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PROPELLER TYPE FLUID TRANSLATING DEVICE

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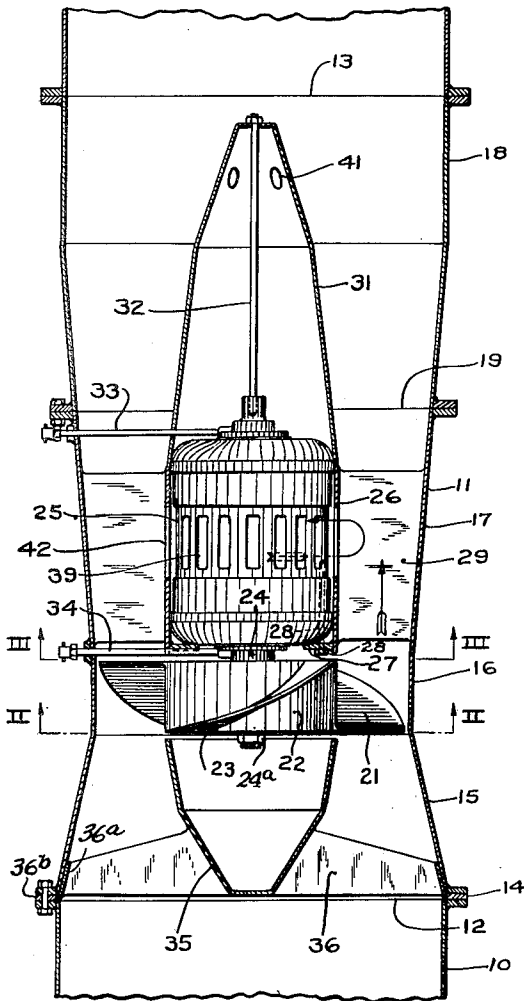


FIG. 1.

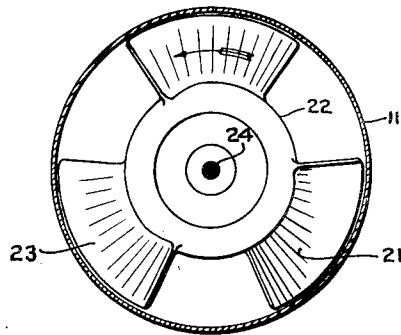


FIG. 2.

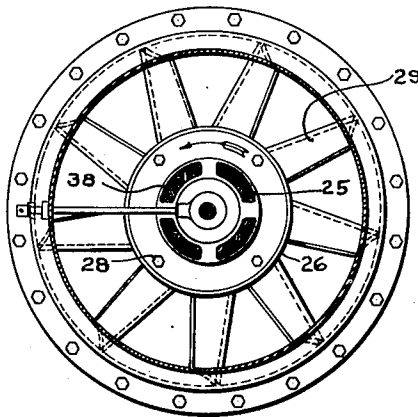


FIG. 3.

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PROPELLER TYPE FLUID TRANSLATING
DEVICE

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Application February 28, 1930. Serial No. 432,149

4 Claims. (Cl. 230—117)

My invention relates to propeller type fluid translating apparatus such as, for example, blowers and pumps, and it has for an object to provide apparatus of the character designated which shall operate effectively, reliably and efficiently and which shall be so constructed and arranged as to provide a flow passage offering a minimum of resistance to the movement of fluid through the apparatus.

It has for still another object to provide a form of apparatus of the character designated which shall embody stationary guide vanes disposed adjacent to the propeller for removing the twist or swirl of the fluid discharged by the propeller and, in order to provide as compact an arrangement of apparatus as is possible, it has for another object to so form the guide vane structure that it serves as a housing for the prime mover driving the propeller.

My invention has for still another object to embody, in the apparatus, an improved form of passage for delivering the fluid to the propeller and it has for a further object to provide new and more effective means for cooling the prime mover in types of apparatus wherein an electric motor is utilized to drive the propeller.

These and other objects are effected by my invention as will be apparent from the following description and claims taken in connection with the accompanying drawing, forming a part of this application, in which:

Fig. 1 is a view, in sectional elevation, of one form of apparatus arranged in accordance with my invention; and,

Figs. 2 and 3 are transverse sectional views taken on the lines II—II and III—III of Fig. 1, respectively.

In Fig. 1, I show a duct or conduit 10 from which it is desired to withdraw gaseous media. In this connection, it is noted that my apparatus is equally well adapted for translating gaseous media or liquid media. However, in the present embodiment, I show, by way of example, a blower which is intended to withdraw air from the duct 10. It embodies a casing 11 having an inlet 12 and an outlet 13, the inlet 12 being connected to the duct 10 by flanges 14.

As shown, the casing 11 has a converging entrant portion 15, a cylindrical or throat portion 16, a diverging portion 17, and a cylindrical discharge portion 18. In order to facilitate manufacture, the casing is provided with a lateral division flange 19. Disposed within the throat portion of the casing is a propeller 21 having a hub portion 22 and a plurality of propeller blades 23.

