Oct. 7, 1941. H. J. FINDLEY 2,258,284

AIR CIRCULATOR

Filed March 25, 1939 2 Sheets-Sheet 1

Fig. 3.

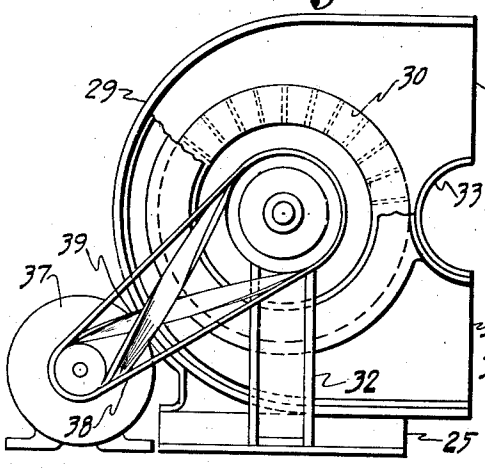


Fig. 4.

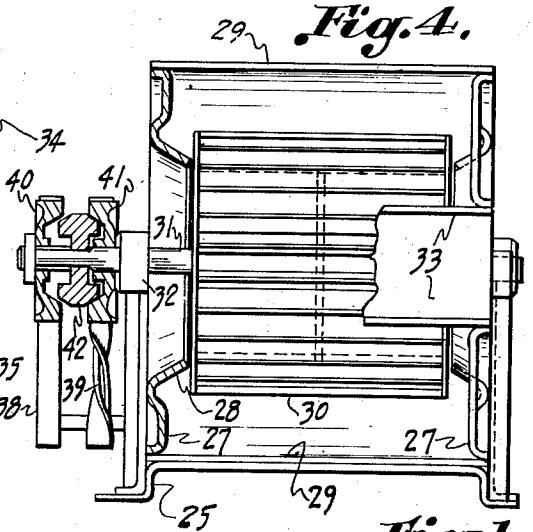


Fig. 1.

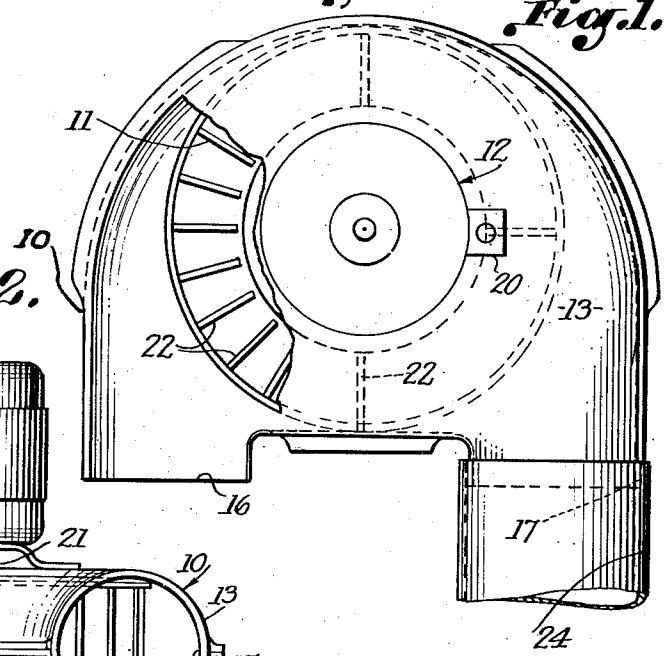
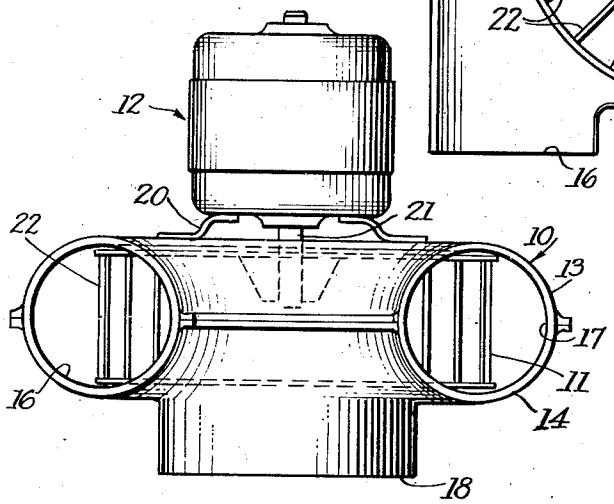


Fig. 2.



