Oct. 5, 1943. E. B. WILLIAMS 2,330,938

MULTIPLE OUTLET BLOWER ASSEMBLY

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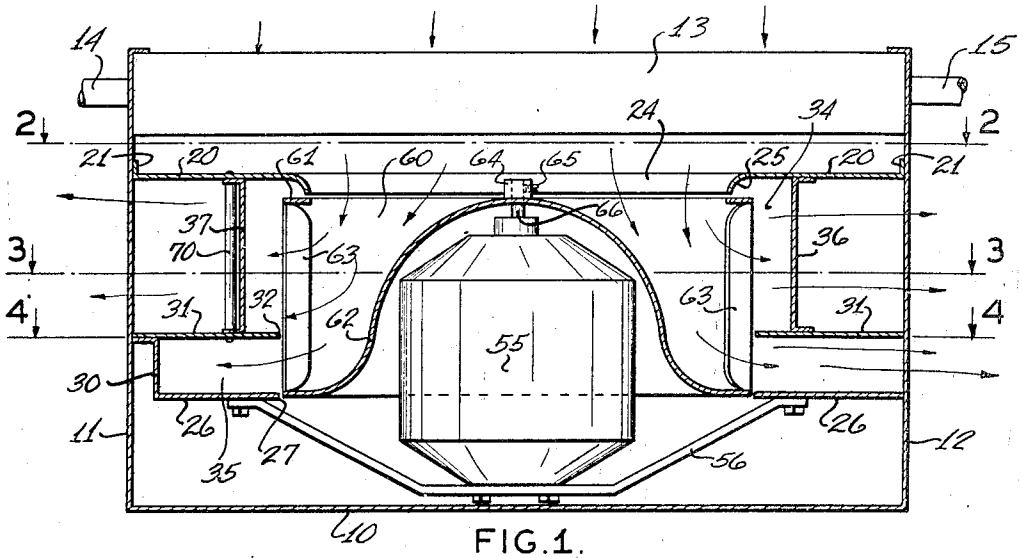


FIG. 1.

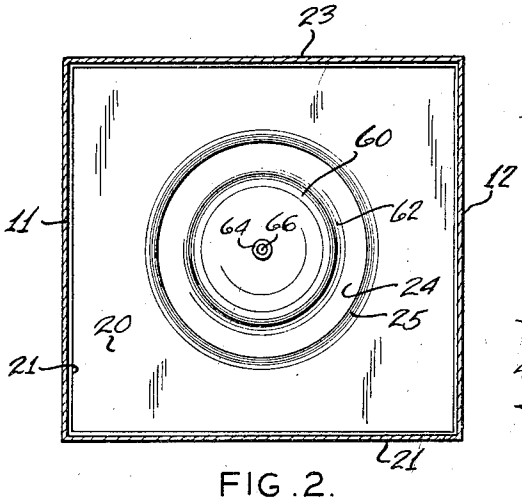


FIG. 2.

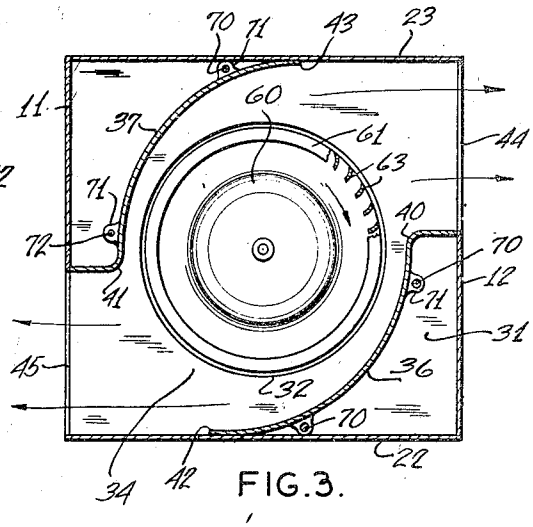


FIG. 3.

