May 7, 1940. F. E. PILLEY 2,200,098

AIR CIRCULATOR AND TEMPERATURE REGULATOR

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Fig. 1.

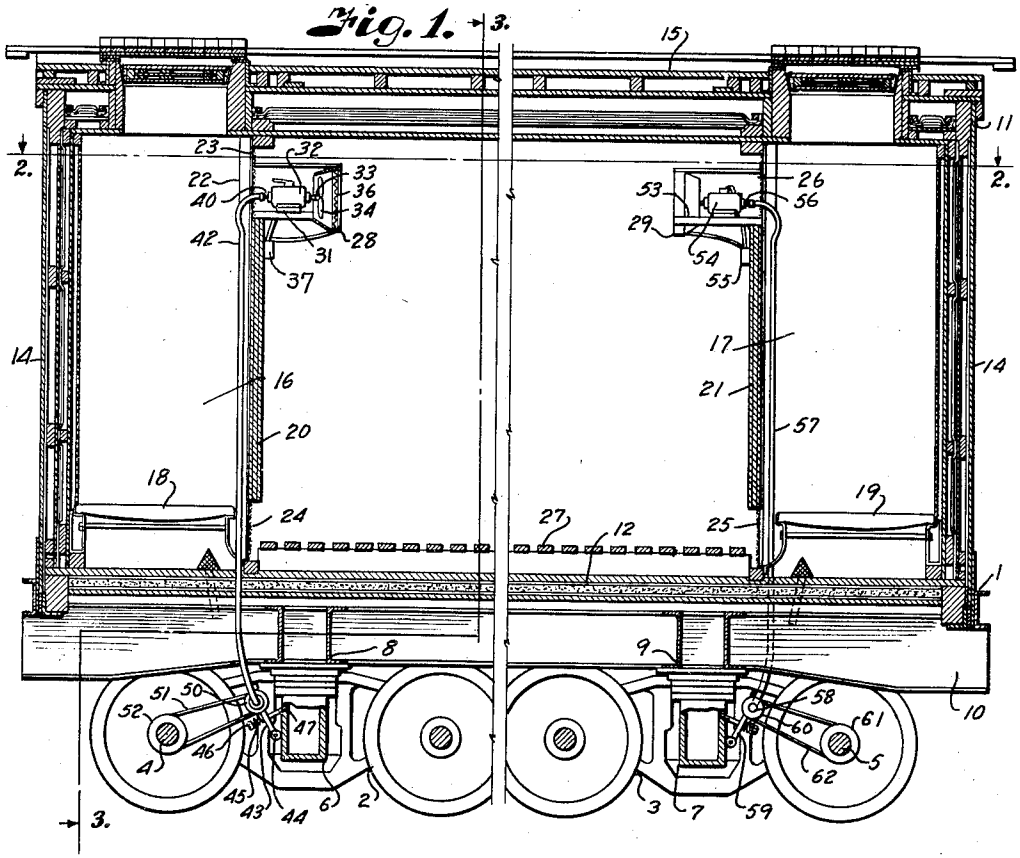
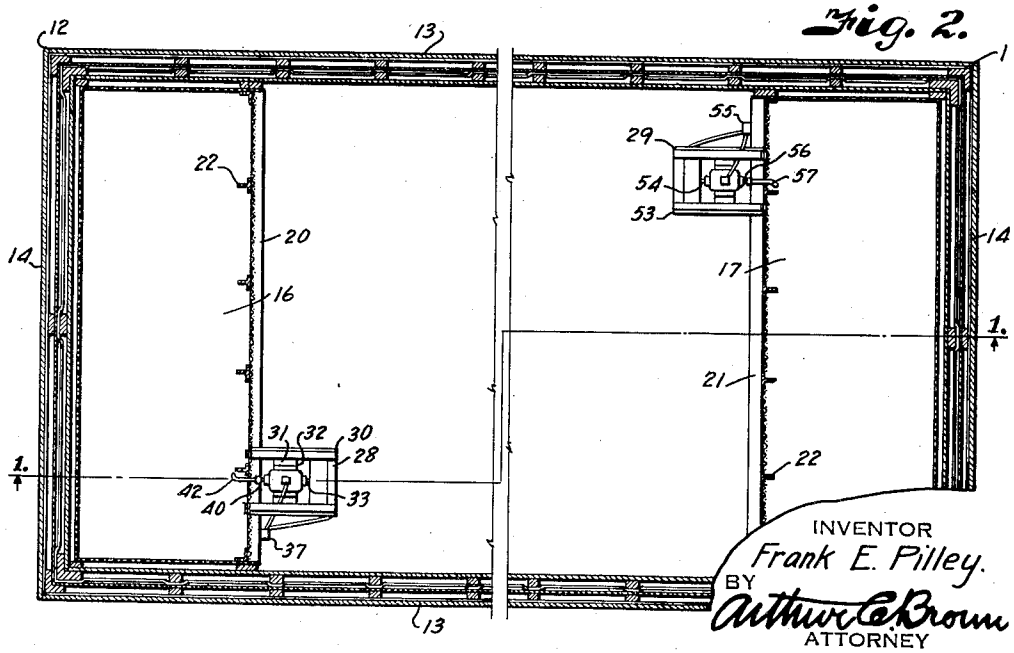


