

Nov. 21, 1939.

H. Y. STEBBINS

2,180,915

REFRIGERATING UNIT

Filed Sept. 23, 1937

2 Sheets-Sheet 1

Fig. 2.

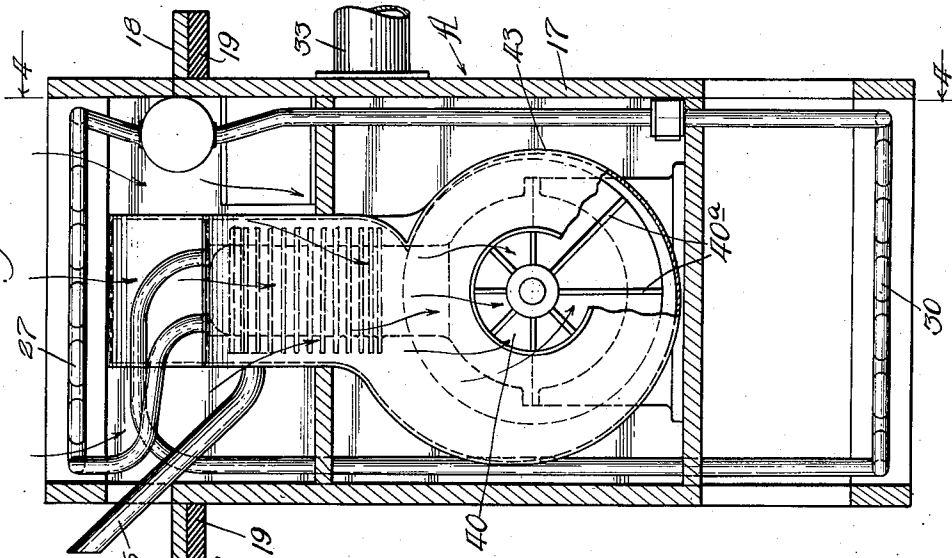


Fig. 1.

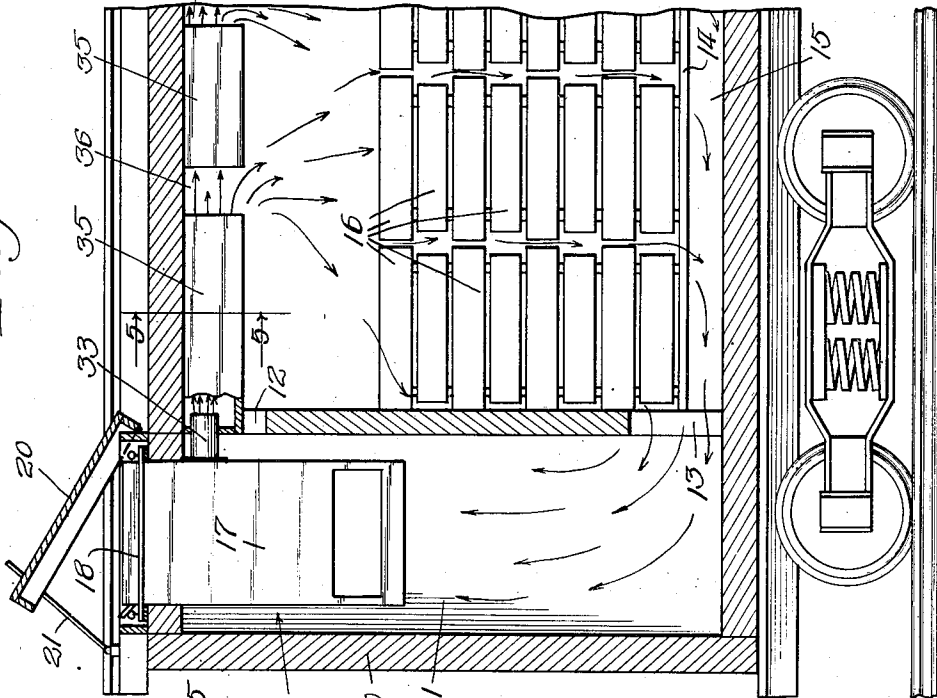
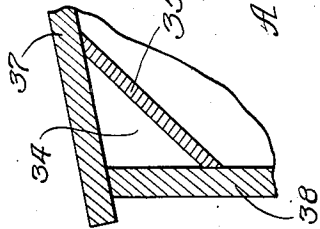


Fig. 5.



