Jan. 14, 1964 C. B. CAMPBELL 3,117,770

COMBINATION AIR WARMING AND CENTRIFUGAL FAN UNIT FOR TRANSMITTING HEATED AIR

Filed April 19, 1961 2 Sheets-Sheet 1

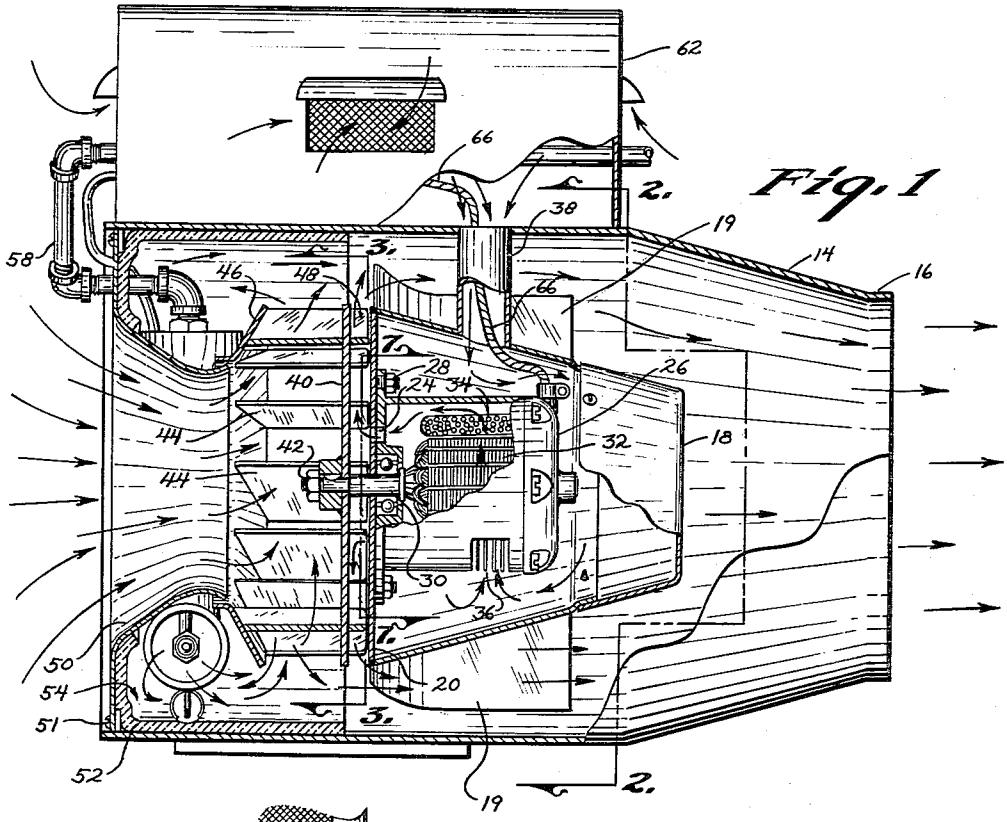


Fig. 1

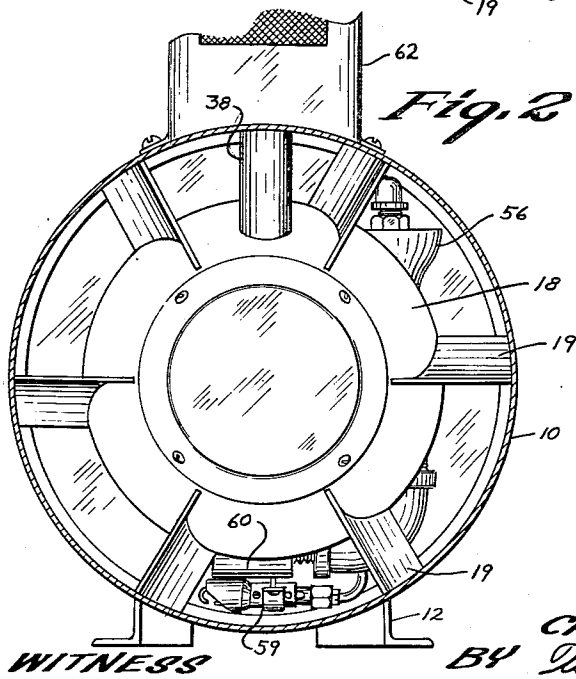


Fig. 2

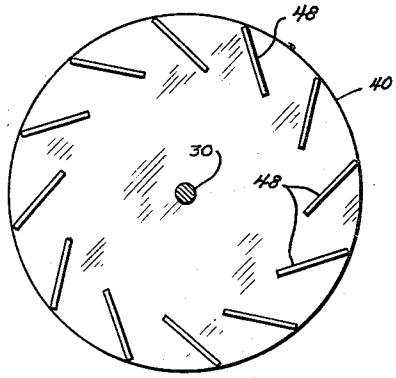


Fig. 3

WITNESS
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Filed April 19, 1961 2 Sheets-Sheet 2