Fig. 2.



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Fig. 3.

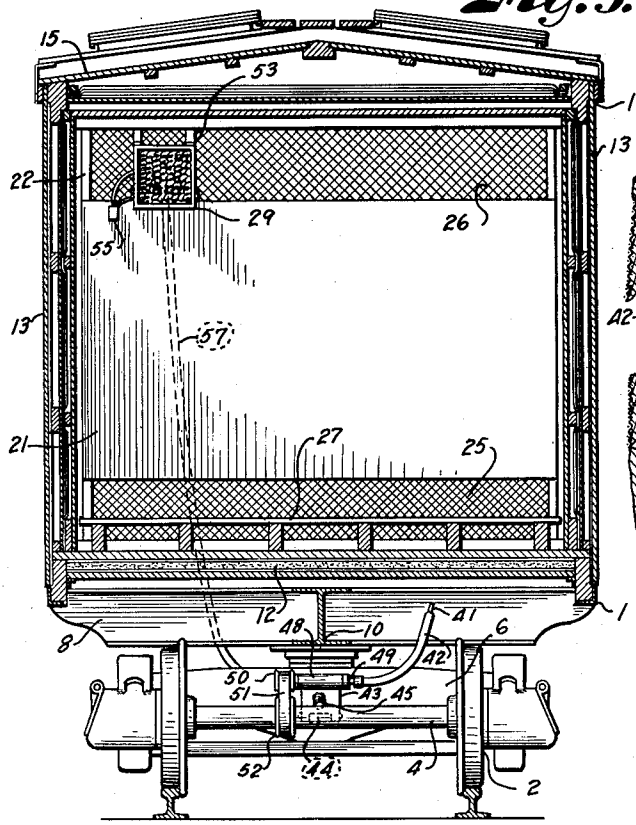


Fig. 4.

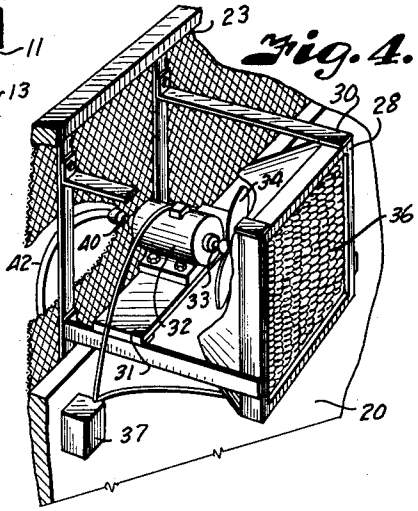


Fig. 5.

