Aug. 23, 1932. H. F. SCHMIDT 1,873,336

PROPELLER TYPE FLUID TRANSLATING APPARATUS

Filed April 26, 1930

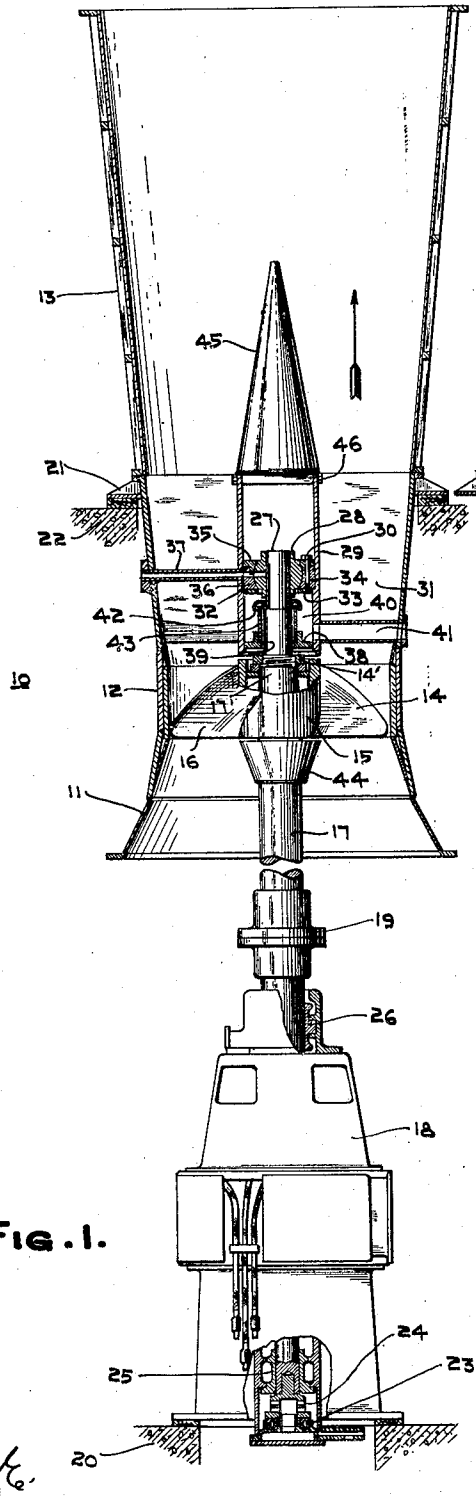


FIG. 1.

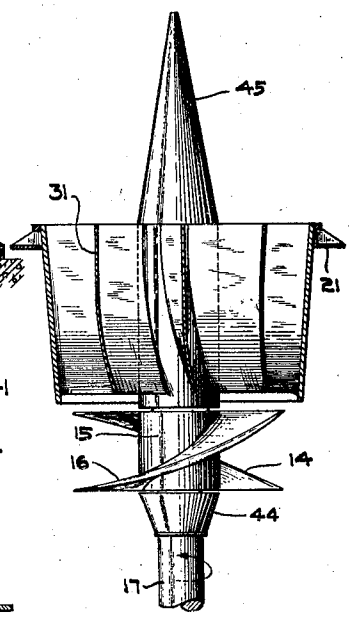


FIG. 2.

WITNESSES:
E. Lutz.
R. J. Ritchie.

INVENTOR
H. F. Schmidt.
BY
A. B. Davis
ATTORNEY

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UNITED STATES PATENT OFFICE

HENRY F. SCHMIDT, OF LANSDOWNE, PENNSYLVANIA, ASSIGNOR TO WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA

PROPELLER TYPE FLUID TRANSLATING APPARATUS

Application filed April 26, 1930. Serial No. 447,613.

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 be capable of operating reliably, effectively and efficiently and which shall be so arranged as to provide an improved structure for supporting the rotating parts.

It has for still another object to provide apparatus of the character designated which shall embody a stationary guide vane structure disposed adjacent to the propeller for altering the direction of flow of the fluid circulated by the propeller, which guide vane structure shall embody an improved form of bearing structure for supporting the drive shaft of the apparatus near the propeller.

It has for still another object to provide apparatus of the foregoing character which shall have an improved form of supporting structure for the apparatus, which form of supporting structure shall be especially applicable to blowers and pumps of large capacities.