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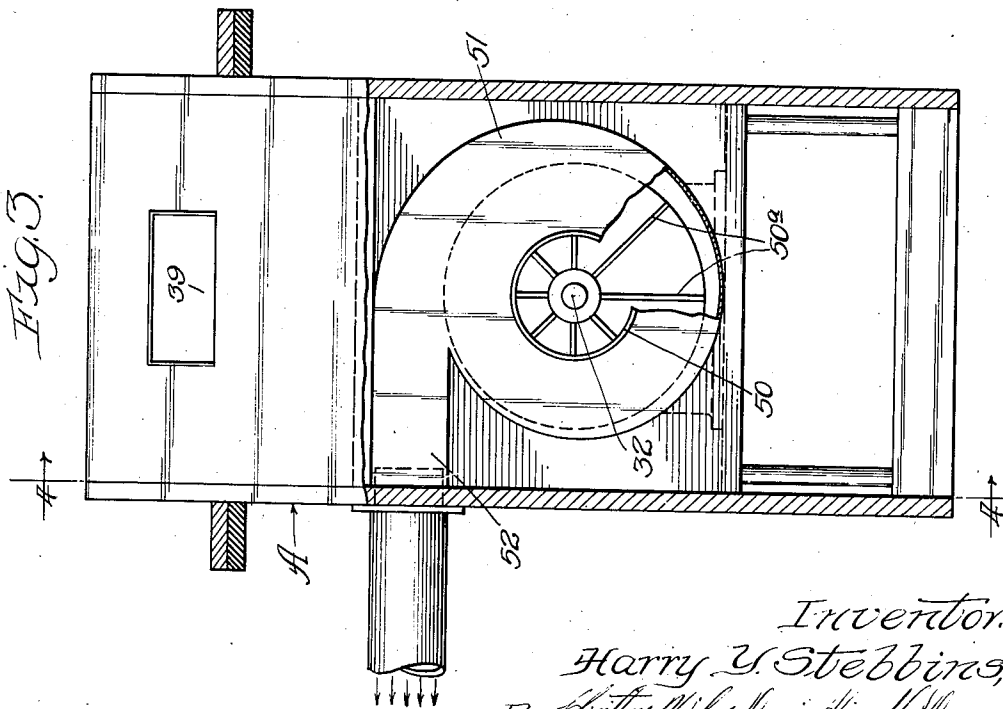
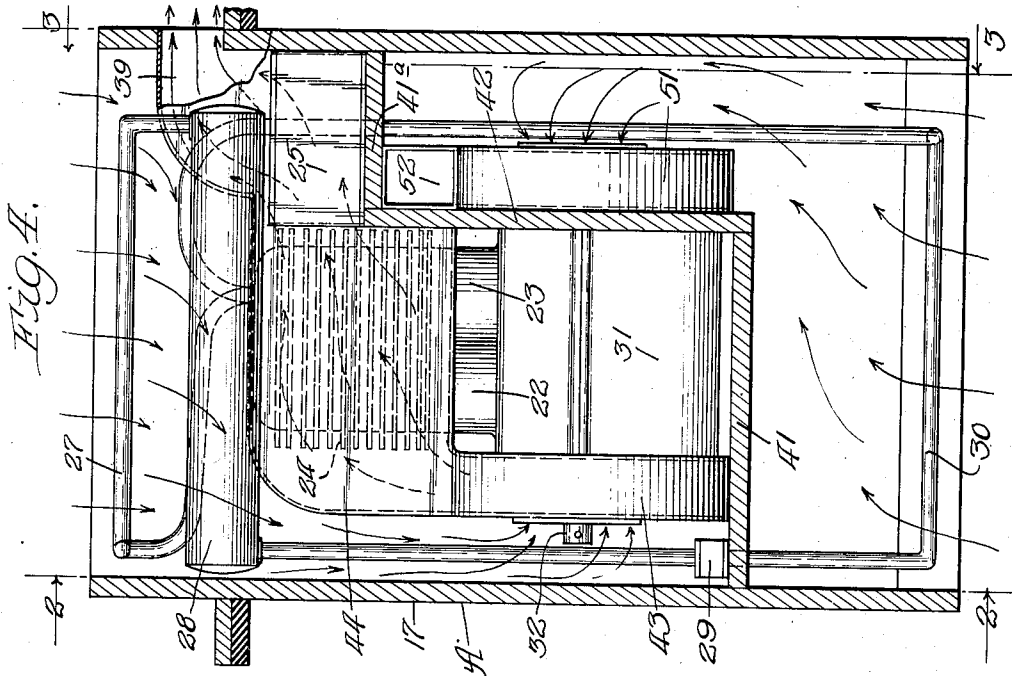
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REFRIGERATING UNIT