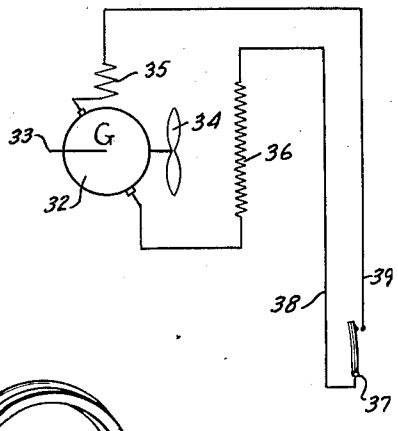
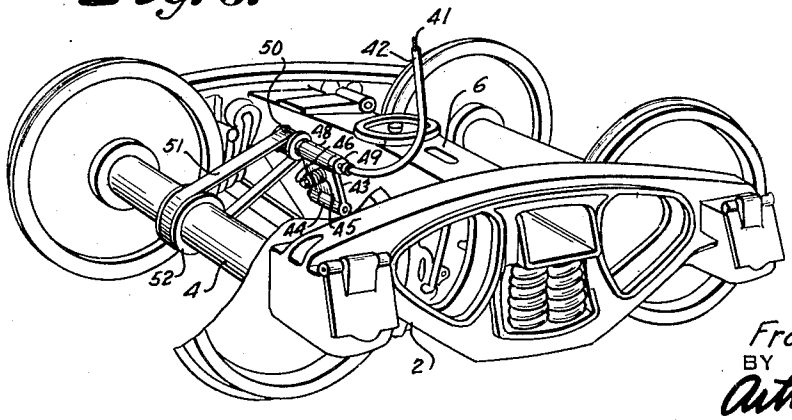


Fig. 6.



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AIR CIRCULATOR AND TEMPERATURE REGULATOR

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Application December 2, 1938, Serial No. 243,566

3 Claims. (Cl. 257—3)

This invention relates to an air circulator and temperature regulator for refrigerator cars and has for its principal object to provide an apparatus of this character adapted to thoroughly circulate air completely throughout the car and to maintain a temperature in the car best suited to the preservation of perishable commodities packed in the car.

In shipping eggs, vegetables, fruits, and other perishable commodities, particularly over long distances, in refrigerator cars, it has been found that regardless of the refrigerant employed, due to the size of the car and the normally closed condition thereof, circulation of refrigerated air is either impeded or insufficient to properly preserve all of the commodities contained in the car. This holds true regardless of hot and cold exterior atmospheric conditions since freezing temperatures are also detrimental to eggs, for example.

A further important object of the present invention is therefore to provide an air circulator and temperature regulator which effectively combats deterioration of perishable commodities in a refrigerator car regardless of weather conditions exteriorly of the car in which the commodities are packed.

Other important objects of the present invention are to provide an apparatus of this character in which substantially duplicate oppositely disposed combined heating and air circulating units are arranged in convenient "out of the way" relation to the contents and structure of the refrigerator car; to arrange the heating and circulating units within the car in such a manner as to utilize and recirculate cooled and humidified air over, under and about all portions of the interior of the car and the contents thereof; to provide for actuation of the heating units in response to actuation of the circulating units and vice versa; to provide for thermostatically controlling actuation of the heating units; to provide novel arrangements for driving or energizing the circulating and heating elements; to provide protective features for driving elements of the units; to provide improved parts and arrangements of parts in an apparatus of this character; and to provide a durable and highly efficient air circulating and temperature regulating apparatus admirably suited for effectively carrying out the noted objects of this invention.

In accomplishing these and other objects of the present invention, I have provided improved details of structure, the preferred form of which is illustrated in the accompanying drawings, wherein:

Fig. 1 is a vertical irregular cross-sectional view on the line 1—1, Fig. 2, through a refrigerator car equipped with apparatus embodying the present invention.

Fig. 2 is a horizontal section through the refrigerator car illustrated in Fig. 1 on the line 2—2 thereof.

Fig. 3 is a vertical irregular section through one end of the refrigerator car on the line 3—3, Fig. 1, at right angles thereto, and particularly showing one of the heating units.

Fig. 4 is a detail perspective view of one of the heating and circulating units constructed in accordance with the present invention.

Fig. 5 is a diagrammatic view of the thermostatically controlled wiring system for the generator and heating element.

Fig. 6 is a detail perspective view of one of the refrigerator car trucks, particularly illustrating the power take-off and drive for energizing the apparatus embodying the present invention.

