Sept. 24, 1940. J. N. H. CHRISTMAN 2,215,901

HEATING AND VENTILATING MEANS FOR VEHICLES

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Fig. 1.

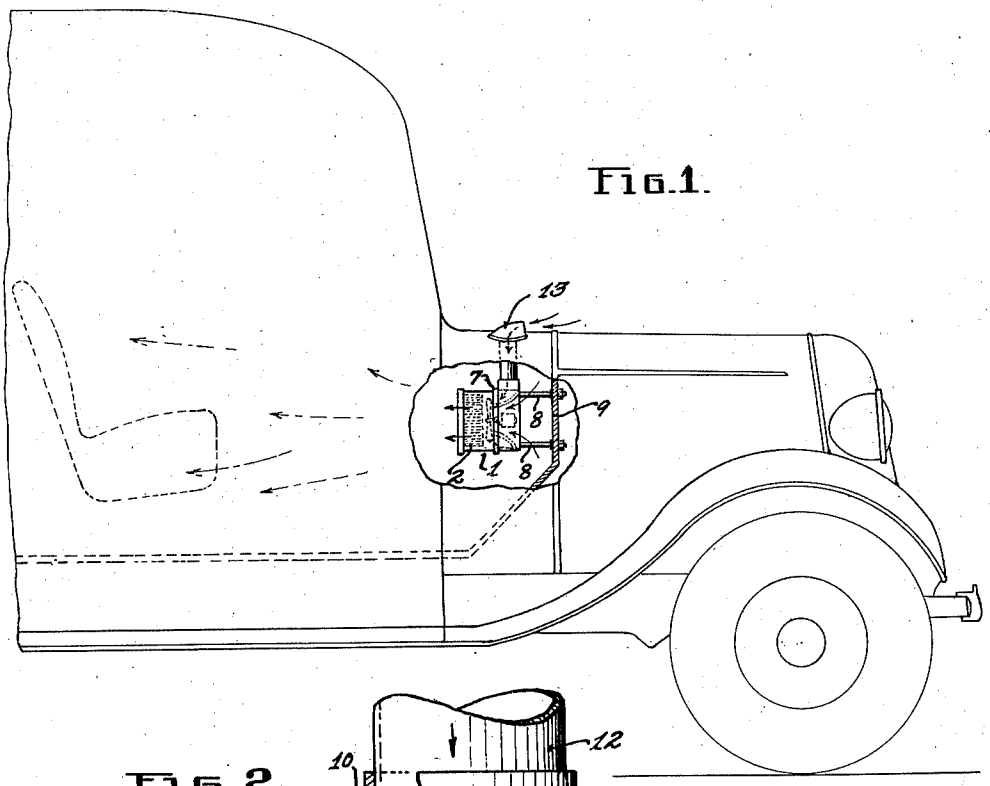
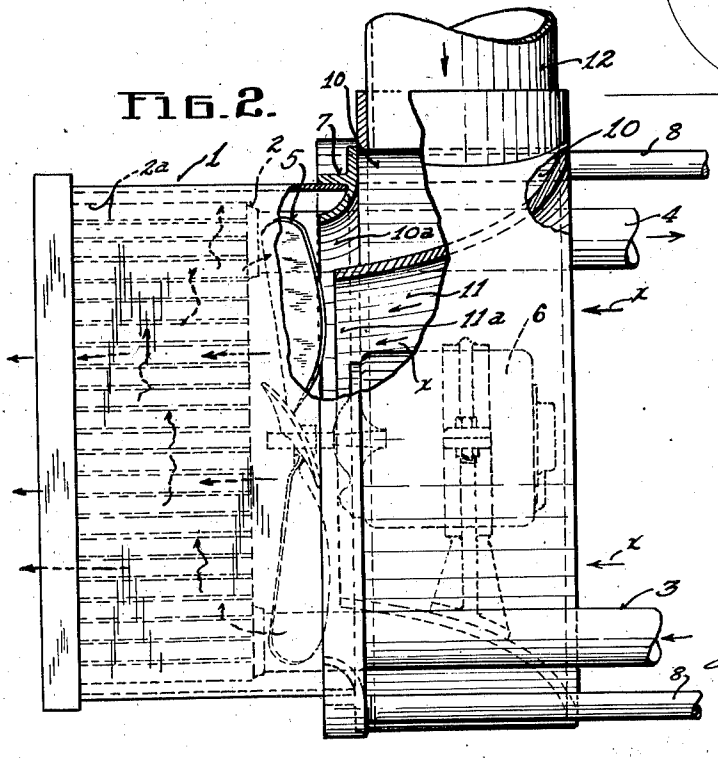



