May 21, 1946. A. I. PONOMAREFF ET AL 2,400,711

BLOWER APPARATUS

Filed Jan. 3, 1944 3 Sheets-Sheet 1

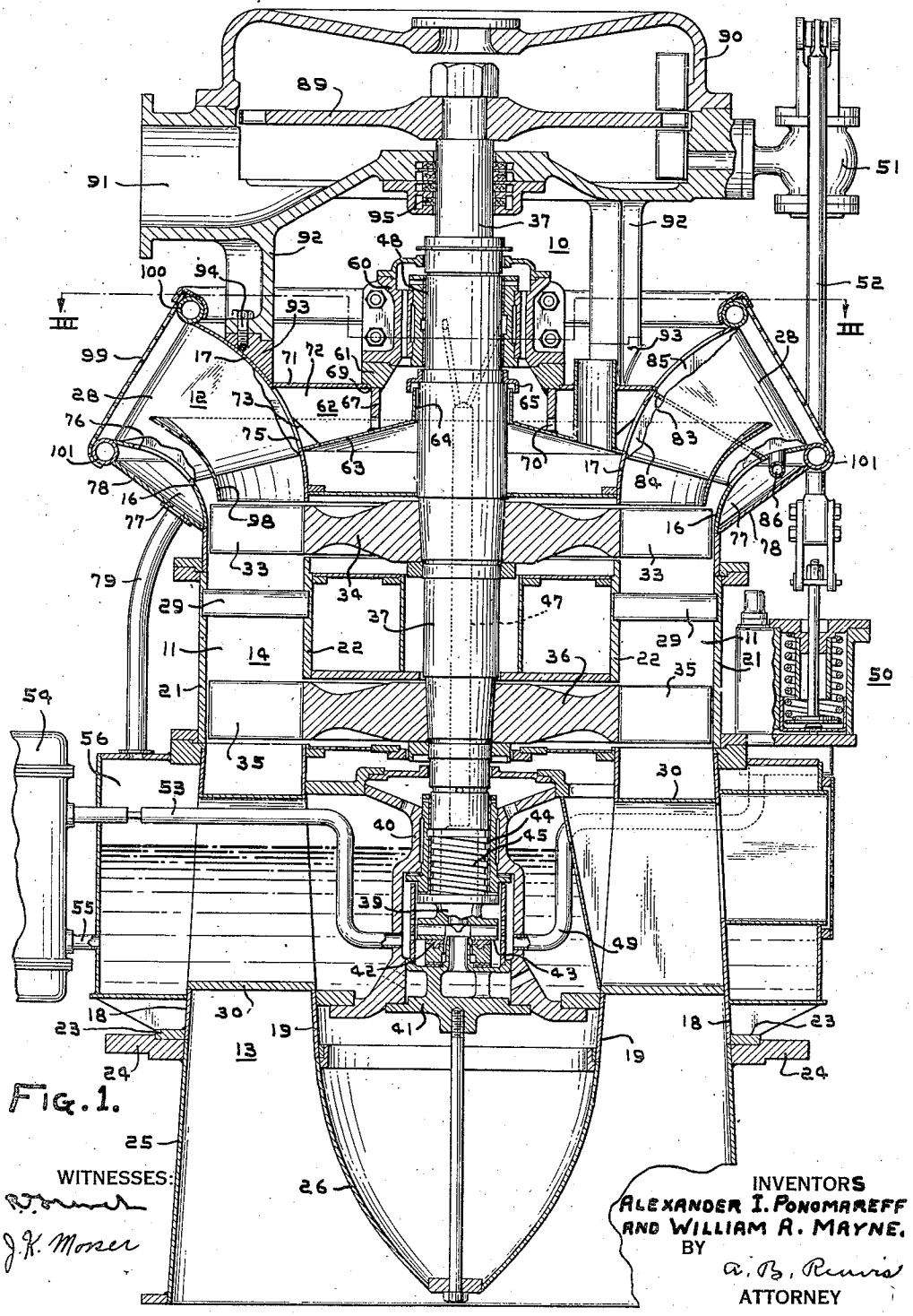


FIG. 1.

