

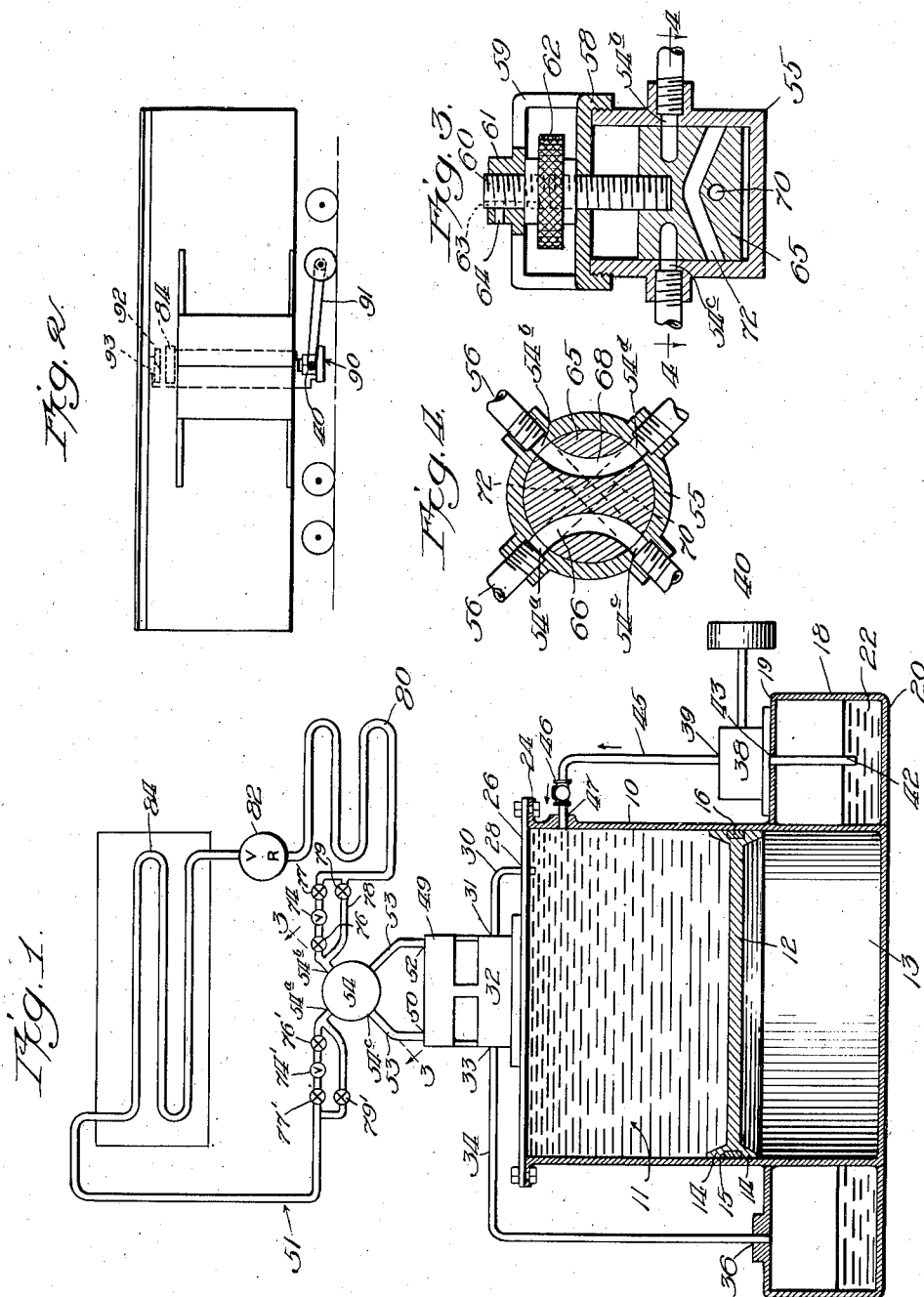
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REFRIGERATING AND HEATING SYSTEM

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REFRIGERATING AND HEATING SYSTEM

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7 Claims. (Cl. 62—117)

This invention relates to refrigerating and heating systems and more particularly to a system for selectively refrigerating or heating vehicles, carriers, conveyances and the like.