Fig. 2.




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HEATING AND VENTILATING MEANS FOR VEHICLES

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FIG. 3

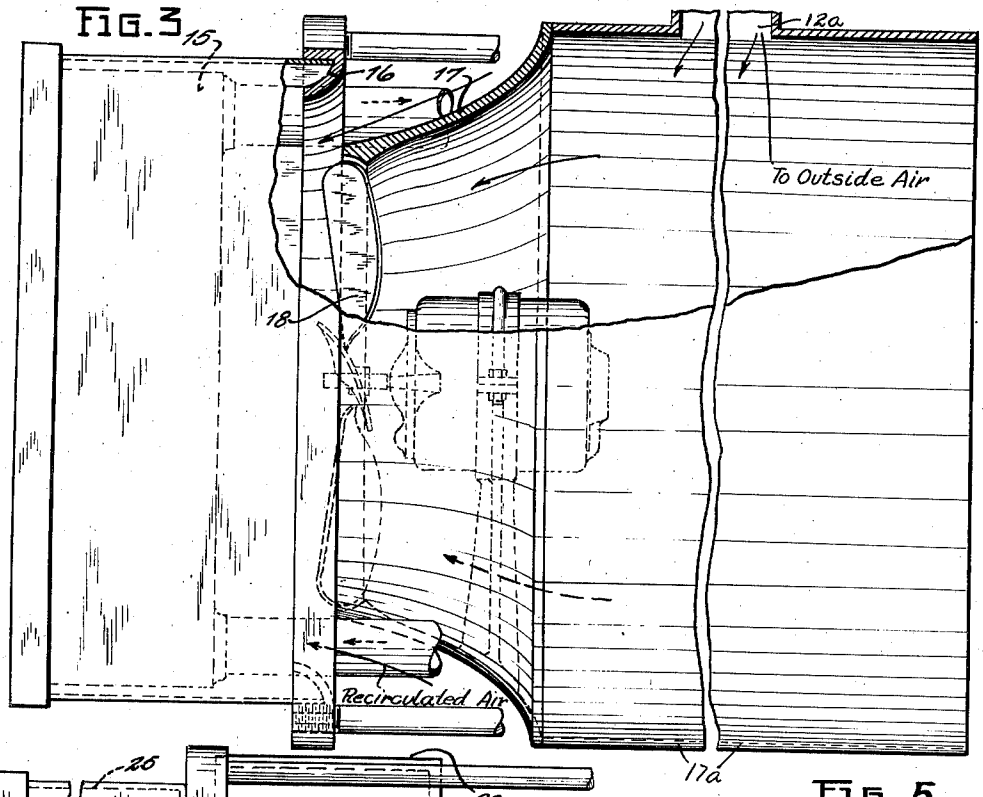
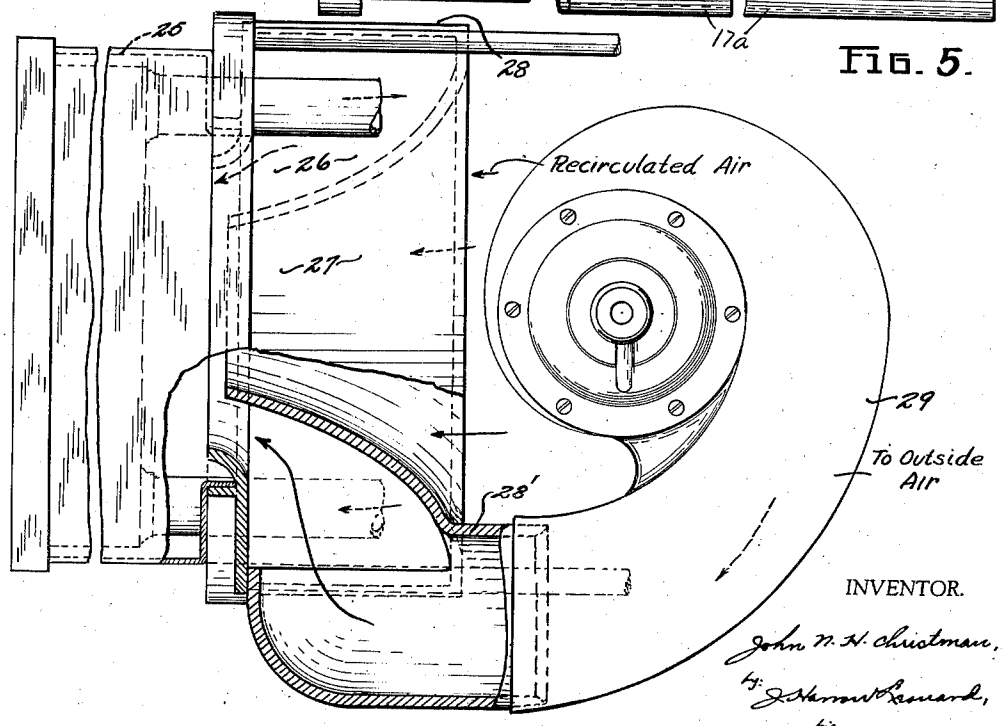