It has for still another object to provide a propeller type blower or pump wherein the stator structure associated with the propeller is supported separately from the stator structure of the prime mover driving the propeller and wherein adequate means for supporting one end portion of the shaft connecting the rotating parts shall be embodied in the prime mover and adequate and improved means for supporting the other end of the shaft shall be embodied in the pump or blower structure.

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, partly in elevation and partly in section, of one form of apparatus arranged in accordance with my invention; and,

Fig. 2 is a view, in elevation, of the propeller and guide vane structure shown in Fig. 1.

In Fig. 1, I show a casing or body 10 having a converging inlet portion 11, an intermediate throat portion 12 and a diverging outlet portion 13. Disposed within the casing 10 is a screw propeller 14 having a hub portion 15 and a plurality of propeller blades 16. 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 has a projected area which is approximately 2/3 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 aparatus of the character illustrated, with a substantially higher efficiency than any other form of propeller of which I am aware.

The propeller 14 is driven, through a drive shaft 17, by any suitable prime mover apparatus such as, for example, an electric motor 18, the propeller being secured upon a tapered portion 17' of the drive shaft by a nut 14'. Provided in the drive shaft 17, between the motor and the propeller, is a coupling 19 for disconnecting the motor from the pump or blower apparatus. In the present embodiment, the driving motor 18 is disposed below the casing 10 and is supported upon a foundation structure, indicated at 20, while the casing 10 is provided with its own supporting feet 21 carried upon a separate foundation structure, indicated at 22. Such an arrangement is especially applicable to blower and pump installations of large capacity wherein the driving motor may be located at a substantial distance from the propeller.

The drive shaft 17 is supported, axially, in the lower end of the motor housing by a suitable thrust bearing 23, the drive shaft being provided with a thrust collar 24 for engaging the thrust bearing. For maintaining the shaft in radial alignment, a suitable steady bearing 25 is also provided in the lower portion of the motor. The steady bearing and

the thrust bearing 23 therefore cooperate to maintain the lower end of the shaft in its proper relation both axially and radially An additional steady bearing 26 is preferably provided in the upper end portion of the motor.

The foregoing arrangement provides adequate structure for supporting the lower end of the drive shaft in proper position both axially and radially. However, in view of the length of the drive shaft 17, the upper end of the latter must be supported so as to maintain it in proper radial alignment and, to this end, I provide the upper extremity of the shaft 17 with a journal portion 27 supported in a bearing 28. The bearing 28 is located within a core or annulus member 29 which is carried from or secure to the blower casing 10 by a plurality of circumferentially-spaced, inwardly converging, stationary guide vanes 31. The later, as shown particularly in Fig. 2, are generally curved in the direction of fluid flow and they function, when disposed on the discharge side of the propeller, to remove the twist or swirl from the fluid circulated by the propeller. For a detail description of the 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.

As stated heretofore, the core member 29 is supported from the casing 10 by the guide vanes 31 and the core member is counterbored at 32 and has attached thereto an annular ring 33, the shoulder of the counterbore and the ring forming a seat for a bearing retainer 34. The latter is divided into upper and lower sections 35 and 36, the upper section 35 interfitting with the lower section and being removable therefrom so as to permit removal of the bearing 28. The upper and lower sections 35 and 36 of the bearing retainer are detachably secured to the ring 33 by studs or tap bolts 30. The bearing retainer 34 is so bored as to conform with the spherical shape of the bearing 28 in order that the latter may be free to angularly adjust itself to the axial disposition of the shaft. Preferably, the guide vanes 31 are secured, at least in part, to the same portion of the casing 10 as the supporting feet 21. Lubricant is supplied to the bearing 28 by a conduit 37 extending radially through the casing.

The lower end of the core member 29 is provided with a plate 38 bored out at 39 to accommodate the drive shaft 17. The plate 38 forms a lubricant receptacle 40 in the lower portion of the core member and, lubricant is drained therefrom through a suitable, radially extending outlet 41. For preventing leakage of lubricant downwardly along the shaft toward the propeller, the drive shaft is provided, adjacent to the bearing 28, with an oil deflector 42, while the plate 38 is provided beneath the oil deflector with an upstanding sleeve 43 for preventing lubricant passing through the receptacle 40 from draining downwardly along the shaft.

