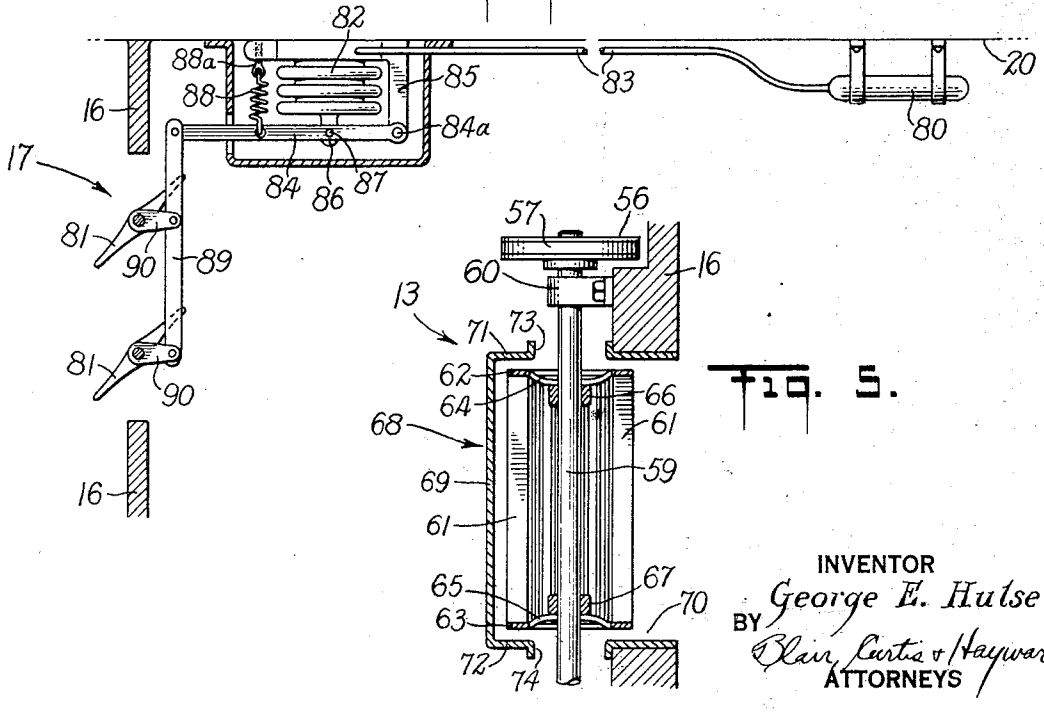


Fig. 5.

INVENTOR
George E. Hulse
BY
Blair, Curtis & Hayward
ATTORNEYS

Patented Jan. 16, 1945

2,367,502

UNITED STATES PATENT OFFICE

2,367,502

REFRIGERATION APPARATUS

George E. Hulse, New Haven, Conn., assignor to The Safety Car Heating and Lighting Company, Inc., a corporation of Delaware

Application July 22, 1942, Serial No. 451,951

4 Claims. (Cl. 62—24)

This invention relates to refrigeration apparatus, and more particularly to apparatus for refrigerating railroad freight cars.

One of the objects of this invention is to provide new and improved refrigeration for a freight car. Another object is to provide apparatus of the above character which is simple, thoroughly practical, and durable in use. Another object is to provide apparatus of the above character which may be manufactured and installed with a minimum amount of labor and other expenses. Another object is to provide apparatus of the above character which will be efficient and dependable in operation. Still another object is to provide apparatus of the above character which will be comparatively free from mechanical complications. Another object is to provide new and improved automatic means for maintaining perishable products at a substantially constant temperature during shipment. Other objects will be in part obvious and in part pointed out hereinafter.

The invention accordingly consists in the features of construction, combinations of elements, and arrangements of parts as will be exemplified in the structure to be hereinafter described and the scope of the application of which will be indicated in the following claims.

In the accompanying drawings in which is shown one of the various possible embodiments of this invention,

Figure 1 is a longitudinal sectional diagrammatic view of a portion of a railroad car with my refrigeration apparatus installed thereon;

Figure 2 is a side elevation, on an enlarged scale and partly in section, of the fan driving mechanism shown in Figure 1;

Figure 3 is a top plan view of the apparatus shown in Figure 2;

Figure 4 is a side elevation, on an enlarged scale, of the damper apparatus shown in Figure 1; and,

Figure 5 is a horizontal section, on an enlarged scale, of the fan taken on the line 5—5 of Figure 2.