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BLOWER APPARATUS

Filed Jan. 3, 1944 3 Sheets-Sheet 2

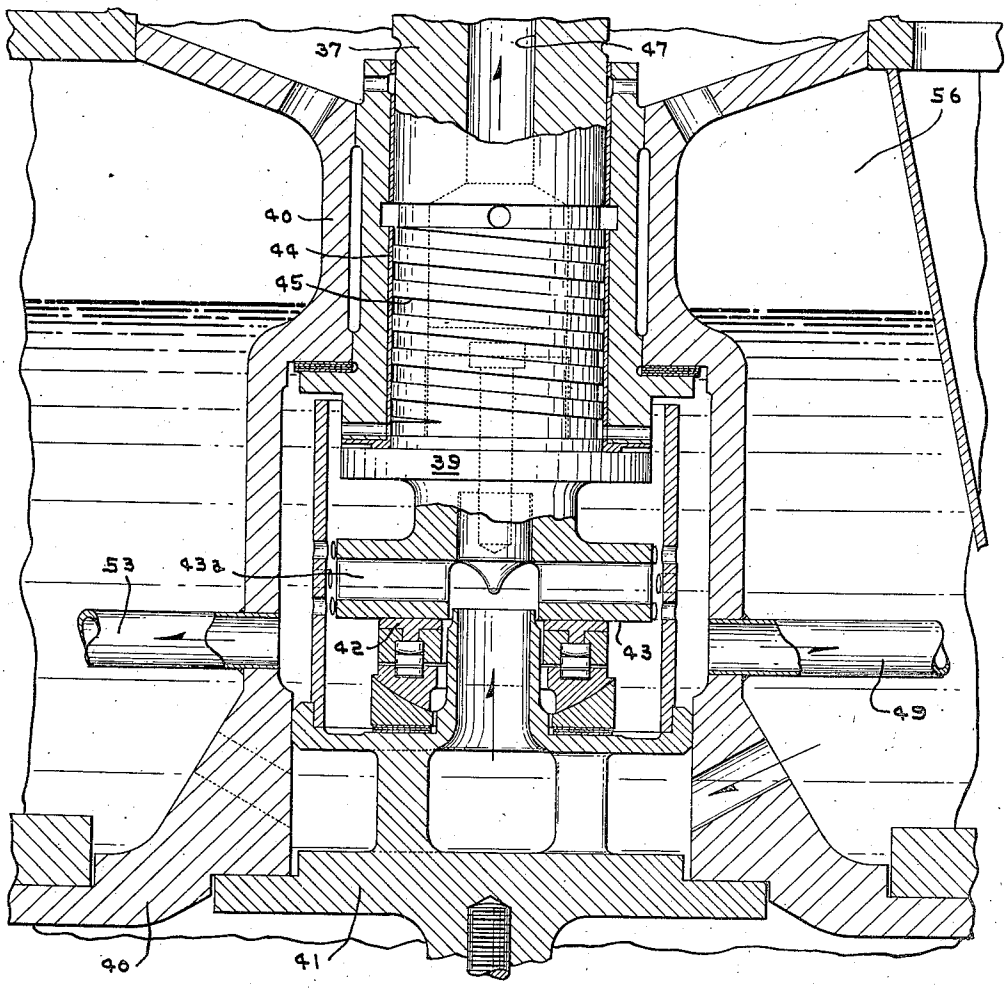


FIG. 2.