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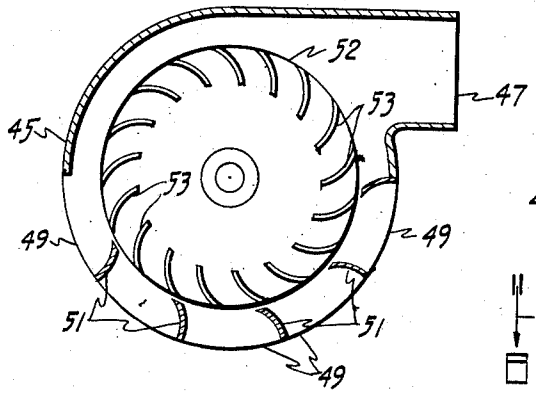


FIG 6

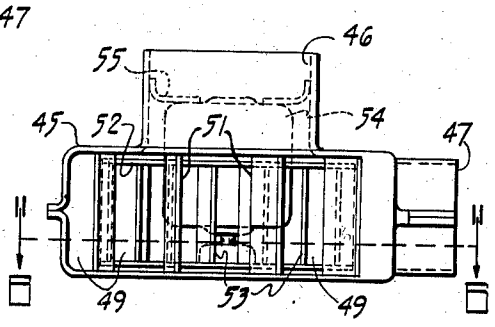


FIG 5

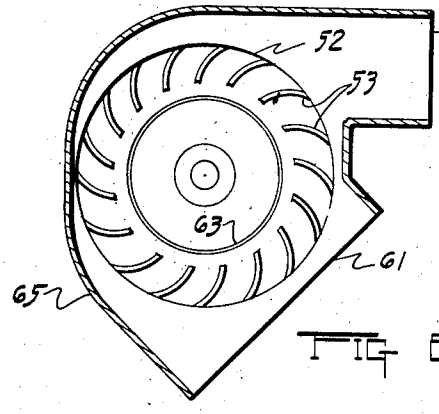


FIG 8

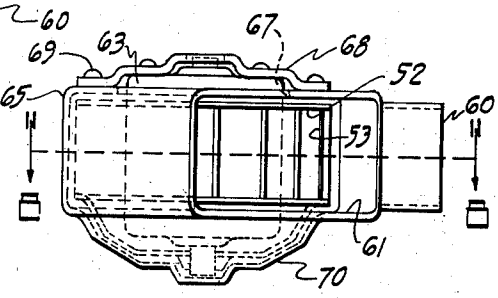


FIG 7

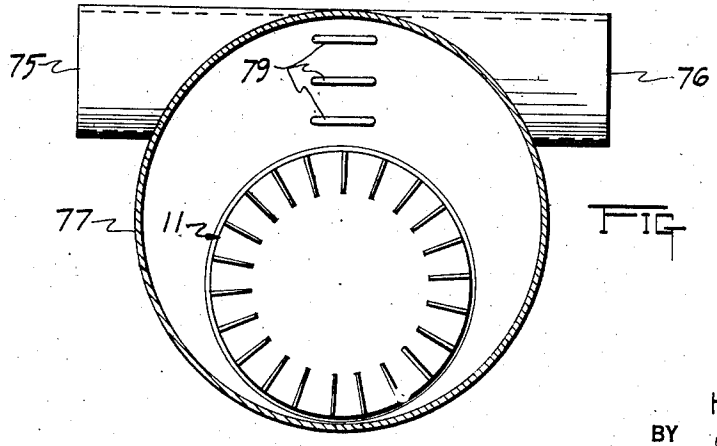


FIG 9

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UNITED STATES PATENT OFFICE

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AIR CIRCULATOR

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Application March 25, 1939, Serial No. 264,267

10 Claims. (Cl. 230—47)

This invention relates to air circulators in general and more particularly concerns a unitary structure or assembly adapted to be used as an individual unit or in combination with a heating or cooling system to function as a circulating medium for the thermally treated air from and to a plurality of selective points.