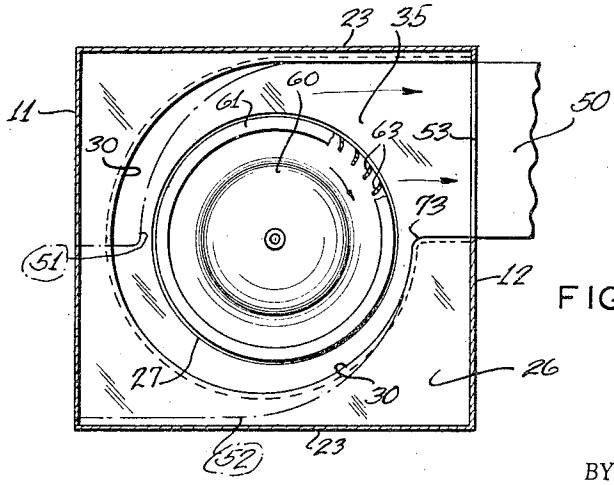


FIG. 4.

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MULTIPLE OUTLET BLOWER ASSEMBLY

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2 Claims. (Cl. 230—47)

This invention relates to improvements in multiple outlet blower assemblies, and more particularly to an improved construction of housing, and combination thereof with a blower wheel particularly adapted for use, for example, in units required to supply air to different zones, under differing pressure conditions. A typical usage of such units is found in automobile body heaters and defrosters.

With the advent of closed vehicle bodies, such as prevalently used on automobiles, the number and variety of types of different designs of heating units have been greatly enhanced in an attempt to provide at low initial cost, and with minimum energy consumption and noise, an adequate supply of warm air for moderation of temperature in the vehicle body. The service demands of units of this general type now include also the provision of a stream or streams of heated air for the purpose of windshield defrosting or the like, the air supply for the latter service generally being delivered through a substantial length of conduit, as by the blower assembly, the defrosting air being delivered under a moderate pressure head.

The present invention has as its general object, the improvement of efficiency and enhanced quietness of operation of a blower housing for the general purpose noted, in such manner that substantially the full output of the blower wheel is utilized efficiently and quietly.

A further object of the invention may be noted as an improved low cost housing construction for units of the type noted, which serves to increase, when compared with prevalent designs of blower for comparable purposes, the volume of air delivered per unit of time, and which serves greatly to augment the velocity as well as the volume of air delivered for defrosting purposes; the defrosting equipment being served by the same displacement member such as the blower wheel which delivers heated air for the warming of the vehicle body space.

A further object of the invention is attained in an arrangement of multiple-purpose housing sections for a centrifugal blower wheel, such that one or a pressure section may be utilized efficiently, without "starving" a companion section or sections utilized to deliver air for vehicle body heating purposes.

Still another object is attained in a blower or heater unit, which requires but a minimum number of parts, each of which is simple and sturdy in construction, may be fabricated from stock materials by only inexpensive tooling equipment, and which will serve without attention or repair over a long period of operation.

A further object of the invention is attained in a more compact heater or blower unit for the general purposes noted, the space economy resulting from present design being particularly reflected in a reduced axial dimensional requirement of the assembly.

Still further objects and advantages are attained in certain advantageous structural details making for sturdiness and compactness of assembly, as well as reduction in costs.

The foregoing and numerous other objects will more clearly appear from the following detailed description of an exemplary embodiment of the invention, when considered in connection with the accompanying drawing, in which:

Fig. 1 is a vertical section of a heater and blower unit to which the present improvements are applied, a driving motor for the centrifugal blower wheel being herein shown in side elevation; Fig. 2 is a horizontal sectional elevation of portions of the device as viewed along lines 2—2 of Fig. 1; Fig. 3 is a horizontal sectional elevation of the unit of Fig. 1 as viewed along line 3—3 thereof, and Fig. 4 is an additional horizontal sectional elevation of the unit of Fig. 1 as viewed along line 4—4 thereof.