Similar reference characters refer to similar parts throughout the several views of the drawings.

As conductive to a clearer understand of certain features of this invention, many difficulties have been experienced in maintaining reliably desired temperatures in refrigerator cars which transport perishables throughout a wide range of climates. Because of temperature variations encountered, refrigeration requirements vary considerably during a trip. Furthermore, if the refrigeration apparatus is of a complicated nature, break downs may be experienced resulting in loss of the load. Accordingly, it is another object of this invention to provide a simple and efficient car refrigeration apparatus which is automatically controlled and in which the hazard of mechanical breakdowns is reduced to a minimum.

Referring now to the drawings, and to Figure 1 in particular, an ice bunker, generally indicated at 10, is positioned within a compartment, generally indicated at 11, in the end of the railroad car, generally indicated at 12. Ice bunker compartments are preferably positioned at each end of the car, but, as the operation and control of each of the bunkers are similar, details of construction are limited to the bunker compartment and its controlling mechanism shown in Figure 1. Air from the car enters compartment 11 through an opening 15 formed in the upper portion of compartment partition wall 16. The size of this opening is controlled by a damper assembly, generally indicated at 17, which in turn is controlled by a thermostatic bulk 80. Air is circulated through the compartment and the car by means of a fan, generally indicated at 13, driven from the axle 14. When the car is moved, the air is circulated by fan 13 in the direction of the arrows shown in Figure 1, and the degree of circulation of air, and thus refrigeration, is controlled by the degree to which the louvers 81 of the damper assembly are opened.

Car 12 is of the usual refrigerated car construction, having a bunker at each end, a dead air space 18 in the top portion of the car, and insulated side walls, end walls, floor 19, and false ceiling 20. Partition 16 extends between ceiling 20 and floor 19, forming compartment 11 which contains ice bunker 10. The ice bunker is preferably of heavy wire mesh construction, and its sides are spaced from the car end wall 21, the car side walls, and partition 16. The bottom of the ice bunker is preferably spaced a substantial distance from the bottom of the car. Thus, air passing through the compartment can circulate around the bunker and underneath it. The top edges of the wire mesh forming the ice bunker are secured to a rectangular-shaped frame 22, which in turn is secured to the ceiling 20 of the car in any suitable manner. A tray 100 is preferably formed on the floor of the car beneath the bunker, and water collected by this tray drains from the car through drainage pipe 101.

The bunker is preferably filled through two hatches extending through the roof of the car. As these hatches are similar in construction, details of construction will be limited to the hatch shown in Figure 1. This hatch, generally indicated at 23, extends through the dead air space 18 in the top of the car and opens into the top of the ice bunker. The side walls 24 of the hatch preferably slant inwardly, forming supports for an insulating plug, generally indicated at 25, which has a dead air space 26 in its center and a cushion 27 made of a resilient material such as rubber extending around its edges. After the bunker is loaded, insulating plug 25 is placed in the hatch opening, and its cushion 27 wedges against the side walls 24 of the hatch to effectively seal the hatch opening. A hatch cover 28 is preferably placed over the top of the hatch and is secured to the top of the car in any suitable manner.

As best shown in Figures 1 and 2, fan 13 is driven from a drum 29 secured to the axle 14 of wheel 30. A bracket 31 (Figures 2 and 3) is secured to the floor 19 of the car in any suitable manner. A barrel member, generally indicated at 32, is pivotally connected to bracket 31 through lug 33 by a pin 34. A rod member, generally indicated at 35, has a portion 36 which extends into the sleeve portion 37 of barrel member 32 and is mounted for longitudinal movement therein (Figure 2). Thrust collars 38 and 39 are formed on the barrel and rod members, respectively, and a compression spring 40 extends between these thrust collars, urging the thrust collars away from each other. A yoke, generally indicated at 41 (Figures 2 and 3), is formed on the lower end of rod member 35, and a shaft 42 extends through and is rotatably mounted in the lower ends of the legs 43 and 44 of yoke 41.