5 The transportation of perishable goods over long distances has always been a problem with carriers. It is known that each year railroad companies pay large sums of money in freight claims on shipments of perishable goods that have spoiled during transit.

10 From the beginning ice has been the mainstay for cooling cars and trucks and for maintaining low temperatures in transit. Ice as a refrigerant in carriers is particularly objectionable because of the high cost and inconveniences attendant its use. The packing of the ice in the chambers of the cars is a cumbersome procedure that requires considerable time and labor. On a long trip it is necessary to replenish the ice supply during the course of the trip in order that a fairly constant temperature may be maintained within the car. It is obvious that the loss of time occasioned by the replenishment of the ice content plus the actual cost of the ice and labor involved in the servicing thereof is a very important factor in the operating costs of the car. The cost of present day car refrigeration tends to boost the price of the transported article far beyond its actual relative value and in some instances makes the shipment of certain perishable goods actually prohibitive.

30 In order to eliminate the use of ice, attempts have been made to install, in the cars, refrigerating machines which are operated by auxiliary gasoline engines. The disadvantages of such an installation are at once apparent. In addition to the cost of operation and maintenance which is comparatively high, the danger of fire or explosion is always imminent.

40 While the cooling of cars and trucks for the preservation of the perishable contents contained therein is a primary consideration during warm weather, it is equally important to provide adequate heat in extremely cold weather to prevent spoilage of said contents through freezing. The usual refrigerating machine comprises essentially a compressor, a condenser coil, an expansion valve and an expansion coil, all of these units being connected in series in the order above outlined. Normally, in the usual cycle of events the refrigerant passes successively through each of the above elements. It is known that considerable heat is evolved in the condenser coils. Since this heat is undesirable in a refrigeration process it is dissipated into the surrounding atmosphere,

exteriorly of the refrigerating chamber. The condition existing is such that the coil into which the refrigerant is first driven, the condenser coil, is actually hot while the other coil, the expansion coil, becomes extremely cold. It is obvious that if the flow of refrigerant were reversed so that it would first enter the coil which, in the first instance, served as an expansion coil, it would now serve as a condenser coil and evolve heat. If this heat were dissipated in the chamber in which originally served as the refrigerating chamber, it is apparent how this heat can be used advantageously to heat the chamber.

One of the objects of this invention is the provision of a refrigerating system which is particularly adapted for cooling freight cars, trucks and the like in which perishable goods are carried.

Another object of this invention is the provision of a refrigerating system for use in carriers which is adapted to derive its motive power from a rotating member of said carrier.

A further object of this invention is the provision of a refrigerating system for carriers which is adapted to operate to maintain same at refrigerating temperature for a reasonably long period of time, after movement of said carrier has been arrested, as when a car is sidetracked or a truck is parked for unloading.

A still further object of this invention is the provision of a system which may be used interchangeably for warming and cooling the interior of a carrier.

A still further object of this invention is the provision of a refrigerating system for carriers which is automatic in operation and simple in construction.

With the foregoing and other objects in view, the invention consists of a novel construction, combination and arrangement of parts as will be hereinafter more specifically described and illustrated in the accompanying drawing, wherein is disclosed an embodiment of the invention.

It is apparent that with the use of a refrigerating machine motive power must be supplied, at all times, to maintain the machine in operation. Where the motive power is derived from a rotating member of the carrier auxiliary means must be supplied to operate the machine when the car is sidetracked preparatory to unloading. While an electric motor may be used for this purpose it would require a source of current at each place where the carrier was stopped. The impracticability of such an arrangement is at once apparent.

To obviate the foregoing, I have provided a

method and means for refrigerating and heating cars and trucks in which the motive power required for operation is derived from a moving member of the carrier and which is so designed that it will continue to operate for a comparatively long interval of time, even after movement of the carrier has been arrested.

In the drawing:

Fig. 1 is a diagrammatic elevational view illustrating the principle of operation of my invention.

Fig. 2 is an elevational view showing diagrammatically the application of my invention to a railroad freight car.

Fig. 3 is a detailed cross sectional elevational view taken on line 3—3 of Fig. 1.

Fig. 4 is cross sectional view taken on line 4—4 of Fig. 3.

