April 8, 1941. W. H. BRETZLAFF ET AL. 2,237,333

SEGREGATED PRESSURE AIR IMPELLING APPARATUS

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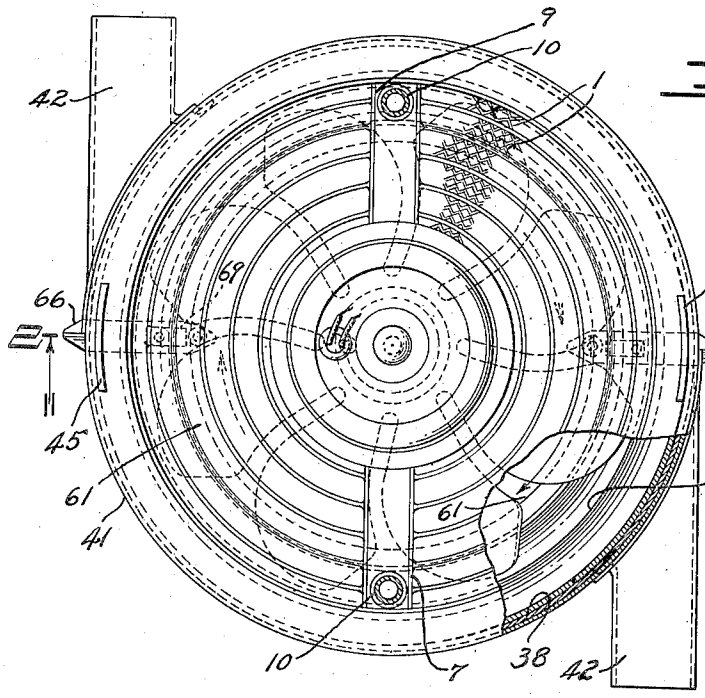

Fig. 1.

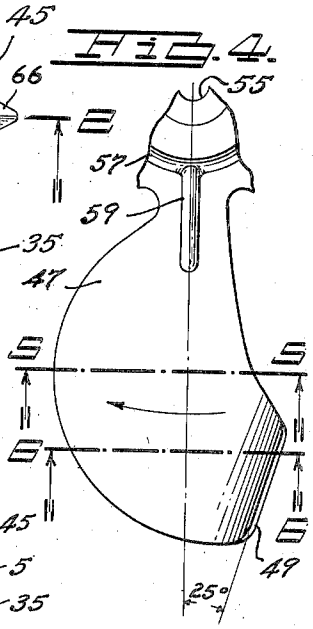

Fig. 4.

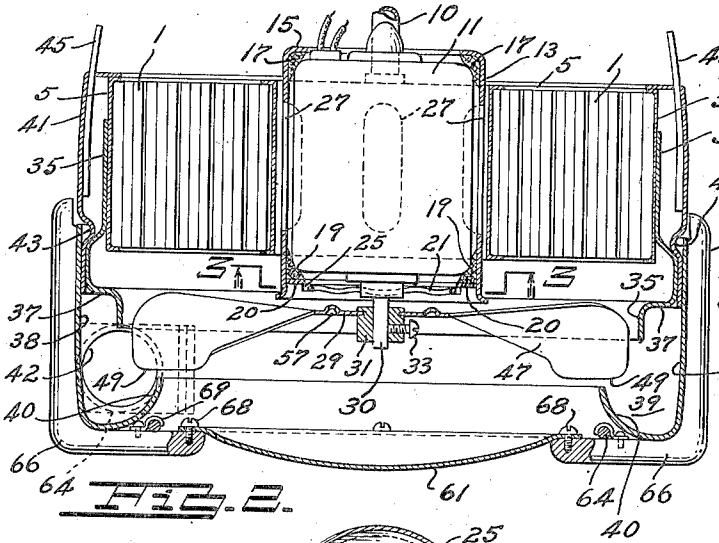

Fig. 2.

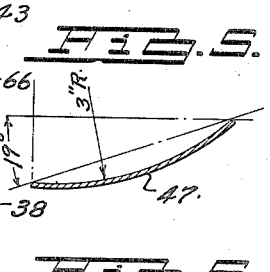

Fig. 5.

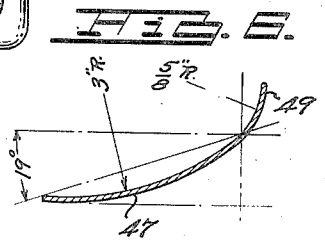

Fig. 6.

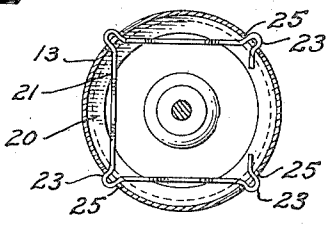

Fig. 3.

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Fig. 8.

