Oct. 25, 1960 H. B. PARKER 2,957,317

REFRIGERATION SYSTEM FOR DELIVERY TRUCKS

Filed Dec. 20, 1956 2 Sheets-Sheet 1

Fig. 1

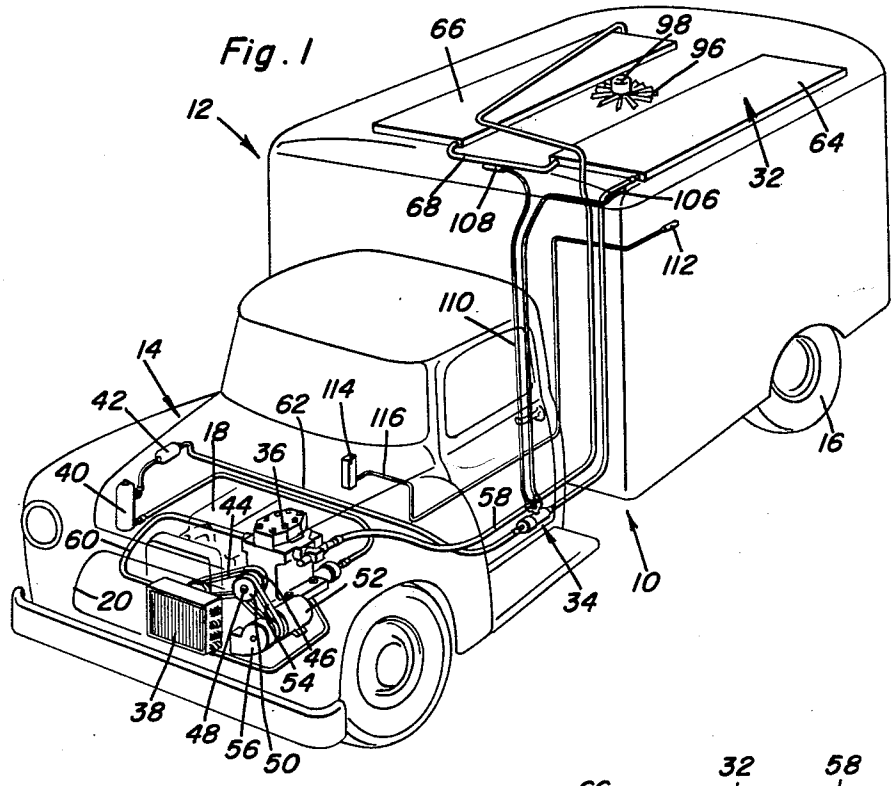
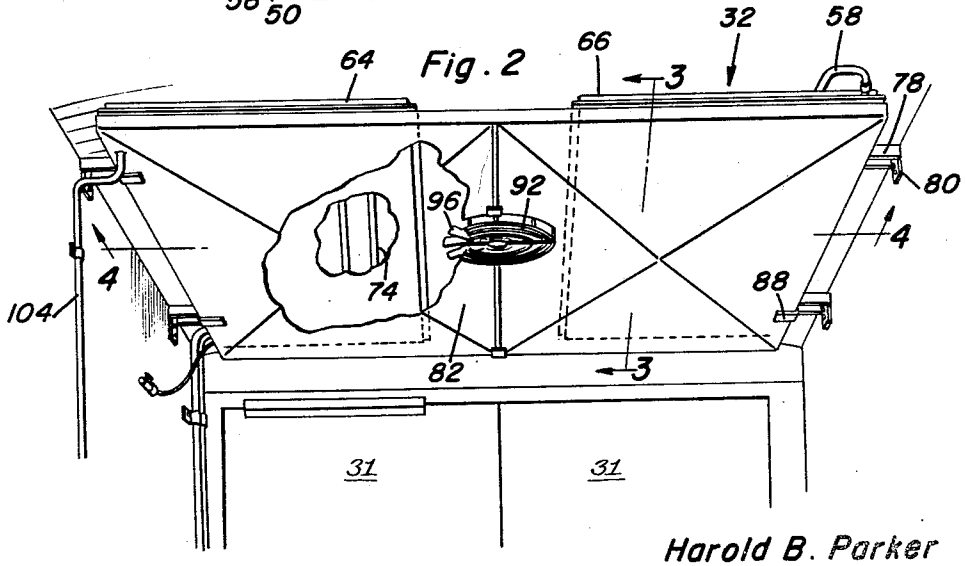