FIG. 5.




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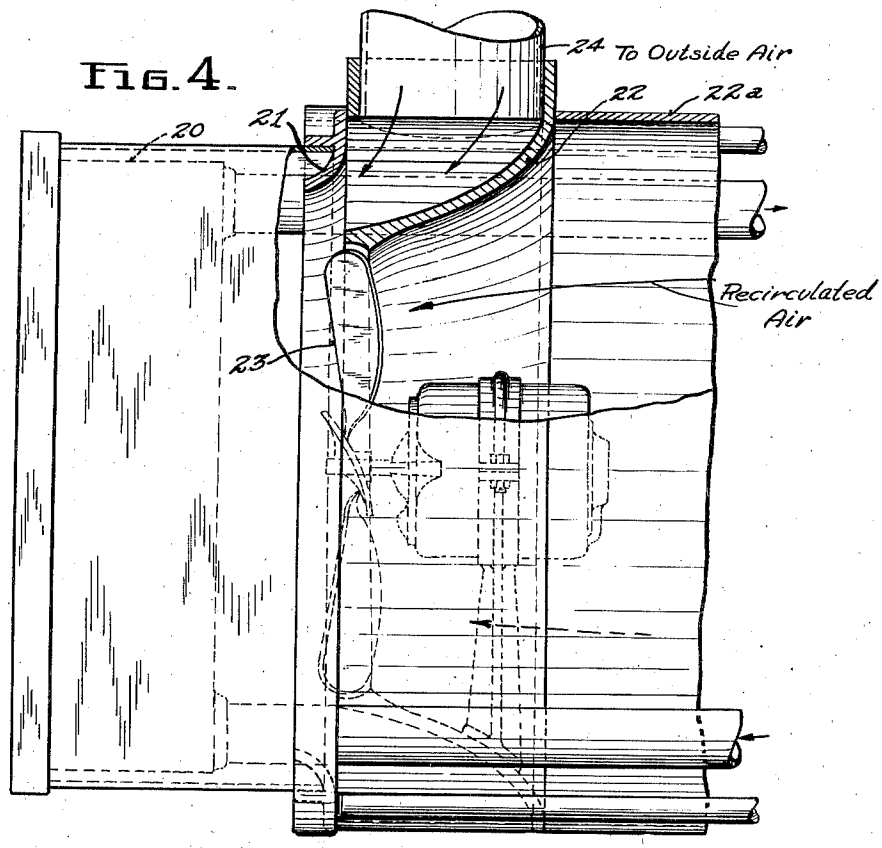
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HEATING AND VENTILATING MEANS FOR VEHICLES