The preferred embodiment of my invention, as illustrated in Fig. 1, comprises a cylinder 10 in which is fitted for sliding movement, a piston 12. Said piston has integrally formed on its periphery opposed annular flanges 14, 14 which are provided with a recess 15 to accommodate a packing ring 16. Surrounding the cylinder 10 is a cylinder 18 provided with top and bottom members 19 and 20 respectively which are welded to the cylinders 10 and 18 to form an air tight annular chamber 22. Mounted on the flange 24 of the cylinder 10 and bolted thereto is a cylinder head 26 provided with a threaded aperture 28 which is adapted to receive a pipe fitting 30. Mounted on the cylinder head is a turbine type hydraulic motor 32 which is preferably of standard manufacture. The inlet port 31 of said motor is connected to the pipe fitting 30 while the outlet port 33 is connected to a pipe 34 one end of which is received in a threaded aperture 36 provided in the top member 19 of the chamber 22.

Mounted on the top member 19 is a fluid pump 38 which may be either of the reciprocating or centrifugal type and which is provided with a pulley 40 for rotatably transmitting power to the pump 38. An intake pipe 42 extends through an aperture 43 in the member 19, into the chamber 22 and is connected with the inlet port 31 of the pump 38. A pipe 45 is connected to the outlet port 39 of the pump 38 and to a check valve 46 which fits into a threaded aperture 47 in the cylinder 10.

It will be seen that the piston 12 is adapted to define two chambers 11 and 13 in the cylinder 10. A predetermined quantity of oil is placed into the upper chamber 11 which is then sealed. Air is then pumped into the lower chamber 13, through a valve not shown, and is compressed so that a predetermined pressure acts on the piston 12 to force the oil through the aperture 28 into the hydraulic motor 32 to operate same, the spent oil passing through the pipe 34 into the chamber 22. As the fluid pump 38 operates oil is drawn through the intake pipe 42 and is pumped through the pipe 45 back into the oil chamber 11. It is obvious that the check valve 46 permits the oil to flow only in the direction indicated by the arrows and that the pressure in the pipe 45 must exceed that in the chamber 11 in order that the valve open and permit the oil to flow into the chamber. As long as the oil pump 38 is being operated, that is, when the car or truck is in motion, the spent oil is continuously being pumped back into the chamber 11, thereby maintaining a rather constant volume of oil in the chamber and a constant pressure on the piston 12. The construction of the piston 12 together with the equal distribution of pressure on the surfaces of

the piston obviates the use of a piston rod for guiding the piston in its travel.

When the carrier is stopped and the pump 38 is not in operation, the compressed air continues to act on the piston 12 and to force the oil through the hydraulic motor 32 to drive same, the spent oil being delivered to the chamber 22. This continues until all of the oil is exhausted in the chamber 11 and the piston 12 has reached the top of the cylinder 10. It will be understood that the capacity of the chamber 22 is sufficiently large to accommodate all of the oil contained in the various other chambers and conduits. When the carrier is again put in motion the pump 38 again operates to pump oil from chamber 22 into chamber 11 to force the piston 12 downwardly and compress the air beneath the piston in the chamber 13.

Mounted on the hydraulic motor 32 and coupled to the motor shaft, not shown, for rotation therewith is a rotary compressor 49 which forms part of a mechanical refrigerating unit indicated generally as at 51. Connected to the inlet and outlet ports 50 and 52 respectively of the compressor 49 as by conduits 53 is a valve 54, presently to be described, which serves to reverse the direction of flow of refrigerant in the refrigerating unit 51.

The valve 54 is comprised of a housing 55 provided with ports 54a, 54b, 54c and 54d adapted to receive conduit pipes 56, and a cover member 58 which is integrally formed with a bridge member 59. A threaded valve stem 60 extends through apertures in the members 58 and 59 and is adapted to be moved vertically by a valve control wheel 62. The stem 60 is provided with a longitudinal recess 63. A pin 64 projecting through a boss 61 in the member 59 engages in the recess and prevents the valve stem from rotating. Fixedly mounted on the end of the valve stem 60 is a valve core 65 which has formed therein conduit bore 66 and 68 which are adapted to register with the ports 54a, 54c, and 54b, 54d respectively of the housing 55. Conduit bores 70 and 72 are formed at right angles to each other in the core 55 and are arranged so that conduit 72 bridges conduit 70, as illustrated in Fig. 3. Said conduits 70 and 72 are adapted to register with the ports 54a, 54d and 54b, 54c respectively when the valve core 65 is raised by means of the valve control wheel 62. From the foregoing it is apparent how a reversal of flow of fluid in a pipe circuit can be effected by the manipulation of the control wheel 62.