A bracket 45 (Figure 2) is mounted on the floor of the car beneath the fan and has a jack shaft 46 rotatably mounted on its arms 47 and 48. A radius rod 49 (Figures 2 and 3) extends between jack shaft 46 and shaft 42, maintaining shaft 42 the radial length of rod 49 from jack shaft 46. Shafts 42 and 46 are rotatably mounted in the bearing portions 50 and 51 (Figure 3) of the radius rod. A pulley 52 is secured to jack shaft 46 in any suitable manner and is connected by a belt 53 to a pulley 54 secured to shaft 42. A friction wheel 55 (Figures 2 and 3) is secured to shaft 42 between the legs 43 and 44 of yoke 41. Thus, compression spring 40 presses downwardly on rod member 35 and, acting through yoke 41, presses the friction wheel into contact with the drum 29 while radius rod 49 (Figure 2) prevents upward movement of the friction wheel. As the drum is driven by the axle, the friction wheel drives the jack shaft 46 through shaft 42, pulley 54, belt 53, and pulley 52.

The fan pulley 56 (Figure 1) is driven through belt 57 (Figures 1 and 2) by a pulley 58 (Figures 2 and 3) secured to jack shaft 46. Pulley 56 (Figure 5) is secured to the fan shaft 59 which is mounted in the bearings of a pair of brackets secured to the floor of the car, one of which is shown at 60. The fan has a plurality of flat blades 61 (Figures 2 and 5) which extend longitudinally of and have their flat sides in planes extending radially from the axis of shaft 59. The ends of the fan blades 61 are secured to annular rings 62 and 63 which are connected to shaft 59 through spiders 64 and 65 and collars 66 and 67.

The fan housing, generally indicated at 68, has a body portion 69 which covers the fan blades and opens into the lading space of the car through an opening 70 (Figures 1, 2 and 5) formed in partition 16 adjacent the floor 19 of the car. The side walls 71 and 72 (Figure 5) of the housing have circular openings 73 and 74 formed therein which are radially disposed with respect to the axis of shaft 59. These openings, as best shown in Figure 5, are positioned to the left of partition 16, as viewed in Figure 1, within compartment 11. As the fan is driven, the rotation of the fan blades draws air into the housing through openings 73 and 74 and exhausts it into the lading space of the car through opening 70 in partition 16. It should be noted that this fan is so constructed that it will exhaust air from compartment 11, regardless of the direction in which it is driven, and thus is operable to circulate the air through the compartment and the car in the direction of the arrows in Figure 1, regardless of the direction in which the car is moving.

The damper assembly 17, which regulates the flow of air through compartment 11 and thus the temperature of the car, is controlled by bulb 80. This bulb, which is mounted on the ceiling of the car a considerable distance from partition 16, is connected to bellows 82 (Figure 4) by conduit 83. The expansion and contraction of bellows 82, which is secured to ceiling 20, are controlled by a suitable volatile liquid contained within bulb 80. A lever 84 is pivotally mounted on a bracket 85 connected to the base of the bellows by a pin 84a and is pivotally connected to a lug 86 on bellows 82 by pin 87. A spring 88, having one end adjustably connected to the base of bellows 82 by threaded pin 88a and the other end to lever 84, normally resiliently urges lever 84 toward car ceiling 20. The end of lever 84 is pivotally connected to a link 89 which, as it moves upwardly and downwardly, shuts and opens louvers 81 through arms 90. The desired temperature in the car is set by screwing pin 88a into or out of the base of the bellows. This varies the tension of spring 88, thus varying the pressure required to move louvers 81. Thus, as the liquid within bulb 80 is volatilized by the rising temperature within the lading space of the car, this pressure acts upon bellows 82 to expand it, moving lever 84 downwardly to open louvers 81. As the temperature within the car drops, the volatile liquid is condensed, spring 88 moves lever 84 upwardly, and louvers 81 are closed.

Thus, in operation, fan 13 is driven from the axle of the wheel drawing cooled air from the ice bunker compartment and exhausting it beneath the floor racks into the lading space of the car. This air filters upwardly through and around the load in the car absorbing heat therefrom, and when it reaches the upper portions of the car, it flows into the ice bunker compartment through the opening in the upper portion of partition 16 to replace the air being withdrawn from the compartment by fan 13. This air is cooled by the ice bunker and then is again exhausted into the car by fan 13. This circulation continues until the temperature within the car is lowered to the desired degree, at which time the thermostatic control automatically limits or prevents further circulation by throttling or closing the louvers 81. When the temperature again rises in the lading space, the louvers are automatically opened to start or increase the circu-

lation through the car and bunker. Thus, the bunker, fan, and damper assembly coact to refrigerate the car and automatically maintain the temperature therein at any desired degree.