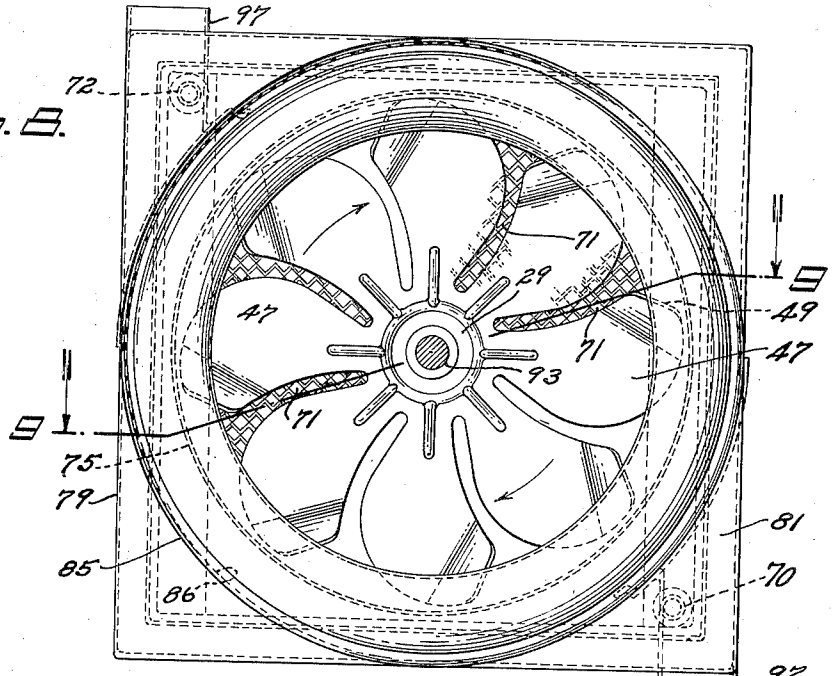
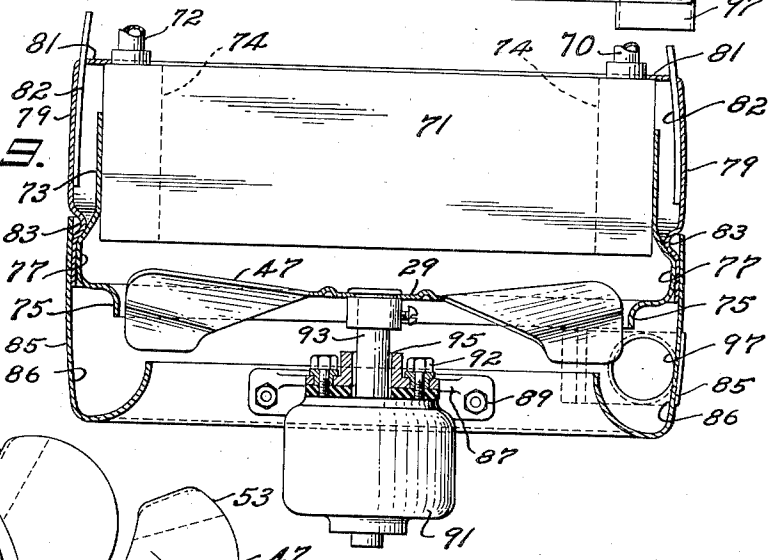


Fig. 9.



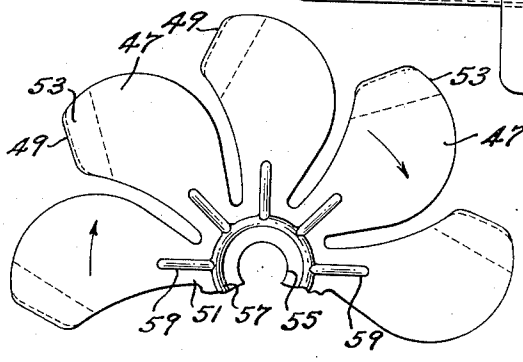


Fig. 7.

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SEGREGATED PRESSURE AIR IMPELLING APPARATUS

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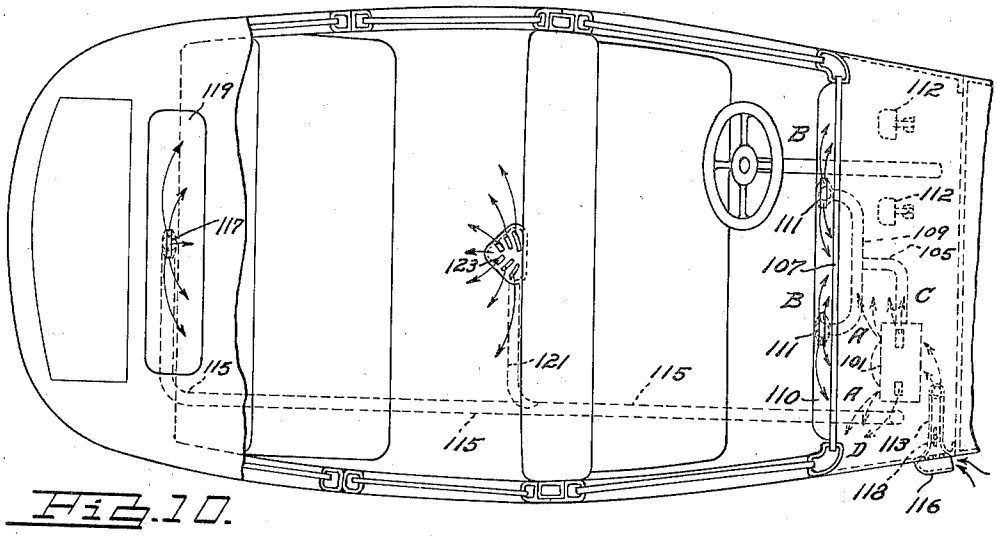

Fig. 10.