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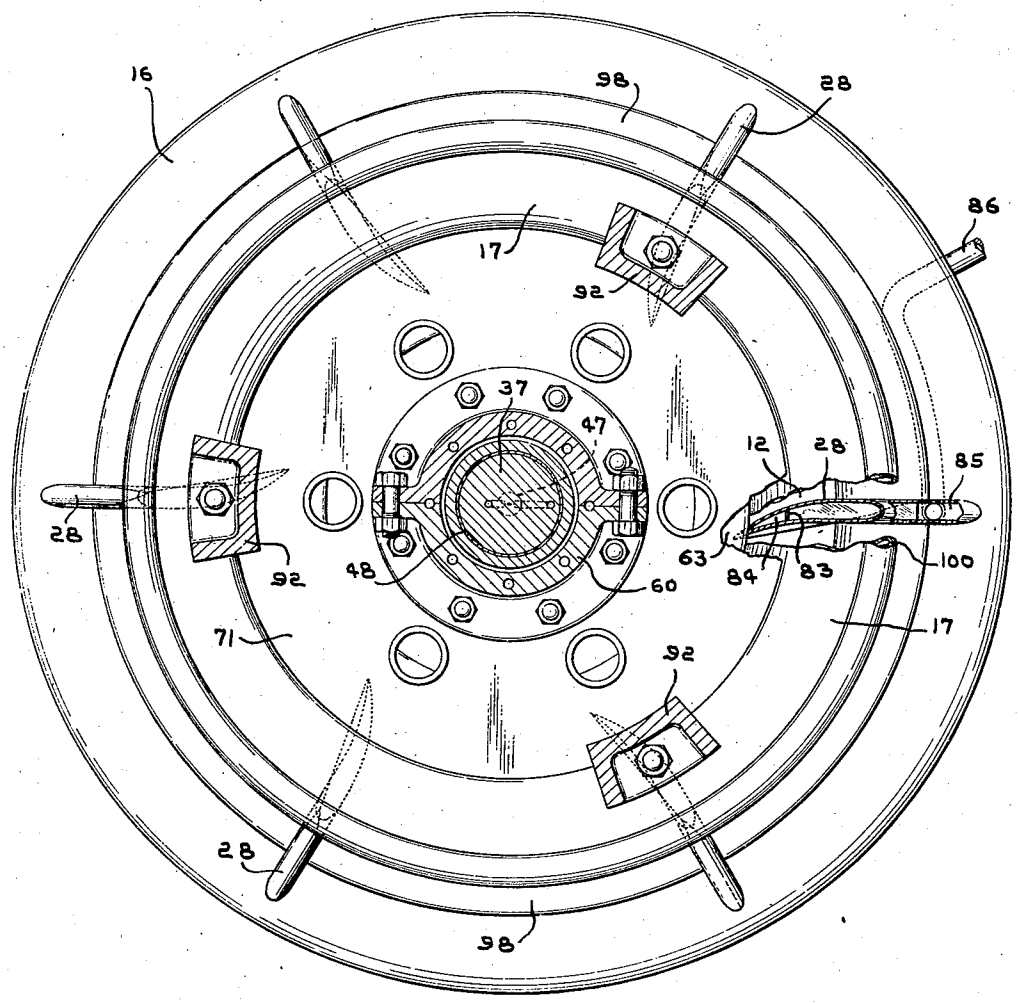
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BLOWER APPARATUS

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FIG. 3.



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UNITED STATES PATENT OFFICE

2,400,711

BLOWER APPARATUS

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Application January 3, 1944, Serial No. 516,792

9 Claims. (Cl. 230—122)

This invention relates to propeller blowers, and has for an object to provide apparatus of this character wherein the motor device for driving the propeller is overhung with respect to the propeller shaft, thereby requiring only one shaft gland, resulting in decreased overall length of the blower unit.

A further object of the invention is to provide, in a propeller blower of the vertical type, a novel fabricated supporting structure for the propeller shaft upper bearing.

Another object of the invention is to provide, in a propeller blower of the vertical type, novel means for returning oil from the upper bearing of the propeller shaft to the reservoir.

Yet another object of the invention is to provide, in a propeller blower of the vertical type, novel means for cooling the oil from the upper bearing during return of said oil to the reservoir.

A further object of the invention is to provide, in a propeller blower of the vertical type, novel slop drain construction.

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

Fig. 1 is a vertical sectional view of propeller blower apparatus embodying features of the present invention;

Fig. 2 is an enlarged sectional view of a portion of the structure shown in Fig. 1; and,

Fig. 3 is a sectional view taken along the line III—III of Fig. 1, looking in the direction indicated by the arrows.

Referring now to the drawings more in detail, the reference character 10 indicates, in its entirety, a propeller blower of the vertical type, wherein a double-walled casing provides an annular passage 11 for flow of air through the apparatus. The annular passage comprises a converging inlet portion 12 and a diverging outlet portion 13, joined by a throat portion 14. The inlet portion 12 is defined by an annular outer wall section 16 and a cooperating annular inner wall section 17. The outlet portion comprises an outer wall section 18 and an inner wall section 19, the outer wall sections 16 and 18 being joined by the outer wall section 21 of the throat section and the inner walls 17 and 19 having the inner wall section 22 of the throat portion located therebetween. The outlet portion 13 carries an external radially-projecting flange 23, secured to the main flange 24, carried by the bottom or last section 25 of the outlet portion, this flange 24 being adapted to be secured to any desired supporting structure, for example, the deck of the ship on which the blower is installed. The lower portion of the casing inner wall terminates in the fairing member 26, providing a streamlined exit for air passing through the blower structure.