Connected in the pipe circuit leading out of the port 54b is a pressure valve 74 arranged to operate at a predetermined pressure. Shut off valves 76 and 77 are positioned on either side thereof. A by-pass pipe 78 provided with a shut off valve 79 is adapted to permit the flow of fluid therethrough when the valves 76 and 77 are closed. Condensing coils 80, expansion valve 82 and expansion coils 84 are connected in the pipe circuit above described. It will be understood that the expansion coils 84 are positioned in a chamber which is to be refrigerated. As will be seen from Fig. 1, a combination of valves similar to that just described is arranged in the pipe circuit which leads from the expansion coils 84 in to the port 54a.

In a normal refrigerating operation the refrigerant which is compressed in the compressor 49 passes through the valve conduit bore 68 through the valves 76, 74 and 77 into the condensing coils 80, through the expansion valve 82 and into ex-

pansion coils 84, where the cooling takes place. The spent refrigerant then flows through the conduit 66 and returns to the compressor 49. In this operation the bypass valve 79 and valves 76', 74' and 77' are closed while the bypass valve 79' is open.

Where heat is required instead of refrigeration the cycle of operations is reversed by turning the valve control wheel 62 and lifting the core 65 so that the valve conduit bores 70 and 72 register with the valve ports 54a, 54d and 54b, 54c respectively. The valves 76', 74', 77' and 79 are opened while the valves 76, 74, 77 and 79' are closed. In this circuit the refrigerant coming from the compressor enters the valve intake port 54d and flows through valve conduit bore 70 through valves 76', 74 and 77' through the coil 84 which now serves as a condensing coil, through the expansion valve 82 into the coil 80 which now serves as an expansion coil and returns to the compressor 49 by way of valve conduit bore 72.

Since the coil 84 is always positioned in a chamber and is used both as a condensing coil and an expansion coil it is apparent how both a heating and cooling of the chamber can be effected.

In Fig. 2 is illustrated diagrammatically the application of my invention to a freight car. The unit which is indicated by the numeral 90 and which includes the oil pressure cylinders, the hydraulic motor and gas compressor is preferably positioned beneath the car and is arranged so that the pulley 40 connected to the shaft of the oil pump 38 can be rotated by the axle of the car as by means of a belt 91. A sprocket and chain or direct gear drive may be used in place of a belt and pulley.

The refrigerating or heating coils 84 are preferably suspended from the ceiling of the car as shown in Fig. 2. A fan 92 adapted to be operated by a hydraulic motor 93 is positioned above the coils and is arranged to circulate air over same. The hydraulic motor is operated in the same manner as the motor 32 hereinbefore described both of which receive power from a common source.

I claim:

1. A refrigerating apparatus for a vehicle comprising air cooling means including a refrigerant compressor, hydraulic means for driving said compressor, a cylinder, a piston therein dividing said cylinder into two chambers, one of said chambers communicating with said hydraulic means and containing an incompressible fluid for actuating said hydraulic means to drive said compressor, a compressible fluid contained in the other of said chambers, a hydraulic pump adapted to be driven through the movement of said vehicle for forcing said incompressible fluid from said reservoir into said first mentioned chamber whereby said chamber is expanded and said compressible fluid in said other chamber is compressed, said piston being thereby continuously urged against said incompressible fluid to energize same for driving said compressor even while the movement of said vehicle is arrested.

2. A refrigerating apparatus for a vehicle comprising air cooling means including a refrigerant compressor, hydraulic means for driving said compressor, a reservoir, a cylinder, a piston therein dividing said cylinder into two chambers, one of said chambers communicating with said hydraulic means and containing an incompressible fluid, a hydraulic pump adapted to be driven

through the movement of said vehicle for forcing said incompressible fluid from said reservoir into said chamber, a compressible fluid contained in the other of said chambers and adapted to oppose movement of said piston in a direction to expand said first mentioned chamber, said compressible fluid, however, being compressed during the operation of said pump, so that upon the arresting of the movement of the vehicle said compressed fluid will urge said piston against said incompressible fluid to energize same for actuating said hydraulic means to drive said compressor.