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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

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REFRIGERATING UNIT

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Chicago, Ill., a corporation of Delaware

Application September 23, 1937, Serial No. 165,397

12 Claims. (Cl. 62—117)

This invention relates to improvements in refrigerating units and more especially such a unit in compact form and especially adapted for use where only a small space is available. As here shown the invention is adapted more particularly for use in connection with the refrigerating or cooling of railroad cars although it is to be understood that the unit may be used for the cooling or air conditioning of rooms, chambers or vehicles of various sorts.

Among the features of my invention is the provision of such a unit which is very compact and adapted to operate without refueling or attention for relatively long periods of time, for example, periods of from eight to ten days.

Another feature of my invention is the designing of such a unit that can be economically built. This is accomplished by its compactness and its freedom from a multiplicity of bolts, screws and the like which are ordinarily incorporated in present refrigerating units.

Another feature of my invention is the making of such a unit that is substantially free from outside wearing parts such as belts, pulleys, pumps, idlers, fan bearings and the like. This is accomplished by employing in the unit a motor compressor unit consisting of two cylinders arranged side by side, one being a motor cylinder and the other a compressor cylinder. In connection with these two cylinders I employ a single crank shaft with an air circulating flywheel on each end. The motor cylinder for example may be a one-cylinder internal combustion engine of the Diesel type, thus furnishing high efficiency in fuel consumption.

My improved device is adapted for use in the standard refrigerator car with substantially no changes or alterations in the car itself. The unit can be operated both before and during loading for the purpose of precooling the car and may then travel with the car, furnishing the necessary refrigeration in transit.

My improved device is adapted to be inserted into the bunker of a refrigerator car either fully or partially through the hatch, and when thus inserted it replaces the plug of the hatch and closes the opening.

Other features and advantages will appear more fully as I proceed with my specification.

In that form of device embodying the features of my invention shown in the accompanying drawings—Fig. 1 is a vertical sectional view of one end of a refrigerator car showing my unit in place; Fig. 2 is a view of the unit itself taken as indicated by the line 2 of Fig. 4; Fig. 3 is a

similar view taken as indicated by the line 3 of Fig. 4; Fig. 4 is a similar view taken as indicated by the line 4 of Fig. 3; and Fig. 5 is a view of the corner of the car taken as indicated by the line 5 of Fig. 1.

As shown in the drawings 10 indicates in general a refrigerator car of conventional construction with an ice bunker 11 at each end provided with the usual opening 12 into the car at the top and a similar opening 13 at the bottom to permit circulation of air from the car through the bunker in the usual manner. 14 indicates the usual false bottom in the car which ordinarily is made of separated slats or grill of some sort to permit flow of air through the same into the space 15 below the false bottom whence it may find an easy passage to the opening 13 for return to the bunker 11. 16 indicates diagrammatically a lading or load in the car, which, for example, may be crates, boxes or the like, containing fruit, vegetables or other materials. Ordinarily the boxes are separated somewhat by slats or other means so air can circulate freely between them and between and through the fruit, vegetables or other materials contained in them. In other words, the load is usually arranged or packed so that the circulating air will reach all parts of it to insure thorough and uniform cooling.

