March 20, 1956 H. D. GUMPPER ET AL 2,738,655

UNITARY REFRIGERATING AIR CONDITIONER

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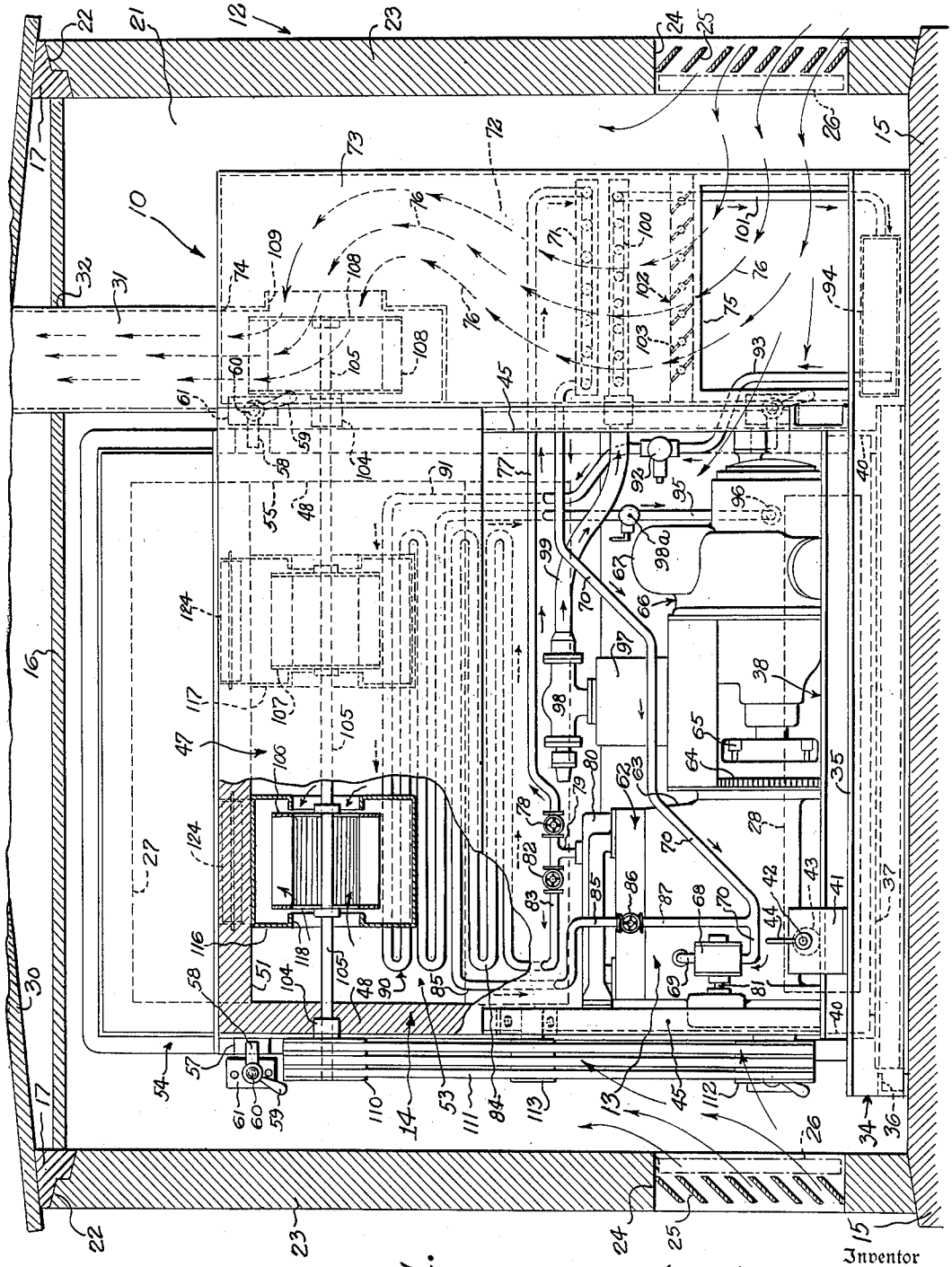


Fig. 1.