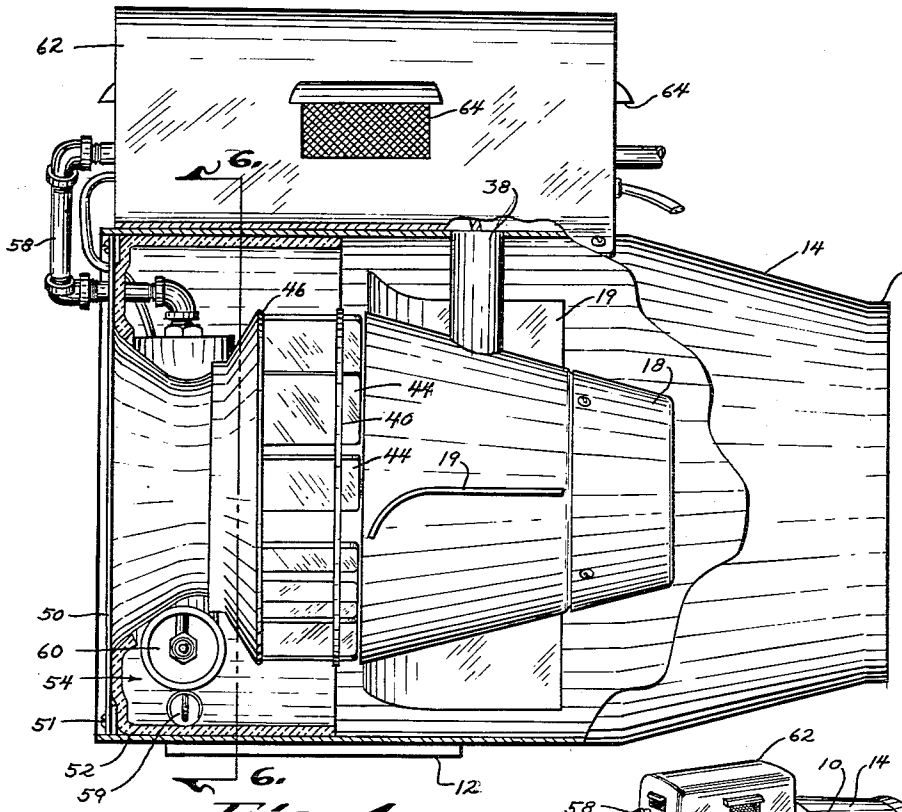


Fig. 4

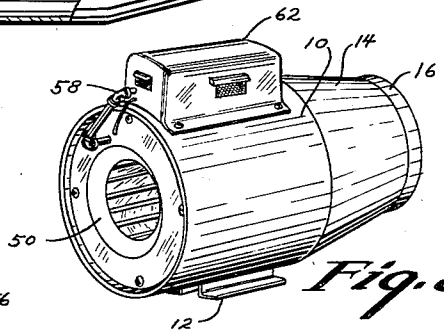


Fig. 5

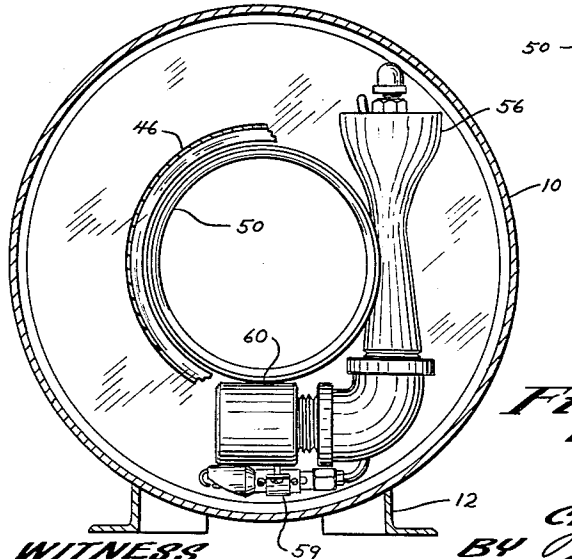


Fig. 6

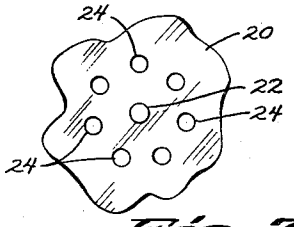


Fig. 7

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United States Patent Office 3,117,770 Patented Jan. 14, 1964

3,117,770
COMBINATION AIR WARMING AND CENTRIFUGAL FAN UNIT FOR TRANSMITTING HEATED AIR

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Filed Apr. 19, 1961, Ser. No. 104,128
5 Claims. (Cl. 263—19)

My invention relates to air movement equipment and more particularly to a centrifugal fan unit that is especially adapted to transmit heated air.

The life expectancy of an electrical fan motor is largely determined by the work load imposed thereon and the operating temperatures to which the motor is subjected. Motor temperatures are largely determined by the work load imposed on the motor, but the operating temperatures of fan motors are sometimes increased when the fan is used to transmit heated air. The air turbulence resulting from placing a burner unit directly in the air stream also increases the load on the fan motor, and hence, this turbulence is also a factor of the motor temperature.

Therefore, the principal object of my invention is to provide a centrifugal fan unit for transmittal of hot air which will reduce the comparative load on the fan motor and which will reduce the motor operating temperatures.

A further object of my invention is to provide a centrifugal fan unit for transmittal of heated air which can utilize an independent source of air for motor cooling purposes.

A still further object of my invention is to provide a centrifugal fan unit for transmittal of heated air which can heat the air without substantially increasing air turbulence.