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Fig. 4.




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# UNITED STATES PATENT OFFICE

2,215,901

## HEATING AND VENTILATING MEANS FOR VEHICLES

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Application April 9, 1936, Serial No. 73,505

12 Claims. (Cl. 98—2)

This invention relates to a heating and ventilating system for vehicles and particularly to a new and improved hot water heater and air circulator for such purposes.

The principal objects of the present invention are to provide a motor vehicle hot water heating system capable of supplying a greater amount of heat than hot water systems of comparable size and cost heretofore provided in combination with an air supplying and circulating means for supplying fresh outside air in larger quantities through the heater without the accompanying dangers of freezing.

A more specific object is to effect better air circulation without a proportional increase in the size of blower means provided for such a purpose and with substantially no increase in the power required for operation.

Other objects and advantages will become apparent from the following specification wherein reference is made to the drawings in which:

Fig. 1 is a fragmentary side elevation, partly in section, illustrating a preferred installation of the present invention;

Fig. 2 is an enlarged side elevation, partly in section, of the water heating and air circulating means shown in connection with Fig. 1;

Figs. 3, 4 and 5 are side elevations, partly in section, illustrating respective modifications of the invention.

Referring to Figs. 1 and 2, there is illustrated a hot water heat exchanger 1, which preferably employs a honeycomb water core 2 having air tubes 2a through which the air is forced and around which the water circulates. The water circulated through the core enters through an inlet conduit 3 and discharges through a conduit 4. Air is forced through the core tubes primarily by a propeller fan 5 which is driven by a suitable motor 6.

In motor vehicle heating, it is necessary to consider statutory requirements of a predetermined volume of fresh outside air. Since this air varies widely in its initial temperature, care must be exercised that the core is not chilled by the air to freezing temperature. The present structure is effective for insuring an adequate supply of cold outside air while at the same time eliminating the danger of freezing of the core.

For this purpose, the heat exchanger 1 is mounted on a support 7 which, in turn, is supported by rods 8 secured to a support 9 in the vehicle body. The support 7 has two compartments, one of which is connected to the outside atmosphere and the other of which is connected to the interior of the car. In the form illustrated, an outside annular compartment 10 and a coaxial inner circular compartment 11 are provided. The outer compartment 10 and inner compartment 11 have coaxial and contracted discharge passages 10a and 11a respectively which terminate in planes parallel to the fan 5 and close thereto and to each other, and provide, in operating effect, air induction bells.

In the form illustrated in Fig. 2, the compartment 11 is open at the rear for the admission of air from within the body, as indicated by the arrow x. The compartment 10, in turn, is in communication with the outside air through a suitable duct 12. The duct 12 is connected to and receives air from the usual cowl ventilator 13 of the vehicle body, immediately below which ventilator the present structure is preferably located. The cowl ventilator 13 is adjustable so that the amount of air admitted therethrough can be controlled regardless of the speed of travel of the vehicle.