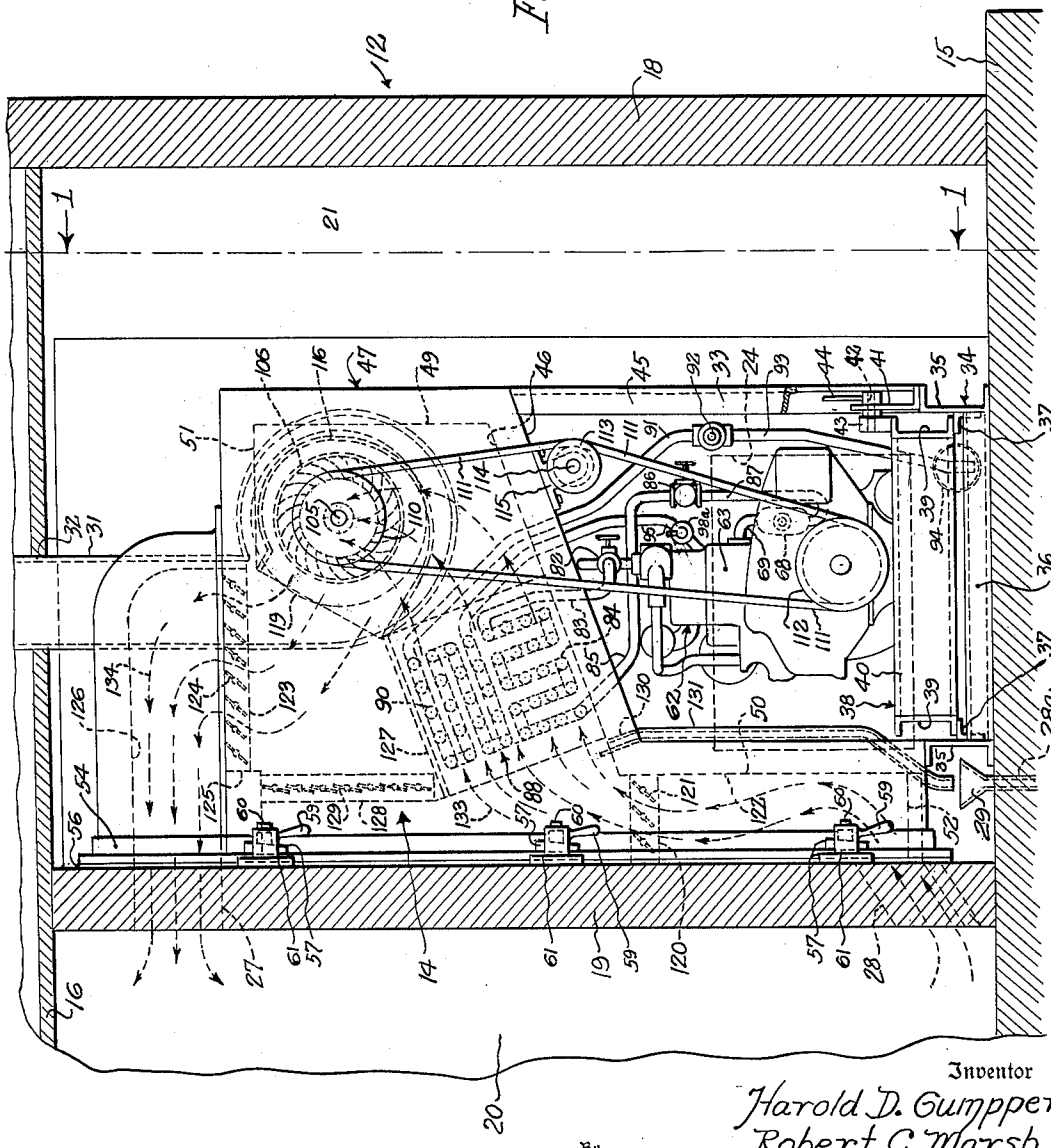
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Fig. 2.



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UNITARY REFRIGERATING AIR CONDITIONER

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6 Claims. (Cl. 62—117.2)

This invention relates to refrigerating apparatus and, in particular, to air refrigerating and conditioning apparatus.

One object of this invention is to provide a self-contained refrigerating air conditioner wherein all of the components thereof are mounted upon a single frame or base, so as to be removable and insertable as a unit into the space in which it is to be used, such as in a railway refrigerator car, refrigerated truck or the like.

Another object is to provide a self-contained refrigerating air conditioner of the foregoing character which is of the most compact construction and arrangement in order that it can be accommodated in the very limited space available for it in railway refrigerator cars, such as in the ice compartment at one end of such a car.

Another object is to provide a self-contained refrigerating air conditioner of the foregoing character wherein the fans and other moving components are driven directly from an internal combustion engine, preferably by belts, and the compressor is driven directly from the engine shaft, so as to give the utmost simplification of arrangement, flexibility of operation so as to handle different refrigeration loads by merely changing the speed, and with absolute dependability so that it will operate with only minor attention for as long a period as two weeks at a time without danger of failure which will jeopardize or ruin the cargo being maintained in a refrigerated condition.

Another object is to provide an engine-driven self-contained refrigerating air conditioner of the foregoing character wherein the internal combustion engine and refrigerant compressor are directly coupled to one another and mounted together as a sub-unit on a sub-base which is also separately removable from the main frame or main base, as by sliding it out of the latter, so as to enable the engine and compressor to be separately serviced outside of the refrigerated space or compartment without the need for removing the air conditioner as a whole.