For brevity of description and in keeping with certain embodiments of the improvements heretofore manufactured, the figures of the drawing illustrate a horizontal type of heater and blower unit, i. e. one in which a centrifugal blower wheel operates in a horizontal plane or planes, and is actuated by a vertical-shaft motor, and in which a water-supplied heater core is disposed substantially in a horizontal plane. It will be understood, however, that such illustratiion does not negative an equal facility for embodying the structural improvements of the blower housing and wheel, in a blower or heater unit of a type in which the core, for example, is disposed vertically and the motor shaft arranged horizontally, or at any other suitable angle.

In reference to the drawing, by suitable coordinating characters, it may be noted that the outer housing of the unit is comprised of a bottom or lower element 10, and a side wall or walls 11 and 12. These housing portions are conveniently formed of sheet metal of suitable gauge, and the housing is preferably, of itself, of open top construction, the top of the housing or one end thereof being occupied and virtually closed as by a circulating radiator or core element 13.

Although the housing 10, 11, 12 is shown as

being of a virtually square or rectangular section, the present improvements may equally well be embodied in a housing in which the portions 11 and 12 are curved, and the side walls thus serve to define a circular or oval structure, or being of other suitable shape as desired.

It will further be observed that the present improvements consist essentially of a multiple-function blower and housing assembly, and that when so understood, the provision or not of a source of heat is optional. Broadly considered, where a heat exchange agency is employed, it may consist either of a heating unit or of a cooling unit for space temperature variation. As most extensively used for the purpose of heating vehicles such as automobile bodies, the element 13 will consist of a core or radiator, usually of cellular construction, the cells of which are open through the core in a depthwise direction as indicated by the arrows of Fig. 1 representing the stream of inflowing air. The exact construction and arrangement of spaces or cells in the core are not material to the present improvements, any suitable form of core member or heat exchange structure being serviceable in this zone of the unit.

When the source of heat is the usual hot water from the cooling system of an automobile engine, a pair or more of conduits or connections for the water may be employed, these being indicated at 14, say for the inlet, and 15 for the outlet or return.

Transversely bridging the walls 11 and 12 of the outer housing is a horizontal partition 20 conveniently provided with an upturned flange or flanges 21 along its perimeter, by which it is assembled as by welding, riveting or the like, so as to derive its support from the walls 11 and 12. In case a rectangular outer casing or housing is utilized, the front and rear walls thereof may be located as shown in Fig. 3 for example, and indicated at 22 and 23.

The horizontal partition 20 is characterized by a central, preferably circular aperture, defining an inlet eye to the wheel housing proper and indicated at 24. By preference the eye 24 is particularly defined by a downturned, convexly rounded flange portion 25 which may be formed by pressing or spinning to bring the lowermost margin of the flange close to, and preferably such that it has not much more than an operating clearance with the inlet end of the wheel.

The opposite end of the wheel housing proper is constituted by a substantially horizontal partition element 26. This is assembled in place in the outer housing in any suitable manner as by flanges (not shown) and is located for the most part in the plane of the opposite end of the blower wheel, hereinafter described. The partition or plate element 26 is preferably provided with an aperture 27 circular in form and of a diameter closely approximating the greatest peripheral diameter of the wheel. As best appears from Fig. 4, and as also indicated by the section of Fig. 1, the plate 26 is specially formed as by pressing or spinning, so that it is shaped to form one or more scroll wings, each of which lies in a curved plane, the greater part of which lies parallel to, but of course located outwardly from the axis of the blower wheel. This scroll wing formation will be hereinafter more particularly described, but is indicated generally at 30.

A third partition element, shown as horizontal in the example illustrated, transversely bridges the outer casing or housing 10, 11, 12 and is indicated generally at 31. This partition also is provided with a central circular aperture, the defining edge of which 32 extends entirely around the periphery of the blower wheel and close thereto, preferably having only a safe operating clearance therewith.