3. A refrigerating apparatus for a vehicle comprising air cooling means including a refrigerant compressor, hydraulic means for driving said compressor, a reservoir, a cylinder, a piston therein dividing said cylinder into two chambers, one of said chambers communicating with said hydraulic means, a given volume of an incompressible fluid contained in said chamber and in said reservoir, hydraulic means adapted to be driven through the movement of said vehicle for pumping said incompressible fluid from said reservoir into said chamber, a compressible fluid contained in said other chamber and adapted to be compressed when said first mentioned chamber is expanded by the flow of incompressible fluid therein, said compressed fluid thereby urging said piston in a direction to expand said second mentioned chamber and to energize said incompressible fluid for actuating said first mentioned hydraulic means to drive said compressor even while the movement of said vehicle is arrested.

4. A refrigerating apparatus for a vehicle comprising air cooling means, a refrigerant compressor, hydraulic means for driving said compressor, a cylinder, a piston therein dividing said cylinder into two chambers, an incompressible fluid contained in one of said chambers for actuating said hydraulic means, the other of said chambers containing compressed air adapted to act on said piston, in a direction to cause the flow of fluid from said first mentioned chamber to actuate said hydraulic means to drive said compressor, means for returning the spent incompressible fluid to said first mentioned chamber whereby said chamber is expanded and the air in said other chamber maintained under compression.

5. A refrigerating apparatus for a vehicle comprising air cooling means, a refrigerant compressor, hydraulic means for driving said compressor, a reservoir, a cylinder, a piston therein dividing said cylinder into two chambers, one of said chambers communicating with said hydraulic means, an incompressible fluid contained in said other chamber and in said reservoir, a compressible fluid contained in the other of said chambers and adapted to act on said piston to energize said incompressible fluid whereby said hydraulic means is actuated to drive said compressor, the spent incompressible fluid thereafter flowing into said reservoir, a hydraulic pump adapted to be driven through the movement of said vehicle for returning said incompressible fluid to said first mentioned chamber whereby the latter is caused to be expanded as said other chamber is caused to be compressed, so that even upon the arresting of the movement of the vehicle the compressed fluid will urge said piston against said incompressible fluid to energize same for actuating said hydraulic means to drive said compressor.

6. An apparatus for selectively heating and

cooling a vehicle and comprising in combination a plurality of coil units adapted for use as condensers or evaporators, a valve system for effecting operation of said coil units as condensers or evaporators as desired, a refrigerant compressor, hydraulic means for driving said compressor, a reservoir, a cylinder, a piston therein dividing said cylinder into two chambers, one of said chambers communicating with said hydraulic means, an incompressible fluid contained in said other chamber and in said reservoir, a compressible fluid contained in the other of said chambers and adapted to act on said piston to energize said incompressible fluid whereby said hydraulic means is actuated to drive said compressor, the spent incompressible fluid thereafter flowing into said reservoir, a hydraulic pump adapted to be driven through the movement of said vehicle for returning said incompressible fluid to said first mentioned chamber whereby the latter is caused to be expanded as said other chamber is caused to be compressed, so that even upon the arresting of the movement of the vehicle the compressed fluid will urge said piston against said incompressible fluid to energize same for actuating said hydraulic means to drive said compressor.

7. An apparatus for selectively heating and cooling a vehicle and comprising in combination a plurality of coil units adapted for use as condensers or evaporators, a valve system for effecting operation of said coil units as condensers or evaporators as desired, a refrigerant compressor, hydraulic means for driving said compressor, a reservoir, a cylinder, a piston therein dividing said cylinder into two chambers, one of said chambers communicating with said hydraulic means and containing an incompressible fluid, a hydraulic pump adapted to be driven through the movement of said vehicle for forcing said incompressible fluid from said reservoir into said chamber, a compressible fluid contained in the other of said chambers and adapted to oppose movement of said piston in a direction to expand said first mentioned chamber, said compressible fluid, however, being compressed during the operation of said pump, so that upon the arresting of the movement of the vehicle said compressed fluid will urge said piston against said incompressible fluid to energize same for actuating said hydraulic means to drive said compressor.

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