Another object is to provide an engine-driven self-contained refrigerating air conditioner of the foregoing character which is substantially free from electric generators and electric motor or other inflexible or undependable auxiliaries and wherein the utmost accessibility is provided for ease of servicing, substantially all of the principal moving parts being accessible from one side of the apparatus.

Another object is to provide an engine-driven self-contained refrigerating air conditioner of the foregoing character wherein defrosting of the air conditioning coil is accomplished by diverting warm water from the engine cooling system to a defrosting coil incorporated in the conditioning coil.

Another object is to provide an engine-driven self-contained refrigerating air conditioner of the foregoing character wherein the blowers or fans for circulating the refrigerated air and for passing outside air over the condenser and engine cooling radiator are mounted on a common shaft and driven directly, preferably by belts,

from the internal combustion engine, thereby further simplifying the installation and accordingly increasing its dependability.

Another object is to provide a self-contained refrigerating air conditioner of the foregoing character wherein provision is also made for heating the air being conditioned, such as when the refrigerator car, truck or ship passes through very cold regions in winter or under arctic conditions, such as when crossing high mountain passes, thereby preventing spoilage of cargo by the application of excessive cold.

Another object is to provide a self-contained refrigerating air conditioner of the foregoing character wherein air cooling, air heating and defrosting are carried out by different setting or manipulation of a set of dampers, the relative positions of which determine the operation of the installation at that particular time.

Another object is to provide a self-contained portable refrigerating air conditioner which by a predetermined setting of its controls will assure a substantially constant cargo space temperature and air condition regardless of changes in the temperature and air condition in the outside environment.

Other objects and advantages of the invention will become apparent during the course of the following description of the accompanying drawings, wherein:

Figure 1 is a side elevation, partly in vertical section, of a self-contained refrigerating air conditioner, according to one form of the invention, as installed in a railway refrigerator car, looking in the direction of the arrows 1—1 in Figure 2; and

Figure 2 is a left-hand end elevation of the air conditioner shown in Figure 1, with the refrigerator car walls in cross-section.

In general, the problem of transportation of fresh fruit and vegetables from the areas in which they are grown to the far distant areas in which they are sold and consumed has been very serious. Particularly in the case of fruit, the temperature of the refrigerated compartment must be carefully maintained so as to avoid both excessively high and low temperatures, such as arise under the different operating conditions of summer and winter, or in different geographical sections of the country, as well as at varying elevations above sea level. Furthermore, the problem is increased in severity due to the recent enormous growth in the use of quick-frozen fruits and vegetables, it being of course desirable that the same refrigerator car equipped with the same refrigerating air conditioner be capable of handling either fresh unfrozen cargoes or frozen cargoes under any geographic or climatic conditions.

Hitherto, refrigerator cars were in past years equipped with ice compartments or bunkers at opposite ends of the car, these being stocked with ice at the beginning of the trip and replenished with ice at intervals of every few days, depending upon the operating conditions. More recently, railroads and shippers have sought to replace ice refrigerating cars with mechanically refrigerated equipment which is more flexible, requires less attention, and will operate over longer periods of time and throughout a greater temperature range of refrigeration than is possible with ordinary ice refrigeration. These more recent mechanical refrigeration installations, however, although an improvement over ice refrigeration, have not been completely satisfactory because of the difficulty of servicing the various components, these being mounted in various locations within the end compartment of the refrigerator car and removable only as separate components.

The isolation of these refrigerator cars, particularly when they are switched from one train to another or stand in railway yards, makes it almost imperative that they be equipped with a prime mover which is independent

of the locomotive or any source of energy outside the car itself. Accordingly, internal combustion engines have been proposed and recently used to drive such refrigerating apparatus. Gasoline engines are undesirable because of the fire hazard accompanying their use, so Diesel engines have been selected as most satisfactory. In prior installations, however, electric motors have been employed to drive the various fans or blowers, compressor, pumps and other auxiliaries and these in turn have required the provision of a generator driven from the internal combustion engine in order to supply the necessary electric current. However, even if the complexity of these prior systems be accepted, nevertheless their electric motors are relatively inflexible, hence may not conveniently be increased or reduced in speed in order to adapt the installation from refrigerating fresh unfrozen food products to refrigerating frozen food products at the necessarily low temperature conditions required.

The present invention eliminates all these electric motors and their generator, together with the electrical auxiliaries required, mounts all of the components upon a single frame structure or base, and drives all of the moving parts directly from an internal combustion engine. The present apparatus is therefore adaptable to either frozen or unfrozen cargoes or to different sizes of refrigerator cars merely by changing the speed of the internal combustion engine and consequently changing the speed of operation of the compressor, fans or blowers and other components.