Objects of the invention include the provision of an air chamber having one or more axial air inlet openings and a plurality of tangentially disposed peripheral outlet openings, and a blower fan therein operable by reversible driving means for selective discharge of air from one or more of said outlet openings; the provision of an air collecting housing of a parti-cylindrical conformation having an axial air inlet opening and two or more tangentially disposed peripheral outlet openings, and a rotatable blower wheel of the radially disposed blade type operable in said housing by reversible driving means for selective air delivery from said outlet openings; the provision of an air collecting housing of substantially an involute scroll type having a single axial air inlet opening and two or more tangentially disposed peripheral air delivery openings normal to said inlet opening and arcuately spaced with relation to each other, and a blower wheel rotatably mounted in said housing and operable by reversible driving means to vary the direction of rotation of said blower for selective discharge of air to one or more desired points; the provision in an air circulator of the above described type in which the reversible driving means is disposed without the air chamber and either directly, or indirectly through a driving belt, is associated with the air impeller for varying the action thereof to achieve a selective air delivery to a predetermined location; the provision in an air circulating assembly of one or more of the above described types having two axially opposed air inlet openings and a plurality of tangentially disposed peripheral outlet openings having transverse partitions in the discharge mouth thereof, and a pair of blower fans mounted back to back on a common shaft under the influence of reversible driving means, said fans having equal, or unequal, air moving capacities in either direction of rotation, or a combination of two fans one having equal air moving qualities in each direction of rotation and the other unequal air moving qualities relative to each direction of rotation.

Other objects of the invention include the provision of a unitary air circulator of the blower type operable by a reversible driving motor eccentrically disposed wholly within the air collecting housing of the scroll type having a single axial air inlet and a plurality of peripheral tangentially disposed air delivery openings normal to the inlet opening and arranged for discharge of air in opposite directions selectively according to the direction of rotation of said air circulator by the reversible driving means.

The above being among the objects and advantages of this invention, the same consists in the novel arrangement and combination of parts hereinafter described, and includes other objects and advantages which will become readily apparent as the following specification progresses and is to be considered in an illustrative sense only, limited in extent only by the scope of the appended claims.

In the drawings like reference characters refer to like parts in the several views and wherein:

Fig. 1 is a bottom plan view of a novel blower housing and air circulator with portions broken away to disclose the interior thereof and embodying this invention; and

Fig. 2 is an elevational view of the novel air circulator of Fig. 1; and

Fig. 3 is a side elevational view with portions thereof broken away and illustrating a modified assembly embodying the teaching of this invention; and

Fig. 4 is an end view of the construction shown in Fig. 3; and

Fig. 5 is an elevational view of a further modified blower unit; and

Fig. 6 is a horizontal sectional view of the modified blower housing of Fig. 5 as on the line 5—5 thereof; and

Fig. 7 is an elevational view of a further form this invention may assume; and

Fig. 8 is a sectional view through the blower unit of Fig. 7 as on the line 8—8 thereof; and

Fig. 9 is a sectional plan view of another modified form of this invention.

Now having reference to the drawings and particularly to Figs. 1 and 2 there is shown the separate units common to all the modifications and generally designated as an air collecting housing 10, a centrifugal blower wheel 11 operable therein, and a reversible driving means 12 coupled to said blower providing selective air delivery through a predetermined outlet from said housing. The air collecting housing 10 in this instance assumes a substantially U-shaped conformation and may be comprised of a pair of stamped complementary dished members 13 and 14 having their marginal flanges in abutting

