

April 21, 1942.

H. HEMMING ET AL
REFRIGERATION APPARATUS

2,280,512

Filed May 2, 1940

2 Sheets-Sheet 1

Fig. 2

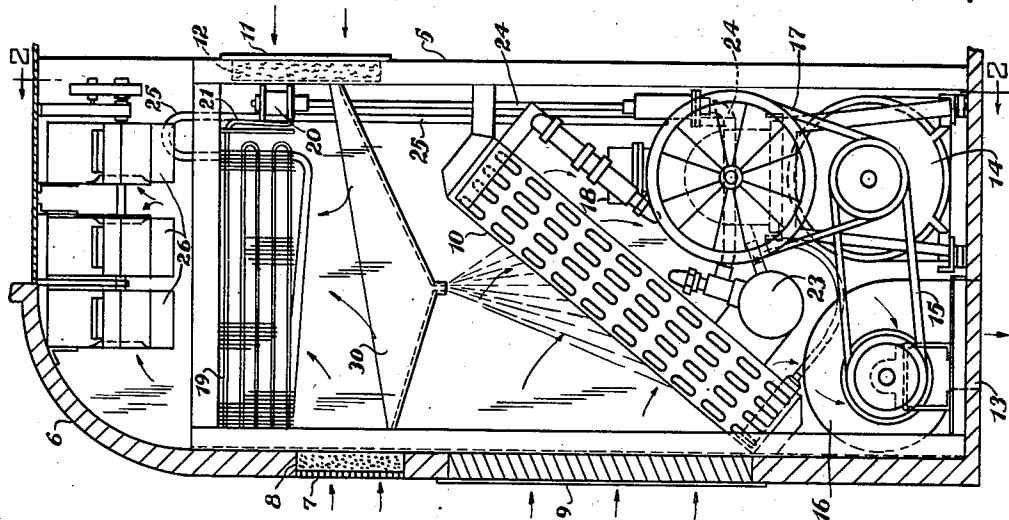
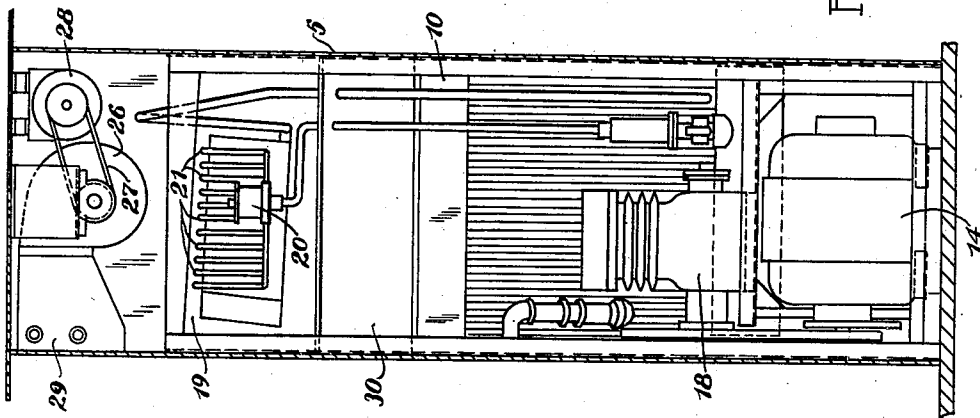


Fig. 1

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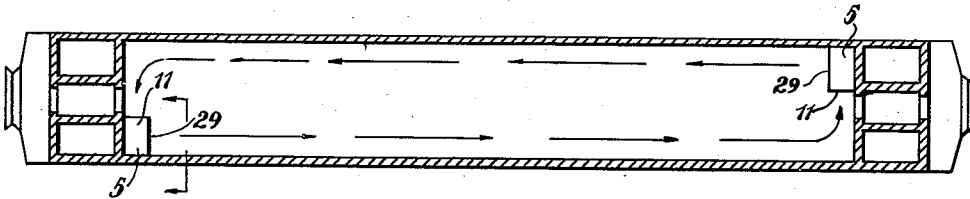