A still further object of my invention is to provide a centrifugal fan unit for the transmittal of heated air which can increase the power output of the motor without exceeding the normal rise in motor temperatures.

A still further object of my invention is to provide a centrifugal fan unit for the transmittal of heated air which will cool the fan motor with a source of clean air other than the heated air stream, and which will further reduce motor temperatures by the location of the burner unit in relation to the heated air stream so that excessive air turbulence, and hence, excessive load on the motor, is reduced.

These and other objects will be apparent to those skilled in the art.

My invention consists in the construction, arrangements, and combination, of the various parts of the device, whereby the objects contemplated are attained as hereinafter more fully set forth, specifically pointed out in my claims, and illustrated in the accompanying drawings, in which:

FIG. 1 is a longitudinal sectional view of my device showing the construction of the centrifugal fan, the motor casing, and the motor housing;

FIG. 2 is a sectional view of my device taken on line 2—2 of FIG. 1;

FIG. 3 is a rear elevational view of the centrifugal fan motor taken on line 3—3 of FIG. 1;

FIG. 4 is a partial sectional view of my device similar to FIG. 1 except FIG. 4 shows the motor housing intact;

FIG. 5 is a perspective view of my device;

FIG. 6 is a sectional view of my device taken on line 6—6 of FIG. 4, and showing my burner element; and

FIG. 7 is a partial frontal elevational view of the motor housing taken on line 7—7 of FIG. 1.