relation and secured together in any well known manner, as by spot welding brazing or other suitable fastening means; the said members forming an air chamber therebetween and constituting a support for the driving unit and an axially opposite air inlet opening, respectively. At each end of the U-shaped housing 10 is an air outlet opening 16 and 17 leading from the interior thereof and tangentially disposed to the outer peripheral wall. Through the lower housing member 14 and axially located with respect thereto is any air inlet opening 18 which may be stamped or punched out when forming the housing member 14, or be a separate sleeve member inserted through and secured to the central aperture in said member. Upon the upper wall of the housing member 13 a bracket 20 is secured thereto providing anchoring means for an electric motor 12 of the reversible type, the rotor shaft 21 of which is in axial relation to the opposite air inlet opening 18. The rotor shaft 21 extends centrally into the hollow center of the housing 10 and secured thereto is a blower wheel 11 of the centrifugal type closely associated with the inner peripheral wall of the housing furtherest removed from the outlet openings 16 and 17. The fan 11, in this instance, has radially disposed blades 22, that provide equal air delivery in either direction of rotation. Obviously if desired a fan of the type shown in Fig. 6 or Fig. 8 might be substituted if more air delivery is required in one direction of rotation than in the other.

In operation, the reversible driving motor is connected with a source of electric power, and assuming the fan to be rotating clockwise, air will be inducted through the axial inlet 18 into the hollow interior of the fan and deflected by the radial blades against the interior peripheral wall of the air housing 10 adjacent to the right hand sides thereof, and since the fan closely approaches the inner wall of the housing at the periphery of the fan furtherest removed from the outlet opening, a center of pressure will be built up in the air stream and transferred from one layer of air to the adjacent air stream, and the path of least resistance being the gradually increasing air chamber adjacent the mouth of the outlet opening 17 air will be discharged therefrom. From the outlet opening 17 the air may be discharged directly to the atmosphere or conducted to any desired point, as by means of the conduit 24 secured thereover. Under certain conditions of operation if an air delivery is desired from the other outlet opening 16 it is only necessary to reverse the direction of rotation of the reversible motor 12 and under a duplicate set of conditions, as above described, air will be inducted through the common axial inlet opening 18 and now in the counterclockwise rotation of the blower fan will be discharged through the outlet opening 16 directly to the atmosphere or any desired point.

The construction shown in Figs. 3 and 4 is analogous to Figs. 1 and 2 but in this instance has been applied to a substantially larger assembly for movement of air in industrial duct work and wherein the size of the unit and the volume of air moved make it impractical to mount the larger driving means on the air housing. In this construction a base member 25 serves as a support for two spaced upright U-shaped frame members 27 having central apertures 28 therethrough. A rectangular sheet metal part 29 is rolled around a portion of the marginal edges of the spaced frame members 27 and secured thereto in any suitable manner and in conjunction therewith defines an air collecting housing. A fan 30 of the centrifugal blower type is rotatably journalled in the housing by a shaft 31 supported on the upstanding channelled and apertured members 32. A semicircular portion 33 provides an air cut-off adjacent the periphery of the fan and defines separate air delivery outlets 34 and 35 tangentially disposed to the peripheral wall of the housing. An electric motor 37 may be secured to the base 25, or at any other convenient point adjacent to the end of the shaft 31, and through belts 38 and 39 may be coupled in selective driving relation to the centrifugal fan. The belts 38 and 39 are arranged so that one belt 38 drives the fan through a free running pulley 40, when the clutching device 42, splined to shaft 31, is engaged therewith; and belt 39 is turned through an angle of 180° between the motor and the pulley so that a free running pulley 41 rotates in an opposite direction to pulley 40, and when the clutching device 42, splined to shaft 31, is engaged therewith will drive the fan in a direction opposite to the first mentioned pulley, that is to say, through the use of the two belts as above described means are provided for selective rotation of the fan in either direction without the necessity of providing a more expensive reversible type of motor.

The operation of this device is substantially similar to that above described for Figs. 1 and 2 and it will suffice to say that clockwise rotation of the fan causes a discharge of air from the outlet opening 34, and counterclockwise rotation causes air to be discharged from the outlet opening 35.