A further advantage lies in the fact that the car is efficiently refrigerated regardless of the speed at which the car is moved. This is accomplished by the fact that the degree of circulation within the car is regulated by the degree to which the louvers are opened, and this in turn is controlled by the temperature of the car. Thus, the fan, which is set to efficiently refrigerate the car at low speeds, cannot overcool the car by increased circulation when the car is moved at a high speed. An additional advantage of the present type of construction lies in the fact that circulation of the air by convection through the bunker compartment and lading space takes place when the fan is not operating. This is permitted because there is a clear passageway through the fan from the compartment into the lading space of the car when the car is not in motion.

Thus, it will be seen that this apparatus is designed to operate in a reliable manner to maintain a substantially constant temperature within the car, and also its efficiency is markedly increased due to the simplicity of its structure and operation. Thus, practical and efficient apparatus for refrigerating a railroad car has been disclosed in which the several objects hereinabove mentioned are successfully accomplished in a practical manner.

As many possible embodiments may be made of the above invention, and as many changes might be made in the embodiment above set forth, it is to be understood that all matter hereinbefore set forth, or shown in the accompanying drawings, is to be interpreted as illustrative and not in a limiting sense.

I claim:

1. In railway car structure, the combination with a chassis assembly and a wall structure forming a lading space and an ice bunker, with a top opening and a bottom opening placing the lading space and ice bunker in communication, whereby air tends to circulate from said lading space through said top opening to said ice bunker and thence through said bottom opening to said lading space again; of a damper assembly positioned in said top opening to restrict the air circulation therethrough; temperature responsive means positioned in said lading space and operatively connected to said damper assembly to control the same whereby the air circulation is reduced as the temperature in the lading space falls; a fan positioned in said bottom opening having its inlet within said bunker and operative regardless of the direction it is driven to exhaust air from the bottom of said ice bunker into the bottom of said lading space, said fan being of a construction to permit substantially unrestricted flow of air through said bottom opening when said fan is not operating; and means mechanically connecting said fan to the car axle to drive the fan without introducing air into the car, whereby movement of the car results in the operation of said fan in promoting the moving of air from the bottom of the ice bunker and into the bottom of the lading space and this air movement is restricted by said damper assembly in accordance with the control effect influenced by said temperature responsive means.

2. In railway car structure, the combination with a chassis assembly and a wall structure forming a lading space and an ice bunker, with a top opening and a bottom opening placing the lading space and ice bunker in communication, whereby air tends to circulate from said lading space through said top opening to said ice bunker and thence through said bottom opening to said lading space again; of a damper assembly positioned in said top opening to restrict the air circulation therethrough; temperature responsive means positioned in said lading space and operatively connected to said damper assembly to control the same whereby the air circulation is reduced as the temperature in the lading space falls; a fan positioned in said bottom opening having its inlet within said bunker and operative regardless of the direction it is driven to exhaust air from the bottom of said ice bunker into the bottom of said lading space, said fan being of a construction to permit substantially unrestricted flow of air through said bottom opening when said fan is not rotating; and driving means for said fan comprising, means mounted on an axle of the chassis assembly, a contact roller riding on said means to be driven by rotation of said axle, a pair of pulleys one of which is connected directly with said roller and the other of which is connected to said fan, and belt means connecting said pulleys whereby the rotation of said axle is transmitted to said fan.

3. Apparatus as described in claim 2 wherein the means mounted on the axle is a drum and wherein said contact roller is mounted to ride on said drum on an extensible pivot arm with one end of the arm pivoted to the chassis assembly and the other end carrying the roller, a coil spring mounted on said extensible arm and biasing said extensible arm toward its extended position, and a rod pivoted at its two ends respectively at the axes of said pulleys and holding said pulleys in spaced relationship to insure the proper tension on said belt means.

4. Apparatus as described in claim 2 wherein said fan is mounted on a horizontal axis with air inlets along its axis, said fan having a plurality of radial vanes spaced from said axis whereby the air is thrown radially from said axis and having a fan housing which directs the exhaust air to said ice bunker.

GEORGE E. HULSE.