Referring to the drawings in detail, Figure 1 shows an engine-driven self-contained refrigerating air conditioner, generally designated **10**, as installed in the end compartment **11** of a conventional refrigerator car **12**, such as is used for transporting fruits, vegetables and other foods or perishable commodities over long distances. The refrigerator car **12** is shown solely for purposes of illustration, as the refrigerating air conditioner **10** is equally adaptable for installation in a motor truck, ship, or even in a stationary building wherein the above-stated objects and advantages of the present invention are sought to be achieved. The refrigerating air conditioner **10** is in turn composed of two sub-assemblies, namely the engine-compressor unit **13** which is also in "package" or unit form and removable as a unit from the blower-evaporator-condenser unit **14** of the apparatus.

The refrigerator car **12** shown for purposes of illustration is represented in a purely diagrammatic form as including insulated floor, ceiling, side and end walls **15**, **16**, **17** and **18** respectively, and a partition wall **19** or bulkhead which divides the interior of the refrigerator car **12** into a refrigerated cargo compartment **20** (Figure 2) and a refrigeration machinery compartment **21**, formerly the ice compartment or bunker of the car. The side walls **17** are provided with door openings **22** for receiving doors **23** to which access is had to either or both sides of the machinery compartment **21**, and each of the doors **23** is provided with an opening **24** containing spaced louvers or shutters **25** and a dust filter **26** for preventing the entrance of dust to the compartment **21**. The bulkhead **19** is also provided with upper and lower air passageways **27** and **28** (Figure 1) through which the refrigerated air is inserted and removed respectively from the cargo compartment **20**. The floor **15** is bored as at **28***a* to receive a drain funnel **29** for discharging the water resulting from the defrosting operation described below. The ceiling **16** is surmounted by a roof **30** (Figure 2), both of which are provided with aligned openings for the passage of a discharge stack **31**, only the ceiling opening **32** being shown.

The various components of the refrigerating air conditioner **10** are mounted and supported upon a frame structure, generally designated **33**, which includes a main base structure **34** composed of longitudinal channel members **35** interconnected at their opposite ends by angle or channel members **36**. Secured as by welding to the inner surfaces of the channel members **35** are angle members or tracks **37**, the members **36** being positioned lower than the members **37** so as to permit an engine-compressor unit sub-base **38** to slide thereover (Figure 2). The sub-base **38** in turn consists of parallel outwardly-facing longitudinal channel members **39** interconnected by end channel members **40**, the lower flanges of the channel members **39** and **40** resting upon and slidably engaging the upper surfaces of the angle members or guide tracks **37**. The various base and frame members are preferably welded to one another. In order to hold the sub-base **38** in a stationary position upon the main base **34**, the latter is provided with an angle bracket **41**, the horizontal flange of which is secured as by welding to the upper flange of one of the side channels **35** of the main base **34**, whereas the vertical flange is bored to receive a shaft **42** on the inner end of which is mounted an eccentric locking cam **43** and on the outer end a hand lever **44** by which the eccentric cam **43** is rotated into and out of locking engagement with the upper flange of the adjacent sub-frame channel member **39**. In practice, the latter is preferably recessed or concaved slightly at its point of engagement with the cam **43** in order to provide a positive locking depression (not shown).

The main frame structure **33**, in addition to the main base structure **34**, includes uprights **45** rising from and preferably welded to the upper flanges of the main base channel structure **34**. The uprights **45** are interconnected by the inclined intermediate bottom wall **46** of a housing, generally designated **47**, which also includes end walls **48** interconnected by laterally-spaced upper and lower rear walls **49** and **50** and a top wall **51**. Secured to the forward edges of the end walls **48** and top wall **51** and lower bottom walls **52** of the housing **47** so as to enclose a chamber **53** therein is a face plate or frame **54** in the form of an open rectangular frame of angle members, the side flanges of which are secured to the outer surfaces of the side, top and lower bottom walls **51**, **48** and **52** respectively, the inner surfaces of these walls defining a central opening **55**. A resilient gasket **56** of rubber or the like is cemented, bonded or otherwise secured to the face plate **54**. Also secured at intervals around the periphery of the face plate **54** are locking wedges **57** which are engaged by the arms **58** of locking levers **59** pivoted at **60** to base plates **61** which in turn are bolted or otherwise secured to the bulkhead **19**. The levers **59** cooperating with the wedges **57** urge the face plate **54** and the entire housing **47** into air-tight engagement with the bulkhead **19**.