It is entirely possible in this construction, instead of inducting air from the single axial inlet, as in the previous figures, to have two oppositely disposed axial inlets and use two fans back to back on the shaft 31, whereby two separate and thermally different air streams may be blended and discharged through either of the outlet openings 34 or 35, selectively, dependent upon the direction of rotation of the fan. Alternatively, one of the two fans may have a reduced air capacity in one direction of rotation and a full capacity in the opposite direction of rotation, for example, the combination of the blower fan 25 in Fig. 1 and the fan of Fig. 6. Likewise transverse partitions may be placed across either outlet opening 34 or 35, or both, to subdivide the air discharge therefrom for conduction to one or more preselected spaced points or to secure any desired combination of thermally treated air.

In the construction shown in Figs. 5 and 6 the air collecting housing has been opened up for a considerable arcuate portion of its peripheral wall, and the blower wheel, while being of the rotary type, instead of having radially disposed blades for equal air capacity in either direction of rotation is what may be called a pressure-streamlined type, or more correctly, a cambered, fluid turbine blade type of blower wheel.

In this adaptation the air collecting housing 45 is of substantially an involute scroll conformation having a single axial air inlet opening 46 thereinto, an air outlet opening 47 normal to said air inlet opening and tangentially disposed on the peripheral wall of said housing, and a series of air outlet openings 49 defined by spaced cambered vector members 51 angularly extending through the housing wall. The hollow centered blower wheel 52 as aforementioned has

cambered blades **53** which provide a concave scoop for attacking the air in one direction of rotation and a convex surface for deflecting the air in the opposite direction of rotation, and hence widely different air moving capacities may be secured for each direction of rotation. A reversible driving motor **54**, supported by a cross bracket **55** suitably secured to the wall of the inlet opening **46**, is coupled to the blower **52**.

In operation, upon rotation of the fan in a clockwise direction, air is inducted through the inlet opening **46** into the hollow center of the fan where it is picked up by the tips of the blades and deflected by the convex surfaces to form a pressure head of a reduced capacity and discharged from the outlet opening **47**. On reversing the direction of rotation of the motor by a suitable reversing switch, and now rotating in a counterclockwise direction, the advancing concave side of the blade now presented to the air stream provides a scoop for a mass of air that centrifugally moves toward the outer tip of the blade and stays there until it is picked off by the adjacent angularly disposed and oppositely dished vector members **51** and discharged with high velocity from the several openings **49** as shown. It is interesting to note that by removing all these vector air deflectors **51** substantially no air will be discharged through the central part of the broad opening but will carry around on the periphery of the wheel and pile up at the extreme right hand side of the opening. Thus these vector members provide a broad fan like section or mass of air delivery over a desired area, and the single outlet opening **46** provides for discharge of air under reduced pressure and volume characteristics selectively by the reversible motor means to any other desired point.

The modified construction shown in Figs. 7 and 8 is somewhat analogous to the form of the invention shown in Figs. 1 and 2 but having two outlet openings **60** and **61** arranged at divergent angles relatively to each other. Additionally, the unit has been made very compact by placing the reversible driving motor **63** within the housing **65**, and having a fan **52** of variable air capacity for each direction of rotation coupled thereto, as in Figs. 5 and 6. The housing **65** has a single upper axial air inlet opening **67** through which the driving means **63** is inserted and partially projects therefrom, and is suitably fastened to a narrow bracket **68** extending across the inlet opening **67** and secured by rivets **69** or other fastening means to the housing **65**. A dished cone shaped cover member **70** is disposed upon the opposite axial cover member **70** is disposed upon the opposite axial side of the housing **65** and provides a cover for the lower end of the driving motor projecting therefrom and the coupling means joining the fan **52** and the motor in driving relation.

