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DUAL FAN CONSTRUCTION

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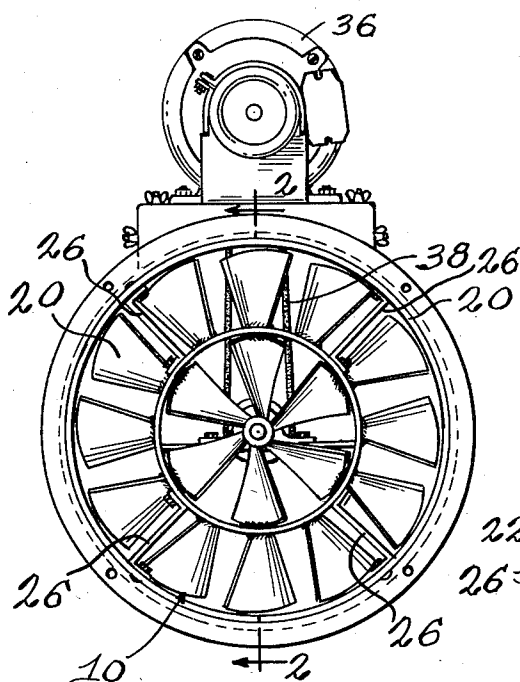


Fig. 1

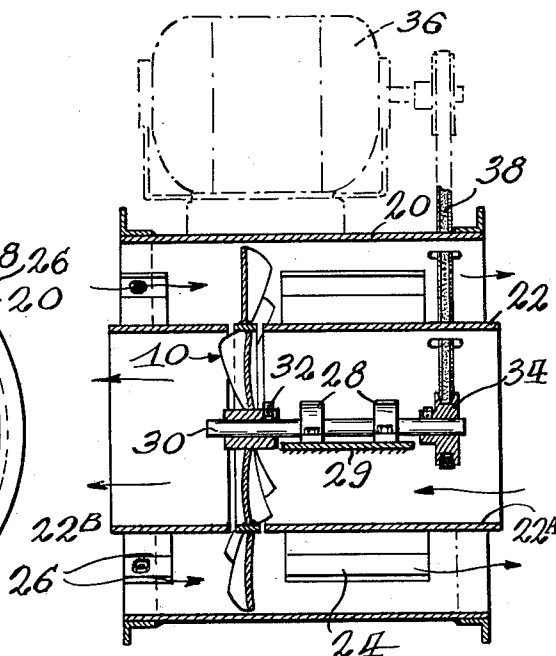


Fig. 2

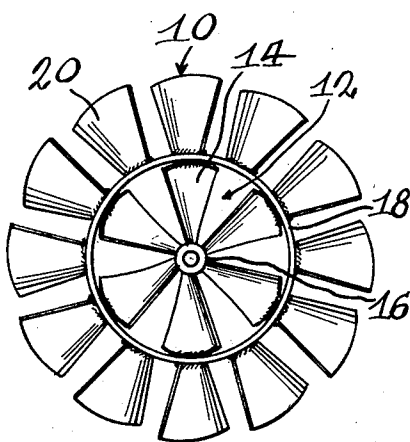


Fig. 3

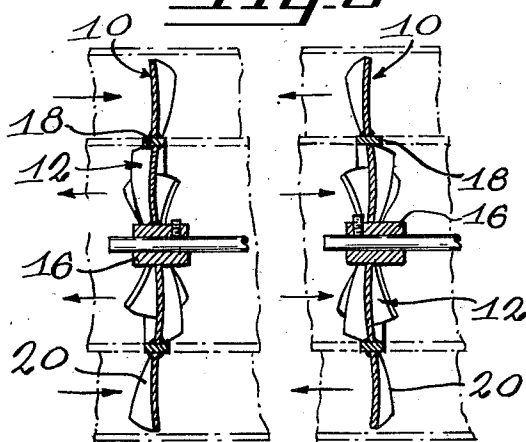


Fig. 4 Fig. 5

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DUAL FAN CONSTRUCTION

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1 Claim. (Cl. 230—117)

The present invention relates to the manufacture of fans and more particularly to the manufacture of fans particularly suited for use in industrial air circulation, ventilating, air conditioning, and heat transfer installations.