Fig. 3

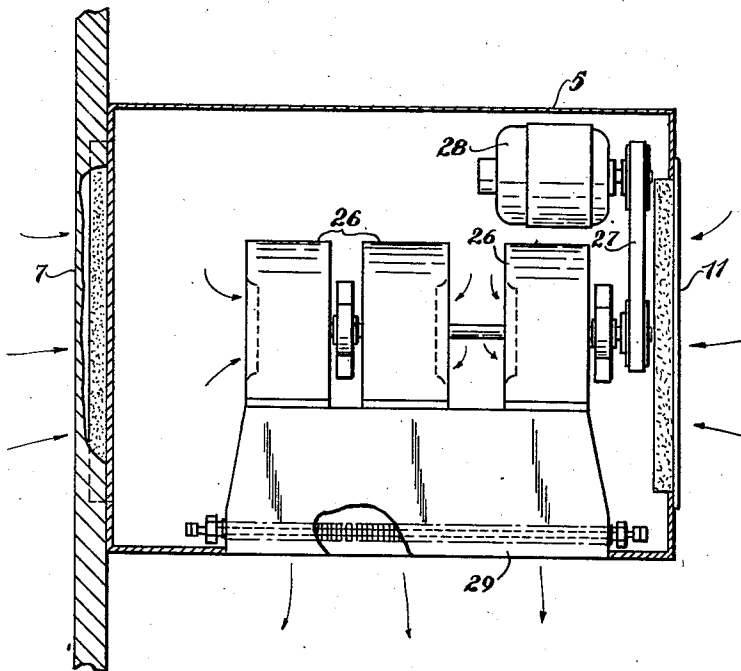


Fig. 4

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UNITED STATES PATENT OFFICE

2,280,512

REFRIGERATION APPARATUS

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Application May 2, 1940, Serial No. 332,864

4 Claims. (Cl. 62-140)

This invention relates to refrigeration apparatus and relates more particularly to mechanical refrigeration units for the conditioning of air.

The embodiment of the invention illustrated was designed for railway passenger cars. In prior air conditioning systems for railway passenger cars, the air cooling units have been mounted in the ends of the cars above the passenger space with longitudinal ducts for the distribution of the air and with the compressor-condenser units mounted on the underside of the cars. It is seen that with such systems, not only was the equipment divided into three separate major units, viz: the air coolers, the ducts, and the compressor-condensers, but in order to include the equipment, new cars had to be designed differently and more expensively, and old cars had to be modified considerably. Then too, the installation expense has been too great.

This invention provides compact units including the air coolers, the compressors-condensers, the blowers and associated apparatus, which may be easily and cheaply installed in a railway passenger car and which do not require distributing ducts. In one embodiment of the invention such units are located in opposite diagonal corners of a car and cooling and supplying the air in an unconfined loop circuit above the passenger space.

An object of the invention is to simplify air conditioning equipment.

Another object of the invention is to reduce the cost of air conditioning installations.

Another object of the invention is to reduce the space required by air conditioning equipment.

The invention will now be described with reference to the drawings, of which:

Fig. 1 is a transverse section through one embodiment of an air conditioning unit according to this invention;

Fig. 2 is a sectional view along the lines 2-2 of Fig. 1;

Fig. 3 is a sectional view through a railway passenger car equipped in its opposite diagonal corners, with the units of Figs. 1 and 2, and illustrates the method of air distribution, and

Fig. 4 is a view looking downwardly with top removed, on the units of Figs. 1 and 2.

The equipment to be described is contained in an upright rectangular unit 5 having an upper portion cut away to accommodate the curved car roof 6. (Fig. 1.) The unit 5 has the outdoor air inlet 7 with filter 8 for the entry of fresh, make-up air; the outdoor air inlet 9 for the entry of air for the cooling of the condenser 10; the recirculated air inlet 11 with filter 12 for the entry of recirculated air from the passenger space, and the air outlet 13 which extends through the floor of the car and serves to dis-

charge to the tracks, the heated air from the condenser 10.

The electric motor 14 drives the blower 16 through the belt 15, and drives the compressor 18 through the belt 17. The blower 16 serves to draw the condenser cooling air through the inlets 9 and 11 and to discharge it through the opening 13.

The finned evaporator 19 extends across the unit 5 in its upper portion and is supplied with refrigerant by the expansion valve 20 and distributor tubes 21. The flow of refrigerant is from the compressor 18 through the connections 22 to the condenser 10, from the liquid receiver 23 through the connections 24 to the valve 20, through the tubes 21 to the tubes of the evaporator 19, and through the connection 25 back to the compressor.

The condenser 10 is tilted with its upper end above the relatively high compressor 18, and its lower end above the relatively low blower 16. This enables a relatively large condenser to be fitted into the limited space available.

The blowers 26 driven through the belt 27 by the motor 28 are mounted to the roof of the unit 5 and serve to draw outdoor air from the inlet 7 and recirculated air from the inlet 11, through the evaporator 19 and then to discharge it through the bulkhead discharge outlet 29. The outlet 29 contains the electric heating elements 31 for heating the air in winter.

The drain pan 30 located between the evaporator 19 and the condenser 10 performs three functions. It separates the air streams passing over the evaporator and the condenser. It collects the moisture condensed from the air by the evaporator 19 and discharges it upon the condenser 10 to provide evaporative cooling. It is funnel shaped so it may be relatively deep for avoiding the splashing out of the water during car movement. It is tilted so that its outlet may spray water upon the maximum surface of the tilted condenser. It is also so placed with respect to the recirculated air inlet 11 that a portion of the recirculated air entering the unit is deflected by the pan 30 to pass over the condenser 10. The capacities of the blowers 16 and 26, and the dimensions of the air passages being so arranged that the volume of recirculated air passing over the condenser is equal to the volume of outdoor, make-up air drawn in through the inlet 7. The inlet 11 is seen to comprise two separate inlets, one for air to the evaporator and the other for air for the condenser.