Fig. 2



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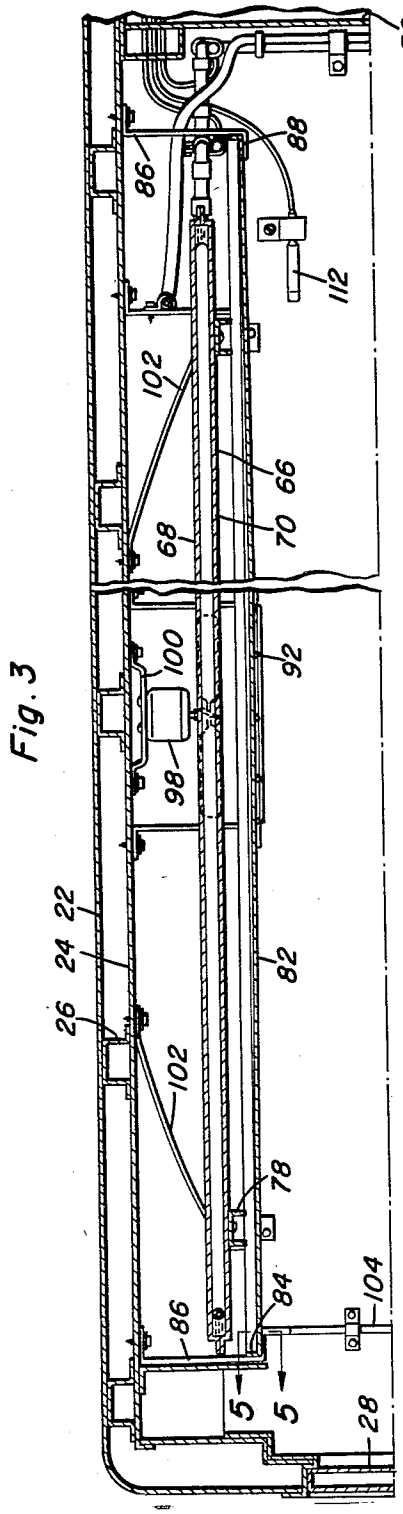