Preferably, as disclosed and claimed in my United States Patent No. 1,596,459, issued August 17, 1926 for "Propeller pump" and assigned to the Westinghouse Electric and Manufacturing Company, the propeller blades have a projected area which is approximately two-thirds of the disc area. In addition, the blades preferably have an increasing axial pitch from their leading to their trailing edges and a constant radial pitch. Propellers having these and additional proportions, as disclosed and claimed in my aforesaid patent, have been found to operate, in apparatus of the character illustrated, with a substantially higher efficiency than any other form of propeller of which I am aware.

The propeller 21 is driven, through a shaft 24, by any suitable prime mover apparatus such as, for example, an electric motor 25. The propeller is detachably secured to the shaft 24 by a suitable nut 24a. The motor 25 is a unitary structure composed of the usual stator or housing element and a rotor element disposed within the housing and supported by suitable bearings carried by the latter. The motor 25 is disposed within an annulus 26, the hub 22 of the propeller being so formed as to have an outer diameter which is approximately the same as the outer diameter of the annulus 26. The propeller hub 22 and the annulus 26 therefore cooperate to form a smooth and substantially continuous surface for the flow of the air thereover. A ring 27 is secured to the inner, lower portion of the annulus 26 for supporting the motor 25, the shaft 24 and the propeller 21. Suitable bolts 28 extend into the motor housing for securing the motor to the ring.

The annulus 26 is supported from the blower casing by a plurality of guide vanes 29 disposed adjacent the discharge side of the propeller. The annulus 26 therefore forms a part of the guide vane structure, which guide vane structure supports the propeller and the motor from the blower casing. The guide vanes 29 are so formed as to comply with the air stream created by the propeller, in order that they may receive the air almost tangentially throughout their entire length. For the specific form of these guide vanes, reference may be had to my copending application, Serial No. 277,650, for "Propeller type blower" and assigned to the Westinghouse Electric and Manufacturing Company. The guide vanes serve to remove, from the air, the twist or swirl created by the propeller, and they are so formed as to avoid offering any appre-

ciable resistance to air flow so that little or no kinetic energy of the air stream is absorbed.

The annulus 26 has superposed thereon a conical fairing member 31 having its apex disposed near the outlet of the blower. The conical member 31 is so formed as to define, with the blower casing, a very gradually diverging annular flow passage. In order to retain the fairing member 31 in position, a rod 32 is fitted between its apex and the housing of the motor. Suitable radially-extending conduits 33 and 34 are provided for supplying lubricant to the bearings of the motor.

Disposed in the inlet portion of the blower casing is a conical fairing member 35 having its apex disposed near the entrance 12 and having its large end portion disposed adjacent to the propeller. Preferably, the large end portion of the conical member 35 has an outer diameter which is approximately equal to the diameter of the hub of the propeller so as to provide a continuous, gradually converging annular passageway. Although, the fairing member 35 may be secured to the propeller and rotate therewith, I prefer, in the present embodiment, to have the conical member remain stationary and it is therefore retained in position by a plurality of circumferentially-spaced, radially-extending brackets 36. The brackets 36 are secured at their outer ends to a frustro-conical shape ring 36a of the same shape as and freely fitting the interior of the entrant portion 15. The ring 36a is suitably secured to a second ring 36b, which latter is disposed between and held by the flanges 14. Thus when the casing 11 is removed from the duct 10, the fairing cone member 35 may be readily removed and access may be had to the nut 24a for disconnecting the propeller 21.

In order to provide ventilation for the motor 25, the latter is provided with customary inlet openings 38 in each of its end bells and outlet openings 39 spaced about its circumference. Air is supplied to the openings 38 in the lower end bell through the space intervening between the propeller hub and the motor while air is supplied to the openings 38 of the upper end bell through openings 41 provided in the fairing member 31. Air discharged through the openings 39 is returned to the air stream through openings 42 in the annulus 26, the openings 42 being located between the guide vanes.

From the foregoing description, the operation of my apparatus will be apparent. When the motor 25 is energized, the propeller 21 is rotated and serves to withdraw air from the conduit 10 and discharge it through the guide vanes 29 to the outlet 13. The guide vanes 29 are so formed that they remove the twist or swirl of the air as it leaves the propeller and hence the air is delivered to the outlet of the blower in substantially an axial direction. From inspection of Fig. 1, it will be apparent that I have devised a form of blower which is exceptionally compact, which advantage is obtained primarily by so forming the guide vane structure that it serves as a housing for the driving motor. It will be further noted that the conical fairing members 31 and 35, as well as the propeller hub 22 and the annulus 26, are all so formed in relation to each other that they cooperate to provide a smooth and continuous annular passageway, which passageway converges in the direction of the propeller and diverges in a direction away from the propeller. The form of the passageway is such that the resistance to be overcome by the air in passing through the blower is reduced

to a minimum and consequently there is little or no absorption of the kinetic energy of the air stream.