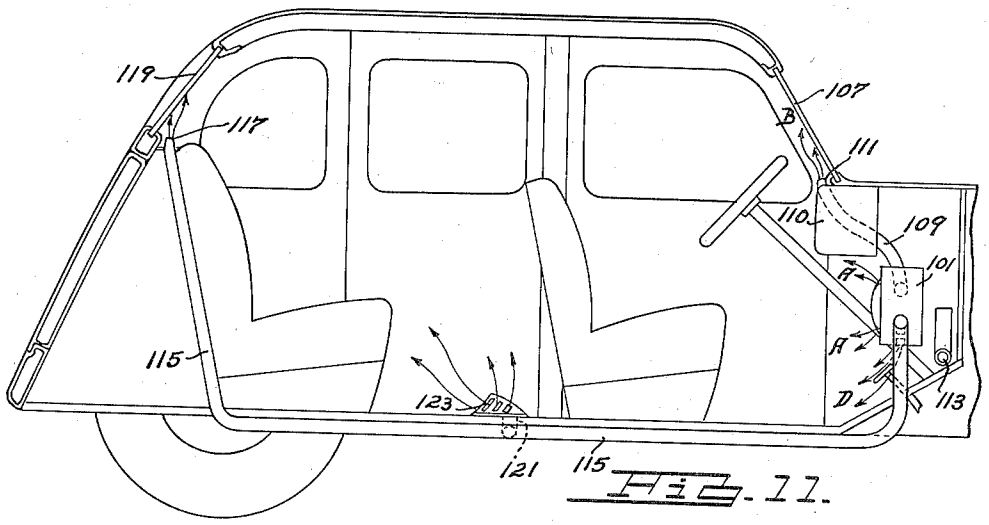

Fig. 11.

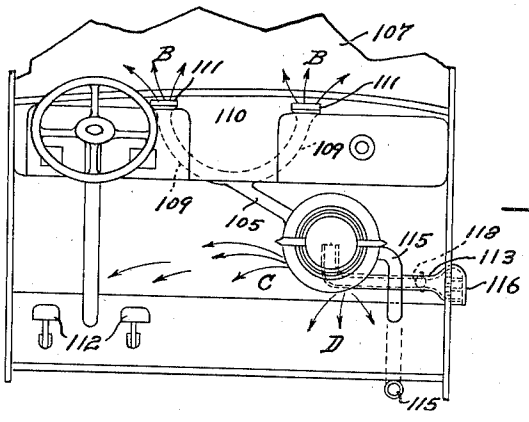

Fig. 12.

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Patented Apr. 8, 1941 2,237,333

UNITED STATES PATENT OFFICE

2,237,333

SEGREGATED PRESSURE AIR IMPELLING APPARATUS

Walter H. Bretzlaff, Detroit, Mich., and Charles P. Grimes, Syracuse, N. Y.

Application August 4, 1937, Serial No. 157,275

10 Claims. (Cl. 257—137)

Our invention pertains to a composite disk type fan unit and system for projecting air both axially and peripherally for heating, ventilating and air conditioning purposes.

A heater unit at the forward end of an auto body will mostly cause local recirculation of its own heated air. This lack of circulation of rear compartment air has left the rear cold.

In our system a large volume of wind shield defrosting air will flow back under the ceiling to displace cold air on the floor.

By means of a flap valve this large volume of hot air under pressure can be directed thru a conduit to the floor at the rear for displacing cold air normally found there.

One model of our heater ejects the normal volume of heated air locally and also provides a large volume of hot air under pressure for defrosting and for remote delivery to eliminate cold spots in the car.

It is an object of our invention to provide an improved segregated pressure air heating or cooling and impelling unit comprising, a heat exchanger core having a predetermined air flow resistance, a disk fan for drawing air through said core, means enclosing a suction chamber extending from said core and coupling closely around the tips of the fan blades, a high pressure air receiving ring enclosing and surrounding the fan, and centrifugal air throwing means on the blades of the fan for throwing a portion of the treated air into the ring to provide a maximum volume and pressure of treated air therein, the centrifugal means being suitably disposed with reference to the fan and the air receiving ring in accordance with the air flow resistance to project the desired volume of high pressure treated air into said ring.

It is a further object of our invention to provide an air conditioning unit of the above type wherein the centrifugal means comprises vanes turned out on the heels of the fan blades, and the air collecting ring is disposed with its edges turned inwardly and back toward said vanes. This special fan or propeller, which may be used in our unit, is claimed in our copending patent application Serial No. 157,274 filed August 4, 1937, and issued October 17, 1939, as Patent No. 2,176,325.

It is another object of our invention to provide a short compact air conditioning unit of the above type having a circular core, and a central motor receiving aperture whereby the motor is supported in the part of the core which is substantially ineffective.

A further object of our invention is to provide such a unit having the motor mounted on a bracket in the center of the air receiving ring.

Another object of our invention is to provide an improved air moving and conditioning system for heating, ventilating and defrosting at separated points in a closed automobile.

The novel features which we consider characteristic of our invention are set forth with particularity in the appended claims. The invention both as to its organization and method of operation, together with additional objects and advantages thereof, will best be understood from the following description of specific embodiments, when read in conjunction with the accompanying drawings, in which:

Fig. 1 is an elevational view of our segregated air impeller unit showing the fan and various features of the construction in dotted lines;

Fig. 2 is a cross sectional view on line 2—2 thereof showing the internal construction of the unit;

Fig. 3 is a sectional view on line 3—3, of Fig. 2 showing the motor mounting and retaining means;

Fig. 4 is a plan view showing one of the composite fan blades;

Figs. 5 and 6 are sectional views on lines 5—5 and 6—6, thereof;

Fig. 7 is a plan view showing the composite air impelling fan;

Fig. 8 is an elevational view showing another embodiment of our segregated pressure unit with the motor omitted for clearness;

Fig. 9 is a sectional view on line 9—9 thereof; and

Figs. 10, 11 and 12 are diagrammatic views representing an installation of our segregated pressure air conditioning unit in an automobile.