In operation, the motor is joined to a source of electric power in series with a reversing control switch (not shown) and, upon a clockwise rotation of the motor, air will be inducted through the axial air inlet **67** into the hollow center of the fan **52**, picked up by the inner edges of the concave surface of the blades **53**, and discharged from the outer edges of the blades toward the outlet opening **60** under relatively high velocity and pressure characteristics. Upon rotation of the motor in a counterclockwise direction, air will again be inducted through the common air inlet and deflected by the convex surface of the blades now presented to the air stream and discharged under relatively lower pressure and volume characteristics from the air outlet opening **61** for distribution to any other desired point. It will be apparent the air circulating units shown in Figs. 5, 6, 7, and 8 due to their compactness, the arrangements of the outlet openings, and the self-contained driving means might be readily usable in an automotive vehicle for installation under the dash, for example, the air inlet openings **46** or **67** may be positioned adjacent to a heat-exchange element and the outlet openings **47** and **60** joined with a conduit means for discharge of thermally treated air adjacent to the vehicle windshield or other desired remote point, while the outlet openings **49** and **61** may be used selectively for discharge of treated air directly to the lower part of the front passenger compartment or spread fan-wise over the width thereof, as from outlets **49**.

The adaption of this invention to the form shown in Fig. 9 is analogous to the forms shown in Figs. 1 and 8 but is modified therefrom by having two outlet openings **75** and **76** in alignment and arranged at 180° relatively to each other. In the sectional plan view illustrated the circular housing **77** has an axially offset air inlet opening as in the previous constructions, and the air discharge outlets **75** and **76** tangentially disposed in the housing wall are in alignment but extend in opposite directions. The blower wheel **11** is of the radial blade type for equal air movement in either direction of rotation, although obviously a blower wheel **52** of Fig. 6 or Fig. 8 may be substituted if unequal air delivery is desired from one or the other outlet. An important feature of this reduced air delivery by running the blower wheel **52** clockwise, as viewed in Fig. 8, is the reduced current consumption or drain on the electrical system which may be critical in some installations, especially on present day overloaded electrical systems of automotive vehicles. The spaced parallel members **79** extending axially with the outlet openings **75** and **76** and disposed transversely of the interior of the housing **77** serve as air straighteners for the air delivered thereto for either direction of fan rotation so that the air stream will not be carried on around the interior periphery of the housing but will be tangentially diverted to one or the other outlet opening **75** or **76** depending upon the selection of the direction of rotation of the reversible driving means.

It will thus be apparent that a new and novel air collecting housing for use in conjunction with a centrifugal blower wheel of the pressure type, or a fluid turbine type blade, which will be coupled to reversible driving means has been disclosed; and that may be built into a compact unit powered structure or embodied in a large industrial duct system having separate externally located reversible driving means coupled thereto by belts or chain drive. While in the foregoing description the different forms of the invention have been termed modifications, they are in reality as viewed from the commercial viewpoint, only specific adaptations of the invention for use under various conditions affecting installation. With this in mind, it will be obvious that this invention as a practical unit for the circulation and/or use in conjunction with thermal heat-interchangers under any and all installation conditions, has genuine practical merit due to its unusual simplicity, low cost, and selective operating efficiency.

What I claim is:

1. An air circulating unit comprising a particircular frame defining an air confining housing and a reversible electric motor supported thereby, a fan in said frame driven by said driving means, an axial air inlet opening in communication with the interior of said frame, a plurality of arcuately spaced tangentially disposed peripheral air outlet openings normal to said air inlet, and said fan operable under the action of said reversible motor means for selective discharge of the major portion of displaced air from one or more of said outlet openings solely by varying the direction of rotation.

2. An air circulating unit comprising substantially circular mated frame members defining an air confining chamber therebetween, a reversible driving means associated therewith, a hollow center fan operable in said frame and housing at least in part said driving means, an axial air inlet opening in communication with the interior of said fan, and two or more arcuately spaced air outlet portions tangentially disposed with respect to the peripheral wall of said frame for a selective air discharge therefrom according to the direction of rotation of said fan by said reversible driving means.

3. In combination, an air circulating unit comprised of substantially U-shaped members secured together and defining an air chamber therebetween, an axial air inlet leading to the central portion of said air chamber, a pair of arcuately spaced air outlet openings normal to the air inlet opening and tangentially disposed to the periphery of said chamber, a blower wheel operable in said chamber having equal air moving capacities in either direction of rotation, and a reversible electric motor supported by said housing and coupled to said fan providing for selective discharge of air from said outlet openings.