Mounted on the sub-frame **38** is a conventional internal combustion engine **62**, preferably a diesel engine having the usual water jacketed cylinder block **63** and flywheel **64**. The flywheel **64** is connected by a coupling device **65** to a conventional refrigerant compressor **66** having multiple cylinders **67** containing pistons (not shown) reciprocated by the operation of the engine **62**. The engine **62** is also equipped with a water pump **68** for cooling purposes having its outlet or discharge pipe **69** connected to the water jacket of the engine cylinder block **63** and its inlet or suction pipe **70** connected to an engine-cooling coil or radiator **71** mounted transversely across the outside air passageway **72** contained in a housing extension **73** located on the right-hand end of the housing **47** (Figure 1). The outside air passageway **72** communicates at its upper end with the stack **31**, which extends downwardly into the housing extension **73** through an opening **74** in the top thereof.

The lower portion of the housing extension **73** is provided with an air inlet opening **75** through which outside air can enter after passing through the spaces between the louvers **25** in the openings **24** and through the dust filters **26**, as indicated by the arrows **76** (Figure 1). From the engine cooling coil or radiator **71**, a water pipe **70** runs to a valve **78** connected on its opposite side to a T pipe **79** leading to the water jacket of a cylinder head **80** mounted on and communicating with the water jacket

of the engine cylinder block 63. The shaft 81 of the water pump 69 is connected to and driven by the engine 62 in the usual way.

Connected to the pipe 79 through which the heated water leaves the engine cylinder head 80 is a valve 82 from which a water pipe 83 leads upward to a defrosting coil 84 from which a return pipe 85 leads back to one side of a valve 86 from the opposite side of which a pipe 87 runs to a connection with the pipe 70. The defrosting coil 84 is a part of a coil nest or assembly 88 mounted upon the upper bottom wall 46 (Figure 2). Also mounted in the same general location and forming a part of the coil nest or assembly 88 is an evaporator coil 90, one end of which is connected to a refrigerant intake pipe 91 extending downward to a conventional expansion valve 92 from which a pipe 93 extends downward to a liquid refrigerant reservoir 94 located at the bottom of the apparatus (Figure 1). The opposite end of the evaporator coil 90 is connected by a pipe 95 to the intake 96 of the compressor 66 on the suction side thereof.

The discharge or pressure side of the compressor 66 is connected through a conventional oil eliminator 97, for removing the lubricating oil from the refrigerant, to a refrigerant shut-off valve 98 from which a compressed refrigerant discharge pipe 99 leads to a refrigerant condenser or refrigerant cooling coil 100, likewise located in the outside air passageway 72 of the casing extension 73 adjacent the engine cooling coil or radiator 71. A refrigerant shut-off valve 98*a* is also placed in the refrigerant suction pipe 95. From the condenser 100, a pipe 10 descends to the liquid refrigerant reservoir 94.

Mounted in the outside air passageway 72 of the housing extension 73 between the air inlet opening 75 and the condenser 100 (Figure 1) is a damper 102 having pivotally-mounted vanes or shutters 103. Mounted in the upper part of the housing 47 and journaled as at 104 in the end walls 48 thereof is a shaft 105 upon which are mounted fans or blowers 106, 107 and 108. The fan 108 is mounted within the lower end of the stack 31 adjacent an inlet opening 109 thereof (Figure 1), so that when the shaft 105 is rotated, air is drawn upward through the passageway 72 from the outside air openings 24 and 75 and damper 102 through the coils 71 and 100 and discharged upward through the stack 31.

Mounted on the shaft 105 is a pulley assembly 110 which is drivingly connected by multiple belts 111 to a pulley assembly 112 mounted on the crank shaft (not shown) of the internal combustion engine 62. Also engaging the multiple belts 111 is an idler pulley 113 which is mounted upon a shaft 114 journaled in a bearing bracket 115 which is bolted or otherwise secured to the bottom wall 46 (Figure 2).

The fans 106 and 107 are mounted in casings 116 and 117 which are secured to the walls of the housing 47 and have central inlet openings 118 and peripheral discharge openings 119. The entrance of the warm air returning from the refrigerated cargo compartment 20 through the bulkhead passageway 28 is regulated by an inlet damper 120 having multiple pivoted vanes 121 and located across a vertical passageway 122 (Figure 2) leading upward between the housing wall 50 and refrigerator car bulkhead 19. The outlet of the refrigerated air from the fans 106 and 107 is regulated by outlet dampers 123 having multiple pivoted vanes or shutters 124 and mounted across an outlet opening 125 in the top wall 51 of the housing 47. Above the opening 125 is mounted an air outlet duct or conduit 126 communicating at its forward end with the air inlet passageway 27 through the bulkhead 19 (Figure 2).

Also mounted in the housing 47 but in a vertical position between the enclosure wall 127 of the coil nest 88 and the top wall or upper wall 51 of the housing 47 is a defrosting damper 128, likewise having multiple pivoted vanes or shutters 129. The inclined bottom wall 46 is bored as at 130 for the passage of a drain pipe 131 which extends downwardly to the drain funnel 29 for carrying away the water resulting from the defrosting of the evaporator coil 90.