The inner casing sections are supported from the corresponding sections of the outer casing by suitable hollow pre-twist guide vanes 28 in the inlet section, intermediate guide vanes 29 in the throat section, and hollow discharge guide vanes 30 in the outlet section. These guide vanes have their inner and outer edges welded or otherwise secured to the inner and outer casing sections, respectively.

Within the throat portion 14 are positioned first stage propeller blades 33, carried by a hub structure 34, and second stage propeller blades 35, carried by a hub structure 36. Both of these hubs are fixedly secured on the vertical shaft 37 with the blades 33 and 35 positioned at opposite sides, axially, of the intermediate guide vanes 29.

The lower terminal portion of the shaft 37 is supported by a combined thrust and radial bearing 39, which includes the bearing housing 40 (Fig. 2), supported from the inner casing section 19 of the outlet portion. A thrust bearing supporting structure 41 is secured to the bearing housing 40 in a suitable manner and carries the thrust bearing 42 which engages the lower end 43 of the shaft 37.

An impeller type pump 43a provides lubrication for the thrust bearing 42 and radial bearing 44, while a viscosity-type pump 45 directs oil under pressure through the shaft bore 47 to the upper radial bearing 48 (Fig. 1). The impeller type pump 43a likewise directs oil, under pressure, through the conduit 49 to the governor mechanism 50, which controls the main motive fluid admission valve 51, through the linkage 52. A conduit 53 conducts oil under pressure from the pump 43a to the oil cooler 54 from which it returns through the conduit 55 to the reservoir 56.

The upper radial bearing 48 is carried by a bearing housing 60, resting on the supporting ring 61, which is carried by a fabricated supporting structure, indicated in its entirety by the reference character 62. This fabricated supporting structure comprises a frusto-conical member 63 having the outer periphery of its base secured to the inner surface of the inner wall section 17 of the air passage inlet portion 12.

The inner periphery of the frusto-conical member 63 terminates adjacent the shaft 37 and

carries a sleeve-like member 64, extending upwardly beneath the downwardly-projecting lip of the skirt member 65, carried by the shaft 37. This overlapping construction of sleeve member 64 and skirt 65 assures that oil discharged from the upper bearing 48 will be deposited upon the upper inclined surface of the frusto-conical member 63, to flow therealong to the inner surface of the inner wall section 17. A tubular member 67 has its base welded, or otherwise secured, to the upper surface of the frusto-conical member 63 and is welded, or otherwise secured, at 69, to the supporting ring 61 thereabove, whereby the tubular member 67 provides vertical support of the supporting ring 61 from the frusto-conical member 63. The tubular member 67 is provided with a plurality of openings 70 in its lower edge, whereby there may be uninterrupted flow of lubricant therepast from the bearing to the inner surface of the inner wall section 17. An annular plate member 71 is disposed horizontally with its outer periphery secured to the inner wall section 17 and its inner periphery correspondingly secured to the supporting ring 61, whereby it serves to transmit radial stresses from the ring to the inner casing.

The three fabricated members 63, 67, and 71 are braced, or interconnected, by a plurality of radial web members 72, disposed in vertical planes and having their lower, inner and upper edges welded or otherwise secured to the members 63, 67 and 71, respectively.

The outer edges of the web members 72 are spaced from the inner surface of the inner wall sections 17, at 73, whereby oil flowing down the inclined surface of the frusto-conical member 63 may likewise flow circumferentially along the inner surface of said inner wall sections 17 past the outer ends of the web members 72. The inner wall section 17 is provided with one or more openings 75 providing communication with the hollow exteriors of the suction guide vanes 28, and the outer wall sections 16 are provided with corresponding openings 76 forming exits from the hollow exteriors of the inlet guide vanes, whereby said guide vanes function as passages for flow of oil from the upper surface of the frusto-conical member 63 to the space 77 provided between the annular outer wall section 16 and a conical plate 78, cooperating with said outer wall section. This space 77 is provided with a conduit 79 for return of oil from the space to the reservoir 56. As oil flows through hollow guide vanes 28 and circumferentially about the lower casing in the space 77, to reach the single discharge conduit 79, it passes in contact with the outer surface of the outer wall section 16, while air in large quantities is passing in contact with the inner surface of said outer wall section, whereby the oil is cooled.