The refrigerating unit itself I have indicated by A. This unit is portable and so proportioned and designed that it can easily be inserted through the hatch of the bunker of the car shown in Fig. 1. It includes a substantially rectangular housing 17 which has a cross sectional size and shape substantially the same as that of the hatch of the bunker so that it can be inserted through the hatch. Near the upper end the housing 17 is provided with an outwardly projecting flange 18 adapted to seat on the edge of the top of the car surrounding the hatch. 19 may indicate a sponge rubber gasket under the flange 18 in order to make a seal. When the unit is in place therefore it will close the hatch and act as a substitute for the regular plug therefor. 20 indicates the usual hinged door over the hatch which is left somewhat open propped up by the brace 21 as shown in Fig. 1 when the refrigerating unit A is in place.

The unit itself includes the two vertical cylinders 22 and 23 arranged side by side and preferably provided with the cooling flanges 24. The cylinder 22 is the motor cylinder and the cylinder 23 constitutes a compressor which may be of any conventional type. The cylinder 22

may be a Diesel engine or other type of internal combustion motor. Since the details of construction and operation of internal combustion engines, compressors, and the refrigerating circuits are so well known, it is not necessary here to explain the same in detail. It will suffice to say that the cylinder 22 may be a Diesel engine of any well known construction which, for example, may be supplied with fuel from the tank 25, the connections thereto not being shown. 26 may indicate the exhaust pipe from the motor. 23 is the compressor which it is to be understood is supplied with the proper inlet and outlet valves of any conventional design. The refrigerating circuit may also be of any conventional design employing the usual condenser coil 27, receiver 28, expansion valve 29 and evaporator coil 30. That is, a refrigerant of any suitable nature is circulated in a manner well known in the refrigeration art from the compressor through the condenser coil, receiver, expansion valve, the evaporator coil and back to the compressor.

31 indicates the crank case for the motor compressor unit in which operates a single crank shaft 32 with an air circulating flywheel mounted on each end. The unit is provided with partitions, ducts and baffles to provide two separate and distinct air circuits, one operated by each of the flywheels. In one circuit outside air is drawn first through the condenser coil and then discharged around the cylinder flanges to the outside. In this manner both the condenser coil and the cylinders are cooled. In the other circuit air is drawn from the interior of the car through the opening 13 in the bottom of the bunker thence upwardly through the evaporator coil 30 where it is cooled and then discharged through suitable ducts into the interior of the car above the load to cool the same. The discharge of this cooled air from the unit, for example may be through the removable pipe section 33 into the interior of the car through the opening 12 at the top of the bunker. If desired, suitable means may be provided to insure a more even distribution of the cooled air throughout the interior of the car. For example, I have here shown the discharge pipe 33 arranged in one corner of the car and entering a conduit 34 in the upper corner of the car formed by the diagonal boards 35 separated somewhat to provide openings 36 throughout the length of the car from which the cooled air may escape into the interior of the car above the load. In Fig. 5, 37 indicates the roof of the car and 38 the side wall.

When the unit is in place the condenser 27 is preferably supported a short distance above the car roof 37 (see Fig. 4) and the exhaust for the air circuit that cools the condenser and motor compressor unit is above the car roof 37, as indicated by 39.

40 indicates the air circulating flywheel or blower which moves the air through the circuit to cool the condenser and motor compressor unit. 40^a, 40^b indicates the vanes on this blower.

The casing 17 contains a horizontal partition 41 with a vertical offset wall 42, the horizontal partition being continued at the upper edge of the wall 42 by the extension horizontal partition 41^a. These walls or partitions 41, 42, 41^a divide the casing 17 into upper and lower chambers. The air circuit for the condenser and motor compressor unit is entirely in the upper chamber, the air being drawn in from above and outside,

through the condenser, thence into the blower casing 43 around the blower 40 and thence discharged into the duct 44 surrounding the motor and compressor cylinders and thence discharged through the outlet 39 above the car roof. It is to be understood that the walls of the duct 44 are continued to confine the airflow from the blower 40 around the cylinders and discharge it through the outlet port 39.