I have used the numeral 10 to generally designate a hollow horizontal cylindrical drum which is mounted on any convenient support brackets 12. A frusto-conical

drum section 14 is welded or otherwise secured to the rearward end of drum 10 and terminates in flange 16 which has a smaller diameter than drum 10. Flange 16 is adapted to be secured to cylindrical air-conveying pipe sections.

A frusto-conical motor housing 18 is mounted in axial alignment within drum 10 and is held in spaced relationship with the drum by a plurality of air straightening vanes 19 which span the distance between the interior of the drum to the exterior of the housing 18. The forward ends of straightening vanes 19 are arcuate as shown in FIGS. 1, 2 and 4. Motor housing 18 has a circular front plate 20 with a center hole 22 and a plurality of holes 24 disposed in a concentric pattern thereabout. An electric motor casing 26 is secured to the rearward side of plate 20 by bolt and nut assemblies 28. Motor casing 26 is so disposed on plate 20 that the power shaft 30 of the motor penetrates and extends beyond center hole 22. As shown in FIG. 1, a plurality of holes in motor casing 26 register with holes 24 in plate 20. Motor casing 26 is of conventional construction and has rotor 32, field windings 34 and an air passageway 36. As shown by the arrows in FIG. 1, air is free to pass into the motor casing 26 through passageway 36, thence through the motor casing itself, and thence through the holes 24 in plate 20. A hollow pipe 38 extends between openings in motor housing 18 and drum 10 to permit the housing to communicate with air outside the drum.

A circular centrifugal fan plate 40 is rigidly secured at its center to motor shaft 30 by means of coupling element 42. Plate 40 is positioned on shaft 30 in spaced relation to motor housing plate 20, as shown in FIG. 1. A plurality of fan blades 44 are welded or otherwise secured to plate 40 and extend forwardly therefrom as shown in FIGS. 1 and 4. Blades 44 are pitched to bite the air as plate 40 is rotated about its center. The forward edges of blades 44 are tapered, and frusto-conically shaped collar 46 is welded or otherwise secured to the forward edges of the blades. Blades 48 are welded or otherwise secured to the rearward side of plate 40 and are positioned as if they were extensions of blades 44. Blades 48 are adapted to move in that space between plate 40 and motor housing plate 20. An air inlet cowling 50 which has its open center portion curved inwardly and rearwardly terminates just inside but in spaced relation to collar 46. Cowling 50 is detachably secured to drum 10 by bolts 51. Insulation material 52 can be secured in any convenient manner within drum 10 in the area surrounding blades 44 and air inlet cowling 50.

An annular space 54 is created around the outside of the center portion of air inlet cowling 50, and an L-shaped burner element 56 is secured therein in any convenient fashion. Burner element 56 is connected to a gas supply by means of pipe 58. An electric spark means 59 extends from the burner head 60 to a control box 62 which is mounted on top of drum 10. A suitable gas control valve can also be associated with pipe 58 within control box 62. The details of this control mechanism do not comprise a part of my invention. Air access openings 64 can be located in box 62 so as to supply a fuel supply of air to pipe 38 and motor housing 18. An electrical conduit 66 can extend from the motor windings and motor casing 26 upwardly through pipe 38 to an electrical control means and a source of electrical current.

The normal operation of my device is as follows: Gas vapors are permitted to flow through burner element 56 and out burner head 60 by means of an appropriate gas control valve in pipe 38. An appropriate control on spark means 59 can cause the gas vapors to be ignited at the point of burner head 60. Electrical energy is then supplied to the conventional motor components within motor casing 26, and motor shaft 30 thereupon rotates