Both of the discharge passages 10a and 11a are within the radial limits of the fan 5 so that the fan 5 concurrently directly draws air from each. The outer marginal portions of the fan, however, usually are more effective than the portions near the axis of rotation as a result of which a higher speed annular stream of air is drawn through the passage 10a than through the passage 11a. Since both compartments have restricted discharge passages which are in inductive relation to each other, the inrushing stream of air through the passage 10a induces additional recirculated air from within the body through the passage 11a, thus assisting the flow of air toward the central portion of the fan. As a result, the cooler outside air entering through the passage 10a is modulated in temperature with the warmer recirculated inside air as it enters the water core so as to reduce the danger of freezing. At the same time, due to inductive effects, the amount of power required for circulating the large volume of induced air is reduced.

When the vehicle is traveling forward, air is forced through the passage 10a independently of the fan. During such operation, a large amount of recirculated air is induced through the passage 11a by the air passing through the passage 10a. If the fan is operating at the same time, it is unloaded to a large extent and consequently less power is required for a given rate of circulation.

In the form illustrated in Fig. 3, the recircu-

lation of inside air is derived entirely from the inducing effect of air driven directly by the fan. In this structure, the heat exchange core **15** is arranged in front of an inducing bell **16**, the inducing bell being open at its rear edge for receiving air from the interior of the vehicle body. A coaxial bell **17** terminating at its forward edge close to the plane of the outlet of the bell **16** is in communication with the outside atmosphere through a suitable housing or duct **17***a* which, if desired, may lead to the cowl ventilator or other desirable source of outside air; for example, by a conduit **12***a* similar to conduit **12** of Fig. 1. Mounted in the plane of the restricted discharge end of the bell **17** is a motor driven propeller fan **18**, the discharge end portion of the bell **17** extending sufficiently close to and a sufficient distance parallel to the axis of rotation of the fan to prevent any appreciable radial spilling of air from the fan. As the fan **18** operates and supplies a high velocity stream of air through the bell **17**, a large amount of air from within the body is induced between the bells **16** and **17** and mixes with the air discharged by the fan so as to modulate the temperature thereof.

The structure of Fig. 3 has the advantage that the colder air is supplied centrally with the warmer recirculated air in surrounding relation thereto and as a result of centrifugal forces is better intermixed with the induced air.

In Fig. 4 is illustrated another modification, wherein the heat exchange core **20** is arranged in front of an outer bell **21** and a coaxial inner bell **22**. In this structure also, a fan **23** is located entirely within the inner bell **22**. The inner bell opens at its rear end into a housing **22***a* which may be in communication with the interior of the body or with the outside air. For the purposes of illustration it is assumed that the housing **22***a* is in communication with the interior of the vehicle body. The outer bell is in communication, through a suitable duct **24**, with a cowl ventilator or other air entrance passage for admitting air from the outside of the body. The duct **24** preferably is in communication with an air inlet passage so arranged that the air is forced into the duct **24** upon forward motion of the vehicle. In this structure, when the vehicle is standing, all of the outside air drawn from the bell **21** is by virtue of induction, the fan **23** drawing air directly only from the bell **22**. When the vehicle is moving forward, the air is forced through the bell **21** due to the forward movement of the vehicle and thus no additional power is required. Such an arrangement meets the exigencies of practical operation in that usually when the vehicle is stopped, doors are opened for admitting and discharging passengers and adequate volume of fresh air is usually admitted through the doors during these operations, and this admission of air need only be augmented by the induction through the bell **21** due to the operation of the fan **23**. Likewise upon forward motion of the vehicle there is induction of recirculated air due to the high velocity discharge through the bell **21**.

In Fig. 5, a more compact structure is illustrated. In this structure the heat exchange core **25** is arranged in front of inner and outer induction bells **26** and **27**, the induction bell **26** being closed peripherally by a suitable wall **28**. A blower **29** is connected to the inlet end **28'** of the bell **26** so as to force a stream of air therethrough which is discharged in surrounding relation to the bell **27** at the restricted discharge passage between the bells and thus induces recirculated air through the bell **27**.