50 indicates the air circulating flywheel or blower on the other end of the shaft for circulating the air from the car through the evaporator coil to cool the air and then back to the car. 50^a, 50^b indicate the vanes on this blower and 51 the casing therefor. When the unit is in place, this blower draws air up from the bottom of the bunker, through the evaporator 30, as shown by the arrows in Fig. 4, and discharges it from the outlet port 52 of the blower casing 51 into the discharge pipe 33 and thence into the car, as already explained. Air is thereby circulated from the bottom of the bunker upwardly through the bottom of the unit, through the evaporator coil 30 to the blower 50, thence through the pipe 33 and distributing duct 35 back into the car, and thence downwardly through the load 16 and back into the bottom of the bunker through the bottom opening 13. The blower 50 is under the horizontal wall 41^a and on the opposite side of the vertical wall 42 from the blower 40. (See Fig. 4.)

It is contemplated that my invention may be incorporated in a mechanical air conditioner for refrigerator cars in the form of a complete self-contained unit which may, for example, have a capacity of from one and one-half (1½) to two (2) tons and a weight of approximately two hundred seventy-five (275) pounds. The unit may be lowered into the top of a standard refrigerator car hatch when necessary to precool or cool perishable products in transit: Since each car ordinarily has two bunkers with two or more hatches, it is seen that one or more of the units can be used simultaneously for precooling or for low temperature use in transit. It is possible to use my invention with no change in the construction of refrigerator cars as now built. The unit can be changed from one car to another in a few minutes and when not in service may be removed from the car. Replacement units can be quickly installed. Two units can be used on each car, one at each end, so that in the event of failure of one, the other will supply at least some refrigeration. The operation cost is very much lower than present icing costs in transit. Lower and more even temperatures can be maintained both in precooling empty cars and precooling loaded cars and cooling loaded cars in transit, than can be accomplished with ice. Owing to the forced draft air circulation cars can carry greater loads than when forced draft is not used. The unit is designed to be used in any type of commodity and is especially adapted to cool meat, where conditioned cars are used at a great saving. Use of my invention should also cut down the total car weight and thus lighten the train load.

The motor and compressor cylinders, 22 and 23 respectively, may be cast en bloc as shown; and may be made by converting a two cylinder internal combustion motor. That is, one of the cylinders of a two cylinder internal combustion motor may be converted into a compressor to form the one-cylinder-motor—one-cylinder-compressor unit of my invention.

While I have shown and described certain em-

bodiments of my invention, it is to be understood that it is capable of many modifications. Changes, therefore, in the construction and arrangement may be made without departing from the spirit and scope of the invention as disclosed in the appended claims, in which it is my intention to claim all novelty inherent in my invention as broadly as permissible, in view of the prior art.

I claim:

1. A refrigerating unit, including: a casing; a substantially horizontal partition in said casing; a cylindrical compressor, condenser and evaporator in the casing connected in a refrigeration circuit, the condenser and the cylinder of the compressor being above the partition and the evaporator below, a refrigerant in said circuit; an internal combustion motor, with a cylinder, in the casing, connected to the compressor, the cylinder being above the partition; a common crank shaft for the motor and compressor; means for circulating air above the partition around the condenser, compressor cylinder and motor cylinder; and means for circulating air below the partition around the evaporator; one of the air circulating means including an air circulating flywheel on one end of the crank shaft, and the other air circulating means being driven from the other end of the crank shaft.

2. A refrigerating unit, including: a motor cylinder and compressor cylinder with a common crankshaft; a condenser and evaporator connected to the compressor cylinder in a refrigeration circuit; a refrigerant in said circuit; an air circulating flywheel on one end of the crankshaft adapted to move air over the evaporator; and an air circulating flywheel on the other end of the crankshaft adapted to move air over the condenser.

3. A refrigerating unit, including: a motor cylinder and compressor cylinder with a common crankshaft; a condenser and evaporator connected to the compressor cylinder in a refrigeration circuit; a refrigerant in said circuit; an air circulating flywheel on one end of the crankshaft adapted to move air over the evaporator; and an air circulating flywheel on the other end of the crankshaft adapted to move air over the condenser and motor cylinder.

4. A refrigerating unit, including: a motor cylinder and compressor cylinder with a common crankshaft; a condenser and evaporator connected to the compressor cylinder in a refrigeration circuit; a refrigerant in said circuit; an air circulating flywheel on one end of the crankshaft adapted to move air over the evaporator; and an air circulating flywheel on the other end of the crankshaft adapted to move air over the condenser and motor and compressor cylinders.