Fig. 3

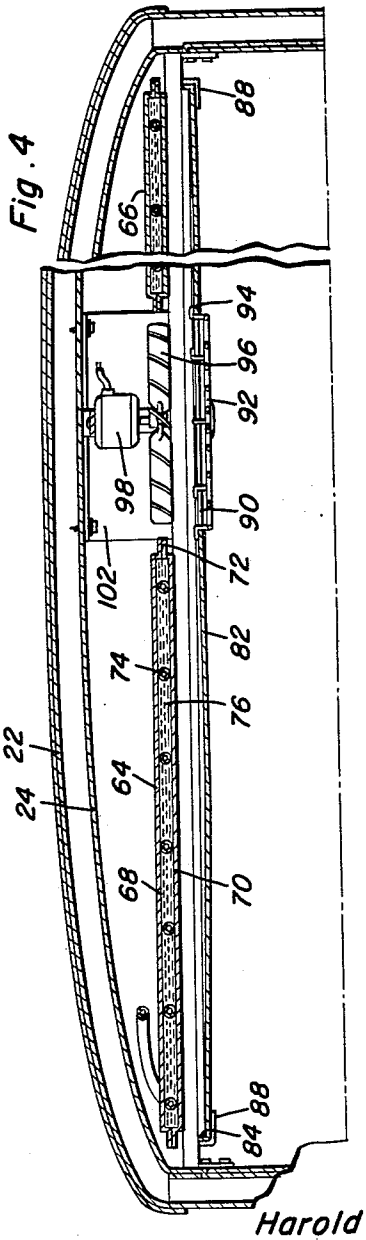

Fig. 4

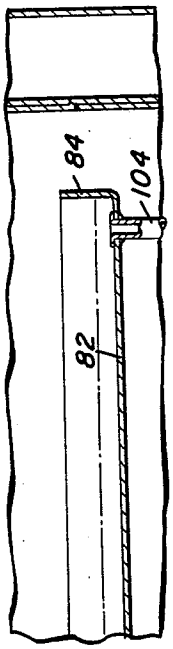

Fig. 5

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REFRIGERATION SYSTEM FOR DELIVERY TRUCKS

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4 Claims. (Cl. 62—186)

The present invention relates to refrigeration systems and more particularly relates to an apparatus specifically adapted for installation in a delivery truck employed in the distribution of products that are necessarily maintained within a predetermined low temperature range at all times.

In present day construction of delivery trucks and especially delivery trucks for dairy products such as milk, it is necessary that the milk be retained at a predetermined low temperature generally ranging from 34° to 40° F. Certain standards have been set up by various health departments and such standards include the requirements that any milk being subjected to a temperature more than 40° must be brought back to the milk processing plant for use in the production of other products since the various regulatory bodies such as health departments will not permit the distribution of milk if it is subjected to the higher temperatures during delivery by the delivery truck. In solving the problem, the general procedure is the provision of a relatively thick and extremely heavy unit in the top of the insulated load carrying body with the unit being filled with a holding fluid with various eutectic fluids being employed for this purpose. Normally, the fluids are lowered to a temperature much below the desired temperature and in fact approach zero degrees F. Due to the large quantity of this fluid, the temperature in the insulated load carrying space will be maintained at the desired level if the doors into the insulated space are not opened too frequently and if the load is emptied relatively rapidly. When it occurs that traffic conditions delay delivery of the products or increased cooling load is produced due to exceedingly high outside temperature or due to opening of the compartment or placing warm empty bottles and cases therein, the cold holding fluid will not adequately maintain the temperature in the load carrying compartment below the allowable maximum level.

Another shortcoming of the cold hold unit presently employed is the tendency of the extremely low temperatures encountered adjacent the cold hold unit sometimes freeze the uppermost products. This also renders the milk unusable and causes damage to the bottles containing the same due to the expansion of the milk during freezing. Also, the exceedingly heavy weight of the cold hold unit which approaches 500 pounds requires an extra heavy reinforced construction for the truck body and even with such reinforcement, this high weight in the top of the body causes damage thereto due to movement caused by rought pavement thus reducing the useful life of the insulated body and reducing the insulation qualities thereof.

In view of the various objectionable features of the cold hold unit, I have provided a refrigeration system adapted especially for milk delivery trucks which is exceedingly light in construction, efficient in operation, easily installed without additional reinforcing, accurately controlled for maintaining a desired temperature in the load carrying compartment and yet relatively inexpensive to install and maintain.

In carrying out the above objects, I provide a pair of cold holding units of light weight construction mounted in the top of an insulated body and separated generally from the load carrying space by a baffle plate having an opening therein with the opening being provided with an air circulating fan that is thermostatically controlled for circulating air over and under the cold holding units thus providing effective control for the temperature of the air with the cold holding units being provided with condensed refrigerant by the use of a compressor driven from the internal combustion engine of the delivery truck during normal operation of the truck with the compressor being driven by an auxiliary motor when the delivery truck is inoperative such as when stored in a garage thus permitting the delivery truck to be employed as a storage area for the milk immediately atfer it is processed and disposed in bottles whereby the alternative driving of the compressor is accomplished by employing a double pulley arrangement with an overriding clutch preferably of the magnetic type. A small fan is provided on the auxiliary electric motor for circulating air over the condensor thereby enabling the refrigeration cycle to operate in periods of normal operation of the delivery truck when the internal combustion engine is being operated for driving the truck and when the truck is garaged or otherwise stored overnight thus maintaining the milk at a desired temperature as determined by thermostatic controls for the evaporator valve as well as the circulating fan in the refrigeration system.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout, and in which:

Figure 1 is a schematic view of the refrigeration system of the present invention installed on a conventional delivery truck having an insulated load carrying body;

Figure 2 is a fragmentary perspective view of the construction of the cold holding unit, the baffle plate and the arrangement of the fan therein as viewed from the rear of the body;

Figure 3 is a longitudinal, vertical sectional view taken substantially upon a plane passing along section line 3—3 of Figure 2 illustrating specific structural details of the various features of the invention;

Figure 4 is a transverse sectional view taken substantially upon a plane passing along section line 4—4 of Figure 2 illustrating further structural arrangements of the present invention; and

Figure 5 is a fragmentary sectional view taken generally upon a plane passing along section line 5—5 of Figure 3 illustrating a drain opening for the baffle plate for permitting discharge of any condensate which may collect on the baffle plate.

Referring now specifically to the drawings, the delivery truck is generally designated by the numeral 10 and includes an insulated load carrying body 12 and a cab and hood assembly 14 which is of conventional construction which is equipped with the usual ground engaging wheels 16, internal combustion engine 18 and other features normally employed in a conventional delivery truck including a radiator for the engine 18 and a grill opening 20 for permitting cooling air to be circulated in relation thereto. The truck body 12 will generally include an outer wall 22 and an inner wall 24 held in spaced relation to each other by structural members 26 with the area therebetween being filled with insulation material if desired. The rear end of the truck body 12 is provided

with openable hinged doors 28 and a front wall 30 which may have a movable partition or section 31 permitting access into the interior of the body 12 from the driver's compartment of the truck 10. The aforementioned construction is conventional and forms no part of the present invention except in its orientation to the refrigeration system of the present invention.

The refrigeration system incorporates a pair of cold holding fluid units generally designated by the numeral 32 which is the equivalent of an evaporator in the usual refrigeration system together with an expansion valve generally designated by the numeral 34, a compressor 36, a condensor 38, a receiver tank 40 and a dehydrator 42. The compressor 36 is mounted in the engine compartment and is driven from a power take-off through a V-belt 44 from the engine 18 to a pulley 46 for driving an input shaft 48 of the compressor 36 thereby driving the compressor in the usual manner. The compressor 36 may be of conventional construction and one which is commercially available for vehicle mounting such as employed in passenger automobile air conditioning units. The pulley 46 is provided with an overriding clutch of the magnetic type with any commercially available type of overriding clutch being acceptable for permitting the compressor 36 to be driven by the V-belt pulley 44 in one direction of rotation when power is being supplied from the internal combustion engine 18 but will permit the pulley 46 to idle freely when the shaft 48 is being driven by an auxiliary pulley 50 mounted on the input shaft 48 of the compressor 36. The auxiliary pulley 50 is driven from an electric motor 52 through a V-belt drive 54 wherein the electric motor 52 is provided with an electrical plug-in adapter (not shown) for association with an electrical outlet for driving the compressor 36 when the truck is parked or garaged. The electric motor 52 also drives a small air circulation fan 56 for circulating air over the condensor 38 when the motor 52 is being used to drive the compressor 36 for causing sufficient air movement to cool the condensor 38. The condensor 38 may also be of any conventional construction such as the finned tube type and is normally mounted forwardly of the radiator and behind the grill opening 20 so that air will pass over the condensor 38 when the delivery truck is in normal forward motion as when the compressor 36 is being driven from the internal combustion engine during the delivery of the products.