Referring more in detail to the drawings:

1 designates a refrigerator car that is conventional except for the application thereto of apparatus embodying the present invention; the car 1 having the usual trucks 2 and 3 comprising axles 4 and 5 and bolsters 6 and 7 upon which structural frame members 8, 9 and 10 are mounted in supporting relation to the body of the car, the car body consisting of a conventional floor 12, side walls 13, end walls 14, and a roof 15. The ends of the car are provided with bunkers 16 and 17 for containing a suitable refrigerant, such as ice, not shown, the refrigerant being supported on suitable platforms 18 and 19 and being separated from the remainder of the interior of the car by bulk-heads 20 and 21. The bulk-heads are spaced from the floor and roof of the car and are mounted upon structural members 22 as in conventional practice to provide circulation channels 23, 24, 25, and 26 communicating the refrigerant bunkers with the interior of the car and with each other. Suitable filling openings and drains are provided for the car and bunkers and the car is provided with the customary insulation as in general practice. A raised floor 27 is also preferably provided in the car to elevate commodities packed in the car, such elevation allowing circulation of air below the commodities and preventing damage thereto by positive wetting as a result of dissipation of the refrigerant. The raised floor also permits moisture on

produce, for example, packed in the car to drain off without causing water-logging of the bottom or lower produce.

Due to the size of refrigerator cars of this character and the relative closeness of commodities packed therein, heat which emanates from the commodities remains in static air layers about the commodities and accelerates deterioration thereof. If air admitted by any means to the interior of the car is of low temperature, for example below the freezing point of the commodities in the car, deterioration of the commodities upon subsequent raising of the temperature thereof is also promoted.

In accordance with my invention, therefore, circulation of air of proper temperature and humidity is maintained within the car, which air is caused to move over, under and about the commodities packed in the car to aid in preserving the commodities.

This is accomplished by the provision of cooperative air heating elements and air circulating members combined as units **28** and **29**. The units **28** and **29** are preferably mounted on the upper ends of the bulk-heads **20** and **21** in oppositely disposed diagonal relation to each other, as particularly shown in Fig. 2, in such a manner as to condition and move all the, normally more stagnant, air at the top of the car and effect circulation and re-circulation thereof throughout the total space in the car.

Each unit **28** and **29** preferably consists of a frame **30**, Fig. 4, mounted on a bulk-head **20**, for example, between the bulk-head and the roof or ceiling of the car and in the circulation channel **23**. A transverse supporting member **31** may then be mounted on the frame for seating a generator **32** having a driven shaft **33**. A propeller **34** is fixed to one end of the shaft **33** to form a fan when the shaft is driven, the pitch of the propeller being the same with both units.

The generator **32** is provided with a field coil **35**, Fig. 5, connected in series circuit with a heating element **36** and a thermostatic switch **37**. The switch **37** is adapted to control energization and deenergization of the heating element in response to actuation of the generator by the shaft **33** when the temperature in the car is so influenced by temperatures exteriorly of the car that it either falls below or rises above a predetermined temperature best suited to the preservation of commodities in the car. For example, the thermostatic switch may be set to energize the heating element when the temperatures exteriorly of the car are below freezing and to deenergize the heating element when temperatures exterior of the car approach approximately 60° to 70° F., to thus allow circulation of refrigerated air to maintain the interior of the car at a temperature of approximately from 32° to 33° F. The switch **37** may be of bi-metallic type and connects, when closed, through conductors **38** and **39**, with the heating element and field coil of the generator respectively in such a manner as to cut out the field coil simultaneously with deenergization of the heating element upon opening of the switch in response to high temperatures, thus preventing damage to the generator when current is not needed for the conditioning of the air.

In order to drive the shaft **33**, actuate the generator and rotate the propeller, the end **40** of the shaft **33** opposite the propeller **34** is connected to a flexible shaft **41** encased in a flexible housing **42** leading in a suitable manner through the bunker **16** and the floor of the car to the bolster **6** of the car truck **2**.

A plate **43**, as shown in Fig. 6, is pivotally mounted, as at **44**, on the truck bolster **6** and is normally urged into contact therewith by a spring **45** mounted on a rod **46** extending through the plate **43** and connected with the truck bolster **6** as at **47**, Fig. 1. A bearing **48** is mounted on the end of the plate **43** opposite its pivoted connection with the truck bolster in which a driven shaft **49** is rotatably mounted, one end of the shaft **49** being connected with the lower end of the flexible shaft **41** and the other end of the driven shaft **49** having a pulley **50** thereon.