One of the hollow suction guide vanes 28 (shown at the right in Fig. 1) is provided with a partition 83 dividing the space therein into a lower passage 84 and upper passage 85, the lower passage 84 functioning to conduct oil from the upper surface of the frusto-conical member 63 to the oil drainage space 77, and the upper passage 85, together with the conduit 86, providing a slop drain for water collecting upon the annular plate member 71.

In the construction herein illustrated, a shaft 37 is driven by a turbine comprising a rotor 89 secured to the upper end of the shaft 37 and enclosed in a casing or stator 90. Motive fluid is supplied to the turbine through the main admission valve 51 and discharges therefrom through the exhaust pipe 91. The turbine casing or stator 90 is supported by a plurality of spaced legs 92 secured to bosses 93, carried by the annular inner wall sections 17 of the inlet portion 12, by suitable means, such as bolts 94. It should be noted that this arrangement of an overhung turbine requires only one shaft sealing gland 95, thereby reducing the cost of manufacture of the apparatus and providing for a unit of minimum overall length, and minimum steam leakage from the cylinder.

Preferably, the inlet portion 12 of the annular passage 11 is provided with an anti-recirculation ring 98, in a well-known manner, and the inlet to this portion is covered by suitable screening 99, retained in operative position upon the beaded edges 100 and 101, by any suitable means.

While the invention has been shown 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 it is desired, therefore, that only such limitations shall be placed thereupon as are specifically set forth in the appended claims.

What is claimed is:

1. In a blower, an outer casing having convergent inlet and divergent outlet portions joined by a throat portion; a propeller in the throat portion and having a hub; a shaft disposed axially of the casing and carrying the propeller hub, one end of said shaft terminating within the divergent portion of the casing and the other end thereof projecting beyond the convergent end of said casing; first guide vane structure associated with the outlet portion of the outer casing and including first vanes having their outer ends joined to the divergent portion of the outer casing and having their inner ends joined to a first inner annular member disposed concentrically with respect to the divergent portion and defining the inner wall of an outlet passage, whereby said inner annular member is supported from the outer casing by said vanes; a first bearing structure carried by the inner annular member and supporting that end of the shaft which terminates within the divergent portion of the casing; second guide vane structure associated with the inlet portion of the outer casing and including second vanes having their outer ends joined to the convergent portion of said casing and having their inner ends joined to a second inner annular member disposed concentrically with respect to the convergent inlet portion and defining the inner wall of an inlet passage, whereby said second inner annular member is supported from the outer casing by said second vanes; a second bearing structure carried by the second inner annular member and supporting the shaft near, but spaced from, the end thereof which projects beyond the casing; and means for driving the shaft.

2. Structure as specified in claim 1, wherein the second bearing is supported from the second inner annular member through intermediate structure including a pair of axially-spaced and laterally-extending annular members having their outer peripheries joined to said second inner annular member; a ring to which the inner periphery of one of said axially-spaced and laterally-extending annular members is secured; an axially-extending tubular member joining the other of said axially-spaced and laterally-extending annular members to the ring; and a plurality

of circumferentially-spaced, radially and axially-extending plate-like members joined at their edges to the axially-spaced and laterally-extending annular members and to the tubular member and providing web structures therebetween.

3. In a vehicle propeller-type blower, a double-walled casing providing an annular passage for flow of air, said passage having a converging inlet portion and a diverging outlet portion connected by a throat portion; a propeller in the throat portion and having a hub; a vertically-disposed shaft carrying the propeller hub and having its lower terminal portion radially aligned with the outlet portion; a combined radial and thrust bearing carried by the outlet portion of the casing and supporting said lower terminal portion of the shaft; means for driving said shaft; a radial bearing for the upper end of the shaft at a point below the driving means; a housing for said bearing; and means for supporting said housing from the inlet portion of the casing, said means comprising a supporting ring to which the housing is bolted, a frusto-conical member having the periphery of its base secured to the inlet portion of the casing, a tubular member surrounding and coaxial with the shaft and secured at its lower edge to the upper surface of the frusto-conical member and supporting on its upper edge the supporting ring, and an annular plate having its outer periphery joined to the inlet portion of the casing and its inner periphery joined to the supporting ring to transmit radial forces from the latter to the former.

4. Structure as specified in claim 3, including vertical radial webs between the frusto-conical member and the annular plate.