The compressor 36 has a suction line 58 connected thereto for receiving hot gaseous refrigerant from the evaporator unit 32 and a high pressure discharge line 60 interconnects the compressor 36 and the condenser 38 for cooling the high pressure hot refrigerant gas after which the condensed refrigerant gas is received in the receiver tank 40 and the receiver tank 40 is connected to the expansion valve by conduit 62 with the dehydrator 42 being arranged in the conduit 62. The expansion valve 34 is disposed in the conduit 62 and is connected to the evaporator unit 32 with the evaporator unit 32 including cold holding units 64 and 66 connected in series by a connecting line 68 with the return line 58 being connected to the rear end of unit 66 remote from the connection of line 62 with the unit 64.

Each cold holding fluid unit 64 and 66 includes spaced plates 68 and 70 joined together at the peripheral edges as designated by numeral 72 with a refrigerant coil 74 disposed therein with the area between the plates 68 and 70 being completely filled with a eutectic holding fluid which may be of any type which will permit such fluid to be reduced to a temperature such as zero degrees F. wherein the entire unit will be completely solidified. The refrigerant coil 74 may be of any non-corrosive substance and the plates 68 and 70 may be of plastic or the like and this construction together with the fluid 76 is relatively lightweight in construction. For supporting the units 64 and 66, a plurality of inverted channel shaped support members 78 are provided in transverse relation to the body 12 with the ends of the channel shaped members 78 being mounted on suitable brackets 80.

Disposed in underlying relation to the evaporator unit 32 is a baffle plate 82 having an upturned peripheral edge 84 that is supported by a plurality of depending brackets 86 secured to the inner wall 24 and including inturned lower ends 88 forming a plurality of ledges for detachably supporting the baffle plate 82. The baffle plate 82 is provided with an enlarged centrally disposed opening 90 having a wire grill or grid 92 supported therein as by projecting lugs 94 on the wire grid engaging the edges of the opening 90. The opening 90 is generally in alignment with a fan 96 powered by an electric motor 98 with the fan unit being supported from a bracket 100 which is also suspended from the inner wall 24. The fan 96 is generally arranged in alignment with the units 64 and 66 and above the baffle plate 82. Downwardly extending baffle plates 102 are provided forwardly and rearwardly of the fan 96 thereby assuring that air drawn through the opening 90 will pass above and below the units 64 and 66 and along the upper and lower surface thereof for effectively cooling the air. The fan 96 may be disposed in any vertical orientation in relation to the cold holding units 64 and 66 to assure that air will pass both below and above these units.

The baffle plate 82 is provided with a depending drain line 104 adjacent one corner thereof for draining any condensate which may be deposited in the baffle plate 82. The baffle plate 82 may be provided with a fall towards this corner or normal shifting of the truck during operation thereof may be relied upon for draining any condensate and in this instance, an upstanding flange may be provided on the opening 90 to prevent any condensate from dripping onto the contents of the truck body.

The expansion valve 34 may be of any conventional construction and is controlled by heat bulbs 106 and 108 with one heat bulb 106 being disposed at the inlet side of the first unit 64 and the other heat bulb 108 being connected to the transfer line 68 interconnecting the units 64 and 66. Each of the heat bulbs 106 and 108 is provided with the usual tube 110 extending back to the expansion valve 34 for controlling operation thereof in response to the temperatures of the refrigerant progressing through the evaporator unit 32.

The fan 96 is thermostatically controlled from thermostatic heat bulb 112 located on the inner wall of the body and is connected to a control switch 114 through the usual capillary tube 116 for controlling operation of the fan 96 in direct relation to the temperature in the interior of the load carrying compartment whereby the air in the load carrying compartment will be immediately circulated in the event the temperature approaches the maximum for which the system is adjusted. It is noted that the evaporator unit 32 is in spaced relation to the side walls of the body whereby the air will be drawn upwardly from the center of the load carrying compartment and the cold air will be discharged at the edges thereof thus providing adequate air circulation for maintaining a substantially constant temperature throughout the volume of the body. Any type of fan may be provided and a manual control may also be provided if desired. The baffle plate 82 also prevents any possible freezing of the pay load since the holding fluid 76 may be carried down to very low temperature without danger of freezing the uppermost portions of the pay load. Any type of refrigerant may be employed in the system although "Freon 12" has been successfully employed and another feature not shown is the provision of a trickle charge for the battery of the delivery truck whereby the battery may also be fully charged during periods of operation of the refrigeration system by the auxiliary motor 52 as when the auxiliary motor is plugged into an electrical outlet. The fan in combination with the large surface area of the evaporation unit 32 will effectively provide flash cooling of hot