While there are many and varied types of fans available, which are utilized for the purpose of introducing or exhausting air from industrial buildings or equipment, the present invention aims to provide a novel fan construction wherein a single fan assembly is capable of performing the double function of exhausting and introducing air through two separate ducts.

Accordingly, the invention comprises of a dual purpose fan which consists essentially of a fan assembly having a first central fan portion comprising of radially spaced-apart blades extending from a central hub, an annular flange surrounding the outer tips of the first set of fan blades and a further plurality of radially spaced-apart blades which extend outwardly from the annular flange.

The first and second sets of blades are arranged concentrically and are disposed so as to be inclined in the same plane but in opposite directions.

In the preferred arrangement, this dual set of fan blades is mounted for rotation within a concentric arrangement of cylindrical casings so that the first central set of blades is adapted to draw or expel air in one direction through a central cylindrical duct or casing while the other or outer set of blades is adapted to expel or draw in air through an annular space provided between the central cylindrical casing and a larger outer casing in the opposite direction. With this arrangement, there is provided means for accomplishing a parallel flow of air in opposite directions by the rotation of a single unit. The division of the air flow by the concentrically disposed casings keeps the individual flows completely separate. As will be appreciated, the pitch applied to both sets of blades can be varied depending on the application and the diameters of both the inner set of blades and the outer sets of blades can also be varied to suit particular applications.

The number of blades on both the internal and external portions of the fan can also be varied and in the preferred construction the combined blades are formed so as to be symmetrical about the central hub so that if desired the entire combined blade assembly can be removed and reversed, thus reversing the direction of the respective air flows delivered from the apparatus.

Having thus generally described the nature of the invention, particular reference will be made to the accompanying drawings wherein there is shown by way of illustration a preferred embodiment, and in which:

Figure 1 is a view in front elevation of a dual fan construction in accordance with the invention.

Figure 2 is a transverse cross sectional view of the construction shown in Figure 1 along the line 2—2 to illustrate the internal arrangement in more detail.

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Figure 3 is a view of the combined fan blade unit as it would appear when removed from the casing.

Figure 4 is a diagrammatic view with the blades being shown in section and the casing shown in dotted lines to illustrate the parallel counter flow with the blade unit mounted in one direction.

Figure 5 is a diagrammatic view corresponding to Figure 4 and showing the reversal of the air flow when the fan unit is reversed within the cylindrical casings.

With particular reference to Figures 1 and 2 of the drawings, a dual fan construction in accordance with the invention consists essentially of a dual blade unit 10 which is made up of a central fan portion 12 having blades 14 extending radially outwards from a central hub 16. The tips of the blades 14 are surrounded by an annular flange 18 and a further plurality of blades 20, making up the second fan assembly, are mounted concentrically to the annular flange 18 in radially spaced-apart relationship.

In the construction illustrated the fan blades 14 are inclined in one direction while the fan blades 20 are inclined in the opposite direction so that the inner fan assembly 12 is adapted to expel air while the outer blades 20 are adapted to draw in air. This illustration is relative only. As shown in Figures 4 and 5, the fan unit 10 is preferably constructed so as to be symmetrical about the central hub 16 so that it can be reversed and thus reverse the respective air flow.

The combined fan unit 10 is mounted for rotation within a first outer casing 21 and a second inner casing 22 which is mounted concentrically of the first casing 21. The second inner casing 22 is divided into two unequal portions 22A, 22B, with the portion 22A being permanently secured in position within the casing 21 by means of supports 24 which are preferably welded to the respective casings.

The front portion 22B of the inner casing 22 is mounted for removal by spaced apart bracket members 26 which are secured to the casing portion 22B and the outer casing 20 by means of suitable nuts and bolts. The portion 22B of the air conducting casing is removable so as to allow for the removal and reversal of the fan assembly unit 10 as previously described.

The fan assembly 10 is supported for rotation within the inner casing portion 22 by a transverse supporting plate 29 which is secured to the inner casing portion 22A so as to extend diametrically across the inner surface of the casing slightly below the axial centre line. Bearings 28 are mounted on the plate 29 in spaced apart relationship and a shaft 30 is mounted within the bearings 28 so as to have one end extending beyond the plate 29 and the casing portion 22A and the other end extending rearwardly of the plate 29 as is shown in Figure 2. The blade assembly 10 is mounted on the forward end of the shaft 30 by means of suitable set screws 32 provided in the hub 16, while a V pulley 34 is mounted on the other end of the shaft 30. The pulley 34 is connected to a motor 36 by means of a V belt 38 which passes through suitable openings 37 provided in the outer casing 21 and the inner casing portion 22A.