In Fig. 5, the blower **29** is shown in the path of movement of the air into the bell **27** for clearness in illustration, but it is to be understood that the blower is arranged preferably wholly to one side of the path of the air entering the bell **27**. The inlet of the blower, not shown, may be connected to the outside air or to the cowl ventilator as described in connection with Figs. 1 to 4. In all cases, therefore, the power required is reduced, first, due to the forward motion of the vehicle which of itself supplies sufficient air to the interior of the body even though the blower or fan is not operating, and second, due to induction of air by the air stream discharged by the fan or blower, little or no additional power for increasing the volume of air in circulation is required. In all instances the warmer air within the body is mixed with cold outside air so as to modulate the temperature thereof as it discharges onto the heating core. Though the above air circulating means is shown in connection with a water core heater, it may be used effectively with exhaust heat exchangers or other types of heat exchangers.

Having thus described my invention, I claim:

1. In a motor vehicle, means for conditioning and circulating air within the body compartment comprising a housing having an open end and mounted on the forward partition wall of the vehicle and containing a heat exchanger core, coaxial bells discharging onto and through said core and the open end of the housing directly into the body compartment and having their small outlet ends in inductive relation to each other, means for admitting outside air from the region in front of the vehicle windshield under pressure incident to vehicle movement to one of said bells, means for admitting air from within the body compartment to the other of said bells for recirculation through said core, and fan means acting directly only on the recirculated air to force it through said other bell and said core.

2. In a motor vehicle, means for conditioning and circulating air within the body compartment comprising a housing having an open end and mounted on the forward partition wall of the vehicle and containing a heat exchanger core, coaxial bells discharging onto and through said core and the open end of the housing directly into the body compartment and having their small outlet ends in inductive relation to each other, means for admitting outside air from the region in front of the vehicle windshield under pressure incident to vehicle movement to one of said bells, means for admitting air from within the body compartment to the other of said bells for recirculation through said core, and selectively operable fan means acting directly only on the outside air to force it through said first bell and said core when the vehicle is stationary or moving at low speeds so that a desired induced flow of recirculating air may be had in either case.

3. In a conventional motor vehicle having a body compartment, a forward wall partitioning it from the engine, a windshield and a body surface below and in front of said windshield; an air conditioning and circulating unit comprising a housing mounted on said partition wall, opening directly into said body compartment, and containing a heat exchanger core, individual co-

axial tapering air conduits having their adjacent small ends discharging air directly through said core, the small ends of said conduits being in mutual flow inducing relationship, means for admitting outside air through the body surface from the region in front of the vehicle windshield under pressure incident to vehicle movement to an inner one of said tapering conduits, means for admitting recirculated air from the body compartment to an outer one of said tapering conduits for flowing therethrough induced by flow through said inner conduit, and a propeller type fan in the small end of said inner tapering conduit to force air therethrough when the vehicle movement induced flow is insufficient.

4. In a motor vehicle heating and ventilating system, a heat exchanger core mounted within and discharging directly into the vehicle body compartment, coaxial open ended bells having their small discharge ends in inductive relationship adjacent one face of the heat exchanger core, said bells forming coaxial passages for the supply of air to said core, a propeller type fan coaxial with the bells, lying close to and between said core face and the inner ends of said bells and having blades extending radially beyond the radial limits of the innermost bell end, and means to drive said fan whereby it draws air directly and concurrently from a plurality of said bells for discharge through said core directly into the body compartment.

5. In a conventional motor vehicle having a body compartment, a forward wall partitioning it from the engine, a windshield and a body surface below and in front of said windshield; a compact air conditioning and ventilating unit comprising a housing mounted on said partitioning wall and containing a heat exchange core discharging directly into the interior of the body compartment, conduit means for supplying air to said core having one end in said housing discharging air onto and through said core and its inlet end opening through the upper body surface forward of the windshield to receive air under pressure incident to the vehicle movement, and an open ended air flow inducing bell having its smaller end positioned in inductive relationship to said conduit and having its other end arranged to receive air from within the body compartment for recirculation thereof induced by flow through said conduit.