In prior railway car installations, the vitiated air was discharged through roof ventilators. This invention recovers the "cold energy" from the vitiated air by using it to cool the condenser. This feature together with the feature of using the moisture condensed from the air for cooling

the condenser evaporatively results in decreased condenser surface and reduced operating expense.

The units 5 are so placed in the car as illustrated by Fig. 3 that the recirculated air inlets 11 border the central aisle between the seats of the car and with the discharge outlets facing the opposite ends of the car. The conditioned air thus is circulated in an unconfined loop circuit above the heads of the passengers, and the chilled air descends without drafts in convection currents in the system of the Patent No. 2,192,221 which issued March 5, 1940 on an application of R. T. Brizzolara.

While one embodiment of the invention has been described for the purpose of illustration, it should be understood that the invention is not limited to the exact apparatus and arrangement of apparatus illustrated as modifications thereof may be suggested by those skilled in the art without departure from the essence of the invention.

What is claimed is:

1. An air cooler comprising an upright substantially rectangular unit having an outdoor air inlet and a recirculated air inlet in opposite walls, a blower in said unit above said inlets, means forming an air discharge outlet in said unit in alignment with said blower, an evaporator in said unit between said inlets and said blower, a tilted condenser in said unit below said inlets, means forming a partition in said unit between said evaporator and said condenser, a second outdoor air inlet below said partition in alignment with said condenser, a compressor below the upper end of said condenser, a blower below the lower end of said condenser, and means forming an outlet from said unit connecting with the discharge of said blower, said compressor, condenser and evaporator being connected in a refrigeration circuit, said first mentioned blower being arranged to draw air through said recirculated air inlet and said first mentioned outdoor air inlet, over said evaporator and for discharging it from said first mentioned outlet, and said second mentioned blower being arranged to draw air through said second mentioned outdoor air inlet, over said condenser and compressor and for discharging it through said second mentioned outlet.

2. An air cooler comprising an upright substantially rectangular unit having an outdoor air inlet and a recirculated air inlet in opposite walls, a blower in said unit above said inlets, means forming an air discharge outlet in said unit in alignment with said blower, an evaporator in said unit between said inlets and said blower, a tilted condenser in said unit below said inlets, a tilted, funnel shaped drain pan in said unit between said evaporator and said condenser, a second outdoor air inlet below said drain pan, a compressor below the upper end of said condenser, a blower below the lower end of said condenser, and means forming an outlet from said unit connecting with the discharge of said blower, said compressor condenser, and evaporator being connected in a refrigeration circuit, said first mentioned blower being arranged to draw air through said recirculated air inlet and said first mentioned outdoor air inlet, over said evaporator and for discharging it from said first mentioned outlet, said second mentioned blower

being arranged to draw air through said second mentioned outdoor air inlet, over said condenser and compressor and for discharging it through said second mentioned outlet, and said pan serving to collect moisture condensed from the air by said evaporator and to discharge same upon said condenser, and serving to separate the air streams passing over said evaporator and condenser.

3. An air cooler comprising an upright substantially rectangular unit having an outdoor air inlet and a recirculated air inlet, a blower in said unit above said inlets, means forming an air discharge outlet in said unit, an evaporator in said unit, a tilted condenser in said unit below said evaporator, a funnel shaped drain pan in said unit between said evaporator and said condenser, a second outdoor air inlet below said drain pan in alignment with said condenser, a compressor below the upper end of said condenser, a blower below the lower end of said condenser, and means forming an outlet through the floor of said unit connecting with the discharge of said blower, said compressor, condenser and evaporator being connected in a refrigeration circuit, said first mentioned blower being arranged to draw air through said recirculated air inlet and said first mentioned outdoor air inlet, over said evaporator and for discharging it from said first mentioned outlet, said second mentioned blower being arranged to draw air through said second mentioned outdoor air inlet, over said condenser and compressor and for discharging it through said second mentioned outlet, and said pan serving to collect moisture condensed from the air by said evaporator and to discharge same upon said condenser, and serving to separate the air streams passing over said evaporator and condenser.

4. An air cooler comprising an upright substantially rectangular unit having an outdoor air inlet and a recirculated air inlet, a blower in said unit above said inlets, means forming an air discharge outlet in said unit, an evaporator in said unit, a tilted condenser in said unit below said evaporator, a tilted, funnel shaped drain pan in said unit between said evaporator and said condenser, a second outdoor air inlet below said drain pan, a compressor below the upper end of said condenser, a blower below the lower end of said condenser, means forming an outlet through the floor of said unit connecting with the discharge of said blower, means forming a second recirculated air inlet below said pan, said compressor, condenser and evaporator being connected in a refrigeration circuit, said first mentioned blower being arranged to draw air through said recirculated air inlet and said first mentioned outdoor air inlet, over said evaporator and for discharging it from said first mentioned outlet, said second mentioned blower being arranged to draw air through said second mentioned outdoor air inlet and said second mentioned recirculated air inlet, over said condenser and compressor and for discharging it through said second mentioned outlet, and said pan serving to collect moisture condensed from the air by said evaporator and to discharge same upon said condenser, and serving to separate the air streams passing over said evaporator and condenser.

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