It will have appeared from the arrangement of the three cross partitions, viz. 20, 26 and 31, that the housing portion about the blower wheel is divided into sections, shown as two in number. For reasons later appearing, these may be referred to respectively as an upper and larger, or heater section 34, and a smaller, more shallow defroster or pressure section 35.

For a purpose similar to the provision of the scroll wing 30 in and partly defining the defroster section 35, section 34 is similarly provided with one or more scroll wings. The trends of these best appear from Fig. 3, wherein they are indicated at 36 and 37 respectively, it being observed that each scroll wing in the heater section has its innermost end located relatively close to the periphery of the wheel, such end on the wing 36 being indicated at 40 and the corresponding end of wing 37 being indicated at 41. The scroll wing 36 actually terminates in an outer end 42 and the corresponding end of wing 37 at 43. The merger of these ends with the walls 22 and 23 of the housing serves virtually to continue or prolong the functional effect of the scroll wings, outwardly to a zone of air discharge from the sides of the casing.

As well known, the discharge port or ports, the two thereof for the heater section of the housing being indicated at 44 and 45 respectively, may be provided with suitable dampers or multiple louvers to control the extent, direction or both, of the air discharged directly into the body of the vehicle as for heating purposes.

Although the usual installations for automobile heating purposes require only a single defroster connection for supply of heated air, this being exemplified by the fragmentary conduit end indicated at 50 (Fig. 4), under certain special conditions it may be desirable to provide the pressure section 35 with a multiple outlet somewhat after the manner of the arrangement shown by Fig. 3. In such case a pair of scroll wings instead of the single scroll structure 30, will be formed into plate 26 or constituted by separate scroll wing elements along the lines indicated by dotted lines, wherein the dual scroll wings are indicated respectively at 51 and 52. As is conventionally employed, the single or multiple outlet from the defroster or pressure section 35 as indicated by the port 53 (Fig. 4), may be provided with a suitable shutoff damper (not shown) so that, except during periods when defrosting air is required, such air may be either precluded from delivery or diverted into the car body space to augment the heating effect of the streams discharged through ports 44 and 45.

Proceeding now to a brief description of the blower wheel per se in the form illustrated, being the general form preferred, there is provided a conventional driving motor for the wheel indicated at 55, and suitably supported as by a frame 56 conveniently mounted below the plate 26 or if desired, extending directly to and deriving its support from the outer walls of the housing.

By preference the wheel proper, indicated generally at 60, is of a type characterized by an open inlet end adjacent the eye 24 of the housing, this part of the wheel being framed on or

by an end ring 61. The opposite end of the wheel is characterized and defined by a substantially imperforate backplate 62, the plate 62 and ring 61 being crimped, riveted or otherwise assembled to the plurality of blades 63 of the wheel. These latter may be individually assembled, or may be formed in a one-piece body element of the wheel, as known in the art. The features of blade construction of the wheel form of themselves no part of the present invention, apart from the combination, and the preference that the backplate 62 be of substantially concavo-convex construction, being deeply cupped with the convex side toward the interior of the wheel. For completeness it is noted that the wheel is provided with a hub 64 secured as by set screw 65 to the shaft 66 of motor 55. The cupped conformity of the backplate 62 not only enables a substantial reduction in the depth or through dimension of the unit, by enabling the motor 55 to be virtually recessed in the wheel, but it should also be noted that the cupped type of wheel is believed to cooperate particularly well with the described arrangement of housing or casing sections and their respective scroll elements.

Centrifugal blower wheels per se of the general type described have heretofore been utilized, and it has been known heretofore to surround blower wheels of this order with a chamber or chambers from which air is discharged to the zones of utilization. However, many of the blower units and heater units for purposes comparable to the present, dispose a centrifugal wheel in a housing section of so-called plenum chamber type, without scroll elements. Also, in the heater or blower units heretofore prevalently utilizing, multiple discharge connections for providing a separate conduit connection for defrosting, have not, as is very important, arranged the pressure section in the manner described, with respect to the blower wheel. The importance cannot be over-emphasized of disposing the pressure section of the housing, where more than one section is formed in or by the housing, nearer the closed end of the wheel. Exhaustive experiments have indicated that, in case for example, the section 35 be located nearest the inlet end of the wheel, the wheel in this zone will actually take in air rather than exhaust same. Definitely no substantial pressure effect is obtained with such an arrangement. Accordingly it is one of the important elements of the present invention that the pressure section be located nearer the imperforate end of the wheel, and opposite the inlet eye thereof.