Preferably, the hub portion 15 of the propeller has approximately the same diameter as the outside of the core member 29 so as to provide an even, nearly continuous surface for the fluid passing through the casing. In addition, the entrant side of the propeller is provided with a conical fairing member 44, while the core member is provided, on its discharge side, with a fish tail or fairing cone 45, both fairing cones, as well as the propeller hub and the core member, cooperating to insure that the fluid passes through the annular passage of the casing with a minimum of resistance to flow. The fairing cone 45 is preferably secured, as by screws 46, to the core member 39 so as to be detachable therefrom to permit removal of the bearing 28.

From the foregoing description, the operation of my apparatus will be apparent. Assuming that the motor 18 has been energized, the shaft 17 is rotated and the propeller 15 is actuated to circulate fluid through the casing in a direction from the inlet 11 toward the outlet 13. The guide vane structure 31 serves to remove the twist or swirl from the fluid as it is discharged from the propeller while the divergent portion 13 of the casing serves to convert a considerable portion of the velocity energy imparted to the fluid by the propeller into energy in the form of static pressure. Inasmuch as apparatus of this character may operate at relatively high rotating speeds, it is necessary that the rotating parts be adequately supported and, hence, the lower end of the shaft is supported both axially and radially by the bearings 23, 25, and 26, while the upper end of the shaft is supported by the bearing 28.

The bearing 28 is carried from the casing 10 by the guide vane structure 31. By means of such an arrangement, the guide vane structure 31 performs not only the function of removing the twist or swirl from the fluid circulated by the propeller, but it also serves the additional function of supporting the bearing 28 from the casing. In order to render the guide vane structure as effective as possible, it is advisable to locate the latter adjacent to the propeller and, in order that the shaft 17 may be so supported as to reduce deflection and avoid vibration as much as possible, it is also advisable that the bearing 28 be located as near as possible to the propeller and, preferably, on the side thereof remote from the driving motor. Hence, it will be apparent that, by supporting the bearing 28 by the guide vane structure 31, both objectives are accomplished and an ideal arrangement is consequently afforded.

In the embodiment illustrated, the stationary portion of the blower or pump structure

is supported independently of the driving motor and the supporting feet 21 of the casing 10 are preferably located adjacent to the guide vane structure 31 so that, the forces imposed upon the bearing 28 are transmitted directly to the foundation 22 and, hence, distortion of the blower casing is avoided. At the same time, the blower structure may be made relatively lighter in weight, a very desirable feature with apparatus of the character illustrated. While, in the preferred embodiment illustrated, I show an arrangement wherein the guide vane structure and the bearing are located on the discharge side of the propeller, it is to be understood that my invention is not confined to locating the guide vane structure and the bearing on that specific side but that my invention contemplates, in its broader aspects, locating the guide vane structure and the supporting bearing adjacent to one side of the propeller.

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 I claim is:

1. In a fluid translating device, the combination of a casing having an inlet and an outlet, a propeller disposed in the casing between the inlet and the outlet for translating fluid therebetween, a prime mover, a drive shaft for connecting the prime mover to the propeller, said drive shaft having a portion projecting beyond the propeller, an annulus member disposed in spaced relation about the projecting portion of the drive shaft, said annulus member having an open end remote from the propeller, a bearing for said projecting portion of the drive shaft, means for supporting said bearing within the annulus member and providing for removal thereof through the open end of the annulus member, and a fairing cone detachably secured to the annulus member and forming a closure for the open end thereof.

2. In a fluid translating device, the combination of a casing having an inlet and an outlet, a propeller disposed in the casing between the inlet and the outlet for translating fluid therebetween, a prime mover, a drive shaft for connecting the prime mover to the propeller, said drive shaft having a portion projecting beyond the propeller, an annulus member disposed in spaced relation about the projecting portion of the drive shaft, said annulus member having an open end remote from the propeller, stationary guide vanes extending between the annulus member and the casing for supporting the former from the latter and for altering the axial direction of the fluid circulated by the propeller, a bearing for said projecting portion of the drive shaft, and means for supporting said bearing within the annulus member and providing for removal thereof through the open end of the annulus member, whereby said bearing may be removed while the propeller, the drive shaft and the guide vanes are in place.

In testimony whereof I have hereunto subscribed my name this 21st day of April, 1930.

HENRY F. SCHMIDT.