A belt drive member **51** drives the pulley **50** and runs over a pulley **52** fixed to the axle **4** of the car truck **2**.

In operation, it is apparent that as the car is moved, to the right for example relative to Fig. 1, the wheels of the truck cause the axle **4** to rotate in a clockwise direction, the effect of which is to rotate the driven shaft **49** in a clockwise direction and the flexible shaft **41**, driven generator shaft **33** and propeller **34** in a similar direction, that is when looking at the propeller **34** from the front as from right to left in Fig. 1. With a normal pitch to the propeller **34** air is drawn from the car and forced through the channel **23**, bunker **16**, channel **24**, above and below the elevated floor **27**, through the channel **25**, bunker **17** and channel **26** where it is repositioned for recirculation through the car.

It has been found desirable, as above indicated, to position the unit **29** in oppositely disposed diagonal relation to the unit **28** just described; however, a duplicate frame **53**, generator **54**, heating element, propeller, thermostatic switch **55**, generator drive shaft **56**, and flexible shaft and casing **57** are employed in connection with the unit **29**.

With the unit **29**, it has been found desirable to connect the flexible shaft **57** to a driven shaft **58** rotatably mounted in a bearing on a plate **59** pivoted to the truck bolster **7** of the car truck **3**. In this instance, the plate **59** and driven shaft **58** are in oppositely disposed relation to the plate **43** and shaft **49** of the unit **28** and as the car is moved to the right, Fig. 1, the wheels on the axle **5** of the truck **3** cause, by means of the pulleys **60** and **61** and the belt-drive member **62** connecting them, the shaft **58** also to rotate in a clockwise direction relative to Fig. 1. A clockwise rotation is also imparted to the flexible shaft and the generator drive shaft **56**, that is, when looking at the shaft **56** from left to right in Fig. 1. The propeller on the shaft **56** also moves in a clockwise direction relative to the viewpoint noted and with a normal pitch for the propeller causes air to be drawn from the bunker **17** and forced throughout the car similarly to the air circulating in response to actuation of the unit **28**.

The units **28** and **29** thus act together in effectively circulating air cooled and moistened by refrigerant in the bunkers over, under and about commodities packed in the car to the end that the commodities are maintained in a fresh state.

Upon reversal of direction of movement of the car, the units are operated in reverse direction to maintain a cycle of circulation in a manner reverse to that just described.

It is apparent that with the apparatus described, only air already in the car is circulated to effect reconditioning of the air and preservation of the commodities, and that exterior air

which varies widely in temperature in different localities is excluded, thus facilitating maintenance of a constant temperature in the car.

It is further apparent that by mounting the axle driven shafts on a pivoted member under tension of a spring, obstacles may be passed over without damage to or loss of belt driving members, the cars also being able to move freely as on curves without affecting or damaging the belt members.

What I claim and desire to secure by Letters Patent is:

1. In an apparatus of the character described including in combination with a refrigerator car, a plurality of air circulating units mounted in the car, one of said units being arranged to draw air from the car and direct said air through a refrigerant bunker in said car, another of said units being arranged to draw air from a refrigerant bunker in the car and direct said air into said car, whereby the air circulating units normally circulate air through said bunkers, heating elements incorporated in said air circulating units, and means responsive to predetermined low temperatures occurring within the car for operating the heating elements to heat the air.

2. An apparatus of the character described including in combination with a refrigerator car, a frame in said car, an air circulating unit mounted on the frame adapted to normally circulate air over refrigerant in said car to circulate refrigerated air within said car, said unit having a heating element incorporated therein, a generator mounted on the frame, a driven shaft in the generator for actuating the same, a propeller on one end of said shaft, means for energizing said heating element when predetermined low temperatures occur within the car, and means for actuating said generator driven shaft to move said propeller for causing an air flow over said heating element to circulate heated air within said car.

3. An apparatus of the character described including in combination with a refrigerator car, a generator in said car having a driven shaft, means on said car for driving said driven shaft to actuate the generator, a propeller on one end of said shaft for normally circulating air over refrigerant in said car to circulate refrigerated air within said car, a heating element adapted to be energized in response to actuation of said generator for heating the air circulated within said car, and means for energizing said generator when predetermined low temperatures occur within said car.

FRANK E. PILLEY.