In the operation of the self-contained refrigerating air-conditioner 10 of the present invention, let it be assumed that the entire apparatus has been mounted, for example, within the end compartment 21 of a conventional refrigerator car 12 and its housing extension 73 connected to the stack 31, as shown. It will also be assumed that the engine 62 is connected to a suitable source of liquid fuel, such as a diesel oil tank (not shown). Let it be assumed that it is desired to refrigerate the air within the cargo compartment 20. The engine 62 is started in the usual way, operating the compressor 66 to compress the gaseous refrigerant entering its intake port 96 from the pipe 95 returning from the evaporator coil 90. The refrigerant may be of any suitable type, such as the so-called Freon 12 or 22 commercially available and well-known to the refrigerating industry under those designations. Other gaseous refrigerants may, of course, be used, the particular refrigerant selected depending upon the installation and being beyond the scope of the present invention. The gaseous refrigerant thus compressed, passes through the oil eliminator 97, the valve 98 and the pipe 99 through the condenser 100 where it is cooled by the upwardly-moving air indicated by the arrows 76 (Figure 1), it being of course assumed that the damper 102 is open at this time. Freed from the heat generated during the compression of the gas within the compressor 66, the compressed refrigerant descends as a liquid through the pipe 101 to the reservoir 94. From the reservoir 94, the liquid refrigerant passes upward through the pipe 93, expansion valve 92 and pipe 91 into the evaporator coil 90 where it absorbs heat from the air passing upward from the lower part of the cargo compartment 20 through the lower passageway 122 and damper 120 which is open at this time. The damper 128, meanwhile, is in a closed position while the damper 125 is open. The air to be refrigerated, indicated by the arrows 133, passes through the evaporator coil 90 (Figure 2) in response to the suction exerted by the fans 106 and 107, and is discharged, after being refrigerated, through the damper 125, duct 126 and upper passageway 27, as indicated by the arrows 134 (Figure 2). The heat extracted from the incoming air 133 by the evaporator 90 is absorbed by the refrigerant passing therethrough, converting it to a gas which returns through the pipe 95 to the intake port 96 of the compressor 66, completing the refrigeration circuit.

During the refrigerating steps of the operation as described above the various components are controlled automatically by control devices which are not shown in the drawings and are beyond the scope of the present invention. These control devices, which are known to refrigerating engineers, include thermostats which govern control valves regulating the refrigerant flow through the cooling circuits of the evaporator coil 90. The head pressure and engine temperature are regulated by varying the position of the shutters or vanes 103 of the damper 102. The speed and loading of the compressor 66 are also controlled by conventional devices associated with the compressor 66 and likewise forming no part of the present invention. While the defrosting coil 84 and evaporator coil 90 are shown as single units superimposed one upon the other within the coil nest 88, in actual practice these are subdivided into several such coils arranged in succession for obtaining the maximum efficiency.

While the engine 62 is thus operating to actuate the compressor 66, its cylinder block 63 and cylinder head 80 are cooled by water circulated through the water jackets thereof by means of the pump 68 and by way of the pipe 79, valve 78 (which is open at this time), cooling coil or radiator 71, and pipe 70. The valves 82 and 86 are closed at this time.

In order to defrost the evaporator coil **90**, as determined automatically or by the operator, as desired, the inlet and outlet dampers **120** and **123** are closed and the defrosting damper **128** is opened. The valves **82** and **86** (Figure 1) in the water lines **83** and **85**, **87** respectively are opened and the valve **78** closed. The valves **78**, **82** and **86**, for purposes of simplicity, are shown as manually operated valves, whereas in practice these valves would be electromagnetically operated in response to the automatic control circuit which determines the commencement of a defrosting cycle in response to temperature or pressure difference across the opposite ends of the evaporator coil **90** or by an electrical or mechanical timer. At the same time, the compressor **66** is unloaded. These automatic devices and unloading arrangements for the compressor **66** form no part of the present invention.

With the valves **78**, **82** and **86** arranged in this manner, the flow of water from the cooling jackets of the engine **62** through the pipes **77** and **70** to and from the engine cooling coil or radiator **71** is terminated and at the same time, the flow of the water heated in the engine cooling water jackets passes upward through the pipes **79** and **83** and the now open valves **82** into the defrosting coil **84** and back through the return pipes **85** and **87** and the now open valve **86** to the pump **68** and thence through the discharge pipe **69** thereof to the engine water jackets again. The heat from the heated water passing through the defrosting coil **84** in this manner is communicated to the evaporator coil or coils **90** disposed adjacent thereto, melting the frost off the latter. The water resulting from the melting frost as a result of this defrosting operation passes downward to the bottom wall **46** and out through the drain pipe **131** and drain funnel **29**.