5. Apparatus as claimed in claim 2, in which the motor and compressor cylinders are cast en bloc.

6. A refrigerating unit adapted to be inserted through the hatch of a bunker of a refrigerator car, including: a compressor, condenser and evaporator connected in a refrigeration circuit; a refrigerant in said circuit; a motor connected to the compressor, the motor and compressor employing a common crankshaft; means for suspending the unit in the bunker of a refrigerator car, said unit substantially closing the hatch when so suspended; means driven from one end of said crankshaft for circulating air from outside the car around the condenser, motor

and compressor, when the unit is so suspended, and returning said air to the outside of the car; and means driven from the other end of said crankshaft for circulating air from the inside of the car around the evaporator, when the unit is so suspended, and returning said air to the inside of the car.

7. A self-contained refrigerating unit, with a condenser, evaporator, and compressor, and an internal combustion motor for driving said compressor, said unit adapted to be inserted at least partially into the bunker of a refrigerator car through the hatch thereof and suspended in said bunker, said unit adapted to cool air in the car, said motor and compressor having a common crankshaft with an air circulating flywheel on each end thereof, one adapted to circulate air over the condenser, and the other adapted to circulate air over the evaporator.

8. A portable self-contained refrigerating unit, with a condenser, evaporator, and compressor, and an internal combustion motor for driving said compressor, said unit adapted to be inserted at least partially into the bunker of a refrigerator car through the hatch thereof, and suspended in said bunker, said motor and compressor having a common crankshaft with an air circulating flywheel on each end thereof, one adapted to circulate air over the condenser, and the other adapted to circulate air from the car around the evaporator and back to the car, when the unit is suspended in the bunker.

9. A self-contained refrigerating unit, with a condenser, evaporator, and compressor, and an internal combustion motor for driving said compressor, said unit adapted to be inserted at least partially into the bunker of a refrigerator car through the hatch thereof and suspended in said bunker, said unit adapted to cool air in the car, said motor and compressor having a common crankshaft, and an air circulating means driven by each end of the crankshaft, one such air circulating means adapted to circulate air over the condenser and the other adapted to circulate air over the evaporator.

10. A portable self-contained refrigerating unit, with a condenser, evaporator, and compressor, and an internal combustion motor for driving said compressor, said unit adapted to be inserted at least partially into the bunker of a refrigerator car through the hatch thereof, and suspended in the bunker, said motor and compressor having a common crankshaft, and an air circulating means driven by each end of the crankshaft, one such air circulating means adapted to circulate air over the condenser, and the other adapted to circulate air from the car around the evaporator and back to the car, when the unit is suspended in the bunker.

11. A refrigerating unit, including: a casing; a substantially horizontal partition in said casing; a cylindrical compressor, condenser, and evaporator in the casing connected in a refrigeration circuit, the condenser and the cylinder of the compressor being above the partition and the evaporator below; a refrigerant in said circuit; an internal combustion motor, with a cylinder, in the casing, connected to the compressor, the cylinder being above the partition; a common crankshaft for the motor and compressor; means for circulating air above the partition around the condenser, compressor cylinder and motor cylinder; and means for circulating air below the partition around the evaporator; one of the air circulating means being driven from

one end of the crankshaft and the other air circulating means being driven from the other end of the crankshaft.

5 12. A refrigerating unit, including: a casing open at the top and bottom; a horizontal partition in the casing with a vertical offset; a cylindrical compressor, condenser and evaporator in the casing connected in a refrigeration circuit; the condenser and the cylinder of the compressor being above the partition; a refrigerant
10 in said circuit; an internal combustion motor, with a cylinder, in the casing, connected to the

compressor by a common crankshaft, the motor cylinder being above the partition, and the crankshaft extending through the vertical offset; means for moving air downwardly through the top of the casing, around the condenser, motor cylinder and compressor cylinder and discharging said air from the casing; and means for moving air upwardly through the bottom of the casing around the evaporator and discharging said air from the casing. 5 10

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