Referring more specifically to Figs. 1, 2 and 3 of the drawings, our segregated pressure air impeller unit comprises a circular heat exchanger core 1 having a motor mounting aperture extending axially through the center. The core may be of any conventional construction available on the market and generally comprises a plurality of finely divided passages through which a heating or cooling medium may be circulated for intimate thermal coupling with the air. The core is enclosed in a suitable shell 5 and has headers 7 and 9 from which the finely divided passages are connected. Connecting conduits 10 extend from the headers and project on the inlet side for connection with any suitable source of heating or cooling medium.

For mounting the fan motor 11, a tubular socket 13 is disposed in the aperture in the center of the core. The motor mounting socket 13 has an inturned flange 15 at one end, and it is wide open with an outturned flange at the other end to freely receive the motor therein. As the motor is inserted its innermost end is seated in an annular cushion 17 of yieldable material such as cork, rubber or other acoustic insulating material, which abuts the inturned flange 15.

After the motor is inserted in the tubular socket, a second annular cushion 19 is pressed into the open end of the socket 13 around the end of the motor where it is held firmly in position by an annular washer 20 and a resilient retainer 21. For this purpose the retainer 21 is preferably of substantially square conformation open at one side and having outwardly looped corners 23. The sides of the retainer 21 may be curved toward and away from the motor instead of being straight in order to provide the desired resilience. The retainer is compressed for insertion into the outer end of the motor socket 13 against the circular washer 20 and cushion 19, after which the looped corners 23 of the retainer 21 spring outwardly through four slots 25 suitably spaced around the side walls of the socket. The inner edges of the circular cushions 17 and 19 are suitably tapered for fitting snugly around the corners of the motor which is supported in a proper concentric position in its tubular socket 13, and acoustically insulated therefrom to provide for silent operation.

The motor is thus mounted in the portion of the core which is practically useless and the unit is short and compact. Vents 27 are provided in spaced relation around the motor supporting socket 13.

A disk type of fan 29 is mounted upon an extended end of the motor shaft 30 where it is supported on a hub 31 secured by a screw 33 and operated adjacent one side of the core 1 to draw air therethrough. By thus mounting the fan and drawing the air through the core the rotative motion of the slip stream from the fan is not interfered with, and improved efficiency is obtained. Also the uninterrupted slip stream, because of its motion of rotation as it leaves the fan, causes the air to be delivered in a spreading cone or umbrella shape. This avoids the discomfort which is caused by a direct blast of heated or cooled air, projected straight out the front of the heater.

A shroud ring 35 of sheet metal is provided which is of circular or annular conformation of a suitable diameter for enclosing around the entire circumference of the fan in spaced relation from the tips of the fan blades, and extending over about as far as the half way point thereof. The shroud 35 extends around the shell 5 of the core 1 through which the air is drawn, and it is possible to obtain greatest effectiveness in its relation to the fan when its inner diameter is about $\frac{3}{16}$ of an inch greater than the outside diameter of the fan. The shroud 35 is provided with an outwardly projecting bulge 37 circumferentially around the portion between the core and the fan, to gain strength, and the portion extending around the fan blades is of reduced diameter.

Enclosing the shroud 35 and the fan is an annular ring or band of sheet metal 38 which is of substantially greater diameter for defining a high pressure air receiving ring or chamber 39 to receive air thrown peripherally from the tips of the fan blades, which are especially designed to provide the maximum volume and pressure, as will be subsequently set forth.

The front edges 40 of the ring 38 are turned in and back toward the outlet side of the fan blades for receiving and segregating the high pressure portion of the air stream, and enclosing the chamber 39. In order to conserve the velocity component of the air projected into the chamber 39, it is important to provide a smooth unobstructed passage therein, as shown. We have found that the velocity head of the air in receiving chamber 39 accounts for about ⅔ of the pressure of the air therein and the static head is only about ⅓ thereof. Outlets 42 connect tangentially from the collector chamber 39 for delivering air therefrom to utilize both the pressure head and the tangential component or velocity head of the collected air. The other or open edge of the band 38 is coupled with the core by extending around a circular housing 41 which fits around the bulge 37 of the shroud. The outer housing 41 extends around the core shell 5, being turned in at its edge for securement thereon.

The outer housing 41 is provided with a circumferential groove 43 which is inwardly depressed for firmly engaging on the bulged portion 37 of the shroud 35.

The shroud 35, the housing 41 and the ring 38 are of sheet metal of a suitable gauge to provide the desired degree of rigidity, and they are secured together in any convenient manner as by welding or by means of screws if desired. A bracket rod 45 is secured on the inside of the outer housing 41, as by welding, and extends therefrom for mounting the unit on the dashboard of an automobile or in any suitable position.