4. In combination, an air circulating unit comprised of substantially U-shaped members secured together and defining an air chamber therebetween, an axial air inlet leading to the central portion of said air chamber, a pair of arcuately spaced air outlet openings normal to the air inlet opening and extending in parallel paths and tangentially disposed to the periphery of said chamber, a blower wheel operable in said chamber with equal air moving capacity in either direction of rotation, and a reversible electric motor secured to a wall of said chamber and coupled to said fan providing for selective discharge of air from said outlet openings.

5. In combination, an air circulation unit comprising substantially circular sheet metal members axially spaced and defining an air collecting housing therebetween, an axial air inlet opening into the housing, a plurality of arcuately spaced air outlet openings normal to the air inlet opening tangentially disposed to the periphery of said housing, a fan operable with predetermined proportions of air movement in either direction in said housing, and a reversible electric motor supported thereby and coupled to said fan providing for selective air discharge simultaneously from one or more of said outlet openings in said predetermined proportionate amounts dependent upon the direction of fan rotation.

6. An air circulating unit comprising air confining means defining a housing of an involute scroll conformation, a reversible electric motor secured thereto, an axial air inlet opening into said housing, two or more arcuately spaced air outlet openings tangentially disposed on the peripheral wall of said housing, and a fan of the rotary blower type operable in said housing under the influence of said reversible motor means for varying the action of said fan and providing the sole means for a selective air delivery through either of said outlet openings.

7. In an air circulating unit, air confining means defining a housing of an involute scroll conformation provided with an axial air inlet in communication with said air collecting member and having two or more arcuately spaced peripheral air discharge outlets, a fan of the rotary blower type operable in said housing comprised of a plurality of cambered air scoops having a greater air capacity when rotating at a given speed in one direction than when rotating at the same speed in the opposite direction, and a reversible electric motor supported by said housing for rotating said fan in either direction providing the sole means for selective discharge of air through either of said air outlets in predetermined proportionate amounts.

8. In an air circulating unit, air confining means defining a blower housing provided with a single axially arranged air inlet opening into the central portion of said housing, said housing having a tangentially disposed air discharge outlet on the peripheral surface thereof, a plurality of arcuately spaced vector members for deflecting and discharging air from the interior periphery of said housing, a fan of the blower wheel type operable in said housing, a reversible electric motor for rotating said fan in either direction for selective discharge of substantially all the air moved through said tangentially disposed discharge outlet or said plurality of peripheral air deflectors in accordance with the direction of rotation of said fan.

9. In an air circulating assembly, air confining means defining a housing having a plurality of peripherally spaced air outlet openings disposed tangentially thereto and oppositely disposed axial air inlet openings normal to said outlet openings, said outlet openings having transverse partition members in the discharge end thereof, one or more fans of the rotary blower type of unequal efficiency in the same or opposite direction of rotation operable in said housing for intaking air through each of said inlet openings, and a reversible electric motor driving means coupled to said fans for selective rotation thereof in either direction of rotation whereby to provide the sole means for a divided air delivery of unequal volume and pressure characteristics to several desired points from said partitioned air outlet openings.

10. In combination, an air circulating unit comprised of a sectional casing of substantially circular mated frame members secured together and defining an air chamber therebetween, a reversible motor supported by said casing, a hollow center fan of the centrifugal type operable in said casing by said motor and housing at least a part thereof, an air inlet opening axially in said casing in communication with the hollow center of said fan, and a pair of arcuately spaced diametrically opposed air outlet openings in the peripheral wall of said casing normal to said inlet opening for selective air discharge therefrom in either direction of rotation of said fan by said reversible driving motor.

HOWARD J. FINDLEY.

CERTIFICATE OF CORRECTION.

Patent No. 2,258,284. October 7, 1941.

HOWARD J. FINDLEY.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 3, first column, lines 57 and 58, strike out the words "cover member 70 is disposed upon the opposite axial"; and second column, line 21, for "adaption" read --adaptation--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 18th day of November, A. D. 1941.

Henry Van Arsdale,
Acting Commissioner of Patents.

(Seal)