The motor is cooled by the circulation of air through the openings 41 into the top end bell of the motor and through the space adjacent the propeller hub into the lower end bell of the motor. As is well understood in the art, the motor is provided with means (not shown) for circulating air therethrough and out of the openings 39. The air thus discharged passes through the openings 42 and commingles with the annular air stream in the blower casing.

From the foregoing, it will be apparent that I have developed an improved form of propeller-type fluid translating apparatus and while, in the present embodiment, I show a form of this apparatus which is intended primarily for pumping gaseous media, it is to be understood that my invention is equally applicable to apparatus of this character for translating liquid media. Furthermore, while, in the present embodiment, I locate the stationary guide vanes and the driving motor housed therein on the discharge side of the propeller, it will be obvious that it is within the purview of my invention to locate them on the inlet side of the propeller.

A further advantage of my improved construction is the low cost of manufacture and the ease of assembly and repair. The motor 25 is a unitary structure readily assembled and replaced and can be made as a standard article of manufacture. It is extremely unlikely that any manufacturing plant which is equipped to make such apparatus as a blower, casing and fairing cone, is also equipped to make electric motors, for they are separate and distinct lines of endeavor and require workmen and engineers of different training and require different machines. However, this condition does not affect the manufacture of my apparatus, for, as stated, the motors can be made as a separate unit and at a plant equipped for manufacturing electrical products. The motor can even be shipped directly to the place of final installation, without the necessity of previous assembly in the apparatus at a second manufacturing plant.

Furthermore, the peculiarities of my construction are conducive to low repair costs. For example, if anything should happen to the motor, the apparatus may be readily taken apart, the motor taken out, a spare motor put in and the parts assembled and placed back in operation, all with little loss of time and service. The defective motor may be repaired at leisure and held in reserve as a spare.

While I have shown my invention in but one form, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various changes and modifications, without departing from the spirit thereof, and I desire, therefore, that only such limitations shall be placed thereupon as are imposed by the prior art or as are specifically set forth in the appended claims.

What is claimed is:—

1. In fluid translating apparatus, the combination of a casing, a propeller disposed within the casing, an annular casing disposed within the apparatus casing adjacent to the propeller, guide vanes for directing the path of the fluid circulated by the propeller and extending between the annular casing and the apparatus casing, an electric drive motor for the propeller disposed within the annular casing, means for de-

tachably securing the drive motor in the annular casing, and a fairing cone for the end of the annular casing remote from the propeller, said fairing cone embodying openings connecting
5 with the interior of the casing for affording circulation of fluid for ventilating the motor.

2. In fluid translating apparatus, the combination of a casing, a propeller disposed within the casing, an annular casing disposed within the
10 apparatus casing adjacent to the propeller, a plurality of guide vanes spaced circumferentially about the annular casing for directing the path of the fluid circulated by the propeller, said guide vanes extending between the annular casing and
15 the apparatus casing, an electric drive motor for the propeller disposed within the annular casing, and means for detachably securing the drive motor in the annular casing, said annular casing
20 embodying circumferentially-spaced openings interposed between the guide vanes for affording circulation of ventilating fluid for the motor.

3. In fluid translating apparatus, the combination of a casing, a propeller disposed within
25 the casing, an annular casing disposed within the apparatus casing adjacent to the propeller, a plurality of guide vanes for directing the path of the fluid circulated by the propeller, said guide vanes being spaced circumferentially and extending
30 between the annular casing and the apparatus casing, a drive motor for the propeller disposed within the annular casing, means for detachably securing the drive motor in the annular casing, a fairing cone for the end of the annular
35 member remote from the propeller, said fairing cone embodying an opening for supplying

ventilating fluid to one end of the motor and said annular member being open at its other end for
affording a supply of ventilating media to the other end of the motor, and circumferentially-spaced openings provided in the annular member
80 between the guide vanes for discharging ventilating fluid from the motor.

4. In fluid translating apparatus, a converging-diverging casing, a cylindrical inner casing
85 disposed axially of the outer casing and having inwardly-extending flange structure at one end, guide vanes connecting the inner and outer casings and constituting means for supporting the inner casing from the outer casing, a unitary motor insertable into and removable from the inner
90 casing and supported from said flange structure, said motor including stator and rotor elements with the rotor element carried by bearings provided at each end of the stator, detachable means
95 for holding the motor in place in said inner casing with one end of the stator abutting said flange structure, a propeller connected to the rotor and arranged adjacent to the end of said inner casing provided with said flange structure, a first
100 fairing cone carried by the outer casing at the side of the propeller opposite to the motor and diverging toward the propeller, a second fairing cone converging away from the end of said inner casing opposite to that provided with said flange
105 structure, and detachable means supported from the motor for holding the second fairing cone in place with its basal end engaging said last-mentioned end of the inner casing.

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