For drawing the air through the core and effectively projecting a portion of it into the high pressure ring or chamber 39, we provide a composite disk type of air impeller 29 which has propeller blades 47 extending from the center of rotation. The angle of pitch of the propeller blades 47 is selected in accordance with the air flow resistance of the particular core 1 for maximum efficiency, and in a unit comprising an eight-inch fan suitable for heating in automobiles, we have found that an angle of nineteen degrees is preferable. The angle of the blade pitch may be varied from four to five degrees from this figure to provide desirable efficiency of operation in different assemblies. The propeller blades 47 are cupped concave in the direction of rotation, and a radius of curvature of about three inches is preferable, as represented in Figs. 5 and 6.

To project a portion of the air peripherally, after it has been drawn through the core into the fan, we provide centrifugal portions or vanes 49 turned out from the plane of rotation on the high velocity portions of the blades, as shown in Figs. 2, 4, and 6. The outwardly turned vanes 49 are inclined at an angle of approximately twenty-five degrees forward from the radius, as shown in Fig. 4, but we have found that this angle may be advantageously varied between fifteen to thirty degrees, as for different heater core resistance. After the air enters the fan a portion is caught and thrown peripherally by the centrifugal vanes acting substantially in supercharger relation, to provide a maximum pressure and volume of heated or cooled air in the collector ring 39.

The centrifugal vane 49 is designed to pro-

vide the greatest possible turned up area at the outermost extremity of the fan blade 47 where, because of the high angular velocity, it is most effective. But if the area of the vane 49, on each blade, is made to exceed the optimum proportions, the speed of the fan will be diminished in accordance with the torque speed characteristic of the motor. Such a speed reduction reduces the volume and pressure of heated or cooled air which can be delivered.

For maximum effectiveness, we make our fan from a blank 51, shown in Fig. 7, which has propeller blades 47 each having an elongated heel 49 extended more radially than the leading portion of the blade. Hence, when the heel portion 49 of the fan blade is turned out from the plane of the fan, its outer edge 53 extends radially out to the maximum circumference of the fan. For the eight-inch fan we have found that it is preferable to turn the vanes 49 up with a radius of curvature of ⅝ inch, as indicated in Fig. 6.

The shape of our especially designed fan can be best illustrated by setting our eight-inch fan into a glass cylinder eight inches in diameter where it can be seen that all the bent up portions 49 continue out to touch the glass.

Our multi-bladed fan made in this manner and conformation effectively draws air through the core and provides a maximum pressure and volume of the treated air in the annular air receiving chamber 39.

The fan is preferably formed from a unitary sheet of metal and a hub receiving aperture 55 is provided in the center of the blank 51, shown in Fig. 7, to receive the hub 31 which has a portion of reduced diameter suitable for fitting therein where it is peened or swaged. In order to strengthen the fan a circular bead or rib 57 is provided concentric with the hub and a plurality of beads 59 connect radially therefrom extending outwardly along the axis of each propeller blade.

This construction provides rigid fan blades which are rigidly supported in the plane of rotation of the fan, and although we have disclosed our improved fan construction embodying eight blades it is to be understood that in accordance with our invention we may utilize any number of blades which are desirable for any particular assembly.

With our special disk type of fan, having blades pitched and a shroud ring enclosing in accordance with the air flow resistance of the core, as previously described, air is drawn through the heater core 1 by the propeller blades 47 in sufficient volume to discharge air both through the open space just adjacent the inside edge 40 of the ring 38, and also a portion into the chamber 39 under pressure. As previously explained, the heated or cooled air which is discharged through the open space spreads out in substantially umbrella shape over a large area for a maximum of comfort. Thus by our fan, we have eliminated the discomfort usually felt when automobile heaters blow a blast of heated air directly upon the nearest passenger, while the passenger in the rear seat freezes.

From the stream of heated or cooled air which is drawn axially into the disk fan, a portion is divided and thrown peripherally by the two-stage or super-charger action of the fan. Because of this action of our fan combination with the shroud ring 35 which encloses the tips of the fan blades in the manner previously described, a large volume of heated or cooled air is provided in the collector ring under sufficiently high pressure and velocity head for tapping it tangentially through the outlets 42 for application for defrosting and heating at remote points in the car.

To partially close the opening in front of the fan we provide a center plate 61 which is of circular conformation disposed concentrically in the center of the inner edge 40 of the collector chamber 39. The front plate 61 may be of any cast or sheet material, and it serves to protect the fan blades 47, while also serving other purposes both useful and ornamental.

The center plate 61 is not necessary for delivering the air in the spread umbrella shape previously referred to, as this is a characteristic of our fan which discharges the free air only in a narrow ring around the inside of the chamber 39. The inner diameter between the inner edges 40 is preferably about $7\frac{1}{8}$ inches, in the particular example previously discussed, and in such a unit the center plate is preferably about 5½ inches in diameter thus leaving an open slot about ¾ inch wide, through which the heated air is discharged into the car, as shown in Fig. 2.

To supplement the protection provided by the disk 61, a circular wire guard 64 is mounted in the annular space between the edges of the disk and the inner edges 40 of the collector chamber. The guard 64 is of wire sufficiently rigid to prevent insertion of fingers and objects through the space into the fan blades. For supporting the disk 61 and the guard ring 64 in properly spaced relation L-shaped brackets 66 are secured along the sides of the unit in any suitable manner, or by screws, and project inwardly toward the disk. The inturned ends of the brackets 66 are secured to the edges of the disk by screws 68 and the guard ring 64 is secured on the inside of the brackets in properly spaced relation as by spot welding or in any suitable manner as by screw secured clamps 69.