When the defrosting operation has been completed, as determined by the control devices mentioned above, the defrosting damper **129** is again closed and the outlet and inlet dampers **123** and **120** again opened, the valves **82** and **86** are closed and the valve **78** again opened, causing the evaporator coil **90** to refrigerate the air in the previously-described manner as the compressor **66** is again caused to compress the refrigerant as described above.

When the refrigerator car **12** passes through a region where undesirably low temperatures are at that time existing, such as in passing over the Continental Divide in wintertime, with certain cargoes, such as unfrozen fresh fruit, it is necessary to supply heat to the cargo compartment **20** in order to prevent spoilage of the cargo. When this becomes necessary, the valves **82** and **86** are opened and the valve **78** closed so as to divert the heated engine cooling water through the defrosting coil **84** as described above in connection with the defrosting operation. At the same time, the compressor **66** is unloaded so that it no longer compresses the refrigerant or supplies refrigerant to the evaporator coil or coils **90**. At this time, however, the defrosting damper **128** is closed, whereas the inlet and outlet dampers **120** and **123** are opened by suitable control devices responding to the existing temperatures, the engine speed is increased, if necessary, to provide a sufficient quantity of heated water to the defrosting coil **84**, whereupon the air drawn through the coil **84** from the cargo compartment **20** by way of the passageways **28** and **122** and the open inlet damper **120** is heated and discharged through the duct **126** and passageway **27** into the cargo compartment **20** by the action of the fans or blowers **106** and **107**. The engine heat is again regulated by regulation of the damper **102** located adjacent and immediately beneath the engine cooling coil **71**.

If at any time it becomes necessary to perform repairs upon either the engine or the compressor **62** or **66** respectively, their various pipes may be disconnected easily from them, whereupon the locking lever **44** is rotated to release the eccentric cam **43** from engagement with the subframe **38**. The engine compressor unit **13**, mounted on its sub-base or sub-frame **38**, may then be slid outward upon the main base structure **34** of the main frame structure **33** and removed from the refrigerator car through one of the doors **23**. It may be replaced immediately by another engine compressor unit **13** which is reinserted by reversing the above procedure and locked in position by means of the handle **44** and locking cam **43**. The various pipes and belts are then reconnected in an obvious manner and the air conditioner **10** placed back in service immediately afterward, if desired, thus preventing any substantial interruption in service and eliminating the necessity for removing the entire refrigerating air conditioner **10** from the refrigerator car **12** for engine or compressor repairs. Even without removing the engine compressor unit **13** in this manner, the fact that the lower portion of the apparatus is completely accessible from the rear as from the right-hand side of the space **21** (Figure 2), enables minor repairs or adjustments to be made upon the apparatus, including the engine compressor unit **13**, without removing either the unit **13** from the air conditioner **10** or removing the air conditioner **10** bodily from the car **12**.

Finally, for comprehensive repairs which cannot be made in either of the ways described above, the entire refrigerating air conditioner **10** may be removed bodily as a unit by unclamping its face plate **54** from the bulkhead **19** by operating the hand levers **59**, disconnecting the stack **31** and then sliding the entire air conditioner **10** out through one of the doors **23**. The stack **31**, shown for purposes of simplicity as in a single piece, in actual practice would be jointed and flanged to enable its separation from the remainder of the air conditioner **10** for easy removal.

What we claim is:

1. A unitary refrigerating air-conditioner for cooling the air of a compartment disposed above a floor and having a sidewall, said air conditioner comprising a supporting frame structure disposed adjacent said side wall, said frame structure being slidably mounted on and supported by said floor independently of said side wall, a refrigerant reservoir mounted on said frame structure, a base slidably mounted upon said frame structure and separately removable therefrom independently of the removal of said frame structure and the equipment mounted thereon, a prime mover and a refrigerant compressor mounted on said base and drivingly connected to one another, an evaporator mounted on said frame structure and connected at spaced locations thereon to said compressor and reservoir, a condenser mounted on said frame structure and connected at spaced locations thereon to said compressor and reservoir, a compartment air circulator drivingly connected to said prime mover and arranged to circulate air from said compartment through said evaporator and back to said compartment, and a condenser air circulator drivingly connected to said prime mover and arranged to circulate cooling air through said condenser.

2. A unitary refrigerating air-conditioner for cooling the air of a compartment disposed above a floor and having a side wall, said air-conditioner comprising a supporting frame structure disposed adjacent said side wall, said frame structure being slidably mounted on and supported by said floor independently of said side wall, a refrigerant reservoir mounted on said frame structure, a base slidably mounted upon said frame structure and separately removable therefrom independently of the removal of said frame structure and the equipment mounted thereon, a prime mover and a refrigerant compressor mounted on said base and drivingly connected to one another, an evaporator mounted on said frame structure and connected at spaced locations thereon to said compressor and reservoir, a condenser mounted on said frame structure and connected at spaced locations thereon to said compressor and reservoir, a compartment air circulator drivingly connected to said prime mover and arranged to circulate air from said compartment through said evaporator and back to said compartment, and a condenser air circulator drivingly connected to

said prime mover and arranged to circulate cooling air through said condenser, said supporting frame structure with said slidable base and said reservoir, prime mover, compressor, evaporator, condenser and air circulators being removable as a single unit from its location adjacent said compartment.