and imparts this same motion to fan or rotor plate 40 and blades 44 and 48. The rotation of the blades 44 causes air to be pulled through cowling 50, and thence through the centrifugal fan comprised of plate 40, blades 44 and collar 46. As shown by the arrows in FIG. 1, the air is then discharged into drum 10 around the periphery of the blades 44. The space 54 is comprised essentially of eddy currents of air which are heated by the ignited gases of burner 56 and are swept into immediate contact and mixture with the incoming air. These eddy currents permit a more uniform temperature distribution than would result if a burner were located directly in the air stream, whether on the intake or discharge side of the fan means. The absence of the burner from dwelling in the direct air stream prevents the turbulence to this stream that normally occurs when burners are located in the air stream on either the inlet or discharge sides of the fan rotor. Thus, the specific location of burner 56 requires a smaller work output by the fan motor for the movement of a given quantity of air, as compared to the other possible locations of the burner, and this savings in work output by the motor results in lower motor temperatures. As the air is heated at the periphery of the fan rotor, it is caught by the arcuate forward ends of air straightening vanes 19 and the air is then directed rearwardly and outwardly from the drum 10.

The rotation of rotor plate 40 permits the blades 48 to pull air from the motor casing 26 through holes 24. This air is discharged into the main heated air stream at the periphery of blades 48. This discharge of air through holes 24 in plate 20 causes fresh cool air to be pulled into the motor casing 26 from housing 18 through passageway 36, and fresh air is then pulled into the housing 18 from conduit 38, control box 62, and the outside atmosphere. Thus, the blades 48 are continuously pulling a source of fresh air over the motor components which serves to keep the motor temperatures at a reduced level. Inasmuch as the environmental use of my device often experiences dust particles and the like in the heated air stream, it is seen that the above motor-cooling action serves to protect the motor from this contamination. Furthermore, the motor cooling action will protect the motor from corrosive air pulled in through the air inlet cowling 50 and given off by the heating element mounted in the drum. It is apparent that if my fan rotor were powered by a motor remotely located from housing 20, the described cooling apparatus would still serve the useful purpose of cooling and protecting against corrosive gases, the bearing means for the fan motor shaft.

Thus, from the foregoing, it is seen that my device will accomplish at least all of its stated objectives.

Some changes may be made in the construction and arrangement of my Combination Air Warming and Centrifugal Fan Unit for Transmitting Heated Air without departing from the real spirit and purpose of my invention, and it is my intention to cover by my claims, any modified forms of structure or use of mechanical equivalents which may be reasonably included within their scope.

I claim:

1. In a device of the class described, a drum having open forward and rearward ends, an enclosed motor housing, means for securing said motor housing within said drum, openings in the sides of said drum and said housing, a pipe connecting the openings of said drum and said housing so that said housing can communicate with the air outside said drum, a power shaft coaxially positioned in said drum and extending forwardly from said housing, a plate rigidly secured to said shaft and in spaced relation to said housing, first blades on the forward side of said plate whereby air will be drawn into the forward end of said drum and to the periphery of said plate upon the rotation of said shaft, openings in said housing adjacent said shaft, blades on the rearward side of said plate adjacent said openings in said housing whereby air will be pulled from said housing upon the rotation of said shaft, a cowling on the forward end of said drum and having its center portion extending inwardly and rearwardly, the center portion of said cowling terminating in an opening adjacent said first blades, the forward end portion of said drum being spaced outwardly from the inwardly and rearwardly extending center portion of said cowling to form an annular space, the outer perimeter of said plate being spaced from the inside wall of said drum to form a space in direct communication with the outer perimeter of said annular space whereby air can be both delivered to and retrieved from said annular space by the supply of air being delivered to the space around said plate, an air heating burner element mounted within said annular space, and means in said housing for rotating said shaft.

2. In a device of the class described, a drum having open forward and rearward ends, a centrifugal fan rotor coaxially positioned in said drum, means for rotatably mounting said fan rotor within said drum whereby the rotation of said rotor will draw air through the forward end of said drum and to the periphery of said rotor, a cowling on the forward end of said drum and having its center portion extending inwardly and rearwardly, the center portion of said cowling terminating in an opening adjacent said fan rotor, the forward end portions of said drum being spaced outwardly from the inwardly and rearwardly extending center portion of said cowling to form an annular space, the outer perimeter of said rotor being spaced from the inside wall of said drum to form a space in direct communication with the outer perimeter of said annular space whereby air can be both delivered to and retrieved from said annular space by the supply of air being delivered to the space around said rotor, an air heating burner element mounted within said annular space, and means in said housing for rotating said shaft.