6. In a conventional motor vehicle having a body compartment, a forward wall partitioning it from the engine, a windshield and a body surface below and in front of said windshield; a compact air conditioning and ventilating unit comprising a housing mounted on said partitioning wall and containing a heat exchange core discharging directly into the interior of the body compartment, conduit means for supplying air to said core having one end in said housing discharging air onto and through said core and its inlet end opening through the upper body surface forward of the windshield to receive air under pressure incident to the vehicle movement, an open ended air flow inducing bell having its smaller end positioned in inductive relationship to said conduit and having its other end arranged to receive air from within the body compartment for recirculation thereof induced by flow through said conduit, and a single selectively operable fan means to force air through said conduit when the flow from vehicle movement is insufficient.

7. A compact motor vehicle heating and ventilating unit comprising a housing shell mounted in the vehicle and having an opening across one end thereof to discharge air directly into the vehicle compartment, a heating core in and extending across said housing, a propeller type fan adjacent and extending across the inner face of said core to force air therethrough, open ended air supply bells coaxial with each other and with said fan axis, having their smaller air discharge ends in the other end of said housing within the diameter of said fan so that it draws air from a plurality of said bells concurrently, and said smaller ends being in inductive relation close to each other and to said fan, a coaxial motor for said fan within the innermost bell, and means to admit fresh outside air under pressure from vehicle movement into the other end of one of said bells.

8. In a vehicle air conditioning unit, a heat exchange core having air passages therethrough, a member circular in cross-section of decreasing diameter toward one end having the small end adjacent one face of said core for directing air flow therethrough, a fan in and extending across said circular member for forcing air through a corresponding section of the core, a housing extending around the sides of the core and forming a plenum chamber partially overlying the outer portions of the core face, and means for causing fresh air from outside the vehicle to be forced into said plenum chamber and through said outer portions of the core and into said vehicle compartment responsive to forward motion of the vehicle.

9. In a vehicle air conditioning unit, a heat exchange core having air passages therethrough, a hollow member circular in cross-section of decreasing diameter toward one end having the small end adjacent one face of said core for directing air flow therethrough, a fan adjacent the small end of said member for forcing air through a corresponding section of the core, a housing extending around the sides of the core and forming a plenum chamber partially overlying the outer portions of the core face, and means for causing fresh air from outside the vehicle to be forced into said plenum chamber and through said outer portions of the core and into said vehicle compartment responsive to forward motion of the vehicle.

10. In a vehicle air conditioning unit, a heat exchange core having air passages therethrough, a fan adjacent the core operable to force air therethrough, a hollow tapered member extending in the direction of the rotation axis of the fan and having an air discharge opening at its small end disposed substantially opposite a center section of the core, and means for taking fresh air from outside the vehicle and conducting it into said hollow member.

11. In a vehicle air conditioning unit, a heat exchange core having air passages therethrough, a fan adjacent said core operable to force air therethrough, a hollow tapered member extending in the direction of the rotation axis of the fan and having an air discharge opening at its small end disposed substantially opposite a center section of the core, said tapered member forming an internal air conduit, and the exterior surface of said tapered member forming an air deflector for a stream of air separated from the stream of air within said hollow member, and means for taking fresh air from outside the vehicle and conducting it into said hollow member.

12. In a vehicle air conditioning unit, a heat

exchange core having air passages therethrough, a fan adjacent the core operable to force air through said air passages, a hollow member extending in the direction of the rotation axis of the fan, and having an air discharge opening at its small end disposed substantially opposite a center section of the core, said hollow member defining an internal passageway for the flow of air and a separated external passageway for the flow of air, and means for taking fresh air from outside the vehicle and conducting it into one of said passageways.

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