3. A unitary refrigerating air conditioner for cooling the air of a compartment, comprising a supporting frame structure disposed adjacent said compartment, a refrigerant reservoir mounted on said frame structure, an internal combustion engine and a refrigerant compressor mounted on said frame structure and drivingly connected to one another, an evaporator mounted on said frame structure and connected at spaced locations thereon to said compressor and reservoir, a condenser mounted on said frame structure and connected at spaced locations thereon to said compressor and reservoir, a compartment air circulator drivingly connected to said engine and arranged to circulate air from said compartment through said evaporator and back to said compartment, a condenser air circulator drivingly connected to said engine and arranged to circulate cooling air through said condenser, said engine having a radiator-equipped cooling circuit connected thereto with its engine-cooling radiator disposed adjacent said evaporator in heat-transmitting relationship thereto and selectively connectible to and disconnectible from said cooling circuit.

4. A unitary refrigerating air-conditioner for cooling the air of a compartment, comprising a supporting frame structure disposed adjacent said compartment, a refrigerant reservoir mounted on said frame structure, an internal combustion engine and a refrigerant compressor mounted on said frame structure and drivingly connected to one another, an evaporator mounted on said frame structure and connected at spaced locations thereon to said compressor and reservoir, a condenser mounted on said frame structure and connected at spaced locations thereon to said compressor and reservoir, a compartment air circulator drivingly connected to said engine and arranged to circulate air from said compartment through said evaporator and back to said compartment, a condenser air circulator drivingly connected to said engine and arranged to circulate cooling air through said condenser, said engine having a radiator-equipped cooling circuit connected thereto with its engine-cooling radiator disposed adjacent said evaporator in heat-transmitting relationship thereto and selectively connectible to and disconnectible from said cooling circuit, and a heated air damper arranged to selectively discharge air heated by said cooling radiator into said compartment and alternatively into a space disposed externally of said compartment.

5. A unitary refrigerating air conditioner for cooling the air of a compartment, comprising a supporting frame structure disposed adjacent said compartment, a refrigerant reservoir mounted on said frame structure, an internal combustion engine and a refrigerant compressor mounted on said frame structure and drivingly connected to one another, an evaporator mounted on said frame structure and connected at spaced locations thereon to said compressor and reservoir, a condenser mounted on said frame structure and connected at spaced locations thereon to said compressor and reservoir, a compartment air circulator drivingly connected to said engine and arranged to circulate air from said compartment through said evaporator and back to said compartment, a condenser air circulator drivingly connected to said engine and arranged to circulate cooling air through said condenser, said engine having a radiator-equipped cooling circuit connected thereto with its engine-cooling radiator disposed adjacent said evaporator in heat-transmitting relationship thereto and selectively connectible to and disconnectible from said cooling circuit, a heated air damper arranged to selectively discharge air heated by said cooling radiator into said compartment and alternatively into a space disposed externally of said compartment, and selectively openable and closable inlet and outlet air dampers disposed preceding said evaporator and following said compartment air circulator.

6. A unitary refrigerating air-conditioner for cooling the air of a compartment disposed above a floor and having a side wall, said air-conditioner comprising a supporting frame structure disposed adjacent said side wall, said frame structure being slidably mounted on and supported by said floor independently of said side wall, a refrigerant reservoir mounted on said frame structure, a base slidably mounted upon said frame structure and separately removably therefrom independently of the removal of said frame structure and the equipment mounted thereon, a prime mover and a refrigerant compressor mounted on said base and drivingly connected to one another, an evaporator mounted on said frame structure and connected at spaced locations thereon to said compressor and reservoir, a condenser mounted on said frame structure and connected at spaced locations thereon to said compressor and reservoir, a compartment air circulator drivingly connected to said prime mover and arranged to circulate air from said compartment through said evaporator and back to said compartment, a condenser air circulator drivingly connected to said prime mover and arranged to circulate cooling air through said condenser, and a locking device selectively securing said base immovably yet releasably to said frame structure.

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2,466,876	Brouse	Apr. 12, 1949
2,513,679	Ritter	July 4, 1950
2,525,868	Corhanidis	Oct. 17, 1950
2,630,687	Action	Mar. 10, 1953
2,694,553	Hicke et al.	Nov. 16, 1954