The importance of the one or more scroll elements such as scroll wings, is also considerable, as favorably affecting the discharge efficiency of the wheel. The entrapment of air by the scroll wing aids materially in definitely directioning the air from the wheel periphery to the zone of its discharge from the casing. This is true whether only one, or two or more scroll wings be provided, respectively in connection with a single or multiple discharge.

It may also be noted that certain attempts have heretofore been made incident to dividing discharge streams from centrifugal blower wheels, to utilize only a partial or fragmentary intermediate partition. In such cases, it is obvious that the air discharged by the blades of the wheel is permitted to recirculate within the chamber about the wheel, and is many times shunted from one to the other of the incompletely separated chambers about the wheel. It will be noted that the complete peripheral embrasure of the wheel by the partition 31 of the present structure, precludes any interchange of air between the chambered sections 34 and 35, thus minimizes "short-circuiting" effects and turbulence, not only within, but between the different sections of the blower wheel housing.

It should be noted that there exists a definite structural advantage and a sturdy low cost assembly from the briefly described arrangement of assembling the scroll elements such as 36 and 37. It is a preference for this purpose that a series, (shown as four) of transverse pins such as 70 be employed, for one purpose of structurally bridging and maintaining in rigid parellelism the plates 20 and 31. This arrangement may also if desired, be utilized between plates 31 and 26. The ends of pins 70 may be provided with screw threads and nuts (not shown) or the opposite ends of the pins may be welded in place, or upset as by riveting. It has been that this assembly expedient markedly minimizes rattles and vibration of metal parts within the housing, such noises being extremely objectionable in the automotive trade.

The pins 70 as will best appear from Fig. 1 and Fig. 3, serve the further purpose of assembly supports or anchorages for the scroll wings such as 36 and 37. The latter are provided with projections, in this case horizontally arranged, apertured ear portions 71, the apertures thereof being indicated at 72, and through the latter the pins 70 extend to hold the scroll wings securely in assembled position.

The operation of a blower assembly embodying the improved construction described, will now have become fully apparent, but it may be noted for completeness that rotation of the wheel 60 by motor 55 serves to draw the ambient air in the present assembly downwardly through the core 13 where it becomes heated, and thence enters along the lines shown by the lower series of arrows, and passes through the eye 14 of housing plate 20, thence into the eye of, and to the interior of the wheel. The air is thence deflected outwardly to a much greater extent in the lowermost portion of the wheel, partly due to the flared conformity of the cup portion 62 of the blackplate. This latter serves it is believed, to aid the wheel in expelling a substantial portion of its intake volume into the defroster section 35, whence it is driven outwardly through the conduit 50 under an appreciable pressure, thence is moved optionally as to direction, either through the defroster lines and ports or to the space to be heated. It should be noted that the hollow or cupped formation 62 of the backplate of the wheel, while advantageous, may be replaced by a substantially planar or other suitable form of backplate. It is however highly desirable that the casing portion arranged to receive and deliver air under a relatively higher pressure, be located around or near that portion of the blower wheel which delivers the relatively greater volume of air. This is usually in a zone located at some moderate axial distance from the inlet zone or zones of the wheel. Thus it appears that the arrangement and adaptation of the wheel, and its relation to the casing, should, as in the illustrated embodiment, provide an effective abutment tending to deflect the air outwardly of the wheel in greatest volume in the zone of the air chamber which in the selected embodiment, serves to supply the defroster equipment.