A rectangular or square heater core 71 is conveniently utilized in the embodiment of our invention shown in Figs. 8 and 9. The heat exchanger core 71 may be of any conventional construction comprising spaced water tubes with air contacting fins between them, and having headers 74 along opposite sides for connection through conduits 70 and 72. The shroud 73 is of a conformation snugly enclosing the core 71 at one end, and drawn down to define a circular rim 75 at the other edge for surrounding the tips of the fan blades in spaced relation. The shroud member 73 includes an intermediate bulge sleeve 77 between the core and the circular rim 75.

An outer housing 79, of suitable conformation, fits around the sleeve 77 and extends in enclosing relation around the rectangular core 71 which it engages by an inturned flange 81 turned in around the rear edge. Supporting brackets 82 are secured into the housing in any suitable way, as by welding. An indented bead or groove 83 is provided extending around an intermediate portion of the outer housing for engaging the rear portion of the bulged sleeve 77 of the shroud as the housing is disposed thereon, whereby the assembled relation between them is rigidly limited.

A band 85 of sheet metal fits around the intermediate bulged sleeve 77, and the adjacent edge of the outer housing, and extends forward around the fan 29 in widely spaced relation. The extended edge of the band 85 is turned inwardly and back toward the tips of the fan blades 47,

on the outlet side, for defining an air receiving chamber 86, as in the first embodiment of our invention. If preferred a scroll type air collector chamber may be provided around the fan tips.

Extending diametrically across between the inturned edges of the sheet metal collector ring is a bracket 87 which is secured thereto by bolts 89 or other fastening means. The fan motor 91 is mounted on the outside of the bracket 87 to which it is secured, as by bolts 92, and the extended shaft 93 of the motor passes through an aperture 95 in the bracket into the space adjacent the core.

The fan 29 which is supported on and driven by the inner end of the shaft 93, is especially designed for cooperating with the air chamber 86 within the collecting ring 85 and the rim 75 of the shroud, as in the first embodiment of our invention, and its operating characteristics are similarly advantageous in this combination. The shroud 73 similarly cooperates with the tips of the fan blades to provide a suction chamber between the fan 29 and the core 71 and the fan delivers a large volume of the heated or cooled air into the chamber within ring 86 for delivery therefrom through outlet conduits 97 connecting tangentially therefrom. The heated air which is delivered by the fan 29 directly into the car passes adjacent the inner wall of the chamber within ring 86 and spreads in the car in substantially umbrella conformation for maximum comfort. Because our fan delivers the air into the car around a substantially circular area, for the reasons previously explained, the position of the fan motor 91 does not interfere with the air flow.

Either modification of our segregated air pressure impelling unit is adaptable for heating or cooling by connecting the heat exchanger core to receive a suitable heating or cooling medium from any convenient source and the operating characteristics of the unit render it especially useful for installations where it is desirable to deliver a portion of the cold or warm air to remote locations while delivering a portion directly in the vicinity of the unit.

The improved operating characteristics of our improved segregated pressure air impeller are particularly advantageous for use in heating and defrosting automobiles, and in Figs. 10, 11, and 12 we have diagrammatically represented one of our units 101 under the instrument board of a sedan automobile of the closed body type. As will be understood, the heater core of the unit may be connected to receive hot water from the cooling system of the engine and the fan may be connected for energization from the storage battery, in any conventional manner. As previously explained, the characteristics of our fan are such that the heated air delivered directly from the unit is projected and distributed in such a manner that the passenger sitting directly adjacent is not exposed to a direct hot blast. Instead the warmed air is spread out to uniformly and comfortably warm the passenger and the interior of the automobile, as represented by the arrows.

In order to defrost the windshield, a conduit 105 as shown in Fig. 12 is connected from one of the outlets of the unit 101 and it extends up for projecting a layer of the heated air B across the inner surface of the windshield 107. For this purpose the conduit 105 connects through branches 109 which pass up behind the instrument board 110 and terminate in suitable air projecting heads or nozzles 111. While driving in cold weather the driver's feet are usually exposed to cold drafts of air which enter around the clutch and brake pedals 112, and in order to eliminate this discomfort we provide an air projecting slit or aperture in the outer side wall of the collector ring for projecting a jet of hot air C down toward the driver's feet. Cold drafts entering around the door adjacent the front passenger may be similarly neutralized, by projecting a jet of hot air D downwardly from the unit. For supplying fresh air in the automobile, an air inlet conduit 113 extends from the inlet side of the unit through the side of the car where it opens through a rain deflector comprising a curved hood 116 for collecting and draining the rain. A damper 118 regulates the portion of fresh air admitted.

For warming the passengers and defrosting the window in the rear of the sedan, we connect a hot air delivery conduit 115 from another one of the outlets which extends tangentially from the air collector ring of our unit to effectively utilize the high pressure velocity head of the air thrown therein from the fan. In this manner a sufficient supply of heated air is provided under suitable conditions of pressure and velocity to pass through the elongated conduit 115 for projecting a jet of hot air from a nozzle 117 against and across the inner surface of the back window 119. The conduit 115 may pass under the floor of the car and it is preferably covered with a layer of suitable heat insulating material.

From the elongated hot air conduit 115 a branch 121 is connected into a register 123 in the floor of the rear compartment which is arranged to deflect air rearwardly as shown. The fresh air hood 116 is mounted above the level of the louvers in the side of the engine hood to avoid hot air and fumes from the engine, and it may be mounted above the roof of the car as will be readily understood.