With this arrangement, rotation of the shaft 30 through the belt 38 from the motor 36 is adapted to rotate the fan assembly 10 causing the inner blade assembly 12 and the outer fan blades 20 to revolve in the same direction. Due to the inclination of the blades of the respective fan portions the air flow induced by this rotation is two-way. While both air flows are parallel and are axial relative to the fan unit they are in opposite directions.

It is contemplated that a fan unit constructed in ac-

cordance with the invention may be used in various applications, for example, it may be used in a duct system, or in a wall installation, or in a roof installation. By way of an example, an experimental model has been built wherein the outer cylindrical casing and consequently the overall diameter of the fan unit was approximately 14 inches, while the inside cylindrical casing and consequently the inside fan assembly 12 was approximately 7½ inches in diameter. When this unit was driven by a ¼ H. P. motor at approximately 1725 R. P. M., with a reduction through the pulley 34 to give a fan speed of approximately 1150 R. P. M., the centre or inner fan unit delivered approximately 250 C. F. M., while the outer fan unit delivered approximately 1600 C. F. M. in the opposite direction. In this experimental model the pitch of the fan blades 14, and 20, respectively, was 45° but it is contemplated that this pitch may be varied depending on the size of the blades, the speed of revolution, and the particular application for which the unit is intended.

As will be appreciated, by reference to the proceeding description and the accompanying drawings the size of the internal fan arrangement and the external fan arrangement may be varied as desired, the pitch of the blades and the number of the blades may also be varied as desired to suit any particular application, the main requirement being that the blades of both inner and outer assemblies are disposed in the same plane and rotated in the same direction, but are inclined in opposite directions to give the counter axial flow required. It is also of prime importance that the inner and outer fan units be separated by suitable cylindrical casings or housings, otherwise, turbulence will occur and the flow in both sections rendered ineffective.

I claim:

A dual purpose fan adapted for use in industrial air circulating systems, comprising a first fixed continuous cylindrical outer casing of constant diameter, a second cylindrical inner casing of constant diameter mounted to and concentrically of said outer casing, said inner casing being in two separate portions, one removable and one fixed with respect to said outer casing with the inner ends of said inner casing portions being disposed in spaced aligned relationship relative to each other in

intermediate the axial length of said outer casing, said inner and outer casings having unobstructed open ends, a supporting plate mounted in and extending transversely across the fixed portion of said inner casing with its bearing surface aligned in the axial direction of said casing, a dual fan assembly mounted for rotation on a shaft journaled on said supporting plate in alignment with the axis of said inner casing, said fan assembly having a central hub mounted on said shaft with a first plurality of fan blades mounted at the roots to said hub so as to extend radially outwards therefrom and at the tips to an annular ring having a diameter equal to the diameter of said inner casing and fitting freely between said spaced inner casing portions to constitute a rotatable continuation thereof, a further plurality of fan blades mounted at the root to the exterior of said annular ring so as to extend radially outwards therefrom in trans-axial alignment with said first set of blades, said dual fan assembly being symmetrical about a trans-axial center line with said first and second blade sets inclined in opposite directions, a driving motor disposed exteriorly of said outer casing, and a driving connection passing trans-axially through said inner and outer casings to said fan assembly shaft.

References Cited in the file of this patent

UNITED STATES PATENTS

1,131,762	Whipple	Mar. 16, 1915
1,672,272	Moore	June 5, 1928
1,991,194	Child	Feb. 12, 1935
2,101,502	Keller	Dec. 7, 1937
2,145,131	Rhines	Jan. 24, 1939
2,189,008	Kurth	Feb. 6, 1940
2,277,868	Meyerhoefer	Mar. 31, 1942
2,279,489	Payne	Apr. 14, 1942
2,414,410	Griffith	Jan. 14, 1947
2,435,138	Heppner	Jan. 27, 1948
2,584,878	Howell	Feb. 5, 1952
2,646,209	Galliot	July 21, 1953
2,677,497	Spooner	May 4, 1954

FOREIGN PATENTS

579,585	Germany	July 31, 1931
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