The air follows obviously a similar course in the heater section **34**. In both sections of the assembly, the air leaving the blade tips at relatively high velocity, strikes the interior face of the scroll wing and is directed toward a proper outlet. In moving through the expanding chamber bounded by wheel surface and scroll, air velocity is reduced, the velocity energy (or kinetic) being changed thereby into pressure or potential energy capable of forcing air through ducts or against other operating back-pressure obstacles in the zone beyond the casing discharge point. The innermost ends **40** and **41** of the wings **36** and **37**, or the corresponding inner end or ends **73** of scroll wing **30** or scroll wings **51** and **52**, mark the start of an energy changing zone. These starting points separate or cut off the high pressure region near the outlet, from the adjacent high velocity zone near the surface of the wheel, thus preventing undue recirculation through the wheel from highest pressure to adjacent lowest pressure sections.

Although the invention has been described by making a somewhat specific reference to a single exemplary embodiment of the invention for a particular usage, the detail of description is to be understood as given in an instructive and not in any limiting sense, many changes being possible in the parts and their arrangement without departing from the intended scope of the invention as defined by the claims hereunto appended.

I claim as my invention:

1. In a multiple-discharge air blower assembly, a casing structure, a centrifugal blower wheel rotatable in the casing structure and constituting the sole air displacement agency in the assembly, the wheel being of a relatively deep or axially elongate type, including a back plate at one end and an open inlet at the opposite end of the wheel defined by an inlet ring portion thereof, a wall member of the casing structure transverse to the wheel axis having an air inlet opening, the margins of which closely approach the inlet ring portion of the wheel so as effectively to constitute a running air seal therewith, a secondary transverse wall member substantially coplanar with the back margin of the wheel, and having an opening of a diameter closely approximating that of the wheel and forming an effective running air seal for the periphery of the wheel, an intermediate wall member forming, with those aforesaid, a pair of scroll housings collectively embracing substantially the full length and full periphery of the blower wheel, the intermediate wall member having a wheel opening, the margins of which closely approach the bladed periphery of the wheel to minimize passage of air between the scroll housings, the intermediate wall member being spaced substantially closer to the back than to the inlet of the wheel, whereby to constitute the rearmost scroll housing as a relatively high pressure air chamber, and the scroll housing nearest the inlet end as a relatively lower pressure chamber, a scroll element in each scroll housing, means formed at least in part by the wall members and casing structure, constituting a tangential air delivery passage from each scroll housing, and means for driving the blower wheel.

2. In an air blower assembly for displacement of air streams at different pressures by means of a single centrifugal blower, a casing structure, a centrifugal blower wheel rotatable in the casing structure and constituting the sole air displacement agency of the assembly, the wheel being of a relatively deep type, including an inwardly cupped back plate, and provided with an air inlet opening in its end opposite the back plate and further including a peripheral inlet ring portion, a wall member of the casing structure transverse to the wheel axis and provided with an air inlet opening the margins of which closely approach the inlet ring of the wheel so as effectively to constitute a running air seal therewith, a secondary transverse wall member substantially coplanar with the back margins of the wheel, and provided with a circular air opening of a diameter closely approximating that of the wheel and forming an effective running air seal for the rear peripheral portion of the wheel, an intermediate wall member forming with those aforesaid a pair of scroll housings collectively embracing substantially the full length and full periphery of the wheel, the intermediate wall member having a wheel opening the margins of which closely approach the bladed periphery of the wheel to minimize passage of air between the scroll housings, the intermediate wall member being substantially planar and being spaced forwardly of the rear peripheral margin of the wheel a distance of the order of one-third the bladed length of the wheel, whereby to constitute the rearmost scroll housing as a relatively shallow, high pressure air chamber, and the scroll housing nearest the wheel inlet as a chamber of greater volume adapted to confine and discharge air at a lower pressure, a scroll element in each scroll housing, means coacting with the scroll elements, and formed at least in part by the wall members and casing structure, constituting a tangential air delivery passage from each scroll housing, and means for rotating the blower wheel.

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