Because of its improved thermal efficiency and air delivery characteristics, our segregated pressure air impeller and heater unit is especially useful in such a system for heating and defrosting thereby contributing to the comfort and safety of winter motoring.

Although we have shown and described certain specific embodiments of our invention, we are fully aware that many modifications thereof are possible, and we do not desire to limit the invention to the exact constructions, connections and arrangements shown.

We claim:

1. A segregated pressure air impeller unit comprising, an open air treating member, a disk type of fan having propeller blades of a suitable pitch in accordance with the air flow resistance of said air treating member, centrifugal air throwing vanes turned up on the trailing edges of said blades for throwing radially a portion of the air drawn onto said blades, the outer end of each of said vanes being inclined at an angle toward the radius of the blade, means for rotatably supporting and operating said fan adjacent one side of said air treating member for drawing air therethrough, enclosure means connecting from one side of the air treating member to form a suction chamber between the fan and the air treating member and forming a restricted shroud enclosing around substantially the midpoints of the tips of the fan blades, and said fan and enclosing shroud being suitably arranged in accordance with the air flow resistance of the air treating member to maintain a suitable sub-atmospheric

pressure between the fan and the air treating member for causing the treated air to be delivered in a diverging air stream from the outlet side of the fan.

2. A diverging delivery air impeller unit comprising, a heat-exchanger core, a disk type of fan having propeller blades, centrifugal vanes turned up on the trailing edges of said blades for throwing radially a portion of the air drawn onto said blades, motive means for rotatably supporting and operating said fan adjacent one side of said core for drawing air therethrough, enclosure means connecting from one side of said core to form a suction chamber between the fan and the core and to form a restricted shroud enclosing around substantially the midpoint of the tips of the fan blades, and said fan and enclosing shroud being suitably arranged in accordance with the air flow resistance of the core to maintain a suitable sub-atmospheric pressure between the fan and the core for causing the core exposed air to be delivered from the composite fan with a high tangential component from the tips of the fan blades in addition to the diverging flow.

3. A segregated pressure air impeller unit comprising, a heat-exchanger core, a disk type of fan having propeller blades of a suitable pitch in accordance with the air flow resistance of said core, centrifugal air throwing vanes turned up on the trailing edges of said blades for throwing radially a portion of the air drawn onto said blades, the outer end of each of said vanes being inclined at an angle toward the radius of the blade, means for rotatably supporting and operating said fan adjacent one side of said core for drawing air therethrough, enclosure means connecting from one side of the core to form a suction chamber between the fan and the core and forming a restricted shroud enclosing around substantially the midpoints of the tips of the fan blades, and said fan and enclosing shroud being suitably arranged in accordance with the air flow resistance of the core to maintain a suitable sub-atmospheric pressure between the fan and the core for causing the core exposed air to be delivered in a diverging air stream from the outlet side of the fan.

4. A segregated pressure air treating unit comprising, a heat-exchanger core having a predetermined air flow resistance, a disk type of fan having propeller blades, motive means for rotatably supporting and operating said fan adjacent one side of said core for drawing air therethrough, a band of sheet metal enclosing the outer edges of said core and projecting therefrom on the side adjacent said fan for enclosing a suction chamber, the projected edges of said band forming a circular shroud ring of suitable diameter and suitably disposed for closely encircling the tips of the fan blades in accordance with the air flow resistance of the core so that a substantial sub-atmospheric pressure is maintained between the fan and the core and the core exposed air is thrown radially and dispersed broadly from the outlet side of the fan in accordance with the predetermined air flow resistance of the core, a second band of sheet metal disposed around said first mentioned band and extending beyond the outlet side of said fan in widely spaced relation around the blade tips, the extending edges of said second band being turned in and back toward the outlet side of said fan for defining a high pressure air collecting chamber of substantially annular conformation to collect a maximum volume and pressure of the radially thrown air, and an outlet for discharging collected air from said chamber.

5. A segregated pressure air treating unit comprising, a heat-exchanger core having a predetermined air flow resistance, a disk type of fan having propeller blades extending outwardly from the center of rotation, centrifugal vanes turned up on the trailing edges of said blades for throwing radially in super-charged two stage relation a portion of the air drawn onto said blades, motive means for rotatably supporting and operating said fan adjacent one side of said core for drawing air therethrough, enclosure mean defining a suction chamber connecting from one side of said core and coupling closely around the tips of the fan blades to maintain a substantially sub-atmospheric pressure in the suction chamber in accordance with the predetermined air-flow resistance of said core for causing the output air to be delivered broadly or semi-radially, a ring like member extending from around said suction chamber for defining a high pressure air collecting chamber of substantially annular conformation surrounding the tips of the fan blades in widely spaced relation and the edges thereof being turned in and back toward the outlet side of the fan for collecting a maximum volume and pressure of air from the diverging slip stream, and an outlet connecting from said collector chamber.