5. In a vertical propeller-type blower, a double-walled casing providing an annular passage for flow of air, said passage having a convergent inlet portion and a divergent outlet portion connected by a throat portion; a propeller in the throat portion and having a hub; a vertically-disposed shaft carrying the propeller hub; a combined radial and thrust bearing carried by the outlet portion of the casing and supporting the lower terminal portion of the shaft; means for driving said shaft; a radial bearing for the upper portion of the shaft; means for supporting said last-mentioned bearing from the inlet portion of the casing, said means including a frusto-conical member having the periphery of its base secured to the inner wall of said inlet portion of the casing and extending therefrom upwardly and inwardly to within close proximity to the shaft at a point below the bearing and adapted to receive on its inclined upper surface oil discharged from said bearing; a plurality of hollow pre-twist guide vanes or supporting struts disposed in the inlet portion of the annular passage and serving to support the inner wall thereof from the outer, said inner and outer walls having openings therethrough providing inlets to and outlets from the hollow interiors of the pre-twist guide vanes or supporting struts, said inlet openings in the inner walls being aligned with the upper surface of the frusto-conical member, whereby oil collecting thereon may flow through the hollow guide vanes to the exterior of the double-walled casing; an oil reservoir; and means for conducting to said reservoir oil flowing through said hollow guide vanes.

6. Structure as specified in claim 5, wherein the means for conducting to the reservoir the oil flowing through the hollow guide vanes includes an annular plate cooperating with the outer wall of the casing inlet portion to provide a flow path for said oil, said outer wall being common to and separating said oil flow path and the air flow path through the blower, whereby the air passing in contact with the inner surface of said common wall cools the oil passing in contact with the outer surface thereof.

7. In a vertical propeller-type blower, a double-walled casing providing an annular passage for flow of air, said passage having inlet and outlet portions connected by a throat portion; a propeller in the throat portion and having a hub; a vertically-disposed shaft carrying the propeller hub; a combined radial and thrust bearing carried by the casing and supporting the lower terminal portion of the shaft; means for driving the shaft; a radial bearing for the upper portion of the shaft; a housing for said bearing; and means for supporting said bearing housing, said means including a frusto-conical member having the outer periphery of its base secured to the inner wall of the casing inlet portion, the member extending upwardly and inwardly to within close proximity to the shaft at a point below the bearing and being adapted to receive on its inclined upper surface oil discharged from said bearing, a vertically-disposed cylindrical member concentric with and spaced from the shaft with its lower edge secured to the upper surface of the frusto-conical member and having one or more openings therethrough adjacent its lower edge for unobstructed flow of oil down the inclined upper surface of the frusto-conical member, a supporting ring secured to the upper edge of said cylindrical member and to which the bearing housing is bolted, and a plurality of hollow guide vanes joined at their inner and outer edges to the inner and outer walls, respectively, of the inlet portion of the casing, said inner and outer walls having openings therethrough communicating with the hollow interiors of the guide vanes, said openings in the inner wall being disposed above the plane of the upper surface of the frusto-conical member, whereby said hollow guide vanes constitute conduits for flow of oil from the frusto-conical member to the exterior of the double-walled casing.

8. Structure as specified in claim 7, including a member cooperating with the outer wall of the inlet portion of the casing to define therewith a passage for flow of oil received from the hollow guide vanes, said outer wall being common to and separating said oil flow passage and the air flow passage through the blower, whereby air passing in contact with the inner surface of said common wall cools the oil passing in contact with the outer surface thereof.

9. In a vertical propeller-type blower, a double-walled casing providing an annular passage for flow of air, said passage having inlet and outlet portions connected by a throat portion; a propeller in the throat portion and having a hub; a vertically-disposed shaft carrying the propeller hub; a combined radial and thrust bearing supporting the lower terminal portion of the shaft; means for driving said shaft; a radial bearing for the upper end of the shaft at a point below said driving means; a housing for the last-mentioned bearing; supporting means for said housing and bearing including a supporting ring to which the housing is secured, and an annular plate member secured at its inner periphery to said supporting ring and at its outer periphery to the inner wall of the casing inlet portion and providing a water-tight closure between said

ring and wall; and a plurality of guide vanes disposed in the casing inlet portion with their inner edges secured to the inner wall and their outer edges secured to the outer wall, one of said guide vanes being hollow and extending above the level of the annular plate member, and said inner and outer walls having openings formed therein communicating with the hollow interior of said one guide vane, whereby said one guide vane provides a discharge passage for water collecting on said annular plate member.

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