3. In a device of the class described, a drum having open forward and rearward ends, an enclosed motor housing, means for securing said motor housing within said drum, openings in the sides of said drum and said housing, a pipe connecting the openings of said drum and said housing so that said housing can communicate with the air outside said drum, an electric motor having a motor casing in said housing and operatively connected to a source of electrical current, a power shaft extending forwardly from said motor and said housing and being coaxially mounted in said drum, a plate rigidly secured to said shaft and in spaced relation to said housing, first blades on the forward side of said plate whereby air will be drawn into the forward end of said drum and to the periphery of said plate upon the rotation of said shaft, openings in said motor casing and said housing adjacent said shaft, an air passageway in said motor casing, blades on the rearward side of said plate adjacent said openings in said housing whereby air will be pulled from said housing upon the rotation of said shaft, a cowling on the forward end of said drum and having its center portion extending inwardly and rearwardly, the center portion of said cowling terminating in an opening adjacent said first blades, the forward end portion of said drum being spaced outwardly from the inwardly and rearwardly extending center portion of said cowling to form an annular space, the outer perimeter of said plate being spaced from the inside wall of said drum to form a space in direct communication with the outer perimeter of said annular space whereby air can be both delivered to and retrieved from said annular space by the supply of air being delivered to the space around said plate, and an air heating burner element mounted within said annular space to heat air delivered into said annular space.

4. In a device of the class described, a drum having open forward and rearward ends, a centrifugal fan rotor coaxially positioned in said drum, means for rotatably mounting said fan rotor within said drum whereby the rotation of said rotor will draw air through the forward end of said drum and to the periphery of said rotor, a cowling

on the forward end of said drum and having its center portion extending inwardly and rearwardly, the center portion of said cowling terminating in an opening adjacent said fan rotor, the forward end portion of said drum being spaced outwardly from the inwardly and rearwardly extending center portion of said cowling to form an annular space, the outer perimeter of said rotor being spaced from the inside wall of said drum to form a space in direct communication with the outer perimeter of said annular space whereby air can be both delivered to and retrieved from said annular space by the supply of air being delivered to the space around said rotor, an air heating burner element mounted within said annular space, and means in said housing for rotating said shaft.

5. In a device of the class described, a drum having open forward and rearward ends, a centrifugal fan rotor having a shaft coaxial positioned in said drum, power means for rotatably mounting said shaft within said drum whereby the rotation of said rotor will draw air through the forward end of said drum and to the periphery of said rotor, a housing for enclosing said power means, means for securing said power means within said drum, the sides of said drum and housing each having an opening formed therein, a pipe connecting the openings of said drum and said housing so that said housing can communicate with the air outside said drum, said rotor having a plate rigidly secured to said shaft and in spaced relation to said housing, first blades on the forward side of said plate whereby air will be drawn into the forward end of said drum and to the periphery of said plate upon rotation of said shaft,

second blades on the rearward side of said plate opposite said first blades, said housing having openings in its wall adjacent said second blades, said second blades adapted to pull air from said housing upon the rotation of said shaft, a cowling on the forward end of said drum and having its center portion extending inwardly and rearwardly, the center portion of said cowling terminating in an opening adjacent said first blades, the forward end of said drum spaced outwardly from the inwardly and rearwardly extending center portion of said drum to form an annular space, a heat producing means in said annular space, said outer perimeter of said plate being spaced from the inside wall of said drum to form a space in direct communication with the outer perimeter of said annular space whereby air can be both delivered to and retrieved from said annular space by the supply of air being delivered to the space around said plate from the forward end of said drum.

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