air permitted to enter the load carrying compartment as when the doors are opened for removal of or placement of articles therein thereby effectively maintaining a constant temperature regardless of the sudden changes in the heat load with the sudden increase in the heat load only tending to melt or raise the temperature of the holding fluid **76** and not throwing any heavy load on the refrigeration system which may be temporarily inactive due to temporary parking of the delivery truck.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly, all suitable modifications and equivalents may be resorted to, falling within the scope of the invention as claimed.

What is claimed as new is as follows:

1. A refrigeration system for a delivery truck having an insulated pay load compartment comprising a compressor, a condenser, a receiver, an expansion device and an evaporator located in communication for forming a refrigeration cycle, said evaporator being mounted in the roof of the insulated compartment and including a pair of cold holding units suspended in spaced relation to the roof of the compartment, a baffle plate disposed under said units, each of said units including spaced plastic walls capable of expansion and contraction without damage with a refrigerant passage therebetween and a freezable cold holding fluid completely filling each unit, and means forcing circulating air over the external surfaces of the walls of said units for controlling the temperature of the pay load compartment, said means for circulating air including a fan disposed between said units for circulating air against the upper and lower surfaces of each unit for effectively cooling the air due to "skin" contact of the air with the exterior surfaces of the walls of the units, said baffle plate having a central aperture underlying the fan and directing the flow of air over the units, said baffle plate being disposed in spaced relation to each unit, the central opening forming an intake for the air circulating fan, and baffle means disposed at the ends of the cold holding unit and spaced from the side walls of the pay load compartment for assuring circulation of air over the side edges of the unit and transverse movement of such air, said baffle plate including upturned edges and a downwardly extending drain conduit extending through the wall of the compartment for draining condensate to the exterior of the compartment thereby preventing drippage of condensate onto the pay load while isolating the pay load from the cold holding units for preventing freezing of the pay load.

2. In combination with a delivery truck for refrigerated products having an insulated pay load compartment, a refrigeration system comprising a compressor driven from the engine of the truck, a condenser cooled by movement of the truck, and an evaporator unit mounted in the top of the pay load compartment, said evaporator unit including a cold holding fluid unit, a baffle plate disposed in spaced relation below said fluid unit for separating the fluid unit from articles in the compartment, said plate having a centrally disposed opening therein forming an air inlet, a fan disposed above the plate for drawing air through the opening and forcing the air over the fluid unit for cooling the air, said fan being thermostatically controlled in response to the temperature in the compartment.

3. The combination of claim 2 wherein said cold holding fluid unit includes a pair of enlarged spaced parallel rigid plates of plastic material having the peripheral edges thereof sealed together, an evaporator tube disposed between said plates, eutectic fluid completely filling the remainder of the area between the plates whereby evaporation of a liquid refrigerant in the evaporator tube will solidify the eutectic fluid and lower the entire outer surface of the plates to the temperature of the solidified fluid, the plastic material of the plates compensating for the expansion and contraction of the eutectic fluid during the changes in state thereof.

4. The combination of claim 3 wherein said baffle plates include upturned edges and a downwardly extending drain conduit extending through the wall of the compartment for draining condensate to the exterior of the compartment thereby preventing drippage of condensate onto the pay load while isolating the pay load from the cold holding unit for preventing freezing of the pay load.

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