6. A segregated pressure air treating unit comprising, a heat-exchanger core having a predetermined air flow resistance, a disk type of fan having propeller blades, motive means for rotatably supporting and operating said fan adjacent one side of said core for drawing air therethrough, tip-up portions turned out on the trailing edges of said fan blades for throwing radially and tangentially a portion of the air charged onto said blades from said core, a band of sheet metal enclosing the outer edges of said core and projecting therefrom on the side adjacent said fan for enclosing a suction chamber, the projected edges of said band forming a circular shroud ring of suitable diameter and suitably disposed for closely enclosing the tips of the fan blades so that the core exposed or treated air is thrown semi-radially and dispersed broadly from the outlet side of the fan in accordance with the predetermined air flow resistance of the core, a second band of sheet metal disposed around said first mentioned band and extending beyond the outlet side of said fan in widely spaced relation around the blade tips, the extending edges of said second band being turned in and back toward the outlet side of said fan for defining a high pressure air collecting chamber to collect a maximum volume and pressure of the semi-radially thrown air and an outlet for discharging the collected air from said collecting chamber.

7. A segregated pressure air treating unit comprising, a heat-exchanger core having a predetermined air flow resistance, a disk type of fan having propeller blades extending outwardly from the center of rotation, motive means for supporting and rotating said fan adjacent one side of said core for drawing air therethrough, centrifugal vanes turned out on the heels of said blades for throwing radially in super-charged relation a portion of the air drawn onto said blades, enclosure means defining a suction chamber around one side of said core and coupling closely around the tips of the fan blades so that a substantial sub-atmospheric pressure is maintained between the fan and the core in accordance with the air-flow

resistance of the core and the outflowing air is delivered divergently, a sheet metal band disposed around said suction chamber and extending around said fan to the outlet side thereof, the edges of said band being turned in and back toward the outlet side of the fan to enclose an annular air collecting chamber for collecting a maximum volume and pressure of the radially thrown air, and an outlet conduit opening through and connecting tangentially from the outer side of said second band in the direction of rotation of said fan for tapping collected air from the collector chamber to effectively utilize both the tangential velocity and the pressure head of the air.

8. A segregated pressure air treating unit comprising, a heat-exchanger core, a disk type of fan having propeller blades, motive means for rotatably supporting and operating said fan adjacent one side of said core for drawing air therethrough, centrifugal vanes turned out on the heels of said fan blades for throwing radially a portion of the air charged onto said blades from said core, a band of sheet metal enclosing the outer edges of said core and projecting therefrom on the side adjacent said fan for enclosing a suction chamber, the projected edges of said band forming a circular shroud of suitable diameter and suitably disposed for closely enclosing the tips of the fan blades in such a manner that the disk type fan is so coupled with the core, a substantially subatmospheric pressure is maintained therebetween such that some of the core exposed air is thrown radially and dispersed broadly from the outlet side of the fan in accordance with the air flow resistance of the core, a second band of sheet metal disposed around said first mentioned band and extending beyond the outlet side of said fan in widely spaced relation around the blade tips, the extending edges of said second band being turned in and back toward the outlet side of said fan for defining a high pressure air collecting chamber to collect a maximum volume and pressure of the radially thrown air, and an outlet conduit opening through and extending from the outer side of said second band tangentially in the direction of rotation of said fan for tapping collected air from the collector chamber to effectively utilize both the velocity and the pressure heads of the collected air.

9. A segregated pressure air impeller unit comprising, a heat-exchanger core, a disk type of fan having propeller blades of a suitable pitch in accordance with the air flow resistance of said core, means for rotatably supporting and operating said fan adjacent one side of said core for drawing air therethrough, centrifugal air throwing vanes turned up on the trailing edges of said blades for throwing a portion of the air with a high tangential component from the tip of each blade, each of said vanes being inclined at an angle forward from the longitudinal axis of the blade, enclosure means connecting from one side of the core to form a suction chamber between the fan and the core and forming a restricted shroud enclosing around substantially the midpoints of the tips of the fan blades, said fan and enclosing shroud being suitably arranged in accordance with the air flow resistance of the core to maintain a suitable sub-atmospheric pressure between the fan and the core for causing the core exposed air to be delivered in a diverging air stream from the outlet side of the fan, air collecting means extending from said suction chamber to the outlet side of the fan to define a high pressure air collecting chamber of substantially annular conformation surrounding the tips of the fan blades, the extended edges of said air collecting means turning in and back toward the outlet side of the fan blades to collect air from the high pressure portion of the diverging air stream, and outlet conduit means connecting from the air collecting chamber tangentially.

10. A segregated pressure air impeller unit comprising, an open air treating member, a disk type of fan having propeller blades of a suitable pitch in accordance with the air flow resistance of said open air treating member, means for rotatably supporting and operating said fan adjacent one side of said member drawing air therethrough, centrifugal air throwing vanes turned up on the trailing edges of said blades for throwing a portion of the air with a high tangential component from the tip of each blade, the outer end of each of said vanes being inclined at an angle toward the radius of its blade, enclosure means connecting from one side of the air treating member to form a suction chamber between the fan and the air treating member and forming a restricted shroud enclosing around substantially the midpoints of the tips of the fan blades, said fan and enclosing shroud being suitably arranged in accordance with the air flow resistance of the air treating member to maintain a suitable subatmospheric pressure between the fan and the air treating member for causing the treated air to be delivered in a diverging air stream from the outlet side of the fan, air collecting means extending from said suction chamber to the outlet side of the fan to define a high pressure air collecting chamber of substantially annular conformation surrounding the tips of the fan blades, the extended edges of said air collecting means turning in and back toward the outlet side of the fan blades to collect air from the high pressure portion of the diverging air stream, and outlet conduit means connecting from the air collecting chamber tangentially.

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